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Presentation of the Content

In the first chapter we present, *Technical Report for the Instituto Tecnológico Superior de la Región Sierra in productivity matters*, by DE LA CRUZ-GARCÍA, Ricardo, MENESES HERNÁNDEZ, José Luis, CASTRO DE LA CRUZ, Jucelly and OLÁN CASTRO, Betsaida, with ascription in the TecNM campus Villahermosa, as a second article we present, *Strategic product design, based on aromatic plants, for the sustainable development of rural communities in a health crisis COVID-19*, by NIVÓN-PELLÓN, Alejandra, UTRILLA-SARMIENTO, Beatriz, RIVERA-AGUILAR, Ma. Asucena and MÁRQUEZ-CASTILLO, Eréndira, with secondment in the Universidad Autónoma de Querétaro, as the following article we present, *Prototype of a mobile application for the registration and diagnosis of patients infected with tuberculosis in the Huasteca Hidalguense region*, by MENDOZA-SAN JUAN, Luis Alberto, SALAZAR-CASANOVA, Hermes, DEL CARMEN-MORALES, Yucels Anaí and MARTÍNEZ-MAGOS, Juan Carlos, with affiliation at the Universidad Tecnológica de la Huasteca Hidalguense, as next article we present, *Characterization of silica sand from grinding and sieving, for use and handling as raw materials by dry means*, by GONZÁLEZ-TOTO, Jorge, with affiliation at the Universidad Tecnológica del Sureste de Veracruz.

Content

Article **ECORFAN Journal-Bolivia**
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Technical Report for the Instituto Tecnológico Superior de la Región Sierra in productivity matters

Informe técnico del Instituto Tecnológico Superior de la Región Sierra en Materia de Productividad

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Abstract

Measuring and improving productivity in today's organizations is of utmost importance, since the context in which we live is very dynamic and organizations are facing accelerated changes. It requires responsiveness to adapt to the demands of the markets and to be competitive. For this reason, companies must implement philosophies that allow continuous study with a comprehensive approach using techniques for measuring productivity. Such is the case of the present research where the performance of public higher education institutions is analyzed, considering the Tecnológico Nacional de México Campus of the Sierra Region, through the promotion of a technical report, where the instrument "Integral Productivity Evaluation Technique (TIEP), which consists of ten elements that favor productivity including context variables, is developed. The implementation of this tool allows the development of an integral diagnosis that is the basis for the proposal of a productivity improvement model.

Integral approach, Productivity improvement, TECNM Campus Sierra Region

Resumen

Medir y mejorar la productividad en las organizaciones actuales es de suma importancia, ya que el contexto en el que vivimos es muy dinámico y las organizaciones se enfrentan a cambios acelerados. Requiere capacidad de respuesta para adaptarse a las demandas de los mercados y ser competitivo. Por ello, las empresas deben implementar filosofías que permitan un estudio continuo con un enfoque integral utilizando técnicas de medición de la productividad. Tal es el caso de la presente investigación donde se analiza el desempeño de las instituciones públicas de educación superior, considerando el Campus del Tecnológico Nacional de México de la Región Sierra, a través de la promoción de un informe técnico, donde el instrumento "Técnica de Evaluación Integral de la Productividad (TIEP) , que consta de diez elementos que favorecen la productividad incluyendo variables de contexto, la implementación de esta herramienta permite desarrollar un diagnóstico integral que es la base para la propuesta de un modelo de mejora de la productividad.

Enfoque integral, Mejora de la productividad, TECNM Campus Sierra Regions

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Introduction

The importance of measuring and improving productivity lies in something continuous, that is to say, something that has no end, which is why it is necessary to create a culture that leads to a constant evolution in organizations, since it is considered as an antecedent of creativity and innovation, which gives a guideline to the competitiveness of companies.

Similarly, measurement is a metric that seeks to measure the efficient performance of processes looking for results that allow identifying areas for improvement, therefore, productivity is a key factor to identify certain deficiencies in companies. In order for this to be done, a performance measurement system is required to quantify the vital signs of the organization and processes.

Likewise, the Integrated Productivity Evaluation Technique (TIEP), (Dantés, 2021), is an instrument that has its foundations in ten fundamental elements for any organization, since it allows to identify not only tangible aspects, but also intangible aspects, which are those where knowledge and attitudes to do things are linked, these aspects are important for the measurement and improvement of productivity. In addition, another significant aspect is that it allows the analysis of external and internal contexts, since they identify the behavior of the variables of the context. This is why its implementation requires a systemic and integral approach.

The research work is focused on analyzing the performance of the Instituto Tecnológico de la Región Sierra, considering as a first mechanism the measurement to know how the institution is working, which will help us to show through the application of an integral instrument of productivity evaluation the detection of needs or circumstances that are impeding the quality of service, generating an integral diagnosis that will be the basis for the proposal of a productivity improvement model, to contribute to a better functioning of the areas and thus increase productivity. It is important to point out that there is no record or history of any similar study having been carried out in this institution. Therefore, there is an area of opportunity for the results obtained to contribute to improved performance.

Having said the above, the general objective is to analyze productivity in higher education in order to propose a productivity improvement model.

Description of the method

The instrument, Integral Evaluation Technique for Productivity (TIEP), is structured by ten elements, priorities for any organization, these elements have the purpose of knowing tangible and intangible aspects, fundamental to be able to carry out the measurement. These elements are listed below:

No.	Elements
1	Conceptual approach to the company
2	Process knowledge
3	Social scope of the organization
4	Planning management
5	Management participation
6	Organizational creativity and innovation
7	Knowledge of the client(s)
8	Technological development
9	Macroeconomic knowledge
10	Integral development of human resources

Table 1 Elements that favor productivity
Source: Authors' elaboration (2021)

For the application of the tool it is necessary for the evaluator to have a systemic and integral approach, as well as knowledge of the external and internal context of the organization, in order to be able to carry out the study according to the profile of the basic elements of productivity.

Another essential aspect for the execution of the instrument is the broad understanding of the context variables, in order to identify the participation of each one of them in the organization. The context variables that make up the instrument are:

No.	Variables
1	Economics
2	Politics
3	Environmental
4	Cultural
5	Technological
6	Social

Table 2 Context variables
Source: Authors' elaboration (2021)

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Finally, according to the scenario studied, the evaluator will examine all the results obtained from the elements that make up the technique used and analyze which variables are impacting the company.

Analysis based on the method

In order to carry out the study and apply the TIEP, the organizational structure of the institute was first identified through the organizational chart, analyzing and selecting the areas with the highest hierarchical levels, since they are the ones that should have a systemic approach to the organization. The departments selected were: *the directorate of planning and liaison, the sub-directorate of liaison, the sub-directorate of planning and the sub-directorate of administrative services.* Subsequently, the representatives of each area were interviewed.

To carry out the comprehensive evaluation, the quantitative evaluation criterion was established by assigning a score from 1 to 10 according to the profile and knowledge of the evaluated element with a weighting in relation to the weight and degree of importance of the context variable ∑P =1.

For the development of the study, four instruments were applied, that is, one instrument for each departmenThe following is an example of the instrument applied to the liaison department.

TIEP (Integral Productivity Evaluation Technique)

Element	Economic variable W	Economic variable E	Political variable W	Political variable E	Environment variable W	Environment variable E	Cultural variable W	Cultural variable E	Technological variable W	Technological variable E	Social variable W	Social variable E	W/S	W/C
1. Conceptual approach to the company	0.1	9	0.11	8	0.11	8.5	0.12	8	0.04	8	0.13	8.5	8.33	0.85
2. Process knowledge	0.1	9	0.1	9	0.14	8	0.1	8.5	0.1	8	0.15	9	8.58	0.99
3. Social scope of the organization	0.11	9	0.13	8.5	0.1	8.5	0.1	8	0.06	8	0.15	8.5	8.42	0.92
4. Planning management	0.12	8	0.09	8	0.1	8	0.05	8	0.1	8	0.12	8	8.00	0.77
5. Management participation	0.13	8.5	0.13	8.5	0.1	8.5	0.17	8	0.12	8.5	0.08	8	8.33	1.01
6. Organizational creativity and innovation	0.12	8	0.08	8	0.08	8	0.12	7	0.18	7	0.05	8	7.67	0.79
7. Knowledge of the client(s)	0.05	8	0.08	8.5	0.06	8.5	0.09	8.5	0.07	8	0.1	9	8.42	0.64
8. Technological development	0.06	7	0.08	7	0.12	7	0.1	7	0.14	7	0.08	7	7.00	0.68
9. Macroeconomic knowledge	0.15	7	0.11	7	0.1	7	0.07	7	0.11	7	0.09	7	7.00	0.74
10. Integral development of human resources	0.06	8	0.09	8.5	0.09	8.5	0.08	8.5	0.08	8	0.05	8.5	8.33	0.63
	1	8.15	1	8.1	1	8.05	1	7.85	1	7.75	1	8.15		

W = Weighting	∑ P = 1
E = Quantitative Evaluation	Range E = 1 - 10

Figure 1 Example, application of the instrument to the liaison department
Source: (Dantes, 2021).

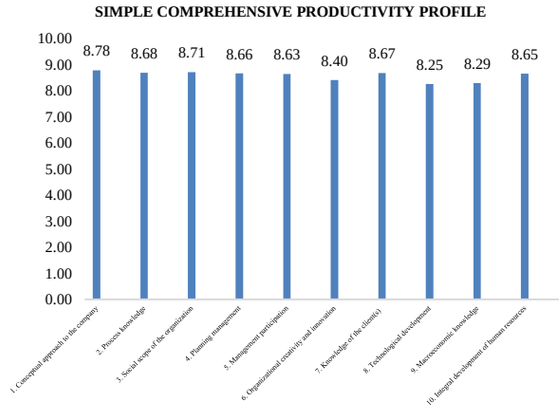
Results

After the evaluations, simple and composite averages were obtained for each department, these being the basis for the design of the institute's comprehensive productivity profiles. The results with a low impact of the integral profile of the departments by simple averages were as follows:

Elements	Simple integral profile	Evaluation range for elements
Technological Development	8.25	1 - 10
Macroeconomic knowledge	8.29	
Organizational creativity and innovation	8.40	

Table 3 Low results of simple integral profile
Source: Authors' elaboration, (2021)

In relation to the integral graph by simple averages of the evaluated areas of the institute, it is possible to observe the general behavior for each element in correlation to the departments of the "planning and liaison directorate, liaison sub-directorate, planning sub-directorate and administrative services sub-directorate". The first thing that can be diagnosed is that they know considerably what the systemic approach is and that they work with all the basic elements of productivity. However, the element that has a slight impact on the profile of the areas evaluated is technological development and then macroeconomic knowledge; therefore, it is recommended that these elements be reinforced.



Graphic 1 Integral Profile of the departments evaluated, by simple averages
Source: Contribution, simple integral profile, 4 persons interviewed

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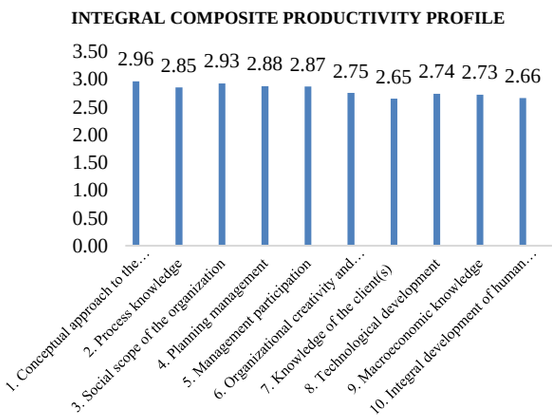
All the observations made above are concluded with the graph of the integral profile of productivity by composite averages, since the average obtained is the quantitative evaluation for each of the qualified departments, being averaged together with the weightings of each of the elements in relation to the variables of the context. Now, the graph expresses numerically how the variables affect the elements that strengthen productivity, which is why it is so important to analyze it, since it is the basis for the proposal of the improvement model.

Therefore, the knowledge of customers and the integral development of human resources are the lowest in the results obtained, considering the degree of importance that the political, social and cultural variables have on the elements, it can also be observed that the elements, macroeconomic knowledge, technological development and organizational creativity and innovation are being impacted, so it is important to consider them, therefore the elements with higher weights can be observed, being those with the highest scores, the social scope of the organization and the conceptual approach of the company.



Graphic 2 Integral profile of the departments evaluated, by composite averages
Source: Input, composite comprehensive profile 4 persons interviewed, 2021

Proposals

One of the fundamental objectives of any organization is to provide resources through goods or services, for this reason, it is important that it satisfies the needs and expectations of its customers. Goods or services are the result of a set of activities, which must be mutually interconnected with the elements that transform inputs into outputs, which is the resource with the attributes required by the market.

Therefore, the purpose of this study is to analyze the behavior of the organization using tools that give results to diagnose and propose improvements in its productivity.

a) Implement the productivity improvement model.

b) Sensitize the personnel to promote an environment of organizational culture.

c) Sensitize all human resources regarding the knowledge of the institutional philosophy, mission, vision, values, purpose of the institution, why it is important to know it and above all to comply with it.

d) Promote the development of the integral approach and the work through identified processes, make them known and look for those responsible, and monitor through the evaluation for the identification of risk, measurement systems should be implemented.

e) Create systemic thinking in all the human resources of the institute, seeing it as a system and not working in isolation.

f) Observe and analyze the variables of the economic, political, social, cultural, technological and environmental context periodically as they impact the institution.

g) Seek links with society.

h) Promote projects for organizational creativity and innovation through proposals for improvement in administrative and educational processes.

i) Promote projects for technological development. As well as, to update the technology in laboratories and training of the same to the personnel.

j) Promote transversal communication between departments, that is, not only with the hierarchically dependent units, but also with those that might not seem to be related, this promotes the organizational social environment.

k) Promote training according to profiles and positions in all units of the institute.

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Model for productivity improvement

Models are graphic representations that allow showing elements and their interactions among them, with the purpose of expressing ideas or critical thoughts.

The productivity improvement model expresses the results and analysis of the study conducted for the Tecnológico Superior de la Región Sierra. The information and design is the researcher's perception, since, derived from the studies obtained and the results captured in the graphs were the basis for this model. It should be noted that the structure is circular with arrows in one direction and others that indicate reciprocity between the external and internal contexts of the system.

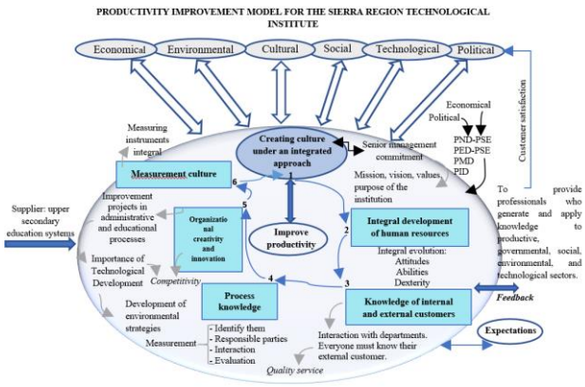

Figure 2 Productivity Improvement Model
Source: Researcher's perception, 2021

The proposal of the present Model for the Improvement of Productivity for the Instituto Tecnológico Superior de la Región Sierra, its main purpose is to create the culture of the integral approach according to the following structure, first of all, it has to keep in mind that it is due to the demands and needs of the variables of the cultural, social, political, economic, technological, and environmental context, which demand a human resource that has the specific and appropriate competencies for each requirement. Therefore, the institute must provide a main actor that generates and applies knowledge to the demanding sectors and conforms to market expectations. It is important to achieve successful results, i.e. outputs, and for this reason an input element is required, in this case there is a main provider, which is the higher education system.

Now, it is significant to mention that the Institute is governed by objectives and guidelines with which it also has a commitment to assume, and this is, through the federal, state and municipal development plans, where there are educational sectorial programs, under which an institutional development plan is formulated, since they will be a key factor for the promotion and development of the institution. In the center of the model, which is the starting point for the improvement of productivity, there is a two-way arrow indicating reciprocity, which will be reflected with element one, which is the culture under the integral approach, as well as the effect with the variables of the context. For the beginning of the approach, it is necessary and very important the commitment of the top management, since one of the first actions will be the review of the mission, vision, values and purpose of the institution, to identify how attached they are working to the institutional philosophies and to implement tactics for all staff to know and practice them. The second approach requires an integral development of human resources in the search for continuous improvement of attitudes, skills and abilities. This will allow them to identify their internal and external customers and lead them to provide a quality service. The fourth element is fundamental, since it can be said that they work with an integral approach if they have identified their processes, if there are people responsible for them and above all if they are evaluated to identify risks and seek better results, it is important that they implement integral measurement systems for continuous monitoring. The fifth element is organizational creativity and innovation, one of the strategies is the proposal of projects to improve administrative and educational processes, which will be the door to technological development, and alternatives for the environment, this will be key to the competitiveness of the institute. The sixth element is to seek a culture of measurement by means of instruments that allow the organization to be measured integrally, that is, tangibly and intangibly, and finally, the institution must satisfy the needs of the client.

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Conclusions

It is essential for organizations to be attentive to the dynamics of the world, since very rapid changes are being observed and, therefore, they must adapt to improve their external and internal context. Consequently, today the variables of the context have become very vulnerable to radical changes, as they demand better goods and services, and above all attributes that can have an impact and benefit them.

For this reason, a key factor in companies is their human capital, so the concern should be its integral development, since it depends on it that productivity achieves satisfactory results, therefore, it is not only looking for the tangible, but also the intangible, as could be analyzed in the application of the instrument, the ten elements that strengthen productivity, are very strategic, as they give the guideline to evaluate the organization in a comprehensive manner and have results to know which variables affect more on the elements.

Within the results obtained for the institution, the elements that have the greatest impact are the knowledge of its clients, in this aspect influences the type of service offered, which is the formation of human capital, for this reason it is very important that the sum of all the elements should focus on meeting all the attributes for the client, another element that impacts is the integral development of human resources, this means that it is essential that people develop competencies of attitudes, skills and abilities, which will help to an integral evolution. Other significant elements are technological development. It is worth mentioning that the institution's purpose includes promoting technological education and conducting scientific and technological research in the entity, which is why the institution should not lose sight of these approaches, as they are important for its clients. The last element that has an impact is macroeconomic knowledge, this element is very important for the high hierarchical levels of the institute, since they must be well informed about the political and economic changes at national and global level, the institution depends on the public treasury, so it must pay special attention to economic changes that affect the country. Finally, the elements with the highest percentage are fundamental to promote the elements mentioned above.

In conclusion, it is recommended that the institution implement the productivity improvement model, since it will help to find areas for improvement and strengthen the institution, it is urgent to analyze how the variables of the context affect the entire institution and to know the reciprocity that exists between them.

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Strategic product design, based on aromatic plants, for the sustainable development of rural communities in a health crisis COVID-19

Diseño estratégico de producto, a partir de plantas aromáticas, para el desarrollo sostenible de comunidades rurales en crisis sanitaria COVID-19

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Abstract

One of the main objectives of the production systems and high-impact products strategic design, supporting economic and social growth in rural communities, is to maintain a continuous exchange of experience and knowledge without compromising integrity and resources of the communities and their inhabitants. Due to the COVID-19 health emergency, the Technological Transfer and Agricultural Innovation Center belonging to the Universidad Autónoma de Querétaro, has seen the need to innovate the traditional way of knowing and evaluating the needs of the communities that open the doors for collaborative work. Using a Phenomenological and Social Construction approach, the result has been a modular workin to design a sustainable product, based on aromatic plants, that impacts both the development of the community and the health of the target user. This interdisciplinary work has been divided into the social and technological system evaluation module, the feasibility of the technological proposal module, and the strategic product design module.

Strategic design, Sustainable product, productive system

Resumen

Uno de los objetivos principales del diseño estratégico para la mejora en los sistemas productivos y diseño de productos, de alto impacto, que apoyen el crecimiento económico y social en comunidades rurales, es el de mantener un continuo intercambio de experiencia y saberes sin comprometer la integridad y recursos de las comunidades y sus habitantes. El Centro de Trasferencia Tecnológica e Innovación Agropecuaria perteneciente a la Universidad Autónoma de Querétaro, se ve debido a la emergencia sanitaria COVID-19, en la necesidad de innovar desde un acercamiento Fenomenológico y de Construcción Social la manera tradicional de conocer y evaluar las necesidades de las comunidades que abren sus puertas al trabajo colaborativo. Dando como resultado un trabajo modular para el diseño estratégico de producto sostenible, a partir de plantas aromáticas, que impacta tanto en el desarrollo de la comunidad como en el beneficio de la salud del usuario final. La colaboración interdisciplinar, se ha dividido en el módulo de evaluación del sistema social y tecnológico, módulo de factibilidad, propuesta y apropiación tecnológica y finalmente módulo de diseño estratégico de producto.

Diseño estratégico, Producto sostenible, Sistema productivo

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Introduction

Volatile or essential oils are the complex mixture of aromatic substances that give flowers fragrance, they also have bioavailable molecules of pharmacological action, widely used in food, liquor, confectionery, perfumery, cosmetics and aromatic therapies. Essential oils are recognized for being the purest blends extracted from nature and for being one of the easiest to isolate and purify. They are commonly obtained by steam distillation, pressing or the use of organic solvents. The volatile oils can be deposited on the petals and organs of the flowers, the pericarp of the fruits such as critics, wood bark, stem and leaves such as cinnamon or roots such as valerian. It constitutes from 0.1 to 1% of the dry weight of the plant. (López, 2004).

Some molecules present in essential oil mixtures are of special therapeutic and pharmacological interest, such as: antiseptic, bactericidal and fungicidal capacity; its irritant properties that stimulate microcirculation or a slight anesthetic or sedative action, decrease of intestinal spasms; anti-inflammatory action, among others. On the other hand, a growing use of essential oils is, according to the United States National Library of Medicine, the "use of fragrances and plant essences to affect or alter the state or behavior of a person and facilitate physical and mental well-being. and emotional" (taken from Sanz and Ortiz, 2007). The oils for therapeutic use must have a guaranteed quality, those extracted with the help of solvents are not considered suitable for this purpose, to be used cutaneously they must be diluted in vegetable oils such as sesame or olive oil to avoid damage to the skin and promote its absorption. The molecules of essential oils are fragile to light and oxidation by air, so they must be kept in tightly closed amber bottles (Lopez, 2004).

Faced with the COVID-19 health emergency, the world observed a phenomenon characterized by the search for preventive treatments or treatments that would reduce the damage caused by this disease and strengthen the immune system.

That is why onion and garlic vegetable extracts are studied in depth for their organosulfur compounds (Guillamon, 2018), essential oils of laurel, clove and thyme, mainly for their protective active principles against external agents such as eugenol, thymol, and linalool and mixture of substances that also raise the immune system (Del Villar Ruiz and Melo, 2010). For its part, cinnamon, together with its essential oil, promotes angiogenesis characterized by the formation of new blood vessels, in addition, its active principle cinnamaldehyde and some phenolic compounds could have an effect to counteract thrombi (Choi DY, et al, 2009), problem associated with COVID-19 disease due to propensity for blood clots (Hincapie *et al*., 2021).

Mexico is rich for its biocultural knowledge and its wide variety of aromatic plants that are generally sold dry in local markets for home consumption, large productions are destined for the national and international industrial process of essential oils for therapeutic purposes. Of these productions, the ecological ones stand out due to their medicinal potential; named according to the Regulation of the European Economic Community 2092/91, which determines for Spanish speakers that: products known as organic will be called organic and are identified as being obtained from sustainable production systems that do not represent damage to the land and maintains a natural balance with the environment by not generating chemical residues or adding pesticides or herbicides.

The support of government programs to productive processes in so-called suburban and rural areas in the state of Querétaro (eg POPMI, Program for the Productive Organization of Indigenous Women; PFRI, Program for Regional Indigenous Funds; PROCAMPI, Program of Coordination for Support to Production Indigenous) has been reflected in the rabbit, fruit, horticultural and livestock production in the 18 municipalities that make up the state for several years, however, when establishing dialogue with some of the beneficiaries of these programs, it is observed that on rare occasions the productive improvement scales to products of high added value and differentiation positioned in the local urban and peri-urban markets. It is frequently observed that only production for family consumption is achieved.

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There is a record of innovation systems and sustainable product development for community support aligned to the 2030 Agenda, in these cases the participation of the Community, State and University has been a technological generation system that benefits local development, as an example the machine earth mixer for the elaboration of artisan bricks, designed and manufactured in the Faculty of Engineering of the Universidad Autónoma de Querétaro (Lara, 2021). Therefore, it is considered important and pertinent not only the passive study of community development and social innovation, but also the active participation by the agents that make up the Higher Education system in the state of Querétaro, students and teachers who in a way together with the community, develop technological packages for the improvement of production systems and the generation of high-impact products in the market that support economic and social growth, while maintaining a continuous exchange of experience and knowledge without compromising integrity and resources of the communities and their inhabitants.

Methodology

Since before the COVID-19 health crisis began, the Center for Technological Transfer and Agricultural Innovation belonging to the Universidad Autónoma de Querétaro (CETTIA-UAQ), has made an exploratory approach to producer communities, from a Phenomenological and Social Construction approach, to know their interests, needs, technological capabilities and exchange experiences and biocultural knowledge. In order to determine whether university participation and intervention is appropriate, when evaluating the possibility of generating competent quality products that support the economic, cultural, social and ecological growth of the communities. Once the initial report is available, due to the change in face-to-face dynamics to meetings on virtual platforms and cellular telephony, the Thematic Analysis is used for the Phenomenological study of the specific needs of the productive groups or consortiums, there is the participation of students of the Bachelor of Agro-Industrial Engineering belonging to the Faculty of Engineering and of the Bachelor of Humanities and Image Production attached to the Faculty of Philosophy both of the Universidad Autónoma de Querétaro (UAQ).

Thematic Analysis aims to make explicit significant constructs represented in language referring to the social experience following the postulates proposed by Schutz in 1973: models postulated from the experience of the participants classified into categories, these must be recognized by the actors on a daily basis (Mieles et al, 2012). To achieve this, we worked for a year with two groups of each semester of students assigned to the aforementioned careers and faculties who were involved in product design projects, they were informed in depth of the characteristics of the communities for work in productive social projects. It is important to highlight that the participating students have been trained for empathic analysis, sustainable and strategic design. For product and image design, tools such as the Value Proposition Map (Sytrategizer, 2021) and the value elements prioritized in the Almquist pyramid in 2016 are used.

Results

We worked with producer groups in the state of Querétaro that are located in a micro region made up of the communities of Gudiños, Panales, La Estancia, La Puerta and Nogales in the semi-desert area, the mentioned communities are classified as indigenous communities of high degree of marginalization.

As a representative example, the demographic characteristics of the Gudiños community located in the municipality of Tolimán in the state of Querétaro, Mexico, where there has been an approach to livestock, horticultural and fruit producers, are shown below. An example is also shown as a representative example of the strategic product design for one of the producer consortiums.

Demographic data Gudiños locality, Tolimán Querétaro municipality, Mexico as of 2010	
Total population in the locality	514
Men:	246
Women:	268
Inhabited private homes	112
Degree of marginalization of the town:	High

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Marginalization estimators		
Indicators of homelessness 2010	Value	%
Inhabited private homes	112	
Lack of quality and living spaces		
Homes with dirt floors	1	0.89
Lack of access to basic services in inhabited private homes		
Homes without drainage	42	37.50
Homes without electricity	1	0.89
Homes without piped water	18	16.07
Homes without toilet	26	23.21
Scholarship		
% Illiterate population aged 15 years or over		11.14
% Population aged 15 years or over without completed primary school		23.10

Table 1 Gudiños locality demographic data, Tolimán Querétaro municipality, Mexico as of 2010
Source: INEGI. Population and Housing Census 2010: Main Results by Locality, Microregions Unit. CONAPO estimates (2011)

In this community, the Plantas Medicinales Gudiños S.C. by R.L. Producers of aromatic plants with high extraction potential, they have intermediate infrastructure for protected cultivation such as: arch tunnels and small non-automated greenhouses for the production of seedlings mainly.

In order to establish collaboration ties between the Universidad Autónoma de Querétaro and said consortium dedicated to the organic and environmentally friendly production of aromatic plants, an exchange of knowledge and evaluation is carried out through the Center for Technological Transfer and Agricultural Innovation. The community is visited, the actors that make up the productive activities of this consortium are known and described, as well as the problems they face. A collaborative strategy is defined according to the needs of the community and the consortium of producers itself in order to generate a productive technological project using the cultivated raw material in order to give it added value and generate sustainable economic resources for the participants.

Different ideas are proposed in some virtual workshops. With the help of the students of the Degree in Agroindustrial Engineering, a value map is established with the tool: "The value proposition Canvas by Strategyzer" based on the analysis of the text The Value Proposition Design (Osterwalder et al, 2014) and the pyramid of value proposed by the article The Elements of Value (Almquist at al 2016).

The first, based on the analysis of effectively recognizing the qualities of a product, related to the characteristics of the potential consumer. While the pyramid of the 30 elements of value is focused on the attributes that the product-consumer relationship gives, strata focused not only on a functional aspect, but also on the psychological aspect of the relationships that are formed at the time of bonding. between the consumer and the producer.

The value map for the proposal is presented below: essential oils obtained from aromatic plants produced in a respectful way with the environment, regenerating cultivated soils, without the use of pesticides, herbicides and extraction without solvents. The oils can be used topically or ingested for their purity, for bactericidal, fungicidal and relaxing purposes. As can be seen in figure 1, the possible users of the essential oils of lavender, rosemary and thyme are described: women between 30 and 50 years old, who are looking for natural alternatives to maintain or improve their health, become involved with the production methods They prefer chemical-free products, appreciate biocultural knowledge, artisan production and knowledge of ancestral medicine. On the other hand, they are willing to acquire the product in specific places, to get involved with the production methods, they are also willing to learn and put new knowledge into practice.

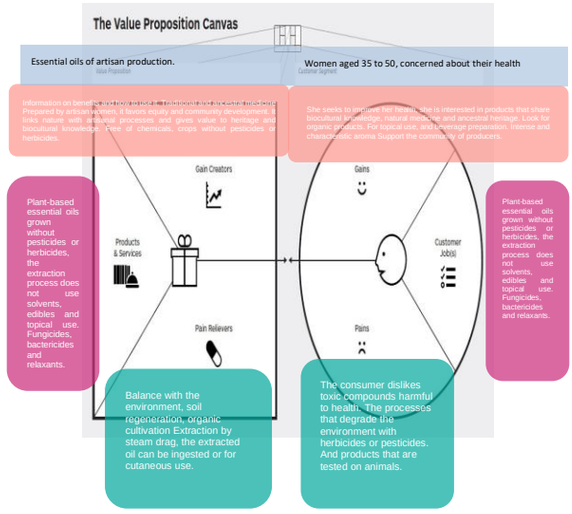

Figure 1 Value map (Strategizer, 2021), of the proposal: essential oils made from organic raw material, for topical consumption or ingested
Source: Own elaboration.

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CETTIA UAQ, evaluates the technological feasibility for the extraction of essential oils with the current production reported by the consortium Plantas Medicinales Gudiños S.C. by R.L. The economic viability is also evaluated and management, prospecting and economic projection strategies are carried out in the short and medium term to analyze the requirements of the production and commercialization of the proposed product. In order to extract the active principles of aromatic plants (lavender, thyme and rosemary), the extraction method by steam dragging is proposed, with a stainless steel still easily adaptable to the spaces and conditions of the community; An initial investment is made of dropper containers of 3 and 5 ml amber color and sesame oil as a vehicle for rapid topical absorption. The purity of the extraction is compared with recognized brands in the market with the HPLC chemical analysis method.

Regarding the strategy proposed for the activities of diffusion, marketing and sale of the product, it is intended that the value chain of essential oils in the community of Gudiños highlights its work of organic production, the balance with the environment from the cultivation of plants putting into practice the regeneration of soils. In addition, it is intended to generate and highlight extraction methods without the use of solvents in order that the oils can be used both cutaneously and ingested. It is perceived as important that the product links the end user with nature, traditional ancestral medicine and artisanal production methods. To transmit the biocultural heritage characteristic of the community. This is intended for the user to obtain assertive information that allows the continuous use of essential oils in the amounts and recommended methods and to feel the expected benefits.

To achieve this, we worked with the students of the Humanities and Image Production (HyPI) degree in order to correctly visualize the needs of the consortium of producers. The students empathically and with the limitations of distance work, learned the degree of marginalization in the community and that there is also a high level of male migration that leads to single-parent families where the economic responsibility falls on the mothers.

Therefore, it is considered important to guide the producers of the region in an appropriate way so that they can place a quality product on the market throughout the year, this would strengthen the community work that the consortium already has and would help sustainably to the economy of some members of the community.

The producers are willing to learn, and get involved in the production process from seedling generation to oil extraction, packaging, labeling and sale of the product. And they are in all the disposition to create bonds with the professors and students of the University.

Therefore, the proposal summarized in figure 2 is the result of a process of analysis and dialogue.

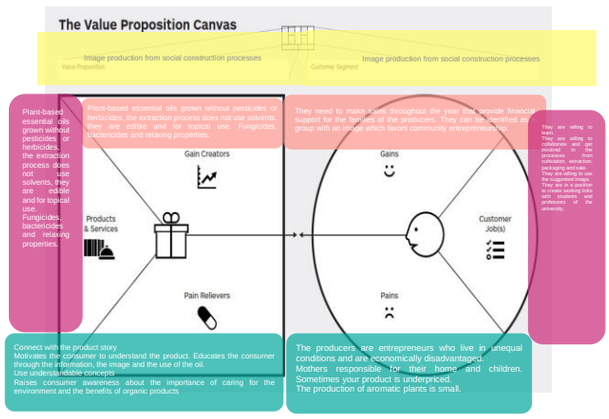

Figure 2 Value map (Strategizer, 2021) of the proposal: Image production from social construction processes for use in essential oils made by women entrepreneurs from the Gudiños community
Source: Own elaboration

This is how the essential values that define the product were reached: an element that improves health, prepared by entrepreneurial women in a rural community, who try to meet their economic needs in an environment surrounded by nature and biocultural knowledge.

An image is presented, taking female producers as the main user, with elements for the creation of content and that can be used in turn on the product label, figure 3.

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The interlaced lines describe the silhouette of three women with their hands on their hearts giving an embrace effect between them, this element aims to represent the community of the producer and brings with it the feeling of integration and sororiad, the latter concept due to the perceived history that portrays the difficulties they have experienced in such a way that they individual women producers and the union before their entrepreneurship. The heart of the center has lavender, rosemary and thyme leaves and flowers. Finally, the image in the background represents the relationship between nature and the product itself and its production methods.

Figure 3 Image designed to represent the production of essential oils by the consortium of producers of aromatic plants in the community of Gudiños Querétaro. Author Eréndira Márquez Castillo

Discussion and Conclusions

This case study is intended to publicize the work generated by the Center for Agricultural Technology Transfer of the Universidad Autónoma de Querétaro. The case of the community of Gudiños in the municipality of Tolimán in the state of Querétaro, Mexico, has been gratifying because the consortium of producers Plantas Medicinales Gudiños S.C. de R.L., has an interest in learning and exchanging knowledge, wants a means of economic generation and its members are committed to the production process. In such a way that it has been possible to generate a model of sustainable social innovation that does not compromise the identity of the community and favors its social, cultural and economic development.

Due to the COVID-19 health emergency, different forms of work had to be found, since community workshops in work areas with the active participation of students, teachers and producers were suspended. The work was implemented by development modules: the social identification and evaluation module, the technical development module and the product design strategy module.

Once the evaluation of the actors that intervene in the productive system has been made, it highlights that the members of the consortium are mothers responsible for the household economy who are economically disadvantaged and that on occasions they have found it necessary to waste their product already that their small productions are sometimes not taken into account. Recognition is made of the technology available and the productive capacity of the consortium. The technological capabilities of the community give us the guideline for the type of process that can be proposed for product development so that technology adoption is simple and natural. Finally, an image is proposed whose value is perceived both by the user of the essential oil and by the consortium of producers since it is proposed as a means to express the needs of their community by giving them their own voice, and that motivates the consumer to understand and know the product as organic and artisan at the same time that sensitizes it to the care of the environment and links with biocultural knowledge. The image and the content should be a point of union that identifies the consortium of producers and gives them a feeling of unity.

The challenge for interdisciplinary and collaborative work between the community, students and teachers of CETTIA was great, and it consisted of transmitting the information in a truthful, objective and analytical way so that each of the modules could face the challenge and complement their contribution with collective knowledge. A new model of technological development and social innovation has emerged with this experience, which allows the generation of strategic products from collaborative work at a distance, which will surely be reflected in product diversification strategies for social development in the communities. rural areas of the region.

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Prototype of a mobile application for the registration and diagnosis of patients infected with tuberculosis in the Huasteca Hidalguense region

Prototipo de aplicación móvil para el registro y diagnóstico de pacientes infectados con tuberculosis en la región de la Huasteca Hidalguense

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Abstract

This project aims to document the migration of the web prototype for the registration of patients potentially infected with tuberculosis in the Huasteca Hidalguense to a mobile application that facilitates usability through different devices for the Sanitary Jurisdiction No.10 of Huejutla de Reyes, Hidalgo. The methodology used is Xp Extreme Programming, which allows rapid development, with a panorama and more used approach to agile software development; it has as phases planning, design, coding and testing. As a result, a mobile prototype was developed, using React Native technology, which is adapted for this project that is intended to be scalable and cover a wide range of devices, regardless of the technology, or the manufacturer because the framework used has the ability to perform cross-platform applications, optimizing development time. This research has as its main advantage the transparency of the application for users, because they will be able to use any mobile device regardless of the operating system for its operation, eliminating restrictions and limitations to the personnel of the Health Jurisdiction for the registration of samples of patients potentially infected with Tuberculosis in the region of the Huasteca Hidalguense, streamlining the diagnostic process.

Tuberculosis, Mobile, Huasteca

Resumen

Esté proyecto pretende documentar la migración del prototipo web para el registro de pacientes potencialmente infectados con tuberculosis en la Huasteca Hidalguense a una aplicación móvil que facilite la usabilidad a través de diferentes dispositivos para la Jurisdicción Sanitaria No.10 de Huejutla de Reyes, Hidalgo. La metodología empleada es Programación Extrema XP, que permite realizar un desarrollo rápido, con un panorama y enfoque más utilizado del desarrollo de software ágil; tiene como fases planeación, diseño, codificación y pruebas. Como resultado se desarrolló un prototipo móvil, usando la tecnología React Native, que se adapta para este proyecto que tiene la intención de ser escalable y cubrir una amplia gama de dispositivos, sin importar la tecnología, ni el fabricante debido a que el framework empleado tiene la capacidad de realizar aplicaciones multiplataforma, optimizando el tiempo de desarrollo. Esta investigación tiene como principal ventaja la transparencia de la aplicación para los usuarios, debido a que podrán utilizar cualquier dispositivo móvil sin importar el sistema operativo para su operación, eliminando restricciones y limitantes al personal de la Jurisdicción Sanitaria para el registro de muestras de pacientes potencialmente infectados con Tuberculosis en la región de la Huasteca Hidalguense, agilizando el proceso de diagnóstico.

Tuberculosis, Móvil, Huasteca

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Introduction

In the Sanitary Jurisdiction No. 10 of Huejutla de Reyes, Hidalgo there is a support web prototype, carried out as a first Stage of the research work presented in this article, but with a limited scope that does not satisfy all the accessibility needs remote, which is what is intended to be achieved in this research.

It is important to remember that this dependency is of great importance for the well-being of the community and, since it does not have a mobile prototype, limitations arise since the web prototype does not meet the needs of registering samples of possible cases of Tuberculosis.

It should be noted that in the Huasteca Hidalguense region there are localities located in remote places, where the internet service is null or inadequate, and it is precisely in these places where the personnel of the Sanitary Jurisdiction No. 10 of Huejutla de Reyes, Hidalgo must perform patient sample records.

That is why the main restrictions presented by the web application is that records cannot be made when the internet service is not available in some localities, the control of the lifting of tests is not properly documented, generating delays in the diagnosis and care of the patients; Therefore, it is necessary to complement the operation of the web system with a mobile application to improve access and information processing, since it is not available and represents delays in the delivery of results and patient care.

With the development of this project, the management of patient data will be optimized to better control the information collected, offering users two technologies that adapt to their work activities either in the office or in the field. Diagnosis has an efficient management, avoiding duplication of registration to the laboratory staff, to reduce the workload and keep a precise control of each sample, so the patient can be attended without delays.

Theoretical fundament

Tuberculosis is caused by Mycobacterium Tuberculosis, a bacteria that almost always affects the lungs. It is a curable and preventable condition. The infection is spread from person to person through the air. When a patient with pulmonary tuberculosis coughs, sneezes, or spits, he expels tubercle bacilli into the air. It is enough for a person to inhale a few bacilli to become infected. It is estimated that a quarter of the world's population has latent tuberculosis, a term applied to people infected by the bacillus but who have not yet become ill and cannot transmit the infection. (WHO, 2018)

Despite technological advances and great efforts by health personnel, tuberculosis continues to be a serious public health problem. Every second, a new TB bacillus infection occurs in the world. According to the figures reported by the WHO, in 2015 a new patient appeared every 3 seconds and another died every 18 seconds. (Orozco, and others, 2018)

Between 2000 and 2011, acute respiratory infections (ARI) remained the main cause of disease in our country. Its incidence rate went from 29,441.34 to 23,672.84 cases / 100 thousand. (SIAVE, 2012).

Tuberculosis in Mexico

Tuberculosis in Mexico has not been eradicated; The number of deaths has been reduced by more than 45 percent, but the incidence has been maintained, with a slight decrease in the number of cases. For 2009, in our country, according to a report edited by the National Committee to Fight Tuberculosis and Respiratory Diseases, 5 thousand Mexicans die a year from this disease, about 30 thousand new cases are known per year and another 1000 are infected daily.

Approximately 84% of patients who enter treatment are cured, 2.5% die and 13.5% are recorded as failure, abandonment of treatment. These proportions vary according to the location of the disease. (Orozco, Nesbitt, & González, 2009). More recent studies estimate that there are 2,000 to 2,500 deaths per year, and according to figures from the Ministry of Health, more than 19,000 new cases are reported annually. (Castillo & Antonia, 2018).

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In Hidalgo, pulmonary tuberculosis continues to be a public health problem, by stratifying municipal risks in 2016 with accumulated mortality from pulmonary tuberculosis 2009-2014, accumulated morbidity from pulmonary tuberculosis 2010-2015, detection coverage 2015, percentage of Drug resistant tuberculosis and percentage of failures, relapses and abandonment of treatment, high risk is identified in 45 municipalities: 12 located in the region of La Huasteca, 3 in the Sierra de Tenango, 8 in the Sierra Alta, 2 in the Sierra Baja, 3 in the Sierra Gorda, 3 in the Tulancingo Valley, 1 in the Mining Region, 1 in the Altiplano and 12 in the Mezquital Valley.

With medium risk, 28 municipalities are recognized, representing 33.3% of the total and the remaining 11 municipalities are classified as low risk. (Secretary of Health of Hidalgo, 2016)

Mobile app

Mobile technologies and their continuous advancement are fostering a new generation of applications, these are the so-called "mobile applications". A mobile application is considered to be software developed for mobile devices. Mobile refers to being able to access data, applications and devices from anywhere and at any time. These types of applications are developed taking into account the limitations of the devices themselves, such as low computing power, low storage capacity, limited bandwidth, etc. (Enriquez & Casas, 2013).

React Native

For React Native, it all started as an internal hackathon 6 project within the walls of Facebook's offices and has since grown into one of the most popular frameworks. React Native did something that web developers had been trying to do for several years before the hackathon: write mobile apps in JavaScript.

Many of the concepts introduced by React are applied in React Native; for example, better health management techniques, a one-way data flow in applications, component-based UI construction, and much more.

It is currently compatible with iOS and Android, and due to its acceptance and success there are plans to expand to other platforms. The main innovation of React Native is that even though the applications are written in JavaScript, they are compiled in native code, so their performance is much better than the so-called hybrid applications. These applications are written in JavaScript, HTML and CSS and run in WebView (a browser built into an application). Additionally, React Native offers a web-like development experience, such as real-time reloading of your application during development, which is very nice. (Lazcano, Valencia, Baena, & Venegas, 2019)

Methodology

Extreme programming (XP)

To illustrate an agile process in more detail, an overview of Extreme Programming (XP), the most widely used approach to agile software development, will be given. Although the first activities with the ideas and methods associated with XP occurred in the late 1980s, the fundamental work on the subject had been written by Kent Beck. A variant of XP called XP Industrial IXP was proposed in a more recent era. IXP enhances XP and targets the agile process to be used specifically in large organizations.

The XP process

Extreme programming uses an object-oriented approach as the preferred development paradigm, and encompasses a set of rules and practices that occur in the context of four structural activities that could be described as their life cycle, which are detailed and developed below: planning, design, coding and testing.

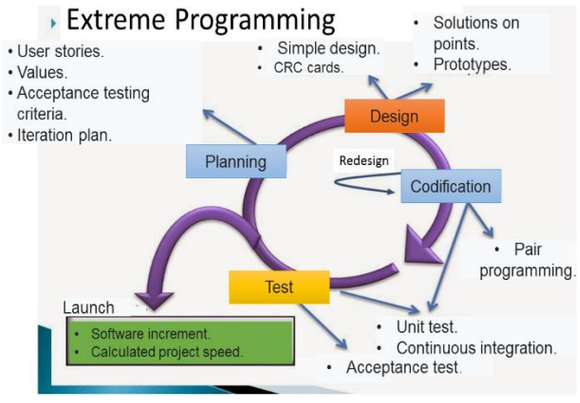

Figure 1 Life cycle of the XP methodology

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Planning The planning activity (also called the planning game) begins by listening to the requirements gathering activity that enables the technical members of the xp team to understand the business context for the software and acquire the sensitivity of the output and key features and functionality that are required. Listening leads to the creation of some "stories" (also called user stories) that describe the required output, features, and functionality of the software to be built.

Design. xp design rigorously follows the ms principle (keep it simple). A simple design is always preferred over a more complex representation. In addition, the design guides the implementation of a story as it is written nothing more, nothing less. Designing for additional functionality is discouraged because the developer assumes it will be required later. Xp encourages the use of crc cards as an effective mechanism for thinking about software in an object-oriented context.

Coding. After the stories have been developed and preliminary design work has been done, the team does not start coding, but instead develops a series of unit tests on each of the stories to be included in the delivery in course (software increment). Once the unit test is created, the developer is better able to focus on what needs to be implemented to pass the test. nothing strange is added (ms). Once the code is complete, it is unit tested immediately, providing instant feedback for developers.

Evidence. It was already said that creating unit tests before coding begins is a key element of the xp approach. The unit tests that are created must be implemented using a framework that allows them to be automated (so that they can be run repeatedly and with ease). this encourages a regression testing strategy whenever the code is modified (which is often the case, given the philosophy of redesign in xp). (Pressman, 2010)

Developing

Planning

In this phase, meetings were held with personnel from health jurisdiction no.10 of Huejutla de Reyes, Hgo. to obtain the necessary requirements in the development of the mobile application. In these meetings, information was obtained corresponding to the color palette, typography, modules, activities, delivery times, type of data to be captured and the traceability of the process. This investigation lasted 14 weeks, then the time management for each activity.

Number.	Activities	Scheduled / Finished	Weeks													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Planning	S														
		F	OK	OK	OK											
2	Design	S														
		F				OK	OK	OK	OK	OK						
3	Codification	S														
		F									OK	OK	OK	OK		
4	Test	S														
		F													OK	OK

Figure 2 Project planning

The different user stories were also carried out, which describe the actions and functionalities to be carried out.

The lists of user histories for the mobile application are login, personnel registration, registration of municipalities, localities, medical unit, personnel, laboratory worker, patients, type of personnel, sending of tests, test section, test notification, section of Control sent, user screen, personal data configuration and medical unit user.

The information collected in user stories is very important since it comes first-hand and accurately describes the needs that each user requires from the application.

User Story	
Number: 12.	**User:** 3 tests will be performed on patients who have symptoms of tuberculosis, they will also be scheduled natural tests every 28 days for their treatment.
Story Name: Test Section	
Business priority: High.	**Developing risk:** The tests must be taken correctly because if the tests are taken incorrectly, they will be rejected.
Estimated points: 0.4 weeks.	**Assigned iteration:** 1st. Iteration.
Responsible programmer: Álvaro Antonio Hernández Perez.	
Observations: Pending.	

Note: This table shows the user story designed for taking patient tests in the mobile app.

Table 1 User Stories example

Design

At this stage, the preliminary sketches of the mobile prototype forms are included. The design of the graphical user interface was prepared based on the design requirements requested by the personnel of the Sanitary Jurisdiction No.10 of Huejutla de Reyes, Hgo. Adjusting to your usability needs. Here are some prototype designs.

Figure 3 Application staff registration screen

Coding

At this stage, once the user stories have been developed and the preliminary design work has been done, a series of unit tests was developed for each of the stories that were included in the current release (software increment) . After the unit test was created, there was instant feedback for developers.

A database was developed that has six tables all related by their primary and foreign key.

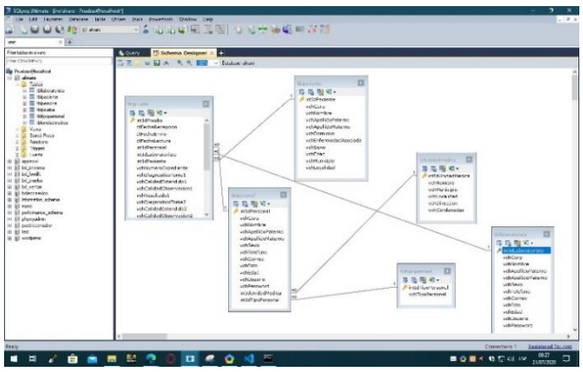

Figure 4 Application database

For the coding of the different modules of the mobile application mentioned in the design stage, the development technologies php, react native and java script were used.

Figure 5 Patient tests screen to be displayed in the application

Once the tests have been taken from the patient, they will appear in the list of tests already taken in the test, the necessary information will appear, such as the name of the doctor in charge of taking the tests, the name of the patient on whom the tests were performed and the laboratory worker. who is in charge of examining the evidence and delivering the results.

Evidence

Data validation tests were carried out to ensure that the information entered in forms is correct, considering user stories.

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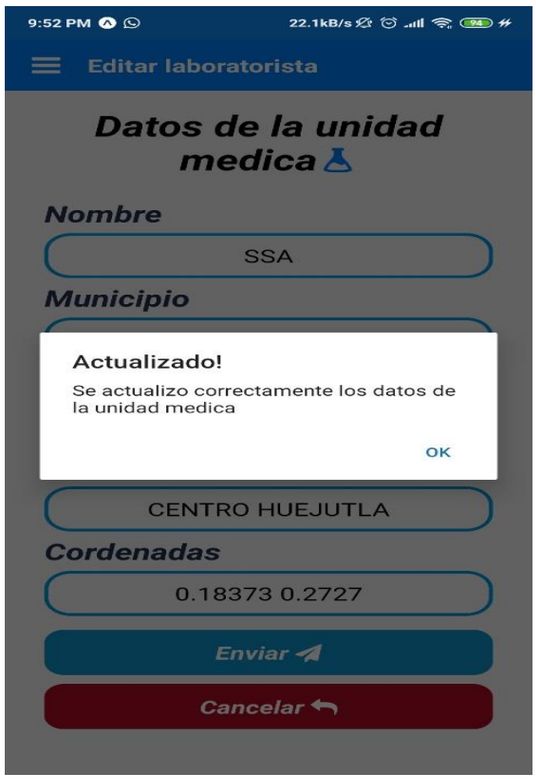

Figure 6 Patient tests screen to be displayed in the application

As you can see, the data of the medical unit is being updated by the administrator since he has found an error in the data and has to be corrected. For this, it has two buttons, one is to cancel the process and the other is to save changes. If the administrator chose the wrong unit just by canceling the process, this will not alter the data, but if it is the correct unit, just saving the changes will give us the message the data was saved correctly.

Results

The result of this research was to develop a mobile application to speed up the registration of patients potentially infected with tuberculosis in the Huasteca Hidalguense.

This process was carried out through constant communication with the personnel of the Sanitary Jurisdiction No. 10 of Huejutla de Reyes, Hgo. and the Academic Body of Information Technologies of the Technological University of the Huasteca Hidalguense where the need arose to migrate some modules of a web application previously developed with the same purpose to a mobile environment and to give continuity to this project to reduce the damage caused by this disease.

With the migration of the application from a web environment to a mobile one, important benefits were obtained, optimizing the registration process due to the reduction of the restriction of making sample registrations due to the lack of internet service in remote places, as well as, opened the range of options in terms of devices used to carry out this process.

The choice of the Extreme Programming (XP) methodology is based on the need to develop an application quickly and adequately so that it could be implemented in a short period of time that contribute to the actions undertaken by the State Secretary of Health. of Hidalgo through Sanitary Jurisdiction No. 10 in the campaign to eradicate tuberculosis in the Huasteca Hidalguense region.

Conclusions

With the completion of the mobile application for the registry of patients potentially infected with tuberculosis in the Huasteca Hidalguense region, a second stage of this project is concluded that complements and adds benefits to the work previously carried out between the Academic Body of Technologies of the information from the Technological University of the Huasteca Hidalguense and the Sanitary Jurisdiction no. 10 from Huejutla de Reyes, Hgo. that were focused on a web environment.

The intention of this project is that the mobile application is first used exclusively by health personnel assigned within the Huasteca region, to later be implemented in other jurisdictions, agencies and health entities of the state of Hidalgo.

It is also proposed to apply the Official Mexican Standards and quality standards for the processing and safeguarding of information, considering the ethics of the users and the privacy, integrity and availability of the data of each patient.

Acknowledgments

To the personnel of the Sanitary Jurisdiction No. 10 located in the city of Huejutla de Reyes, Hidalgo.

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Characterization of silica sand from grinding and sieving, for use and handling as raw materials by dry means

Caracterización de la arena silica a partir de la molienda y tamizado, para el uso y manejo como materias primas por vía seca

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Abstract

Objectives

The present research work allows to apply the grinding and sieving in the characterization of raw materials by dry way in Chemical Engineering in the same way it allows studying the behavior of the diameters and the distribution of the particles from the sand screening silica, whose purpose is to determine the efficiency in the grinding of solids, in the sieving of particles of different sizes from Tyler sieves, whose purpose is to characterize the silica sand as solid raw materials by dry way, related to the different applications of the unit operations such as: in the glass, ceramic, metallurgy, foundry, construction, abrasive and drying industries.

Methodology

This article describes the methodology of the grinding and sieving of silica sand in the laboratory of Chemical plants of the Technological University of the southeast of Veracruz, from which the operation is developed and obtaining its efficiency, as a product in the mesh 70, from the screening and characterization of this solid raw material by dry method. for later uses in industry and in Chemical Engineering.

Contribución

Las industrias hoy en día requieren del analisis de sus materias primas de acuerdo a las especificaciones de los clientes, es por ello que la molienda y el tamizado ha permitido a la ingeniería Química un amplio desarrollo en las operaciones unitarias, así como la mejora de la calidad en los productos solidos ya sea por vía seca o húmeda, en este proyecto se desarrolla un tratamiento por vía seca de la arena silica. a partir de la molienda en un molino de bolas y tamizado en un tamizador Axial desarrollado en el Laboratorio de plantas de la Universidad Tecnológica del Sureste de Veracruz, se pretende comercializarlo con empresas del ramo, como: MADISA, cuyo propósito sea aplicarlo en la producción, elaboración y manufactura de envases de color ámbar ya se medicinal o envases de cerveza (Retsch,2012).

Engineering, Processes, Prototypes

Resumen

Objetivos

El presente trabajo de investigación, permite aplicar la molienda y tamizado en la caracterización de materias primas por vía seca en la Ing. Química de la misma forma permite estudiar el comportamiento de los diámetros y la distribución de las partículas a partir del cribado de la arena silica, cuyo propósito es determinar la eficiencia en la molienda de sólidos, en el tamizado de partículas de diferentes tamaños a partir de tamices Tyler, cuyo propósito es caracterizar la arena silica como materias primas sólidas por vía seca, afines a las diferentes aplicaciones de las operaciones unitarias como: en la industria del vidrio, cerámica, metalurgia, fundición, construcción, abrasivos y el secado.

Metodología

El presente artículo describe la metodología de la molienda y tamizado de la arena silica en el laboratorio de plantas Químicas de la Universidad Tecnológica del sureste de Veracruz, de la cual se desarrolla la operación y obtención de la eficiencia de la misma, como producto en la malla 70, a partir del cribado y caracterización de esta materia prima solida por vía seca. para usos posteriores en la industria y en Ing. Química.

Contribution

Industries today require the analysis of their raw materials according to customer specifications, which is why grinding and sieving has allowed chemical engineering a broad development in unit operations, as well as the improvement of the quality in solid products either by dry or wet route, in this project a dry treatment of silica sand is developed. From the grinding in a ball mill and sieving in an Axial sieve developed in the Plant Laboratory of the Universidad Tecnológica del Sureste de Veracruz, it is intended to commercialize it with companies in the field, such as: MADISA, whose purpose is to apply it in production, elaboration and manufacture of amber containers, whether medicinal or beer containers (Retsch,2012).

Ingeniería, Procesos, Prototipos

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† Researcher contributing as first author.

Introduction

This research project describes the methodology of unit grinding and mallet operations, as India Moreno, E. G, (2001). He mentions that the operation and graphic interpretation of the characterization of the grinding and sieving of silica sand, used in various applications of Chemical Engineering, Despite the situation of the pandemic, controlled research is still being carried out at the facilities of the Technological University In the Chemical plants laboratory, silica sand is selected due to its applications, in addition to that it was donated by the MADISA company, based on these conditions it is decided to use the prototypes already previously designed in previous years and proceed to operate them to give a report of the results of this project, from a ball mill and an axial type sieve, its control system allows the user to modify variables such as time, adjust it according to their needs, which is a functional prototype to screen and characterize particle diameters.

It is important because it allows to characterize solids and calculate the efficiency of the dry milling of raw materials

Description of the design method and characterization methodology

Selection of raw material

In the first instance, according to Perry & Green (2012), the decision is made to select the raw material, considering the design conditions of our prototype and the availability of the raw material. It has a hardness of 7 on the Mohs scale; specific gravity of 2.65; refractive index of 1,548, lacks obvious exfoliation; It has pyroelectric and piezoelectric properties, being found naturally as silica rocks in clay sand mounds, according to these conditions, the raw material is ground in the ball mill and corroborated that the equipment does silicon rock due to hardness. As indicated in fig. 1

Figure 1 Illustration of the crushing and grinding of silicon rock
Source: (Own elaboration, 2021)

The silica stone is crushed and grinded for 30 min in the ball mill, with a hardness of 7 on the Mosh scale, as indicated in Figure 1, then the screening is carried out on the Axial sieve for 15 min, as indicated in Figure 2, designed in the plant laboratory of the Universidad Tecnológica del Sureste de Veracruz.

Figure 2 Axial Sieve
Source (Own elaboration, 2021)

The operation of the sieve is essential for the screening of the raw material, according to Smith, (2007), he mentions that it is more efficient with horizontal movement, it is much more efficient than vertical shaking movement, Axial in 15 min automatically on the control panel display, it is programmed and the start and stop cycle, programmed in the ARDUINO, is fulfilled.

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We proceed to record the weights of the Silica sand, of each of the sieves, placed from larger to smaller particle diameter, to later record the data in tables and corresponding graphs in Microsoft Excel, as indicated in Figure 3.

Figura 3 Tyler Sieves
Source (Own elaboration, 2021)

Tyler sieves are ordered from largest to smallest diameter, coarse solids to fine solids from largest to smallest particle diameter in (mm or in). The sieves are arranged vertically, and the mesh is developed before and after crushing and grinding in the ball mill. It is preferable to carry out a sieving prior to grinding to know the conditions and the graphic behavior of the raw material, this allows to know in which% the silica rock enters and to know the% of fine solids according to the client's specifications and the data sheets. techniques of silica sand as a product (Santos Carpio J.C., 2021).

When consulting Perry (2012), we set ourselves the task of carrying out a methodology of the sequence of operation of the process.

Analysis of the method and programming of the prototype

Milling and sieving operation methodology

Figure 4 Feeding the raw materia, Ball mill
Source: (Own elaboration, 2021)

a) The raw material, previously weighed (1000 grs) together with the balls, is introduced for grinding in ranges of 10 and 15 min, in the mill, as indicated in fig. Four.

b) The raw material is removed together with the balls and fig. 4

c) Once the sample is collected, it is introduced to the axial sieve to develop the Malleo, as indicated in fig. 5

Figure 5 Axial Sieve
Source: (Own elaboration, 2021)

d) Subsequently, the sieving is started in ranges of 1 min, 5 min according to the operation and specification needs.

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Figure 6 Display, screen of the Axial sieve module
Source (Own elaboration, 2021).

Results of the analysis of the method and programming of the prototype

Characterization of the silica sand

For the purposes of characterizing the raw material, we took on the task of collecting data from the Laboratory of grinding and sieving in an operation mode of 15 min of grinding and 10 min of sieving, below, the results table is indicated of the granulometric analysis.

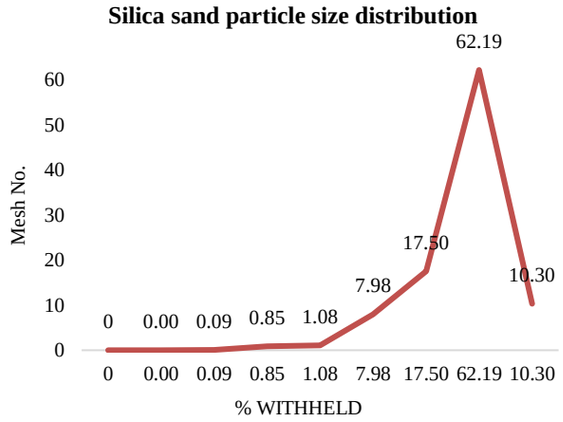
In table 1 it can be observed in an experimental way that the highest% retained is found in mesh 8, with 62.19%, which indicates that it is the product obtained, its granulometry favors since it represents 37.81% of passing solids However, efficiency can be improved by developing N characterizations, until the specification of either the supplier or the customer is met and from the point of view of the investigation of the solid being analyzed. Whether they are zeolites, calcium carbonates, concretes, aggregates, limestone, marble, silicon sands etc. (Chryssis, 1989).

Mesh No.	D (mm)	Mesh weight (gr)	Sample weight (gr)	Fraction	% Retained	% of interns
8	2.36	449.6	0	0	0	100
14	1.4	446.3	0	0	0.00	100
30	600um	437.8	0.9	0.00090	0.09	99.91
40	425um	432.5	8.5	0.00850	0.85	99.15
50	300um	362.6	10.8	0.01080	1.08	98.92
60	250um	380.4	79.81	0.07981	7.98	92.02
70	212um	378	175.01	0.17502	17.50	82.50
80	180um	379.3	621.89	0.62194	62.19	37.81
200	75um	347	103	0.10300	10.30	89.70
0		0				
CHAROLA		400	999.91	1.00	100.00	

Table 1 Characterization of silica sand
Source: (Own elaboration, 2021)

Representation and graphic interpretation of silica sand

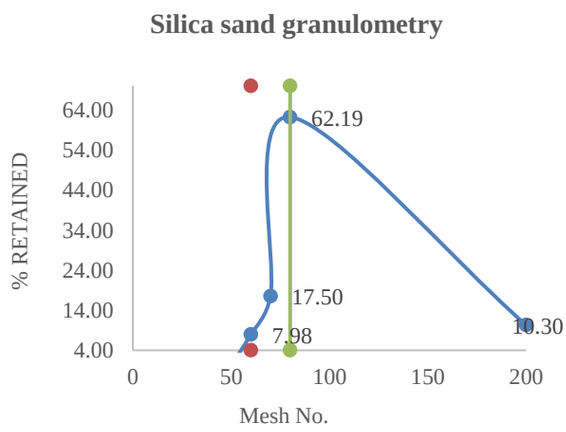
From the data in Table 1, collected from the laboratory, we proceed to develop the particle distribution of the product, the granulometry with respect to the% retained and the granulometry with respect to the sieve opening. Next, the representation of graphic 1, graphic 2 and graphic 3 is indicated.



Graphic 1 *Product distribution*
Source (Own elaboration, 2021)

As can be seen in graphic 1, it is observed that the product is obtained in the 80 mesh, with 62. 19% of retained solids. For study purposes this raw material, we indicate that the corresponding particle diameter is 180 µm.

In the same way with the data obtained in the laboratory, from the table 1, we develop the corresponding granulometry, to confirm the size of the product that is being characterized based on the No. of mesh with respect to the% retained, obtaining Graphic 2.



Graphic 2 *Granulometry of the product*
Source: (Own elaboration, 2021)

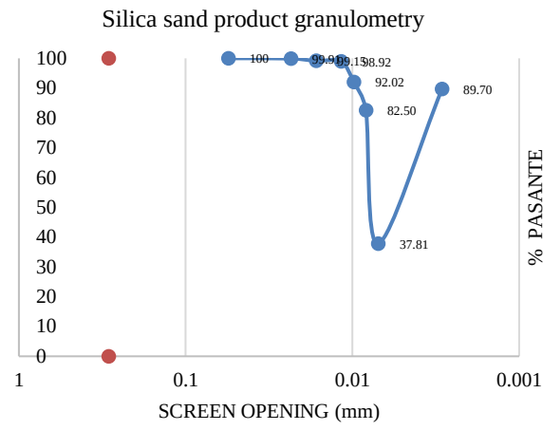
Indeed, it is corroborated and verified that indeed the 80 mesh is the product obtained, according to the literature Perry (2012), silicas are raw materials that are applied in the chemical industry, for the production of Amber colored containers in medicines, in beers and in chemical reagents, of which the blocking of light is necessary since these substances are hygroscopic.

In the same way, from the experimental table, table No. 1, the opening of the sieve of our product is elaborated and analyzed with respect to the% passing, that is, the% that passes through each sieve, according to the particle diameter of silica sand, obtaining 37.81% of solids passing through the 80 mesh. With this, the experiment and the graphical representations of the characterization are concluded.

Without a doubt, this analysis is of great importance for the glass processing industry in its different presentations and applications. (Tapia medina, 2021).

The ball mill and the sieve used in this research for the purposes of writing and publishing this article are functional for the purposes for which they were created, for the investigation and characterization of solids by dry method, with hardness on a scale of Mosh, for soft materials from 0 to 3, with operation up to 60 min of operation of the ball mill with 30 min of rest and with sieving of 5, 10, 15 min according to the needs of the project and research, it should be clarified that the sieve, according to its programming in ARDUINO, in seconds, which works every minute, allowing the restart at the end of the count at 60 seconds of operation. (Mohan & Robbins, 2003).

From the data in table 1, we obtain the% of solids that pass through the sieve opening, as indicated in the graphic 3



Graphic 3 Sieve opening vs% passing
Source: (Own elaboration, 2020)

This efficiency represents 62.19% in an operation time of 15 min of grinding and 10 min of sieving. With 37.81% of solids passing through.

Results

According to Retsch (2012), a laboratory test was developed. Next, the results obtained from the particle distribution of silica sand in a 15 min grinding operation. Where the weight of sample A, fraction A and% Retained A, represents the raw material before being crushed and / or ground by a ball mill and the weight of sample B, fraction B and% Retained B, represents the finished and sieved product, by this prototype, of this research work (Perry, 2012)

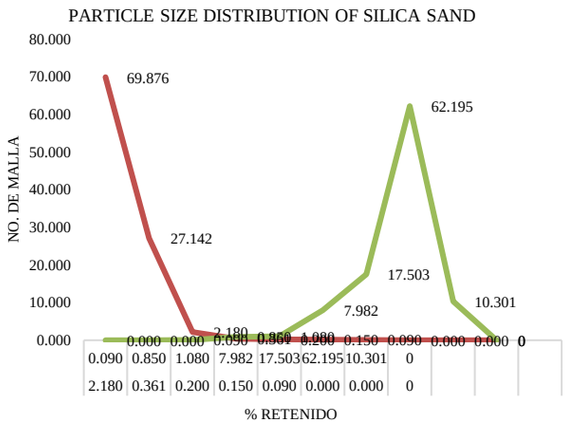
Next, it is indicated in table 2. The laboratory analysis of the distribution of the grinding particle and sieving of the silica sand and in graph 3, the graphic interpretation is observed, obtaining an efficiency of 62.19% of grinding, as product in mesh No. 80 according to the specification of the characterization of silica sand.

Malla	Fracc. A	Fracc. B	% Retenido A	% Retenido B	%Pasante A	%Pasante B
8	0.699	0.00	69.876	0.00	30.12	100.0
14	0.271	0.00	27.142	0.00	72.85	100.0
30	0.022	0.00	2.180	0.09	97.82	99.91
40	0.004	0.00	0.361	0.85	99.63	99.15
50	0.002	0.01	0.200	1.08	99.80	98.92
60	0.002	0.08	0.150	7.98	99.85	92.01
70	0.001	0.17	0.090	17.50	99.91	82.49
80	0.000	0.62	0.000	62.19	100.0	37.80
200	0.000	0.10	0.000	10.30	100.0	89.69

Table 2 Characterization before and after grinding and sieving of silica sand
Source: (Own elaboration, 2021)

Figure 7 Results of sieving in mesh 80
Source (own elaboration, 2021)

The following figure represents the product obtained in mesh No. 80 of the characterization of the silica sand, as a result of the characterization of the silica sand.



Graphic 4 Product obtained in mesh No. 80
Source (Own elaboration, 2021)

Observations

1. After operating the axial strainer for more than one hour, allow 20 minutes so that the motor does not overheat.

2. Press the buttons well, since being a capacitive screen it will not respond correctly if it is not pressed correctly.

3. Operate the ball mill for a maximum of 60 min, let it rest for 30 min, preferably work in less time, to avoid overheating of the motor and the belts.

Suggestions

1. Maintain the mechanical system of the sieve once a year.

2. Lubricate the rods, rails and the mechanical system of the sieve, preferably monthly.

3. When it is required and there is wear of the neoprene coating of the ball mill on its external part, it is advisable to change it, to avoid overheating in the balls.

4. When there is a need and there is deterioration in the bands, it is preferable to change them.

Appreciation

This project was financed by the Technological University of the southeast of Veracruz, by the Rectory, managers and the finance department, who work as a team, to improve the quality of the institution, it would not be possible without the workforce of students of the Chemistry Engineering career to carry out laboratory tests and characterizations of the raw materials under study, for the interpretation of the results and the writing of this article.

Conclusions

This project is functional for the purposes for which it was proposed, however, it can have continuous improvement, to have higher performance in terms of the pretreatment of solid raw materials, not only for the University laboratories, even for the Industry chemistry, it is advisable to improve the time per material, in order to obtain a specific pattern which can help you when looking for a granulometric analysis.
As we now know there are improvements and innovations in control, which are coming to the market in the field of technology that provides instruments, which help us in our daily or specific activities, that is why we seek to make the grinding process more efficient and sieving, from the automated control of the same, with a low economic cost for the purposes and specifications according to the need in the investigation.

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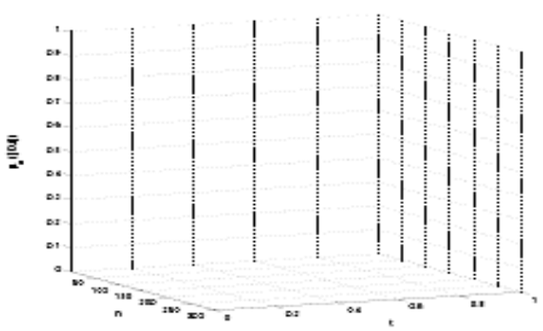

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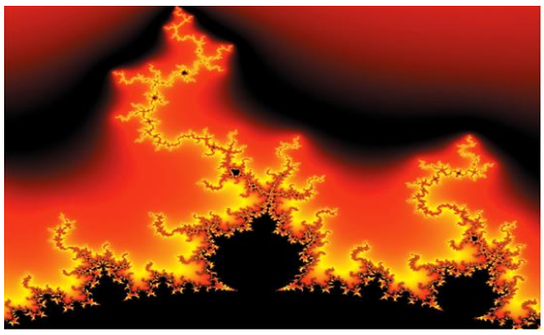

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