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Innovation as a Competitive Advantage for Public Universities Managed through Innovation Parks. The Specific Case of the Technological Innovation Park of the Universidad Autónoma De Sinaloa

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ABSTRACT : Sinaloa is not far from other Mexican states where the relationship between industry, university and government does not converge on the same axis that leads to regional development to place the state in the first places in terms of competitiveness in technological development. In this state, the main activity has focused on primary production within the agricultural sector and not on innovation that generates high value-added products. Scientific production and its impact on regional competitiveness were evaluated when it is linked through the management model of the Technological Innovation Park of the Autonomous University of Sinaloa. Some of the results indicate that the PIT-UAS has a high potential to promote growth and economic development through the link between Higher Education Institutions and companies, whether they are established organizations, technology-based or Spin-off, as well as to promote academic and inter-academic production through publications and dissemination in high-impact magazines, congresses, symposia, and other activities that allow the dissemination of knowledge, all this through government incentives that promote and support said activities.

Keywords: Triple Helix, Competitiveness, Innovation, Innovation Park, Inter-academic cooperation.

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1. INTRODUCTION

The role of Higher Education Institutions (HEIs) is essential to promote innovation, in coordination with other sectors such as the private sector and the State itself, since they seek the development of the community in which they develop and, therefore, together, they can promote rapid economic development in the region in which they operate.

Leydesdorff (2001) [1] points out that innovation can be considered as an example of interaction; Likewise, Etzkowitz (2003) [2] points out that, in recent decades, business projects that involve academia, universities or research centers have been increasing. In turn, universities are more related to research projects that include knowledge transfer, economic returns and changes in university culture and increase the interaction between the university and its environment.

Having said the above, one of the most widely used forms currently in developed countries to generate innovation within the university and transmit it to society is the creation of Spin-off companies, Technology Parks and incubators, with the purpose of establishing real collaborative actions that allow meeting the needs of society and universities (Morales Rubiano, Pineda Márquez and Ávila Martínez, 2012) [3].

Within this scenario, the figures of the Science and Technology Parks, have emerged as spaces of convergence between the problem and the response of the actors involved, who see the need to have instruments that generate tools so that society and companies are more competitive within their environment, that is, so that all actors of the Triple Helix benefit from the generation of knowledge.

Etzkowitz and Leydesdorff (1995) [4] say that the Triple Helix is an alternation between the spheres that make up this model (university, industry and government), and they emphasize that the relationships between them remain in transition, since each of the members seeks to develop their own mission. One of the main contributions of this model is to be able to be used for the development of technologies, technology transfer and incubation of new companies.

That said, the International Association of Science Parks (IASP, 2009) [5] conceives a technology park as a geographical concentration of companies, research centers, universities and service providers, among other economic actors, that make intensive use of knowledge and technology and engage in productive activities linked to each other.

Thanks to the collaboration of universities, companies, military organizations, venture capital entities and even government departments, it was possible to create a business, social and research fabric that allowed a rapid techno-scientific advance for decades in Silicon Valley, to which the Science Parks and technological ones link their experience as an immediate antecedent (Ondátegui Rubio, 2001) [6].

Thus, with the aim of analyzing the impact factors that trigger research and innovation in Higher Education Institutions, this research work seeks to analyze the innovation and competitiveness generated through the Technological Innovation Park of the Universidad Autónoma de Sinaloa (PIT-UAS) and its impact on the development of applied research at this university. This is supported by different sources that speak about the importance of collaborative work to boost competitiveness between regions and affirm that, according to the results found, these Parks can generate high benefits in a short time.

Having said the above, the statement of the problem for the present investigation is immediately exposed, which describes the context of the problem that this study tries to solve.

Statement of the problem and justification

The constant changes in the world and the opening of global markets make innovation necessary. For this to take place, it is necessary to establish or form areas that create an environment. According to the Frascati Manual (2002) [7], innovation is understood as "the transformation of an idea into a marketable product or service, a new or improved operational manufacturing or distribution procedure, or a new method of providing a social service" (p. 33).

This innovation can come from areas within companies, or from alliances between private institutions and academia. It is this last collaboration mechanism where the particular interest for this research lies, since the cooperation between the Company and the Institution of Higher Education leads to a more conducive technological innovation and to accelerate learning, bringing with it the improvement of processes at inside the company. In addition, the research focuses on the supply and demand directed to companies to stimulate their operation by creating an environment that supports decent livelihoods for local communities to improve their economic development (Porter, 2000)[8].

In Mexico, the link between the productive sectors has been a task that has taken on a recent boom among Higher Education Institutions, being understood as the fourth mission within their policies and development plans. As a result, there are Universities and Research Centers at the national level that have managed to form strategic alliances of great significance for the local and regional development of their spheres of influence.

However, in the national scenario there is still a gap between the university, business and government, which is reflected in the disaggregated efforts to solve similar problems. For this reason, the generation of alliances that allow increasing the productivity of companies through innovation, which have a favorable impact on the competitiveness of the region, is relevant.

Sinaloa is not far from other Mexican states where the relationship between industry, university and government does not converge on the same axis that leads to regional development to place the state in the first places in terms of competitiveness in technological development. In this state, the main activity has focused on primary production within the agricultural sector and not on innovation that generates high value-added products.

This research focuses on the situation in the Autonomous University of Sinaloa and its role in the innovation processes in the state through the Technological Innovation Park, since there is a lack of deep and systematic studies on these issues. The University can be an element that stimulates research, development and innovation activities, through the research units it has, but the limited relationships between the actors give rise to stagnation in the innovation processes in the region. Consequently, it is important to determine the attributes or characteristics of each of the actors and the relationships found from the university in order to know if they are appropriate to be integrated into the consolidation of the innovation process. Next, the systematization of the research carried out is presented in figure 1, in which the questions, objectives and hypotheses of the study carried out are observed.

Questions	Objetives	Hipotesis
<u>Central question</u> What is the level of impact on regional competitiveness when the scientific productivity of the Autonomous University of Sinaloa is generated and linked through the management model of its Technological Innovation Park? <u>Specific questions</u> What are the incentives for innovation with the generation of knowledge and high-level training in Sinaloa? How is the creation of new companies promoted with the link for development and entrepreneurial training in Sinaloa? What is the level of contribution	<u>Overall objective</u> Evaluate scientific production and its impact on regional competitiveness when it is linked through the management model of the Technological Innovation Park of the Autonomous University of Sinaloa. <u>Specific objectives</u> Define and determine the promotion of the creation of new companies with the link for development and entrepreneurial training in Sinaloa. Identify incentives for innovation based on the generation of knowledge and high-level training in Sinaloa.	Scientific productivity has a positive impact on regional competitiveness when it is generated and linked through the management model of the Technological Innovation Park.

to the development of the environment with the generation of knowledge and high-level training in Sinaloa?	Quantify the level of contribution to the development of the environment with the generation of knowledge and high-level training in Sinaloa.	

Figure 1. Systematization of the research

2. THEORETICAL FRAMEWORK

2.1. Competitiveness

Competitiveness is a key concept for the analysis of economic growth in the new global environment. Competitiveness involves companies or branches and industrial sectors, but on a broader level, also countries or economic regions and defines, ultimately, the standard of living of societies. However, the truth is that competitiveness is a concept that admits multiple approaches, which generates differences in terms of its interpretation, understanding and measurement (López, Méndez & Tacero, 2009) [9].

Thus, it is said that competitiveness refers to a specific physical area and is closely related to the economic concept of productivity, in the sense that a higher performance of natural resources, labor and capital is an indispensable condition to achieve that a country or region increase their competitiveness.

In the Institute for management development (IMD) [10], the figures are classified into four factors: 1) Economic performance, 2) Government efficiency, 3) Business efficiency, 4) Infrastructure. In the World Economic Forum (WEF), the data is classified into 12 factors without additional classifications (Benzaquen et al., 2010) [11]. The objective of the WEF and IMD indices is to classify countries in terms of their business climate, using a significant number of attributes condensed into a single index.

Thus, being competitiveness a key factor for the present study, it is important to highlight more specific aspects of it, which are of vital importance for the explicitness of the research and are presented in a summarized way in Figure 2.

Competitiveness	Definition
Regional	The ability of an economy to generate and maintain a favorable environment for the creation of value and the promotion of development (Porter, 1998) [12].
Sistemic	It is identified with the export capacity of an economy: "competitiveness is the capacity of a country, a sector or a particular company to participate in foreign markets" (Feenstra, 1989) [13].
Business	It refers to the ability to provide products and services more effectively and efficiently than its competitors.
Of nations (Porter)	The competitive strategy is the one that establishes the success or failure of companies, becoming an indicator to measure the ability of a company to compete against the market of its commercial rivals. In addition, it argues that competitive companies make competitive regions, therefore, nations with this characteristic also result in countries with greater wealth for their inhabitants and greater well-being in general (Cabrera et al., 2011) [14]. The competitiveness diamond is one of Porter's greatest contributions.

2.2. Intelligent organizations

It is considered imperative to introduce the topic of intelligent organizations, given the nature of the case study organization (PIT-UAS), since it begins with systemic thinking, which is responsible for finding the point where actions and modifications can lead to significant improvements and long-lasting changes produced by well-localized changes, made in the right place. For this reason, companies that offer services, or have carried out transformations in their distribution and customer service systems, or are in the process of carrying out such transformations. Senge (1990, cited in León, Heberth & Yataco, 2003) [15] suggests that the organization is an open system where the behavior of the members is interrelated, thus systemic thinking crosses contingency theory and the strategic literature of recent years, making Senge an heir to these currents.

Senge (2005, cited in Becerra & Sánchez, 2009) [16] points out that in order to transform organizations and they succeed in the market, they must become intelligent organizations, where people learn to train together and expand their attitude to create the desired results. Learning requires own skills, it is not just a way to increase skills and capacity for action (Becerra & Sánchez, 2009) [16]. Under the same order of ideas, in the Gopal and Gagnon (1995) model, tacit knowledge (individual and intuitive) is transformed into explicit (formal and systematic) and is divided into three areas: 1) knowledge management, which constitutes an encounter or discovery of the intellectual capital of the organization; 2) information management, which is the consolidation of information as the basis of knowledge and 3) learning management, which closes the cycle of transformation of tacit knowledge into explicit by establishing proposals and learning prototypes (Nieves and León, 2001) [17].

2.3. Innovation models and Triple Helix

Innovation is a synonym for change, as described by Escorsa and Valls (2003) [18]. A company that innovates means that it is changing, evolving and offering new products and / or services, or in turn, adopting new manufacturing processes. These authors point out three fundamental aspects of innovation in a company:

1) Technological progress, which refers to the appearance of new products over time, which offer better quality or benefits;
2) The internationalization of the economy, based on a globalized world, since there will be more and more competition, even from unsuspected countries,
3) Demassification of markets, which indicates that, even in a globalized world, there is a tendency to manufacture personalized products that are directed to specific markets.

In addition to the various definitions that exist of innovation, and the implications that it contains, an aspect that is of great interest to know is that of discovering the way in which the innovation process is carried out. That is, the phases through which companies carry out their innovation developments. To examine the stages that arise in the innovative process in organizations, different researchers have provided a series of models that explain and allow visualizing the routes and phases involved in it. For this reason it is of interest to analyze the different visions that have evolved over the last decades, through the exposition of the most scientifically recognized models: Technology push model (Rothwell, 1994) [20], Mixed innovation model (Rothwell and Zegveld, 1985) [19], Model of the demand pull or market push (Rothwell, 1994) [20], Model by departmental stages (Sarem, 1984) [21], Model of technological innovation (Marquis, 1969) [22], Model of technological innovation (Kline, 1985) [23], Integrated Model (Rothwell, 1994) [20], Network Model (Rothwell, 1994) [20], London Business School Model (Chiesa, Coughlan and Voss, 1996) [24].

From the previous models, it is possible to better understand innovation, and the concepts that comprise it. The model that most closely resembles or could be used in this research project is the integrated one, presented by Rothwell (1994) [20], since it contemplates basic research or the idea, in which it integrates Universities and State agencies, which it makes the development and launch of the product or service faster. However, most of the explanatory models of the innovative process, studied to date, have turned out to be unable to capture the full complexity of the innovative reality. As advances have been made in understanding the development of innovation, new increasingly sophisticated prototypes have emerged. At present, the models coexist in their different forms (King & Anderson, 2003) [25].

2.3.1. Triple Helix

This study analyzes the interaction between the State, University and Company with the model of Etzkowitz and Leydesdorff (1995) [4], which proposes that the actions of the University promote the creation of knowledge, since it plays a fundamental role between the company and the government and in how these are developed to create innovation in organizations as sources of knowledge creation. This model is an intellectual process aimed at visualizing the evolution of relations between university-society and, on the other hand, characterized by the intervention of the university in economic and social processes.

The model allows a link between disciplines and knowledge, where the university has a strategic role and is the basis for generating relationships with the company. The development of these relationships has been widely discussed in different types of research that seek to develop the corresponding actions between government, company, university. The model proposed by Etzkowitz and Leydesdorff (2000) [26] proposes a gradual decrease in the differences between disciplines and different types of knowledge, as well as between the different instances related to the link between the university, the company and the government, allowing analysis from the particular optics of each case, in pairs or in an integral way. One of the objectives of the Triple Helix is the search for a model that reflects the complexity of the bonding concept, taking into account the environment in which the relationships between bonding agents are based. Based on the above, it can be argued that universities can use the Triple Helix model to make alliances or establish more solid contacts with the government and industry sectors. This would help them in the creation of university spin-off companies, a way to innovate products, services or processes, which would provide them with greater development opportunities.

2.4. Conceptual framework

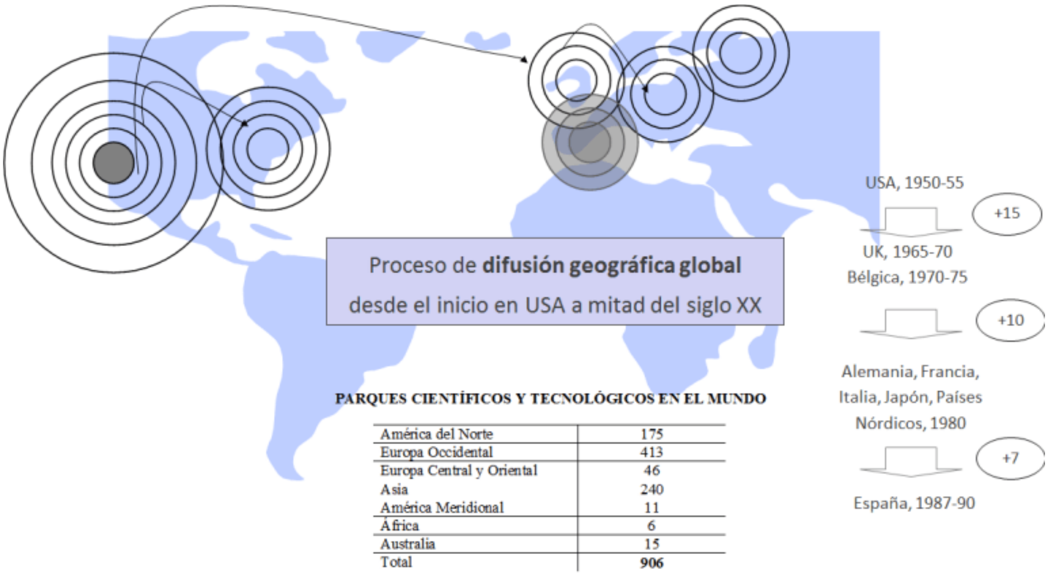
Scientific and technological parks, means of innovation, and new industrial spaces or Technopolis are spaces organized under a certain entity or legal structure in order to create an area that integrates science and technology, relates to the different agents of the knowledge system and of place to the "alliance" or the convergence in the "multidisciplinary encounter" that provokes and develops this space. The mission of all this is to generate new knowledge and transfer it together with technology to society for the creation and development of innovation. These Parks concentrate knowledge and invest in R&D, equipping them with equipment, infrastructures and techno-scientific platforms. They build a critical mass, with the integration and cooperation of research groups, scientific centers, laboratories and business R&D centers, etc., with the common objective of creating in this innovation space (Bueno Campos, 2006) [27].

Put in another way, a technology park is a physical space with an infrastructure necessary for the creation of technology-based companies and research centers, both public and private, in order to facilitate the carrying out of research and development activities (R&D) (Romera Lubias, 2011) [28].

According to a study by the Este País Foundation (2009) [29], the creation of Industrial Parks and, more recently, Technology Parks is based on the geographic concentration of organizations in places where they share access to basic goods and services, and can establish links and coordinate to carry out their productive activities, reduces costs and represents a favorable strategy to increase productivity and create jobs.

2.4.1. Success stories

The success story that has resonated the most in the world since its inception and that has been replicated throughout the planet due to its overwhelming fame and innovative developments, patents, etc. is the "Silicon Valley", better known as Silicon Valley , Figure 3 proposed by Soncin (1999) [30] shows the innovation parks that have emerged from it and that have put innovation as an example of promoting the economic development of the regions in which they are located.



América del Norte	175
Europa Occidental	413
Europa Central y Oriental	46
Asia	240
América Meridional	11
África	6
Australia	15
Total	**906**

Figure 3. R&D, technological innovation and development of the territory

3. RESEARCH METHODS

The present study was carried out during the period 2017-2020 and allowed observing different events that occurred in the PIT-UAS, the qualities of the object of study, as well as the differences and areas of opportunity in terms of its productivity. It is a social type of research, inquiring about a problem that impacts the environment in which it operates. Said study was carried out from the field study in different academic units and faculties of the city of Culiacán, Sinaloa. The behavior of its teachers and academics, their scientific production and their contributions to the university and possible strategic alliances with other higher education institutions were observed.

For practical purposes, this research was developed in seven phases, which are developed in Figure 4.

Fhase	Description
1	A bibliometric study was carried out in the Conricyt databases, more specifically, in the Thompson Reuters, Web of Science and Elsevier Scopus publishers, as well as Google Schoolar on topics related to Innovation Parks and universities. The main government pages were also used, such as the websites of the Ministry of Economy, the National and State Development Plan, and the Institutional Development Plan of the Autonomous University of Sinaloa, among other official sources.
2	The current model of the PIT-UAS was studied and to do this, a SWOT analysis was carried out with respect to the current model of it through observation, in addition, information was collected with the PIT staff to know the operation of the park. A survey was also carried out among the academics who have collaborated in the park to find out their availability of multidisciplinary cooperation, as well as the tool developed by Dr. Zóchitl Araiza Garza (2007, cited in Araiza Garza, Velarde López, y Chávez Rangel, 2014) [31], a structured questionnaire to measure inter-company cooperation.
3	Internal indicators were reviewed and analyzed, for which an internal diagnosis was carried out in the organization in order to detect areas of opportunity. This was carried out through a production analysis of the PIT, satisfaction surveys, field observation, obtaining data on academic productivity, as well as making a comparison with the international standards that the PIT-UAS implements.
4	External indicators were reviewed and analyzed following the triple helix model, for which an internet search of government institutions with participation in innovation such as CONACYT, and the State Development Plan (PED) [32] Sinaloa 2017-2021 was carried out to know the number of programs enrolled in the National Quality Postgraduate Program (PNPC) and review the strategic axis regarding economic development in relation to science, technology and innovation, the website of the PIT-UAS was also reviewed, in addition to the observations in the visits to PIT-UAS facilities.
5	Relevant indicators of systemic competitiveness were sought, for this purpose the website of the

	World Economic Forum was visited, as well as other relevant magazines on economic issues such as El Economista (2018, 2018b) [33] [34] and El Universal [35] and also the Foro Consultivo Científico y Tecnológico A.C. (FCCYT, 2014) [36].
6	Indicators that measure business competitiveness were searched; for this, the report resulting from the second review of the CEPAL conference on science, innovation and STI (2016) [37] was reviewed to find the data of the aforementioned indicators and the report was taken as support prepared by the technical team of the activities of the Network of Science and Technology Indicators (RICYT), Iberoamerican and Interamerican led by Albornoz and Barrere (2018) [38].
7	An improvement proposal was made in the areas of opportunity of the same so that the organization produces better results in terms of productivity and its model can be replicated in other Institutions of Higher Education in the field of Science, Technology and Innovation, it will allow the organization meets its short and long-term goals in a timely manner and even streamlines them, which will empower the PIT-UAS to improve its global indicators and serve as an example or know-how for other HEIs interested in scientific productivity and STI.

Figure 4. Phases or the research method

4. RESULTS

In the first phase, the bibliometric study on the topics of Innovation Parks and universities yielded more than 150 results between articles, editorial material and book chapters, among others, during the period 2010-2019. No specific theory was found on the subject of Innovation Parks and universities, but several studies were found in different areas. In the second phase, it was obtained that the UAS Technological Innovation Park has an instrument that reveals the steps and guidelines required for administrative support in the planning, monitoring and closing of Applied Research Projects (PIA, figure 5) of the institution, which is applicable to the institution when providing human and technical resources. The PIA process contains the stages of defining the scope, formalization, follow-up and closing of the PIA depending on the requests of the applicant and according to the stages programmed in the specific agreements, thus achieving user satisfaction.

Returning to what was raised in the methodological part within this phase, it is necessary to point out the SWOT analysis, which is developed in Figure 6.

	Strenghts	**Weaknesses**
Internal factors	Analyzing the different capacities that the PIT-UAS has, it was found that it is a well-defined organizational unit (U.O.). Their areas are linked in order to meet a common goal, always taking their commitment into account and providing the best performance and productivity at all times to meet the established goals. In addition, it has specialized personnel in most areas of the U.O., to whom it provides the equipment and tools suitable for their areas of expertise and knowledge.	There are different factors that can cause deficiency within the PIT-UAS. Among the most relevant is the lack of specialized personnel in certain areas of the unit, which also influences the solution of requests by other departments. This causes an excess of pending tasks that delay the completion of some projects. It has certain obsolete technological equipment, in addition to the lack of continuous maintenance thereof to extend its useful life.
	Oportunities	**Threats**

External factors	The factors that are related to the improvement of the U.O. they are based especially on the link with other units and clients, in order to generate different attractive and innovative projects, in addition to the diffusion and communication within the PIT-UAS to attract potential clients. Constant training of staff is key to keeping them updated and prepared for new projects.	There are situations that can cause future danger in this organization. Among the most relevant are changes in the government, not having the support of the government and other associations, which would seriously affect the operation and implementation of profitable projects for society. Competition from other universities and organizational units of the same line of business that excel in technology-related projects and activities reduces the level of potential clients. Not having contingency plans is a great threat, since this causes the projects not to be delivered on time.

Figure 6. SWOT analysis of the PIT-UAS

Now, continuing with phase 2 and as described in the methodology, an adapted version of the questionnaire prepared by Dr. Zóchitl Araiza Garza (2007) was used to measure the level of inter-academic cooperation of the PIT-UAS, finding that, the 44 academics surveyed, whose ages vary between 23 and 63 years, with an average age of 40 years, 13 are women, represented by 29.5%, and 31 men with a percentage of 68.2%. It was also found that the age that is repeated the most (6 times) is 33 years, corresponding to 13.13% of the researchers.

According to the questions referring to the needs that prompted the faculty of academics in order to establish a cooperation activity with other faculties or companies, there is an average of 3,895 among the 16 questions answered.

Table 1 Cooperation needs

Cooperation needs	Media	Mínimum	Máximum	Valid
Total	3.895	3.351	4.432	37

Taking into account the indicators with an average greater than 4, the most relevant needs towards cooperation with other faculties or companies are to increase the academic offer, complement part of their academic processes, improve the quality of their processes (admissions, hiring of teaching staff, study plans), decrease time in technological development and innovation, develop technological capabilities and carry out training and orientation courses for faculty staff. Once the cooperation needs had been reviewed, the second part of the questionnaire was analyzed to find out how inter-academic cooperation is rated. Table 2 shows the level of importance assigned by academics to the inter-academic cooperation index, on a scale from 1 to 5, where 5 is of greater relevance. The total mean is 3,434, which means that in general the level of importance assigned by academics to inter-academic cooperation is at an average level. However, of the four types, the one they consider most important is that of cooperation to innovate.

Table 2 Inter-academic cooperation

Types of cooperation	Media	Minimum	Máximum	Valid
Cooperation to Produce	3.410	2.613	4.194	31
Cooperation to Innovate	3.724	3.161	4.000	31
Market Cooperation	3.176	2.577	3.846	26
Cooperation to Manage	3.410	2.621	4.034	29
Total	3.434	2.520	4.200	25

In summary, academics believe that inter-academic relationships in general are necessary for the proper functioning of academic productivity, through better communication between HEIs and their faculties. In this way, it will be possible to improve the academic offer and its processes in terms of study plans, hiring of teachers, etc. Likewise, a significant decrease would be achieved in the time it takes for technological development and innovation, which, according to the researchers surveyed, is the most important index of inter-academic cooperation.

In the third phase, the different results were found from academic production to business, industrial design, models and projects managed and awarded, as well as the resources obtained and participation in external calls, among other indicators, which demonstrate the diversification of the Park and the importance of this in an Institution such as the UAS. It should be noted that the reduction in the decline in the productivity of the park and the zero resource obtained in 2019 and 2020 was mainly due to the change of the government in turn and the quarantine situation that has existed since the beginning of the current year.

Now, in terms of field observation, it was found that this institution has several technological projects such as: electronic prototypes, design and modeling, artificial intelligence, 3D printing, renewable energies, to name a few, which need resources and materials. for its development and operation. This leads to identifying the needs for both material and financial resources to carry out the activities that generate the proposals of the research projects, as well as the constant training of the personnel related to these projects. In relation to this external audit, it was found that there is documentation that still does not meet the updated regulations of the ISO 9001: 2015 standard, and others are already in that process. Therefore, those responsible and operational for this process still need the necessary training, along with what was mentioned in the previous paragraph, to improve the PIT's management system and processes. This external audit is carried out every year to analyze that the accredited process is being followed, reviewing and observing faults if they exist.

In the fourth phase, it was found that the Sinaloa Innovation Agenda adheres to the regional development policies promoted by CONACYT, aligned with the objectives of the Special Science, Technology and Innovation Program (PECITI). In this way, Sinaloa proposes four components to boost the economy through the knowledge society, which are: increase the physical infrastructure, develop capacities for the generation of knowledge, generate talent and develop capacities for entrepreneurship (CONACYT, 2015) [39].

It is worth mentioning that, in the state, the members of the Council for the Economic Development of Sinaloa (CODESIN) have expressed the importance of incorporating science, technology and innovation in the region to be more productive with the integration of the quadruple helix at the moment to make decisions. Thus, the Innovation Agenda is being taken into account to achieve the R&D objectives towards the year 2035, related to strategic projects and public policies that concern the economic growth of Sinaloa (CONACYT, 2015) [39]. In national investment in Science and Technology, it is estimated that developed countries allocate between 1.5 and 3.8% of their GDP to the GIDE. However, in Mexico, the value of this indicator has been constant for years without exceeding 0.5% of the value of its GDP. In 2014, the GIDE in Mexico represented 0.54%, when other countries, such as Korea and Japan, allocated 3.58 and 4.29%, respectively, in the same year (PED, 2017). At the state level, Sinaloa invested in 2011 the equivalent of 0.01% of GDP applied to Private Spending on Scientific Research and Experimental Development (IDE), occupying position 24 at the national level (CONACYT, 2014) [40]. In Mexico, support for Technology Based Enterprises (EBT) is given through the National Entrepreneur Week, which is organized annually by the Ministry of Economy and the National Entrepreneur Institute. It is an event suitable for entrepreneurs and businessmen; is an effort to encourage scientific-technological applications in new businesses, where the essence of EBT is complemented by means of the recently implemented Ecosystem of Innovation, oriented to processes, so that this type of companies can be created in less time and with a zero cost (PIT-UAS, 2017) [41].

For its part, in Sinaloa and more precisely in the PIT-UAS, about 60 technology-based companies have been linked and incubated, of which a record has been kept since the institution began its management in 2014. It should be noted that it does not It is the only function of the Park, since industrial design is also carried out, trademarks and patents are registered, resources are obtained for projects, and external calls are attended, among others that will be mentioned later. In this way, it is necessary to highlight the support of the specialized personnel that the PIT has, such as the researchers who provide their services to the Park with specialized consultancies, as well as the administrative team that is in charge of searching for calls for the assignment and resource management in order to promote new research projects. There is also the support of students from different faculties who carry out their social service in the institution. Thus, through these resources in conjunction with federal support, and the staff that it has, the necessary tasks are carried out for the operation of the PIT-UAS.

In the fifth phase, the IMCO (2019) [42] shows the results by indicator of the innovation sub-index (meso, meta, macro and micro), where it is observed that R&D spending, high technology exports and the population in large cities had positive changes between 2015 and 2017, but, on the contrary, the coefficient of invention, scientific and technical articles, the index of economic complexity, the growth of total factor productivity, companies in Fortune 500 and GDP in services they were not so benefited in the same period.

Thus, Table 3 presents a SWOT on the summary of target, macro, meso and micro competitiveness in the region.

Table 3 SWOT Competitiveness in the region

	Strenghts	**Weaknesses**
Internal factors	<u>Meta</u> Creation and development of human resources to generate and disseminate new scientific and technological knowledge. <u>Macro</u> Environment suitable for direct foreign investment, macroeconomic stability, good market size. <u>Meso</u> Improvements to the institutions in terms of administrative efficiency. <u>Micro</u> Increase in number of patents, growth of FDI in R&D.	<u>Meta</u> Insecurity, lag in education, difficulty attracting and retaining talented workforce. <u>Macro</u> Long hours of work, cost of living, youth unemployment rate. <u>Meso</u> Transparency, security, inequality. <u>Micro</u> Low investment of national GDP for R&D
	Oportunities	**Threats**

External factors	Meta Train and educate the population, incorporate new technology, IES-government-business collaboration. Macro Improve competitiveness through a healthy relationship with the US, give continuity to the implementation of structural reforms in education and energy, encourage public investment in infrastructure and Housing. Meso Improvements in transportation and health infrastructure. Micro Efficiently link the needs of the business sector, the development of science, technology and innovation.	Meta Insecurity, lag in education, difficulty attracting and retaining talented workforce. Macro Long hours of work, cost of living, youth unemployment rate. Meso Transparency, security, inequality. Micro Low investment of national GDP for R&D

Source: Own elaboration with data from CEPAL [37] [43], FCCYT [32], PED [32] y WEF [44].

In the sixth phase, it was found that in the Doing Business index for 2020, Mexico is ranked 60 out of the 190 that make up this ranking, which classifies countries according to the ease they offer to do business. In the last year, Mexico is almost 12 percentage points below the average of the 10 first-level economies (World Bank, 2020) [45].

The economic impact that digitization has had in Latin America and the Caribbean has contributed to 4.3% of the accumulated growth of GDP between 2005 and 2013, equivalent to 195,000 million dollars and it is estimated that it has created 900,000 jobs per year. Of the 23 countries in the region, by 2014, 17 are already implementing a national digital agenda, including Mexico, while the rest are preparing one, or have not yet begun to do so (CEPAL, 2016) [37].

Scientists need a workplace to carry out their functions, but in Latin America, half of the laboratories with more than 100 scientific publications as of 2010 are in Brazil (104), while Mexico has 32 with a 16% share (CEPAL, 2016) [37]. Between 2007 and 2016, the number of articles published by authors from Latin America and the Caribbean in the SCOPUS database increased by 96%, while Brazil had an increase of 102% (Albornoz & Barrere, 2018) [38].

Now, as mentioned above, in terms of business productivity, it can be seen that the PIT-UAS has had visits from 252 entrepreneurs, 30 companies have been linked and four incubated, as well as two projects linked to international companies, considering within a strong framework within the guidelines established by CEPAL regarding types of relationships between University-Business.

Finally, phase 7 deals with a proposal for improvement and a replicable model based on the collection and analysis of the data obtained, as well as the strengths and areas of opportunity of the institution, which generated a series of indicators that will allow evaluating the quality of the performance of the PIT-UAS on a constant basis, these are: registered patents applied for, utility models applied for, registered trademarks applied for, industrial design applied for, distinctive signs requested, copyrights requested, patents granted, industrial designs granted, distinctive sign awarded, project proposals presented, projects approved, calls attended, resource obtained, students who have participated in projects, postgraduate students in stay PIT-UAS, undergraduate students who have participated in the PIT-UAS, students who have visited the PIT -UAS, entrepreneurs who have visited the PIT-UAS, related companies, incubated companies, awards obtained , certifications obtained, conferences / lectures, research stays within the PIT-UAS, scientific articles, theses about the PIT-UAS, international conferences and projects related to international companies. Each indicator will yield a rating, which will be used to evaluate the Park's performance from time to time and to establish improvements in the areas of opportunity that are observed. This model, based on the present research, can be replicated by other Higher Education Institutions that seek to establish a PIT in their facilities and determine how profitable and beneficial it would be for them.

Thus, a point to highlight is also that there was a general interest among students from different faculties to participate in the institution. This is important because it sets the tone for them to be interested in academic production and the development of innovative projects.

That said, an improvement in the current procedure of applied research projects is proposed, where the Technological Innovation Park is empowered to be able to carry out the necessary procedures in legal matters and thus reduce the time in question of reviews, as well as signatures, even up to a month or more for each one. It should be clarified that in order to achieve improvement in these processes, the activation of the Technology Transfer Office within the facilities of the Innovation Park (as it is currently) and those in charge of validating the procedures to be carried out will be necessary. For this, the diagram in Figure 7 is proposed, where the above is established.

5. CONCLUSIONS

Enough data was rescued that allow a comprehensive view of the subject under investigation, finding that universities are a fundamental part of the development of human resources that allows generating and disseminating innovative scientific and technological knowledge. On the other hand, trade protectionism, insecurity, weaknesses in the labor market, the attraction of talents and weak institutions have a negative influence on competitiveness in Latin America and Mexico.

Sinaloa is in a median with respect to the other states of the country in terms of investments in STI; It has strengthened the generation of human capital through the increase of quality postgraduate programs and scholarships, however, according to the State Development Plan, STI research has not been carried out in the most optimal way due to lack of trained researchers or funding , Between other reasons. Therefore, it is concluded that there is still much to be achieved in terms of innovations to raise the levels of competition at all levels of systemic competitiveness and the development of our country. In this way, different factors were found, both problematic and opportunities for improvement in the PIT-UAS, which include the almost null call for academic producers of scientific research to take advantage of the institution's facilities, which leads to a lack of knowledge of the existence of the same and, therefore, the almost null performance of inter-academic activities among the academic units of the Autonomous University of Sinaloa. The academics surveyed believe that inter-academic relations in general are necessary for the proper functioning of academic productivity, since, contrary to what is thought, the faculties, far from being antagonistic (the eternal discussion on social sciences and exact sciences), must complement each other and function as a large company that looks after the good of society in general, and not only the needs of its field of research. If this is achieved satisfactorily, it will be possible to improve and increase the academic offer, and complement and mutually improve their processes in terms of study plans, teacher hiring, admissions, etc. It would also achieve a significant decrease in the time it takes for technological development and innovation, which, according to the researchers surveyed, is the most important index of inter-academic cooperation.

That said, there is a lack of interest in applied research, both on the part of students and universities, which do not encourage students to develop scientific articles on the social problems that affect companies, government and society in general.

Thus, it is necessary to support this type of institutions so that they generate interest, not only in undergraduate students, but also in academics, since the PIT-UAS is considered an institution in which they can develop their projects. innovative and scientific productivity. This would take place by developing from research articles to spin-offs and EBT, as well as supporting external companies that seek advice to develop their own projects.

Thus, based on the research questions presented and linking them with the applied surveys, it was found that to a large extent, the faculties have maintained some type of cooperative activity with other faculties on at least some occasion, in the last 5 years, thanks to who share instruments, technological innovation projects, training their staff, support each other to obtain certifications, for the incorporation of new technologies, carry out joint events, share technical advice, exchange technical information and also carry out activities that form multidisciplinary human resources through training academic committees of various faculties, synods and thesis tribunals.

In turn, an area of opportunity was detected to work with the faculties in relation to the cooperation, since to a limited extent they access export markets jointly, nor do they share information to export. In the same way, they share little in the transport for the distribution of their products and neither do they jointly access credit. On the other hand, other cooperation activities between faculties that were found were:

a) Social service and professional practices.
b) Science and technology contests with students
c) Preparation of new postgraduate courses
d) Incorporation of recent graduates in areas of engineering and based on the application of a protocol established in the faculty job bank. This activity has recorded countless success stories that have changed the lives of many engineering professionals.

On the other hand, with the optimization of the PIT bureaucracy, companies would be more willing to approach to request their services; In turn, with the experience gained and the institutionalization of the procedures, it would be increasingly simple to have access to government resources to develop Spin-offs with which, in addition to generating innovation, they will create jobs by stimulating the local economy. All of this could be possible if the organization had its own bank account to manage the resources generated. With this, the resource that is obtained through calls or by payment of external services can be handled in a timely manner in accordance with a financial plan previously established in the processes, and thus the bureaucracy mentioned in the surveys would be eliminated. and it would speed up the working time of those involved, who would have the material and tools in shorter periods of time to carry out the work properly.

Based on the university organic law, it is allowed to have a bank account in the concentrator of the institution itself with permission from the finance secretary and rector. To do this, it is necessary to follow the procedures for their verification, which will require specific jobs to be able to perform these functions in accordance with the university regulations, and fully comply with the transparency law of the federation.

With the above, the PIT-UAS would also help to promote the entrepreneurial culture since new entrepreneurs will have access to the clearer procedure to follow in order to create a greater number of Spin-offs that help technology transfer, which can be used for other projects that will also create more technology and if so, all these innovations can be patented, which is a very important factor in favor of the Mexican economy.

Another point that considerably affects the PIT is the public policies of our country, created by the government in order to stabilize, distribute the funds collected and transfer them to society. Although in recent years these have been increasing and becoming more relevant at the international level, even with the help of international organizations such as the OECD, in Mexico there is still much to do on this issue, both at the national level and within the universities to facilitate and promote research that emphasizes the development of Spin-off. If these missing public policies were activated, the PIT would be much more attractive to organizations and stakeholders.

In this way, it can be summarized that the PIT-UAS has a high potential to promote growth and economic development through the link between Higher Education Institutions and companies, whether they are established organizations, technology-based or Spin-off, as well as to promote academic and inter-academic production through publications and dissemination in high-impact magazines, congresses, symposia, and other activities that allow the dissemination of knowledge, all this through government incentives that promote and support said activities.

Finally, the present study can be deduced from the concern to learn more about the participation of technology-based companies in the region in the innovation ecosystem within the triple helix framework in order to know the level of digital transformation in which they are and the benefits they have had thanks to this, as well as the type of digital skills requested so that, together with the university, qualified human capital can be formed that can be part of this type of companies and help them to be competitive in this transition to the fourth industrial revolution, the digital one.

From another perspective, it is considered important to delve into the study of public policies that encourage research outside of scholarships and university salary, for example, through the formation of academic bodies of exclusive scientific production of the different areas of the PIT-UAS and projects through which federal resources are lowered for the benefit of society through knowledge.

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