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Artículos Científicos

La formación de talento e innovación a través de la vinculación y los modelos de hélice basados en la sociedad del conocimiento

The Formation of Talent and Innovation Through Linking and Helix Models Based on the Knowledge Society

Treinamento e inovação de talentos por meio de modelos de ligação e hélice baseados na sociedade do conhecimento

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Resumen

El objetivo primordial de este artículo es explicar de qué forma incide la formación de talento y la innovación en los procesos de vinculación que se llevan a cabo entre las universidades y la sociedad civil y organismos empresariales. Lo anterior mediante un estudio de caso sobre la industria mueblera de Jalisco, a través del modelo de triple hélice, cuádruple hélice y quíntuple hélice. Uno de los resultados contundentes es que la formación de talento y la innovación influyen en el fortalecimiento del sector mueblero jalisciense. Asimismo, en el campo de la vinculación se percibe la conformación de actores clave a nivel local y nacional para la integración de una red de agentes heterogéneos esenciales para la generación de desarrollo y crecimiento de este sector. Ahí, las instituciones de educación enfrentan el gran

reto de participar en la transferencia de los resultados de sus investigaciones producto de la formación de talento hacia las empresas y la sociedad en general, con la finalidad de que esta apropiación genere riqueza alineada a las políticas públicas para contribuir al desarrollo sostenible del estado de Jalisco.

Palabras clave: agentes heterogéneos, formación de talento, innovación, sector mueblero, vinculación.

Abstract

The main objective of this article is to explain how the formation of talent and innovation affects the processes of linking that are generated between heterogeneous agents: universities in coordination with civil society and business organizations. The above through a case study on the furniture industry in Jalisco, through the model of Triple, Quadruple and Quintuple Helix. One of the overwhelming results is that the formation of talent and innovation influence the strengthening of the furniture sector of Jalisco, as well as the formation of key actors at the local and national levels for the integration of a network of heterogeneous actors essential for the generation of development and growth of this sector. In this scenario, education institutions face the great challenge of participating in the transfer of the results of their research product of the formation of talent towards companies and society in general, with the purpose that this appropriation generated wealth aligned with public policies to contribute to the sustainable development of the state of Jalisco.

Keywords: heterogeneous agents, talent training, innovation, furniture sector, linkage.

Resumo

O principal objetivo deste artigo é explicar como o treinamento e a inovação de talentos afetam os processos de vinculação que ocorrem entre as universidades, a sociedade civil e as organizações empresariais. O exposto acima, através de um estudo de caso sobre a indústria moveleira em Jalisco, através do modelo de hélice tripla, hélice quádrupla e hélice quíntupla. Um dos resultados impressionantes é que o treinamento de talentos e a inovação influenciam o fortalecimento do setor moveleiro de Jalisco. Da mesma forma, no campo da ligação, percebe-se a conformação dos principais atores nos níveis local e nacional para a integração de uma rede de agentes heterogêneos essenciais para a geração de

desenvolvimento e crescimento desse setor. Lá, as instituições de ensino enfrentam o grande desafio de participar da transferência dos resultados de suas pesquisas, como resultado do treinamento de talentos para as empresas e a sociedade em geral, para que essa apropriação gere riqueza alinhada às políticas públicas. contribuir para o desenvolvimento sustentável do estado de Jalisco.

Palavras-chave: agentes heterogêneos, treinamento de talentos, inovação, setor moveleiro, articulação.

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Introduction

The dynamic environment of scientific work focuses on the knowledge-based society, where, in turn, the evolutionary dynamics of the economy plays a fundamental role, as does innovation, which takes into account models focused on the coordination of actors involved in the generation and application of knowledge. In this sense, the training of talent through the university-company-State relationship represents a pillar for the transfer of knowledge and its social application with a view to generating well-being and improving the quality of life of communities and the business sector. say open innovation (Rexhepi, Abazi, Rahdari, Angelova, 2019).

This research is derived from a doctoral thesis research and focuses on the multidimensional nature of innovation; It focuses on the formal and informal relationship between industry, the university, intermediate organizations, the action of public programs and business strategies.

It has macro, meso and micro implications that, in certain cases, strengthens the sector and agents, and in others, hinders action due to weak links. The cooperation and link between the heterogeneous agents that strengthen and articulate the industry-academy-government relationship (training, research and knowledge transfer) has been analyzed by multiple approaches: from the Sábato triangle (Sabato and Botano, 1968), which it includes the interrelation of the State, the industry and the academy up to the quadruple and quintuple helix.

In cases of success, the action of the levels (macro, meso and micro) can generate a positive integration, articulating the transversality of technological, organizational or complementary support dimensions that can generate solutions to the problems of inter-

organizational collaboration. The micro dimension depends on the meso and macro, they cannot be completely separated from each other if you want to understand the context and, consequently, solve problems. These assume the collaboration between the public-private sector or the involvement of a multiplicity of interdependent or heterogeneous actors to generate joint actions (Casalet and Stezano, 2009). However, problem solutions depend on the conditions, the context and the institutional and technological structures available to each heterogeneous actor. Hence the importance of analyzing the link between these heterogeneous agents that manifests itself, in this case, in the furniture sector of Jalisco.

Methodology

The methodology used was a mixed approach. On the one hand, it describes all the information obtained from the survey applied to companies integrated to the different associations and chambers of the Jalisco furniture sector, such as the Association of Furniture Manufacturers of Jalisco (Afamjal), the Association of Furniture Manufacturers of Ocotlán (Afamo), National Chamber of Commerce (Canaco) of Tlaquepaque and the Chamber of the Furniture Industry of the State of Jalisco (Cimejal). The sample was 290 companies. On the other hand, experts in linking higher education institutions and experts in linking different government agencies in the macro, meso and micro dimensions with their respective strategic axes were interviewed.

To do this, we proceeded to categorize the corresponding variables for the analysis, as shown in Table 1.

Tabla 1. Ejes estratégicos y dimensiones de análisis micro, meso y macro

Ejes Estratégicos	**Dimensiones**		
	Macro	**Meso**	**Micro**
Vinculación	Vinculación macro	Vinculación meso	Vinculación micro
Apoyos	Apoyos macro	Apoyos meso	Apoyos micro
Recursos humanos (RH)	RH macro	RH macro	RH micro

Fuente: Elaboración propia

Explanation of the dimensions (macro, meso and micro) from the perspective of the Jalisco furniture sector for the generation of innovation

The multi-level participation perspective referred by Geels (2006a, 2006b) can generate a governance network made up of heterogeneous actors, which, in turn, constitutes the triple, quadruple and five-fold helix for the production of knowledge and innovation (Carayannis, Acikdilli , and Ziemnowicz, 2019).

In this collaboration of multiple actors in the furniture sector, the macro dimension alludes to the sociotechnical landscape, to more generalizable spaces, which are not in niches or in the sociotechnical regime, since the changes come from the historical aspect, to the over time. These generalizable spaces refer to the aspect of globalization, environmental problems and cultural changes that occur in the furniture industry influenced by other international markets that, in some way, participate directly or indirectly in the development of the furniture sector. That is why, at this level, the exogenous and endogenous variables that intervene in the development of the sector and the economic conditions that this sector has, international cooperation and public science, technology policies can be taken into account. and both sectoral, state and national innovation that have guided the industry to be competitive.

At the meso level the sociotechnical regimes enter (a relationship between the social and the technical), that is, the groups involved directly and indirectly enter (union institutions: chambers and associations); there is a certain communication between these groups, there is even a transmission of knowledge between them. In this way, the institutional structure of the furniture sector, both union, financial and academic, which generates support (economic, collaborative, social, etc.) for said sector, is taken into account.

At the micro level, technological niches are formed, where “radical innovations” are generated from the interaction of the actors, that is, you can work together doing research and development (R&D). In this sense, for the development of these niches at this level there are certain rules that play with individuals and are not generalizable, the interactions between groups linked to production and innovation processes. Therefore, the conditions of the furniture companies in the state of Jalisco are taken into account, the type of associationism they have with respect to the link with other heterogeneous agents, for example, if there are links with some universities, research centers or some another institution, whether local, national or international.

Development

The development of innovation in different explanatory approaches

In this section the notion of innovation is traced from the contributions of Bush (July 1945), who focused on the policy of scientific research; from the studies by Freeman (1975) and Freeman and Soete (1997) on “the economic theory of industrial innovation”, whose support is to a large extent the analysis of Adam Smith (2011) on “the wealth of nations”, who he studied the advances in machinery used in the manufacturing and industrial industries of the 18th century, as well as the contributions of Marx, who focused on the "technical innovation" of capital goods; of course from the contributions of Schumpeter, (1996), where innovation becomes relevant in the economy, especially in the product, process or system that was carried out in industrial companies in the first half of the 19th century. These contributions from Schumpeter identified the network of research laboratories and universities with the industry that assigned full-time professional work; It allowed him to observe and describe the knowledge produced in companies. Innovation is also nourished by the contributions of Nelson and Winter (1982), who aimed to evaluate and consolidate science, technology and innovation; Freeman (1975), for his part, spoke of a "National Innovation System", which was taken up by Lundvall (1992) and Nelson (1993), who developed it extensively and focused mainly on public policies that play a role. important in economic development and for the integration of heterogeneous agents for the production of knowledge and innovation.

Shortly after, the adaptation of the Sábato triangle towards the helix model; taken up by Etzkowitz and Leydesdorff (1995), they adopted it to the “triple helix” approach: university-company-government, and later the quadruple helix is generated, which includes the “civil association” (Ahonen and Hämäläinen, 2012 ; Arnkil, Järvensivu, Koski and Piirainen, 2010; Bautista, 2015b; Etzkowitz, 2018). In addition, so far in the 21st century, attempts have been made to generate the “five-fold helix”, which involves actors from society in general; likewise, democracy between propellers and environmental issues (Carayannis, Barth and Campbell, 2012; Carayannis and Campbell, 2014; Carayannis, Acikdilli and Ziemnowicz, 2019), and the contributions of Geels (2006a, 2006b), which include this fifth propeller to have a multi-level cross-sectional interaction (macro, meso and micro).

Linkage and innovation in the case of the furniture sector in Jalisco

The Jalisco furniture sector has had contact with international markets and with some institutions that are exclusively dedicated to training human resources for specialization; Institutions such as the Technological Institute of Furniture, Wood, Packaging and Related (Aidima) of Spain, for example, have collaborated to some extent with the sector to position it competitively. It is evident that the furniture and wood sector has benefited from specific training with some groups of countries such as Germany, which aims to increase productivity, training in the use of technology and infrastructure to strengthen the installed capacity in each of the companies, in addition to the different scientific, technological and innovation policies established by the state and national government for the competitiveness of the Jalisco furniture sector.

At the macro level, one of the aspects that intervenes directly or indirectly is the international cooperation that the furniture sector of Jalisco has had: the experiences of the sector with other international academic institutions and especially the experiences in international and global markets.

In the meso part, meanwhile, all the participating institutions are shown, taking as a reference the contributions that Casalet (2015) presents to frame this level on technological paradigms. These institutions have benefited to some extent the development of the furniture sector.

At the micro level, as can be seen in figure 1, the furniture industry's drive towards innovation is also noteworthy; Furniture design competitions are shown where, in addition to companies, students from different universities are participating, such as the University of Guadalajara, the Technological and Higher Studies Institute of Monterrey, the Pan-American University and the Autonomous University of Guadalajara. Likewise, the Government through the Jalisco State Council of Science and Technology participates under the quadruple propeller model. (Coecytjal).

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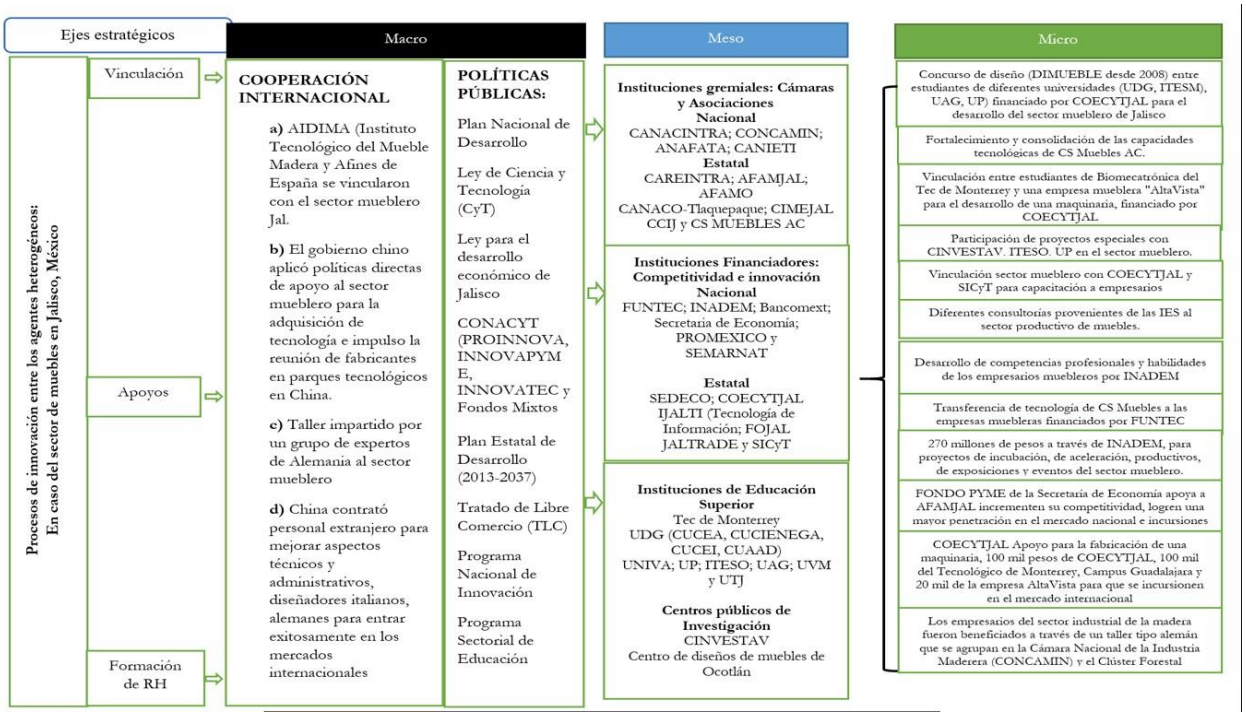
Figura 1. Dimensiones de los ejes estratégicos del sector mueblero de Jalisco



Fuente: Elaboración propia

International cooperation

The participation of the furniture sector in Jalisco, Mexico, since the 90s has had participation in international markets. Among them, the United States has been the main market for furniture entrepreneurs in Jalisco: above all, the doors for exhibitions and events have been opened, including a furniture exhibition center at Casa Chicago for the past five years. Thus, it has been working over time to internationalize, supporting itself with economic actors (international organizations) and academics (for example, Aidima).

According to Lozano's research (2010), the furniture industry in Jalisco had a slight cooperation with Aidima in the 90s: it was supported by the installation of a furniture quality control laboratory. Given this, the furniture sector began to make efforts to create international contacts, proposals were created to attend international exhibitions to attract international buyers and, consequently, to strengthen international exhibitions in the state of Jalisco, mainly in the Guadalajara Metropolitan Area (ZMG), Cienega Region and in the municipality of Tlaquepaque, where furniture artisans are housed.

The international market is characterized by the concentration of large buyers in outlet type multi-stores (IKEA), which are located in European countries (France, Germany, United

Kingdom, Sweden). On the other hand, there are independent sellers that are located on the Italy side (Lozano, 2008). Companies like IKEA are the most innovative and have branches in different parts of the world. In fact, in 2019 IKEA arrived in Mexico. In addition, they use the best technology to manufacture all their products. In this sense, they collaborate with different universities and other intermediate organizations to strengthen furniture stores and give them greater prestige. One of the characteristics of these stores is that they take advantage of the technology that is manufactured in all advanced industrial countries and, generally, their investment is very high. That is why their products achieve a great impact, in addition to using different strategies to attract larger potential customers: a clear example for the furniture sector in Jalisco to strengthen its technological capabilities and be able to compete in the foreign market with the best products, prices, quality and, above all, innovation.

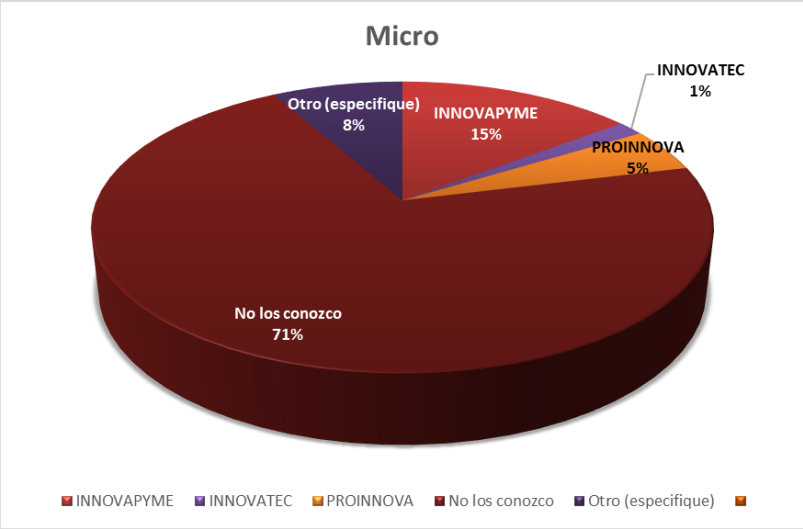
In a survey carried out at the 2012 Furniture Expo, carried out in the capital of Guadalajara, academics from the University of Guadalajara were able to detect that several of the international buyers had not bought products different from those they saw in previous years because they did not There was no state-of-the-art technology implemented or implemented; usually the technology used is intermediate (Madrigal, Bautista y Ruiz, 2012).

National, state and sectoral public policies that mark the competitiveness and innovation of the furniture sector in Jalisco

In Mexico there are certain programs that the National Council of Science and Technology (Conacyt) has, such as Proinnova, Innovapyme and Innovatec, in order to stimulate innovation for the strengthening and impact on the national economy. Likewise, the sectoral funds, mixed funds, the National System of Researchers (SNI), the National Program of Quality Postgraduates (PNPC), among others, that exist to strengthen the capacities and innovation structures of both universities and companies .

Of the companies that participated in the study, at the micro level it is highlighted that 71% do not know the supports that are granted through the Conacyt calls; Of those who did answer that they knew about these supports, the highest percentage, 15%, points to the one provided to small and medium-sized enterprises (SMEs), called Innovapymes, followed by Proinnova with 5% (see figure 2).

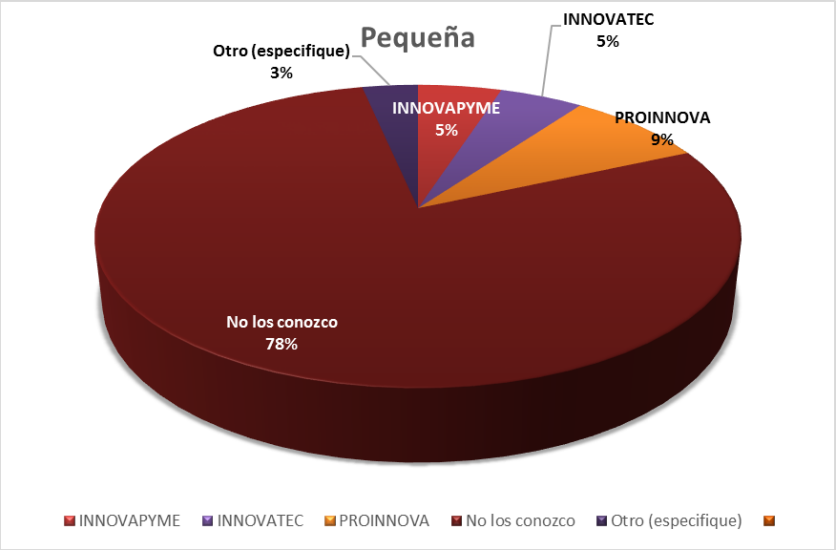
Figura 2. Apoyos de Conacyt recibidos en las empresas muebleras a nivel micro



Fuente: Elaboración propia

In a disaggregated way, in the small company it stands out, analogously to the previous figures, that 78% admits not knowing about these supports; It is noteworthy, however, that 9% recognize programs related to the field of innovation, such as Proinnova. These companies, which are mostly familiar, need to strengthen the linkage items in order to grow, as well as innovation in order to be more competitive globally. It is important to note that having specialized intellectual capital to respond strategically in terms of innovation represents a challenge for these companies because they do not have the economic capital oriented to innovation and design that is usually required of this type of company.

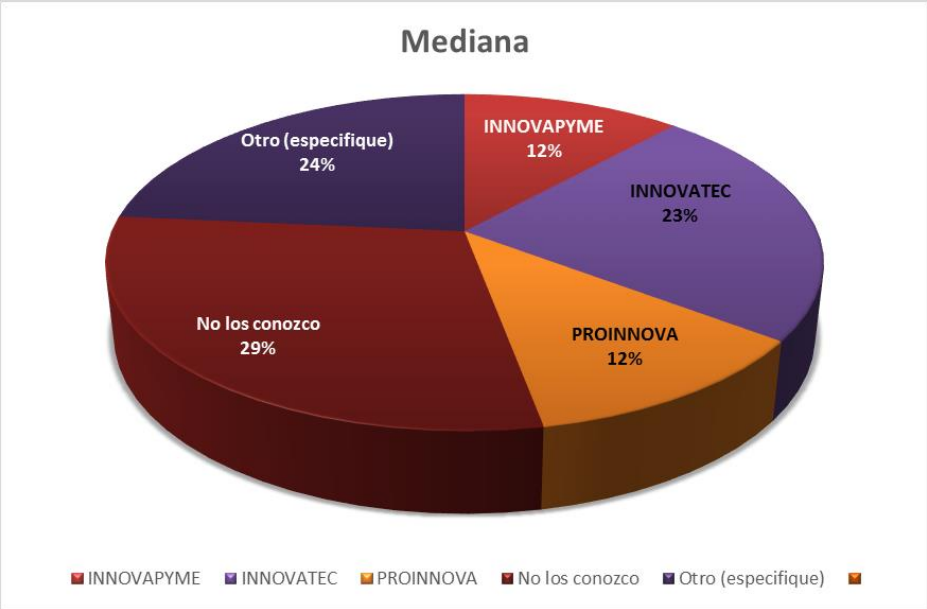
Figura 3. Apoyos de Conacyt recibidos en las empresas muebleras a nivel pequeñas empresas



Fuente: Elaboración propia

In the case of medium-sized companies, there is a higher percentage of companies that mention recognizing some type of support: both Innovapyme and Proinnova stand out with 12%, although the highest percentage is concentrated in the supports that are more closely related to issues of innovation and technology, such as Innovatec with 23%. These types of calls are aimed at developing disruptive projects to strengthen creative, entrepreneurial and innovative skills through technology transfers and commercialization. Lastly, 24% relate other types of support, such as those offered to strengthen their competitiveness through cameras.

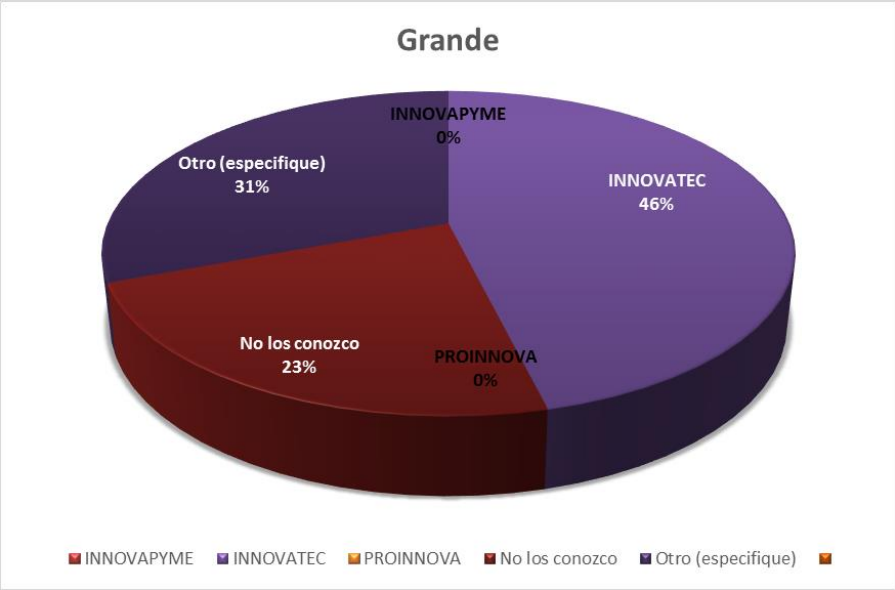
Figura 4. Apoyos de Conacyt recibidos en las empresas muebleras a nivel medianas empresas



Fuente: Elaboración propia

The furniture companies that are most consolidated by the number of employees and the capacity for their competitiveness are mostly familiar with the program offered through the Innovatec call. This type of call is characterized by being oriented to the strategic sectors of Jalisco. Likewise, it establishes a greater link between companies and the educational sector with the incorporation of both undergraduate and postgraduate students so that they can develop projects that incorporate elements of Industry 4.0, such as the Internet of Things, artificial intelligence and digitization.

Figura 5. Apoyos de Conacyt recibidos en las empresas muebleras a nivel grandes empresas



Fuente: Elaboración propia

To continue strengthening innovation in the country, the Science and Technology (S&T) Law, created in 2002, was reformulated, first in 2009 and a second time in 2015, to generate even more innovation, strengthen the capacities of regional universities and national and to support the productive sector.

Progress was manifested from the National Development Plan (PND) 2013-2018 (Government of the Republic, 2013); There, some objectives and actions were announced for higher education institutions to make links with the productive and social sectors, as a new network for the generation of innovation and, consequently, of competitiveness. Details objective 3.5: "Make scientific, technological and innovation development pillars for sustainable economic and social progress" (Gobierno de la República, 2013, p. 128). Likewise, during the administration of Enrique Peña Nieto, there was the Education Sector Program 2013-2018 (PSE), which aimed at building innovative structures. There is also the National Innovation Program (PNI), sustained in article 3 of the Political Constitution of the United Mexican States, as well as in the S&T Law. The PNI understands the importance of innovation in Mexico, the integration of an innovation ecosystem, which includes the pillars of innovation that have to do with national and international markets, business strengthening, financing for innovation projects, exploitation of human capital and the institutional regulatory framework. We must not forget the Special Science and Technology Program

(Peciti), which proposed to strengthen the appropriation of knowledge and innovation based on the actions of the PND 2013-2018 to trigger scientific, technological and innovation growth in Mexico (Gobierno de la República, 2013).

At the state level is the Jalisco State Development Plan (2013-2033), which points to the construction of heterogeneous agents (Bautista, 2015a). This plan had already been aligned with the federal perspective of the PND-2013-2018 with the aim of promoting technological development, scientific research and innovation through coordination between sectors that contribute to the formation of human capital with high levels of specialization. . In addition to this, the sectoral objectives: 1) to propitiate the conditions for the strategic link between academic and economic sectors; 2) promoting innovation and entrepreneurship for scientific and technological development, and 3) reducing the digital divide in the entity's productive and social sectors. The Jalisco government has also published the so-called Law of Science, Technological Development and Innovation of the State of Jalisco, which basically alludes, in its first articles, to the carrying out of scientific, technological and innovation activities promoted and regulated by the government structure.

There is also a sector plan from the Ministry of Science and Technology Innovation (SICyT) of Jalisco, which has the mission of promoting, facilitating and promoting the creation and adoption of an innovative and competitive culture, as well as the goal of, Starting in 2019, position Jalisco as the most innovative state and with the highest technological development index in Mexico. The SICyT also works with regional projects for the design of differentiated public policies, high-level human resources according to local needs, scientific-technological ecosystems for regional development, and increasing investment in science, technology and innovation at the state and regional level, in joint with Aguascalientes and Michoacán.

In this sense, some organizations that are committed to innovation in the Tapatian furniture industry are the Coecytjal and the SICyT, from where the development of public and private actions related to the advancement of science and technology are promoted, encouraged and coordinated. and innovation, efforts that are already supported by Conacyt through competitiveness and innovation programs.

In 2015 the Law of Acquisitions and Disposals of the State of Jalisco was approved by the local Congress. This is the materialization of agreements between the organizations that make up the Council of Industrial Chambers of Jalisco (CCIJ) with which, for example,

it is obliged that acquisitions are local so that an economic spill is generated in the entity. In this line, the wood and furniture industrialists can benefit; It is expected that in a short time, clusters can be formed in the entity, emphasizing the conditions of the main suppliers so that better costs and efficiency are obtained through economies of agglomeration. As it was said, in the approval of this law the members of the unionized organizations of the furniture sector met, especially the Regional Chamber of the Transformation Industry of the State of Jalisco (Careintra) and the Afamjal, and was led by the president of the CCIJ, from which the furniture and other electronics organizations and the association of industrial parks of the state of Jalisco joined this new law.

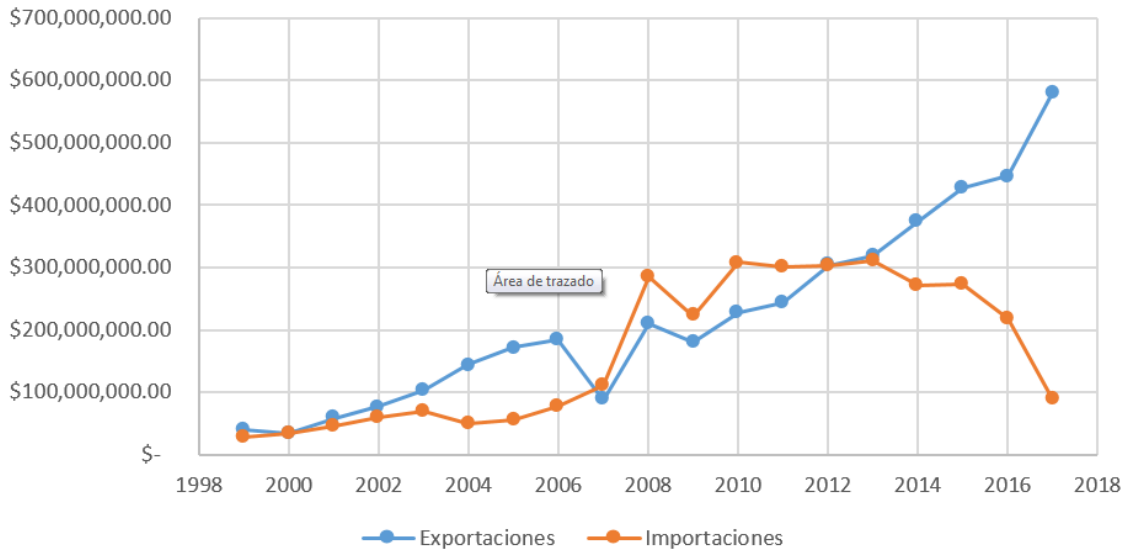
In addition to all of the above, we can mention the different free trade agreements promoted by the Mexican Government for the commercialization and export and import of products from other countries, for example, the North American Free Trade Agreement (NAFTA) between States United, Canada and Mexico that was enacted since 1993 and entered into force in 1994 to strengthen trilateral relations in conducting business. This in some way has greatly benefited and affected the furniture production sector at the national level, since efforts have been made to boost exports to these countries; however, the type of tariff is high and this undoubtedly implies a high cost and expense for furniture producers. Other treaties that have been signed are the Northern Triangle, which includes countries such as El Salvador, Guatemala, Honduras and Mexico; the treaty with Costa Rica, with Nicaragua and the Group of Three Treaty (G-3) (Colombia, Venezuela and Mexico); treaties with the European Union, with Israel, with Bolivia, Chile, Uruguay, Argentina, among other countries, in order to strengthen business relations with Mexico.

Thanks in part to these treaties, the furniture industrial sector ranked 6th out of all advanced manufacturing industry in Mexico, since in 2010 it was exporting worldwide equivalent to 2.23% of the national gross domestic product (GDP) (ProMéxico, 2011). Regarding Mexican furniture exports, the main destination is the North American market: in recent years, its participation percentage has remained between 3.39% and 4.29%. In contrast, China has diversified its markets and its percentage of exports to the United States has decreased: for 2011 it only reached 38.65% of its total exports; while the North Americans maintain their preference to import Chinese products: around 50% of the total imports of the United States are Chinese.

By 2014, the national furniture sector had consolidated in the country as the fourth largest furniture exporter, behind only China, Canada and Vietnam. In this sense, the Jalisco furniture industry participates with 16.28% of the GDP over the manufacturing industry nationwide: it occupies the second place after the State of Mexico (Lozano, Madrigal and Bautista, 2012).

The participation of the Jalisco furniture sector in international markets involved an import during 2014, according to data provided by the Ministry of Finance and Public Credit [SHCP] (cited in the Jalisco State Information System [Seijal], 2015), of $ 271,702,615.28 and an export of $ 373,778,051.16; instead, in 2017 the import was 181 972 762.00 dollars and the amount of 447 332 224.00 dollars was exported (Instituto de Información Estadística y Geográfica [IIEG], 2018).

Figura 6. Exportaciones e importaciones de muebles de Jalisco



Fuente: Elaboración propia con base en IIEG (2018)

This means that there is a great difference between what has been exported versus what has been acquired, there has been an essential increase in exports worldwide in recent years. There is a positive trend regarding the export of furniture in international markets: it means that the sector has been consolidating since 2013 and 2014, despite a decline in previous years, for example, from 2007 to 2012 it was predominant The import of such furniture, almost a whole six-year term, but from 2013, as already mentioned, there began to be a slight increase in exports and it seems that it has been maintained. This also has a lot to

do with the investments, public policies and science, technology and innovation policies of both the national and state governments for exports. Technologies, designs and the quality of products also influence the furniture sector, since in international markets there is a high demand in these areas.

Support generated to strengthen the competitiveness and innovation of the furniture sector in Jalisco

The participation of government bodies is constituted through specific actions and programs towards the growth of companies. Normally there is a concurrence of funds that support the productive sector and which in some way or another can be accessed with relative ease, of course covering certain protocols, either through the chambers or the furniture association, which receive certain benefits from this link between government and sector.

On some occasions, collaboration with government agencies with small and medium-sized companies was encouraged; on other occasions projects were generated through organizations or business chambers; The generation of export consortia was supported, as well as to improve the behavior of the production chain; but unfortunately in the last three years they had not been very successful. In this regard, figure 7 shows forceful responses that are based on the actions and policies that are reflected in the Jalisco State Development Plan (2013-2033) and, consequently, on the support received to strengthen its production and commercialization.

The link between government and business agencies is vital to strengthen the competitiveness of companies in the furniture sector, however, it does not occur in a significant way. According to the companies that were studied, there are actions aimed at meeting the innovation policies that are part of the aforementioned State Development Plan, especially taking into account their opening, but not their consolidation. This is due to the fact that very little progress has been made as there are no strategic alliances that allow the impetus for these companies.

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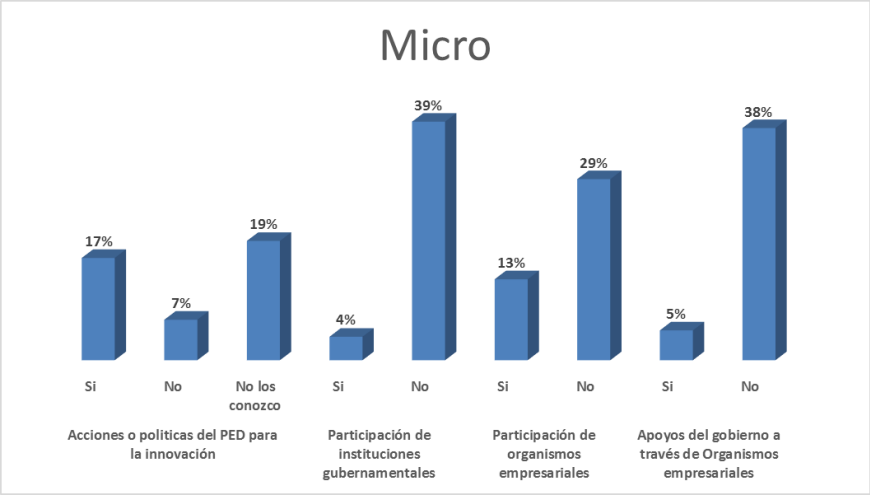
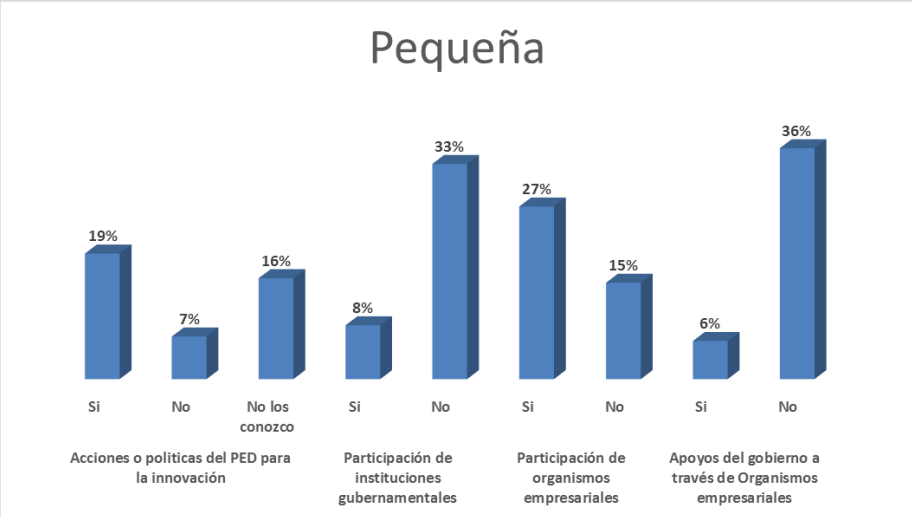
Figura 7. Participación con organismos gubernamentales y empresariales de las empresas micro



Fuente: Elaboración propia

As for the small companies that are in the present investigation, they report that they have participated in actions and public policies set forth in the State Development Plan aimed at the field of innovation, mostly in the area of design; however, a high percentage, 33%, points to the lack of links with government institutions; The companies refer to greater links with organizations and business chambers, some of them affiliated with the furniture industry cluster or the Jalisco Chamber of Commerce. Likewise, only 6% stated that they have government support through other business organizations.

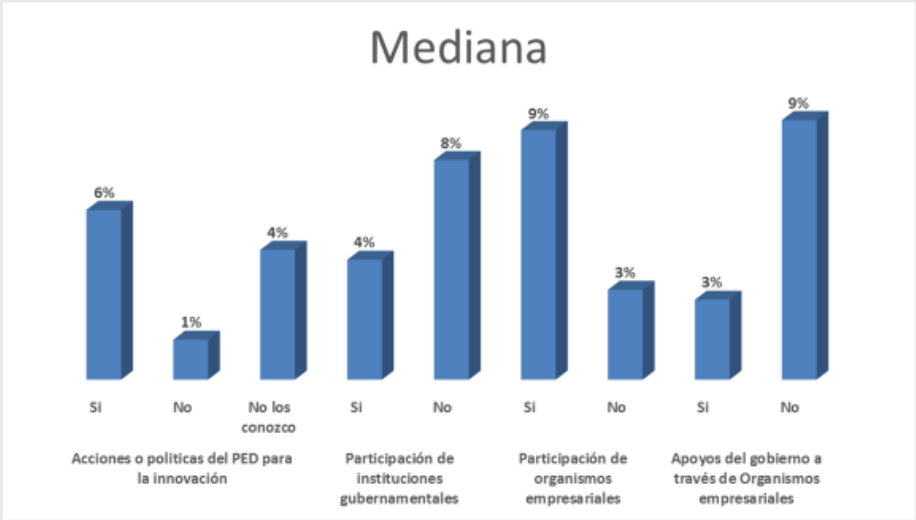
Figura 8. Participación con organismos gubernamentales y empresariales de las empresas pequeñas



Fuente: Elaboración propia

In the case of the medium-sized companies that participated in the study, in a similar way to what was mentioned above, they indicate that there is no close collaboration relationship, as shown in Figure 9; for example, with the government linkage part, a response of only 8% was obtained; a slightly higher indicator, 9%, with the share of peer business organizations, as well as the chambers and clusters of the sector. Even so, 6% highlight their participation through the actions of the State Development Plan.

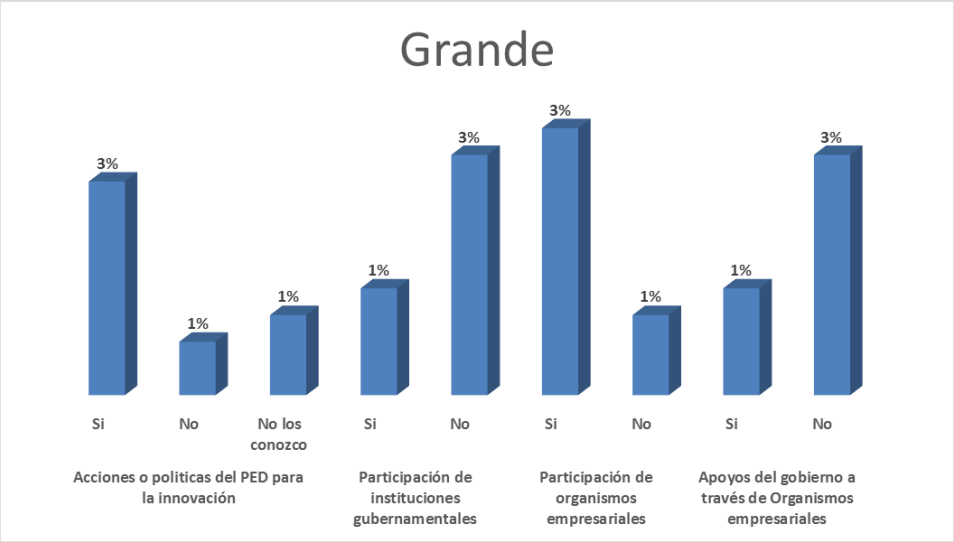
Figura 9. Participación con organismos gubernamentales y empresariales de las empresas medianas



Fuente: Elaboración propia

The large participating companies, for their part, refer to having innovation-oriented actions in relation to the areas of technological development and design, a link of only 3% with government participation, as well as other business organizations, which sets the tone for seeking to establish closer and more strategic cooperation and thus achieve higher levels of competitiveness as a result of its innovation and presence in local, national and international markets.

Figura 10. Participación con organismos gubernamentales y empresariales de las empresas medianas



Fuente: Elaboración propia

With the above described, we can point out that 38% of micro companies, as well as 38% of small companies, have never participated with the Government in the period from 2006 to 2014, only 5% of micro companies and 4% of small companies. has participated during those years. And, on the other hand, 6% of medium-sized companies and 2% of large companies have also not participated with any government entity. Only 5% of medium-sized companies and 3% of large companies participated in any project with the Government to strengthen innovation and competitiveness in their facilities. Despite the existence of government programs, in some universities they are not disclosed with a focus on the development of furniture companies.

Discussion

As has been shown, the multidimensional nature of innovation establishes the relationship of formal and informal linkage by industry, the university, intermediate organizations, the action of public programs and business strategies. In this sense, public policies play an important role in economic development and in the integration of heterogeneous agents for the production of knowledge and innovation, as established in the literature through the contributions of Nelson and Winter (1982) and Freeman (1975) highlights the role of the "National Innovation System", also indicated by Lundvall (1992)

and taken up again by Nelson himself (1993), focusing mainly on public policies, which acquire an important role in economic development and, as mentioned, in the integration of heterogeneous agents for the production of knowledge and innovation.

According to the data obtained in this study, the implications of the innovation processes are established at the macro, meso and micro levels, which, in certain cases, strengthen the sector and the agents, and in others, hinder action by weak links.

It is for this reason that cooperation and linkage between the heterogeneous agents that strengthen and articulate the industry-academy-Government relationship (training, research and knowledge transfer) are necessary to generate innovation that empowers communities and generates well-being and quality. of life.

Due to the above, it is necessary to strengthen innovation ecosystems, where national and international markets are proactively and reciprocally linked, resuming business competitiveness, as well as diversifying the sources of financing for innovation projects, the use of human capital and the institutional regulatory framework.

Conclusions

For more than four decades, the furniture sector has had participation in international markets with its exports and interactions with world-class companies and organizations. However, the strategies they have used to reach these heights have not yet been explained: production of this it occupies the first places at national level. What has been concluded in this work derived from a doctoral thesis is that the conformation of several key actors, groups of local, state and even national business organizations was detected, as well as the participation of the Government (federal, state and municipal), although with little participation of other heterogeneous agents on the side of the academic sector (such as higher education institutions, public research centers, intermediate agents, etc.) in the furniture sector. Although from the PND 2013-2018 (Government of the Republic) the detonation of innovation in Mexico was mentioned, it has not been possible to form a forceful human capital in the sector with high levels of specialization.

It is concluded that the training of specialized human talent in the furniture sector is required, from the involvement of the universities; It is necessary to promote this link with the demand of the productive sector. Although there have been support from the state government to strengthen competitiveness and innovation in the sector, this training of talent

has not been fully achieved, an example of this is that 82% of micro, small and medium-sized companies are unaware of the support and they have never participated in this strengthening. This means that there is little support for training talent for innovation.

The participation of the academic sector specifically with the furniture sector reflects between low and medium complexity in the processes of linking with different heterogeneous actors in the state of Jalisco. This means that there is little participation from universities (public and private), public research centers, among others, and therefore, low participation of design students in the furniture sector, university consultancies, as well as supports that were created especially for the promotion and promotion of the furniture sector in Jalisco by the state and federal government.

One of the contests that the Afamjal carries out, entitled Dimueble, linking with students of the Tecnológico de Monterrey for the realization of machinery, funds obtained through the Inadem and the Support Fund for Micro, Small and Medium-sized Enterprises, innovation programs de Conacyt, despite being unknown by the majority of the sample participating here, these actions of heterogeneous agents play an important role for the economic development of the sector, since they can come from research, knowledge management, science policies , technology and innovation and the Government in guiding public policies and the actions of companies and the value chain where they are integrated.

In the table of macro, meso and micro dimensions, the actions carried out between companies with the academic sector are exemplified, which serve as the basis for creating public policies and triggering joint projects. This micro dimension refers to beyond a simple cooperation or signing of agreements, that is, it represents and shows results carried out inter-institutionally and with other heterogeneous agents.

Finally, it is worth emphasizing that there is a waste of the innovation funds that are available from the Government; the reflection of the results is not very favorable for the furniture sector in this sense.

Future investigations

The next investigation that follows is to validate the training of talent for innovation at the national level, based on innovative models and, consequently, to determine the transfer of scientific, technological and innovation knowledge in productive sectors, such as furniture and the technological sector. with universities at the state and national level.

References

Ahonen, L. and Hämäläinen, T. (2012). CLIQ: A Practical Approach to the Quadruple Helix. In MacGregor, S. and Carleton, T. (eds.), *Sustaining Innovation. Collaboration Models for a Complex World* (pp. 15-29). London, England: Springer.

Arnkil, R., Järvensivu, A., Koski, P. and Piirainen, T. (2010). *Exploring Quadruple Helix: Outlining User-Oriented Innovation Models.* Tampere, Finland: University of Tampere.

Bautista, E. (2015a). La importancia de la vinculación universidad-empresa-gobierno en México. *Revista Iberoamericana para la Investigación y el Desarrollo Educativo*. *5*(9). Recuperado de https://www.ride.org.mx/index.php/RIDE/article/view/106/464.

Bautista, E. (2015b). La vinculación entre agentes heterogéneos para la producción de conocimiento e innovación. *Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, *5*(10), Recuperado de https://www.ride.org.mx/index.php/RIDE/article/view/112/496

Bush, V. (July 1945). As We May Think. *The Atlantic*. Retrieved from https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/.

Carayannis, E. G. and Campbell, D. (2014) Developed democracies versus emerging autocracies: arts, democracy, and innovation in Quadruple Helix innovation systems. *Journal of Innovation and Entrepreneurship Springer*, *3*(12). Retrieved from doi.org/10.1186/s13731-014-0012-2.

Carayannis, E. G., Acikdilli, G. and Ziemnowicz, C. (2019). Creative Destruction in International Trade: Insights from the Quadruple and Quintuple Innovation Helix Models. *Journal of the Knowledge Economy*. Retrieved from doi.org/10.1007/s13132-019-00599-z.

Carayannis, E. G., Barth, T. D. and Campbell, D. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(2). Retrieved from doi.org/10.1186/2192-5372-1-2.

Casalet, M. (2015). El mito de Sísifo: Avances y nuevos desafíos en la apropiación de los paradigmas tecnológicos. En Santos, M. J. y Cruz, R. D. (coords.), *Innovación tecnológica y procesos culturales. Perspectivas teóricas* (pp. 215-230). Ciudad de México, México: Fondo de Cultura Económica.

Casalet, M., y Stezano, F. (2009). Cambios institucionales para la innovación: nuevos instrumentos de política científica y tecnológica. El caso del consorcio Xignux-Conacyt. En Villavicencio, D. y López de Alba, P. L. (coords.), *Sistemas de innovación en México: Regiones, redes y sectores* (pp. 187-215). México: Plaza y Valdés.

Etzkowitz, H. (2018). Innovation Governance: From the "Endless Frontier" to the Triple Helix. In Meusburger P., Heffernan M. and Suarsana L. (eds.), *Geographies of the University*. Cham, Switzerland: Springer.

Etzkowitz, H. and Leydesdorff, L. (1995). The Triple Helix – University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development. *EASST Review*, *14*(1), 14-19.

Freeman, C. (1975). *La teoría económica de la innovación industrial*. Madrid, España: Alianza Editorial.

Freeman, C. and Soete, L. (1997). *The Economics of Industrial Innovation.* London, England: Routledge.

Geels, F. W. (2006a). Co-evolutionary and multi-level dynamics in transitions: The transformation of aviation systems and the shift from propeller to turbojet (1930–1970). *Technovation*, *26*(9), 999-1016. Retrieved from doi.org/10.1016/j.technovation.2005.08.010.

Geels, F. W. (2006b). Multi-level perspective on system innovation: relevance for industrial transformation. In Olsthoorn, X. and Wieczorek, A., *Understanding Industrial Transformation: Views from Different Disciplines* (pp. 163-186). Dordrecht, Netherlands: Springer.

Gobierno de la República. (2013). *Plan Nacional de Desarrollo 2013-2018.* México: Gobierno de la República .

Instituto de Información Estadística y Geográfica [IIEG]. (2018). Industria mueblera. Ficha sectorial. Jalisco, México: Instituto de Información Estadística y Geográfica. Recuperado de https://www.iieg.gob.mx/contenido/Economia/fs_Mueblera.pdf.

Lozano, K. (2008). La relación local-global y la perspectiva de los sistemas productivos de muebles. En Rodriguez, R. A. (coord.), *Teoría, metodología y estudios de caso de desarrollo local* (pp. 135-168). Guadalajara, México: Universidad de Guadalajara.

Lozano, K. (2010). *Desarrollo local a partir de los sistemas productivos locales: el caso de la industria mueblera de Jalisco*. (tesis doctoral). Universidad Nacional Autónoma de México, Ciudad de México. Recuperado de http://www.economia.unam.mx/cedrus/publicaciones/tesis/tesis-doctorado.html.

Lozano, K., Madrigal, T. y Bautista, E. G. (2012). Estratégicas empresariales del sector muebles de Jalisco, ante la competencia China y el rol del clúster. (avance de investigación). Recuperado de https://www.academia.edu/35276919/ESTRATEGIAS_EMPRESARIALES_DEL_SECTOR_MUEBLES_DE_JALISCO_ANTE_LA_COMPETENCIA_CHINA_Y_EL_ROL_DEL_CLUSTER.

Lundvall, B. A. (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London, England: Pinter.

Madrigal, E., Bautista, E. y Ruíz, R. (2012). El mueble mexicano y su competitividad versus el asiático: percepción comprador internacional. *Red Internacional de Investigadores en Competitividad*, *6*(1). Recuperado de https://www.riico.net/index.php/riico/article/view/438.

Nelson, R. R. (1993). *National Innovation Systems: A Comparative Study*. Oxford, England: Oxford University Press.

Nelson, R. R. and Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*. Massachusetts, England: Harvard University Press.

ProMéxico. (2011). *Diseñado en México. Mapa de ruta de diseño, ingeniería y manufactura avanzada*. Ciudad de México, México: ProMéxico. Recuperado de https://www.gob.mx/cms/uploads/attachment/file/60156/MRT-Manufactura-Avanzada.pdf.

Rexhepi, G., Abazi, H., Rahdari, A. and Angelova B. (2019). *Open Innovation Models for Increased Innovation Activities and Enterprise Growth*. In Rexhepi, G., Hisrich, R. and Ramadani, V. (eds.), *Open Innovation and Entrepreneurship*. Cham, Switzerland: Springer.

Sabato, J., & Botano, N. (1968). La ciencia y la tecnología en el desarrollo futuro de América Latina. Revista de la integración, 11, recuperado de. http://docs.politicascti.net/documents/Teoricos/Sabato_Botana.pdf .

Schumpeter, J. (1996). Capitalismo, socialismo y democracia. Barcelona: T.I Ediciones.

Smith, A. (2011). *La riqueza de las naciones*. Madrid, España: Alianza.

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