

Patents and Social Innovation at Mexico's State Public Universities

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Abstract

The transfer of technology from universities to society has acquired a strategic role in promoting economic and social development, particularly following the enactment of the Bayh-Dole Act in the United States, which enabled universities to protect and commercialize intellectual property funded with public resources. In Mexico, State Public Universities (SPUs) possess the autonomy to define their own academic trajectories, allowing them to align their core functions with the social needs of the regions where they operate. This research aims to identify the necessary and/or sufficient conditions that foster technology transfer processes with significant social impact (TTPSI) within SPUs. To this end, the study employs Qualitative Comparative Analysis (QCA), a methodological approach suitable for determining the conditions that enable these transfer processes to succeed. The results reveal that university social responsibility (USR) emerges as the only necessary condition to explain TTPSI. In contrast, the conditions related to innovative development capabilities (IDC), engagement capabilities (EC), and institutional capabilities (IC) fail to meet the consistency criterion as necessary conditions. These findings underscore the relevance of designing institutional policies that focus on social impact, beyond the mere number of patents generated or agreements signed with the productive sector.

Keywords: Qualitative Comparative Analysis; Social Relevance; Technology Transfer; State Public Universities in Mexico.

Introduction

The enactment of the Bayh-Dole Act in 1980 in the United States positioned university patents as a mechanism to protect intellectual property derived from publicly funded research, enabling universities to negotiate licensing agreements with the private sector (Nugent & Keusch, 2010). This mechanism has consolidated itself as a key strategy for fostering technology transfer and the commercial exploitation of scientific knowledge developed within academia. In this context, universities have played a fundamental role not only in the creation of disruptive technologies but also in the continuous improvement of existing technologies through applied research, patent development, and industry collaboration (Tushman & O'Reilly, 1996; Etzkowitz, 2008).

The strategic management of intellectual property—including patents, licensing agreements, and spin-offs—has allowed universities to evolve from traditional academic institutions into innovative universities (Arechavala, 2011), seeking to balance their educational and scientific missions with the generation of economic value (Geuna, 2001). Over the past decades, this process has strengthened the relationship between academic institutions and the industrial sector, particularly in countries that have adopted innovation policies as part of their economic development agenda (Bozeman et al., 2015). This evolving relationship has sparked growing interest in understanding how universities can bridge the gap between academic knowledge and market needs.

Numerous studies have explored the university-industry linkage (Nlemvo, Pimay & Surlemont, 2002; Siegel, Waldman & Link, 2003; Siegel et al., 2004; Hindle & Yencken, 2004; Vohora, Wright & Lockett, 2004; Bercovitz & Feldman, 2006) from a critical perspective, emphasizing that the success of technology transfer depends not only on the volume of patents or signed agreements but also on the social relevance of the innovations transferred.

Mexico's State Public Universities (SPUs) constitute higher education institutions created through decrees issued by local legislatures under the legal framework of decentralized public bodies (SEP, 2019). As autonomous institutions, SPUs retain the authority to define and design their academic trajectories and policies in alignment with the needs of the communities where they operate and with their core functions of teaching, research, cultural dissemination, and community services. These characteristics enable SPUs to implement mechanisms and actions aimed at developing their own capacities, thereby promoting innovation processes and technology transfer (Arechavala, 2011).

The objective of this research consists of identifying the necessary and/or sufficient conditions that SPUs in Mexico must consider at the institutional planning level to promote the generation of patents with strong social relevance. To this end, this study applies Qualitative Comparative Analysis (QCA) as an appropriate methodological approach. Drawing on quantitative and qualitative information from case studies, the research identifies the conditions that drive the generation of patents with social relevance.

The findings reveal that university social responsibility (USR) emerges as a condition that explains the desired outcome—namely, technology transfer processes with high social impact (TTPSI). Furthermore, the results indicate that innovative development capability (IDC), engagement capability (EC), and institutional capability (IC) do not meet the consistency criterion to be considered necessary conditions.

Theoretical Framework

Technology transfer requires constant interaction among universities, industry, and society to ensure the effective adaptation of generated knowledge to real-world applications. The Triple Helix model, proposed by Etzkowitz and Leydesdorff (2000), suggests that innovation arises from the interaction between universities, industry, and government. This approach repositions universities beyond their traditional role as knowledge producers, establishing them as strategic actors within innovation ecosystems, capable of actively contributing to productive and social transformation through partnerships with other sectors.

Similarly, scholars such as Mowery et al. (2001), Link and Scott (2005), and Chaminade and Vang (2018) have emphasized the importance of aligning universities' technological capabilities with the actual demands of productive and social sectors.

The social relevance of university patents has gained increasing attention within contemporary academic debates. Mowery and Nelson (2000) highlight the need to ensure that patented discoveries benefit society as a whole, rather than merely serving private actors with commercial exploitation capabilities. This requires fostering knowledge generation that addresses social challenges through accessible, sustainable, and scalable technological solutions.

Within this context, the concept of social innovation emerges, understood as a process that addresses unmet social needs not covered by the market or the state through new and more effective solutions (Mulgan, 2006), or as new ideas—products, services, and models—that meet social needs, build social relationships, and foster new forms of collaboration (Murray et al., 2010).

Social innovation focuses on improving quality of life, particularly for vulnerable populations, through sustainable strategies that can be replicated across different settings. Universities, therefore, operate not only as generators of scientific knowledge but also as active agents of social transformation.

In this regard, Bayuo, Chaminade, and Göransson (2020) examine the role of universities in fostering and enhancing social innovations through three core functions: teaching, research, and community engagement. Their research identifies a shift among universities, moving beyond the prioritization of technology transfer and commercialization towards more active involvement in knowledge generation alongside social sectors, with the goal of providing coordinated solutions to social problems. Likewise, Menter (2024) argues that universities should adopt a more inclusive innovation perspective, capable of generating both social and economic value in response to global challenges such as climate change. This shift demands institutional transformations in technology transfer mechanisms, which must be reconfigured to promote the co-creation of social value and facilitate social innovation processes.

In the Latin American context, research by Cobo-Gómez (2023) demonstrates how universities have promoted collaborative models with local communities to co-create sustainable solutions to specific problems, fostering bidirectional knowledge transfer processes.

Similarly, within the Mexican context, Molina-Sánchez and Hernández García (2020), through a comparative study of universities, stress the need to integrate social innovation competencies into academic programs. Their research identifies creativity, collaboration, social leadership, and project management as key skills for the success of social entrepreneurs. This educational approach strengthens the training of students capable of developing initiatives that, beyond technical feasibility, generate a positive impact on society.

At a more specific level, within Mexico's public universities, Alvarado (2020) analyzes the strategic role these institutions can play in generating scientific, technological, and social solutions during emergencies. Drawing from the case of the Autonomous University of Querétaro, he documents how the institution spearheaded the development of an experimental COVID-19 vaccine by leveraging its internal technological capabilities and coordinating the specialized knowledge of its academic community for the collective well-being. This experience highlights how public problems can be effectively addressed through initiatives that integrate applied research, social engagement, and inter-institutional collaboration, demonstrating the transformative potential of universities when they act as active agents in contexts characterized by high social needs.

QCA Methodological Approach: Sample Design and Data Collection Instruments

Qualitative Comparative Analysis (QCA) constitutes a methodological approach designed to identify sufficient and/or necessary conditions that form causal configurations explaining a desired or relevant outcome (Schneider & Wagemann, 2010). This method applies Boolean logic to uncover causal relationships (Parente & Federo, 2019), an essential feature of most social phenomena, which become better understood through necessity and sufficiency relations. In other words, a desired outcome results from the interdependence of multiple conditions (conjunction), while multiple pathways can lead to the same outcome (equifinality), and the absence of certain conditions that produce a desired outcome does not necessarily mirror the conditions that lead to the opposite outcome (asymmetry) (Calderón-Altamirano & Rodríguez, 2023).

QCA offers an alternative to traditional correlation-based methods for establishing causal conditions associated with expected or desired outcomes (Woodside, 2016). Beyond serving as a tool for case study analysis, this approach enables empirical data analysis to generalize findings, considering potential replication in future studies and facilitating the construction of logical propositions following the qualitative examination of the phenomenon under investigation (Woodside & Zhang, 2012).

The QCA research process unfolds through three main stages (Schneider & Wagemann, 2010; Woodside, 2016). First, relevant conditions and the outcome of interest are selected and calibrated based on the specific QCA variant applied (fsQCA, csQCA, or mvQCA). The second stage involves necessity analysis, which determines whether particular conditions consistently appear across all cases that exhibit the desired outcome. Finally, the sufficiency analysis identifies which conditions or combinations of conditions suffice to explain the desired outcome.

Sample Design and Data Collection Instruments

This study applies the fuzzy-set variant of QCA (fsQCA) within the broader Qualitative Comparative Analysis approach. This variant integrates qualitative and quantitative tools to analyze causal configurations in social phenomena, enabling the assessment of degrees of set membership represented by continuous values ranging from 0 to 1, rather than relying on strict dichotomous classifications. This approach facilitates determining each case's degree of inclusion or exclusion regarding the explanatory conditions and the outcome of interest (Cronqvist & Berg-Schlusser, 2008). The analysis requires selecting cases from the study universe that exhibit sufficient similarity or comparability to allow examination through specific theoretical dimensions (Ragin, 2008a).

The selected universe consists of the 35 State Public Universities (SPUs) operating across Mexico's 32 states. These institutions, created through decrees issued by local legislatures, function as decentralized public entities with legal autonomy, granting them the authority to define and design their academic trajectories according to the needs of the communities where they operate. Their academic strategies align with their core functions of teaching, knowledge generation and innovative application, as well as cultural extension and dissemination (SEP, 2019).

Within this framework, knowledge and technology generation and transfer extend beyond fundamental university responsibilities, serving as a critical pathway for promoting socially relevant innovations capable of offering solutions to societal challenges and contributing meaningfully to collective well-being.

To measure the conditions—specifically the sufficiency relationship between each condition and the outcome—the study deployed a survey targeting individuals responsible for technology transfer offices within the SPUs. Leveraging Mexico's right to information framework, the survey instrument was distributed through the National Transparency and Public Information Access Platform. The survey aimed to collect data on the number of patents registered by each institution, categorized by field of knowledge, and to identify those patents resulting from university-industry collaboration processes.

Additionally, the survey included a component to assess the social relevance of the patents, understood as the extent to which patented inventions address problems identified by the universities themselves through diagnostic processes, applied research initiatives, or collaboration schemes with social actors. This approach sought not only to quantify technological output but also to assess its potential social impact within specific contexts.

The study also gathered information on the mechanisms implemented to ensure that technology transfer activities positively impact society; the perceived effects of such activities on community well-being and quality of life; factors that, from the respondents' perspective, could enhance these activities to better address social needs; and the extent to which they believe knowledge transfer from universities to industry and businesses generates positive outcomes for the community.

Table 1. Conceptualization of Conditions and Desired Outcome.

Condition	Definition
Innovative Development Capability (IDC)	Refers to the generation of patents by field of knowledge.
Engagement Capability (EC)	Refers to patents resulting from university-industry-society collaboration aimed at solving specific problems.
Institutional Capability (IC)	Refers to the implementation of technology and knowledge transfer processes toward productive and social sectors.
University Social Responsibility (USR)	Refers to the policies and programs implemented by the university through its teaching, research, and outreach functions to generate a positive societal impact and contribute to social development.
Desired Outcome	Definition
Technology Transfer Processes with High Social Impact (TTPSI)	Refers to the university's ability to ensure that patented inventions respond to social needs. This implies that developed technologies not only meet criteria of novelty and technical applicability but also contribute to addressing specific social challenges.

Source: Own elaboration.

Based on the conceptualization of the conditions and the desired outcome, this study proposes the hypothesis that innovative development capability, engagement capability, institutional capability, and university social responsibility constitute sufficient and necessary conditions for achieving technology transfer processes with greater social impact within Mexico's State Public Universities.

The final sample consisted of 22 SPUs that provided responses to the survey through the National Transparency and Public Information Access Platform.

Results Analysis and Application of the fsQCA Model

To apply the fsQCA model, the study documented the cases of the institutions that completed the data collection instrument. Table 2 presents the frequency with which the conditions appear in each of the State Public Universities (SPUs) analyzed.

Table 2. Presence of Conditions in the Case Studies

Case (SPUs)	IDC	EC	IC	USR
Aguascalientes	0	0	0	1
Baja California	1	0	0	1
Baja California Sur	0	0	1	1
Campeche	0	0	0	0
Coahuila	0	0	0	1
Colima	0	1	1	1
Guanajuato	1	0	1	0
Guerrero	0	0	0	0

Hidalgo	1	1	1	1
Jalisco	1	1	1	1
Morelos	1	0	0	0
Nuevo León	1	1	1	1
Oaxaca	0	0	0	0
Querétaro	0	0	0	0
Sinaloa	1	1	1	1
San Luis Potosí	0	0	1	1
Sonora	1	1	1	1
Tabasco	0	0	1	1
Tamaulipas	0	0	0	1
Tlaxcala	0	0	0	0
Veracruz	1	1	0	1
Yucatán	1	0	0	0

Source: Own elaboration.

Table 3 presents the membership scores assigned to each of the conditions that constitute the causal configurations analyzed. These scores range from 0 to 1, following the principles of fuzzy set analysis (fsQCA) proposed by Ragin (2008a). The assignment of these values relied on the indirect calibration method, which transforms empirical data into membership scores based on theoretically grounded qualitative assessments (Pappas & Woodside, 2021). This method requires that measurements be constructed using criteria that establish thresholds (anchor points) distinguishing between full membership (values close to 1), full exclusion (values close to 0), and intermediate zones reflecting uncertainty or partial membership.

Table 3. Membership Scores for Conditions in the Case Studies

Case (SPUs)	IDC	EC	IC	USR	TTPSI
Aguascalientes	0.00	0.00	0.00	0.50	0.00
Baja California	0.17	0.00	0.00	0.25	0.50
Baja California Sur	0.00	0.00	0.13	1.00	0.50
Campeche	0.00	0.00	0.00	0.00	0.50
Coahuila	0.05	0.00	0.00	0.25	0.50
Colima	0.04	0.38	0.13	0.75	1.00
Guanajuato	0.53	0.00	0.13	0.00	0.50
Guerrero	0.00	0.00	0.00	0.00	0.00
Hidalgo	0.29	0.13	0.13	0.75	1.00
Jalisco	0.67	0.25	0.50	1.00	1.00
Morelos	0.15	0.00	0.00	0.00	0.00
Nuevo León	1.00	0.50	1.00	1.00	1.00
Oaxaca	0.00	0.00	0.00	0.00	0.00
Querétaro	0.01	0.00	0.00	0.00	0.00
Sinaloa	0.21	0.38	0.13	0.50	1.00
San Luis Potosí	0.05	0.00	0.13	1.00	1.00
Sonora	0.16	1.00	0.50	0.75	1.00
Tabasco	0.02	0.00	0.13	0.75	0.00
Tamaulipas	0.04	0.00	0.00	0.50	0.50
Tlaxcala	0.00	0.00	0.00	0.00	0.00
Veracruz	0.17	0.13	0.00	0.75	1.00
Yucatán	0.10	0.00	0.00	0.00	0.00

Source: Own elaboration.

The Calibrate function receives each condition to be calibrated, along with the full membership, crossover, and full exclusion thresholds, transforming the data into values within a range between 0 and 1. For the calibration process, the following cut-off points were established for all conditions: 1.00 (full membership), 0.67 (crossover point), and 0.33 (full exclusion). For the desired outcome, the thresholds were set at 0.95 (full membership), 0.45 (crossover point), and 0.25 (full exclusion). Once these thresholds were defined, data calibration was performed using the fsQCA 4.1 software (Ragin & Davey, 2022).

Table 4. Calibrated Membership Scores in fsQCA 4.1

SPUs	IDC	EC	IC	USR	TTPSI
Aguascalientes	0.00	0.00	0.00	0.18	0.00
Baja California	0.01	0.00	0.00	0.20	0.57
Baja California Sur	0.00	0.00	0.01	0.95	0.57
Campeche	0.00	0.00	0.00	0.00	0.57
Coahuila	0.00	0.00	0.00	0.02	0.57
Colima	0.00	0.07	0.01	0.67	0.96
Guanajuato	0.23	0.00	0.01	0.00	0.57
Guerrero	0.00	0.00	0.00	0.00	0.00
Hidalgo	0.03	0.01	0.01	0.67	0.96
Jalisco	0.50	0.02	0.18	0.95	0.96
Morelos	0.01	0.00	0.00	0.00	0.00
Nuevo León	0.95	0.18	0.95	0.95	0.96
Oaxaca	0.00	0.00	0.00	0.00	0.00
Querétaro	0.00	0.00	0.00	0.00	0.00
Sinaloa	0.02	0.07	0.01	0.18	0.96
San Luis Potosí	0.00	0.00	0.01	0.95	0.96
Sonora	0.01	0.95	0.18	0.67	0.96
Tabasco	0.00	0.00	0.01	0.67	0.00
Tamaulipas	0.00	0.00	0.00	0.18	0.57
Tlaxcala	0.00	0.00	0.00	0.00	0.00
Veracruz	0.01	0.01	0.00	0.67	0.96
Yucatán	0.01	0.00	0.00	0.00	0.00

Source: Own elaboration.

The next step involved running the Truth-Table Algorithm to generate the truth table, which computes all possible configurations of conditions that may occur, providing 2^k rows, where k represents the number of conditions and 2 reflects the presence or absence of each condition (Ragin et al., 2017).

Table 5. Truth Table

IDC	EC	IC	USR	Number	TTPSI	Raw Consist.	PRI Consist.	SYM Consist.
0	0	0	0	13	0	0.362094	0.216486	0.25105
0	0	0	1	6	0	0.792929	0.743215	0.807256
0	1	0	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1

Source: Own elaboration.

To analyze the conditions or combinations of conditions that are necessary and/or sufficient to produce the desired outcome, the truth table was refined by setting a consistency threshold of 0.80 (Ragin, 2008b). This process revealed the configurations that potentially explain technology transfer processes with higher social impact (TTPSI). Table 5 shows that configurations three and four are the only ones considered sufficient to achieve the desired outcome.

Table 6. Modified Truth Table

Config.	IDC	EC	IC	USR	Y=0	Y=1	N	NY	Consist.	XY
1	0	0	0	0	UAA UABC UACAM UAdcC UGTO UAGro UAEM UABJO UAQ UAS UAT UATX UADY		13	13	0	F
2	0	0	0	1	UABCS UACOL UAEH UASLP UJAT UV		6	6	1	F
3	0	1	0	1	-	UNISON	1	1	1	V
4	1	0	1	1	-	UANL	1	1	1	V

Source: Own elaboration.

According to the fsQCA approach, if a configuration is sufficient to explain high performance, all cases within that group must exhibit the desired outcome (Y=1).

Table 6 presents the cases corresponding to each causal configuration based on the values from the truth table. Configuration one shows that the combination of IDC, EC, IC, and USR fails to explain the desired outcome for the SPUs located in thirteen states. Configuration two suggests that the presence of USR allows SPUs from six states to potentially achieve TTPSI. However, only configurations three and four lead to the desired outcome, with the SPUs in the states of Sonora and Nuevo León, respectively, exhibiting different sets of present conditions.

Table 7. Intermediate and Parsimonious Solution
 (Consistency threshold: 0.80)

Causal Configuration	Row Coverage	Unique Coverage	Consistency
<i>Intermediate Solution</i>			
$\sim IDC * EC * \sim IC * USR$	0.0810811	0.072072	1
$IDC * \sim EC * IC * USR$	0.0927928	0.0837838	1
<i>Parsimonious Solution</i>			
EC	0.118018	0.0792793	1
IDC	0.158559	0.0513513	0.988764

IC		0.123423	0.00180179	0.992754
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Source: Own elaboration.

The table 7 presents the causal configurations by type of solution. The intermediate solution includes two possible combinations, both reaching a consistency value of 1, with coverage values of 8% and 9%, respectively, of the cases exhibiting the desired outcome (ITPSI).

Regarding the parsimonious solution, three configurations emerge. The first configuration, characterized by the presence of EC, shows a consistency value of 1 and covers 11% of the cases. The second configuration, defined by the presence of IDC, presents a consistency value of 98% and covers nearly 16% of the cases. The third configuration, involving the presence of IC, reaches a consistency value of 99%, covering 12% of the cases.

To determine whether a condition must be present for the desired outcome to occur, each of the conditions within the causal configurations requires evaluation in terms of necessity (Ragin, 2008^a).

Table 8. Necessary Conditions
 (Consistency threshold: 0.80)

Condition	Consistency	Coverage
IDC (Innovative Development Capability)	0.158559	0.988764
EC (Engagement Capability)	0.118018	1.000000
IC (Institutional Capability)	0.123423	0.992754
USR (University Social Responsibility)	0.801802	0.844501

Source: Own elaboration.

In the case of the SPUs, Table 8 presents the results of the necessity analysis, applying a consistency threshold of 0.80. The results indicate that IDC, EC, and IC do not qualify as necessary conditions. However, the same analysis shows that USR reaches a consistency value equal to or greater than 0.80, thus confirming its status as a necessary condition.

Discussion and Conclusions

This study analyzes the causal configurations that may explain technology transfer processes with social impact in Mexico's State Public Universities (SPUs). In this context, it is recognized that the human-centered innovation approach promoted by the General Law on Humanities, Sciences, Technologies, and Innovation (LGCHTI) provides a regulatory framework that encourages universities to align their core functions with the generation of socially relevant knowledge that contributes to collective well-being.

From this perspective, University Social Responsibility (USR)—understood as the set of policies and programs implemented by SPUs through their teaching, research, and outreach functions to generate a positive social impact—emerges as a condition present in the causal configurations of the intermediate solution and constitutes the only condition meeting the consistency criterion to be considered necessary. This finding relates to the ethical and social commitment that SPUs must assume in the communities where they operate, along with the need to establish

institutional practices that strengthen university-society relations. One of the concrete outcomes of these efforts is their consolidation in generating patents and knowledge with a tangible impact on collective well-being, in line with the principles established by the LGCHTI.

In addition, Innovative Development Capability (IDC), defined as the generation of patents by field of knowledge, and Institutional Capability (IC), referring to the implementation of technology and knowledge transfer processes toward productive and social sectors, appear in one of the causal configurations of the intermediate solution and also in the parsimonious solution. This suggests that, within SPUs, academic fields with higher patent output—such as technical sciences (chemistry), agricultural sciences (biotechnology), and health sciences (medicine)—closely relate to achieving the desired outcome, especially when these areas are combined with institutional transfer capabilities and a vision oriented toward social impact.

A representative case that illustrates the configuration with the presence of IDC, IC, and USR is the Autonomous University of Nuevo León (UANL). This university has developed and transferred patents such as “A Modified Antigen for the Detection of Antibodies Against Brucella and Method of Use” and “Genetically Modified Methylophilic Yeasts for the Production and Secretion of Human Growth Hormone”. These patents result from UANL's tech-push approach to impactful research, supported by institutional collaboration mechanisms that steer innovation toward the common good. This approach ensures that knowledge generation does not solely function as a means to secure additional resources but rather transforms into a tool for social development.

Finally, Engagement Capability (EC)—referring to patents resulting from university-industry-society collaboration aimed at solving specific problems—appears alongside USR in one of the causal configurations of the intermediate solution. This suggests that, although this form of engagement does not qualify as a necessary condition on its own, its presence, combined with USR, may prove essential for achieving successful technology transfer processes with social impact.

However, based on the information provided by the SPUs, only seven universities report patents derived from this tripartite collaboration, suggesting that EC remains underdeveloped among SPUs. This highlights an opportunity to strengthen social innovation through strategic, sustained partnerships—an indispensable requirement for consolidating technology transfer processes with high social impact and public value.

References

Alvarado, L.R.A. (2020). La universidad pública ante el COVID-19: El caso de la Universidad Autónoma de Querétaro. *Debates sobre Innovación*, 5(1): 1-6.

Arechavala, R. (2011). Sistemas regionales de innovación en México y Canadá: una comparación de retos en el desarrollo de la innovación tecnológica. *Revista de la Educación Superior*, 42, 41-57.

Bercovitz, J. y Feldman, M. (2006). Entrepreneurial universities and technology transfer: a conceptual framework for understanding knowledge-based economic development. *Journal of Technology Transfer*, 31(1), 175-188. DOI: 10.1007/s10961-005-5029-z

Bozeman, B., Rimes, H. y Youtie, J. (2015). The evolving state-of-the-art in technology transfer research: revisiting the contingent effectiveness model. *Research Policy*, 44(1), 34-49. DOI: 10.1016/j.respol.2014.06.008

Calderón-Altamirano, E. y Rodríguez, J.C. (2023). Transferencia de tecnología universidad-industria en las universidades públicas estatales de México: Un análisis configuracional. *Journal of Technology Management & Innovation*, 18(4), 18-30. DOI: 10.4067/S0718-27242023000400018

Chaminade, C. y Vang, J. (2008). Globalisation of knowledge production and regional innovation policy: Supporting specialized hubs in the Bangalore software industry. *Research Policy*, 37(10), 1684-1696. DOI: 10.1016/j.respol.2008.08.014

Cobo-Gómez, J. (2023). Social innovation in the Latin-America University Context (tesis doctoral). Pontificia Universidad Javeriana. Recuperado de: <http://hdl.handle.net/10554/65594>

Cronqvist, L. y Berg-Schlosser, D. (2008). Multi-value QCA (mvQ-CA). En: Rihoux, B. y Ragin, C., *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*. Sage, Thousand Oaks.

Etzkowitz, H. (2008). *The Triple Helix: University–Industry–Government innovation in action*. Routledge. <https://doi.org/10.4324/9780203929605>

Etzkowitz, H. y Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and “Mode 2” to a Triple Helix of university–industry–government relations. *Research Policy*, 29(2), 109-123. [https://doi.org/10.1016/S0048-7333\(99\)00055-4](https://doi.org/10.1016/S0048-7333(99)00055-4)

Geuna, A. (2001). The Changing Rationale for European University Research Funding: Are There Negative Unintended Consequences? *Journal of Economic Issues*, 35(3), 607–632. DOI:10.1080/00213624.2001.1150639

Hindle, K. y Yencken, J. (2004). Public research commercialisation, entrepreneurship and new technology-based firms: an integrated model. *Technovation*, 24, 793-803. DOI:10.1016/S0166-4972(03)00023-3

Link, A. y Scott, J. (2005). Opening the ivory tower’s door: An analysis of the determinants of the formation of U.S. university spin-off companies. *Research Policy*, 34(7), 1106-1112. DOI: 10.1016/j.respol.2005.05.015

Menter, M. (2024). From technological to social innovation: toward a mission-reorientation of entrepreneurial universities. *Journal Technol Transfer*, 49, 104-118. <https://doi.org/10.1007/s10961-023-10002-4>

Molina-Sánchez, R. y García, P. (2020). Study of Competences Required for Entrepreneurship and Social Innovation: Comparative Case of Different Mexican Universities. En R. Pérez-Urbe, D. Ocampo-Guzman, C. Salcedo-Pérez, L. Piñero-Cortes, y M. Ramírez-Salazar (Eds.), *Handbook of Research on Increasing the Competitiveness of SMEs* (pp. 493-515). IGI Global Scientific Publishing. DOI: 10.4018/978-1-5225-9425-3.ch022

Mowery, D., Nelson, R., Sampat, B. y Ziedonis, A. (2001). The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980. *Research Policy*, 30(1), 99–119. DOI: 10.1016/S0048-7333(99)00100-6

Mulgan, G. (2006). The Process of Social Innovation. *Innovations: Technology, Governance, Globalization*, 1(2), 145-162. DOI: 10.1162/itgg.2006.1.2.145

Murray, R., Caulier-Grice, J. y Mulgan, G. (2010). The open book of social innovation. En: *National Endowment for Science, Technology and the Arts (NESTA) & The Young Foundation*. London, UK.

Nlemvo, F., Pimay, F. y Surlemont, B. (2002). A stage model of academic spin-off creation. *Technovation*, 22(5), 281-289. DOI: 10.1016/S0166-4972(01)00019-0

Nugent, R. y Keusch, G. (2010). Salud mundial: Lecciones de la Ley Bayh-Dole. En *Gestión de la propiedad intelectual e innovación en agricultura y en salud: Un manual de buenas prácticas*. Fundación para la Innovación Agraria (FIA) y Public Intellectual Property Resource for Agriculture (PIPRA).

Parente, T. y Federo, R. (2019). Qualitative comparative analysis: justifying a neo-configurational approach in management research. *RAUSP Management Journal*, 54(4), 399-412. DOI:10.1108/RAUSP-05-2019-0089

Ragin, C. (2008a). Measurement versus Calibration: A Set-Theoretic Approach. *In The Oxford Handbook of Political Methodology*.

Ragin, C. (2008b). *Redesigning Social Inquiry*. University of Chicago Press, Chicago.

Ragin, C. y Sean, D. 2022. *Fuzzy-Set/Qualitative Comparative Analysis 4.0*. Irvine, California: Department of Sociology, University of California.

Schneider, C. y Wagemann, C. (2010). Standards of good practice in Qualitative Comparative Analysis (QCA) and fuzzy-sets. *Comparative Sociology*, 9(3), 397-418

Siegel, D., Waldmann, D. y Link, A. (2003). A financial sustainability review: change and adaption in the voluntary sector as the economy recovers. *Research Policy*, 32(1), 27-48.

Siegel, D., Waldman, D., Atwater, L. y Link, A. (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: Qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management*, 21(1-2), 115-142. Doi.org/10.1016/j.jengtecman.2003.12.006

SEP (2019). Secretaría de Educación Pública. Instituciones de Educación Superior. <https://www.educacionsuperior.sep.gob.mx/instituciones.html>

Tushman, M. y O'Reilly, C. (1996). Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *California Management Review*, 38(4), 8-29. DOI: 10.2307/41165852

Vohora, A., Wright, M. y Lockett, A. (2004). Critical junctures in the development of university high-tech spinout companies. *Research Policy*, 33(1), 147-175. DOI: 10.1016/S0048-7333(03)00107-0

Woodside, A. (2016). *Bad to Good: Achieving High Quality and Impact in Your Research*. Emerald, Bingley.

Woodside, A. y Zhang, M. (2012). Identifying X-Consumers Using Causal Recipes: “Whales” and “Jumbo Shrimps”. *Journal of Gambling Studies*, 28, 13-26. DOI: 10.1007/s10899-011-9241-5