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Spreading academic entrepreneurship: Made in Mexico

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Abstract This work presents REPITA (*Research-Ecosystem-People-Intellectual Property-Transfer-Alignment*), a prescriptive and repeatable model for successful technology-based academic entrepreneurship, synthesized from research of academic entrepreneurship in developing economy conditions. In this work, we identify three deficiencies in Mexico's entrepreneurship ecosystem: research skills, high technology, and technology transfer. We then present a solution that has been recognized by the Organization for Economic Co-operation and Development (OECD) for fueling high-tech university spin-offs with science and technology doctoral research. Lessons from 48 spin-off projects are synthesized in the newly proposed REPITA model, which prescribes connecting a basic research platform to applications, catalyzing the entrepreneurship ecosystem with resources and incentives, combining highly specialized people in entrepreneurial teams, setting generous and flexible intellectual property policies for the knowledge economy, transferring technology per entry and exit strategies, and aligning technology and business incubation. Finally, we propose a tool that presents academic entrepreneurship theories in an actionable format for university administrators and entrepreneurs. These results are not a theoretical framework on their own, but rather a real-world organizational model based on theory for impelling technology-based, academic spin-offs with economic impact. Taken together, this contribution may be useful to practitioners and provocative for researchers.

1. The rise of academic entrepreneurship

Although entrepreneurship is not the university's traditional raison d'être, it has become a priority for institutions seeking to generate revenues and

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elevate brand status. Academic entrepreneurship refers to university researchers commercializing university research through new business enterprises. State-of-the-art suggestions for boosting academic entrepreneurship via technology transfer include increasing faculty quality as well as faculty size, investing in patent protection, expanding industry relations, launching interdisciplinary research centers, and rewriting university incentives in favor of commercialization at the expense of scientific publication (Hsu, Shen, Yuan, & Chou, 2015). These actions cannot all be feasible within a university with a historical set of priorities and limited resources. Through the experience of dozens of academic startups in this decade, a Mexican university is defining a sustainable model for high-tech academic entrepreneurship that could teach other institutions a few lessons.

1.1. Mexico's academic entrepreneurship priority

Donald Trump isn't the only one talking about Mexico. In 2015, *Inc*. magazine called Mexico an "undiscovered opportunity for entrepreneurs" (Rampton, 2015) and, although it may be unexpected, academic entrepreneurship is a rising trend in Mexico, presenting opportunities to the country and the region. The Mexican National Council of Science and Technology, abbreviated to CONACYT by its Spanish initials, plays a role similar to the National Science Foundation (NSF) in the U.S. It coordinates an innovation program named FINNOVA that connects applied research with entrepreneurs and companies, helping to transfer technology between academics and businesses and assisting academic institutions in the creation of spin-offs. Preliminary research reports that 13% of Mexican university and research institute researchers have been or are involved in spin-off creation (Gutiérrez & Montemayor, 2012). Beyond these summaries, however, the practitioner's experience of Mexican academic entrepreneurship has not been studied and shared. What does the spread of academic entrepreneurship in Mexico have to teach about how universities can impel successful spin-offs that create returns to their scientific, social, and economic communities?

The lessons learned from a first-of-its-kind entrepreneurship experiment have been assimilated into a model called REPITA, which prescribes six actions:

1. *Research*: Structuring a basic research platform toward applications;
2. *Ecosystem*: Catalyzing the entrepreneurship ecosystem with resources and incentives;
3. *People*: Combining highly specialized people in entrepreneurial teams;
4. *Intellectual property*: Writing more generous and flexible intellectual property (IP) compensation policies for the knowledge economy;
5. *Transfer*: Transferring technology per entry and exit strategies that respect young businesses and profit the technology transfer office (TTO); and
6. *Alignment*: Aligning technology and business incubation.

Before arriving to the model, dozens of high-technology academic spin-offs were studied in an experimental entrepreneurship program called *incubation cells*, which was recognized by the Organization for Economic Co-operation and Development (OECD) for teaching "business competencies to doctoral students" (OECD, 2012). Tecnológico de Monterrey, the Mexican academic institution with the most patents filed and spin-offs created in recent history (Yeverino-Juarez, 2015), hosted this experiment. Lessons learned from the experiment are synthesized into the prescriptive REPITA model.

1.2. How does academic entrepreneurship work?

Universities have recently earned a primary role in the study of entrepreneurship as practitioners and theorists have asked how academic entrepreneurship works. One idea, the *resource-based framework* (Wernerfelt, 1984), was applied to university entrepreneurship by O'Shea, Allen, and Chevalier (2005). This framework suggests that the heterogeneity of each university's resources gives unique characteristics and opportunities to each of the university's spin-off activities. There are four resource categories that explain differences in university entrepreneurship: human, institutional, financial, and commercial resources. These resources help transfer innovations from university research to commercial markets.

Research supports these four resource categories. Hsu et al. (2015), as well as Powers and McDougall (2005), found human resources such as quantity and quality of researchers to be relevant for the successful production of spin-offs in universities and research centers. O'Shea, Allen, Mores, O'Gorman, and Roche (2007) and Valdez and Richardson (2013) determined that intangible