TECHNOLOGY AND INNOVATION IN LATIN AMERICA

The Need for a Turning Point

Edited by
OSCAR JAVIER MONTIEL MÉNDEZ
LORENA ÁLVAREZ-CASTAÑÓN
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Technology and Innovation in Latin America

This book reads on two levels. On the one hand, we find the normative level, which is essential for innovation to make a substantive contribution to development, understood as the expansion of the capacities of all people to live lives they consider valuable. Here, reflections on innovation flourish about equity, sustainability, participation, and solidarity. On the other hand, we find a concrete level of technology and innovation in diverse fields, ranging from just energy to transformations in the manufacturing industry, including new technology-based enterprises. The caliber of the challenges that technologies and innovation pose to Latin American and Caribbean societies, the type of paths to follow, and the institutional capacities available to address them emerge from this book. The book convinces its readers that the region is at a turning point and offers a rich perspective, anchored in ethics and facts, on what to do and how to do it so that it points to human and sustainable development.

—***Judith Sutz*, Professor at University of the Republic, Uruguay**

The authors offer hope for Latin America through a catch-up process of innovation and entrepreneurship. The book presents research advocating transformative innovation in the quest for Latin America's sustainable ecological, energy, and manufacturing development. This means a collaborative process among Latin American Nations, such as the Amazon region of Peru, Mexico, Ecuador, Brazil, and throughout Latin America. This groundbreaking book argues for major changes in the rules of the globalization game's legal framework, policies, regional education model, long-term perspective on energy justice, and new relation between industrial production and ecosystem ecology. It requires new narratives that focus on transformational niches and new business models with socio-environmental benefits. The proposals stress the need for collaboration between public and private stakeholders with positive outcomes for innovation programs. This includes lab development innovation and entrepreneurship as a strategic direction in higher education institutions. High praise for the well throughout proposals based upon solid research methods.

—***David Michael Boje*, Professor Emeritus New Mexico State University**

Technology and Innovation in Latin America: The Need for a Turning Point

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This book is dedicated to everyone involved, directly or indirectly, to the region's innovation ecosystem, and to their trust and hope in the innovation and technology as a trigger for sustainable transformation.

The time has indeed come, and a turning point is needed.

Latin America's Rubicon is in sight. Will the region be able to cross it and once and for all unleash its potential?

The book proposal and all the book chapters were subject to a double-blind review process, done by academic experts in the field of Innovation, and with worldwide recognition.

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Technology and Innovation in Latin-America Toward the Hope of Transformation

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Latin-America has been labeled as an unequal territory and has shown to be highly vulnerable to the ups and downs of the external sector, which has caused its development to have an unstable behavior (ECLAC, 2019, 2022). Economic stagnation in the region occurs in parallel with incremental discomfort and technological change – which moves everything at a different pace. Latin-America has grown based on a productive and export structure centered on sectors with low productivity and little technological dynamism (Álvarez, 2021; ECLAC, 2019, 2022); however, the globalization process has caused technological transformations in the Latin-American region and public policies have attempted to stimulate innovation and technological change (Haraguchi et al., 2024; Katz, 2023). The technology and the innovation in the region have been driven by temporary changes; however, the structural changes with which these categories could drive development in the region have not systematically occurred in any Latin-American country (Santiago et al., 2023; Suarez & Goren, 2023).

According to the chapter by **Heijs and Guerrero**, the new waves of robotization and Artificial Intelligence (AI) could accelerate the relocation of productive activities; this would strongly alter the socioeconomic dynamics in the region, and the way to "compensate" for this is to build technological capabilities. Likewise, these authors defend the idea of promoting production with technologies not protected by patents to take advantage of the indirect effects of the still existing stock of foreign direct investment flows as the last opportunity to accelerate the learning process of human capital. In this context, the chapter by **Santiago and Heredia** shows that Latin-American countries have made progress in digital connectivity and have adopted advanced digital technologies to achieve social and

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economic digitalization; however, the greatest public challenge in the region is to systematically take advantage of digitalization to promote more equitable development through fundamental capabilities.

Nevertheless, the series of incentives for technological and innovation activities in the region have not been sufficiently disruptive to systematically contribute to its development (Álvarez, 2022; Arocena & Sutz, 2021; Casas, 2020; Giraldo, 2019). Besides, technological change has required more efficient processes of technological adaptation and diffusion of innovation as a structural condition of the ecosystem, and the social demand for innovation to (re)focus on addressing the problems of the region has been very strong. Along these lines, **Graf**'s chapter shows that it is essential to guarantee inclusive ecosystems based on innovation and technology to foster social welfare. Likewise, **Suarez and De Fuentes** argue that it is essential to break the inertia of gender inequality in science and technology to move toward inclusion. Moreover, **Arroyo** shows the contribution of green innovation to sustainability and focuses her recommendation on regional collaboration to achieve a turning point.

The literature review showed that the operationalization of inclusion must be (re)discussed in light of new innovation policies and socially responsible research agendas because this allows to achieve transformative innovations approaches (Godonoga & Sporn, 2023; Villa et al., 2023). In this sense, the chapter by **Ávila-Robinson, Miyashita and Sengoku** discusses how as research and technological development advances in LATAM, it is imperative to integrate ethical and social concerns into innovation processes to achieve inclusive, creative, and sustainable societies. In this context, the scientific production based on collaborative and cooperative university work is seen as the greatest challenge to generate research with greater scope and impact in the region as **Arocena** discusses in his chapter. However, this author shows that profound changes are required and scientific and technological research toward sustainable and socially inclusive innovation must be reorientated and proposes that public universities have a protagonist role, and its involvement (re)acquires greater relevance.

The need for a national policy and regional agreements on AI is essential (Haraguchi et al., 2024; Santiago et al., 2023); its integration into specialized and transversal curricula is urgent at the different university levels – undergraduate and postgraduate. This implies (re)prioritizing investment in infrastructure, (re) building digital capabilities and (re)orienting research agendas to achieve equitable and sustainable access to technology (Álvarez, 2021; Arocena & Sutz, 2021; ECLAC, 2022; Katz, 2023). Structural change in basic education is essential. Furthermore, STI requires interdisciplinary and intradisciplinary approaches and a shared vision of its contribution to achieve the welfare, energy justice, and transformative innovation. In this tessitura, the chapter by **Harman, Saravia and Osorio-García** shows the need for a STI paradigm shift in Latin-America, in which the innovation and technology facilitate spaces for critical thinking and learning toward systemic transformation – innovation based on territorial capital. Besides, the chapter by **Mejía-Montero** shows that materializing social innovation is a potential path for innovation and technology to take advantage of traditional

values and community practices and for these to impact the development of LATAM.

In this sense, **Rezende da Costa, Naves Arantes, Barros, and Cagica Carvalho** coincide that the open innovation approach and the cooperation are the triggers of the innovation in Latin-America. Interregional research has been raised as essential for the region to advance structurally. The chapter by **Morales-Gualdron and Quiñones-Mosquera** puts on the table for debate the need for transnational research to trigger academic spin-offs as a mechanism for technology transfer. Along these lines, Heijs and Guerrero propose a turning point for policies based on greater cooperation between Latin America and the Caribbean countries to obtain sufficient power in geopolitical terms and in global trade negotiations. This collaboration is especially relevant to gain access to technologies, commercial and management capabilities, and market size advantages, since this could guarantee a decent standard of living. In the face of these complex scenarios, the chapter by **Jasso and Torres** shows the catch-up process and discusses the scientific and technological collaboration between countries and agents through of an example: the development of the vaccine against COVID-19.

Along these lines, the chapter by **Pufal, Barbieux, Camboim, Avila, Netto, and Zawislak** discusses firms' trend to adopt a reactive rather than proactive approach, diverging from pathways conducive to innovation; this persistent reactiveness limits their potential for innovation. However, **Matuoka-Mizumuto and Discua-Cruz** shows a micro level that a strategy of stronger regulatory forces facilitates innovation and internationalization in agro-industrial production chains. Finally, this is strongly strengthened in the chapter by **Canales-García, Roman-Sanchez, and Mosquera-Laverde**, who propose four environments in innovation behavior – AI, triple helix cooperation activities, human capital, and institutional relations for technological innovation. So, this editorial project contributes to the discussion of technology and innovation in Latin-America and brings to the debate table the pressing need for a turning point to respond to the main transformations that the region has experienced. Since, this collective effort is based on the belief that innovation and technological advancement can be decentralized to foster a systemic agreement of degrowth accompanied by social redistribution of wealth and to (re)think and (re)discuss the role of the company, the society and the State.

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Part 1

Conditions, Complexities, and Challenges

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Chapter 1

Technology and Innovation: Priorities and Approaches

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Abstract

This research aimed to analyze the categories of technology and innovation based on their interrelated properties with a scope on the Latin-America region and to show how these categories have taken over everyday life and cannot be disassociated to explain their practice in this region. The methodological approach was qualitative, which included a systematic review literature and an interview of 10 Latin-American experts from six countries. Based on the findings, theoretical approaches to technology and innovation categories in the Latin American context, research directions, and practical trends from a long-term perspective were identified; these emphasizing the knowledge passed down through generations. In conclusion, the region has accumulated innovation capabilities – knowledge, technology, and skills – which have not been translated into productive products, process, or management; however, these have been translated into practical efforts with a social approach as shown in the chapters of this book.

Keywords: Latin-American innovation; Latin-American technology; approaches innovation; STI; innovation practical trends; Latin America

Introduction

The literature review consistently showed the impact of the linear relationship between technology and innovation on economic growth (Lee, 2019;

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Pakkan et al., 2023; Park et al., 2021); in Latin-American, this seemingly inseparable vision has driven its study as if innovation were only "technological innovation" (Casas, 2020; Dutrénit et al., 2021; Giraldo, 2019; Pufal & Zawislak, 2022). Hence, two basic currents for its study are identified: business innovation and "other" innovation. The first has focused on guaranteeing business competitiveness and the second on the multidimensional solution that involves development – social, environmental, and economic (Álvarez et al., 2018; Gandarilla, 2010; Qureshi et al., 2021). In Latin-America, three groups of studies on innovation and technology have been identified for over 40 years: (a) cultural studies of science, technology, and innovation; (b) science, technology, and society studies, which have critically questioned about science for what and for whom; (c) technoscience, whose studies have focused on terms of productivity and business competitiveness and have been the productive force of contemporary capitalism – domination of nature for profit (Álvarez et al., 2018; Casas, 2020; Giraldo, 2019; Qureshi et al., 2021).

These studies have overlapped with categories on actors involved and their forms of interaction – open, close, and hybrid (Álvarez & Palacios, 2021; González & Álvarez, 2019); furthermore, these have related with applications – social, environmental, frugal, among others (Jahanger et al., 2022; Johnstone & Schot, 2023; Qureshi et al., 2021). Thus, this chapter aimed to analyze the cases of technology and innovation based on their interrelated properties with a scope on the Latin-America region, and to show how these categories have taken over everyday life and cannot be disassociated to explain their practice in this region. Latin-American was analyzed as a geographic spatiality because Latin-American countries are often regarded as living laboratories for research, given their unique social, cultural, and economic profiles (Aguinis et al., 2020), and current generations in this region tend to exhibit persistence, innovation, and a drive to improve new technologies, making this region particularly relevant (Montiel et al., 2022). Thus, the chapter is structured in sections; the first shows the methodological framework; in the second, the findings were shown as theoretical approaches, research directions, and practical trends. Finally, the conclusions were presented.

Materials and Methods

The research was exploratory with an explanatory emphasis. The methodological approach was qualitative, and the process was integrated into two phases. The first was a systematic review of literature. The second was 10 interviews applied in six Latin-America countries – Argentina (AR), Chile (CH), Colombia (CO), El Salvador (SV), Mexico (MX), and Peru (PE). Data triangulation was used to support internal validation while the participation of experts from different countries allowed generalization, thus contributing also to external validation (Yin, 2013).