

Innovation And Development In The Brazilian Amazon: Analysis For Brasil's Northern Region

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Abstract :

Innovation, as an outcome of the knowledge generated by a continuous learning process, plays a central role in the debate on development, since the economic success of enterprises increasingly depends on their ability to learn and innovate. From this perspective, this article aims to analyze the innovation of firms from Brazil's Northern Region. For this purpose, a descriptive analysis will be made, based on the data of the Technological Innovation Research (PINTEC) of 2024 collected by the Brazilian Institute of Geography and Statistic (IBGE), which sample consisted of 3.830 local enterprises that implemented some sort of innovation. The results show that innovative efforts undertaken by enterprises are substantially marked by high expenditures on machinery and equipment acquisition, while investments in training, internal and external research and development acquisition are low, which may interfere the generation of new knowledge and, therefore, the development of the studied region.

Keywords: Innovation. Development. Northern Region.

Date of Submission: 01-12-2025

Date of Acceptance: 11-12-2025

I. Introduction

In recent years, the swift alterations induced by technological advancements and the unyielding speed of innovation have positioned knowledge and learning at the forefront of the literature on this topic. The rise in competitiveness and the necessity to incorporate technical advancements into productive operations have compelled enterprises to implement strategies based on their inventive capabilities. Consequently, alongside investing in research and development and fostering collaborative strategies among firms, as well as between firms and public institutions that encourage innovation, the capacity of economic agents to recognize, assess, and exploit opportunities presented by globalization has become imperative (BASTOS; BRITTO, 2017).

Diniz, Santos, and Crocco (2006) contend that local and regional scales have become pivotal as centers for innovative activity, as capital migrates across territories in pursuit of optimal returns. Nonetheless, each region possesses distinct characteristics, rendering it imprudent to presume that a singular development trajectory can be uniformly applied throughout diverse geographic areas.

Longhini et al. (2017) assert that the execution of research and development designed to provide new information and insights invigorates market dynamism and fortifies productive chains, resulting in advantages for enterprises, sectors, nations, and regions. Audy (2017) emphasizes that innovation is propelled by the organization of new knowledge and learning, rendering it a perpetual and dynamic process. The author underscores the significance of sustaining dynamic relationships that foster creation, innovation, and

transformation within the local context.

The present research examines the innovation processes of enterprises in Brazil's Northern Region by analyzing measures of innovation output and effort, highlighting the significance of the topic. The analysis utilizes data from the Technological Innovation Survey (PINTEC) for the period 2012–2014, encompassing a sample of 3,830 enterprises that executed various forms of innovation. Given the region's deficiency in research exploring the correlation between innovation and development, a descriptive analysis of these data would facilitate the identification of the region's innovation patterns and allow for initial judgments about their consequences for regional development.

This article comprises five sections, including the introduction. The second section offers contextual background on the region's capacity to foster innovation and its influence on development. The third section delineates the methodological approaches employed in the investigation. The fourth section elucidates and analyzes the findings. The fifth section provides final observations.

II. The Importance Of Innovation In Local Development

The initial discourse on innovation can be attributed to Schumpeter's foundational work. In his early writings, he highlighted the significance of small and medium-sized firms in fostering and disseminating innovation, along with the crucial role of the entrepreneurial agent in executing these processes. In subsequent times, characterized by significant economic transformations, Schumpeter presented a more developed contribution, emphasizing the increasing significance of major firms, especially in relation to the establishment of vast frameworks necessary for innovation to transpire (BOTELHO; MAIA; PIRES, 2012).

In recent decades, the global economy has experienced significant transformations that have fundamentally changed production connections and organizational structures within companies. Accelerated technology changes necessitate institutional adjustments to emerging societal requirements and the exploration of new markets. Diniz (2001) asserts that alterations in industrial patterns are essential for motivating enterprises to expand their economic scopes, so broadening their sources of capital, markets, and technologies outside their geographical confines—especially when spatial distances diminish in the modern economy.

Cassiolato and Lastres (2001) contend that rapid globalization necessitates organizations to alter their industrial frameworks, making innovation and knowledge critical factors for the development of nations, regions, localities, sectors, and enterprises. Competition today transcends mere pricing strategies; it increasingly relies on the structuring of learning and knowledge processes that can modify institutional and industrial frameworks, hence augmenting institutional competitiveness.

Diniz, Santos, and Crocco (2006) assert that in modern society, where knowledge production and utilization are paramount, traditional comparative advantages based solely on natural resources are increasingly supplanted by dynamic competitive advantages rooted in the capacity to generate knowledge and foster innovation. To maintain these advantages, ongoing generation of new knowledge and capabilities is necessary, allowing agents to recognize and exploit opportunities presented by technological development.

From this viewpoint, the economic performance of local agents essentially relies on their capacity to specialize in activities where they possess dynamic comparative advantages stemming from their characteristics and continuous creative endeavors. The success of local enterprises relies not only on internal competences essential for sustaining innovation but also on research and development activities and the local capacity for learning, which cultivates an environment conducive to transformation and advancement in regional and collective learning (DINIZ; SANTOS; CROCCO, 2006).

No universal approach or method is relevant in all contexts. Every region, locale, or sector adheres to its unique developmental trajectory, rendering the replication of historical experiences unattainable. Formal and informal interactions among agents and institutions within the local environment create inventive networks where communication, cooperation, and coordination facilitate the innovation process (DINIZ; SANTOS; CROCCO, 2006, p. 89).

Asheim (1996) underscores the significance of the local component as a vital context for innovative endeavors, asserting that the availability of skilled human capital adept at recognizing and evaluating opportunities generated by technical innovation is indispensable. Moreover, collaborative networks within companies and between companies, research institutions, universities, and training centers are essential for establishing a synergistic system of knowledge and learning through the exchange and sharing of experiences. According to these scholars, authentic learning is fundamentally interactive and socially integrated within the institutional, local, and cultural contexts in which individuals function.

Consequently, competences cultivated through interactions among varied agents facilitate the creation and dissemination of technical advances, embracing dimensions that surpass mere research and development. Consequently, regions and localities must have specialized infrastructures that enable the exchange of knowledge, ideas, and learning. Considering the political, economic, historical, and cultural particularities of each locality, these factors are crucial for producing technological discontinuities that affect—and are affected

by—the productive, social, political, and institutional frameworks, leading to non-linear and non-sequential development paths (CASSIOLATO; LASTRES, 2005).

Lundvall (2010) posits that, in contrast to conventional perspectives, innovation is not an isolated and independent occurrence that intrudes upon the system from external sources, disturbing its equilibrium. Innovation emerges from a rigorous and ongoing learning process facilitated by interactions among agents, contrasting with Schumpeter's previous perspective focused on the individual entrepreneur. Consistent with this rationale, Diniz (2001, p. 9) posits that innovation arises from the amalgamation of research, development, and their interplay with the prevailing economic and social conditions, facilitated by intra-firm and inter-firm dynamics.

Utilizing Lundvall and Johnson's (1994) idea of the learning economy, knowledge and learning are fundamental components for innovation and competition within regional frameworks. Diniz, Santos, and Crocco (2006) contend that while geographic proximity is significant, it is inadequate for fostering good knowledge-creation processes. In addition to cognitive reasoning, each region relies on its unique historical development and the capacity of local agents to foster significant interactions and synergies.

In this context, Johnson and Lundvall (2000) contend that the learning economy extends beyond advanced technologies; it includes how individuals, regions, and nations leverage their unique skills to develop new competencies, productive configurations, and institutional frameworks. Diniz (2001) asserts that a locality's productive and institutional potential hinges on its ability to learn and innovate, especially since technology advancements perpetually reduce product life cycles, necessitating swift responses and feedback mechanisms for research and innovation.

Feitosa (2011) underscores that regional development relies on collaborative endeavors from innovative enterprises generating new knowledge and local actors adept at assimilating these transformations. A region must exhibit extensive innovation, fostering local learning capacity and establishing integrative systems grounded in cooperation, complementarity, interdependence, and the enhancement of collective endeavor. The development of innovation relies not only on the capabilities of individual firms but also on the capacities of other organizations and institutions within the economic system. Institutional systems, characterized by distinct learning mechanisms and interaction forms, empower locations to actively influence innovation processes. Regions thus transform into cognitive spaces where shared values, trust, and other intangible assets enhance interactive learning dynamics (FEITOSA, 2011, p. 41).

Santos and Mendes (2018) contend that places with entities that generate and share novel information experience more fast development than those that just replicate existing patterns. This transformative potential promotes local development by attracting new sectors through enhanced scientific and technology infrastructures, resulting in enduring feedback effects that encourage innovation. Consequently, production and income levels typically increase, along with reinvestment in regional learning and knowledge infrastructures, so enhancing both internal and external competitiveness.

This discourse on the significance of regions, innovation, and knowledge formation prompts an inquiry into the efficacy of the Manaus Free Trade Zone (ZFM), established in the 1960s, in promoting growth in Brazil's Northern Region. A protracted discussion exists regarding whether the ZFM has genuinely stimulated innovation or just assimilated technology from other areas of Brazil or beyond.

Lyra (1995, p. 5) observes that among the numerous critiques of industrial policies implemented in the ZFM—particularly assertions regarding its inability to foster innovative activities that could establish a robust technological foundation—one critique is particularly prominent: the industrial policy in the ZFM was predominantly dependent on fiscal incentives tailored to firms situated in the region, within a framework of substantial national tariff protection. The sequential use of these incentives may have resulted in the establishment of an industrial park with restricted competitiveness. As a result, numerous sectors may face difficulties in sustaining themselves if subjected to increased competition.

Panariello and Wilber (1990) contend that the ZFM has failed to provide substantial innovative initiatives that could bolster the competitiveness of enterprises in the Western Amazon. In recent years, these companies have depended mostly on fiscal incentives from national industrial strategy, failing to create a regional technological foundation necessary for the swift innovation required of them. Furthermore, there are considerable deficiencies in human resource training and credentials across all tiers, alongside inadequate collaborative networks among private entities and between these entities and state organizations tasked with fostering innovation.

Consequently, the ZFM has undertaken few new initiatives to enhance the competitiveness of enterprises in the Western Amazon. These firms, having relied heavily on fiscal incentives for their survival, may be significantly impacted by recent policy changes, potentially presenting substantial challenges to their ongoing operations in a region characterized by considerable difficulties and inequalities stemming from its geographic context.

III. Methodology

The main aim of this study is to examine the innovation activities conducted by companies in Brazil's Northern Region utilizing data from the 2024 Technological Innovation Survey (PINTEC). The Northern Region, which includes the states of Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, and Tocantins, encompasses an area of 3,853,575.6 km², accounting for roughly 45.32% of Brazil's total territory (IBGE, 2010).

The methodological framework relies on a descriptive analysis of innovation outcome indicators (innovation rate and types of innovation) and innovation effort indicators (internal R&D activities, external R&D acquisition, external knowledge acquisition, machinery and equipment procurement, and training). The metrics presented in Table 1 allow us to deduce the innovation patterns employed by enterprises in the region and to contemplate their potential implications for regional growth.

Table 1. Description of Variables Used in the Study

Variable	Description
Innovation Rate	Ratio between the number of firms that engaged in some type of innovation and the total number of firms in the sample.
Types of Innovation	Product innovation, process innovation, and combined product and process innovation.
Net Sales Revenue (NSR)	Net revenue from the sale of goods and services in 2011 and 2014, as reported in firm balance sheets or in the Simples tax regime.
Innovation Effort	Activities undertaken by the firm to support innovation: (1) internal R&D; (2) external acquisition of R&D; (3) acquisition of other external knowledge (excluding software); (4) acquisition of machinery and equipment; (5) training.
R&D Expenditure/NSR	Sum of innovation-related expenditures divided by Net Sales Revenue.
Qualification Level of Personnel Engaged in R&D	Personnel dedicated to R&D activities, full- or part-time: researchers (postgraduate, undergraduate, high school, or elementary education), technicians (undergraduate, high school, or elementary education), and support staff (e.g., administrative workers).
Funding Sources	Sources used to finance internal R&D: firm's own resources, private funding, public funding, and foreign sources.

Source: Prepared by the author based on PINTEC (2014).

This study uses information sourced from a specialized tabulation created for this research, derived from the 2024 edition of the Technological Innovation Survey (PINTEC), conducted by the Brazilian Institute of Geography and Statistics (IBGE) to examine innovation activities in industrial enterprises and selected service sectors. In the Northern Region, data were gathered from 3,830 enterprises of varying sizes that adopted some type of innovation, whether in product and/or process, either new or significantly enhanced, thus clarifying the empirical universe examined in this study.

It is essential to highlight that IBGE gathers this data via surveys filled out by companies that have implemented innovations. The survey provides aggregated data for the industrial sector and specific service activities across Brazil's principal geographic regions: Central-West, North, Northeast, Southeast, and South. These activities include extractive industries, food manufacturing, beverage production, communications equipment manufacturing, petroleum refining, among others. This research will utilize disaggregated data from PINTEC (2014) to conduct a detailed analysis of the industrial activities where innovation efforts and outcomes are most concentrated in the studied region, focusing specifically on industry and selected service sectors.

IV. Results And Discussion

This section examines the primary innovation metrics and initiatives implemented by industrial enterprises in Brazil's Northern Region, utilizing data from the 2024 Technological Innovation Survey (PINTEC).

Recent studies (AVELLAR; BOTELHO, 2016) indicate that Brazil's innovation rate significantly lags behind that of wealthy nations. This disparity is further highlighted by the relatively restricted involvement of the business sector in research and development endeavors. Table 1 indicates that merely 36.4% of Brazilian enterprises implemented innovations between 2014 and 2024. Upon analyzing the innovation rate—defined as the proportion of firms that adopted any form of innovation relative to the total number of firms in the sample—across the principal geographic regions of the country, it is evident that the North (43.4%), South (41.1%), and Northeast (37.2%) demonstrated the highest percentages of firms involved in innovation during the examined period.

Table 1. Innovation Rate in Brazil by Major Geographic Region, 2024

Major Region	Total Firms	Innovative Firms	Innovation Rate (%)
Brazil	117,976	42,987	36.4
North	3,830	1,661	43.4
Northeast	14,306	5,314	37.2
Southeast	60,423	20,354	33.7
South	32,501	13,370	41.1
Central-West	6,915	2,288	33.1

Source: Prepared by the author based on data from PINTEC (2024).

The regional disparities in innovation rates are generally ascribed to the significant proportion of smaller enterprises in the North and Northeast regions, especially due to the absence of substantial large-scale industries in these areas. This conclusion is corroborated by research including Viotti et al. (2005) and Botelho, Maia, and Pires (2012), which indicate that while empirical data suggests innovation rates generally rise with firm size, the innovation endeavors of small firms are more substantial—thus contesting the notion that innovation is primarily linked to large corporations.

Despite Brazilian industries engaging in innovation initiatives, expenditures on innovation-related activities account for merely 2.12% of net sales income. Upon analyzing this indicator for the Northern Region, the proportion is below the national average (1.83%), principally influenced by investments in the extractive industry (7.67%), which corresponds with the region's economic framework (Table 2).

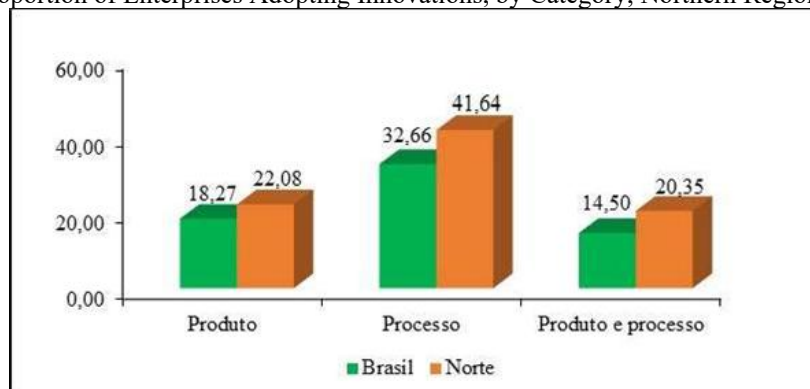
Table 2 - Comprehensive Innovation Endeavor by Specific Activities, Northern Region – Brazil, 2024 (% of total)

Industry Total and Selected Activities	Net Sales Revenue (R\$ 1000) [A]	Total Innovation Effort (R\$ 1000) [B]	(%) [B/A]
Brazil	2.714.621.726	57.638.335	2,12
Northern Region	119.227.482	2.179.845	1,83
Extractive Industries	2.265.772	173.865	7,67
Food Products Manufacturing	11.597.807	165.629	1,43
Beverage Manufacturing	10.609.080	152.123	1,43
Communications Equipment Manufacturing	30.142.397	602.119	2,00
Other Industrial Activities	64.612.426	1.086.109	1,68

Source: Prepared by the author based on data from PINTEC (2024).

Concerning the nature of innovation, Figure 1 indicates that 41.64% of the innovation initiatives by enterprises in the Northern Region pertain to process innovation, whereas merely 20.35% implemented both product and process innovation. This trend is similarly evident at the national level, where process innovation (32.66%) is prominent compared to other categories. This signifies that the region's innovation profile is predominantly defined by the integration of machinery and equipment into the production process—innovations that are, in many instances, novel solely to the firm itself. In summary, both at the national and regional levels, the dominant innovation paradigm predominantly relies on absorption and incremental enhancement rather than the creation of original innovations.

Figure 1 – Proportion of Enterprises Adopting Innovations, by Category, Northern Region – Brazil, 2024



Source: Prepared by the author based on data from PINTEC (2024)

This conclusion is corroborated by examining expenditures categorized by kind of innovation endeavor. Brazilian companies designated 40.20% of their innovation expenditures for the procurement of machinery and equipment, while in the Northern Region, this figure increases to 45.84%, surpassing the national average. Significantly, 95.94% of investments from the extractive industry were allocated to this category of innovation. The predominant portion of innovation investment is allocated to the procurement of machinery and equipment, while expenditures on internal research and development (28.26%), external acquisition of R&D (15.42%), external knowledge acquisition (0.75%), and training (0.64%) are notably minimal—both at the national level and within the Northern Region (Table 3). This situation indicates that enterprises mostly assimilate or modify ideas originating from outside the region or country, a trend also recognized in the research conducted by Viotti et al. (2015).

Table 3 – Expenditures Associated with Innovative Activities in Industry, Categorized by Selected Activities and Type of Effort, Northern Region – Brazil, 2024

Industry Total and Selected Activities	Internal R&D Activities	Internal R&D Activities	Internal R&D Activities	Internal R&D Activities	Internal R&D Activities
Brazil	31,53	7,95	4,19	40,20	1,03
North	28,26	15,42	0,75	45,84	0,64
Extractive Industries	-	0,47	0,27	95,94	0,33
Food Products Manufacturing	1,24	0,25	-	86,40	0,21
Beverage Manufacturing	20,02	3,83	-	64,26	0,24
Communications Equipment Manufacturing	53,50	42,70	-	2,24	0,41
Other Industrial Activities	24,06	6,63	1,14	53,23	0,95

Source: Prepared by the author based on data from PINTEC (2024)

An additional critical problem pertains to the qualification level of workers involved in R&D operations inside organizations that have adopted product and/or process innovations. The statistics indicate a distinct preference for employing individuals with college degrees (3.37%) and those possessing only high school or primary education (3.86%) for internal research and development tasks. This trend may indicate both the reduced expense of sustaining this workforce type and the scarcity of PhD-level researchers in the area (Table 4).

Table 4 – Personnel Involved in R&D Activities in Firms that Implemented Innovations, by Qualification Level, Northern Region – Brazil, 2024

Industry Total and Selected Activities	Researchers			Technicians		Others
	Postgraduate	Undergraduate	High School or Elementary Education	Undergraduate	High School or Elementary Education	
Brazil						
North	6.373	37.900	8.632	10.601	9.959	6.733
Extractive Industries	110	1.280	333	305	113	67
Food Products Manufacturing	-	-	-	-	-	-
Beverage Manufacturing	8	22	8	2	1	-
Communications Equipment Manufacturing	25	36	2	5	5	4
Other Industrial Activities	22	140	11	39	4	7
	56	1.082	313	259	104	56

Source: Prepared by the author based on data from PINTEC (2024).

**Refers to personnel employed on a full-time basis.*

Only 110 persons (1.72%) employed full-time possess postgraduate degrees (Table 4). Historically, keeping PhD-level professionals in the region has been challenging, mostly due to insufficient incentives—particularly financial ones—and the unstable working conditions generally provided, a problem exacerbated in the private sector. Moreover, the limited quantity of doctoral-level experts in the Northern Region, relative to other Brazilian areas, may indicate a conscious inclination among private enterprises to refrain from employing highly trained individuals. Such individuals are often regarded as expensive, prompting corporations to limit internal R&D efforts to initiatives that do not yield substantial technological modifications in their goods or processes.

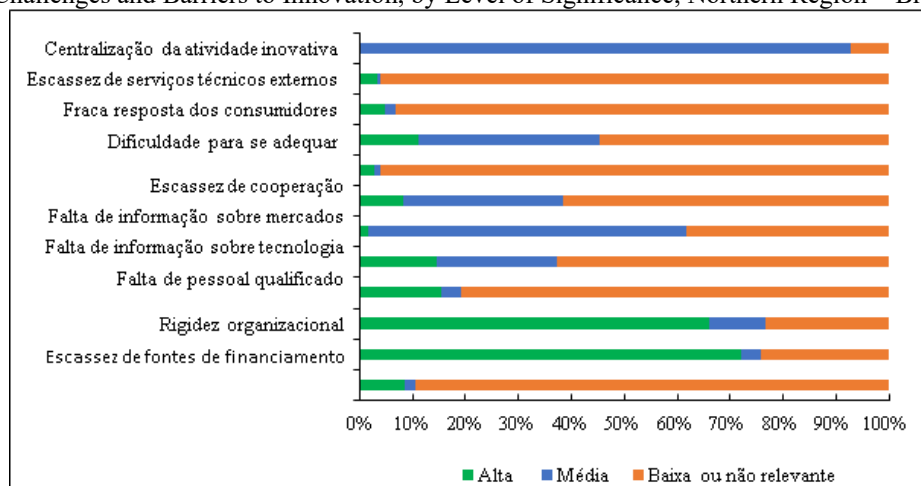
This issue becomes increasingly significant when analyzed through the framework of theories that highlight the necessity of creating and sharing new information for regional and national advancement. As

competitive pressures escalate—an intrinsic characteristic of capitalism competition—the pursuit of advantage increasingly relies on innovation, which emerges from the generation of new knowledge and learning rather than through pricing strategies. Thus, when productive agents are unable to assimilate and produce creative initiatives that distinguish them from competitors, they jeopardize not only minimal productive returns but also the possibility of market exclusion.

The interplay among study, practical experience, and action—manifested through mechanisms such as experiential learning, applied learning, interactive learning, and iterative learning—is pivotal to development (COOKE, 1998; LUNDVALL; JOHNSON, 1994). Learning processes are essential for regional development, as they yield numerous advantages for the areas in which they take place. These benefits include the decrease of transportation expenses, enhanced dissemination of economic information, growth of international and interregional commerce in goods, alterations in production, consumption, and service trade dynamics, as well as an increased movement of capital and individuals.

In light of the problem of promoting innovation in Brazil, PINTEC gathers data on the primary obstacles cited by companies in the Northern Region, irrespective of their innovation status. The primary difficulties identified (Figure 2) are elevated expenses (72%) and a lack of financial sources (68%). Moreover, companies highlight the centralization of innovation efforts (92%) and the deficiency of knowledge regarding existing technologies (60%).

Figure 2 – Challenges and Barriers to Innovation, by Level of Significance, Northern Region – Brazil, 2024 (%)



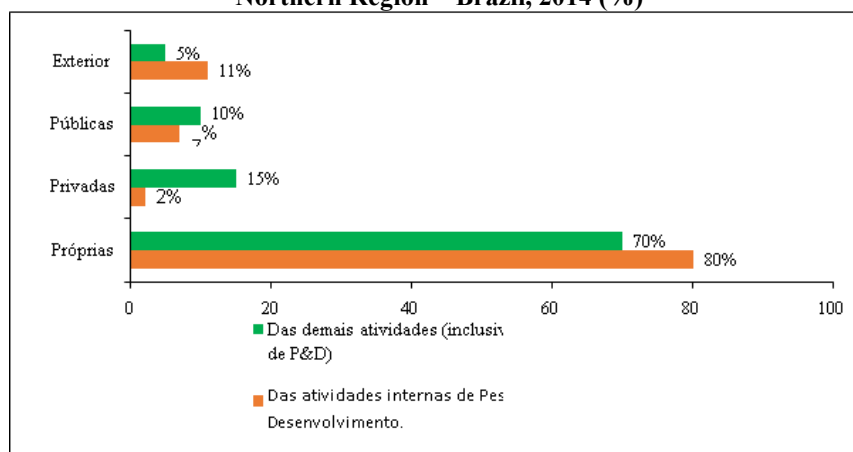
Source: Prepared by the author based on data from PINTEC (2024).

A variable that may enhance innovation in the Northern Region is the formation of collaborative partnerships between private enterprises and public institutions that foster innovation. Nonetheless, companies do not perceive the lack of collaboration as an impediment to innovation. This may signify the challenges organizations encounter in establishing or sustaining collaborative relationships with other entities, whether governmental or private. The perception that the scarcity of qualified personnel is not a hindrance may indicate a mentality among regional business leaders who regard elevated wages merely as an expense, neglecting the prospective benefits such investments could yield for corporate performance and regional advancement through the generation of new knowledge, products, and processes (Figure 2).

The recognition of limited finances as a primary barrier to innovation is substantiated by the observation that 80% of internal R&D operations and 70% of other innovation-related initiatives are financed via the firms' own resources. Merely 7% of enterprises in the region obtained public funding for internal research and development, although 10% depended on public sources for alternative operations, encompassing external R&D. Significantly, 11% of the financing for internal R&D endeavors is sourced internationally (Figure 3). Moreover, the challenges in forming partnerships A contributing aspect to enhancing innovation in the Northern Region is the formation of collaborative partnerships between private enterprises and public institutions that foster innovation. Nonetheless, companies do not perceive the lack of collaboration as an impediment to innovation. This may signify the challenges organizations encounter in establishing or sustaining collaborative relationships with other entities, whether governmental or private. The perception that a shortage of qualified personnel is not a hindrance may indicate a mindset among regional business leaders who regard higher wages merely as an expense, neglecting the potential returns such investments could yield for the firm's performance and regional development through the generation of new knowledge, products, and processes (Figure 2).

The recognition of limited finances as a primary barrier to innovation is substantiated by the reality that 80% of internal R&D initiatives and 70% of other innovation-related endeavors are financed by the firms' own resources. Merely 7% of enterprises in the region obtained public support for internal research and development, although 10% depended on public funds for other activities, including external R&D. Significantly, 11% of the financing for internal R&D initiatives is sourced internationally (Figure 3). Moreover, the data indicate challenges in forming partnerships and collaborative relationships, as previously noted, alongside a deficiency in governmental support policies for the region—especially for small enterprises—designed to bolster innovation capacity and enhance productive infrastructure.

Figure 3 – Funding Sources for Internal R&D Activities and Other Innovation-Related Initiatives, Northern Region – Brazil, 2014 (%)



Source: Prepared by the author based on data from PINTEC (2024).

Based on the aforementioned findings, it can be concluded that enterprises in the Northern Region of Brazil exhibit a trajectory of technical change analogous to that observed nationally—predominantly reliant on investments in machinery and equipment acquisition, without fostering or disseminating new knowledge within the region. This tendency leads to other ramifications, such as diminished productive dynamism, restricted competitiveness and productivity, and inadequate integration into emerging markets, all of which tend to exacerbate sectoral imbalances.

In this context, despite the significance of the Manaus Free Trade Zone for the Northern Region, its efficacy in fostering new knowledge and learning warrants scrutiny, as the majority of innovative initiatives depend on technologies created elsewhere in Brazil or imported from overseas.

V. Conclusion

The analytical examination of PINTEC 2024 data revealed that the innovation initiatives pursued by enterprises in Brazil's Northern Region are predominantly focused on the procurement of machinery and equipment. In other words, corporations persist in assimilating and enhancing discoveries originating from other Brazilian regions or abroad, rather than creating original developments.

Simultaneously, although the private sector invests minimally in the development of new knowledge in the region, companies assert that the lack of trained workers does not impede innovation. In a more competitive landscape fueled by knowledge and learning, innovation-based technical change has become crucial for distinction, directly impacting a company's market sustainability.

Considering that elevated expenses are identified as the primary barrier to innovation, it is sensible to assert that fostering innovation necessitates substantial resources, especially in technologically sophisticated industries.

It is apparent that numerous enterprises in the region—frequently family-owned—perceive innovation expenditures exclusively as additional expenses, neglecting the potential market advantages and economic returns these investments may generate. This viewpoint results in negligible alteration of the regional productive foundation, markedly constraining local economic vitality and, as a result, the generation of employment prospects.

These findings suggest that organizations will only attain substantial economic success when they acknowledge the strategic significance of innovation, essential for maintaining competitiveness and addressing escalating competitive pressures. This acknowledgment is vital for promoting local and regional changes that enhance overall growth.

This research aims to contribute to the discourse on the relationship between innovation and

development in the Northern Region, which remains underexplored, by providing initial insights into how inadequate investment in R&D may impede regional development. This study did not intend to perform a comprehensive examination of this relationship or to assess the direct effects of innovation on development. Consequently, these restrictions create opportunities for future research.

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