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From Dependency to Innovation Autonomy: The Evolution of Brazil's Innovation Ecosystem Through the Lens of the Fintech Sector

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Abstract

This thesis investigates how Brazil has developed an increasingly autonomous innovation ecosystem, through the analysis of its fintech sector. It examines whether Brazil is moving beyond the adoption of foreign technologies and business models towards greater domestic capacity to generate, adapt and scale innovation in response to its local needs. The study combines academic literature, secondary data and three case studies such as Nubank, Pix and PagBank. The overall findings show that Brazil's innovation trajectory has been driven by the interaction of market gaps, entrepreneurial capabilities, proactive institutional intervention and shared digital infrastructure. The thesis argues that Brazil's autonomy should not be understood as technological self-sufficiency, as the country remains strongly connected to global technologies, capital and knowledge networks from other countries. Rather, autonomy reflects an increasing capacity to selectively combine and adapt external resources, while developing domestic capabilities to generate and scale solutions to local challenges. The Brazilian fintech sector therefore provides us evidence of a broader transition towards a more autonomous innovation ecosystem, although some significant structural constraints continue to persist and shape its further development.

Methodological section

Declaration of the use of Artificial Intelligence (AI) tools

I, the undersigned, Martina Perissinotto, student ID number 892881, enrolled at Ca' Foscari University of Venice in the Master's Degree Programme in International Management, author of the final dissertation entitled "*From Dependency to Innovation Autonomy: The Evolution of Brazil's Innovation Ecosystem Through the Lens of the Fintech Sector*", under the supervision of Professor Stefano Micelli, being aware of the sanctions provided for under Article 76 of Italian Presidential Decree No. 445 of 28 December 2000, and of the forfeiture of benefits provided for under Article 75 of the same Decree in the event of false or misleading declarations, and assuming personal responsibility pursuant to Articles 46 and 47 of Italian Presidential Decree No. 445 of 28 December 2000, n. 445,

DECLARE

That I have used generative artificial intelligence technologies to support various aspects of the research and writing of my final dissertation, specifically:

- *GPT-5.6 Luna, version released in July 2026;*
- *Claude Sonnet 5, version released in June 2026.*
- *Information on how the AI tools were used:*
 - *Revision and optimisation of texts to improve clarity and coherence;*
 - *Correction of grammar, syntax and English language;*
 - *Support in the organisation and structure of content;*
 - *Rephrasing of sentences and paragraphs to improve clarity and readability.*
- *Chapters concerned: Chapters 1–7.*
- *The author independently verified the accuracy and reliability of the information generated or suggested by the AI tools by cross-checking it against academic, institutional and other reliable sources.*

FURTHER DECLARE

that all material generated by AI tools has been carefully verified, reviewed and reworked by the author, who assumes full responsibility for the quality, accuracy and academic integrity of the work.

Chapter 1: Introduction to the Brazilian Market

The decision to focus this thesis on Brazil was also influenced by the amazing opportunity that I had to pursue part of my double degree programme in the country. Living and studying in Brazil gave me the possibility to gain first-hand exposure to an economic and social context that is often perceived from abroad mainly through narratives of poverty, underdevelopment, insecurity and limited opportunities for economic and social progress. These perceptions, especially in Europe, can contribute to a simplified and biased representation of Brazil that does not fully capture the country's economic complexity, dynamism and capacity for innovation.

Experiencing the country directly encouraged me to move beyond these stereotypes and gain first-hand exposure in a country characterized by remarkable diversity, resilience, and entrepreneurial spirit. This experience therefore, not only strengthened my prior opinion of how much potential this country has, but also confirmed my conviction that Brazil deserves greater attention; not only as one of the world's largest emerging economies, but also as a country capable of generating innovative solutions to domestic challenges and progressively build innovation capabilities of its own.

1.1 Brazil as an Emerging Economy

Over the last decades, emerging economies have become increasingly important actors in the global economic scenario. During historical economy, the concept of emerging economy has always been debated and as for today it generally refers to countries that have experienced significant economic, financial and demographic development while becoming increasingly integrated into international trade and investment flows. These economies are typically characterised by industrial expansion, urbanisation and rising income levels, while still bearing some structural, institutional and technological characteristics that distinguish them from advanced economies. The BRICS has historically represented an important reference point for discussions about emerging economies, while institutions such as MSCI, FTSE Russell, the World Bank and the International Monetary Fund have developed different criteria and indicators to classify and monitor these markets.

The concept is particularly relevant for our analysis of the Brazilian case because it describes an economic environment in which there are significant opportunities for development coexisting with persistent structural constraints. As we will discuss in Chapter 2, emerging economies should not simply be considered less developed versions of advanced economies. Rather, they often present and follow different development trajectories in which the acquisition of external technologies and knowledge is combined with processes of technological learning,

adaptation and local innovation. This trajectory and their development can therefore involve both catching up with advanced economies and creating solutions that respond specifically to domestic market conditions and needs.

Within this context, Brazil provides one of the most representative examples. It is the largest economy in Latin America and one of the world's major emerging economies, with a large domestic market, substantial territory and a highly diversified productive structure. Through the analysis we will carry out about its economic trajectory, we will see how its economic scale and demographic weight have historically provided important conditions for industrialisation, entrepreneurship and market development. However, at the same time Brazil's development has always been characterised by persistent regional inequalities, institutional and infrastructural constraints and exposure to external economic conditions.

These characteristics indeed highlight an important feature of the Brazilian development trajectory: the coexistence of significant domestic capabilities with continued integration into international economic and technological networks. International integration has allowed the country to access capital, technologies, knowledge and markets, supporting industrialisation and economic growth. However, we will analyse how relying on external resources may also constrain the ability of an emerging economy to independently determine the direction and pace of technological development.

The theoretical literature we will present in Chapter 2 is particularly relevant in this respect. Important concepts that we will later discuss such as technological catch-up, absorptive capacity and leapfrogging suggest that emerging economies can progressively strengthen their technological capabilities by acquiring and adapting knowledge originating elsewhere. Over time, these learning processes may allow firms and institutions to move beyond simple technology adoption and develop more autonomous innovation capabilities. Brazil's recent digital transformation provides an important example in which these processes can be observed. Digital technologies have created new opportunities for entrepreneurship and business-model innovation, while also allowing emerging economies to overcome some traditional infrastructural limitations. We will examine how in financial services in particular, digitalisation has created opportunities to address historical market inefficiencies and expand access to services to previously underserved populations.

For this reason, the key question for an emerging economy is not only how rapidly it can achieve economic growth, but also whether it can develop the innovation capabilities, institutions and technological base that are necessary to sustain development over time. Brazil's status as an emerging economy should therefore be understood not only in terms of the constraints that

distinguish it from advanced economies, but also in terms of the opportunities created by technological gaps, institutional reforms, entrepreneurial activity and the country's unresolved market needs. This combination makes Brazil a particularly relevant case for examining the relationship between economic development, technological dependence and innovation autonomy.

1.2 Traditional Dependency vs. Current Transformation

For our analysis it is fundamental to analyse Brazil's contemporary innovation ecosystem compared to its historical relationship with external economic and technological actors. In chapter 3 we will examine much of its economic history: how Brazil developed through strong integration into international markets, initially being a commodity export and later through industrialisation and participation in global production networks. During the twentieth century, industrialisation was supported by state-led development, foreign direct investment, multinational corporations and imported technologies and organisational practices. Consequently Brazil was able to develop significant productive and industrial capabilities however while still remaining strongly connected to external sources of capital, technology and knowledge.

This trajectory can be interpreted through the theory of dependency which was developed by two important authors, Cardoso and Faletto, who provided fundamental sources for this thesis. In their work on dependency and development in Latin America, indeed, they argue that dependence should not be understood as a static condition or an inescapable barrier to development, on the contrary, these two can actually coexist. A complementary perspective is provided by Keun Lee, whose work on technological catch-up highlights the limitations of development strategies based primarily on imitation, imported technology and cost-based competitiveness. Once emerging economies are able to reach a certain level of industrialisation, they cannot continue relying on these mechanisms of imitation, since they may become insufficient to sustain long-term development unless domestic innovation capabilities are progressively strengthened.

This distinction is particularly important in the Brazilian case, in which economic development and industrialisation did not eliminate the country's dependence on external technological and financial resources. Instead, the ecosystem created the necessary foundations upon which domestic capabilities could progressively develop.

In this context this thesis analyzes how over the last two decades, Brazil has experienced significant changes in its innovation landscape. The expansion of startups and technology-based

companies, the development of digital infrastructure, the growth of fintechs and the introduction of new regulatory frameworks have contributed to the emergence of a more dynamic domestic innovation ecosystem. And the Brazilian's financial sector provides a particularly relevant illustration of this transformation.

We will further discuss as these developments do not, however, imply that Brazil has moved from dependence to complete independence. Rather, the relevant change concerns the country's growing capacity to determine how external and domestic resources are combined, adapted and deployed to address domestic challenges.

This tension between historical dependency and the development of new domestic capabilities constitutes the starting point of this thesis. The central issue is therefore whether Brazil's recent innovation dynamism represents a broader change in the nature of its development model, or simply a more sophisticated form of technology adoption and adaptation. The following sections address this question by using the fintech sector as the empirical context through which Brazil's evolving innovation capabilities can be examined.

1.3 Research Aim: From Dependency to Innovation Hub

Building on this research problem, this thesis investigates Brazil's evolving innovation capabilities and their role in the country's transition towards greater innovation autonomy. The analysis uses the development of the Brazilian fintech ecosystem as an empirical lens, examining how technological change, entrepreneurial activity, digital infrastructure and institutional support have contributed to the emergence and scaling of locally adapted financial solutions. By focusing on this sector, we will explore whether Brazil's ability to develop, coordinate and scale innovation in response to domestic market needs represents a broader shift away from a historically dependent model towards a more autonomous innovation ecosystem. To address this question, rather than examining innovation through individual technological inventions alone, the thesis considers how innovation is developed and scaled through the interaction of private firms, public institutions and digital infrastructure.

For this reason, we focus on three main case studies representing these different dimensions: Nubank, as an example of private-sector innovation in consumer financial services; Pix, as an example of public digital infrastructure developed by the Central Bank of Brazil; and PagBank, as an example of private-sector innovation supporting merchants and small businesses. Examining these cases together allows us to assess whether Brazil's innovation capabilities extend beyond individual firms and reflect broader activities and developments at the ecosystem level.

Therefore, the concept of innovation autonomy is central to the analysis. As developed throughout the thesis, it does not imply complete technological self-sufficiency. Instead, it refers to the ability to develop, adapt, coordinate and scale innovative solutions domestically while remaining connected to international sources of technology, capital and knowledge. The analysis therefore focuses not on whether the technologies underlying these innovations originated in Brazil, but on the country's capacity to transform and deploy them in response to domestic needs.

The evidence from these cases, together with the empirical findings presented in Chapter 6, will be used to assess the extent to which the development of the fintech sector reflects a broader transition towards a more autonomous innovation ecosystem of the whole country.

1.4 Research Question

In light of the research aim described above, this thesis addresses the following central research question: **to what extent is Brazil evolving from a historically dependent economic and technological model towards a more autonomous innovation ecosystem, as evidenced by the development of its fintech sector?**

The formulation “to what extent” reflects the fact that dependence and autonomy are not mutually exclusive conditions. Indeed, the research does not assume that Brazil has achieved technological independence, but rather examines whether its growing capacity to develop and scale innovation represents a shift towards greater innovation autonomy while remaining connected to international networks.

To address this question, the thesis analyses the Brazilian fintech ecosystem through academic literature and three case studies: Nubank, Pix and PagBank. Together, we are able to earn different perspectives on how private firms, public institutions and digital infrastructure contribute to the development and scaling of innovation in response to domestic market needs. The central research question is further supported and explored with the following sub-questions:

- How has Brazil's historical economic structure changed, and therefore shaped its dependence on external capital, technology and knowledge?
- How has Brazil's innovation ecosystem evolved in recent decades, particularly in the financial sector?
- What do the cases of Nubank, Pix and PagBank reveal about Brazil's domestic capacity to develop, adapt and scale innovation?

- What market, entrepreneurial, institutional and technological factors have contributed to the development of these capabilities?
- To what extent do these developments indicate a transition towards greater innovation autonomy, and what constraints remain?

These questions guide the structure of the thesis. Chapter 2 provides the theoretical framework concerning emerging economies, technological catch-up, absorptive capacity, leapfrogging, innovation systems, institutional conditions, firm capabilities and fintech development. Chapter 3 examines the historical and structural transformation of the Brazilian economy, with particular attention to the evolution of its relationship with external capital, technology and knowledge. Chapter 4 focuses on the development of the Brazilian fintech ecosystem and the technological, institutional and market conditions that have supported its expansion. Chapter 5 presents the three case studies of Nubank, Pix and PagBank and examines the innovation capabilities reflected in each case. Finally, Chapter 6 brings together the evidence from the case studies to identify the main drivers, constraints and opportunities shaping Brazil's innovation ecosystem and to assess the extent to which the findings support a transition towards greater innovation autonomy.

Chapter 2 – Theoretical Framework: Innovation and Emerging Economies

In the last decades, in the global economic scenario we have increasingly heard talking about emerging markets and emerging economies as they had a pivotal role in world economic development. Countries belonging to this category represent the rawest but with the highest growth rate players in the economic world. They are often characterized by rapid industrialization, expanding consumer markets, and increasing participation in global trade and investment flows. However, despite their strong growth potential, in recent years the economic recessions and financial crises have shown that even the most promising emerging economies can experience and suffer significant reduction in growth rates, economic downturn and structural vulnerabilities. And this is what this paper aims to analyze: through the examination of the case of Brazil: we aim at studying the relationship between innovation, institutions, and economic development in emerging markets and how all these factors can contribute to the economic growth and independence of a country.

This chapter provides a theoretical framework necessary for understanding the key role of innovation processes in emerging economies. It first defines what emerging markets are and

identifies their main characteristics, constraints, and opportunities. By first analyzing the innovation dynamics, technological catch-up, and leapfrogging processes, we proceed by finally discussing the role of institutions, governments, firms, and digital transformation within the broader National Innovation System.

2.1 Characteristics of Emerging Markets

Before proceeding further, it is necessary to define what constitutes an emerging market. The concept generally describes an overall country economy that, over the last decades, has been experiencing a fast development from the financial, economical, demographical point of view, while transitioning toward market-oriented policies and greater economic liberalization. As a result, emerging economies are characterized by increasing integration into the global economy, industrial expansion, urbanization, and rising income levels, however, while still maintaining some structural characteristics of developing countries.

What is central in the reasoning of why emerging markets experience high growth rates, is not only the rapid pace of economic development itself, but also the adoption of government policies that favour economic liberalization, privatization, foreign direct investment, and adoption of a free-market system.

Countries included in the BRICS group (Brazil, Russia, India, China, and South Africa) represent some of the most relevant examples of emerging economies due to their economic size, demographic scale, and geopolitical importance. In previous years, in fact, the BRICS group has always been taken as a reference when talking about emerging economies, leading to the general thought that their main characteristics usually include:

- Rapidly developing economies;
- Large populations and growing middle classes;
- Vast territorial dimensions;
- Abundant natural and strategic resources;
- High GDP growth rates over recent extended periods;
- Progressive integration into international markets.

However, these characteristics do not fully include all the typical characteristics of emerging markets, nor do they even constitute mandatory requirements for the classification of a country as an emerging market.

Further than the already well known BRICS classification, we are able to understand that emerging markets play a pivotal role in the world economy, since many other classification, institutions and indexes have been developed to analyse them.

For example, FTSE Russell and MSCI are two global financial institutions that widely recognize and classify emerging markets, through some standards and criteria to distinguish them from the developed ones. Not only these but, other international organizations such as the World Bank and the International Monetary Fund (IMF) provide cross-country indicators and criteria to compare data that allow researchers and investors to analyze growth dynamics, institutional quality and financial development.

Hence, when discussing emerging economies, institutions such as FTSE Russell and MSCI play a central role as they provide useful and important frameworks for classifying and evaluating emerging markets, which are widely and internationally recognized. Their classifications are particularly important for global investors since they influence important business decisions through allocation of capitals, portfolio strategies, and perceptions of market stability and growth potential.

The FTSE Russell provides clear information about how their classification is carried out. The framework used is the FTS Equity Country Classification which is based on a transparent and rules-based methodology that evaluates how much a country's financial market is developed, efficient and accessible. In fact, according to the latest FTSE Russell classification framework, countries are generally divided into four categories:

- developed markets
- advanced emerging markets
- secondary emerging markets
- frontier markets

We can see that the broad “emerging market” definition includes, in turn, advanced and secondary emerging economies. The criteria generally used by the FTSE framework to evaluate countries are some specific dimensions such as market infrastructure, regulatory quality, transparency, liquidity, operational efficiency, and openness and accessibility to foreign investors. All these criteria show that emerging markets status is not determined only by economic growth rates, but also by the quality of institutions and the maturity of the financial market.

The classification framework also evidenced the transitional nature of emerging markets. In fact, emerging economies are not static in their categories, but their economies evolve according to institutional change, financial and technological advancement and sophistication. This transition is closely related to the innovation process, technological upgrading, digital transformation, and industrial modernization.

Despite the advantages aforementioned and evidenced by the classical BRICS classification, emerging economies are also characterized by institutional instability, unequal wealth distribution, infrastructural limitations, and political uncertainty, which in recent years have been fundamentally influencing their development (which on the contrary the FTSE index analyses and takes into account). These structural conditions strongly influence the way countries are able to acquire, exploit and implement innovation within their economic systems. Therefore, in such environments, innovation becomes closely related to firms' ability to navigate uncertainty, institutional instability, and resource scarcity.

2.1.1 Innovation in Emerging Markets

When discussing emerging economies, innovation is a key term as it represents one of the main drivers of economic development and ability to catch competitive advantage. In the actual contemporary business world, innovation is now often associated with technological advancement, scientific progress, high levels of research and development (R&D), and ability to lead in high-technology industries. However, in the context of emerging markets, we are able to understand that innovation assumes a broader and more context-specific meaning.

Innovation in emerging economies is not only limited to technological advancement, rather, it refers more generally to the ability of a country, firm, institution, and economy to adapt, transform, and improve in certain aspects or activities according to local needs and constraints. Innovation may therefore happen in different sectors such as logistics, distribution systems, financial services, organizational models, production processes, marketing strategies, and digital solutions, in addition to scientific and technological progress.

As a result, to the extent of emerging economies, innovation is often adaptive and context-specific, meaning that it depends on the economy's ability to change with respect to the local context and new needs and trends arising, rather than purely science and technology driven. We can understand that changes considered innovative within emerging markets may not necessarily be tied to new technology adaptation or advancement, but may instead represent innovations relative to the local economic and institutional context. Hence, as a result

innovation in developing economies is strongly linked to economic modernization and the capacity of enterprises to respond in creative ways to structural limitations.

The relationship between quality and innovation is also reflected in the classification framework previously mentioned, developed by FTSE Russell and MSCI. The framework, in fact, emphasizes that countries with more transparent financial systems, stronger legal frameworks, greater market accessibility, and more efficient regulatory institutions tend to provide better conditions for innovation, technological investment and advancement. Hence, the ability to innovate of emerging economies is deeply connected not only to firms' capabilities but also to the level of institutional and financial development of the national economy.

However, to even better understand innovation in emerging economies, it is important to analyse a theoretical framework capable of capturing the complexity of these environments. To do so, Robert E. Hoskisson, Lorraine Eden, Chung Ming Lau, and Mike Wright identified four fundamental theoretical elements that are particularly relevant and useful for analyzing firms operating in emerging markets, which are: Institutional Theory (IT), Transaction Cost Theory (TCT), Resource-Based Theory (RBT) and Agency Theory (AT)¹:

- **Institutional Theory (IT)** emphasizes how external institutional factors influence firm behaviours and strategic decisions. Emerging economies are often characterized by weak formal institutions, unstable regulatory systems, and strong political influence over markets. As a result, firms operating in these contexts become highly sensitive to legal, political, and social pressures. Innovation advancement and strategies are not only shaped by the market opportunities that a country has to offer, but also by their need to align with institutional expectations and alignment. Legal frameworks, government regulations, social norms, and political structures directly affect how firms decide to operate and their innovation capabilities. Consequently, companies must continuously adapt their organizational structures and strategies to survive within unstable institutional environments.
- **Transaction Cost Theory (TCT)** refers to the costs associated with market exchanges, that means all the activities of negotiating, monitoring and enforcing contracts within the emerging market economy, but also with external parties of already developed countries. It therefore highlights mainly the influence these types of costs have on

¹Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in Emerging Economies. *The Academy of Management Journal*, 43(3), 249–267. Retrieved June 2, 2026, from <https://doi.org/10.2307/1556394>

determining whether market, hierarchy or hybrid forms are most suitable as governing models. In emerging economies it is quite logical that these costs are typically quite high due to the weak legal and institutional system already mentioned, and moreover due to information asymmetries which is very common to happen in these kinds of economies. As a result, companies often decide to implement and rely on alternative governance structures, such as hierarchical organizations or network based relationships to reduce the uncertainty. These organizational arrangements facilitate innovation by improving coordination, resource sharing, and trust among economic actors in environments where markets alone cannot efficiently regulate exchanges.

- **Resource-Based Theory (RBT)** focuses on how firms achieve competitive advantage through their ability of acquiring unique resources and capabilities. In emerging markets, valuable resources often go beyond technological capabilities and include political connections, relational networks, local market knowledge, and organizational adaptability. Firms capable of effectively combining these resources with strategic flexibility and decisions are generally better in innovating and competing both in domestic and international markets. However, firms in emerging economies frequently face resource scarcity, technological obsolescence, and institutional volatility. Mainly because it may happen that resources that were previously valuable under one political or economic scenario might not be the same important and effective under a different and more market oriented institution scenario.
- **Agency Theory (AT)** examines governance structures and the relationship between owners and managers within firms. It focuses on finding and establishing the most appropriate and suitable governance model to ensure managers, being the agent, act in the interests of the owners. In emerging economies, agency problems may become more severe due to weak corporate governance systems, limited transparency, concentrated ownership structures, and institutional instability.

Together, these theoretical perspectives demonstrate that innovation in emerging markets is not solely determined by technological capabilities. Instead, innovation is deeply embedded within institutional contexts, governance structures, resource availability, and firms' ability to adapt strategically to uncertainty.

2.1.2 Technology in emerging markets: Technological Catch-Up and Absorptive Capacity and leapfrogging

Even if innovation assumes a much broader meaning in emerging markets, the ability of a country to innovate, develop, adopt and diffuse new technologies remains objectively fundamental when talking about economic development and long-term competitiveness of a country.

When discussing economic growth in emerging economies, the concept of **technological catch-up** becomes central. Technological catch-up refers to the process through which developing countries reduce the technological and productivity gap that separates them from advanced economies. In emerging countries, this often occurs through technology transfer, foreign direct investment, imitation, and adaptation of technologies developed in advanced countries. Rather than developing new entire technologies from the beginning, emerging economies are able to accelerate development by following what already developed countries have done and adopting existing technologies more rapidly.

In this regard, two important authors, Perkins and Neumayer ²argue that emerging economies can benefit from the so-called significant “latecomer advantage.” Latecomer advantage refers to the fact that, since developing countries are able to see how new technology is adapted in developed countries, they can spot strengths and areas of improvement, enabling them to later adopt these new technologies in a more efficient way. In this manner, firms in developing countries are capable of taking advantage of technological advances that have been made by first - comer countries. As a result, emerging markets generally have smaller portions of obsolete technologies and infrastructures, allowing them to adopt and diffuse newer technologies more rapidly. The logic can be explained by the fact that developed countries already possess large stocks of old technologies, infrastructure and overall systems whose replacement is expensive and slow. On the other hand, emerging countries have fewer sunk investments in old technologies and are less constrained by the costs of replacing old and outdated infrastructures. Such conditions allow emerging economies to adopt new technologies more rapidly and directly, fostering a faster process of modernization through technological diffusion.

² Perkins, R., & Neumayer, E. (2005). The International Diffusion of New Technologies: A Multitechnology Analysis of Latecomer Advantage and Global Economic Integration. *Annals of the Association of American Geographers*, 95(4), 789–808. <https://doi.org/10.1111/j.1467-8306.2005.00487.x>

As a result, emerging countries catch up technologically not necessarily through original invention but instead through adoption, diffusion, adaptation and integration of technologies already existing in developed economies.

Leapfrogging is an important consequence arising from the latecomer advantage. Leapfrogging occurs when countries bypass intermediate technological stages and adopt advanced technologies directly. Digital technologies provide important examples of this phenomenon. Many emerging economies expanded mobile banking and digital payment systems despite lacking traditional banking infrastructure. Similarly, mobile internet technologies allowed several countries to bypass fixed-line telecommunications systems entirely. The transaction cost theory previously examined provides an additional explanation for this phenomenon: by allowing firms and consumers to avoid certain costs and underdeveloped traditional infrastructure, digital technologies are able to reduce transaction costs, improve efficiency and facilitate the rapid adoption of new services and business models, so enabling the so called leapfrogging.

Important authors such as Xiaolan Fu, Carlo Pietrobelli, and Luc Soete³ argued that technological catch-up in emerging economies cannot rely only on the importation of foreign technologies or on foreign direct investment (FDI) alone. Even though globalization, international trade, and foreign investment are important factors constituting the modernization process and technological diffusion of a country, foreign technologies and the latecomer advantage do not automatically provide the capability of innovating domestic markets. In many cases, imported technologies remain embedded within machinery, production systems, or multinational corporations without being actually adopted and absorbed by local firms and institutions. Furthermore, technologies developed in advanced economies are often designed and tailored according to their specific economic structures, capital intensities, and infrastructural realities, making them not so suitable and partially inappropriate for the socio-economic contexts of emerging countries. Consequently, successful technological catch-up requires not only access to foreign technologies but also the ability of emerging markets to develop previous innovation capabilities and adapt imported technology to local needs and conditions.

³ Fu, X., Pietrobelli, C., & Soete, L. (2011). The role of foreign technology and indigenous innovation in the emerging economies: Technological change and catching-up. *World Development*, 39(7), 1204–1212. <https://doi.org/10.1016/j.worlddev.2010.05.009>

The author Keun Lee⁴ supports this, stating that latecomer should not only focus exclusively on imitation of advanced countries or remain specialized in low-value-added production because it's easier and convenient to them. Instead, successful catch-up often requires creating and following a specific path, meaning that industrial and technological innovation need to be adapted to specific conditions and opportunities of the local economy. In this regard, Lee argues also that emerging economies can reach technological leapfrogging by specializing in short-cycle technologies, which are sectors characterized by rapid technological change, lower entry barriers, and fast innovation cycle, for example information and communication technologies (ICT), software industries, digital technologies, and fintech. In these types of sectors firms from advanced economies possess less accumulated advantages, allowing latecomer countries greater opportunities to compete and innovate.

In the regard of technological catch-up, **absorptive capacity** becomes fundamental. According to the Resource-based theory previously analysed, absorptive capacity can be considered a strategic capability that enables firms and countries to recognize, absorb, adapt and apply external knowledge and technologies conforming to their local context and opportunities. The term “absorptive capability” was initially associated with absorption of foreign investment, a concept that later evolved into a broader explanation of how economies are able to acquire and use knowledge. Therefore, emerging economies must possess sufficient human capital, skilled labor, education level and systems, domestic research and development (R&D) and qualitative institutions to effectively recognize, assimilate and exploit external knowledge. Although we already saw that innovation is not only tied to scientific and technological advancement, we have to recognize that local R&D activities are particularly important for the advancement of a country; not only because they generate pure innovation directly, but also because they improve the learning capabilities of firms and institutions, strengthening their ability to absorb and adapt foreign technologies. Therefore, technological catch-up depends on a complementary strategy that combines external technology acquisition with internal innovation efforts (absorptive capacity), a process which is often referred to as “walking on two legs” from some scholars.

Moreover, global economic integration plays a crucial role in facilitating technological catch-up. In fact, participating in international trade, global value chains, and competitive global markets gives a first opportunity to firms to be exposed to new knowledge, technologies, managerial practices and innovation networks.

⁴ Lee, K. (2013). *Schumpeterian analysis of economic catch-up: Knowledge, path-creation, and the middle-income trap*. Cambridge University Press.

Another important effect is the so-called “regional diffusion” which refers to the opportunity for countries to learn from neighbouring economies that have already adopted new technologies. However, while FDI and international integration may help stimulate technological development, they might also create a sort of dependency if domestic firms limit themselves at imitating other countries and fail in developing independent innovation capabilities. This theory is also supported by the author Keun Lee, previously mentioned. According to the latter many emerging countries first experience rapid growth through low labor costs, natural resources exports, foreign investment, and industrialization coming from the imitation of other developed countries. However, many of these countries later experience stagnation and often fall into what the author defines “middle-income trap”, according to which countries fail into transitioning from imitation-driven growth toward innovation-driven development. In this manner, sustainable and continuous economic and technological catch up requires not only industrial expansion but also the creation of new technological capabilities capable of supporting continuous development and growth.

Finally, another important point evidenced by Lee is that a successful catch up is possible only if supported by National innovation systems (NIS), including the interaction between governments, firms, universities, research institutions and financial systems.

2.2 National Innovation System

The concept of the National Innovation System (NIS) was developed by Christopher Freeman⁵, Bengt-Åke Lundvall⁶, and Richard Nelson⁷, and provides one of the most important theoretical frameworks for understanding how innovation develops at national level. According to this perspective, innovation does not occur in isolation but rather it comes from systemic and social interactions among governments, firms, universities, financial institutions, and research organizations. In fact, the NIS approach emphasizes that innovation is actually a collective and interactive process based on knowledge creation, learning, and the diffusion of technology across the economy. If a country is able to develop innovation, it depends not only on the technological capabilities of firms themselves but also on the quality of institutional coordination and the effectiveness of the broader economic, political, and social environment.

⁵ Freeman, C. (1974), *The Economics of Industrial Innovation*, Harmondsworth: Penguin Books.

⁶ Lundvall, B.-A. (ed.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

⁷ Nelson, R. R. (ed.) (1993), *National Innovation Systems: A Comparative Analysis*, New York: Oxford University Press.

This is also closely related to the institutional theory that we explained before, as both recognize that innovation is not solely the result of individual firm efforts but is deeply influenced by the institutional environment that shapes interactions among economic actors, incentives for innovation, and the diffusion of knowledge.

The National Innovation System is particularly important in emerging economies because institutional structures significantly influence firms' innovation capabilities. Institutions provide the "rules of the game" that structure economic and social interactions. These include legal systems, regulatory frameworks, political structures, cultural norms, and financial systems, all of which shape the opportunities and constraints faced by firms. The NIS theory explains that different countries have different abilities and opportunities to develop and achieve innovation because they possess fundamental differences in institutional quality, learning systems, and the capacity of institutions to support technological development and knowledge diffusion. In this sense, innovation is not simply the result of research and development (R&D) activities alone, but also strongly depends on the interaction between organizations, policies, education systems, and economic structures.

2.2.1 Role of Institutions

Institutional policies and institutional change have the power to strongly influence organizational behaviour of firms and their dynamics of innovation. In line with the previously mentioned Institutional Theory, institutions shape firm's behaviour by defining establishing both the formal and informal rules that govern economic interactions: they play a fundamental role in shaping the conditions under which firms operate and therefore the conditions in which innovation can emerge and develop. Stable and efficient institutional systems create an environment that can promote and encourage firms to invest in long-term innovation activities, as they reduce uncertainty and provide clearer economic expectations. For example, effective legal and regulatory frameworks help protect intellectual property rights, allowing companies to use and actually benefit from their innovative efforts and upgrading without fearing the risk of other companies imitating or even more of unfair appropriation. Similarly, trustworthy and solid constructed financial institutions facilitate firms to access capital and credit, enabling them to finance their research, technological development, and expansion projects. Governments may also encourage innovation through supportive public policies, incentives for entrepreneurship, investment in education and infrastructure, and the promotion of technological learning and knowledge diffusion across the economy.

On the contrary, weak institutional environments have the opposite effect, meaning that they tend to discourage innovation and technological upgrading. In many emerging economies, firms operate in contexts characterized by political instability, inconsistent regulations, bureaucratic inefficiencies, corruption, and weak contract enforcement. These conditions increase the uncertainty in which firms operate and consequently, increase of transaction costs, making long-term investment in innovation riskier and less attractive. Infrastructural limitations and restricted access to financing may further reduce firms' capacity to develop new technologies or compete internationally. Therefore, institutional weaknesses often slow technological diffusion and limit the overall potential capacity of the economy to innovate.

Institutional instability represents one of the most distinctive reasons why emerging economies struggle and are still called "emerging" compared to developed countries, as it has a direct impact on firms' innovation processes and economic behaviour. In these contexts, legal systems, regulatory frameworks, and property rights protections are often inconsistent, underdeveloped, or subject to frequent political and economic changes. As a consequence, firms are frequently forced to operate in highly uncertain conditions and environments where contracts may not be effectively respected and enforced and predicting future market conditions is difficult. It is mainly this uncertainty that increases the risks for firms when looking at long-term investments, particularly in areas such as research, technological development, and innovation, which usually require significant resources and long time horizons before generating some profit in return.

Another important factor is that unstable institutional environments tend to make investors more hesitant and less confident when deciding to invest in developing countries. For this reason, firms must dedicate additional resources to manage risks, overcome bureaucratic obstacles and build informal mechanisms of trust and coordination, bringing transaction costs to arise. All these conditions can slow the diffusion of new technologies and decrease and weaken firms' ability to compete internationally.

However, institutional instability does not generate only constraints. As highlighted in several of the phenomena discussed throughout this chapter, in many emerging economies, firms are forced to find new solutions to overcome these challenges and stimulated at responding by developing alternative, adaptive and flexible forms of innovation. As a result, companies often create alternative organizational structures, strategic alliances, informal business networks, and locally adapted business models capable of functioning effectively despite these institutional

limitations. Consequently, innovation in emerging markets tends to be highly context-specific, as firms must continuously adapt their strategies and organizational practices to local realities and evolving institutional conditions.

2.2.2 Government, Firms, and Universities

Within the National Innovation System and according to the Institutional theory, governments, firms, and universities represent the principal actors responsible for the generation, diffusion, and application of innovation. Their interaction and interplay is often described as the “Triple Helix” model, which was developed by Henry Etzkowitz and Loet Leydesdorff. According to this model, innovation is the result coming from the continuous collaboration and interaction between these three institutional elements rather than from the single activities pursued by individual companies. The triple helix model sustains the theory that innovation has become, during years, a systemic process, meaning that technological and economic development depend on the capacity of these institutions to cooperate, exchange knowledge, and coordinate resources among them effectively. This perspective supports the idea that we previously developed about innovation, meaning that it is not simply the result of R&D investments or market competition alone, but rather the outcome of dynamic relationships between public institutions, private firms, and knowledge-producing organizations (such as universities) operating within a broader innovation ecosystem. In this context, the Agency theory previously mentioned provides additional insights into the coordination of challenges that may arise among these different actors, whose objectives are not always perfectly aligned.

One of the central aspects of the Triple Helix model is that the traditional boundaries that were once separating governments, firms, and universities become less defined and progressively more interconnected and flexible. In this regard, it happens that an institution can assume and adopt some of the roles that were traditionally associated with other institutions. For example, firms do not only limitate themselves solely at producing goods and services but they also engage directly in research, technological development, and workforce training, which has always been a specific role of universities or other formative organizations. Governments don't only assume the role of regulators, but increasingly act as active facilitators and promoters of innovation by financing high-risk sectors, supporting entrepreneurship, creating innovation infrastructures, and coordinating collaboration among economic actors. Also universities, similarly, are not only working on their traditional educational and research functions, but are now actively behaving as entrepreneurial institutions directly involved in technology transfer, patenting, startup creation, and regional economic development.

This transformation is particularly important in knowledge-based economies, where innovation now highly depends on the circulation and commercialization of knowledge. An important and valuable result of the Triple Helix model is that it is able to encourage and promote “entrepreneurial universities,” which are institutions capable not only of generating scientific knowledge but also of transforming research into commercial and technological applications. Hence, universities become active actors in the economic environment that contribute directly to innovation ecosystems through collaboration with firms, participation in research partnerships, incubation of startups, and support for technological entrepreneurship. In emerging economies, this role becomes even more relevant because universities may contribute to strengthening domestic technological capabilities, supporting technological catch-up, and improving human capital formation.

In the meantime, governments play a particularly central role in shaping innovation systems within emerging economies. Through privatization programs, trade liberalization policies, industrial strategies, infrastructure investment, educational reforms, and regulatory changes, governments are the actors most influencing market conditions, access to resources, and competitive dynamics. However, given their fundamental role, according to the Triple Helix perspective, governments are not simply regulators correcting market failures; they also function as coordinators and prime mover of innovation processes. Public institutions, in fact, can actually stimulate cooperation between universities and industries, finance technological development projects, establish incubators and science parks, and support the emergence of innovation networks capable of incentivizing long-term economic development.

Consequently, this brings firms in emerging economies to often rely heavily on relationships with government actors and research institutions to obtain financing, reduced uncertainty, access to knowledge, and secure market opportunities. This explains also why in environments characterized by institutional instability and resource constraints, firms frequently develop and adapt innovation strategies based on strategic alliances, organizational flexibility, and collaborative networks. This finds reasoning also in the Resource-based theory previously mentioned, which demonstrates how firms differ in their ability to innovate according to the resources and capabilities they possess. And this, once again, demonstrates how innovation is not a factor depending only on individual firm capabilities, but becomes strongly dependent on interaction and coordination among institutions.

The Triple Helix model also highlights that innovation systems evolve dynamically through institutional adaptation and self-organization. As economies are now heavily relying on digitalization of processes and knowledge-based, the interaction between governments, firms, and universities becomes even more important for sustaining technological learning, entrepreneurship, and competitiveness. In emerging economies, strengthening the interactions and collaborative relationships between universities, government and firms is essential for supporting technological upgrading, facilitating knowledge diffusion, and promoting long-term economic development within the present global digital economy.

2.3 Digital Transformation and Financial Innovation

In recent decades, digital transformation has become one of the main drivers of economic, technological, and social change in both advanced and emerging economies. The rapid diffusion of digital technology has provided the economy with relevant tools such as internet connectivity, mobile communications, cloud computing, artificial intelligence, big data, and in general, information and communication technologies (ICTs), which have profoundly transformed the way firms conduct their business activities: how they produce, compete, communicate, and interact with consumers and the overall global trade. As a consequence, economic activity has increasingly shifted toward digitally connected systems in which data, technological infrastructures, and digital platforms play a central role, resulting in a real sense of dependency from these tools. In fact, this transformation has not only modified production systems and business models but has also reshaped the way financial services, consumption patterns, labor markets, and innovation processes are conducted and carried out. As this thesis has the central objective of analysing the economy in emerging markets, we are going to see how deeply digital technologies affect these countries. In fact, in emerging economies, digital transformation has represented and still represents a unique opportunity to overcome some of the structural limitations that have always been traditionally associated with developing markets, such as weak infrastructures, limited financial access, and institutional inefficiencies. Within this context, financial innovation and the development of fintech have become important central mechanisms through which emerging economies are now able to actually upgrade their economy and pursue technological modernization, economic inclusion, and long-term development.

2.3.1 Digital Economy and Technological Change

The advent of the digital economy represents a fundamental transformation in how business activities are organized and conducted all around the world. In fact, nowadays digital technologies increasingly influence production processes, market structures, communication systems, and the circulation of information and knowledge. While in traditional industrial economies growth was highly dependent on physical capital and manufacturing capacity, in digital economies the business is heavily relying on the well-functioning of technological infrastructure, data innovation and knowledge-based activities. In this manner, information and communication technologies (ICTs) have therefore become essential drivers of productivity, competitiveness, and economic growth. Technological change and the consequent development of the digital economy have progressively transformed economies especially the one of the emerging countries, bringing them to be more interconnected centers, characterized by strong and intensive knowledge production systems, in which the development, diffusion, and management of information play a central role in the value creation of a business. As a consequence, digital transformation does not only affect technological sectors but also broader economic areas, fundamentally changing and influencing labor markets, organizational models, consumer behavior, and the way firms and institutions interact with each other, in both domestic and global markets. In practice, the overall benefits that digital transformation brings is that it allows firms and governments to improve efficiency by reducing transaction costs (as also demonstrated by the Transaction Cost Theory), facilitating communication, and increasing access to information and markets. Thanks to the spread of internet connectivity and mobile technologies emerging, markets have experienced an accelerated integration into global production networks and international digital markets. At the same time, digitalization increasingly supports emerging economies in transitioning toward different models of development, characterized by knowledge production where innovation capabilities, technological learning, and human capital become essential sources of competitiveness and long-term growth. In this context, developing countries are encouraged to invest into strategic and well-structured information and communication technologies (ICTs) in order to successfully shift toward the so-called digital economy, by facilitating the adoption of internet connectivity, mobile networks, and digital platforms, which increasingly function as fundamental structures for economic participation, innovation, and market integration. Thus, technological change is a very powerful factor within a developing country's economic system, but its effectiveness increasingly depends on the ability of these countries to develop

digital infrastructures, invest in education and human capital, support innovation ecosystems, and facilitate the diffusion of knowledge across firms and institutions.

However, as we already saw for all the previously analysed elements, the digital economy can also create new challenges for emerging economies. If developing countries are not able to adequately adopt new technological tools and give right access to the population, significant inequalities in internet access can arise, as well as technological infrastructure, digital skills, and investment capacity, which may limit once again, inclusion and reinforce already existing social and economic inequalities within a population's country. Furthermore, one sensitive issue arising especially in the last decades, is that digitalization might generate concerns related to cybersecurity, data governance, technological dependency, and market concentration. Since, as we already said, digital economies are increasingly dependent on data and digital infrastructures, problems might arise related to digital trust, privacy protection, and technological sovereignty. As a result, digital transformation to be efficient requires not only the ability of emerging countries to successfully adopt technological change, but also to install effective institutional frameworks capable of supporting sustainable, secure, and inclusive development.

2.3.2 Fintech as a Driver of Innovation

One of the most significant manifestations of digital transformation is financial innovation, particularly through the development of Fintech. The term comes from the combination of "financial" and "technology" and in fact it refers to the integration of digital technologies into the provision of financial services, with the ability to fundamentally transform the way individuals and firms access, manage, and exchange financial resources. What is different from traditional banking systems, which often rely on physical infrastructures and complex bureaucratic procedures, fintech solutions use digital platforms and mobile technologies to make financial services faster, more accessible, and more efficient.

The emergence of fintech was largely driven by both technological and structural factors. The rapid diffusion of smartphones, internet connectivity, cloud computing, and big data technologies created the technological foundations and also the consequent need for the development of digital financial services. A general sentiment of dissatisfaction with traditional banking systems also had a contribution, particularly after the global financial crisis of 2008, that brought people to search for more flexible, transparent, and customer-oriented financial solutions.

In many emerging economies, particularly, what drove the most the development of fintech were the traditional limitations of financial institutions such as high banking costs, limited geographic coverage, bureaucratic inefficiencies, and low levels of financial inclusion. All these factors, in fact, further accelerated the expansion of fintech platforms as alternatives to traditional banking systems, capable of providing accessible financial services to broader segments of the population.

As a consequence, the development of fintech has significantly transformed financial markets by introducing new business models and increasing competition within the financial sector. Fintech, in fact, constitutes the provision of traditional financial services through digital platforms: digital payment systems, mobile banking, peer-to-peer lending platforms, crowdfunding services, digital wallets, robo-advisory systems, and alternative credit scoring mechanisms have significantly altered the way financial services are produced and consumed. What is really advantageous is that through the use of algorithms, data analysis, and artificial intelligence, fintech companies are able to provide better services as they can better evaluate credit risk, personalize financial products, and improve service efficiency more rapidly than many traditional banking institutions. This is also closely related to the Resource-based Theory Which demonstrate the success of fintech firms, whose competitive advantage often derives from proprietary technological capabilities

The expansion of fintech also demonstrates the increasing importance of innovation ecosystems and technological entrepreneurship within digital economies. Fintech often emerges as a result from interactions among startups, venture capital investors, technological firms, universities, financial institutions, and governments, which all operate within the larger scenario of digital innovation systems. Startups play a particularly important role because they are business models often characterized by more flexibility and capability of experimenting new innovative technologies and solutions. Thus, fintech increasingly operates within an ecosystem in which technological experimentation, entrepreneurial activity, and digital innovation are at the center of the development process.

Nevertheless, the growth of fintech also creates important regulatory and institutional challenges. The increasing digitalization of financial systems raises concerns related to cybersecurity, data privacy, financial stability, fraud prevention, and consumer protection. Governments and regulatory institutions therefore play a central role in creating frameworks capable of balancing innovation promotion with market stability and public trust.

This aspect highlights how, once again, institutions play a crucial role in the development of economic activities and in this case of fintech. In fact, while on one hand fintech represents one

of the most prominent elements for development, on the other hand it is notable how this success and efficiency really depend on the support of institutions and their relationships within the digital financial services.

To conclude, fintech represents overall one of the most relevant examples of how digital transformation is able to reshape economic activity through innovation, technological change, and the development of new organizational models. By reducing transaction costs, increasing efficiency, expanding financial accessibility, and creating new forms of financial intermediation, fintech has become a major driver of innovation within both advanced and emerging economies. But in emerging markets particularly, fintech represents not only a technological phenomenon but also a strategic opportunity for economic modernization, financial inclusion, entrepreneurship, and long-term development.

2.3.3 Financial Inclusion and Digital Payments

One of the most important socio-economic outcomes of digital transformation and fintech innovation is the possibility of providing more financial inclusion. Financial inclusion refers to the ability of providing as many individuals and businesses as possible access to affordable and reliable financial services, which is considered fundamental for economic participation, entrepreneurship, poverty reduction, and long-term development. Having access to financial systems, especially remotely, allows individuals not only to save transfer money, but also to access credit, insurance, and investment opportunities that might help economic stability and social mobility.

In many emerging economies, however, large segments of the population didn't historically have the opportunity to access financial services due to structural and institutional limitations such as: geographical distances, high operational banking costs, insufficient financial infrastructures, income inequality, and limited physical access to banking services. As a result, all these obstacles often restricted access to credit, savings, insurance, and payment systems, particularly for low-income populations and small businesses located in peripheral or rural areas. These conditions for example were especially evident in the case of Brazil's history. Its vast territorial extension, as well as its strong regional inequalities and uneven banking infrastructure, have always constituted an obstacle in the diffusion of traditional financial services across the country. In this context, the emergence of digital financial technologies represented one of the most important opportunities for the economic growth of Brazil: not

only for technological innovation but also for providing a new mechanism of financial inclusion and institutional modernization.

Mobile banking and digital payment systems are the two elements that constitute the most important innovations in the fintech sector: it is especially thanks to these services that greater parts of the population now have access to financial services. Through smartphones and internet-based platforms, users can transfer money, pay bills, access credit, manage investments, and conduct financial transactions without the need of having direct access to traditional banking infrastructures. As evidence, in many emerging economies where large segments of the population have always historically lacked access to formal banking services, mobile financial technologies became important tools for overcoming infrastructural limitations and expanding financial participation. In this sense, digital payments represent not only a technological innovation but also a process of institutional and economic modernization giving the opportunity to emerging markets to experience the so- called technological leapfrogging explained earlier.

The emergence and growth of digital payments systems has increasingly transformed the financial landscape of emerging economies by developing more integrated, accessible and efficient financial ecosystems. Examples such as Kenya's M-Pesa, India's UPI, and in particular Brazil's Pix show that digital payments can be not only technological applications but wider financial infrastructures that can reshape economic participation and accelerate financial inclusion. Interoperability, one of the key elements behind the success of these systems, is the possibility for different banks, fintech companies and payment service providers to operate within the same digital network. These types of interoperability allow to reduce the fragmentation of the financial system, reduce transaction costs, increase accessibility and facilitate the rapid dissemination of digital financial services to both individuals and businesses, which reflects one of the key principles of the Transaction cost Theory previously explained.. In the thesis, in fact we will analyse the Brazilian case, Pix which represents a particularly significant example because the system was actively developed and coordinated by the Central Bank of Brazil, demonstrating how important and influencing can be the role of public institutions in supporting digital innovation and building digital public infrastructures capable of modernizing financial systems.

At the same time, the diffusion of digital finance also highlights the fact that financial inclusion not only depends on technological innovation itself, but also on wider infrastructural and institutional conditions that needs to be taken into consideration. The effectiveness of digital payment systems remains strongly influenced and dependent by elements such as internet

connectivity, smartphone access, digital literacy, cybersecurity, and the availability of financial infrastructure in remote areas. Consequently, the inequalities and limited regional development of a specific country may still constitute obstacles for the fully inclusive potential that digital transformation offers within emerging economies. Because when actually supported by adequate infrastructures, effective regulatory frameworks, and strong institutional coordination, digital payments can actually become powerful drivers of innovation, financial inclusion, and economic modernization.

To conclude, digital financial innovations not only contribute to improving access to financial services but also constitute a driver of technological innovation and economic growth of a country, like in the successful implementation in the Brazil's case, which we will further analyse in the next chapters of this thesis.

2.4 Concluding Remarks: Theoretical Implications for the Brazilian Case

The theoretical framework developed through this chapter provide a fundamental analytical base for understanding the transformation of emerging economies and, more specifically, the Brazilian case which will be examined in the following chapters. The literature reviewed highlights a key insight, according to which innovation in emerging economies cannot be explained only through the technological advancement. Rather, it emerges from the interaction between institutional conditions, firms' capabilities, public policies, technological learning path and the boarder innovation ecosystem of the country.

The analysis on the emerging economies has shown that countries such as Brazil operate in environments characterized by both significant constraints and opportunities. Institutional weaknesses, resource limitations, and technological gaps may constitute an obstacle for development, but they may also stimulate adaptive forms of innovation and encourage firms to create new business models tailored to local needs. In this context, the concepts of technological catch-up, absorptive capacity and leapfrogging help explain how emerging economies can accelerate development by acquiring, adapting, and eventually generating new technologies.

The National Innovation System perspective additionally emphasized the importance of interactions among governments, firms, universities and other institutions in supporting and facilitating technological development. Moreover, the Institutional Theory shows how the quality of formal and informal institutions shapes innovation outcomes, while the Resource-based Theory highlights the role of the specific abilities of firms and their knowledge resources. The Transaction cost Theory provides a useful perspective to understand the diffusion of digital technologies and fintech products, which fundamentally help reduce inefficiencies and facilitate

access to financial services. All together these theoretical perspectives construct a comprehensive framework for analysing innovation process and development in emerging economies.

Furthermore, the final discussion of the digital transformation, fintech innovation and financial inclusion demonstrate the ability of technological change to increasingly contribute in reshaping economic development pathways of a country. Digital technologies not only create new opportunities for productivity growth and entrepreneurship but also allow emerging markets to overcome the traditional infrastructure limitations that always characterized them and expand access to essential services to poorer citizens.

These theoretical insights will serve as the basis for the analysis of the Brazilian case in the following chapters. In particular, they will help analyse whether Brazil has evolved from a historically dependent economy toward a more innovation-oriented development model, finally providing the answer that this thesis aims to achieve. By also investigating how its institutional environment has influenced technological and entrepreneurial activity, and how digital transformation and fintech innovation have contributed to expanding financial inclusion, we will understand how the country strengthened its position within the global innovation landscape.

Chapter 3: Brazil's Economic and Innovation Transformation

In this chapter we will proceed by analysing the historical trajectory of Brazilian economic evolution, examining the key historical, structural and institutional transformations that have shaped the contemporary ecosystem and innovation landscape of the country. In order to understand the opportunities, constraints and still existing challenges of modern Brazil, it is essential to trace the macro-economic historical phases that redefined its society and economy. The following section systematically breaks down the historical path of the country, analysing from its very first agrarian colonial origins to the state-led industrialization of the mid-twentieth century, the macroeconomic stabilization of the 1990s, and the commodity-driven growth of the 21st century.

3.1 Historical Economic Structure

Brazil is now the 10th biggest economy in the world and the first in Latin America. Brazilian growth, economic development and industrialization have originated from a long history that we are going to analyze. We will divide the history of Brazilian economy in 6 phases:

1. Colonial economy and export-oriented agriculture
2. Coffee economy and early industrialization
3. Import Substitution Industrialization (1930–1980)
4. Debt crisis and hyperinflation (1980s)
5. Plano Real and economic liberalization (1990s)
6. Commodity boom and economic transformation (2000s)

The colonial economy and export-oriented agriculture

The colonial period constitutes the longest and the most foundational period in Brazilian history, lasting over three centuries from the initial arrival of the Portuguese in the Brazilian land in 1500 to the declaration of independence in 1822. This extensive era strongly influenced and dictated the nation's subsequent socioeconomic development by establishing an economic model entirely based on colonization and export-oriented agriculture. In fact, the years from 1560 to 1690 were the so-called “era of the sugar” in which Brazil became for most of the time the largest producer and exporter of the world. During the sixteenth century especially, the export-oriented model was accelerated by European mercantilism, which can be described as an economic system in which global powers were pushing towards exploring overseas territories and exploiting their natural resources in order to maintain a positive trade balance.

As just mentioned, the Portuguese were the first to arrive in Brazilian territory which they were treating with relative neglect, as they preferred focusing their energy on the lucrative Asian spice trade. However, this neglect immediately started to give rise to important tensions due to the intense geopolitical competition of that time. In fact, foreign competitors, mostly the French, began organizing expeditions to the Brazilian coast to gather the brazilwood and establish their own settlements too, for example the France Antarctique in Rio de Janeiro. The Portuguese Crown immediately recognized this menace and possibility of losing the power on this massive territory with no permanent occupation, and decided to systematically colonize all the Brazilian land.

However, at that time the Portuguese crown did not have the right financial capital to fund and establish an empire administration directly, and therefore decided to first create a decentralized system of governance known as donatary captaincies (*capitanias hereditárias*), in which the

coast was divided into fourteen strips of land granted to wealthy private nobles (donatários). These individuals were notable people that distinguished themselves in operations in other colonies or had other type of connection with the crown; they were supposed to explore the captaincies with their own resources and gather capital to administer them. However, given immense legal and economic autonomy, they started acting in their own interests and shifted the financial burden of defending and developing the colony for the crown onto private land investors. For these reasons, most of the 14 captaincies failed, also given to isolation and indigenous resistance. Only two maintained their status and efficacy: Pernambuco and Bahia (which are two states in the Northeast region of Brazil). The success of these regions was dictated by geography; they possessed the ideal tropical climate and rich, fertile clay soil (massapê) required for the cultivation of the sugarcane. During these years these areas started to become important centers of production and exportation. Consequently, the colonial economy rapidly shifted from a simple model of resource extraction toward an agrarian system dominated by a monoculture, responsible for all the profits arising from global exports. The central pillar of this economy was the engenho (sugar mill). The engenho was much more than a farm; it was a complex socioeconomic institution. It combined massive agricultural fields with sophisticated industrial infrastructure, including crushing mills, boiling houses, and refining facilities powered by waterwheels or oxen.

Working and operating in an engenho was incredibly dangerous, as it demanded intense capital and labour inputs. To meet this insatiable demand for labor, the Portuguese constructed a brutal and deeply entrenched system of human exploitation, which characterized and influenced all subsequent Brazilian history. Initially, Portuguese concentrated on the slavery of the indigenous population. However, without the right defense indigenous population was subject to devastating European diseases, like smallpox; or were able to use their profound knowledge of the interior terrain to escape from the Portuguese.

This escapism and lack of indigenous slaves signed a transition toward the Transatlantic slave trade, in which millions of enslaved Africans were forced to migrate towards the Americas. In this manner, African labor quickly became the structural backbone of the entire export economy. The violent reliance of the economy on enslaved populations became inherent in the Brazilian economy, history and culture, leaving structural social inequalities that continue to characterize modern Brazilian society till today.

The aforementioned "Sugar Age" made possible for Brazil to become the wealthiest asset in the Portuguese Empire. However, the Portuguese crown established the so-called "Pacto Colonial" (colonial pact) a mercantilist arrangement according to which Brazil was legally forbidden from

developing domestic manufacturing or trading with any nation other than Portugal. This ensured that the colony maintained a strict monopoly over the highly profitable international sugar trade, buying raw Brazilian sugar at depressed prices and reselling it to Europe at much higher premium prices.

This prosperous model of economy also created a strong imbalance of power between the colonial administration and private landowners. Wealthy mill owners were operating for their own interests like feudal lords, dominating local municipal councils (*câmaras municipais*) and ignoring the royal laws. This strong private autonomy was also carried out in the frontier by the so-called *bandeirantes*. They were expeditionaries from the south who were committing unauthorized explorations deep into the South American interior land. Their primary goal was to capture indigenous captives to sell them as slaves and search for precious metals, completely ignoring the official borders established by European treaties.

Seeing that the Crown was losing fiscal and territorial control, the Portuguese attempted to centralize its loose administration in 1549 by establishing a Governor-Generalship based in Salvador, Bahia. While this decision aimed at reclaiming its royal authority and regaining power over individual captaincies, its efficiency and practical success was highly restricted. Being not able to recall all the control, the state remained highly dependent on the private capital, armed militias, and agricultural output of the local plantation to maintain and defend the colony; as a consequence the government was continually forced to compromise with private interests of local owners. Thus, this unequal relationship left Brazil structurally bound to a rigid, economic model: an export-dependent economy owned by a powerful agrarian elite, characterized by systemic slavery.

Coffee economy and early industrialization (1822-1930)

The transition away from a sugar-centric economy was triggered by many geopolitical conflicts. After the Dutch were expelled from North-east Brazil in 1654 they moved and established in the Caribbean, taking the Brazilian sugar-producing techniques with them. The resulting rise of highly efficient British, French and Dutch Caribbean sugar productions had a massive impact on Brazil's global monopoly, causing international sugar prices to collapse by the end of the seventeenth century. Since the colony faced severe economic stagnation, the Portuguese explorer aforementioned (*bandeirantes*) discovered then massive gold deposits in the interior of Minas Gerais (state in the south-east) in the 1690s. This gave rise to the so-called Brazilian Gold Rush, shifting the country's economy and political center away from the northeastern sugar plantations that had always been the economic center, to the southeast states such as Sao

Paulo, Rio de Janeiro and Minas Gerais. Is in this historical period that today's Brazil economic center started forming in southern states, leaving the north states poorer and less industrialized creating the disparity between north and south Brazil that still today characterizes Brazil.

However, when the gold mines eventually dried up by the late 1700s Brazil desperately needed to rebound its economy and find a new export commodity. They found it in the early 1800s with coffee, which was present and thrived in the same southeastern lands by now constituting the economic and political center of Brazil and ultimately was able to reconstitute the Brazilian economy by providing the financial capital for the nation's early industrial factories. By the 1830s coffee was accounting for more than 40% of the value of Brazilian exports. The coffee economy was highly focused in the state of São Paulo, where the rise of the coffee export generated great financial capital, which gave the opportunity to wealthy planters (so-called paulistas) to reinvest into the first commercial banks and manufacturing enterprises. The official first industrialization started in Brazil. Because coffee was grown deep inland, the massive profits arising from it were able to fund the construction of expansive railway networks and modern ports, providing the foundation of a good and fundamental logistic infrastructure that Brazil's early industrialization needed in order to move goods. Indeed, in their book *The Oxford handbook of Brazilian economy*⁸, the authors named this the "spillover effect"; in which these railways and infrastructures allowed factories to easily transport raw material and finished goods across the country, solving Brazil's historic transportation problem.

Furthermore, another important event in the early industrialization of Brazil was the abolition of slavery in 1888. For this, coffee planters in the Southeast, especially in São Paulo which was becoming the most developed industrialized center of the nation, started operating with paid wage labor, importing millions of European immigrants, mostly Italians. This was a massive transformation in the Brazilian economy, shifting from a slave-based system into a free-market economy. Free immigrants earning normal wages needed clothes, shoes and food, creating a robust domestic consumer market based on basic manufactured goods like textiles and processed food.

Import Substitution Industrialization (1930–1980)

Since the start of its export-agriculture based economy, Brazil was in a classic dependent relationships with the US and the Western Europe: it exported raw agricultural commodities such as sugar and coffee, as we previously analysed, to the Global North and imported 100%

⁸ Azzoni, C. R. (2018). *The Oxford Handbook of the Brazilian Economy*. Oxford Handbooks Online; Oxford University Press. https://www.academia.edu/113688182/The_Oxford_Handbook_of_the_Brazilian_Economy

of its manufactured goods such as machinery, clothes and cars from them. However, in 1929 the Great Depression hit Brazil too: coffee prices collapsed and the country was no longer able to afford to import all the manufactured goods from Europe or the US. This already singled out a complete dependence on external powers, and the government understood an intervention was necessary. Indeed, between 1930 and 1980, Brazil underwent a dramatic economic transformation through the so called state-led Import Substitution Industrialization (ISI), that allowed Brazil (and also other latin american countries) to shift from a vulnerable agricultural exporter into a deeply diversified urban-industrial economy. This historical moment constituted one of the most influential steps of the Brazilian economy. As highlighted by two important Brazilian economists Werner Baer and Isaac Kerstenetzky⁹, however, ISI was not implemented as a policy itself to rebound economy but was born as a defense mechanism and an inevitable shift driven by declining global earnings for the traditional primary export goods and low income elasticity for commodities in advanced Western economies. In Brazil, the ISI was initiated by the president of that time, Getúlio Vargas, following in fact, the 1929 Great Depression and the consequences of World War II after. Thus, many experts define the ISI in Brazil as the evolution of an accidental product of external crises into a highly deliberate, continental strategy to achieve autonomy from the global economic “center”, which was constituted, indeed, by the US and Western European countries. It was defined as continental strategy since Brazil only mirrored the broader Latin American “populist” movement led by contemporaries leader in other countries such as Juan Domingo Perón in Argentina and Lázaro Cárdenas in Mexico, which created a collective push for autonomy and sovereignty of the south america that was later formalized theoretically by Raúl Prebisch and the UN Economic Commission for Latin America (CEPAL).

The implementation of ISI was aimed at promoting a domestic industrial complex, in which the Brazilian government utilized aggressive policy tools. One of these, was the so-called “law of similars”, which gave massive tariff protection to domestic producers that produced or intended to produce a good similar to an imported one, by penalizing imports and effectively stimulating the development of vertical integration. Consequently, both foreign and local firms were incentivized at establishing internal supply chains to avoid being excluded from the Brazilian market, given the non reliability of imported goods and forced to establish local supplying firms to feed their primary plants.

⁹ Baer, W., & Kerstenetzky, I. (1964). Import Substitution and Industrialization in Brazil. *The American Economic Review*, 54(3), 411–425. <http://www.jstor.org/stable/1818525>

Another important policy was the SUMOC Instruction 113 issued by the central bank in 1955, which allowed foreign investors to import capital equipment without any exchange cover if the investment was considered desirable as supporting value to the domestic market. This policy strongly stimulated foreign investors and consequent capital inflows to invest in basic industries such as motor vehicles and steel.

Moreover, in December 1950 it was created the Brazil-United States Economic Development Commission which provided important visions and suggestions about the structural development and changes in the economy. This commission also recommended the foundation of a development bank established in 1952 and carried out a massive fund in infrastructure and heavy sectors like chemicals, machinery, steel and transport.

The implementation of these policies had massive economic and structural impacts as it was registered an industrial surge of 262% between 1947 and 196, giving the possibility to the Brazilian economy to achieve a highly balanced, self-reinforcing networks of industries alongside with domestic success and employment rate expansions especially in the automotive and machinery sectors. The motor vehicle industry stood out as one of the most successes of the implementation of ISI, massively contributing to the total economic impact with employment generation and gross value added.

However, important authors highlighted how Brazil's ISI did not bring a perfectly balanced economy. On the contrary, this rapid development also generated a number of significant domestic bottlenecks, including delays in the expansion of infrastructure, particularly the insufficient capacity of the power supply system, a severe shortage of training facilities for specialized human capital, persistent regional inequalities, a misalignment between agricultural production and the food requirements of an increasingly urbanized population, and a limited effort to diversify the country's export base.

In fact, many authors analyzed how ISI had a positive impact only until the 1950s after which it started to show imperfections and downside of the economic model. Most importantly, they highlighted how ISI represented a complex paradox of economic independence: while it successfully revolutionized Brazil's colonial economic style highly dependent on American and European finished goods, it did not eliminate the external dependency, it only changed its form and structure.

To build its advanced industries, in fact, Brazil relied on a "Triple Alliance" developed by the state under the president of that time Juscelino Kubitschek. Under this framework, the state was providing the infrastructure, energy and steel and invited American and European Multinational Corporations such as Ford, Volkswagen, and chemical giants, to establish some

factories and operate inside Brazil. Meaning that while goods were “Made in Brazil” the property of the technology, engineering designs and a massive share of profits was still belonging to and flowed back to parent companies of the Global North. Consequently, because this Triple Alliance and state expansion was sustained by massive loans from US and Western European commercial banks, later on the framework hit a point of structural exhaustion. When the US Federal Reserve strongly increased global interest rates around 1980, the resulting international debt crisis and hyperinflation suppressed the much desired and almost achieved industrial sovereignty of Brazil, forcing the nation to enter in a decade of deep financial dependence from Western creditors and international lending institutions. In fact, as many authors in the history evidenced, the failure of ISI in Brazil was fundamentally constructed in its inability to find the right financing mechanism.

What is important to highlight is the fact that ISI did not only provoked a financial crisis but contributed to develop some of the most radical problems rooted in Brazilian economy and society. After the nation entered into the catastrophic 1980s debt crisis, the state entered in a vicious cycle of hyperinflation. As a consequence the prices and wages of the state automatically rose to match inflation everyday, making this inflation structurally impossible to control. Another pillar problem was the strict trade protectionism carried out during the ISI such as the “*las of similars*” previously mentioned: while this protectionism was necessary to give birth to early industries, keeping it in place for too long was backfired. Since Brazilian factories were entirely dependent on foreign powers, they had no incentive to innovate, modernize, or cut costs. Yes, Brazil was able to produce almost everything internally but was producing goods that were technologically obsolete, of poor quality and incredibly expensive compared to international standards (especially in electronic and automotive sectors).

Finally the ISI model highlighted a deep social contradiction within the economic model. In order to maximize profits for industrial development, the state actively suppressed the wages of the working class which led to extreme income inequality which are still present today.

Debt crisis and hyperinflation (1980s)

The 1980s is defined in the history of Latin American countries as the “Lost decade” which was considered the most impactful crisis in the historical economy of Brazil.

The 1980 marked, in fact, an interruption to the long history of growth that characterized Brazil since then, from the abolition of the colonial economic system to the primary effectiveness of import substitution industrialization policies. However, as we previously saw, it was precisely these excessive protectionist policies one of the main causes of the decline.

During this regime not only the Brazilian economy, but all Latin American countries were relying on great loans provided by the US and Western Europe, arriving to accumulate over US\$ 300 billion in debt with international banks, with Brazil heavily relying on this external financing to fuel its domestic investment and subsidize private industry. However, the supposed growth model implemented by Brazil started collapsing following three main massive external shocks in 1979, which contributed overall to the economic crisis:

- the second global oil shock that tripled the price of petroleum and spiked Brazil's import bills
- a sharp rise in international rates that drastically increased the annual interest payments on past borrowings
- and the severe US recession from 1979 to 1982 that cut off the demand for Latin American exported products

Given this situation, bank creditors which already showed signs of concern and mistrust, after seeing the debt level sharply increasing refused to issue new loans and completely stopped the flow of external financing to Brazil by 1982.

Following other Latin American countries' decline, international banks led by the International Monetary Fund (IMF), intensified pressure on Brazil debtors and government to implement aggressive economic adjustment according to the creditor's strict policies. This economic adjustment forced Brazil to rapidly cut imports and boost exports in order to achieve a massive trade balance surplus; this was pursued through highly damaging massive devaluations of local currency that cut wages by around 10% directly negatively affecting the working class.

The consequences on Brazilian economy was devastating: the country suddenly shifted from being a net capital importer in the 1970s to a net capital exporter in the 1980s, forcing to drain its domestic economy by sending almost 5% of its entire GDP directly to external powers abroad solely to pay the interests on its massive foreign financial debt. This contributed to an overall severe drop in total domestic investment from a level of 31.7% in 1975 down to 18.9% by 1990. This unsustainable rate of foreign debt and its associated costs provoked a deep financial crisis, eliminating Brazil's saving capacity and its ability to act as a primary driver of economic development, by causing a severe domestic distributive conflict. In this conflict, the Brazilian government decided to print more money in order to finance its massive state-owned enterprises (SEOs) and public debts which caused a vicious cycle of hyperinflation. As a consequence the prices and wages of the state automatically rose to match inflation everyday, making it structurally impossible to control: inflation, in fact, skyrocketed from 93.5% in 1981 to an absurd level of 1,863.6% by 1989. The state also tried to implement subsequent

stabilization experiments, which resulted unsuccessful, proving that domestic price stability and economic recovery were impossible to achieve without first finding a definitive solution to the international debt crisis.

Real plan and economic liberalization (1990s)

Following the crisis of the “Lost decade” of the 1980s, in the Brazilian nation characterized by continuous hyperinflation, stagnant growth, the state started orchestrating and implementing some attempts of economic recovery. In this period the Brazilian economy was indexed, which means that wages, rents, prices and contracts were legally tied to past inflation and automatically adjusted upward every month.

Only after six failed stabilization attempts that had left the Brazilian population exhausted and economically drained, arrived the foundational cornerstone of this decade with the implementation of the Real Plan in 1994 by Fernando Henrique Cardoso's economic team (consequent president of the state), which successfully decreased hyperinflation where prior attempts had always failed.

The Real Plan consisted in implementing a gradual voluntary and trust-based indexation process through a temporary accounting currency: the Unidade Real de Valor (URV). Instead of freezing prices and forcing citizens to change their economic behaviour under threat or penalty, they introduced the URV as a stable unit of account that for months lived alongside the dying hyperinflated old currency. Because the URV value was remaining stable, the government gave the time to citizens to make a natural, smooth and voluntary switch towards the alternative currency. Different from the previous coercive six attempts, the economy was not forced to change overnights and also this gave time to hyperinflation to gradually readjust without causing ulterior massive shortages. Once the entire population had naturally transitioned to use URV value to calculate the true cost of goods, wages and contracts, the government took the final decisive step of dropping the old, inflated currency and turning the URV into a new physical currency, the Real.

However, other important decisions initiated years before, supported the success of the Real Plan, one of these, maybe targeted as the most influential, was the process of re-opening the Brazilian economy to foreign competition. This action was aimed at stimulating and promoting the modernization of all industrial sectors through the competition with foreign goods. Another important initiative was the implementation of an aggressive liberalisation plan characterized by a rapid reduction in trade barriers, which suddenly forced the highly protected domestic manufacturing sector to compete with intense foreign rivals, altogether with an ambitious

privatization program targeting state-owned enterprises in sectors such as telecommunications, steel and mining that stood out as the largest during the 1990s.

However, the economic transition was also highly criticized, since the plan underlying structure locked Brazil into a highly restrictive trap of interest exchange rate. Moreover, in 1988 the Brazilian government issued the new constitution that contributed to the intensification of inflationary pressures: it forced the federal government to send tax revenues to states and cities without however passing any of its spending responsibilities. This imbalance left the federal government with a huge financial deficit that could not be recovered by other sectors of the economy.

Many experts, in fact, stated that since the Real Plan did not contemplate a restructuring of the public sector (therefore failing to adjust the massive fiscal imbalances left by the new constitution) it had only relied on indirect artificial measures to suppress prices.

In order to defend the newly established currency against the recurrent inflation and attract external capital necessary to fund the balance of payment, the Central Bank established and maintained incredibly high domestic interest rates so as to keep the Real overvalued and anchored to the US dollar. While this policy massively favored and encouraged inward foreign direct investment (IFDI) and portfolio flows, many of these investments and much of this capital was speculative, volatile and short-term rather than directed at the aim of expanding fixed capital and domestic infrastructure.

Through all mid 1990s, this insatiable and uncertain situation produced severe and destabilizing side effects in the Brazilian macroeconomic landscape of that period. The overvalued exchange rate imposed by the Central bank hindered Brazil's historic trade surpluses, forcing the country to enter into a cycle of accumulating trade deficits that required a continuous flow of foreign speculative capital just to stay present. At the same time, the Central Bank was forced to issue massive amounts of debt at unimaginable real interest rates to clean out the liquidity from these foreign inflows, provoking an explosion of the federal public debt. Consequently, the dangerous combination of massive levels of interest rates and the domestic economy resulted in a major banking crisis, in which private businesses and consumers were unable to repay back loans altogether, leaving the banks with unprecedented levels of assets that were not performing. This economic crisis forced a financial operation from programs like PROER (Program to Stimulate the Restructuring and Strengthening of the National Financial System) launched by the Brazilian government in 1995 in order to save the economy that cost almost US\$20 billion.

However, it was a very fragile arrangement put into place in order to save the economy without any practical actions. Indeed, this fragility became fully exposed in 1997 when the Asian

financial crisis started and the 1998 Russian default, since global investors panicked and backed out from emerging markets.

Facing global investors abandoning the domestic economy, the Brazilian government was forced to abandon its exchange rate anchor letting the Real severely devalue.

Moreover, to restore international confidence and prevent future come back of hyperinflation, Brazil adopted an economic policy framework aimed at implementing inflation targeting, flexible exchange rates and strict primary fiscal surpluses.

To conclude, while in the 1990s Brazil was successfully able to achieve price stability, dismantling an old state-led model and integrating the state into globalization, the tools and techniques it used to fix the economy created a whole new set of issues that held the country back from growing properly. Indeed, because the Brazilian government relied on keeping the interest rates at very high levels to protect the new currency, regular Brazilian business owners couldn't afford loans and therefore had to expand their companies or invest in long-term projects. As a consequence, instead of being dependent on inflation, Brazil became highly dependent on foreign investors and international markets to keep its economy afloat.

Commodity boom and economic transformation (2000s)

After the crisis of 1990s, Brazil experienced the so-called “commodity boom” of the 2000s which fundamentally changed the nations’ macroeconomic trajectory, working as a powerful shield that dissociated Brazilian economy from its historical past growth constraints and inabilities. The commodity boom was called such since it represented a period of rapid, synchronized and intense price increases across primary, raw materials. While commodity prices usually fluctuate, the 2000s growth is widely recognized by economic historians as a “commodity super-cycle”. Indeed, an economic expansion of this type, usually, fades within a few years, however this particular super-cycle was unique and it lasted exceptionally long, starting around the 2000s until it peaked around 2011/2014.

This historical economic period represented one of the biggest opportunities for the Brazilian economy, in which prices of the goods that were exported in massive quantities, mainly soybeans, iron ore, crude oil and beef, suddenly skyrocketed on the global market.

Moreover, another important factor contributing to the decade of the commodity boom and maybe the primary catalyst of this economic super-cycle was the historic rapid industrialization and urbanization of China. China's economic transformation and development created an insatiable unprecedented demand for raw inputs, constructing a deeply (but also symmetrical) relationship with Brazil. Since hundreds of millions of Chinese citizens were moving from rural

areas to cities, China engaged in the largest infrastructure and real-estate development and building in history. In order to develop its urban center, build skyscrapers, bridges, railways and factories, China needed massive amounts of steel; and Brazil, which was the country at that time that was possessing the largest and high-quality deposits of iron ore, became China's primary target source. This happened also for the agricultural sectors. China's middle class were experiencing a dietary shift from grain-based to meat consumption. In order to satisfy its population, China required great amounts of animal feed to nurture its livestock and poultry industries; thus, Brazil responded transforming its vast territories into a global agriculture powerhouse, exporting millions of tons of soybeans to China annually. Moreover, to power its massive manufacturing sector, China's energy consumption escalated to incredible levels; this energy demand coincided with Brazil's discovery of massive deep water oil in reserves, positioning the nation as a vital supplier of crude oil for the Chinese market.

This fruitful relationship with China represented an important opportunity for the Brazilian economy, bringing a massive influx of US dollars into the national economy which allowed the state to liquidate external debt, accumulate international reserves and eliminate its traditional external vulnerability. Thus, the commodity boom allowed the longest continuous cyclical expansion in modern Brazilian history, lasting from 2003 to 2014. Consequently this external beneficial relationship did not just alter trade balances, it transformed the internal distribution of income and capital accumulation inside the country. What is fundamental, however, was how the Brazilian administration navigated this positive economic wave: rather than treating the economic boom as a passive revenue stream, the government actually leveraged it to drive and promote overall economic and social development across the country. During the initial phase of the expansion (2003-2008), indeed, the administration of the current president Lula leveraged this macroeconomic stability to stimulate domestic demand through real minimum wage increases, credit expansion, and targeted social welfare transfers. This strategy brought an effective structural shift in the distribution of income.

However, the incredible duration of the boom and the expansionary policy implemented by the government, ultimately brought to a contradiction: because the economy was shielded from external crashes over a decade, the domestic labor market grew at exponential rates, arriving at reaching an historic low unemployment rate of 6.8% ¹⁰by 2014. However, this prolonged full employment fundamentally changed the balance of class power, in which the working class gained immense bargaining power, giving rise to numerous labor strikes as workers started

¹⁰ The World Bank. (2019). Unemployment, total (% of total labor force) (modeled ILO estimate) - Brazil | Data. Worldbank.Org. <https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=BR>

demanding higher pay. As a result, wages began growing much faster than the actual labor productivity with firms suddenly facing massive labor costs. As a consequence, by 2010-2014, firms could no longer offset these continuously rising costs or absorb them through higher sales volume, resulting in a serious squeeze in profit margins.

With profit collapsing, private companies stopped investing and the Brazilian economic engine finally reached a stall period: by 2014-2015 the nation entered into one of the worst recession in its history.

To conclude, it is evident that the commodity boom represented a profound contradiction in the development of the Brazilian economy: by successfully distancing the nation from foreign shocks, it allowed the domestic market to experience expansion long enough to generate a serious distributive conflict between capital and labor, ultimately undermining corporate investment and laying the groundwork for the mid 2010s economic crisis.

From a colonial export-oriented system to a diversified emerging market economy, Brazil experienced a radical economic transformation shaping its current economic structure.

The following section analyses the main structural characteristics of the Brazilian economy today.

3.1.1 Structural characteristics of the Brazilian economy

Brazil is the tenth-largest economy in the world and the first in Latin America, with a nominal GDP of US\$2.19 trillion in 2024 and a real GDP per capita of US\$10,616¹¹. With 205.3 million inhabitants in 2024 spread across its large land of roughly 8,515,770 km², Brazil is the seventh-largest country in the world by territory. The country is highly urbanized: 87.4% of the population, or 177.5 million people, lives in urban areas, while only 12.6% (25.6 million people) remains in rural areas. This urbanization rate signals a structural shift away from a rural, agrarian society that characterised Brazil for many years (as we analysed before) toward a services and industry-driven urban economy, though. Even though, as later sections show, it does not translate into uniform prosperity across the national territory.

Political and Federal Structure:

Brazil is organized as a Federative Republic composed of 26 states plus the Federal District (Brasília, the political capital). The Constitution establishes a separation of powers into legislative, executive, and judiciary branches, in which the President serves as both Head of

¹¹ Brazil | World Bank Group. (2025). Worldbank.Org. <https://www.worldbank.org/ext/en/country/brazil>

State and Head of Government, elected by universal suffrage for a four-year term, renewable once. This federal structure allows the decentralization of political authority across states while concentrating the economic and administrative power in the hand of urban centers.

Economic Geography: Where Brazil's Economy Is Made

Although Brazil's economy is well spread through all the states and nationally integrated, its productive core is mainly concentrated in the Southeast, which alone generates half of the country's GDP. The country has four regional concentration hubs:

- **São Paulo** is also known as the financial capital of South America, in which most of Brazil's tertiary sector activities are carried out such as: finance, services and technology, while the broader São Paulo state functions as the country's main manufacturing and agribusiness base. Especially the city of Campinas, within the state, has emerged as a high-tech and innovation hub where numerous corporate and important enterprises have their own headquarters.
- **Rio de Janeiro** is the city that provides the largest tourism inflow of the country with a central role in the oil, gas, and maritime industries, also hosting a notable concentration of corporate activity as well.
- **Minas Gerais**, particularly Belo Horizonte, is the mining and industrial powerhouse of the country, producing iron ore and gold and serving as a major producer of steel, coffee, and dairy. For this reason also, the state constitutes one of the most attractive economic centers for foreign direct investment especially from Europe with a high concentration of French, Italian and German enterprises.
- **Brasília**, beyond its political function, sustains a robust service sector, a large public administration apparatus, and subsequently high per-capita income.

This pattern shows how the Brazilian economy present a disproportionate weight of economy production and creation, which is mainly carried by a small number of states with clear specialization: finance and technology in São Paulo, energy and logistics in Rio de Janeiro, extractive and heavy industry in Minas Gerais, and public/administrative services in Brasília.

Size and Trajectory of the Economy

During its history, Brazil's GDP growth has been volatile but can still be considered contained within a moderate range in recent years. The economy contracted sharply by 3.3% in 2020 caused by the COVID-19 pandemic: a severe shock which was comparable to the severe recession of 2015, when similar critical data were registered. The country was able to recover but unevenly: growth rebounded to 4.8% in 2021, slowed to 3% in 2022, and came back up to 3.4% in 2024. This pattern oscillation and of sharp contraction followed by unequal and

moderate recovery suggests that in this historical period Brazil's economy achieved to be resilient enough to avoid prolonged depression, but not yet on a stable high-growth trajectory. In fact, Brazil was ranked as the world's 10th-largest economy in 2025, confirming its systemic weight and contribution to global trade despite this volatility.

Productive Structure: Sectoral Composition

The services sector has always consistently represented the largest share of Brazilian GDP, followed by industry and then agriculture. However, in recent years the relative weights and contribution of the different sectors have shifted:

- **Agriculture** rose slightly, reaching 6.24% of GDP in 2023.
- Brazil is one of the world's largest agricultural exporters. Having built its economy on exporting coffee, sugar, and cacao in the 1960s–70s as previously analysed, it has since become a leading global supplier of soybeans and soy products, maize, cotton, sugar, coffee, orange juice, meat, and ethanol. The sector employs approximately one-fifth of the national workforce.
- Brazil is also a mining powerhouse: the world's leading producer of niobium, the second-largest producer of iron ore, and a significant producer of tin, bauxite, manganese, gold, quartz, and gemstones.
- **Industry** remained approximately stable after the 2016–2019 recession, standing at 22.6% of GDP in 2023 (22% in 2024).
- Brazil's manufacturing sector is relatively more developed than that of other Latin American economies, contributing 22% of GDP in 2024 and employing close to 10% of the workforce. The energy sector is one of the critical structural pillar of the country as Brazil ranks among the world's top 10 oil producers, while also holding substantial renewable generation capacity concentrated in hydropower, solar, and wind.
- **Services** suffered a more pronounced decline after 2020, falling from 61.45% to 56.91% of GDP in 2021, and has since recovered slowly, reaching 58.88% in 2023 (near 60% in 2024, accounting for 71% of total employment).
- The service sector is certainly the crucial engine of the Brazilian economy as it represents close to 60% of GDP and 71% of total employment, even though the sector's GDP share has not fully returned to pre 2020 pandemic conditions levels.

This specification of sectoral data reveals that Brazil's tertiary sector constitutes the highest share for output and employment, but with agriculture and mining/extraction acting as its most globally competitive and export-generating segments.

The Labor Market

Brazil registered an unemployment rate of 6% in 2025, which signals a significant improvement from the historic peak of 13.7% recorded in 2020. The national minimum wage, which was actually entered into force on January 1st, 2026, is set at BRL 1,622/month (equivalent to 277€ approximately)

Labor informality remains a structural weakness of the country: the informal employment rate was 35.62% in 2025, the lowest level since mid-2020, meaning that still nearly 37 million people work without formal registration, contracts, or legal protection and it also often associated with lack of access to a type of social protection. In this regard the government is trying to implement policies and reforms aimed at increasing formal work contracts and simplified registration for independent workers. Moreover, informality is geographically unevenly distributed, as the North and Northeast regions record significantly higher rates than the South and Southeast, a pattern consistent with the broader historical division and income disparity of North and South regions that is inherent in the country's history. People most affected by labor informality are especially black and brown workers, women, and low-income populations, indicating that Brazil's labor market structure reproduces, rather than corrects, already existing social inequalities.

International Trade

In 2025, Brazil recorded exports of \$348.7 billion against imports of \$280 billion, resulting in a positive trade balance of \$68 billion¹². The main exports are soybeans (\$6.97B), crude petroleum (\$4.8B), iron ore (\$2.47B), frozen bovine meat (\$1.38B), refined petroleum (\$1.17B). While the main imports are refined petroleum (\$1.53B), cars (\$1.25B), motor vehicles/parts and accessories (\$847M), packaged medicaments (\$744M), integrated circuits (\$705M). The primary trading partners are China (\$11.6B) and the United States (\$3.12B), followed by Argentina (\$1.3B), Singapore (\$1.13B), and the Netherlands (\$1.09B). Imports come mainly from China (\$6.05B), the United States (\$3.1B), Russia (\$1.34B), Argentina (\$1.18B), and Germany (\$1.16B).

These trade figures confirm that Brazil is a commodity-exporting economy, of mainly agricultural goods, ore, energy, and that imports higher-value-added manufactured goods such as vehicles, electronics, pharmaceuticals, which constitutes a classic structural asymmetry of resource-rich emerging economies, with China as the dominant trade partner on both sides of the trade.

¹² Resultados do Comércio Exterior Brasileiro - Dados Consolidados. (2022). Economia.Gov.Br. https://balanca.economia.gov.br/balanca/publicacoes_dados_consolidados/pg.html

Social Indicators

Brazil's Human Development Index (HDI) reached 0.786 in 2025, one of its highest scores on record which also goes above the world average of 0.744 (based on 185 countries). Life expectancy at birth is a noteworthy data as it stands at 76 years, with the index also incorporating schooling and gross national income per capita, signaling a lower living and social opportunity compared to Europe which stands at 81 years approximately.

The poverty rate stood at 23% meaning that around 48 million people lived on less than \$8 a day at 2024 purchasing power adjusted price, while around 7 million people (around 3%) live in extreme poverty with less than \$3 a day, the lowest ever recorded. In this regard, national averages distribution of poverty show a deep regional disparity: the poverty rate in the North reaches 35.3%, almost double the national average, while in the South it stands at just 7.7%. This confirms that Brazil's aggregate social indicators are a statistical mix of a much richer South/Southeast and a considerably poorer North/Northeast. Moreover, data show a strong racial and gender inequality strengthening this regional divide: of the working population white people, though a minority (43%), earn on average 74% more than black and mixed-race workers. Women and even more, black women are the most affected, earning only 44% of the average income of white men.

Macroeconomic Stability

Inflation: during Brazil's monetary history the country suffered extreme volatility, especially in the decade 1986-1996 when it peaked at 2,947.7% in 1990, followed by a decline to 432.8% in 1991, and a rebounded to 2,075.9% in 1994. Since then, inflation has been kept under much tighter control, though 2025 registered a rate of 5%, the highest since the 9.3% recorded in 2022 during the pandemic recovery.

Interest rate (Selic): the interest rate of the central bank of Brasil Selic (from the acronym of the Special System for Settlement and Custody) stood at 14.3% as of July 2026, which is used as the primary tool to contain inflation and shape lending, financing, and investment conditions across the economy.

Public debt: the public debt of the country stood at 81.9% of GDP, equivalent to approximately 10.4 trillion Reais.

The decision of keeping a high policy rate together with the combination of the elevated public debt suggests that Brazil is actively trading growth-supportive monetary conditions in order to achieve an inflation control and fiscal sustainability aimed at pursuing a stabilizing but growth-constraining economy.

Economic Attractiveness

Foreign Direct Investment (FDI): the net FDI inflows reached \$77.68 billion, after an ongoing recovery from the 2020 pandemic-era which reached \$38.27 billion. In terms of percentage, the FDI inflow rate represented 3.407% of GDP in 2025, a broadly stable trend since 2020 (2.593%), making Brazil the world's fifth largest FDI recipient. The United States and European countries remain the largest source of these investments, with major investors coming from the US, Netherlands, Spain, France, Germany and Italy. Outflows, by comparison, remain much smaller, at around 1.205% of GDP, indicating that Brazil is structurally a net capital importer rather than an outward investor.

As its internal market, Brazil possesses one of the largest domestic economies in the world, sustained by its large population, abundant natural resources, and diversified economy. At the same time, structural challenges still persist such as bureaucracy, a high tax burden, and income inequality.

After having analysed all the above reported data, several structural conclusions emerge that are relevant for understanding broadly the overall economic and social situation of Brazil.

1. **A dual, concentrated economy:** Brazil's productive capacity is geographically concentrated in the Southeast cities of São Paulo, Rio de Janeiro, Minas Gerais and administratively in Brasília, which together hold the burden of the national economic output. This concentration produces regional specialization (finance/tech, energy/logistics, mining/heavy industry, public administration) but also contributes to the persistent North/Northeast–South/Southeast divide which is also visible in terms of poverty rates, HDI, and labor informality.
2. **Limited commodity-driven economy:** Brazil's trade structure based on exporting soybeans, crude oil, iron ore, and meat while importing refined fuel, vehicles, pharmaceuticals, and integrated circuits, reflects a resource-based growth model. The positive trade balance is a strength, but the composition shows how the country is still heavily relying on primary and semi-processed goods rather than higher-value manufacturing. China as an increasingly central trade partner on both the export and import side, could signal a dependent economic model.
3. **Service-based with limited productivity growth: Brazil's internal economy is mainly driven by the service sector** which accounts for nearly 60% of GDP and 71% of employment. However, the industry is contributing in a comparatively smaller output relative to its employment share; meaning that Brazil's growth model still depends on a large, service sector that employs many people than on productivity gains rather than industrial upgrading.

4. **Resilient but volatile growth:** the significant change of GDP from -3.3% (2020) to 4.8% (2021) and back down to 3–3.4% (2022–2024) illustrates an economy capable of rebounding from shocks but without a stable, sustained high-growth path. This is typical of a middle-income economy that is affected by external changes in commodity prices and periods of tighter economic policies.
5. **Progress on poverty and inflation control, but with structural fragility:** the historic lows experienced by the country in extreme poverty (3.2%) and unemployment recovery (from 13.7% in 2020 to 6% in 2025) signal a genuine improvement in social conditions. However, labor informality above 35%, a high Selic rate (14.3%) needed to contain a rebound of inflation (5% in 2025), and public debt near 82% of GDP show that these gains remain based on a fragile macroeconomic scenario that constrains fiscal and monetary flexibility going forward.
6. **Persistent inequality as a structural feature:** regional (North vs. South poverty gap of 35.3% vs. 7.7%), racial (74% income premium for white workers), and gender (black women earning 44% of white men's income) disparities are not marginal statistical data but recurring and inherent in Brazil's history, that mutually reinforce themselves and are present across labor markets, regional development, and social indicators. Therefore, any assessment of Brazil's economic strength must be read taking into account this deep internal inequality.
7. **Attractive to foreign capital despite structural frictions:** what is fundamental to highlight is that Brazil's position as the world's fifth-largest FDI recipient, combined with one of the largest domestic markets globally, confirms that there is a sustained international confidence in its long-term market potential, even if the bureaucracy, high taxation, and inequality remain recognized as structural constraints.

Overall, the data analysed show Brazil as a large, resource-rich, federally decentralized economy with a genuine macroeconomic and social progress over its past five years, but whose growth remains geographically concentrated, commodity-dependent, and structurally unequal. Since all these features remained inherent in Brazil's economic history, they appear as durable characteristics of its economic model and not only temporary conditions, which represent the strongest constraint preventing the country from full development.

3.1.2 Dependence on external models

As analysed from previous sections it is already evident how Brazil has always shown a clear dependence with the USA and Western countries. However, during its history Brazil has gone

through periods of much stronger economic and political dependence as of today, starting from the very beginning of its history during the colonial and European influence which lasted from the 1500s until around 1900 in which first Brazil was a Portuguese colony until 1822. In this period the country's economy was largely export-based on raw materials (sugar, gold, coffee) to European Markets. Later on, in the 20th century began the strong influence of the U.S. after World War II, in which the United States became Brazil's main external partner and political reference. Since then, the U.S. became an important source of investment, technology, and finance, in which period many American multinationals corporations established operations in Brazil. Therefore, until this moment, the U.S. and Europe were Brazil's main export markets and trading partners. More recently, however, Brazil has diversified its external relations. China overtook the United States as Brazil's major partner in 2009 (as we saw in the previous section), reducing Brazil's reliance on Western export markets while increasing the dependence on Chinese demand for commodities.

The book "Dependency and Development in Latin America" by Fernando Henrique Cardoso and Enzo Faletto¹³ provides a fundamental theoretical framework about dependency in Latin American countries. Despite the book was published in 1968 it is still very valuable today, as it provides the foundation for understanding the historical roots of Brazil's economic dependence, and at the same time, offers key insights for evaluating whether the recent developments in innovation and fintech that we are analysing represent a movement toward greater economic and technological autonomy of the country.

In this regard, the two authors formulated an *historical-structural* methodology designed to explain the economic trajectory and socio-political factors that characterize poorer nations (in the book specifically the Latin American ones). By developing their framework, Cardoso and Faletto rejected two other theoretical approaches that were dominating at that time. The first theory developed by Walt Rostow stated that poorer countries undergo a temporary underdevelopment stage that they would overcome by adopting Western technology, capital and social patterns. While the second theory from Andre Gunder Frank, argued that integration with global capitalisation inevitably causes permanent stagnation, passive subordination, and the so-called *development of underdevelopment*. In this regard, Cardoso and Faletto, argue that dependency is neither a static, external condition nor an inescapable trap. The book, in fact, argues that dependence and development should not be understood as mutually exclusive phenomena. Contrary to these two previous theories which say dependence is an impossible

¹³ Cardoso, F.H. and Faletto, E. (1973) *Dependencia y Desarrollo en America Latina: Ensayo de Interpretacion Sociologica*. Mexico: Siglo Veintiuno Editores.

obstacle to overcome, they demonstrate how dependency is a dynamic social relation where external global market forces directly intersect with internal class conflicts, domestic political alliances and state institutions in each nation. According to this “Dependent Development Theory” the *peripheral* (poorer) countries can experience industrialization, modernization and economic growth thanks to this interaction, while remaining structurally dependent on external sources of capital, technology and knowledge. This interpretation also provides a useful connection with the concept of the middle-income trap discussed in the previous chapter. While Cardoso and Faletto explain how countries can achieve economic expansion without surpassing structural dependency, Keun Lee additionally argues that many emerging countries eventually reach a stage in which industrialization based on imitation is no longer sufficient to sustain development. Countries that continue to rely primarily on imported technologies, foreign investment and cost-based competitiveness risk remaining trapped at the same middle-income levels unless they develop their own innovation capabilities. Therefore, Lee's framework can be interpreted as an evolution of the dependency perspective: the challenge is no longer to achieve only economic growth, but transforming technological dependence into the ability of producing indigenous innovation.

From this perspective, Brazil's historical economic development can be interpreted as a process of strong influence by external actors and models. Throughout most of the 20th century, indeed, industrialization of the country was highly supported by foreign direct investment, multinational corporations, imported technology and organizational practices that were coming primarily from Europe and later, the United States. These external contributions provided for a significant part of the economic growth and industrial expansion of Brazil. However, they also reinforced a pattern in which important elements such as technology, machinery and appliances, and strategic decision making, remained fundamental resources of imports from advanced economies. As a result, Brazil's modernization often occurred through the importation, adoption and adaptation of foreign technologies rather than through the generation of indigenous innovations.

A particular important contribution of the book is its emphasis about the evolving nature of dependence. The authors argue that dependence is not limited to trade relationships or colonial legacies but is increasingly generated through technological and knowledge asymmetries. In advanced economies, technological production and leadership becomes a source of power, and those countries that rely mainly on imported technologies remain vulnerable and indeed dependent on modern economies. This argument is strongly reflected in the case of Brazil in which, in turn, its economic dependence shifts in a traditional sense to technological

dependence, a concept closely related to the literature discussed in the previous chapter about the technological catch-up, absorptive capacity and innovation systems.

Hence, the book provides an important point of view for understanding Brazil's historical position inside the global economy. For decades, the country was participating in international production networks only to receive foreign technologies and capital, while advanced economies bore the control over innovation-producing activities. From this perspective, the main purpose of this thesis is not simply to assess whether Brazil has experienced economic growth, but rather to investigate whether the country is moving beyond the imitation-based model described by Keun Lee and overcoming the structural technological dependence highlighted by Cardoso and Faletto. The constant emergence of new dynamic startups, the rapid growth of companies, the development of national digital infrastructure such as Pix, and the increasing capacity of Brazilian companies to generate and adopt innovative solutions suggest that the country might be moving toward a more independent model of development. If this transition is confirmed, it would suggest that the Brazilian innovation ecosystem is contributing not only to economic modernization but also to reducing the structural dependence that has historically characterised the country's development.

3.2 The Rise of the Brazilian Innovation Ecosystem

Although Brazil's historical economic development was largely influenced by the dependence on foreign capital, technologies, and development models, the country experienced an innovation trajectory that significantly transformed its economy over the last two decades. As we previously analysed from the dependency theory, while external actors continue to play an important role in the Brazilian economy, an ever increasing number of domestic activities have and will continue to contribute to the emergence of a more dynamic and innovative ecosystem. This transformation has been characterized by an interplay of different factors such as technological progress, entrepreneurial activity, development of digital infrastructure and new institutional reforms.

3.2.1 Growth of startups

The expansion of the startup population in the Brazilian economy over the past decades has been one of the most visible manifestations of the country's innovation ecosystem growth, and the numbers are surprising both in terms of scale and resilience. The number of startups skyrocketed from an average of 4,100 new firms in the first years of 2015-2019 reaching around

12,700 in the last years of this window, which account for an increase of 207%¹⁴. The country, finally counted 14,065 startups by the end of 2021 spread across 78 communities and 710 municipalities. This growth was not equally distributed all over the country (the structural challenge that characterizes Brazil in almost every aspect): São Paulo alone hosted 4,027 startups, followed by Minas Gerais with 1,240, Rio Grande do Sul (976) and Rio de Janeiro (880), confirming the same Southeast-centred concentration that we previously analysed. As of 2026, with more than 20,000 active companies, and an annual ecosystem increment of 17.7% from April 2025 to April 2026, the country hosts around 25 unicorns valued +\$1 billion, accounting for a total combined startup value of \$137.8 billion. In terms of sectoral orientation, most Brazilian startups operate in the fintech sector, in which the country ranks 19th globally and 1st in South America. The sector, indeed, is the leading industry with around 11% of startups operating in it, followed by agritech, logistics, education, and other services. Moreover, the large majority of these ventures operate in B2B commerce, with Software as a Service (SaaS) as the most adopted business model (around 39,1%). An important thing to note is that this expansion continued largely non-stop also during and after the COVID-19 pandemic, in which capital continued to flow into this ecosystem even through 2020 and 2021. This period of acceleration culminated in a wave of unicorn creation. This made Brazil the country with the highest number of unicorns in Latin America, the third ranked in the Americas behind only the United States and Canada, and the second largest among all emerging economies after India. Of these, fintech accounted for more than a third while the remaining were spread across mobility, food delivery, edtech, proptech, e-commerce, logistics, gaming, identity technology and wellness, a diversification that evidences the underlying vitality of the ecosystem rather than a narrow, single-sector phenomenon. Among the country's most successful startups, Nubank (which is the foundational case of this thesis), Creditas, C6 Bank, Neon, and EBANX have transformed the financial services industry by offering digital banking, lending, and payment solutions. Beyond fintech, companies such as QuintoAndar (PropTech), Loggi (LogTech), MadeiraMadeira (e-commerce), Nuvemshop (e-commerce platform and SaaS), Wildlife Studios (gaming), Alice (HealthTech), and Unico (digital identity technology) demonstrate the increasing diversification of Brazil's innovation ecosystem.

This rapid expansion of Brazil's startup ecosystem has not occurred by chance but has been driven by a combination of factors such as technology, regulation, economy and demography

¹⁴ Sebrae Startups. (2026). *Sebrae Startups Report Brasil 2025: Insights do panorama nacional das startups atendidas pelo Sebrae*. Observatório Sebrae Startups.
<https://observatorio.sebraestartups.com.br/en/estudo/sebrae-startups-report-brasil-2025>

which altogether created a favourable environment for the evolution of entrepreneurship, innovation and the emergence of high-growth companies. One of the most significant factors has been the digital transformation of the Brazilian economy, which is closely related to the literature analysed in the previous chapter. Another important factor related to this, which also constitutes one of the pillars of this thesis is the introduction of Pix, the instant payment system launched by the Central Bank of Brazil in 2020, whose revolutionary contribution will be thoroughly analysed in chapter 5. In addition, the Open Finance ¹⁵which allows systems to securely share their financial data between authorised institutions, stimulated this growth, by enabling new entrants to compete more effectively with traditional banks and fostering a more dynamic and competitive financial market. Another important factor has been Brazil's large domestic market which brought a major competitive advantage. As we saw previously, with its population of more than 200 million people, the country offers startups access to a vast consumer base with diverse needs and increasing demand for digital solutions. Its significant internal market allows many startups to achieve significant scale within Brazil before expanding internationally, making the country an attractive destination for both entrepreneurs and investors.

Finally, the factor that most influenced and supported (and still does) this growth is the consistent capital venture inflows, providing financial resources to innovative companies at different stages of their growth. Venture capital, indeed, refers to investments made in startups and high-growth companies that have strong market potential but often lack access to traditional financing (which is, in turn, a startup at his birth). Brazil's venture capital market has shown strong activity across all stages of startup development. Early-stage financing was particularly dynamic, with 200 Pre-Seed¹⁶ transactions raising US\$47 million and 279 Seed transactions¹⁷ raising US\$320 million. These figures indicate that a significant number of new entrepreneurial ventures continue to emerge and receive financial support during their initial stages of development. However, the largest amount of capital was concentrated in more mature startups: although with fewer transactions, 51 Series B¹⁸ funding rounds raised US\$1.92 billion, while 27 Series C rounds attracted US\$2.04 billion. This demonstrates that investors were willing to

¹⁵ Mandatory standardize framework established by the Central Bank of Brazil.

¹⁶ Earliest stage of funding, when entrepreneurs have only an initial idea or a prototype and require capital to validate their business concept.

¹⁷ Funding state in which the startup has already developed its first product or service and seeks to attract its initial customers.

¹⁸ As the company grows and demonstrates the viability of its business model, it may raise Series A, Series B, and Series C funding rounds, each providing increasingly larger investments to support expansion, market penetration, internationalisation, or acquisitions.

commit substantially larger amounts of capital to companies that had already validated their business models and were preparing to scale their operations, enter new markets, or expand internationally.

Despite these strong financial willingness, the ecosystem structure in which Brazilian startups (but also general startups) operate well diversified with both constraint and opportunities as we also saw in the previous theoretical chapter. Indeed, the exponential growth of the Brazilian startup ecosystem has been actively shaped and sometimes also constrained by public policies, which we will analyse in the next section.

Moreover, the rapid expansion and creation of new unicorns tells only a part of the story of what actually drives growth inside individual Brazilian startups. An important insight evidenced by the literature is that the typical Brazilian startup remains small and pre-revenue which means that more than a half employ up to 5 people and generate less than R\$50,000 in annual revenue, underlying that the unicorn phenomenon exists but in a much larger base of early-stage, resource constrained ventures.

A study¹⁹ conducted taking into account 137 Brazilian service startups, using the dynamic capabilities framework, offers a complementary perspective. Contrary to the most common narrative that possessing technological sophistication is the primary source of start-up growth, the study found that neither the capability of *sensing technological options* nor that of *coproducing and orchestrating* (which means networking with partners and other firms) has a statistically significant relationship with growth. Indeed, the author interprets this result as evidence that an excessive focus on technology could even induce a form of organizational myopia, and that the benefits of networking may be indirect or constrained by the actual resource at disposal of the firm, also balanced by an inability to absorb the resulting flow of information. What did significantly and positively predict growth and expansion were other two important capabilities fundamental in management theory: sensing user needs (such as observing, analyzing and segment customer demand) and scaling and stretching, which refers to the capacity to replicate a service consistently across organisations while leveraging the brand reputation to enter in new markets. In other words, the Brazilian firms that are most likely to grow are not necessarily the most technologically advanced, but those that are better able to continuously learn from their customers and to design business models that are genuinely scalable, repeatable, profitable and only after bare technological advancement.

¹⁹ Teixeira, E. G., Moura, G. L. de, Lopes, L. F. D., Marconatto, D. A. B., & Fischmann, A. A. (2021). *The influence of dynamic capabilities on startup growth*. RAUSP Management Journal, 56(1), 88–108. <https://doi.org/10.1108/rausp-08-2019-0176>

These findings suggest that despite notestanding and important success of small fintech unicorns, the sustainable growth of the broader Brazilian startup ecosystem is more closely tied to market-sensing discipline and business model design efficiency than to the depth of a firm's technological capability alone. This also demonstrates that the fundamental characteristics of emerging economies such as technological catch up and leap frogging are not sufficient on their own.

All taken together, these evidences depict an ecosystem that has matured rapidly on almost every macro-level indicator such as firm counts, unicorns creation, networking partnerships and its position in global innovation ranking, while still facing structural obstacles at the individual level of the firm and the national innovation system more broadly. Indeed, the vast majority of Brazilian unicorns were built on market opportunity rather than on intellectual property generated within the country's own National Innovation System. The growth of start-ups in Brazil should therefore be understood not as a single, linear success story, but as a rapidly and constantly evolving ecosystem whose future trajectory will depend on whether in primis the right institutional policies will support this expansion. This should go along with firms' engagement and development capabilities in order to close the gap between the country's now well-established capacity to create and finance start-ups and its still-developing capacity to convert domestic scientific and technological knowledge into sustained, homegrown innovation-led growth.

3.2.2 Development of digital infrastructure

Digital infrastructure refers to the technological and institutional foundations that allow individuals, businesses and governments to carry out fundamental activities such as exchange of information, access to digital services and conduction of economic activities online.

In Brazil, none of this growth in startups and innovation would have been possible without a parallel and consistent effort made by the Brazilian government to build and expand the country's digital infrastructure, facilitating expansion through digital entrepreneurship and financial inclusion. This process of development and digitalisation has been carried out for more than a decade and has turned Brazil into one of the leading examples of digital transformation in the public sector. Over the past decade, indeed, the Brazilian government implemented a comprehensive digital transformation strategy which allowed the expansion of digital connectivity, modernisation of public services and fostering of innovation across all the Brazilian economic sectors. What was fundamental that actually enabled this evolution was the intuition of the government to not focus solely on technological investments, but to implement

a strategy which combined infrastructure development with supporting institutional reforms to create the conditions necessary for digital entrepreneurship and economic growth.

This process began in 2010, when the government launched the National Broadband Plan (PNBL), with the main goal of expanding and bringing internet access to the whole population of the country, especially to those regions that lacked this technological access the most (mainly North and North-east regions). The plan aimed to bring broadband internet access to 40 million households by 2014, an objective which was not possible to achieve in time, but the Ministry of Communications kept working on it afterwards to build networks, access points and expand public fiber optic networks. By 2014, 43% of Brazilian households resulted in having internet connection, which was also allowed by the continuously growing demand from the lower middle class of the country. However, this progress was still very uneven, as the more industrialized areas of the South and South-east regions reached higher levels of internet access compared to North, Northeast and Northwest areas (especially rural ones), which remained poorly connected. The same gap was also evident inside cities, where the wealthier neighbourhoods had good broadband access while nearby poorer and favelas households were still dependent on small private internet shops, free public telecenters, or slower and more expensive 3G mobile connections. As of 2026, some progress has been made and today, Brazil has one of the world's largest online populations, enabling startups to reach millions of potential customers through digital platforms while significantly reducing customer acquisition and distribution costs.

Additionally, Brazil has also made significant progresses in the digitalisation of government services, moving from simple e-Government service toward a broader and more coordinated strategy known as Digital Transformation. In 2018, the OECD reviewed Brazil's digital, government policies and provided the country with numerous recommendations for improvement, for example making digital policies more consistent across the public sector, expanding digital services to states and municipalities, developing digital skills among public workers, and continuing to update the legal framework in order to support all these changes. Taken this, Brazil responded creating the Digital Transformation Strategy, known as the E-Digital in the years of 2018 and 2022. This strategy was built and carried out by a group of nine government bodies all collaborating together, coordinated by the Ministry of Science, Technology, Innovation and Communications, and including also public consultations of the private sector, universities and civil society. The E-Digital Strategy is structured around four main areas of digital transformation: the data-driven economy, connected devices, new business models, and digital government and citizenship. To support the achievement of these objectives,

the strategy is supported by five "enabler" areas, namely the development of network infrastructure and digital access, the promotion of research and development activities, the strengthening of trust in the digital environment, investments in education and professional training, and the enhancement of the international dimension of Brazil's digital agenda in order to reinforce the country's role in global digital policy discussions.

Together, these elements still aim today to build a more dynamic and competitive economy based on data, connected technology and automation, while also making government services easier to access and more efficient.

These strategies have produced visible results which were measured through the E-Government Development Index (EGDI) developed by the United Nations e-Government Survey. This index measures how well a country delivers communication and social services online across more than 190 countries, and rose steadily from 0.5006 in 2010 to 0.7010 in 2022, while its world ranking improved from 61st to 49th over the same period. As of 2026, this index stands at 0.8403, ranking 50th (Italy, for example, bears a lower score of 0.8356). Another important progress implemented by the Brazilian government is the digitalisation of its services. At the center of this progress there is the development of the gov.br platform: the federal digital platform that has become central gateway through which citizens can access a wide range of public services online, covering areas such as science and technology, business and commerce, taxes and administration, agriculture, social assistance, education, justice, health, employment, infrastructure and transportation. For this reason, in 2021 the World Bank also named Brazil the second most advanced country in the world in digital government. Around 80% of the Brazilian population (but also foreign citizens) now uses this platform. Some individual cities have also become known internationally for their proactivation to implement their own digital progress: Rio de Janeiro built a real-time data system, originally created to respond to the 2010 floods, that now helps 30 different municipal agencies manage transportation, energy, public safety and health; also the city of São Paulo has used funding from the Inter-American Development Bank to modernize its public service platform and strengthen its state data center, as part of a broader US\$1 billion "Brazil More Digital" investment program; and Porto Alegre has engaged more than a million residents in online and offline decision-making about local public services.

Therefore, this Digital Transformation strategy has brought clear practical benefits to the country; Brazil's Secretary of Digital Government estimated that digitalization has saved society around R\$4.6 billion, due to the opportunity of cutting the time and cost involved in dealing with government paperwork and bureaucracy: in fact, tasks that used to require citizens

to visit an office in person, wait in line and fill out paper forms can now be carried out completely online, which also allow to reduce errors and makes services faster and more consistent. Moreover, the government highlights benefits such as new improved public services, greater citizen participation and stronger national ICT infrastructure. However, at the same time this progress did not solve every problem. Significant challenges associated with the digital transformation are cybersecurity, privacy concerns, protection of citizens data and software management. Also the digital divide present in different regions of the country is still a real issue, particularly for people with disabilities and for economically disadvantaged groups, even though several programs have tried to reduce this gap: for example the Rede Marista de Solidaridade initiative carried out in Porto Alegre to expand public web access, the Digital Inclusion Centers established in areas such as Nova Santa Marta (a city with one of the lowest human development levels in Rio Grande do Sul), and the Bolsa Família social program which has reached about 2 million users through its digital payment system, and in the state of Bahia, Citizen Assistance Service Centers bring together more than 500 federal, state and municipal agencies in convenient locations such as shopping malls and transportation hubs.

Overall, the development of Brazil's digital infrastructure has provided fundamental technological and institutional foundations necessary for the emergence of a dynamic innovation ecosystem. By expanding digital connectivity, modernising public administration, and facilitating access to government services, the country has created an environment in which startups and digital businesses can scale more efficiently. However, taken as a whole, this digital infrastructure development present the same pattern and challenges seen in the country's startup ecosystem: fast, internationally recognized progress built through collaborative strategy and investment, but still showing significant real gaps between its most developed regions and cities and the poorer ones, with some portions of the population still harder to reach.

3.2.3 Regulatory and innovation policies

From the previous section we already understood the substantial contribution of the Brazilian state within the growth of the startup ecosystem of the country, and in this section we will analyse even deeper how this development has been supported by the increasingly proactive role of the State in actually promoting innovation through public policies and institutional support. Rather than acting only as a regulator, the Brazilian government aimed at creating an environment in which innovation, entrepreneurship, and technological development could thrive by coordinating all the collaborating actors involved such as public institutions, research organizations and the private sector as well. In this manner, the Brazilian state has decided how

to shape the legal, institutional and financial environment in order to stimulate startups emergence and growth. Its role comprehended several and complementary layers of actions including: the historical evolution of national science technology and innovation policy (ST&I), targeted legislation addressing the specific needs of startups, and a series of federal programs designed to connect these companies with capital, industry and research institutions.

During its history, Brazilian ST&I policy moved through some distinct phases that gradually increased the significant contribution of the state as a real targeted innovation enabler. During the 1950-1980s, the state protected emerging industry and created some important institutions such as CNPq (National Council for Scientific and Technological Development) and CAPES (Coordination for the Improvement of Higher Education Personnel), followed by FUNTEC (Technological Development Fund) and **FINEP** (Funding Agency for Studies and Projects) in the 1960s, laying the basework for a national system of scientific and technological development, even though at that time there was little integration between academic research and the productive sector. Over the years, the FINEP expanded its traditional financing activities by introducing important programmes specifically aimed at supporting innovative companies and encourage technological development. Among the most significant initiatives the agency conducted the INOVAR Programme, created to support the birth of innovative micro and small enterprises through venture capital promotion, investment forums, business development networks, and training programmes for risk capital agents. The programme marked an important shift towards supporting high-growth entrepreneurial ventures and giving new life to Brazil's venture capital ecosystem.

FINEP also restructured its financing instruments to better support startups through another important program, the PROINOVAÇÃO (Proinnovation) which was introduced to provide repayable financing for research, development, innovation, and technological projects carried out by Brazilian companies. Alongside this project, the agency launched other projects such as PAPPE (Program to Support Research in Companies), which offered non-repayable financial support through partnerships with state research foundations, with the aim to promote greater coordination between federal and regional innovation policies. All these initiatives provided a significant shift from the traditional industrial policies for financing towards policies specifically aimed at stimulating technological innovation. From 2004 FINEP became one of the principal responsible federal agencies for implementing the Industrial, Technological and Foreign Trade Policy (PITCE), and alongside the Digital Transition strategy previously analysed became the pillar of the establishment and growth of the startup ecosystem in Brazil.

Additionally, FINEP introduced other initiatives targeting young innovative firms. It created the INOVAR Semente programme to support companies in their pre-operational stage, while the Juro Zero (Zero Interest) programme was implemented to provide small innovative businesses with access to low-cost credit through simplified procedures and decentralised partnerships. These measures aimed to reduce financial barriers for entrepreneurs while improving access to funding during the early stages of business development.

Also from the legislative point of view, the state carried out many activities to address structural obstacles. The first one was the Economic Freedom Law (Lei nº 13.874/2019) which reduced licensing requirements and reinforced the principle that public authority cannot restrict economic activity without a justified public interest. The Legal Framework for Science, Technology and Innovation (Lei nº 13.243/2016) was aimed at strengthening cooperation between universities and industries. While the most decisive intervention, was the **Legal Framework for Startups** (Complementary Law nº 182/2021), which was the law that for the first time gave Brazilian startups a formal legal identity and built a coherent set of instruments and policies according to that definition; it facilitates the collaboration between startups and public administration, increases the juridical certainty for investors and entrepreneurs and encourages investments for innovative companies. Also the establishment of the so-called **regulatory Sandbox**, had a great impact as it constituted a regulatory space in which startups are allowed to test innovative products and services under temporarily more flexible rules and supervision from regulators.

Other additional initiatives carried out by the State were establishing substantial training and connection partnerships with accredited business accelerators, to give specific support service to startups through free training, business mentoring and investor networks, with the most important being EMBRAPPII and SEBRAE.

Contrary to the common role as a regulator of banks, the Central Bank of Brazil acted as a primary catalyst in the country's tech and startup environment, through the key initiatives of the establishment of the instant payments system (Pix) and the Open Finance framework aforementioned.

Finally, the Brazilian government's regulatory reforms were not only aimed at digitalising the financial system, they also pursued broader pro-competition objectives by reducing the dominance of the traditional oligopoly of banks, facilitating the entry of new market participants, and fostering a more competitive financial sector. At the same time, all these policies were guided by intrinsic social objectives at the base, such as expanding financial inclusion, reducing the number of individuals without access to any bank system, providing

affordable financial services, and improving access to credit for both individuals and small businesses. Together, these measures created a more open and inclusive financial ecosystem, providing favourable conditions for the growth of innovative fintech companies such as Nubank and PagSeguro which we will analyse in next chapters.

To conclude, the evolution of Brazil's innovation ecosystem suggests that the country during its economic history, has progressively improved and strengthened its domestic innovation capabilities through the expansion of startups increasingly based on technology, the development of digital infrastructure, and the implementation of innovation-oriented public policies. These developments indicate that the country is implementing a gradual shift away from a model based exclusively on the adoption of foreign technologies toward one that ever more promotes indigenous innovation. However, the concept of whether these transformations are sufficient to reduce Brazil's historical economic and technological dependence, remains an open question. More specifically, it is necessary to assess whether these policies and institutional efforts have actually allowed the country to develop more autonomous innovation capabilities, or whether innovation continues to rely mainly on the adaptation and diffusion of technologies coming originally from more advanced economies. The following chapters address this question by examining the development of the Brazilian fintech ecosystem, especially through the cases of Nubank, Pix and PagSeguro, with the aim of evaluating whether they represent evidence of a more autonomous and innovation-driven development model.

Chapter 4. The Development of Fintech and Digital Services in Brazil

4.1 The Brazilian Fintech Ecosystem

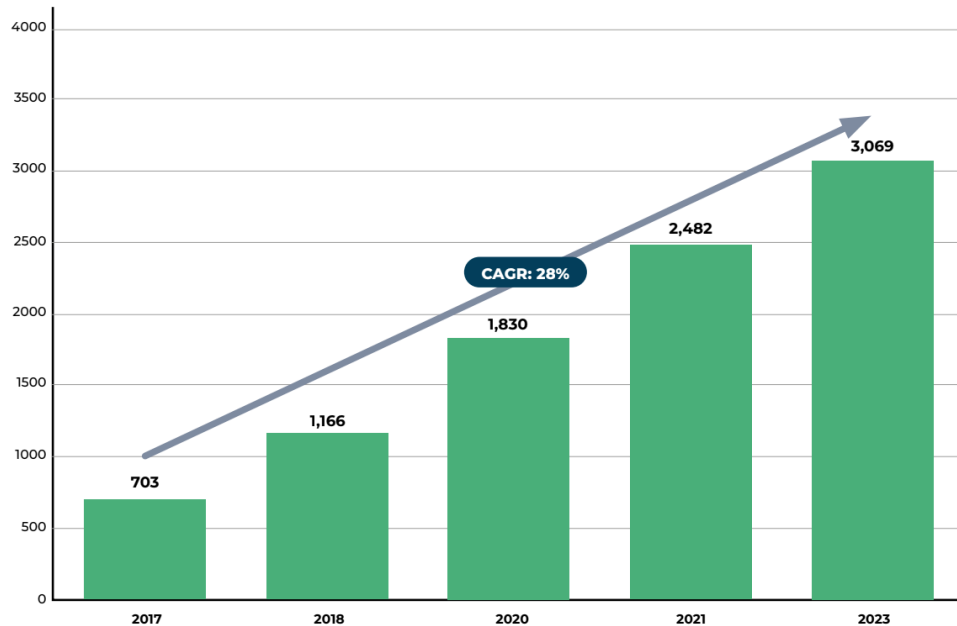
As we saw in the previous chapter, in the past decade Brazil has emerged as the leading fintech market in Latin America, driven by technological progress, increasing digitalisation and support from regulations and policies. The combination of widespread usage of smartphones, improved connectivity, growing demand for more accessible financial services, and innovation oriented policies has created a favourable environment for the development of digital financial solutions. As a result companies increasingly entered the market, transforming the way individuals and businesses make use of banking systems, payments, credit and other financial services. This section examines the evolution of the Brazilian fintech ecosystem by analysing its market growth, the main industry segments and players and the key factors that have contributed to this expansion.

4.1.1 Market growth

As we saw in the previous chapter, Brazil underwent a period of severe hyperinflation in the 1990s. The Plano Real allowed for economic stabilisation marking the beginning of recovery, although in this resolution three of the largest private banks went bankrupt. The subsequent stabilisation of the financial sector led to a wave of consolidation, in which around 40 banks existing at that time merged into what are the 5 large banks that exist today. Despite this consolidation brought stability, security and results in the Brazilian financial system, it also gave birth to an oligopoly of traditional banks that still prevails today. For much of the period that followed, the economy was characterized by small competition, strict rules to access to financial services, largely uniformed conditions across all the traditional banks, which were bearing the control over the financial system, concentrating together 80% of the country's financial assets. These conditions left little incentive for the creation of more accessible products and more competitive services.

Against this economic context, the Brazilian fintech ecosystem has expanded rapidly over the last decade. The number of fintech startups has increased continuously, reflecting both growing entrepreneurial activity and rising demand for digital financial services. Across Latin American countries, the number of fintechs grew from 703 in 2017 to 3069 in 2023, a surprising increase of around +340%, with Brazil accounting for approximately 60% of the regions' fintechs and ranking first in Latin America. This growth has been exponential since 2008, with a higher growth after 2015, and even more after 2021 as seen in Figure 1²⁰.

²⁰ Finnosummit. (2024, June 20). *Fintech Ecosystem in Latin America and the Caribbean Exceeds 3,000 Startups*. Finnosummit. <https://www.finnosummit.com/en/fintech-ecosystem-in-latin-america-and-the-caribbean-exceeds-3000-startups/>



Investment activity has played a crucial role in the development of the Brazilian fintech ecosystem. The country has attracted the largest share of fintech investment in Latin America, at around 10\$US representing around 65% of regional investment, followed by Mexico with \$US3 and Argentina of \$US1.

4.1.2 Main segments and key players

The Brazilian fintech ecosystem has developed well beyond just digital banking, including solutions across a wide range of segments, in which the main key players are:

- Digital banking: key players are Nubank (the case study of this thesis), Banco Inter, C6 Banks, PicPay, PagBank and Neon
- Payments (including cross-border): EBANX, PagSeguro, Stone, PagBrasil and RecargaPay
- Credit and loans: Creditas, Geru, Open Co, Cora
- Investments (WealthTec): XP Inc., NuInvest, Warren, Toro Investimentos
- Private/ business financing: Nexoos, BizCapital, Cora, Open Co
- Insurance (InsurTech): Thinkseg, Justos, Pier
- Debt negotiation: Acordo Certo, QuiteJá, BLU365
- Crypt assets and ledgers : Mercado Bitcoin, Foxbit, Hashdex, Transfero

Among these, digital banks reserve particular attention since they operate on border scale and had and still have disruptive potential. Legally, a digital bank is simply a fintech, but it deserves

a separate treatment because of its business model and competitive weight. In fact, digital banks offer and commercialise services digital accounts that in practice perform the same functions as a traditional deposit account, carrying activities such as account opening, transacting, and other banking operations, but entirely online and without physical branches. This allows digital banks to raise and manage third-party funds without the usual obstacles that traditional physical banks always face such as dealing with costly, long-term infrastructure and workforce networks, which often include selling products from other financial institutions under an open-architecture model.

Nubank illustrates this process well: the company initially founded focused on fee-free credit cards, expanding with a fee-free account offering the functional equivalent of a traditional deposit account, which we will analyse later in detail.

4.1.3 Drivers of expansion

Several correlated factors explain the rapid expansion of fintech in Brazil, starting from **smartphone and internet penetration**. The rapid spread of smartphones has allowed millions of people to access financial services for the first time and directly from their phone, without the need to visit a physical bank branch, a particularly important factor especially for people in rural areas. This has reduced the cost of financial access and favoured the adoption of mobile banking, digital payments and fintech applications more broadly.

Also the rapid diffusion of internet access, especially through mobile networks, has been a fundamental prerequisite for the development of the digital economy, facilitating the diffusion of digital platforms, cloud services and financial applications through which fintechs operate. The following indicators give a snapshot of digital financial services and digital connectivity in Brazil last registered in 2024²¹, allowing an easier understanding of how the fintech and digital financial services are enabled by the environment of the country:

- Account ownership among adults (people aged 15+) at a bank or similar institution, or use of a mobile money service in the past year: 68% (2014), 70% (2017), 84% (2021), 86% (2024).
- Of adults aged 15+: 1% hold only a mobile money account, 57% hold both a bank and a mobile money account, and 28% hold only a bank account.

²¹ Global snapshot of indicators and enabling regulations. (2024). *Worldbank.org*.
<https://digitalfinance.worldbank.org/country/brazil> .

- 38% of adults report formal saving (at a bank or similar institution, or via a mobile money account).
- 47% report formal borrowing (from a bank, via credit card, or via a mobile money account).
- 77% report using digital payments (mobile money, debit/credit cards, mobile phone payments, or online bill/purchase payments).
- Mobile network coverage: 30% of the population is covered up to 4G, 63% additionally has 5G coverage, and 7% remains uncovered.
- Brazil scores 78 on an index of mobile infrastructure enablement. This index expresses a composite measure of infrastructure, affordability, consumer readiness, and content and services. The country scores the highest in Latin America, reflecting Brazil's advanced mobile ecosystem.

Financial exclusion as a market opportunity has been another fundamental factor. For many years, the traditional banking system was defined by high account costs, strong concentration among a handful of large banks, a limited bank presence in peripheral and rural areas, and therefore, difficult or impossible access to financial services for large segments of the population, resulting in high rates of **unbanked citizens**. This produced considerable **consumer dissatisfaction**, driven by high fees, bureaucratic procedures, long waiting times and limited accessibility. This is closely related with the instant payment system **Pix**, which we will discuss further below, since it has been one of the most important factors in reducing the share of the unbanked population.

Moreover, as we already saw in the previous chapter, the Open Finance **regulatory innovation** of the Central Bank of Brazil has been one of the most significant reforms supporting this shift, enabling customers to voluntarily share their financial data, switch providers more easily, compare offers, and access more personalized services. This has given fintechs the ability to compete with large traditional banks without needing to build an equivalent proprietary customer database, fostering greater competition, innovation, new business models and more personalised services. This dynamic can be read through the lens of the Transaction Cost Theory presented in Chapter 2: by reducing information asymmetries between financial institutions and consumers, Open Finance lowers the transaction costs that had previously protected incumbent banks, making it easier and less costly for new entrants to compete on equal terms.

This explains why Brazil's fintech ecosystem is the most developed in Latin America, together with the fact that the country possesses the region's most advanced regulatory framework for

financial innovation, which evidences that a well-designed regulatory environment tends to correlate with greater sectoral development and growth. The Central Bank's **Open Finance** regulation, in particular, pursues several explicit objectives such as:

- Encourage innovation
- Enable digital financial services being integrated in the financial customers' day-to-day
- Promote competition
- Reduce information asymmetry between financial services providers
- Facilitate new business models implementation
- Increase the efficiency of the National Financial System (SFN) and the Brazilian Payment System (SPB)
- Promote financial citizenship.
- Favor new forms of relationship among the participating entities, their customers, and partners.

4.2 Digital Payments and Financial Inclusion

Given these insights about the main drivers and previous background that characterised Brazil before the diffusion and development of fintech, we are now going to analyse how the entrance of digital payments has revolutionized the economic and social picture of the country by bringing one of the most important results, such as financial inclusion.

4.2.1 Evolution of payment systems: from cash to pix and open finance

The evolution of the system of payment of a country reflects its border economic and technological development. Payment systems not only facilitate financial transactions, but it also influences market efficiency, financial inclusion, productivity and the diffusion of innovation throughout the economy. In this section we will analyse this evolution for Brazil, which provides an interesting case as in slightly more than a decade was able to transform its financial system historically dominated and based on cash and traditional banking instruments into one of the world's most advanced digital payment ecosystems. This transformation was not driven by a single innovation, but from a set of broader processes of digitalization combining technological progress, institutional reforms, regulatory innovation, and changing consumer behaviour. More specifically, we will analyse how Brazil went from cash, TED, DOC, boletos bancários (bank slip) and Pix.

For most of the twentieth century, cash represented the primary instrument of payment in Brazil which reflected the country's historical economic structure and characteristics of a

predominantly rural economy, limited banking penetration, and high levels of informality as we already previously saw. As the economy gradually modernized, new payment instruments were introduced as cheques which became increasingly popular in the 1950s, particularly among business and middle-income households, but hyperinflation happened later through the 1980s and early 1990s reduced purchasing power of consumers paying with any form of deferred payment, encouraging workers to spend their wages as soon as they were paid to avoid the constant erosion of the currency. Only after the implementation of the Plano Real in 1994, which as we saw was successfully able to stabilize inflation, consumers began to make greater use of formal financial services, saving products, and electronic payment instruments. In 2002 came another major structural change to the payment infrastructure with the reform of the Brazilian Payment system (Sistema de Pagamentos Brasileiro – SPB). This reform introduced by the Banco Central do Brasil provided a more secure and efficient payment infrastructure reducing systemic risks and improving interbank transfers through instruments such as the Transferência Eletrônica Disponível (TED) and the Documento de Crédito (DOC). TED transfers represented the fastest traditional bank transfer available before Pix and were transfers that were usually completed within the same business day, often in less than an hour, if they were initiated during the banks' operating hours. They had no maximum transfer limit and for this reason it became the preferred payment option for higher-value transactions. DOC, instead was slower as funds were only credited on the following business day and transfers had a limit of R\$4,999.99. Both payment methods also required the users to provide detailed banking information, such as the recipient CPF (Brazilian fiscal code), bank branch, and account number and could only be used during banking hours. What is important to understand is that all these limitations were further eliminated with the adoption of Pix, which made instant payments available at any time of the day using only simple identifiers such as phone number, email address, CPF, or a QR code.

At the same time alongside with bank transfers, boletos bancários became also one of the most widely used payment methods, especially for bill payments and commercial transactions and were therefore essential during the growth of e-commerce during 2000s, when internet banking and TED/DOC transfer actually started to substitute more cash and cheques. Additionally, cards entered the market and followed a similar trajectory: debit cards, linked directly to a current or savings account, allowed instant, real-time deduction of funds and, unlike credit cards, could never generate debt, since a purchase is authorised only if sufficient balance is available at the moment of the transaction. Credit cards that were introduced in the 1970s were however widely adopted only later, and they function as a revolving line of credit consolidating a period's

purchases into a monthly bill that can be paid in full (avoiding interests) or in installments or partially, at typically high interest cost.

Although the implementation of all these instruments significantly improved the efficiency of financial transactions in Brazil, several limitations continued to persist. Indeed, transfers were generally restricted to banking hours, transaction costs remained relatively high, and access to financial services was still uneven across the country, particularly in remote and rural areas.

The important advancements that we previously saw such as smartphone diffusion, internet connectivity, increasing investments of banks in digital platform and the birth of fintech companies introducing new financial solutions, enabled this fundamental revolution of the payment systems, by allowing millions of Brazilians to familiarize with digital financial services and creating the technological and behavioural conditions necessary for a more profound transformation of the payment system. Rather than replacing the existing payment methods overnight, digital payments gradually complemented and improved the traditional financial infrastructure. In this manner, debit and credit cards contributed to reshaping payment methods too: contactless (NFC) payments shortened the transaction time at the point of sales and both increasingly incorporated loyalty and cashback features that reinforced their place in everyday consumption. Therefore, the digitalisation of payments was the result of a progressive evolution of the financial ecosystem rather than a single technological innovation of the moment.

The real shift, however, arrived in 2020 when the Banco Central do Brasil finally implemented Pix, which constitutes the most significant turning point in the digital payment ecosystem of the country. It was not only the establishment of a new method of payment, as Pix fundamentally transformed the country's payment infrastructure by enabling instant, low cost and continuously available transactions. Its rapid adoption by the Brazilian population accelerated the replacement of cash for daily transactions and actually reduced the use of traditional bank transfers for small-value payments. Pix, in fact, quickly became one of the most widely used payment methods in Brazil, demonstrating how technological innovation supported by effective regulations of public institutions, can rapidly reshape consumer behaviour, satisfaction and therefore financial markets of a country.

Evidences show that Pix did not simply substitute existing payment instruments, but also expanded access to financial digital services to a larger share of the Brazilian population. Indeed, many individuals who had never previously used electronic transfers adopted Pix as their first digital payment method ever, especially young people and lower income populations (a large portion of the North and Northeast regions). At the same time, thanks also through this

news introduction the different payment methods existing started to become more specialized: Pix emerged as the preferred solution for everyday, low-value transactions, while TED continued to be used mainly for higher value transactions. These developments suggest that Pix did not only modernize the payment system but also enabled at expanding financial inclusion and integrating unbanked populations into the formal financial sector.

Additionally, as we also previously saw, the modernization of Brazil's payment ecosystem continued development with the implementation of Open Finance, which was initially introduced by the Banco Central do Brasil as Open Banking. This constitutes an equally important step since, while Pix transformed the payment infrastructure itself, Open Finance represented the next stage of digital financial development actually by creating and enabling a more integrated and interconnected financial system. Moreover, today Open Finance is considered one of the most comprehensive worldwide frameworks and complements Pix in supporting the country's broader digital transformation.

Overall, it is important to note how the smooth transition from cash-based transactions to a fully digital financial ecosystem did not happen for each technological advancement on its own, but by the cooperation that these advancements had between each other. This reflects a long-term strategy and process in which regulatory action, digital technologies, market competition and changing customer preferences altogether transformed the country's financial landscape supported by the right regulatory support.

4.2.2 Role of innovation in access to financial services

According to a study developed by the Central bank of Brazil²², 30% of adult population did not have a bank account in 2017, and for the low-income people, and among low-income individuals only 57% had one. After the implementation of Pix and the initial development of fintech this rate rose to 82% of low income people having a bank account, arriving at 86.4% of adults with a financial account in 2024.

This trajectory is consistent with the World Bank's Global Findex Database 2021²³, which identifies Brazil as one of the developing economies with the most significant progress in

²² Banco Central do Brasil. (2026). Bcb.Gov.Br. <https://www.bcb.gov.br/detalhenoticia/663/noticia>

²³ Demirguc-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Singer, D. (2022). The Global Findex Database 2021. In [openknowledge.worldbank.org](https://openknowledge.worldbank.org/entities/publication/b74e1909-3ecf-5009-b51c-8527fc4eeefb). Washington, DC: World Bank.
<https://openknowledge.worldbank.org/entities/publication/b74e1909-3ecf-5009-b51c-8527fc4eeefb>

account ownership since 2017, together with other countries such as Ghana, Morocco and South Africa, taking overall adult account ownership to 84% by 2021 (81% among poorer adults).

What is fundamental is that this analysis is revealing not simply that more Brazilians hold an account, but that innovation has transformed how they actually use financial services, meaning not only for payments, but also for savings, borrowing, and investing. One of the most important insights is in fact, that financial services shifted from a branch-centered model, in which the five traditional banks held the oligopolistic control to a user-centered, digital model. This progressive shift, driven by the interaction between the Banco Central do Brasil, incumbent banks and fintech companies, is consistent with the National Innovation System perspective introduced in Chapter 2: financial innovation in Brazil has not emerged from isolated firms acting alone, but from the coordinated evolution of public institutions, private firms and the regulatory framework that connects them.

This shift also represents a democratization of finance: where in the past opening an account required physical branches, to do paperwork, bureaucratic delays, high costs, and long waiting times, while today smartphones are the primary tools used to access banking services, with digital identity verification, accounts opened in minutes, and services available 24/7. What this thesis aims to analyse, however, is that technology alone is not the decisive factor, it is instead the reduction of barriers to access that matter the most.

This growth in access was possible mainly because of the deeper transformation that bank underwent in their business models. While the market once offered standardized products, limited competition, and few operators serving a large and diverse population with little differentiation, it now provides personalised services, improved user experience, algorithm-driven decision making, Open Finance, APIs, and digital ecosystems that expand their reach to a much larger and diversified customer base, which constitutes the real driver of change in the financial and banking system.

The Global Findex data provides evidence of how this transformation was not only targeted at increasing the number of bank accounts, more importantly it changed the way people actually use financial services. Brazil is among the economies where account ownership is accompanied by a frequent use of digital payments. In 2021, more than half of Brazilian adults used digital payment methods to purchase goods and services, which constituted a much higher share than the average for developing economies. At the same time only a small proportion of Brazilian account owners did not use any form of digital payment, while cash became significantly less common for everyday transactions. What is interesting emerging from data, is that many Brazilians also pay utility bills directly through their bank accounts or mobile applications

instead of using cash. Furthermore, compared with many other developing countries, a larger share of individuals making use of formal borrowings in Brazil, takes place through credit cards rather than traditional bank loans. All these trends suggest that digital financial services have become an integral and maybe even fundamental part of the everyday economic life of Brazilian citizens, rather than simply representing an alternative to cash payments.

Moreover, once again, government policy reinforced this shift since Brazil is among the developing economies where higher share of government wage payments than of government transfers or pensions is paid directly into an account, suggesting that the government itself make use of financial digitalization for distribution of public wage (recurrent payments in particular), which helped promote and anchor even more the habit of holding and using an account. The COVID-19 pandemic further accelerated this process, pushing many Brazilian citizens to make their first digital merchant or utility payment during that period, a consistent pattern which took place also in broader countries of Latin America as documented by the World Bank.

Another important factor is how these more personalized and accessible financial products enabled economic empowerment of the population. The bigger access to financial services, in fact, allowed the creation of micro-enterprises, direct sales, access to credit, and the building of credit history, evidencing how innovation increases not only efficiency but also economic opportunity.

However, these findings suggest that important barriers still remain. Greater access to digital financial services does not automatically mean that all individuals are able to use them confidently. In Brazil, for instance, data show how a greater portion of unbanked women are more likely than unbanked men to report the need of assistance to use a bank account. This highlights that financial inclusion depends not only on access to technology but also on the fact that digital innovation must be accompanied by financial education, digital skills, and effective consumer protection in order to ensure that every citizen can benefit equally from these new financial services.

In a country such as Brazil, this transformation has been particularly significant because as we know from all the history that we previously analysed in recent chapters, a large share of the population has always historically faced structural barriers to accessing formal financial services. Digital innovation has progressively reduced these barriers, enabling millions of individuals and small businesses to participate more actively in the overall economy of the country. In this manner, innovation has become not only a driver for technological change but also an instrument of economic inclusion, productivity and social development.

Finally, the Brazilian experience demonstrates how digital innovation, when supported by appropriate institutional frameworks, government led digitalisation regulations, and widespread technological adoption, can transform the relationship between citizens and financial system while contributing to broader economic modernization.

Chapter 5. Case Study: Nubank and the Brazilian Fintech Ecosystem

In this chapter we are finally analysing the core case studies that provide essential evidence to understand the research aim of this thesis. Starting from the core case studies of Nubank, we are going to analyse how the establishment of this startup revolutionized the Brazilian fintech sector, following with a deeper description of the Pix phenomena and an additional case study of PagBank to actually understand how digital payments changed the Brazilian ecosystem.

5.1 Nubank as the Core Case Study: Digital Banking Disruption

Nubank constitutes the core case study of this thesis, since it's Brazil's first-ranked fintech and one of the most prominent unicorns, widely considered one of the most successful technological startups to have scaled into a major company in Brazil, and which contributed and still does today to the independence and economic development of the country. Indeed, its trajectory provides valuable insights for assessing the development of Brazil's domestic innovation capabilities and understanding how the country is progressively moving from the adoption and adaptation of foreign technologies towards the development of a more autonomous technological model and business solutions. By analysing Nubank's business model, value proposition and growth strategy we will be able to examine not only its impact on the Brazilian banking system, but also its overall contribution on the economic and technological development of the country.

Nubank was founded in 2013 in São Paulo by the Colombian David Vélez, Brazilian Cristina Junqueira, and American Edward Wible and has since then grown into the largest digital bank in the world, serving 139 millions of clients in Brazil, Mexico and Colombia.

The actual CEO Vélez, a Stanford MBA who had previously worked as a partner at Sequoia Capital, moved to São Paulo in 2012 to lead the venture firm's expansion into Brazil. The idea of Nubank came directly from his own frustrating experience of trying to open a bank account in the city: The traditional problems such as bureaucratic, time consuming and often difficult processes that characterised Brazil's banking system, convinced him of the presence of an

unmet need to make people's approach and relationship with banks way simpler. As already discussed in Chapter 4, this frustration reflected a broader structural condition of the Brazilian banking oligopoly and its persistently high rate of financial exclusion. In this context, even those who could actually access financial services often faced long lines in the physical branches, restricted opening office hours, and a confusing and sometimes intimidating experience in signing up for banking services. Having noted this common, strong need, Vélez wanted to provide a solution. However, lacking the local market knowledge and a background in consumer banking, Vélez brought on Edward Wible, a computer scientist who had spent most of his career in private equity, as CTO, and Christina Junqueira, a previous strategy consultant who had worked as a project manager in Itaú Unibanco's consumer loan and credit card division, who who also reporteddd having similar structural problems related to high fees and confusing communication.

The combination of skills brought together by the three founders such as international financial expertise, technical capability, and first-hand knowledge of the Brazilian banking system, offers an early illustration of the Resource-Based Theory discussed in Chapter 2: Nubank's initial competitive advantage did not rest on a proprietary or newly invented technology, but on the recombination of existing financial, technological and local-market capabilities suited to the Brazilian context. This is consistent with Keun Lee's argument, also introduced in Chapter 2, that emerging-market catch-up frequently proceeds through the adaptive recombination of available knowledge rather than through original invention.

Together, the three founders decided to disrupt Brazil's traditional banking system and challenge its established structure, launching the unorthodox purple Nu card in 2013, with the aim of transforming the financial landscape of Latin America. Operating in such a complex sector, it was inevitable that the company initially faced significant obstacles from the outset. As we previously saw, the Brazilian banking sector was dominated by an oligopoly of mainly five institutions: Itaú, Bradesco, Santander Brasil, Banco do Brasil, and Caixa Econômica Federal, which were holding 80% of the market power. For these reasons, banking industry experts were very skeptical that a team including two non-Brazilian founders could compete with these oligopolistic players. Moreover, the founders also had to struggle with important regulatory hurdles, until a subsequent "regulatory revolution", including the 2013 Payment Institutions Act and, later, Resolution 4.656/2018, gradually simplified the process of offering payment services and banking licences in Brazil and helped open the door for fintechs. Nonetheless, despite this early skepticism and difficulties, the founders' conviction in the strong underlying mission allowed the company to persevere. Nubank launched what was, at the time,

a genuinely revolutionary product: the first no-fee credit card in Brazil, fully available and manageable through a mobile application without the need to visit a physical branch. This characteristic of zero fees and complete digital autonomy was a groundbreaking novelty in the Brazilian market and the company was able to quickly attract the attention of some of the world's most important investors, including Sequoia Capital, Tiger Global Management, Berkshire Hathaway, and Tencent. As reported by the company, today 62% of Brazilian adults use Nubank, while more than 28 million people have obtained their very first credit card through the company.

Over time, Nubank has significantly enriched its product offerings, going beyond its original no-fee credit card in order to serve a wider share of the population with different financial needs, while still remaining consistent with its primary fundamental objective of eliminating the need for physical branches and reducing costs. As of today, the total current product offering of Nubank includes:

- **Digital account and payments (Pix included):** first of all the company offers users the option to open a personal digital account, the NuConta, which allows customers to manage day-to-day transactions and savings from anywhere and at any time. The company subsequently decided to integrate peer-to-peer transfers through Pix, allowing the national real-time payment system. Rather than developing its own product of instant payment infrastructures, Nubank incorporated Pix into its platform, allowing customers to use the national digital payment system directly through the Nubank application.
- **Investments through Easynvest:** following Nubank's acquisition of the investment platform Easynvest, the company expanded its offerings and operation into investment services. With this new offering, customers now have access to stocks, bonds, mutual funds, and other investment instruments through the same application used for their banking activities, making Nubank not only a simple digital bank but a more diversified financial platform.
- **Personal loans:** Nubank also introduced flexible personal loans, initially offered independently and, from 2021, through a partnership with the fintech Creditas. Customers can simply request these loans and are then approved directly through the mobile app, with the important characteristic of being presented with competitive and transparent terms.

- **Life insurance:** Nubank further expanded its financial offering into insurance through Nubank Vida, a life insurance product launched in collaboration with one of its partners, Chubb. This feature, as well as the others, is directly accessible from the mobile app.
- **Business banking:** the company did not limit itself to targeting individuals but also developed a business banking account aimed at small and mid-sized enterprises, in order to extend even more its customer base beyond individual consumers and into the business segment.
- **Expansion of the credit card portfolio:** besides the iconic original purple fee-free credit card, commonly referred to as “Roxinho”, Nubank subsequently implemented additional products in order to target different customer segments. These include more luxury options, which are a Platinum card oriented towards travel benefits and, since 2021, the Ultravioleta premium card, aimed at higher-income Brazilian customers which represented an important expansion of Nubank's value proposition beyond its original mass-market positioning and into the premium segment.
- **New safety tools:** some of the most recent new product launches from the company include a new suite of tools, educational materials and support teams. In this manner, Nubank has launched two new channels in charge of supporting customers who are victims of fraud, theft and robbery. According to this new feature customers can use the Reporting Channel and Me Roubaram (I was robbed, in Portuguese) website to report these types of criminal activities
- **NuPay + Uber:** a significant new launch recently made by Nubank was the implementation of a payment option in Uber in Brazil. Uber is the most used way of personal travel and transportation and therefore, this partnership brings an unprecedented integration of Nubank products that allow users to pay for their rides with one simple and safe click in the Uber app.
- **Additional limit for Pix on credit:** the last launch implemented by Nubank is setting specific credit limit for eligible customers when using Pix on credit cards. These additional credit lines are a way for the company to offer limit increases that respond to customer's needs.

Taken together, all these varied products constituting the large portfolio of Nubank's financial services reflects the original strategy of the company to identify a specific market gap: a large portion of the Brazilian population with limited or no access to basic financial services, and to progressively satisfy their need by building an accessible and user-friendly range of easy manageable banking products.

5.1.1 Business Model and Value Proposition

The business model of Nubank is based on some important core values that the company clearly declares based on providing innovative and pioneering solutions. Its business model, in fact, was built around addressing two major shortcomings that its founders identified in Brazil's traditional banking system: **complexity** and **lack of transparency**. Traditional Brazilian banks have always provided very bureaucratic and non-intuitive procedures designed around the bank's internal procedures rather than customers' needs. As previously mentioned, since remote support was poor or often entirely absent given the low internet connection and equal access opportunities, even what were to be thought the simplest operations required the customer to personally visit a branch, resulting in long queues and slow resolution times. The second problem identified by the founders was a lack of transparency. Individuals always claimed confusing and not so clear policies and unexplained fees related to transactions, account maintenance, and credit card operations, which have always left many users feeling like "hostages" of contracts they had signed without truly understanding, creating a real information asymmetry between the financial institution and the simple consumer. Nubank decided to respond to this need by entirely digitising the resolution of these problems, building products that customers could understand, use, and control autonomously through a single mobile application. The main explicit objective was to make people's financial lives easier and increase the number of people who could have a positive interaction with banking services. All this purpose is explicitly contained in the company's own mission statement which cites "to fight complexity, red tape, and the inexplicable burdens people have become unpleasantly used to, while being fair, transparent, and aiming to "wow" customers through service quality". A third important pillar reinforces these two principles: the center-oriented business services. Nubank has invested heavily in fast, friendly, and personalised customer service delivered through the application itself, an approach that was subsequently developed into in-house customer service team, known as "Xpeers", always ready to respond to customer requests and inquires, and in occasional "WOW" gestures that go beyond ordinary service expectations. A significant example of this involved sending a client whose credit card had been chewed by her dog a small rubber bone as a replacement gift, an atypical approach that was later formalised into a partnership-branded product.

Considering this, it is clear how Nubank operates through a **branchless, mobile-first digital banking model**, in which the application represents the company's principal and first point of contact with customers, allowing it to maintain a low-cost operating structure. Despite this, it is important to say that Nubank is not part of the formal Brazil's National Financial System but

instead operates as a financial and payment institution regulated and supervised by the Banco Central do Brasil. Thinking about all the free-fee products offered by Nubank, one could ask how it is possible for the company to still remain profitable, and the answer is that is actually this branchless structure which allows it to attract new customers with a very low-cost acquisition strategy. Indeed, rather than relying on heavy traditional advertising like traditional banks, Nubank has been able to acquire customers cheaply through organic word of mouth, a dynamic culture reinforced by its customer-centric and, in the years following its launch, in very low marketing costs alongside with a constant organic growth through social media and referrals. Another important aspect is that the company also makes extensive use of transaction data and machine learning across automated functions such as credit scoring, fraud detection, and customer support. This includes also an additional important feature of its own proprietary credit-scoring system, which constitutes a clear example of the Resource-Based Theory logic introduced in Chapter 2: it is a firm-specific, data-driven capability that is difficult for competitors to replicate and that generates a sustained competitive advantage, assign to every customer a behaviour-based credit score related with its credit tracking, enabling the company to extend modest initial credit lines and thus serving many unbanked customers, rather than relying on the traditional credit-history criteria that had always excluded them from the traditional banking system.

For these reasons, Nubank provides a significant example of how effective is building a business model combining low-cost or fee-free entry products with a diversified set of revenue streams. Besides the organic traffic that aims at reaching, the company earns a net interest margin on customer credit balances, personal loans, and asset financing; it also collects interchange fees, which are a percentage charged to merchants each time a customer taps or swipes their debit or credit card; and it monetises marketplace offerings such as investment brokerage, insurance distribution, and international currency transfers. This business model is at the same time supported by a deliberate growth flywheel: very low entry barriers, in the form of fee-free digital savings accounts and zero-fee entry-level credit cards, which are used to attract underbanked customers. Another important feature is how the company implements a gradual increase in offers to these same customers: by accumulating trust and transaction history, the Nubank proposes higher-margin lending and wealth products, increasing average revenue per active user over time, while keeping unit servicing costs largely flat. This flywheel is, in turn, sustained by the fundamental customer-centric culture described above that Nubank was able to provide. Therefore, the combination of humanised service, low institutional hierarchy, and continuous product proposals based on direct customer feedback constitutes a

powerful business model that fosters the engagement and loyalty of customers thus keeping acquisition costs low and organic referrals high. In this way, the original value proposition based on simplicity and transparency becomes a self-reinforcing driver of growth. Finally, a fundamental insight is arising from the analysis of Nubank's business model, which illustrates more than a simple digitalisation of traditional banking services. Its branchless structure, technology-driven operations, customer-centric value proposition, diversified revenue streams, and ability to progressively expand its product ecosystem demonstrate how a Brazilian company has developed a scalable alternative to the traditional banking model. At the same time, the case is able to give us important awareness and initial basis for examining the broader question of whether Brazil is moving from the adoption and adaptation of technologies developed elsewhere towards the development of domestic innovation capabilities. According to this context, in the next section we will proceed in analysing how Nubank's model has translated into sustained competitive advantages and broader changes within the Brazilian banking sector.

5.1.2 Growth Strategy and Scaling Dynamics

From the previous section it is already possible to understand how Nubank's growth trajectory illustrates an insightful scaling strategy through which the company was able to progressively transform a single financial product into a broader complete digital financial ecosystem. In order to have a clearer picture of the whole growth strategies and scaling dynamics of Nubank we should proceed by analysing the product and strategy trajectory implemented by the company.

The venture launched its very first product, the famous purple credit card in 2014, initially using it not only as a revenue-generating product but also as a way to build a customer base, establish market presence, and gather important proprietary customer data. This foundation was followed by a progressively expansion through the introduction of NuAccount in 2017, a prepaid card in 2018, personal loans and business accounts in 2019, and insurance and investment products through NuVida and Easynvest in 2020 and 2021. This progressive diversification of the product portfolio allowed the company to satisfy an ever increasing number of financial needs of different customers, all within the same digital ecosystem while creating and implementing opportunities for cross-selling and allowing a deeper customer engagement. This signals how growth did not rely only on the acquisition of new users: it was also based on increasing the value the company was able to generate exploiting already existing customers.

What is important to highlight is the fact that Nubank was able to support this expansion supported by a self-reinforcing growth model in which customer acquisition, data accumulation, product improvement, and referrals continuously reinforced one another. Each new customer generated additional behavioral and transactional data to be studied, which could be used to improve credit assessment, personalize products, and enhance the overall user experience. The venture, in fact, was and it is still able today, to provide a better customer experience, therefore generating greater engagement and word-of-mouth referrals, attracting additional users and generating further data. The so called member-get-member referral model was particularly important in the initial phases of this process: it allowed to make customer recommendations a real major acquisition mechanism enabling Nubank's to reduce its reliance on conventional marketing expenditure. Notable, this model was reinforced by the company's digital-first infrastructure: unlike incumbent banks, in fact, Nubank did not need to replicate an extensive branch network in order to reach new customers, since its own business model was allowing the company to expand its customer base with a structurally different cost model. Therefore, its growth strategy can therefore be understood as a combination of low-friction digital acquisition, data-driven product development, and network-based customer expansion. Moreover, the ability to reach previously underserved segments was another central component of this strategy. As we saw in the previous section, Nubank entered a Brazilian banking market characterized by the concentrated power of incumbent banks and a widespread dissatisfaction with traditional banking services, while deliberately lowering the barriers to access to financial products. In its early stages, the company implemented relatively modest credit limits, in some cases around US\$10 per month, to approve customers who might have been rejected by conventional credit-scoring models. Therefore, rather than targeting only customers that already had access to financial services and were also well served by traditional banks, Nubank was able to reach underbanked consumers and first-time credit card users. And by the end of 2021, approximately 20% of new customers were using a credit card for the first time. Nubank was able to achieve this positioning by setting an extremely simple onboarding process: in order to subscribe customers only required to be over 18, possess a Brazilian CPF, reside in Brazil, and have a smartphone. Additional to this, account opening could be completed in approximately three minutes, while cards were generally delivered within three to fifteen days. These characteristics significantly reduced the financial and administrative barriers traditionally associated with becoming a bank customer and helped Nubank expand into segments that had been underserved by the traditional institutions.

Another important factor was scalability, which was consequently embedded not only in Nubank's technology but also in its organizational model. The company adopted a relatively flat and decentralized structure, with cross-functional teams organized around specific customer problems rather than traditional functional departments. Customer service employees were also given a lot of authority and autonomy in resolving customer issues, while the company was concentrating great effort and placed considerable emphasis on maintaining a diverse and entrepreneurial organizational culture during its rapid expansion. These organizational characteristics together with the company's technological infrastructure allowed the set up of a decision-making model relatively close and based on customer's behaviours, thus enabling teams to experiment and respond quickly to emerging needs. In this sense, Nubank's ability to scale was not simply a consequence of having a digital product; it also depended on organizational arrangements implemented by the venture to preserve speed and flexibility as the customer base was constantly expanding.

The rapid expansion of this model was supported by substantial external financing. Nubank was able to raise US\$2 million in seed funding in 2013 and subsequently progressed from Series A to G financing rounds between 2014 and 2021, attracting the right support from important investors; notable to note that it also obtained debt financing from institutions such as Goldman Sachs and Fortress. This sequence of supporting capital financing provided Nubank with the right resources necessary to invest in technology, acquire customers, expand the product portfolio, and enter new markets before the business had reached mature profitability. Following these spiraling positive effects, Nubank's valuation increased from approximately US\$500 million at the time of its Series C round to around US\$50.6 billion with also its planned 2021 IPO, while its customer base expanded from approximately 10 million users in 2019 to 48 million by the fourth quarter of 2021. The company also recorded its first profitable quarter during this period, which however, experts maintain that it should not be interpreted as evidence of fully established or sustained profitability. In fact, the rapid increase in users and valuation occurred alongside continuing raising questions about the long-term sustainability of the business model, giving light to the debated distinction between successful scaling and mature profitability.

The scale achieved by Nubank generated also a visible competitive response from Brazil's traditional banking sector. The company's expansion was projected to contribute to a loss of approximately R\$16 billion in fee income for incumbent banks in 2022, encouraging therefore traditional institutions to accelerate their own digital strategies. Many responses included the

development of digital banking propositions such as Bradesco's Next and Itaú's Iti, as well as the supposed closure of physical branches and broader efforts to reduce the costs associated with traditional banking infrastructure. The competitive impact of Nubank therefore had effects beyond its own customer base: its growth was able to contribute to a broader transformation of the whole Brazilian banking market by increasing competitive pressure on traditional banks and thus stimulating an acceleration in the digitalization of financial services.

A key aspect of its growth strategies and scaling dynamic was the choice of the company to subsequently begin to reproduce elements of this model outside Brazil, particularly through its expansion into Mexico and Colombia, while also becoming visible at world level by signalling broader international ambitions through its 2021 investment in Indian neobank Jupiter. These moves suggest that the company's growth strategy was increasingly considered as transferable and replicable to other emerging markets characterized by large underbanked or underserved populations and increasingly digital consumers. However, its international expansion signals an important key insight: the company's model was not focused on inventing entirely new financial technologies, but on recombining digital technologies, data-driven credit assessment, mobile interfaces, simplified onboarding, and customer-centric design in response to specific market conditions. The competitive advantage of Nubank, therefore, emerged from the adaptation and integration of existing technological capabilities into a business model suited to the Brazilian context.

A valuable study developed by Kawamoto et al. (2023)²⁴, supports this interpretation. The article provides an interesting consideration of how mobile payment success determinants offer a useful analytical framework for understanding Nubank's scaling dynamics. Based on comparative case studies of Nubank, (namely Safaricom's M-Pesa and Ant Financial's Alipay²⁵), as well as a survey of 43 industry experts, the authors identify organizational qualities, coverage, and bundling as three important internal determinants of success. What emerges is that Nubank particularly fits the organizational-qualities dimension: the authors characterize its organizational structure as organic and its decision-making as decentralized, closely corresponding to the flat, team-based model that we described above. Organizational qualities were also the factor most supported by the academic research, reinforcing the

²⁴ Kawamoto, C. T., Spers, R. G., Fleury, A. L., et al. (2023). Determinants of success of mobile payments as innovations: An exploratory study based on the extant literature, the M-Pesa, Alipay, and Nubank cases, and the opinion of experts. *Future Business Journal*, 9, 93. <https://doi.org/10.1186/s43093-023-00272-7>

²⁵ M-Pesa is a mobile money service launched by Safaricom in Kenya, while Alipay is a digital payments platform developed by Ant Financial (now Ant Group) in China. Both are widely cited examples of large-scale digital financial services platforms

argument that Nubank's scalability depended not only on its digital technology but also on its organizational capacity to adapt and innovate.

Moreover, the study highlights how Nubank stood out from the other cases in terms of coverage. Unlike M-Pesa and Alipay, which were able to leverage previous networks created by telecommunications and e-commerce ecosystems respectively, Nubank did not initially possess a comparable external network. Instead, it relied on its own value proposition, aggressive pricing, digital distribution, and customer acquisition strategy to build its user base from scratch. Kawamoto et al. describe this as a "start large" or self-built strategy and identify it as an area requiring further research. This insight is particularly valuable and relevant for our analysis of Nubank case study, especially because it highlights its significant role within Brazil's innovation ecosystem: rather than simply exploiting an existing platform or network created by another dominant industry, Nubank developed its own customer network and digital infrastructure, progressively transforming it into a broader financial ecosystem.

Finally, another fundamental perspective from Kawamoto et al. is how the dimension of bundling identified in the study provides an additional explanation for Nubank's evolution from a single-product fintech into a diversified financial platform. At the moment in which the authors of the study gathered the data (2023), Nubank was associated with three service categories and had achieved approximately 32% credit-card penetration among its customers. Although these figures represent only a part of the company's subsequent expansion, they are consistent with the broader trajectory we described above, in which the initial credit-card proposition was complemented after by accounts, lending, insurance, investment, and business services. The product bundling implemented by the venture, therefore, strengthened the relationship between customer acquisition and customer value, allowing Nubank to monetize and retain users across multiple financial needs.

Taken together, Nubank's growth demonstrates that its scalability resulted from the interaction of different mutually reinforcing capabilities rather than from a single technological innovation. First of all digital infrastructure was able to reduce the cost and complexity of distribution; secondly, a simple and accessible customer proposition facilitated acquisition among underserved segments; referrals and data generated a self-reinforcing growth loop; product bundling increased engagement and customer value; decentralized organizational structures supported rapid experimentation; and receiving external capital financing allowed expansion before the business reached mature profitability.

To conclude, from the perspective of Brazil's emerging innovation ecosystem, the significance of the Nubank case therefore lies not simply in the adoption of digital banking technologies,

but in the company's ability to adapt and recombine them with locally specific market conditions to create a scalable and successful Brazilian business model. At the same time, the distinction between rapid scaling, high valuation, and sustained profitability remains important: Nubank's trajectory demonstrates the capacity of Brazilian firms to generate and scale digital innovation, while also showing that scaling capabilities alone do not necessarily guarantee a sustainable or autonomous innovation model.

The gradual implementation of Open Finance reflected the broader strategy of the Banco Central of fostering innovation, increasing competition, and modernizing the country's financial structure through a cohesive and strongly regulated approach. This demonstrates that where there is regulation, there is space for innovation to grow

5.1.3 Impact on the Brazilian Banking Sector

From our analysis of the previous section it is already evident how Nubank's emergence, as part of the broader expansion of fintechs in Brazil, has contributed to a significant transformation of the country's traditional banking sector. Building on the banking-market concentration already discussed in Chapter 4, it is worth noting that this concentration was also associated with high borrowing costs. As we previously seen, historically the Brazilian banking market was highly concentrated, with a small number of large oligopolistic institutions holding the majority of market power and relying on extensive physical branch networks. This concentration was also associated with high borrowing costs. A working paper by Rui Xu (2026)²⁶ for the IMF shows that, in 2023, the difference between the average interest rate charged by Brazilian banks on loans and the cost at which banks obtained funding exceeded 30 percentage points, compared with a global average of less than 6 percentage points; and half of this spread approximately, was attributable to banks' administrative costs and profit margins. In practical terms, this meant that the cost of borrowing in Brazil was extremely high relative to the cost of obtaining funds, reflecting both the high operating costs of traditional banks and the margins they were able to earn in that highly concentrated market.

Nubank entered this environment precisely. By its foundation in 2013, the initial purple credit card as first product and all the subsequent offerings, Nubank obtained its own banking license in 2018, allowing it to broaden its range of financial services and compete more directly with incumbent banks And, as we previously discussed, its growth therefore represented more than

²⁶ Xu, R. (2026). Fintech Competition and Banks' Shrinking Margins in Brazil. *IMF Working Papers* 2026, 007, Article A001, A001. <https://doi.org/10.5089/9798229037075.001.A001>

the entry of another financial institution: it introduced a different model of delivering banking services, based on digital distribution, lower operating costs, and reduced dependence on physical infrastructure.

The scale of this expansion illustrates the extent to which digital financial institutions were able to challenge established players. According to another relevant study developed by Venturini et al. in July 2022²⁷, Nubank had reached approximately 62.3 million customers in Brazil, representing a 51% increase compared with the previous year and making it the fifth-largest financial institution in the country by number of customers, ahead of Santander Brasil's 56.1 million. Including its operations in Colombia and Mexico, the company had approximately 65.3 million customers internationally at that point.

By the end of 2024, Nubank had reached approximately 100 million customers in Brazil, according to the IMF study, including around 22 million people who were accessing formal financial services for the first time. This scale demonstrates that digital banks were no longer serving only a small technology-oriented niche but had become significant competitors within the Brazilian financial system.

The greater expansion of digital players is also visible in the composition of Brazil's largest financial institutions by customer base. In 2015, no bank that was exclusively only digital, was among the fifteen largest institutions in the country. By 2020, two digital institutions had entered this ranking, while by the first quarter of 2023, eight of the fifteen largest institutions by number of customers were exclusively digital. These included Nubank, Original, Mercado Crédito, Ame Digital, PagBank, C6 Bank, Inter, and Neon. Nubank alone reported more than 73 million customers at that point, right ahead of the other digital competitors. The speed with which digital institutions entered the ranks of Brazil's traditional banking system and the ranking of the largest financial players, therefore illustrates a broader structural shift in the competitive landscape rather than the success of a single company.

This growing competitive pressure that digital banks have brought has also generated some significant effects on the behavior and performance of traditional banks. Xu's study provides interesting empirical evidence especially for the broader fintech competition, rather than Nubank alone. The IMF study, indeed, finds that, between 2018 and 2024, increasing fintech competition was associated with an average reduction of 2.7 percentage points in commercial banks' lending rates and a 0.9 percentage point reduction in their net interest margins. At the

²⁷ Venturini, V. H., Ribeiro, L. da S., Nascimento, J. C., & Leske, A. D. C. (2026). *CONCENTRAÇÃO BANCÁRIA NO BRASIL: UMA ANÁLISE DO IMPACTO DOS BANCOS DIGITAIS*. *Revista De Geopolítica*, 17(2), e1589. <https://doi.org/10.56238/revgeov17n2-082>

individual bank level, a one-standard-deviation increase in exposure to fintech competition was associated with a 3.7 percentage point decline in average lending rates and a 1.3 percentage point decline in net interest margins. At the same time, operational efficiency improved by approximately 0.5 percentage points, suggesting that incumbent banks responded to competitive pressure by reducing some administrative costs and investing in digital channels. The competitive pressure also affected bank profitability. A one-standard-deviation increase in exposure to fintech competition was associated with a 3.6 percentage point reduction in return on equity and a 0.7 percentage point reduction in return on assets. However, besides this, the effect brought by fintech and the subsequent competition, was not simply a reduction of the lending activities of traditional banks. In fact, the study finds that banks did not experience an equivalent decline in overall loan volume. Instead, the increase in fintech operations and exposure revealed a 32% reduction in the number of borrowers per bank, accompanied by an increase in the average loan size of the remaining customers of a similar magnitude. This suggests that incumbent banks responded by focusing their target towards higher-value customers, while fintechs increasingly competed for smaller and previously underserved borrowers. Taken together, all these findings indicate that the impact of Nubank and other fintechs was not only about capturing market share, but their emergence created an overall sensation of pressure on the economics of traditional banking, especially in terms of pricing, margins, operating efficiency, and customer segmentation.

This transformation was not only limited to the economic side. Nubank was also able to change Brazilian consumers' expectations regarding what a banking relationship should look like. Before the emergence of digital banks, customers were used to a banking experience characterized by physical branches, administrative procedures, fees, queues, and relatively slow service. Nubank replaced much of this model with low or no-fee products, digital onboarding, continuous access through a mobile application, and a stronger emphasis on customer service, including 24-hour support through digital channels. As a result, there was a significant shift in the general perception of banking services, making it to be understood as a service that should be available through a smartphone rather than a physical location. Nubank therefore disrupted not only the economics of banking but also the way customers interacted with financial institutions.

In the past, traditional banks were consequently forced to respond by accelerating their own digital transformation. As discussed earlier in this study, Bradesco developed Next, Itaú

launched *iti*, and Santander introduced Superdigital²⁸, together with other numerous digital initiatives. Incumbent banks also increased investments in digital technologies, redesigned mobile applications, simplified onboarding processes, and reduced their reliance on physical branches. For this reason, the closure of some physical branches can be interpreted not only as a cost-cutting strategy but also as part of a broader transition away from branch-centered banking towards digital distribution and user-centered. The significance of this process lies in the fact that fintech innovation generated critical effects beyond the firms that introduced it: once digital challengers, as were Vélez, Junqueira and Wible, demonstrated that financial services could be delivered more cheaply and conveniently, traditional institutions were forced to adapt even when they did not directly lose all of their customers to fintechs.

Another important dimension of this transformation, that is recurrent in this study, is financial inclusion. Nubank's original value proposition was particularly suited to customers who were underserved by traditional banks, including individuals with limited access to credit and people entering the formal financial services and system for the first time. Its digital onboarding, low barriers to entry, and data-driven approach to credit assessment allowed the company to reach customer segments that have always been difficult for traditional institutions and often were considered costly to serve. Once again Xu's IMF analysis provides relevant data about how the broader fintech sector was able to produce measurable results in this area. According to the author, the number of active borrowers served by fintech lenders in Brazil increased from almost zero in 2018 to approximately 60 million in 2023, equivalent to almost 40% of the adult population. Fintech lenders also accounted for approximately 25% of the credit-card market and 12% of the non-payroll personal-loan market. These figures indicate that fintech competition has not simply redistributed customers between already existing institutions but has expanded the formal credit customer base by creating new channels through which individuals can access financial services. Specifically, Nubank's own customer base provides a particularly clear illustration of this process: by the end of 2024, approximately 22 million of its Brazilian customers were accessing formal financial services for the first time.

However, what is fundamental to note, is that Nubank's growth should not be interpreted as the result of entrepreneurial activity alone. Its successful expansion was possible because it took place in an environment in which regulation increasingly facilitated the entry of new financial players and encouraged competition. The supporting role of the Central Bank of Brazil had a

²⁸ Next was Bradesco's digital banking platform, while *iti* was Itaú's digital wallet and financial services platform and Superdigital was Santander's digital account and payments platform.

major impact, since it progressively established the regulatory conditions (through the so-called Resolução) required for digital financial services to develop. These successive regulatory steps illustrate the Institutional Theory perspective introduced in Chapter 2: formal institutions were progressively adapted to accommodate new market entrants, while at the same time shaping the strategic options available to those entrants. The first resolution CMN/BCB nº 4,480 of 2016, allowed deposit accounts to be opened and closed entirely through digital channels, reducing the need for physical interaction with banks. Subsequent Resolution CMN/BCB nº 4,656 of 2018 introduced specific regulatory categories for credit fintechs, including Direct Credit Societies (SCDs) and Peer-to-Peer Lending Companies (SEPs), making Brazil an early mover in creating a dedicated regulatory framework for these business models. Resolution CMN/BCB nº 4.658/2018 of 2018 established requirements concerning cloud computing, data processing, and cybersecurity, while Resolution CMN/BCB nº 4,753 of 2019 further simplified digital customer relationships.

Subsequently, the regulatory framework of the country evolved towards greater experimentation and interoperability among institutions. In 2020, the Central Bank of Brazil introduced a regulatory sandbox through Resolutions 29 and 50, allowing some selected financial innovations to be tested in a controlled regulatory environment. At the same time, the development of Pix, and Open Finance created additional digital infrastructure and supporting regulation through which financial institutions and fintechs could compete and develop new services. Brazil, indeed, was able to experience such a significant evolution thanks to these initiatives that were part of a broader strategy of the Central Bank of Brazil aimed at increasing competition, improving efficiency, promoting financial inclusion, and modernizing the country's financial system. Regulation therefore played an important enabling role in the development of Brazil's fintech sector. Additionally, this relationship was not static: as fintech companies grew and began to resemble traditional financial institutions in scale and importance, the regulatory framework also became more demanding. Starting in January 2023, the Central Bank of Brazil introduced progressively higher capital requirements for certain fintech institutions, with implementation extending through 2025. This evolution reflects an attempt to not only stimulate innovation but also competition and financial stability alongside equal conditions between traditional and digital institutions.

The Brazilian case, therefore, suggests that financial innovation was not generated by fintech companies in isolation. Rather, it emerged from the interaction among different actors: entrepreneurial firms, incumbent banks, regulators, digital infrastructure, and increasingly sophisticated consumers. Nubank's success was enabled by this environment, but its success

was also able to contribute to the transformation of the environment itself. This reciprocal relationship is a key defining characteristic of an innovation ecosystem: firms respond to existing institutional and technological conditions while simultaneously creating competitive and technological pressures that lead other actors to adapt.

Despite these positive effects, the transformation of the Brazilian banking system through fintech competition also presents some limitations and potential unintended consequences. One of the main concerns is that greater access to credit does not necessarily translate into greater financial well-being, particularly in a market, like the Brazilian, where consumer credit is already deeply embedded in everyday consumption. The country has, in fact, a widely used way of installment payments (in Portuguese, *parcelado*), which allows consumers to spread the cost of purchases over several months, which has become a central feature of credit-card usage even for simple daily transactions such as groceries. According to the Central Bank of Brazil, nearly half of credit-card transactions involved installment purchases in 2020, accounting for approximately 70% of outstanding credit-card balances. Although this mechanism can make goods and services more affordable by allowing individuals to distribute payments over time, it also increases the extent to which everyday consumption can depend on credit. This becomes particularly problematic when consumers are unable to repay their credit-card balances anymore and move into interest-bearing installment arrangements, which carry substantially higher costs.

This widespread use of consumer credit provides an important base for understanding the increase in household indebtedness observed in Brazil in recent years. Xu's analysis shows that the country's household debt-to-income ratio increased from approximately 37% in 2018 to almost 50% in 2022, while more than 45% of consumers were reported to have defaulted on financial obligations in 2023, compared with less than 40% in January 2018. This increase, however, cannot be attributed to fintechs or the *parcelado* system alone. On the contrary, the IMF identifies several factors contributing to the accumulation of household debt such as high credit costs, limited household savings, low financial literacy, and a strong reliance on credit. Nevertheless, the expansion of digital financial services adds another important insight to this issue: by making credit faster, easier, and more widely accessible, fintechs can reduce barriers to borrowing while also increasing the importance of responsible credit use.

This increasing problem of indebtedness required a policy response from the state. The Brazilian government, indeed, implemented the so called *Desenrola Brasil*²⁹, programme which helped more than 15 million people to renegotiate approximately R\$50 billion in overdue debt, illustrating the extent to which household over-indebtedness had become a broader economic and social concern.

The Brazilian case of Nubank therefore highlights an important and serious correlation within the concept of financial inclusion: the same mechanisms that make financial services more accessible can also increase consumers' exposure to debt if access to credit is not carried out together with adequate financial literacy, responsible lending practices, and consumer protection. Financial inclusion should therefore not be understood simply as increasing the number of people who can access credit, but also as ensuring that this access contributes to the sustainable improvements of households' financial well-being.

Another limitation is that fintech competition places sustained pressure on the margins and profitability of incumbent banks. Although this pressure can encourage efficiency and innovation, a rapid decrease in bank profitability could create broader financial-stability concerns if financial institutions respond by taking excessive risks or measures of reducing investment in essential services. The detailed and tight regulatory policies introduced by the Banco Central do Brasil, therefore illustrate the need to balance competition with systemic stability. And finally, digitalization can create new forms of exclusion even while reducing traditional barriers to financial access. Those shares of the population that still have limited digital literacy, restricted access to smartphones, or inadequate internet connectivity may find themselves disadvantaged by a banking system that increasingly assumes digital access. Consequently, the shift from branch-based to app-based banking does not eliminate financial exclusion, rather, it can change its nature.

In conclusion, we are able to say that greater competition does not necessarily eliminate market concentration altogether, since large fintechs can themselves become dominant players as they achieve scale, accumulate data, and benefit from network effects. Nubank provides a clear example of this dynamic. Having started as challenger fintech to one of Brazil's largest financial institutions by customer base, the company illustrates how today's disruptors are able to gradually acquire characteristics which were traditionally associated with incumbents. This raises an important question for the long-term evolution of the Brazilian financial ecosystem:

²⁹ *Desenrola Brasil - Portal de Dados Abertos do Banco Central do Brasil*. (2023). Bcb.Gov.Br. <https://dadosabertos.bcb.gov.br/dataset/desenrola-brasil>

whether fintech-led competition will produce a permanently more diverse and competitive banking structure, or whether market power will eventually become concentrated in a new generation of large digital institutions.

Overall, Nubank's impact on the traditional Brazilian banking sector extends well beyond its own commercial growth. Its emergence contributed to greater competitive pressure, lower lending costs, changes in incumbent banks' business models, broader financial inclusion, and a fundamental shift in customer expectations. At the same time, it is important to remark how these changes have been feasible because reinforced by a regulatory and technological environment that included Pix, Open Finance, and a progressively more supportive fintech framework. The Brazilian case consequently suggests that financial innovation has more understanding and meaning at the ecosystem level: rather than being produced by fintech firms alone, it results from the interaction between private innovation, incumbent adaptation, regulatory action, digital infrastructure, and consumer adoption. This interaction provides important evidence for the broader question of this thesis, suggesting that Brazil's emerging innovation ecosystem is increasingly capable not only of adopting external technologies, but also of adapting and scaling them into locally developed solutions with systemic effects.

5.2 Enabling Ecosystem: Pix as Public Digital Payments Infrastructure

Coming to the other foundational case study of this thesis, we will proceed by analyzing thoroughly the case of Pix, the instant payment system launched by the Banco Central do Brasil. In the first place, Pix should not be considered simply as another fintech product competing in Brazil's financial market, rather, it represents a form of public digital infrastructure established and operated by the Banco Central do Brasil, which created the necessary conditions for the private sector to subsequently innovate and develop. In this sense, Pix exemplifies the National Innovation System and Triple Helix perspectives introduced in Chapter 2, in which the state acts not merely as a regulator but as an active coordinator and "prime mover" of innovation among firms, incumbent banks and other institutions. In fact, unlike Nubank (or PagBank that we will later examine), whose growth resulted from private investment aimed at addressing gaps in the traditional financial system, Pix was born from a deliberate decision by the Brazilian state to intervene in the financial ecosystem. In this context, the Banco Central do Brasil chose to act not only as a regulator of payment services but also as the institution responsible for designing, operating, and governing the country's instant payment infrastructure. This decision to directly intervene in the payments market was taken after a long-standing diagnosis of what were the actual structural weaknesses in Brazil's retail payment system. Early in 2005, the

Banco Central do Brasil had already identified significant challenges, such as poor interoperability among competing payment arrangements, excessive verticalization between banks and card acquirers, a high reliance on cash compared with peer economies, and regulatory gaps in retail payments. For this reason, the Banco Central developed further studies together also with the Ministries of Finance and Justice further exposed anticompetitive practices, especially in the card industry. All these studies and diagnosis culminated in the 2013 Payment Systems Act developed by the bank, which enlarged the supervising power of the institution beyond traditional banks and including also payment institutions, establishing an important legal foundation for subsequent developments in the payments market. As reported in the IMF report “Pix: Brazil’s Successful Instant Payment System” the bank's objectives for Pix were subsequently explicit: *reducing reliance on cash, increasing financial inclusion, strengthening competition within a historically concentrated banking sector, and modernizing the country's payment infrastructure by making transactions faster and more secure.*³⁰

What distinguishes Pix from a conventional private payment product is therefore its role as a shared and interoperable infrastructure. Additionally, the Banco Central is responsible for the operation of the so called SPI - Instant Payment System, which provides the settlement infrastructure, maintains the centralized Transaction Accounts Identifiers Directory (DICT), and establishes the rules governing participation in the scheme. This institutional design is profoundly important as it prevents any individual bank, fintech, or big-tech company from controlling the payment network itself. Therefore, rather than allowing a private platform to become the dominant infrastructure through which instant payments are processed, the Banco Central do Brasil created a common way and tool accessible to different types of financial institutions. This deliberate institutional choice turned out to be particularly relevant, since according to other unsuccessful international experiences in which private platforms have acquired significant control over digital payment ecosystems.

The Banco Central do Brasil’s decision to maintain control over the payment infrastructure also became visible in its approach to private-sector alternatives. A notable example was the choice of suspending WhatsApp Pay in June 2020, shortly before the launch of Pix. According to a study developed by Schapiro et al.³¹ the bank justified the decision by referring to potential risks to competition, efficiency, and privacy within the national payments system. The episode

³⁰ Dept, I. M. F. W. H. (2023). Pix: Brazil’s Successful Instant Payment System. *IMF Staff Country Reports*, 2023(289). <https://doi.org/10.5089/9798400249266.002.A004>

³¹ Schapiro, M. G., Mouallem, P. S. B., & Dantas, E. G. (2023). PIX: explaining a state-owned Fintech. *Brazilian Journal of Political Economy*, 43(4), 874–892. <https://doi.org/10.1590/0101-31572023-3470>

illustrates that the institution was not simply creating Pix as another competitor in the payments market, its objective was to actively shape the conditions under which digital payment services could develop and ensure that the emerging infrastructure remained under public oversight.

Precisely because Pix operates as shared infrastructure rather than as a proprietary product, its relationship with the fintech sector has been complex. On one hand, payment institutions and digital banks were able to use the new infrastructure to offer instant payments to their customers and, in some cases, expand their customer bases and establish full banking subsidiaries, increasing competition for deposits with incumbent banks. On the other hand, Pix also reduced the advantages in terms of cost and speed that some fintechs had previously thanks to their digital payment services. Additional subsequent evidence suggests that digital banks experienced larger declines in fee income, net interest margins, and financial stability than traditional banks. Pix therefore did not simply stimulate fintech growth, instead, it functioned as a public service that changed the competitive conditions for both incumbent banks and challengers.

It is particularly important to understand this aspect as part of Brazil's broader innovation ecosystem. This, indeed, highlights how the system did not simply create opportunities for fintechs, but it also removed some of the advantages that they had previously enjoyed and forced financial institutions to compete on other dimensions. As a consequence, the case of Pix illustrates how public infrastructures are able to simultaneously stimulate private innovation and reshape the competitive environment in which that innovation takes place.

5.2.1 Institutional design and functioning

The institutional design of Pix is centred around the guidances of the Banco Central do Brasil, which acts simultaneously as the scheme's owner, operator, regulator, and supervisor. This represents a relatively centralized institutional arrangement compared with other major instant payment systems. The study of the IMF (2023), in fact, provides an important comparison with other emerging countries. In India and China, for example, the operation of the payment infrastructure is delegated to dedicated clearing entities, more specifically the National Payments Corporation of India and the China National Clearing Center, respectively, while the central bank maintains regulatory and supervisory responsibilities. In Brazil, the Banco Central deliberately retained the operational function within the institution itself.

Two Fundamental components of the design of Pix form its core institutional functioning. The first is the Instant Payment System (SPI), which is the centralized settlement infrastructure operated by the Banco Central do Brasil. Indeed, Pix operates through a real-time gross

settlement (RTGS) infrastructure, meaning that payment transactions are processed and settled individually and in real time, meaning that when a Pix payment is made, the transfer is processed immediately through the settlement infrastructure instead of waiting for a periodic clearing cycle. Once the transaction has been successfully settled, it is considered final and cannot normally be reversed by the payment system. This is a particularly fundamental characteristic of its structure, which contributes to the speed and security of Pix payments. The settlement system also distinguishes between direct and indirect participants. Direct participants are financial institutions that have direct access to the settlement infrastructure and hold specific settlement accounts with the Central Bank of Brazil. Indirect participants, on the contrary, do not hold these accounts directly and therefore access the settlement system through a direct participant or a settlement agent. This structure allows a wider range of financial institutions and payment providers to participate in Pix while maintaining centralized settlement through the central bank.

The second component is the Transaction Accounts Identifiers Directory (DICT), a centralized database that connects specific personal users data, such as telephone numbers, tax identification numbers, email addresses, or randomly generated keys, to the recipient's underlying transaction account. This eliminates the need for users to provide their detailed banking information required for conventional transfers such as TED or DOC. Another significant characteristic is that the DICT also supports fraud-prevention mechanisms, which have become increasingly relevant as the scale of Pix transactions has expanded.

This detailed and specific infrastructure design was deliberately constructed as the participation in Pix was intentionally designed to be broad. More specifically, financial and payment institutions authorized by the Banco Central do Brasil and holding transaction accounts are eligible to participate, while institutions with more than 500,000 active accounts are required to do so. Smaller institutions can participate voluntarily provided that they satisfy the relevant technical, operational, and regulatory requirements³². This mandatory participation of large institutions was important because it ensured that the country's major banks were present on the same payment infrastructure rather than allowing the system to develop around a limited group of early adopters, thus ensuring a major participation and adoption. Indeed, according to the Bank for International Settlements, this combination of mandatory participation by large

³² the Banco Central do Brasil provides a list of technical requirements which however changes according to the type of the participant.

institutions and centralized governance under the BCB was one of the principal factors contributing to Pix's rapid adoption.³³

The design of Pix can also be understood through the institutional factors identified in the study developed by Schapiro et al. (2023). First, the Banco Central do Brasil participation in international regulatory networks, including the Committee on Payments and Market Infrastructures and the Bank for International Settlements, provided a great opportunity to have access to international experience concerning payment systems and the risks associated with private or potentially dominant digital platforms. Second, the Banco Central's institutional history contributed to its preference for maintaining authority over the payments sector rather than delegating the development of the infrastructure to other actors of the private sector. Third, the Banco Central's relationship with incumbent banks also influenced the implementation of the scheme. Schapiro et al. (2023) describe this relationship as a long lasting "relational contract" which went across several areas of financial policy. Although Pix had the potential to reduce some bank fee income, its expected initial impact on fees of current accounts remained relatively limited compared with the overall business of large traditional banks, which helped reduce resistance to its implementation.

Taken together, all these institutional and technical choices explain how Pix functions as well as why it was developed as a public payment infrastructure rather than as a privately operated alternative. The Banco Central do Brasil's centralized role, the interoperability of the system, and the broad participation requirements created the right foundations and a common infrastructure that could be adopted simultaneously by banks, fintechs, cooperatives, and other payment institutions. This architecture was particularly successful for achieving rapid adoption because users did not need to join a specific private platform in order to make or receive instant payments.

5.2.2 Adoption and impact on the financial system

The adoption of Pix has been successfully exceptional both in absolute terms and in comparison with other instant payment systems (as we previously mentioned the Indian and Chinese). According to the IMF data report, within two and a half years of its launch, Pix had already reached more than 140 million individuals, equivalent to approximately 80% of the adult population, as well as 13 million firms. Monthly transaction volumes had exceeded 3 billion,

³³ Duarte, A., Frost, J., Gambacorta, L., Koo Wilkens, P., & Shin, H. S. (2022, March 23). *Central banks, the monetary system and public payment infrastructures: lessons from Brazil's Pix*. Bank for International Settlements. <https://www.bis.org/publications/bulletin-52-central-banks-monetary-system-and-public-payment-infrastructures-lessons-brazils-pix>

with an average transaction value of approximately US 88 billion. The system continued to expand thereafter, indeed by May 2026, according to the Banco Central do Brasil's figures³⁴, Pix had more than 170 million individual users, around 80% of the entire Brazilian population, and more than 7 billion monthly transactions, with approximately R\$ 3 trillion in monthly transaction volume. A peak of more than 313 million transactions was recorded on a single day in December 2025. The IMF also notes that Brazil experienced one of the fastest adoption rates of electronic instant payments measured in transactions per capita following the implementation of Pix. The scale of this adoption demonstrates that Pix rapidly moved beyond being a new payment technology and became an important component of everyday financial activity.

Additionally, the rapid rate of adoption also reflects a significant change in payment behaviour. Always according to Banco Central do Brasil data, Pix transactions are predominantly relatively small in value: as of December 2022, 61% of transactions were below R\$100, indicating that the system is widely used for everyday person-to-person and person-to-business payments rather than only for large-value transfers. This pattern is consistent with one of the bank's original objectives of reducing reliance on cash, while also contributing to the decline of traditional electronic transfer instruments such as TED and DOC. Although conventional bank transfers continued to account for a significant share of total transaction value because of their use for large payments (especially for business-to-business arrangements), their relative importance in transaction numbers declined after the introduction of Pix. The IMF study explains how the speed of the system is fundamental to understand this shift: Pix transactions are settled in approximately three seconds on average, compared with approximately two days for debit-card transactions and up to 28 days for credit-card settlement, while individual users can make Pix transfers without paying a fee. In this manner, Pix therefore became particularly attractive for frequent, low-value payments that had traditionally been made using cash or cards. The rapid diffusion of Pix also had and still has important implications for financial inclusion. The Banco Central explicitly identified inclusion as one of the objectives of the system, and the data suggest that Pix brought previously inactive users of electronic transfers into the digital payments ecosystem. The IMF registered that, by December 2022, approximately 71.5 million individuals had used Pix despite never having made any electronic credit transfer during the preceding year. The absence of fees for individuals, relatively low costs for merchants, and a

³⁴ Banco Central do Brasil. (2026). *Pix em números- Estatísticas*.

<https://www.bcb.gov.br/estabilidadefinanceira/pix-em-numeros-estatisticas>

standardized easy user experience across participating institutions, reduced some of the practical traditional barriers associated with digital payments. However, it is necessary to distinguish that using an instant payment system should not automatically be compared with full financial inclusion. Access to a payment mechanism is different from access to the broader financial services such as credit, savings, or insurance, also because the way Pix is used differs across the different demographic and geographic groups. Pix should therefore be understood as an important enabler of financial inclusion rather than as sufficient evidence of complete financial inclusion by itself.

Additionally, the impact of Pix on the Brazilian financial system has extended beyond the simple increase in the use of digital payments. By making instant and low-cost payments easily available across financial institutions through a single common infrastructure, Pix has changed the competitive dynamics of the payment market and reduced the opportunity of individual banks to differentiate themselves only through the providence of payment services. This represents an important difference from payment technologies developed and controlled directly by individual banks, such as proprietary card networks, since Pix provides a unique standardized payment infrastructure that is accessible across the whole financial system.

The implications of this shift are particularly relevant for the competitive relationship between traditional banks and digital financial institutions. On the one hand, the widespread availability of Pix has lowered barriers for smaller banks and fintechs, allowing them to offer instant payment services without having to develop and maintain their own payment infrastructure. On the other hand, since the same infrastructure is available also for traditional banks, some of the speed and convenience advantages that initially were only specific to digital players, have become less exclusive. As a result, their competition has increasingly shifted towards other elements of the banking relationship, such as credit, investment products, customer experience, pricing, and the broader range of services offered to customers.

Pix therefore illustrates the dual nature of Brazil's financial innovation process. Rather than simply creating another competing payment product, the Central Bank's infrastructure changed the conditions under which both incumbent banks and fintechs operate and compete with each other. It simultaneously reduced barriers to entry for smaller digital players and encouraged established institutions to adapt to a more digital and competitive environment.

This change at the level of market structure illustrates why Pix should be understood as an enabling infrastructure rather than as innovation conventional only to fintechs. Several payment institutions and digital banks were able to use Pix to expand their customer bases and, in some cases, establish banking subsidiaries, increasing competition for deposits with large incumbent

institutions. At the same time, since the Banco Central do Brasil retained control over the payment system and ensured interoperability, there was no possibility for any individual fintech or big-tech platform to capture the infrastructure itself. The system therefore shifted competition away from control over the payment network and towards other dimensions of financial services, including product diversification, customer relationships, and pricing.

Overall, Pix represents a significant transformation of Brazil's payment system, not only because of the speed and scale with which it was adopted, but also because of the way it was able to reshape the structure of the payment market. Through the implementation of a publicly coordinated infrastructure and the successful strategy of acquiring broad participation across financial institutions, the Banco Central do Brasil was able to make instant payments widely accessible while promoting interoperability, competition, and lower transaction costs. At the same time, the system created new opportunities for financial institutions and fintechs to develop services aligned with the new common infrastructure, while encouraging incumbent banks to accelerate their own digital transformation. Pix therefore represents more than a single successful payment technology: it illustrates how public institutions can play an active role in creating the technological and regulatory conditions necessary to stimulate and allow the emergence and scaling of financial innovation

5.3 Enabling ecosystem: PagBank, enabling digital payments for SMEs

PagBank was selected as a supporting case study because it allows us to have a third, different dimension of the transformation of Brazil's financial ecosystem: the merchant side. While Nubank illustrates the consumer-oriented side of private sector financial innovation and Pix illustrates the role of the state in building and regulating shared digital infrastructure, PagBank shows how digital financial services have transformed the way micro, small and medium-sized enterprises (MSMEs) access and use payment and financial services. In this manner, we have three cases that address different sides of the same broader transformation in order to have a better understanding of the process, with PagBank providing a specific perspective on the role of digital payments in supporting smaller businesses.

The case study of PagBank is particularly relevant because the company developed from a payment solution for small merchants into an integrated financial platform.

The company was founded in 2006 as PagSeguro, initially to facilitate secure online payments for users of the UOL portal group³⁵, of which it remains a part. From this initial focus on online

³⁵ UOL (Universo Online) is a Brazilian internet and digital services group founded in 1996. PagSeguro was established within the UOL group in 2006.

payments, PagSeguro progressively expanded into merchant acquiring, point-of-sale (POS) solutions, digital banking and credit. This evolution of the company culminated in the creation and launch of PagBank Digital in 2019 and the consolidation of the company's services under the PagBank brand in 2023. Rather than remaining focused only on payment processing, the company decided to progressively build a broader ecosystem connecting payment acceptance with banking and financial services for individual entrepreneurs, micro-merchants and SMEs. A key step in the development and success of the company was PagSeguro's entry into the Brazilian acquiring market. In fact, in 2013, the company became the first non-bank acquirer authorized to process Visa and Mastercard transactions in Brazil, contributing to the opening of a market that had always been dominated by already established acquiring institutions. In 2015, PagSeguro launched *Moderninha*, its mobile point-of-sale (mPOS) device, together with a prepaid card, with the aim of expanding access to electronic payment acceptance among smaller merchants. These developments were important because the company specifically had the objective to address practical barriers that many small businesses were facing, for example accepting card payments traditionally were requiring access to payment infrastructure that was more difficult or costly for smaller operators to obtain. Instead, PagSeguro's model wanted to aim at making payment acceptance simpler and more accessible to merchants operating at a much smaller scale. The subsequent choice of the company to expand into banking and credit transformed this initial payment relationship into a broader proper financial relationship with the merchant.

This trajectory distinguishes PagBank from the previous case of Nubank. While Nubank initially approached the financial system from the consumer side through credit cards and digital banking, PagBank developed a product for the merchant side of the payment chain. Its expansion can therefore be understood as a progression from payments to banking and credit, in which the payment relationship provides the initial point of contact, while additional financial services were able to nurture this relationship and monetize it too. This makes PagBank particularly relevant for analysing how digital payment technologies can affect not only individual transactions, but also the broader financial integration of small businesses.

5.3.1 Business model and POS ecosystem

The structure of PagBank's business model is closely connected to the aim of surpassing the barriers that historically limited smaller merchants' access to electronic payment infrastructure. PagSeguro's entry into the acquiring market and the launch of *Moderninha* addressed these barriers by providing smaller businesses and individual entrepreneurs with a relatively simple

way to accept card payments. The POS device constituted not only a product to be sold to merchants, but the starting point of a broader customer relationship building. This distinction is important for understanding the success of PagBank's business model, since the value of the POS is not only in the device itself, but in its ability to bring merchants into the company's wider financial ecosystem.

Its business model indeed, provides that once a merchant begins processing transactions through PagBank, the company can offer additional services, including a PagBank digital account, payment settlement, sales-management tools, insurance and credit products. Payments therefore function as the acquisition channel of new customers for the company, while banking and credit provide additional opportunities for users retention and monetization. This model also allows PagBank to gather essential data about how merchants carry out their financial activity through the transaction they generate in the platform, in order to study, anticipate and then satisfy their needs. Indeed, this use of transaction data to understand and anticipate the needs of merchant reflects the concept of absorptive capacity discussed in Chapter 2: PagBank's ability to recognize, process and apply information generated through its own platform constitutes a firm-level capability for converting external transactional activity into internal product innovation. Indeed, the company can later use these data to support the provision of additional financial products, particularly credit and working-capital solutions. This cross-selling strategy is identified by PagBank as one of the most important sources of sales, as well as using transaction data to support its credit offering among its strategic priorities.

This is reflected in the broader ecosystem of the company's revenue model. Additionally, payment acquisition remains a central source of revenue, with merchants paying fees for processing card transactions. The importance of *parcelado* payments in Brazil is also relevant in this model, as we saw also in the previous section, since PagBank enables merchants to receive installment payments and applies differentiated fees depending on the type and volume of transactions. Beyond payment processing, the company can generate additional revenues through banking services, credit products and other financial solutions. This signals an important insight about PagBank's business model, according to which the POS device has therefore a strategic role that extends beyond its direct sale: it establishes a recurring relationship through which the company can progressively expand the range of services used by the merchant.

Another important feature of its business model is its omnichannel strategy. PagBank's payment offering now extends beyond traditional physical POS terminals and includes QR-code

payments, Pix, payment links, Tap On, online checkout and other digital payment solutions. This evolution allows the company to reduce its dependence on a single payment channel while allowing merchants to accept payments across different physical and digital environments. The company has also expanded payments beyond the traditional POS devices, including online, in-app and cross-border payments, as part of its broader strategic priorities.

Moreover, PagBank differentiates its POS offering according to the different characteristics of merchants they serve, rather than relying on a single standardized device. Its portfolio ranges from smaller and more basic machines targeted for individual entrepreneurs and lower-volume sellers, to devices that are more advanced in design for merchants with greater transaction volumes and more complex operational needs. This segmentation allows PagBank to serve its products to different stages of development of businesses while maintaining the possibility of expanding the relationship as their payment needs grow. The underlying logic is to implement a progressive expansion of the ecosystem: payment acceptance creates the initial relationship, transaction activity generates data, and the resulting relationship creates opportunities to provide banking and credit services.

This model explains PagBank's continued success and expansion beyond its original merchant-acquiring business. This is given by its current strategy which combines payments with digital banking, credit and other financial products, while maintaining a specific focus and priority on SMEs. Moreover, the ability of the company to cross-sell financial services across its merchant and consumer customer base and to use its existing transaction relationships to expand its credit offering, provide additional reasons for its success. PagBank's development consequently illustrates how a fintech can use payment infrastructure not simply as a unique product functioning on its own, but as the foundation for a broader financial ecosystem built around recurring customer relationships and data-driven services.

5.3.2 Financial inclusion and cash-to-digital transition

The importance of PagBank's model extends beyond its commercial strategy because payment acceptance represents a significant step towards the company's objective of providing financial inclusion to smaller businesses. For merchants that were operating mostly with cash, the ability to accept digital payments introduced them to a wider set of financial services while also creating a record of their business transactions. PagBank's model therefore contributes to what can be described as a cash-to-digital transition on the merchant side: rather than focusing only on consumers' adoption of digital payments, it addresses the ability of small businesses to participate in an increasingly digital payment environment.

The mechanism behind this transition is relatively straightforward. A merchant that previously relied primarily on cash can use a PagBank POS or other digital payment solution to accept debit and credit cards, Pix, QR-code and contactless payments. This does not automatically mean that the business becomes formally integrated into the financial system, but it can facilitate that process by creating a transaction history which is traceable and establishing a relationship with a regulated financial institution. Once the merchant has a PagBank account and a record of payment activity, additional services such as credit, insurance and other banking products can become more accessible.

This process is particularly relevant for MSMEs because they may face greater difficulties in accessing traditional financial services. Making digital payment infrastructure more accessible to small businesses can help them overcome one of the barriers to participating in the digital economy. At the same time, the transaction data generated through the payments processed in the PagBank platform generate important information about the merchant's sales and financial activity. This information can help PagBank better understand the merchant's business and assess its potential need and eligibility for credit. PagBank's model therefore connects three processes: the adoption of digital payments, financial inclusion, and access to credit. By accepting digital payments through the platform, merchants can build a transaction history that may facilitate their access to additional financial services.

As seen in the sections, also in PgaBank case study the broader regulatory transformation of Brazil's payment market helped create the conditions for this development. Law 12.865/2013³⁶ established a regulatory framework for payment institutions and opened the payment market to non-bank participants, with the broader objectives of increasing competition and promoting financial inclusion. PagBank's development illustrates how such regulations play a key role in enabling new types of financial institutions to enter the payment market and serve customers that were not necessarily well served by traditional banking institutions. Its subsequent development into a fully licensed digital bank further expanded the range of financial services that could be offered through the same customer relationship.

PagBank itself considers financial inclusion one of the center pillars of its corporate positioning. The company describes its mission in terms of *disrupting and democratizing financial services [...] by delivering a secure, affordable, simple, and mobile-first digital banking ecosystem for*

³⁶ Banco Central do Brasil. (2026). *Payments schemes*. <https://www.bcb.gov.br/en/financialstability/paymentschemes>

*both merchants and consumers*³⁷. Also its sustainability reporting states that PagBank has brought millions of previously unbanked micro and small entrepreneurs into the formal financial system; even though it is important to highlight that these figures and claims should be interpreted as company-reported evidence rather than independent proof of a causal impact. Nevertheless, the mechanism staying at the base of the objective is consistent with the structure of PagBank's business model: payment acceptance provides the entry point, transaction activity creates a financial record, and the resulting relationship can facilitate access to banking and credit services.

To conclude, PagBank's role in the cash-to-digital transition should therefore be understood as broader than simply as an institution that was able to replace cash with electronic payments. Its significance and impact lie in the possibility of using payment activity as a bridge towards a wider financial relationship for smaller businesses. Through lowering the barriers to payment and connecting merchants to digital accounts, transaction histories and additional financial products, PagBank illustrates how payment innovation can contribute to the gradual integration of MSMEs into the formal financial system.

5.4 Cross-Case Discussion and Key Insights

Having examined Nubank, Pix and PagBank individually, it is now possible to analyse the intersections between these case studies and how they dialogue with one another. What is important to first evidence is that each case was deliberately selected to represent a different part of Brazil's financial ecosystem, meaning that the broad transformation of the sector did not come from a single point of the system, but from a cross collaboration.

Nubank illustrates private-sector innovation on the consumer side, Pix illustrates the role of the state in creating and governing shared digital infrastructure, while PagBank illustrates private-sector innovation on the merchant side, particularly among micro, small and medium-sized enterprises (MSMEs). When analysed separately, each case still provides important evidence about the development of Brazil's fintech sector, however, when considered together, they reveal a broader and more systemic transformation. Indeed, the three cases do not represent three isolated examples of successful digital finance. Rather, they show different and complementary ways through which innovation can emerge within the same ecosystem. In this section therefore we will move from a case-by-case analysis towards a cross-case interpretation,

³⁷ About Us and Our History - IR | Pagbank. (2025, July 30). IR | Pagbank.
<https://investors.pagbank.com/pagbank/about-us-and-our-history/>

first examining the interaction between Nubank, Pix and PagBank, and then discussing what these interactions have brought for the overall transformation of Brazil's financial ecosystem and for the broader research question of this thesis.

5.4.1 Interaction Between Nubank, Pix and PagBank

The first immediate point of interaction between the three cases is infrastructure. Neither Nubank nor PagBank developed their own national instant-payment infrastructure, instead, they both integrated Pix into their existing platforms once it became available, using it as a common payment infrastructure rather than attempting to build a different proprietary instrument. For instance, Nubank integrated Pix into its digital banking application, allowing customers to make and receive instant transfers, while PagBank incorporated Pix into its broader omnichannel payment offering together with QR codes, payment links, POS terminals and other payment solutions. This shared decision of relying on a common public infrastructure illustrates an important characteristic of the Brazilian financial ecosystem, according to which private firms compete with one another and with traditional banks over products, pricing, customer experience and financial services, while at the same time they all rely on the same underlying infrastructure operated and governed by the Banco Central do Brasil.

In this sense, it is possible to understand that Pix does not compete with Nubank and PagBank, instead, it provides a common ground base according to which both companies can build differentiated services. By providing an already functioning and interoperable instant-payment infrastructure, the Banco Central was able to reduce the need for individual financial institutions to develop their own real-time payment systems. This allowed to decrease the traditional technological and financial barriers that have always been associated with offering instant payments and enabled private firms to concentrate their resources on the services built around the infrastructure rather than on the infrastructure itself.

At the same time, Pix did not operate only as a neutral enabler of fintech activity. It also changed the competitive conditions in which Nubank, PagBank and traditional banks operate. Before the introduction of Pix, digital financial institutions could differentiate themselves partly through the speed, convenience and relatively low cost of their digital payment services. Once the Banco Central made instant payments widely available, interoperable and generally free for individuals, these characteristics became much less exclusive to fintechs. Competition consequently shifted towards other dimensions of the financial relationship. Nubank increasingly differentiated itself through its broader product ecosystem, data-driven credit assessment, customer experience and personalised support, while PagBank focused on the

depth of its relationship with merchants, combining payment acceptance with banking, credit and other financial services.

Pix can therefore be understood as a kind of leveling mechanism. On the one hand, it lowered barriers for smaller and newer financial institutions by providing access to a common payment infrastructure. On the other hand, it reduced some of the advantages that digital firms could previously use to distinguish themselves from traditional banks. This is an important characteristic of public infrastructure within an innovation ecosystem: it does not simply create opportunities for new firms, but can also change the basis on which all firms compete.

A second important connection between the three cases is of course the regulatory framework that developed underneath them. The law 12.865/2013, more precisely, represents an important first common point since it established a broader regulatory framework for payment institutions and expanded the Banco Central's supervisory role beyond the traditional banking institution one. This framework was fundamental for the development of both private cases as it allowed non-bank participants to enter the payment market and created the institutional conditions for companies, in our case PagSeguro, to enter and acquire and for fintechs such as Nubank to expand their activities. At the same time, the same regulatory framework formed part of the institutional foundation on which the Banco Central could later develop and govern Pix.

All the other subsequent regulatory developments reinforced this process as well. Resolution 4.480/2016 saw in previous sections, facilitated the opening and closing of accounts through digital channels; Resolution 4.656/2018 established specific regulatory categories for credit fintechs; and the regulatory sandbox introduced in 2020 created additional opportunities for controlled experimentation. These measures should not be considered isolated regulatory decisions. Indeed, taken together, they formed a fundamental institutional framework that progressively opened the Brazilian financial system to new participants while giving more authoritative power to the Banco Central in supervising and coordinating the growing digital financial sector. Nubank, PagBank and Pix therefore emerged within the same broader regulatory transformation rather than independently of it.

Another additional connection between the cases is the similar business logic that can be observed in Nubank and PagBank. Although they target different customers, both companies developed a business model in which an initial product or service created a relationship that could later be expanded through additional financial services. Nubank initially used its fee-free credit card to attract customers and subsequently expanded its product offering into digital accounts, loans, investments, insurance and other products. While PagBank similarly used

payment acceptance and its own POS solutions as an entry point for merchants and then expanded this relationship through digital accounts, credit, insurance and other financial services.

We can see how in both cases, transactions play an important role as they generate important information about customer behaviour and financial activity. For Nubank, transaction and behavioural data can contribute to credit assessment and allow the company to personalise its financial services and provide a unique user experience. For PagBank, payment activity provides information about merchants' sales and transaction patterns, which can support the analysis and later the provision of new financial services such as working-capital credit.

Pix contributes to this ecosystem by facilitating and enabling a much larger volume of digital payments. By making instant payments widely accessible and at zero cost, it helped expand the volume of transactions made in the digital financial system, creating further opportunities for private firms to build services around digital financial activity. However, this doesn't attribute the full recognition of the development of Nubank's or PagBank's data-driven models directly to Pix. Rather, Pix should be understood as an infrastructure that stimulates and strengthens the digital environment in which these models operate.

Finally, we can state that both the three cases interact through their relationship and effect on incumbent banks. Nubank challenged traditional banks primarily on the consumer side, particularly in credit cards, digital banking and eventually lending and other financial services. PagBank introduced competitive pressure on the merchant side through acquiring, POS solutions and digital payment services. While Pix affected the whole payment environment more broadly by making instant and interoperable payments available across the financial system, reducing the ability of individual banks and fintechs to differentiate themselves simply through payment speed and cost.

These changes should not be treated as three independently causes of the changes observed in traditional banking, on the contrary, they represent different dimensions of the same broader competitive transformation. As we saw, the competitive environment created by these developments encouraged the already existing traditional institutions such as Bradesco, Itaú and Santander to accelerate their own digital transformation, develop new digital platforms, redesign their mobile services and reduce their reliance on traditional physical branches.

The cross-case comparison therefore reveals that the three cases perform different but complementary functions. Nubank represents the private innovation focused on the consumer side, PagBank represents the private innovation focused on merchants and MSMEs side, and

Pix represents a public infrastructure designed to connect and enable the wider financial system. Their importance and success lies indeed in this complementarity. Together, they show that the transformation of Brazil's financial ecosystem did not occur through a single technological innovation or through the actions of a single company, but through the contribution and interaction of different actors operating at different levels of the system.

Through the analysis of all these elements together, and in light of the theoretical framework developed in Chapter 2, the three cases offer three different insights for this thesis' research question on the extent to which Brazil is developing an autonomous innovation ecosystem. First of all, it is possible to understand that innovation in this ecosystem is not originated from a single type of actor: it emerges from the parallel and interdependent action of an entrepreneurial private firm addressing consumers (Nubank), a public institution building shared infrastructure (Pix), and a private firm addressing an underserved business segment (PagBank). This distribution of innovation across state, market and firm-level actors is precisely what we described in the National Innovation System and Triple Helix frameworks, introduced in Chapter 2, which predict for economies where technological development depends on institutional coordination rather than on isolated R&D efforts. Second, these three innovations do not simply coexist: they actively reinforce one another. Pix lowered the cost and technical barriers for Nubank and PagBank to offer instant payments, while the scale reached by Nubank and PagBank in turn increased the volume and everyday relevance of the infrastructure that Pix provides; at the same time, the competitive pressure generated by all these three actors pushed incumbent banks to accelerate their own digital transformation, which further embedded digital and instant payments into the Brazilian financial system. This mutually reinforcing dynamic is consistent with the Transaction Cost Theory, in which a reduction in transaction costs achieved by one actor (the public infrastructure) lowers the costs of innovation for other actors (private fintechs), which in turn generates additional volume and legitimacy for the shared infrastructure itself.

Last but most important for the research question of this thesis, we were able to see how none of the three cases represents the invention of an entirely new technology: instant payments, mobile banking, data-driven credit scoring and POS acquiring all had international precedents. What the case study of Brazil demonstrates, instead, is the capacity to adapt and recombine existing technologies to address specific, locally defined problems such as the historically concentrated and exclusionary banking oligopoly, a large underbanked population, and financially excluded micro and small merchants. This is consistent with the technological catch-

up and leapfrogging literature introduced in Chapter 2 (namely, by Perkins and Neumayer; Keun Lee): rather than simple imitation, the three cases show emerging-market firms and institutions building solutions whose value lies precisely in their fit with Brazil's own structural conditions, rather than in the fact of being completely new technologies. It is this ability of locally adapt, more than the technology itself, that constitutes the clearest evidence of an emerging domestic innovation capability.

5.4.2 Implications for Financial Ecosystem Transformation

Taken together, the three case studies support one of the central arguments of this thesis: the transformation of Brazil's financial system cannot be explained by looking at only one single firm or actor in isolation. Instead, it is better understood as the result of an interactive ecosystem in which private entrepreneurship, public infrastructure, regulation, incumbent adaptation and consumer and merchant adoption continuously influence one another.

The first implication is therefore that financial innovation in Brazil has increasingly become a phenomenon at the ecosystem-level rather than at the purely firm-level. Nubank and PagBank provide evidence of private companies identifying market gaps and developing business models around them, while Pix shows that public institutions are able to play an active role in shaping the technological environment in which private innovation of the country takes place. The three cases consequently illustrate different mechanisms through which innovation can emerge: entrepreneurial recombination in the case of Nubank, public infrastructure and institutional design in the case of Pix, and business-model adaptation to underserved merchants in the case of PagBank. This shows how there is not a single model of fintech innovation in Brazil, rather, there are different forms of innovation interacting with each other in the same ecosystem.

A second implication concerns the role of regulation. The Brazilian experience demonstrates that regulation, and the state itself, does not necessarily have to be an obstacle to innovation. On the contrary, when designed to increase competition, interoperability and access, regulation can create the conditions in which innovation becomes easier to develop and scale. The evolution of Brazil's fintech regulatory framework, together with the creation of Pix and Open Finance, demonstrates how the Banco Central do Brasil progressively positioned itself from a purely supervisory role to an active participant in the development of the financial ecosystem. Moreover, the later introduction of higher capital requirements for some specific fintech institutions shows that regulation continued to evolve together with the ecosystem, as these companies became larger and more relevant. The relationship between regulation and innovation was therefore a dependency relationship: regulation enabled innovation, innovation

transformed the financial system, and the resulting transformation required regulation to adapt again.

The third but perhaps most important implication concerns the nature of Brazil's emerging innovation capability. The evidence from Nubank, Pix and PagBank didn't serve the aim of suggesting that Brazil has achieved technological autonomy in the sense of inventing all the technologies on which its digital financial system is based. Since mobile banking, digital payments, data analytics, machine learning and real-time payment systems all have international precedents. Also from the evidence of the Nubank's case, as illustrated by the comparison with M-Pesa and Alipay, which demonstrate that successful innovation does not necessarily require the invention of an entirely new technology. Instead, a country can gain competitive advantage because of the combining of existing technologies, organisational capabilities and business-model innovations in response to specific local conditions.

A fourth implication is that this transformation has produced both opportunities and new forms of risk, since the same mechanisms that increased access to financial services could also create new vulnerabilities. Nubank's credit assessment based on user behaviour, PagBank's transaction-based approach to merchant credit and the ease of making instant digital payments through Pix, as we saw, can all reduce traditional barriers to financial access. However, easier access to credit does not automatically translate into an improved financial well-being of the population. As previously discussed, Brazil's high reliance on installment credit, combined with high borrowing costs and relatively low household savings, has contributed to overall indebtedness of Brazilian citizens. Accordingly, digital financial services should therefore not be evaluated only based on how many previously underserved customers they bring into the financial system, but also according to whether that access is sustainable and accompanied by adequate financial education, responsible lending and consumer protection.

The fifth and last implication concerns the relationship between disruption and market concentration. The Brazilian experience demonstrates that successful fintech innovation can increase competition without necessarily guaranteeing that market power will remain unchanged. Nubank began as a challenger of the status quo of the highly concentrated banking sector but has later developed a very large customer base and a broad portfolio of financial products. PagBank followed a similar path, evolving from a payment solution into an integrated financial ecosystem for merchants and consumers. Their growth demonstrates the ability of fintechs to challenge incumbents, but it also gives rise to the possibility that successful challengers could acquire some of the characteristics of the institutions they originally confronted.

This could bring to an important long-term tension within the Brazilian ecosystem. One of the main objectives and reasons for the design of Pix and the broader regulatory framework was indeed to prevent the concentration of essential payment infrastructure in the hands of a single private actor. However, market concentration can also emerge from customer relationships, data, credit and financial products even when the infrastructure supporting the system remains open and interoperable. The future evolution of Brazil's financial ecosystem will therefore depend not only on the ability to promote innovation and competition, but also on the ability to prevent the emergence of a digital concentration that was initially born to replace the traditional existing concentration originally challenged.

Overall, the cross-case analysis suggests that Brazil's financial transformation should not be understood as a simple transition from traditional banking to digital banking. It represents a revolutionary change in the relationships between the state, private firms, financial institutions, consumers and merchants. Public infrastructure such as Pix creates common technological foundations; regulation establishes the conditions under which different actors can participate; fintechs such as Nubank and PagBank develop differentiated services according to these foundations; and consumers, merchants and incumbent banks continuously respond to these challenges and to reshape the resulting competitive environment.

The three cases therefore provide evidence of an innovation ecosystem that has become increasingly capable of generating, adapting and scaling digital financial solutions through the interaction of different actors such as private entrepreneurship, public infrastructure and adaptive regulation. This does not mean that Brazil has become technologically autonomous or independent from international technologies and knowledge. Rather, the evidence and analysis carried out shows a new different form of autonomy: the growing domestic capacity to determine how technologies are combined, regulated, implemented and scaled in response to Brazil's own economic and social needs.

Chapter 6. Analysis and Discussion

The analysis carried out in the previous chapters provided evidence that Brazil's financial innovation ecosystem has developed through the interaction of several mutually reinforcing factors. The three case studies of Nubank, Pix and PagBank showed us that innovation, in this case in Brazil, cannot be explained simply by the adoption of technologies developed elsewhere. On the contrary, the Brazilian ecosystem has been shaped by the interaction between

market needs, entrepreneurial activity, public institutions, digital infrastructure and the country's specific socioeconomic and macroeconomic conditions.

Therefore, in this chapter we will analyse the results arisen from previous sections in order to gain fundamental insights necessary to respond to the research question of this thesis.

6.1 Key drivers of innovation in Brazil

The analysis conducted in the previous chapters allows us to identify the several interconnected drivers of innovation in Brazil's financial ecosystem. Rather than resulting from a single determining factor, from the analysis we performed it is possible to understand that Brazil's innovation trajectory has emerged from the interaction of some main drivers.

The first and most fundamental driver is the presence of significant and persistent market gaps that the country has presented during its history. As analysed in chapter 3, Brazil's banking sector has been characterized for decades by a high degree of concentration, relatively high costs of financial services and unequal access to credit and banking products. A large population remained underbanked or underserved, while micro, small and medium-sized enterprises also faced difficulties accessing payment infrastructure and formal financial services. These conditions created substantial unmet demand and therefore strong incentives for firms to develop alternative solutions. In this sense, the Brazilian fintech ecosystem emerged not simply because new technologies became available, but because those technologies could be applied in order to solve concrete and unmet problems within the domestic financial system.

The second driver is the entrepreneurial capacity of private firms to recombine existing resources and technologies into new business models. Nubank and PagBank illustrate how Brazilian companies have used digital technologies to redesign traditional financial services according to lower costs, greater accessibility and simplified customer experiences. This shows how their innovation therefore does not necessarily depend on the invention of completely new technologies. Instead, it is often the result of the combination of existing technological capabilities with new organizational structures, customer relationships, data-driven services and business models adapted to Brazilian market conditions. This supports the perspective brought by the Resource-Based Theory that we saw in chapter 2, according to which competitive advantage can arise from the way firms combine and exploit resources rather than simply from possessing or producing unique technologies. It is also consistent with the idea of technological catch-up, under which emerging economies can accelerate development by adapting and

recombining existing technologies rather than following the same technological path performed from more advanced economies.

The third driver is the fundamental active and evolving role of the state, particularly the Central Bank of Brazil. The regulations, reforms and institutional initiatives implemented by the organ, created the right conditions that enabled new firms to enter the financial market and compete with established institutions. Measures such as the creation of new categories of financial institutions, the development of Open Finance and the introduction of Pix demonstrate that regulation in Brazil has not followed market developments precisely. Differently, in several cases, public institutions were the ones that have actively shaped the environment in which innovation takes place. This institutional capacity is particularly important because it reduced some of the barriers that traditionally protected incumbent financial institutions and allowed new business models to reach consumers at scale.

The fourth driver is the development of a shared digital infrastructure at the state level. Pix is particularly important in this regard because it created a common and interoperable payment infrastructure that could be used by banks, fintechs, businesses and consumers. By reducing transaction costs and standardizing access to instant payments, this infrastructure created a common basework in which private firms could develop differentiated products and services. However, the importance of this factor goes beyond Pix itself: it demonstrates how public infrastructure can complement private innovation by reducing structural barriers to entry and making digital financial services easier to develop and scale.

All these drivers were in turn reinforced by some specific broader structural conditions. Brazil's population of more than 200 million people constitutes such a large domestic market in which successful digital products can scale rapidly. At the same time, significant socioeconomic disparities and differences in financial access that we previously analysed, created a wide range of potential use cases for fintech services. The combination of a large market and substantial unmet demand effectively created an environment in which Brazil constituted a large-scale testing base for the development of new digital financial innovation.

Moreover, macroeconomic conditions also played an enabling role. The stabilization occurred after the implementation of the Plano Real reduced the extreme instability caused by inflation that had characterized previous decades, while subsequent economic development and periods of strong commodity revenues contributed to greater financial stability and investor confidence. These conditions were important in supporting the development of financial markets and helped attract domestic and international capital to Brazilian technology companies. However, it is important to mark how macroeconomic stability alone cannot explain the emergence of the

fintech ecosystem. It should therefore be understood as a facilitating factor rather than as a direct source of innovation.

Overall, these insights suggest that no single driver would have been sufficient to produce the transformation observed in Brazil on its own. Market gaps created demand for new solutions; entrepreneurial firms developed and scaled those solutions; institutions created rules and incentives that facilitated competition; and shared digital infrastructure provided the foundation for their wider adoption. The large domestic market and macroeconomic conditions strengthened these processes. From these evidence we are able to see how the interaction and mutual reinforcement of these factors is what best explains Brazil's innovation trajectory, rather than any one of them in isolation.

6.2 Interaction between market, institutions and technology

The study of the development of Brazil's fintech ecosystem also demonstrates that market forces, institutions and technology do not operate independently. On the contrary, they interact dynamically, with changes in one dimension influencing the development of the others. The three case studies provide us with particularly strong evidence of this interaction as they represent different levels of the same financial ecosystem and its development, in particular: private-sector innovation directed at consumers, public-sector innovation in payment infrastructure, and private-sector innovation directed at merchants and small businesses.

This relationship between institutions and firms is not purely unidirectional. As we analysed, the Central Bank of Brazil created the right regulatory conditions that facilitated the entry and expansion of fintech companies, but the rapid growth of these companies also changed the structure of the financial market itself and created new regulatory challenges. Indeed, as digital financial institutions became increasingly significant competitors for traditional banks, regulatory frameworks had to evolve accordingly. This suggests a process in which there has been a reciprocal adjustment with institutions shaping market development while market development, in turn, was influencing institutional responses. If we take into account the perspective of Institutional Theory, the Brazilian case therefore illustrates how institutions and organizations continuously adapt to one another rather than developing independently.

Pix provides another important example of this interaction. Its development demonstrates that the state can act not only as a regulator but also as a provider and designer of the rules and bases of the overall market infrastructure. The Central Bank was able to establish common technical standards, governance rules and settlement infrastructure, creating a framework that allowed

different financial institutions to participate in the same payment system. This institutional intervention reduced some of the transaction costs associated with the long and fragmented payment systems and created consequent network effects that supported the rapid adoption of the new system.

The interaction between public infrastructure and private innovation is particularly relevant when considering our case studies Nubank and PagBank. From our analysis it emerged how once a common digital payment infrastructure became available, private firms could focus more strongly on differentiating their product offering and therefore their customer experience, credit services and business models rather than having to build completely separate payment networks. In this sense, it is notable how public infrastructure did not replace private innovation; it created conditions that could make private innovation easier to scale. This relationship can also be interpreted through the Transaction Cost Theory. Digital infrastructures such as Pix reduce the costs associated with making and receiving payments, while Open Finance can reduce information and switching barriers by facilitating sharing own financial information for payments under standardized conditions. Lower transaction costs can therefore reduce some of the advantages historically enjoyed by incumbent institutions and make it easier for consumers and smaller businesses to access alternative providers.

At the same time, while this common infrastructure can reduce some of these structural barriers, firms still need specific and own resources to compete. This is where the logic of the Resource-Based Theory becomes relevant. Companies can differentiate themselves through proprietary data, customer relationships, technological capabilities, credit-scoring models, product design and organizational capabilities. Therefore, the result is not a system in which public infrastructure determines private innovation, but one in which public and private capabilities are developed and operate at different but complementary levels.

The Brazilian case can consequently be understood also through the broader perspective of the National Innovation System and the Triple Helix model, according to which government, firms and knowledge-producing institutions interact in the development of innovation. The Brazilian financial ecosystem illustrates this interaction particularly clearly because the Central Bank was able to take at times a highly proactive role in designing and operating infrastructure, while private financial companies have developed services that increasingly perform functions of broad economic relevance.

The three cases therefore reveal a system in which technology, institutions and market demand reinforce one another. Market problems create incentives for firms to innovate; firms' innovations generate new forms of demand and competition; public institutions respond to and

shape these developments; and shared infrastructure creates the conditions to allow further private-sector innovation. This cycle is strongly significant for the research question, rather than the analysis of any individual technological innovation because it indicates the emergence of an ecosystem capable of continuously generating and adapting innovation.

6.3 Is Brazil becoming an autonomous innovation hub?

The central research question of this thesis asks whether Brazil is moving from a position of technological and economic dependency towards a more autonomous innovation ecosystem, through the deep analysis of the Brazilian fintech sector. The evidence presented throughout the thesis suggests that the answer is yes, but in a qualified sense. Brazil is becoming increasingly autonomous in its capacity to generate, organize, adapt and scale innovation, but this does not mean that it has achieved fully economic and, more specifically, technologically self-sufficiency.

The three case studies provide stronger evidence for this conclusion when considered together rather than when examined separately. Nubank demonstrates the ability of a Brazilian fintech to challenge already established banking models and develop scalable digital financial services. PagBank demonstrates how private firms can redesign payment and banking services around the needs of merchants, entrepreneurs and underserved users. And Pix demonstrates that Brazilian public institutions are also capable of designing and implementing digital infrastructure that were successful at national scale. These are not simply three independent examples of successful financial innovation. Together, they reveal innovation capabilities operating across different levels of the financial system: firms, public institutions and shared infrastructure.

This distinction is important as it gives us meaningful insights for the case of Brazil. A country could host successful individual fintech companies without necessarily possessing a broader innovation ecosystem. Indeed, the combination of private-sector innovation, institutional capacity and national digital infrastructure is what provides stronger evidence that Brazil has developed capabilities that extend beyond the single abilities of individual firms. Therefore, we are able to say that the ecosystem is able to generate innovation through different actors and to create conditions in which these actors can interact and reinforce one another.

The institutional side of this argument is strongly represented and testified by the role of the Central Bank of Brazil. What is important to note is indeed, how the Bank has not simply regulated an already-existing market, it has also actively shaped the conditions under which

financial innovation can develop. Its regulatory framework for fintechs, the implementation of Pix and Open Finance, and the development of the regulatory sandbox that we saw in chapter 4, all illustrate this proactive approach. The Banco Central describes the sandbox as a controlled environment in which authorized entities can test innovative financial or payment projects for a limited period of time and under specific regulations provided to them. Its stated objectives include stimulating innovation and business-model diversity, increasing competition and addressing the needs of financial users. This proactive regulatory approach illustrates that the Bank has acted not only as a regulator of innovation, but also as an institutional enabler of it. This is the same logic that we noted in the regulatory framework for fintechs, which was introduced to increase competition and efficiency in credit markets while creating a formal institutional framework for new financial business models.

The development of Pix is particularly relevant to this argument. Although the dynamic of instant digital payments was not invented exclusively in Brazil, the Brazilian system reflects a specific case in which an institutional design was successfully adapted to the country's financial structure and policy objectives. The Central Bank combined technological infrastructure, regulatory authority and national-scale implementation to create a payment system tailored for the country and designed around Brazilian market conditions. This clearly represent an institutional and organizational innovation rather than technological invention in the narrow sense. It therefore provides one of the clearest examples in this thesis of autonomy exercised through the adaptation and recombination of existing resources rather than through original technological invention.

This interpretation is consistent with the broader literature on innovation in emerging economies that we discussed also in chapter 2 and it is also supported by another important author. In its paper, Figueiredo ³⁸examines Brazilian latecomer firms, showing that the accumulation of innovative capabilities can produce fundamental results that go beyond the technological catch-up. His evidence demonstrates that firms can progressively develop different types and levels of capabilities and use them to implement increasingly complex innovative activities, even when they start operating from a position of technological disadvantage. This perspective is particularly relevant to Brazil's financial ecosystem because it suggests that innovation capacity should not be measured only by whether a country invents

³⁸ Figueiredo, P. N. (2014). *Beyond technological catch-up: An empirical investigation of further innovative capability accumulation outcomes in latecomer firms with evidence from Brazil*. Journal of Engineering and Technology Management, 31, 73–102. <https://doi.org/10.1016/j.jengtecman.2013.10.008>

the underlying technologies. The ability to learn, adapt, recombine and deploy technologies in increasingly sophisticated ways can represent itself an important form of innovation capability.

However, at the same time we cannot ignore the persisting limitation of overall Brazil's autonomy. Many of the technologies that support digital banking, including smartphones, cloud computing, artificial intelligence, digital security technologies and advanced payment technologies, are originated from global technological ecosystems, rather than being products of the single Brazilian economy. Moreover, what emerged from our analysis is that the ecosystem strongly relied on international funding and therefore Brazilian fintech companies remain connected to international financial and investment networks. As we saw for Nubank, for example, it attracted substantial investment from international investors during its expansion. In this manner, Brazil cannot be described as technologically self-sufficient or completely independent from foreign capital, knowledge and technologies.

Additional external evidence on innovation capabilities reinforces this concept while also supporting the broader argument. WIPO's (World Intellectual Property Organization) Innovation Capabilities Outlook 2026 ³⁹ emphasizes that innovation success does not depend on isolated technological capabilities, but on how different capabilities connect and reinforce one another. The report tracks more than 2,500 innovation capabilities across 193 economies and finds that only a small share of countries are actually realizing their technological potential at this time. This framework is relevant for our Brazilian case because it shifts the focus from technological ownership to the ability of an innovation ecosystem to combine capabilities across science, technology, entrepreneurship and production. This suggests that Brazil's position should therefore be seen as evidence of meaningful innovation capability rather than as evidence of technological independence.

Moreover, from our analysis another significant insight emerged is that technological dependence and innovation autonomy are not necessarily mutually exclusive. What arose is that a country does not need to invent every underlying technology in order to develop an autonomous innovation ecosystem. What matters is its capacity to determine how technologies are selected, adapted, combined, regulated and deployed to address domestic problems. From this perspective, Brazil has developed significant capabilities.

³⁹ World Intellectual Property Organization. (2026). Innovation Capabilities Outlook 2026. WIPO Knowledge Repository. <https://doi.org/10.34667/tind.59097>

In this manner, the Brazilian case can suggest a broader definition of innovation autonomy. According to this, indeed, innovation autonomy can be understood as the capacity of a country and its institutions to identify local problems, mobilize available technological and organizational resources, create appropriate institutional frameworks, and develop and scale solutions that respond to domestic needs. This definition is narrower than technological self-sufficiency but more appropriate for understanding innovation in such a globally interconnected economy in which we live today.

Under this definition, Brazil shows substantial evidence of increasing autonomy. We saw how its financial ecosystem is not simply importing foreign models and reproducing them domestically. Instead, Brazilian firms and institutions have increasingly adapted the technologies and business models to specific national conditions, while also creating original institutional arrangements and infrastructures. The combination of private-sector innovation, proactive institutional capacity and shared infrastructure is therefore more significant than the technological origin of each individual component.

To conclude, we can say that Brazil remains internationally connected and continues to rely on global technologies, capital and knowledge, but it is increasingly capable of shaping how these resources are combined and applied within its own innovation ecosystem.

Brazil should therefore be considered an increasingly autonomous innovation hub, but not a self-sufficient one. Its autonomy can be considered relative rather than absolute: it lies in the capacity to generate, adapt and coordinate innovation across firms, institutions and infrastructure, rather than in independence from the global technologies, capital and knowledge networks on which it continues to rely.

6.4 Comparison with developed economies

The overall study of the Brazilian trajectory becomes clearer when compared with more mature financial ecosystems in developed economies. The comparison should not be interpreted as a way to simply assess which country has more advanced technology, but rather as an analysis of the different conditions and mechanisms through which financial innovation has developed. Different from Brazil, in many advanced economies, financial systems have historically benefited from relatively mature banking infrastructures and high levels of financial inclusion. In these cases innovation has therefore often taken place within an already-established financial system, through the digitalisation, specialisation and improvement of existing services. By contrast, Brazil was characterised by rapid technological adoption with persistent structural

gaps in financial access, competition and payment infrastructure, creating opportunities for digital technologies to address more fundamental limitations of the traditional financial system. Despite this, it is fundamental to remark how Brazil cannot simply be described as a country that is technologically behind developed economies. The OECD provides important data that evidence the relatively rapid fintech adoption despite Brazil's lower level of economic development. According to these data, in 2019 fintech adoption among Brazilian consumers reached 64%, equal to the average across the 27 economies covered by the OECD study and comparable to or above several advanced economies, including Germany (64%), the United States (46%) and France (35%). At the same time, China and India recorded substantially higher adoption rates of 87%⁴⁰. These figures suggest that the diffusion of digital financial services does not necessarily follow the same path as the overall economic development: emerging economies can achieve high levels of digital adoption even when their broader financial and economic systems are less mature.

This is observable also in digital payments. According to the OECD's Latin American Economic Outlook 2024⁴¹, around 80% of adults in Brazil and Chile had made or received a digital payment, compared with an average of 95.6% across OECD economies. Although Brazil remained below the OECD average, the relatively small gap is easily notable given the difference in economic development between Brazil and the OECD as a whole organization. These data therefore reinforce the idea that Brazil's digital financial transformation has developed more rapidly rather than simply following the traditional and usually delayed trajectory of developed economies.

This difference becomes particularly evident mainly when considering the role of digital payment infrastructure. In Brazil, digital innovation developed partly as a response to structural problems within the financial system. As we mentioned in previous chapters, the IMF noted how Pix was introduced with explicit objectives of reducing reliance on cash, increasing financial inclusion, strengthening competition in a relatively concentrated banking system and modernising the overall national payment system. Noted the rapid adoption of the system seen in chapter 5 (we remember approximately 80% of the adult population, and 13 million firms reached in only two years and a half), the IMF also reports that Brazil experienced the fastest

⁴⁰ OECD (2020), *Going Digital in Brazil*, OECD Reviews of Digital Transformation, OECD Publishing, Paris, <https://doi.org/10.1787/e9bf7f8a-en>

⁴¹ OECD et al. (2024), *Latin American Economic Outlook 2024: Financing Sustainable Development*, OECD Publishing, Paris, <https://doi.org/10.1787/c437947f-en>

adoption rate in terms of transactions per capita gained since implementation when compared with other electronic payment systems globally, including those in advanced economies.

Another important study developed by the Bank for International Settlements (BIS)⁴² supports this. The BIS in fact, developed a useful comparison of Pix with instant payment systems of other 100 jurisdictions such as UPI in India, Swish in Sweden and FedNow in the USA. Besides confirming the extraordinary adoption rate, BIS highlights how the full public property of Pix, operated and regulated by the Banco Central do Brasil had a clearly successful impact compared to others of developed markets, in which system payments are often fragmented, operated by private institutions or with elevated commissions. The mandatory participation of all big banks, the standardization and interoperability of the user experience are indeed identified as the main ingredients of the Brazilian success and what differentiated it from other countries' systems. Moreover, BIS cites Pix as the primary case study for the development of the Digital Euro designed by the European Central bank and other sovereign digital currencies. It demonstrates how a public payments infrastructure could coexist in real time with the private sector, stimulating the competition in high added value services rather than on transaction commissions.

Moreover, in a mature financial system like the one of a developed country, consumers already have relatively broad access to formal banking services and established digital payment infrastructures, in which fintech innovation can focus more on improving convenience, personalisation, efficiency and specialised services. In Brazil, on the contrary, fintechs could address more fundamental gaps in access, affordability and competition. In this manner, digital technologies not only enabled the improvement of existing services but also the restructuring of how financial services were delivered to consumers and small businesses.

This does not mean that developed economies have followed a precisely incremental innovation model, nor that Brazil has completely bypassed traditional financial infrastructure. Rather, it highlights that the difference lies in how significant are the structural gaps as a source of innovation. The unique characteristics of Brazil such as its large domestic market, historically uneven access to financial services and concentrated banking structure created strong incentives to use digital technologies to expand access to more people and to challenge business models of incumbent banks. The result was a form of digital transformation in which technological adoption and market restructuring occurred simultaneously.

⁴² José Aurazo, Frost, J., & Kosse, A. (2024, December 18). *Faster digital payments: Global and regional perspectives*. Bank for International Settlements. <https://www.bis.org/publications/paper-152-faster-digital-payments-global-and-regional-perspectives>

This distinction is important for the central argument of this thesis. Brazil's emergence as an innovation hub cannot be assessed only by asking whether it has developed the same technologies as advanced economies. Its success and unique feature lies in the way technological adoption, institutional innovation and market restructuring have interacted among each other. The evidence therefore suggests that Brazil's trajectory represents not only a simple delayed process of catching up with developed economies, but a distinct path in which digital technologies have been used to address structural challenges and create new forms of financial infrastructure and business models.

6.5 Constraints and Opportunities

Despite this thesis highlights the significant progress achieved by Brazil's fintech ecosystem, the development of digital financial services still presents, and sometimes creates, new challenges. Indeed, greater access to financial products does not automatically mean greater financial welfare. The same technologies that reduce barriers to financial inclusion can also make borrowing and financial transactions faster and easier, potentially increasing exposure to financial risks.

One important concern that already emerged is household indebtedness. As we previously saw, the expansion of digital and instalment-based credit (*parcelado*) has made borrowing more accessible and can help households smooth consumption. However, the easy and widespread use of credit-card instalments also creates future payment obligations for users, while missed payments can result in high-cost revolving or installment debt. In this context, the growth of financial access must be accompanied by responsible lending, financial education and effective consumer protection since digitalisation can also create new forms of exclusion. Individuals with limited digital literacy, poor internet access or insufficient familiarity or ability to use digital financial products may remain excluded even when financial services are technically available to them. The regional inequalities previously introduced therefore remain an important constraint, particularly given the socioeconomic and infrastructural differences between Brazilian regions. Another study of the OECD ⁴³provides other important insights about Brazil's development and constraints. Firstly, it notes that, although Brazil has made significant progress in expanding digital infrastructure, there still remains an unequal access to high-speed internet across regions and many adults still lack basic digital skills. These

⁴³ OECD (2026), Foundations for Growth and Competitiveness 2026, OECD Publishing, Paris, <https://doi.org/10.1787/40a7532f-en>

limitations reduce the extent to which digital innovation can be diffused equally across the population, which was also one of the primary objectives of Pix. Financial inclusion should consequently be evaluated not only in terms of the number of people gaining access to digital accounts or payment systems, but also in terms of their ability to actually use these services safely and effectively.

Cybersecurity and data governance represent another important challenge. With financial services becoming increasingly digital and dependent on large quantities of personal and transactional data, protecting consumers from fraud, cyberattacks and misuse of information is becoming ever more difficult and essential. Moreover, the growing role of artificial intelligence and data-driven credit assessment makes these issues even more relevant because automated systems can influence access to credit and other financial services. The ability to expand digital innovation while maintaining consumer trust and their security will therefore remain an important condition for the sustainable development of Brazil's financial ecosystem.

But beyond the financial sector itself, Brazil's capacity to build and consolidate an autonomous innovation ecosystem is also influenced by broader structural constraints. As we have seen, the country benefits from a large domestic market, a strong entrepreneurial base and the ability of firms and institutions to develop solutions under complex regulatory and operational conditions; these characteristics provide an important foundation for experimentation and scaling. At the same time, however, regulatory complexity, administrative burdens and barriers to competition can increase the cost of establishing and expanding businesses. The OECD identifies, indeed, regulatory barriers as a significant constraint on business dynamism, investment and productivity in Brazil and argues that reducing such barriers could facilitate the entry of new firms and strengthen competition. This is particularly relevant for innovation because the ability to create new solutions is not sufficient if firms still face some important obstacles when trying to scale them.

Additionally, macroeconomic and financial conditions represent another significant constraint. In this manner, domestic investment in Brazil has remained relatively weak in past decades, while limited fiscal space and insufficient private resource mobilisation have contributed to infrastructure gaps. The access to finance is particularly relevant for innovative firms because startups often require substantial investment before reaching profitability or achieving an international scale. Overall, the remaining uncertainty surrounding economic conditions, combined with high financing costs, can increase the risks associated with long-term investment in innovation. These factors can therefore limit the ability of Brazilian startups and technology companies to move beyond successful domestic experimentation and compete internationally.

Human capital represents another structural challenge that the country still faces. Brazil has a significantly strong university system, as well as research institutions and innovative companies, but disparities in educational outcomes and access to quality and more specifically equal education continue to constrain the development of skills required by an increasingly technology-intensive economy. In fact, the report highlights substantial differences in educational quality and access across socioeconomic groups and regions, while data show that government expenditure per tertiary student, including research and development, remains considerably below the average. These limitations matter for innovation because technological development depends not only on physical and digital infrastructure but also on the availability of workers with the skills required to develop, implement and commercialise new technologies. This suggests us that the relationship between universities, research institutions and businesses therefore represents both a constraint and an opportunity. Brazil possesses relevant scientific and entrepreneurial capabilities, but stronger connections between knowledge production and commercial application could increase the economic impact of these capabilities. More effective collaboration between universities, firms, government institutions and financing organisations could facilitate knowledge transfer, research commercialisation and the development of technology-intensive businesses. The OECD for this reason, emphasises that stronger links between education, skills and labour markets, together with improved infrastructure and institutional conditions, can support productivity, knowledge diffusion and technological adaptation. In this sense, the challenge for Brazil would not simply to increase the quantity of research or innovation, but to improve the mechanisms through which knowledge is transformed into economic activity that is scalable.

Competition presents an additional potential paradox. We saw how fintechs emerged in part by challenging the concentration of Brazil's traditional banking sector, but successful fintech companies can also themselves become very large and economically significant. Our analysis suggests in fact that the long-term development of the ecosystem will therefore depend on maintaining effective competition while ensuring financial stability and adequate consumer protection. In this sense, the objective should not simply be to replace traditional incumbents with new dominant firms, but to create a market in which innovation remains continuous and contestable, which is consistent with the OECD's emphasis on reducing regulatory barriers and strengthening competition as a means of improving business dynamism and productivity.

The overall above mentioned constraints, however, coexist with significant opportunities. Firstly, Brazil's large domestic market constitutes an important opportunity for firms of

developing and testing solutions at considerable scale before expanding internationally. This is particularly relevant in digital financial services, where the size and diversity of the Brazilian market create strong incentives for firms to develop products adapted to complex local needs. The case studies we analysed of Nubank, Pix and PagBank illustrate how the initial solutions and objectives of the company developed after in response to the present domestic conditions and were able to reach national scale by potentially providing a basis for international expansion.

The continued development of digital technologies also can create opportunities beyond traditional financial services. Open Finance, in concordance with its objectives, can increase competition and enable more personalised financial products by facilitating the secure sharing of financial information across institutions. Artificial intelligence can support more sophisticated credit assessment, fraud detection and customer service, provided that these technologies are implemented responsibly. And at the same time, these improvements in digital infrastructure and digital skills could allow a larger share of the population to participate in the digital economy. The opportunity therefore is not represented only by expanding existing digital services, but also in using digitalisation to generate new forms of economic activity and innovation.

International integration represents another important opportunity, but also an area in which Brazil still faces limitations. The OECD notes that Brazil is still integrated into global value chains mainly because of commodities and trade openness, which is still relatively low compared with other emerging economies. Greater integration into international markets, knowledge networks and technology ecosystems could nevertheless provide Brazilian firms with access to capital, expertise, technologies and new customers.

The Global Findex report of The World Bank⁴⁴ is another important resource that supports this idea. This study similarly identifies increased competition, trade openness and integration into regional and global value chains as the potential drivers of Brazil's emergence as a global innovation hub. According to this, internationalisation should therefore not be understood as contradicting autonomy; instead, the ability to access and being able to incorporate external resources can strengthen domestic innovation capacity when firms and institutions retain the capability to adapt these resources to local conditions.

For our thesis international expansion is particularly relevant to answer the question of autonomy. What is important to highlight is that if Brazilian companies are able not only to

⁴⁴ *The Global Findex Database* (2025) The World Bank
<https://www.worldbank.org/en/publication/globalfindex/report>

solve domestic problems but also to transfer their business models and technological capabilities to other markets, the country's role would increasingly move from technology and business-model adopter to technology and innovation exporter. The choice of analyzing the case of Nubank was indeed to demonstrate that the company's international expansion provides an initial example of this potential, although the long-term success of these strategies remains to be demonstrated. More broadly, it is important to add that the ability to internationalise Brazilian innovation will depend on whether domestic firms can overcome constraints related to capital, talent, infrastructure, regulatory complexity and international competitiveness that we mentioned above.

Taken together, these constraints and opportunities help us understand that Brazil's innovation trajectory should be understood as an ongoing process rather than a completed transformation and full autonomy. The country possesses several important foundations for innovation: a large domestic market, entrepreneurial capabilities, increasingly sophisticated digital infrastructure and institutions capable of designing and implementing innovative solutions. However, the structural limitations in regulation, infrastructure, education, access to finance, digital inclusion and international integration continue to affect the ability of the country to translate these capabilities into a sustained and globally scalable innovation.

The findings presented in this chapter are indeed particularly relevant to the central research question of this thesis, according to which Brazil's autonomy does not appear to result from technological self-sufficiency or from the elimination of external dependence. On the contrary, it is associated with the growing capacity of Brazilian firms and institutions to identify domestic problems, combine external and domestic resources, develop solutions adapted to local needs and scale them through national and potentially international markets. Therefore, we are able to say that the persistence of structural constraints does not prevent or invalidate the emergence of an increasingly autonomous ecosystem; instead, it determines the conditions under which this autonomy can continue to develop.

To conclude, all the findings of this thesis indicate that Brazil has developed an increasingly sophisticated and relatively autonomous innovation ecosystem in the financial sector. This development and transformation did not come from technological independence in the traditional sense. Rather, it has emerged from Brazil's growing capacity to combine market demand, entrepreneurial capabilities, institutional innovation and digital infrastructure in order to respond to local needs.

The three case studies are particularly important in supporting this conclusion. Nubank, Pix and PagBank represent different actors and levels of the financial system, but when analysed together they reveal a common process: while private firms identify and address market gaps, public institutions create enabling infrastructure and regulatory conditions, and users and businesses adopt these solutions at national scale. Indeed, taking into account their interaction is what provides the strongest evidence of an ecosystem rather than analysing them individually. Brazil therefore appears to be moving from a model based primarily on the adoption of technologies and financial models that were developed in other countries towards a model characterised by an increasing innovation autonomy. However, this autonomy remains relative because Brazil continues to depend on global technologies, international capital and international knowledge networks. This dependence on external resources however, does not prevent the country from the ability to produce domestic innovation. What has changed from the country's historical economic structure is Brazil's ability to decide how these resources are combined, adapted and deployed to solve its own economic and social challenges.

The Brazilian experience consequently suggests that becoming an innovation hub does not require to achieve complete technological self-sufficiency. In the globally interconnected economy in which we live today, a more meaningful form of autonomy can be considered as the capacity to generate, coordinate, adapt and scale innovation domestically while remaining connected to international networks. From this perspective, Brazil can be considered an increasingly autonomous innovation hub, although not a self-sufficient one.

Chapter 7: conclusions

7.1 Main Findings

This thesis investigated the extent to which Brazil is evolving from a historically dependent economic and technological model towards a more autonomous innovation ecosystem, using the examination of the development of its fintech sector as the empirical context. The analysis combined the theoretical literature on innovation in emerging economies with secondary data and three case studies: Nubank, Pix and PagBank. The findings suggest that Brazil has developed increasingly sophisticated domestic innovation capabilities, particularly in the financial sector, although this transformation does not imply technological or economic self-sufficiency.

The first main finding is that Brazil's innovation trajectory has been shaped by the interaction of several mutually reinforcing factors rather than by technological development alone. We saw how the analysis identified persistent market gaps, entrepreneurial capabilities, proactive institutional intervention and shared digital infrastructure as key drivers of innovation. Brazil's large and diverse domestic market provided some significant unmet needs, particularly in relation to financial access, payment services and services for underserved consumers and merchants. These conditions created opportunities for private firms to develop new business models, while public institutions were fundamental in creating the right necessary regulatory and technological conditions that enabled innovation to develop and scale in the country.

The three case studies chosen provide complementary evidence of these dynamics. Nubank demonstrates how private entrepreneurship can challenge the status quo of already established business models and develop scalable digital financial services around previously underserved consumer needs. PagBank demonstrates how private innovation can address the needs of merchants, entrepreneurs and small businesses through integrated digital payment and financial services. Pix, in contrast, demonstrates how fundamental is the role of Brazilian public institutions and their capacity to design, implement and govern shared digital infrastructure at national scale. Considered together, the three cases show that innovation in Brazil is not a product coming from individual firms only, but it emerges through the interactions among private companies, public institutions, infrastructure, consumers and businesses.

A second important finding is about the nature of the innovation itself. None of the three cases represents the invention of an entirely new technology. Mobile banking, instant payments, data-driven credit assessment and payment acquiring were not striking new products, they all had international precedents. However, the Brazilian cases demonstrate the ability of the country to adapt and recombine existing technologies, organisational capabilities and business models in response to specific domestic challenges. This suggests that innovation autonomy in an emerging economy should not be evaluated only if there are any new technologies invented domestically, but also according to the ability to adapt, combine, govern and scale them effectively in a local context.

The third main finding concerns the role of the institutional environment. The Brazilian case showed us how public intervention does not necessarily act as a constraint on private innovation. Through regulatory reforms, Pix, Open Finance and other initiatives, the Central Bank of Brazil has played an active role in shaping the conditions and creating the right environment in which financial innovation can develop. This highlights how both public and private capabilities were therefore able to operate at different but complementary levels:

institutions provide infrastructure and regulatory conditions, while firms develop their differentiated products and services within this environment. This interaction among these actors supports the interpretation of the Brazilian financial sector as an innovation ecosystem rather than simply a collection of successful fintech companies.

The central finding of the thesis is therefore that Brazil appears to be moving towards greater innovation autonomy, but in a qualified sense. The results from our analysis do not imply automatically the conclusion that Brazil has become technologically independent or self-sufficient. As evidenced, the country remains strongly connected to international technologies, capital and knowledge networks. Nevertheless, the thesis also showed how a continued external dependence does not prevent the development of domestic innovation capabilities. What has changed is the always greater ability of Brazil to determine how external and domestic resources are combined, adapted and deployed to address its own economic and social challenges.

Innovation autonomy should therefore be understood as a relational and multidimensional concept rather than as the complete elimination of external dependence. The Brazilian experience suggests that an emerging economy can remain strongly integrated into global networks while at the same time being able to develop the domestic capabilities required to generate, coordinate, adapt and scale innovation. From this perspective, Brazil can be considered an increasingly autonomous innovation hub, although not a self-sufficient one.

However, the findings highlight that this transformation still presents some important constraints and therefore, remains incomplete. Important structural limitations related to regulation, infrastructure, education, access to finance, digital inclusion and international integration continue to affect Brazil's ability to transform its innovation capabilities into sustained and globally scalable outcomes. The development of the fintech ecosystem should therefore be understood as an ongoing process rather than as a testimony of a completed transition.

To conclude, the analysis also highlights some important tensions within the transformation of the whole financial ecosystem. Greater digital access does not automatically guarantee greater financial welfare, since as we have seen, an easier access to credit can coexist with indebtedness and new forms of financial risk. Moreover, increased competition does not necessarily eliminate market concentration, because successful fintechs may become the large and influential market actors. These tensions demonstrate that innovation autonomy is not only a fact of technological capability, but also of the institutions and conditions under which innovation develops and produces broader economic and social effects.

7.2 Limitations

Despite the important insights arisen in this thesis, there are several limitations that should be acknowledged.

First, the analysis focuses specifically on the Brazilian fintech sector. This sector represents a particularly important example since it is an environment very suitable for innovation autonomy, as it combines technological change, entrepreneurial activity, institutional intervention and digital infrastructure. However, the findings cannot automatically be generalised to Brazil's entire innovation ecosystem. There are other sectors, such as biotechnology, manufacturing, agritech, energy or aerospace, that may be characterised by different technological requirements, institutional conditions and levels of international dependence. The conclusions of this thesis should therefore primarily be interpreted within the context of financial and digital innovation. Moreover, the whole question of innovation autonomy is strongly shaped and influenced by the current political scenario of the country and the actual geopolitical legislation, which was not possible to take into account due to its broader scope.

Second, the empirical analysis is based on three case studies: Nubank, Pix and PagBank. These cases were selected because they represent different dimensions of the Brazilian financial ecosystem and allowed us to gain a comparison between private-sector innovation and public digital infrastructure. Nevertheless, three cases cannot 100% capture the full diversity of Brazil's fintech ecosystem. Other fintech companies, financial institutions, regulators, technology providers and users could provide additional perspectives that are not fully represented in this research.

Third, the study relies primarily on secondary data and publicly available information. This provides access to a broad range of company information, institutional reports, market data and academic research, but it also limits the analysis to only information that are publicly available and may be affected by the possible differences in data availability, reporting practices and measurement methodologies. In particular, although the research initially included a primary-data component through a survey and semi-structured interviews, the number of responses obtained was not sufficient to support robust conclusions or meaningful generalisation. Therefore, these data were not incorporated into the main analysis, but were still taken into consideration in the general evaluation. This represents a limitation, as a larger number of responses could have provided additional perspectives on the Brazilian fintech and innovation ecosystem.

Finally, we are able to say that innovation autonomy is itself a complex and multidimensional concept. The thesis arrived at the conclusion that it should be considered as the capacity to adapt, combine, coordinate and scale innovation domestically while remaining internationally connected. This provides a useful framework for analysing the Brazilian case, but other dimensions of autonomy could also be considered, including technological ownership, domestic R&D capacity, intellectual property, access to strategic technologies, talent development and international competitiveness. The conclusions should therefore be understood as an assessment of innovation autonomy from the specific perspective chosen and adopted specifically in this thesis.

7.3 Future Research

After having produced this thesis, it is evident how the abovementioned limitations also provide several directions for future research.

Firstly, future studies could extend the analysis beyond fintech and examine whether the patterns identified in the Brazilian financial sector are also present in other strategic industries, leading probably to a broader conclusion. Comparative research across sectors such as agritech, health technology, energy, aerospace or manufacturing could indeed help determine whether the development of domestic innovation capabilities represents a broader characteristic of Brazil's economy or it is a particular characteristic and trajectory of the current digital financial services sector.

Secondly, future research could take into consideration a higher number of case studies within the fintech ecosystem. Examining additional Brazilian fintechs, incumbent banks, payment institutions and technology providers could in fact provide a broader understanding of how innovation capabilities develop across different types of organisations. Analysing a larger sample would also make it possible to compare different business models and assess whether the mechanisms identified through Nubank, Pix and PagBank are consistently observed across the ecosystem.

Thirdly, future studies could incorporate primary research through interviews with entrepreneurs, regulators, investors, technology professionals and other ecosystem actors. This could provide interesting insights about the internal processes through which Brazilian firms acquire, adapt and develop technological capabilities, as well as into how public institutions and private actors perceive the evolution of Brazil's innovation ecosystem.

Fourth, a study that takes into account a more longitudinal approach with a deeper analysis over time could provide a better understanding of whether the increasing innovation autonomy

identified in this thesis is also sustained over time. Tracking indicators such as domestic R&D, patent activity, startup creation, venture capital, technological capabilities, international expansion and the development of digital infrastructure could help determine whether Brazil is continuing to move towards greater autonomy or whether the current transformation is specific to this current picture and also if it remains concentrated in specific sectors and firms.

Finally, future research could focus also on a larger comparative perspective by examining Brazil alongside other emerging economies. In this thesis we provided a minimum comparison with other emerging countries given the narrower scope of the analysis. But comparing Brazil on a deeper level with countries that have followed different paths of technological catch-up and digital transformation could help identify which institutional, market and technological conditions are most important for developing innovation autonomy. Such research could integrate and also further explore the relationship between international integration and autonomy, particularly whether access to global capital, technologies and knowledge can strengthen rather than undermine domestic innovation capabilities when countries possess the capacity to adapt and use these resources effectively.

Overall, further research could therefore go beyond the question of whether Brazil is becoming more autonomous and investigate the conditions under which this autonomy can be sustained, expanded across sectors and translated into the overall international competitive innovation landscape.

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