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A look at the information technology sector in Northeast Brazil

Um olhar sobre o setor de tecnologia da informação no Nordeste brasileiro

Una mirada al sector de las tecnologías de la información en el Nordeste brasileño

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Abstract:
The objective of this paper was to identify the municipalities in the Brazilian Northeast with potential for productive specialization in the Information Technology sector in 2023. Initially, a literature review was conducted on the Information and Communication Technology (ICT) sector, and the specific Information Technology (IT) segment. Subsequently, considering the strategic importance of the IT sector for the economy, the role of productive arrangements in promoting the growth and strengthening of the local economy was discussed. To achieve the proposed objective, a widely recognized methodology in the literature was adopted, capable of identifying potential local productive arrangements: the Location Quotient. The Location Quotient was calculated for each CNAE class related to the IT sector, applying specialized filters: Relative Participation greater than 1% and a minimum threshold of 10 establishments per class. The use of this methodological approach allowed the identification of municipalities in the Northeast with potential for productive specialization in the IT sector, highlighting them as strategic centers for development and innovation.

Keywords:
Information and Communication Technology. Information Technology in the Northeast. Potential Productive Specialization. Local Productive Arrangements.

Resumo:
O objetivo deste artigo foi identificar os municípios do Nordeste brasileiro com potencial de especialização produtiva no setor de Tecnologia da Informação em 2023. Inicialmente, realizou-se uma revisão bibliográfica sobre o setor de Tecnologia da Informação e Comunicação (TIC) e o segmento específico de Tecnologia da Informação (TI). Em seguida, considerando a relevância estratégica do setor de TI para a economia, discutiu-se o papel dos arranjos produtivos no fomento ao crescimento e fortalecimento da economia local. Para alcançar o objetivo proposto, adotou-se uma metodologia amplamente reconhecida na literatura, capaz de identificar arranjos produtivos locais potenciais: o Quociente Locacional. O Quociente Locacional foi calculado para cada classe do CNAE relacionada ao setor de TI, com a aplicação de filtros especializados: Participação Relativa superior a 1% e um limite mínimo de 10 estabelecimentos por classe. A utilização dessa abordagem metodológica permitiu identificar os municípios do Nordeste com potencial de especialização produtiva no setor de TI, destacando-os como centros estratégicos de desenvolvimento e inovação.

Palavras-chave:
Tecnologia da Informação e Comunicação. Tecnologia da Informação no Nordeste. Especialização Produtiva Potencial. Arranjos Produtivos Locais.

Resumen:
El objetivo de este artículo fue identificar los municipios del Nordeste brasileño con potencial de especialización productiva en el sector de las tecnologías de la información en 2023. En primer lugar, se realizó una revisión bibliográfica sobre el sector de las tecnologías de la información y la comunicación (TIC) y el segmento específico de las tecnologías de la

información (TI). A continuación, dada la importancia estratégica del sector de TI para la economía, se analizó el papel de los arreglos productivos en el fomento del crecimiento y el fortalecimiento de la economía local. Para alcanzar el objetivo propuesto, se aplicó una metodología ampliamente reconocida en la literatura que permite identificar posibles arreglos productivos locales: el cociente de localización. Este se calculó para cada clase de la CNAE vinculada al sector de TI, con dos filtros específicos: una participación relativa superior al 1 % y un mínimo de 10 establecimientos por clase. Este enfoque permitió identificar los municipios del Nordeste con potencial de especialización productiva en TI y destacarlos como centros estratégicos de desarrollo e innovación.

Palabras clave:
Tecnologías de la información y la comunicación. Tecnologías de la información en el Nordeste. Especialización productiva potencial. Arreglos productivos locales.

1. Introduction

The world has experienced the transition to Industry 4.0, known as the “Fourth Industrial Revolution”, characterized by increased productivity, competitiveness and industrial quality through the integration of technological innovations into production processes. In this context, the Cultural Industry, marked by its dynamicity and transformative capacity, assumes a strategic role within this revolution, by encompassing sectors linked to technology that use creativity and innovation to implement solutions aligned to contemporary social, cultural and economic demands. The development and application of these technologies are crucial for current economic growth and represent a significant potential to boost progress in the coming years.

Amid this technological progress, the Information and Communication Technology (ICT) sector has grown considerably, playing an essential role in automation, improving communication and sharing information. On the other hand, the Information Technology (IT) sector, which is part of the most comprehensive ICT sector, is fundamental in optimizing these processes. In addition, it interacts directly with global trends of modernization, influencing and being influenced by social and economic transformations. The development of this sector promotes the growth of other areas, mainly through productive agglomerations, which generates numerous positive externalities. Among them, the incentive to innovation, the increased efficiency of processes through automation, the strengthening of knowledge exchanges through networking and the creation of new employment opportunities.

All these factors result in an increase in the productivity of companies that employ the technologies produced in this sector, which directly contributes to the increased competitiveness and market positioning of these companies. In this perspective, investment in this sector is key to local social and economic development, since it enables the creation of

considerable comparative advantages and results in the attraction of capital, companies and skilled labor to act on it. (PEREIRA and SILVA, 2010)

Given the context, this study aims to identify potential productive specialization of the IT sector, a key segment within the broad spectrum of the ICT sector. As the IT sector has shown significant advances that directly impact the productivity and competitiveness of companies, besides representing a great potential in productive innovation and economic diversification, this study will focus on the identification of these potentialities in municipalities in the Northeast. Based on this analysis, it is expected that the results obtained will serve as a basis for studies and actions aimed at formulating and implementing public policies aimed at these municipalities, in order to enhance their economic growth and promote local sustainable development.

The article is structured in three sections, in addition to this introduction. The first points out the importance and contextualization of the IT sector in Brazil, the second describes the methodology adopted in the study and the third analyzes the results obtained. Finally, there are the main conclusions of the work.

2. Theoretical framework

The implementation of technological parks in Brazil is an example of the search for incentives for productive development in the country, since they enable the sharing of innovative productive techniques that contribute directly to the increase in the productivity of companies in the regions where they are implemented and, consequently, increase the wealth produced in these areas. In the Northeast, more specifically in the city of Recife, there is the Porto Digital, considered one of the main technological parks in the country, developed through the union between government, University and private initiative. It is a pole of success that attracts highly qualified professionals, investment capital, consecrated companies and projects that seek in the pole the necessary artifices to be established in the market. Porto Digital, despite its main focus on the IT sector, also seeks to expand to other sectors also linked to Creative Economy, which reinforces the importance and impact of this area on the economy as a whole. (LMA et al., 2022).

Since 2008 and, taking into account this growing influence of Creative Industry on Brazil's economic development, the Firjan system began to make an official mapping of the Information and Communication Technology sector, bringing unique data that demonstrate its impact on the country's economy. The measurement of the impact of Creative Industry is

essential to understand not only the scope, but also the potential of this sector, which, despite the increasing relevance, ends up receiving little attention from the authorities as a potential for local development. As a very heterogeneous area, Firjan (2022) classifies Creative Areas into 4 segments subdivided into 13 sectors. In the Technology segment, there are the sectors of Biotechnology, Research and Development and the Information and Communication Technology sector. Thus, although the focus of this work is Information Technology (IT), it is understood that it is inserted in a broader context of the Information and Communication Technology (ICT) sector. Therefore, understanding the ICT sector panorama in Brazil and the Northeast, through specific assessments aimed at Creative Economy, is essential to evaluate the development of the creative complex in which the IT sector is integrated.

The last edition of Mapping covers the period from 2017 to 2020 and brings important data on the ICT sector in Brazil and the Northeast. It is important to note that the period from 2017 to 2020 includes the first year of the Covid-19 pandemic, so that it is possible to notice the resilience and growth of this sector even in this crisis scenario. The technology segment experienced, as a whole, a growth of 12.8% in employment ties in the period analyzed, while other areas of Creative Industry, such as Culture and Media, suffered strong contractions. In this sense, in view of the positive performance of the technology sector despite the negative shock of Covid-19, an important agenda is opened on the implementation and incorporation of new technologies in the various segments of the economy that depend on face-to-face labor in their production processes. The discussion, in this case, involves the possibility of digitizing some links in the production chains of these sectors, in order to make them more resistant to possible external shocks. This shows how the development of the ICT sector also contributes positively to the growth and security of several other sectors in the economy.

It is possible to notice a growth of 18.5% in the employment relationships of the ICT sector between the years 2017 and 2020 (Firjan, 2022). The growth of this area in Brazil is linked to the increasingly common need to computerize the operational activities of companies, in addition to the concern with the application of technological innovations within Brazilian industries, which aim to increase their relative competitiveness in the market. More broadly, the Technology segment in 2020 corresponded to 37.5% of the total of formal creative links according to the same Mapping (Firjan, 2022).

According to a report made available by the Ministry of Science, Technology and Innovations (MCTI, 2022), the Software and ICT Services Industry in Brazil recorded an estimated production of US$ 53.3 billion in 2021. This significant value, resulting from the IT segment, corresponds to 82.8% of the total services produced by the ICT sector. In addition,

the segment registered a growth of 6.5% compared to 2020, which reinforces the increase in demand for IT products and services in the country. In the same direction, the Brazilian Association of Software Companies (ABES, 2023) points out that Brazil has maintained 1.6% of investments in technology at a global level, in addition to 37.2% of investments in Latin America. Thus, the country is among the 10 largest global powers in the technology market, a significant result that reflects the consistent growth of the IT sector in Brazil in recent years.

Thus, given the growing highlight of the IT sector, the identification of productive agglomerations appears as a key strategic approach to understand the local dynamics linked to the sector. Such agglomerations have the potential to strengthen the economies of the areas where they are established, boosting the economic development of the regions in question.

3. Materials and methods

The present study aims to identify the potential for productive specialization of the Information Technology sector in the municipalities of the Northeast, related to the year 2023. To this end, a widely recognized and consecrated tool was used in the literature, able to carry out this identification in a well structured way: the Location Quotient (LQ). Several studies, such as Rezende and Diniz (2013), apply the indicator in the identification of industrial clusters, aiming to analyze the local productive specialization. The versatility and applicability of this indicator make it particularly effective in this type of analysis. Here it is used to punctuate the potential of specialization, in the recognition that there are other approaches that add to this indicator to corroborate with more accurate results.

The LQ was adapted to use Northeast Brazil as the reference region. The index was obtained through the ratio between two proportions: in the numerator there is the representation of the percentage of the sector chosen in the local economy and in the denominator there is the percentage of the same sector in the national economy. According to Crocco et al. (2006), there is productive specialization of an activity i in a region j when the Location Quotient is greater than 1. However, the authors include two additional criteria to characterize an activity as a local productive specialization. After verifying that the LQ of the activity in the region is greater than 1 (or, in the case of this study, the LQ of the class in the municipality being greater than 1), it is necessary that the activity represents at least 1% of the national employment of that sector.

For this study, this correspondence is made in relation to the regional employment of that specific class, being the relative share equal to the ratio between the employment of class i in the municipality j and the employment of class i in the Northeast. In addition, agglomerations

with LQ greater than 1 and relative share greater than 1% should finally meet the “density criterion”. According to this last criterion, cluster classification is attributed only to productive agglomerations that have at least ten establishments in the sector in question (or class, in the case of this study). Thus, aiming to use the LQ as a tool to identify potential local productive arrangements (LPAs) of activities related to the IT sector, and considering the criteria proposed by the authors in the mentioned study, the present study carried out the estimates of the index respecting these guidelines[1]. The following chapter presents the results found after the application of this index in the data mentioned.

The database used in the study to collect information on employment relationships in Brazil was the Annual Social Information Report (RAIS) from the Ministry of Labor and Employment (MET), for the year 2023. It is important to highlight that RAIS only considers formal contractual relationships, which may lead to underestimation of the total number of employment contracts in the IT sector. In addition, underreporting may also lead to insufficient representation of the labor market related to the sector analyzed, since the data are collected from the sending of this information by the contracting companies. Furthermore, it should be noted that companies whose main activity is not directly related to the area of Information Technology are often classified only according to their majority activity, which can distort the true extent of the sector in the region analyzed.

Nevertheless, despite these limitations, the use of RAIS in a study of this nature is fundamental, as this database allows for both sectoral and geographical analyses. On the one hand, it enables an in-depth assessment of the development and growth potential of a specific sector. On the other hand, it provides detailed data on municipalities, essential for the productive characterization of a region and for the understanding of the local dynamics of that sector.

This study used data from employment relationships of activities related to the Information Technology sector related to 1,794 municipalities in the Northeast region of Brazil. Considering the search for greater specificity, the data published by RAIS regarding the classes that make up the Information Technology services were used to calculate the index proposed for each municipality in the Northeast. Chart 1 shows the classes related to the IT sector (as well as the hierarchy of subdivisions of the sector) defined by CNAE 2.0, the latest version of the classification at the time of this study.

Box 1 – CNAE 2.0 and the subdivisions of the Information and Communication section

Section:	J Information and communication
Division:	62 Information technology service activities

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Group:	62.0 Information technology service activities
Class:	62.01-5 Custom software development
	62.02-3 Development and licensing of customizable software
	62.03-1 Development and licensing of non-customizable software
	62.04-0 Information technology consulting
	62.09-1 Technical support, maintenance and other information technology services

Source: Prepared by the authors.

4. Results and discussion

The Northeast currently has 1794 municipalities. Among these, 182 municipalities had an LQ greater than 1 in at least one of the IT sector classes, indicating a certain level of concentration of economic activity. However, when applying the additional criteria for relative share (RS > 0.01) and minimum density of 10 establishments, this number was reduced to 12 municipalities.

In 2023, therefore, it is concluded that 12 municipalities in the Northeast are characterized as potential local productive arrangements in at least one of the classes of activities related to the Information Technology sector (listed in Chart 1). These municipalities thus represent the main potential for productive specialization in the region. Table 2 presents the complete list of these municipalities.

Box 2 – Municipalities in Northeast Brazil with potential for productive specialization in information technology

State	**Municipality**
MA	Imperatriz
	São Luís
CE	Eusébio
	Fortaleza
RN	Natal
PB	Campina Grande
	João Pessoa
PE	Olinda
	Recife
AL	Maceió
SE	Aracaju
BA	Salvador

Source: Prepared by the authors.

It is observed that only the state of Piauí has no municipality classified as potential LPA in any class of activities related to the IT sector. On the other hand, the capitals of the other states are all characterized as potential PLAs. In addition, both in Ceará and Pernambuco, in which two municipalities were identified as potential LPAs, it is possible to note that these municipalities are geographically very close, which may indicate an integration between them in relation to the activities of the sector in that state.

4.1 Maranhão

In the state of Maranhão, two municipalities were identified as potential PLAs: Imperatriz and São Luís. Table 1 presents the specific class of the IT sector that each of these municipalities has potential for productive specialization. In both, the class identified is "Technical support, maintenance and other information technology services". In the same table, it is possible to observe the Location Quotient (LQ), relative share (RS) and the number of establishments present in the class of highest productive concentration of each municipality.

Table 1 – Local productive arrangements in information technology in Maranhão: LQ, RS and establishments

Maranhão (MA)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Imperatriz	Technical support, maintenance and other information technology services	1.72	1.95%	15
São Luís	Technical support, maintenance and other information technology services	3.69	14.35 %	38

Source: Prepared by the authors.

In the case of São Luís, capital of the state, it is noted that the municipality has a significant concentration of employment in the class of "Technical support, maintenance and other information technology services", accounting for 14.35% of the total jobs of this class in the Northeast. Imperatriz, although she has a lower concentration of jobs in this class, also has an important relative share, with almost 2% of the class jobs in the region.

In view of the concentration of this class in São Luís, and the emerging potential in Imperatriz, the importance of implementing measures that take advantage of the potential promoted by productive agglomeration in IT sector activities is reinforced. Moreover, considering that there is a local structure focused on this specific class, there is an opportunity

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to expand this impact to other classes in the sector in order to foster local and regional development. As an example of local measures aimed at strengthening the Information and Communication Technology sector, two projects have been implemented by Sebrae in the municipality of Imperatriz in 2023. They are the “Ecossistema Local de Inovação” and the “Nordeste On” that seek to encourage the development of the innovation and technology market from a set of actions and projects aimed at promoting competitiveness and dynamism in the internal market. (SEBRAE, 2025)

4.2 Ceará

In the state of Ceará, two municipalities were identified as potential PLAs: Eusébio and Fortaleza. Table 2 details the specific classes of the IT sector in which these municipalities have potential for productive specialization. In Eusébio, the municipality holds this potential in the classes “Development and licensing of customizable software” and “Information technology consulting”. On the other hand, Fortaleza stands out in the classes “Information technology consulting” and “Technical support, maintenance and other information technology services”.

By observing the LQ and RS values for each class in the two municipalities (also presented in Table 2), it is evident the significant relevance that the state of Ceará has in the IT sector in the Northeast region. In the class “Information technology consulting”, for example, where both municipalities are characterized as potential LPAs, they together represent about 77.29% of the total employment of the class in the region, a significant percentage.

Table 2 – Local productive arrangements in information technology in Ceará: LQ, RS and establishments

Ceará (CE)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Eusébio	Development and licensing of customizable software	1.62	6.37%	10
	Information technology consulting	3.89	15.32 %	10
Fortaleza	Information technology consulting	2.42	61.97 %	53
	Technical support, maintenance and other information technology services	1.77	45.33 %	124

Source: Prepared by the authors.

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Fortaleza, the state capital, exhibits a remarkably high relative share in both classes in which it has potential for productive specialization. In addition, the municipality stands out for the considerable number of establishments in each of these classes, which reinforces the importance of the productive agglomeration of companies in the same sector. According to the Ranking Connected Smart Cities 2024, Fortaleza occupies the 4th position on the Technology and Innovation axis among cities across the country. In addition, the city ranks 16th in the ranking of the country's smartest and most connected cities, which reflects its growing influence as a technological and innovative hub nationally. (CONNECTED SMART CITIES, 2024)

The city receives several incentives that contribute to its prominent position in the IT sector. In 2022, for example, the city of Fortaleza sanctioned a tax incentives Act aimed at the IT sector, establishing an automatic reduction of the tax rate to 2% for information technology services that presented a 60% increase in financial performance compared to the previous year. This benefit has been granted to specific services, such as: development and licensing of computer programs, consulting in information technology, data processing, providers and hosting services on the internet and technical support and maintenance of IT services. It is noted that both classes in which Fortaleza has potential for productive specialization were contemplated by this incentive, evidencing the search for the potentialization of areas already highlighted in the municipality, while also creating opportunities for the growth of other classes. (ANUário do CEARÁ, 2022)

In addition to tax incentives, measures such as training in the IT area were also implemented by the city of Fortaleza, with the creation of programs such as “Juventude Digital”, “TechEduca” and “Fortaleza Capacita”. These actions aim to boost competitiveness in the sector, reinforcing the concern with the growth and sustainable strengthening of it and, consequently, the state as a whole. (FI GROUP BRASIL, 2023) Ceará, therefore, has been continuously standing out in the Information Technology sector and this growth has been reflected in the economic performance of the state. According to data released by ACATE (2024), Ceará led the largest revenue evolution in the country's technology sector in 2023, with a discharge of 7.8%. The municipalities of Eusébio and Fortaleza are important examples of the presence and potential of the sector in the state, demonstrating its increasing local and regional relevance.

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4.3 Rio Grande do Norte

In the state of Rio Grande do Norte, only the municipality Natal was considered as potential LPA. The state capital presented potential for productive specialization in three classes of activities related to the IT sector: “Custom software development”, “Development and licensing of customizable software” and “Technical support, maintenance and other information technology services”. Table 3 details these classes, presenting their respective values related to the LQ, RS and the number of establishments.

Table 3 – Local productive arrangements in information technology in Rio Grande do Norte: LQ, RS and establishments

Rio Grande do Norte (RN)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Natal	Custom software development	1.58	3.92%	51
	Development and licensing of customizable software	1.99	4.96%	37
	Technical support, maintenance and other information technology services	1.18	2.92%	60

Source: Prepared by the authors.

Natal presents a number of relevant incentives for the growth of IT-related activities. The Metrópole Digital Technology Park (Metrópole Parque) is a prominent example and success of the integration between the academy, government and private companies in the municipality. The park was created in 2017 by the University Council (CONSUNI) of the Federal University of Rio Grande do Norte in order to drive activities related to technology, innovation and entrepreneurship. In 2023, the park reached the mark of 100 accredited companies, a significant number for this type of initiative, which reinforces the importance of Christmas in the development of activities related to the IT sector in the state. In addition, companies in the sector linked to the park receive several benefits commonly associated with integration to technological parks, such as tax incentives, consultancy and training projects. (UFRN, 2023)

It is also noteworthy that the Christmas note as possible LPA in three of the five classes of activities related to the IT sector is a relevant indicator of the diversity and prominence of the capital as a strategic center for the sector. The continuous growth of this sector, combined

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with the preservation of this diversity of services, is essential for the advancement of local economic development.

4.4 Paraíba

In the state of Paraíba, two municipalities were identified as potential PLAs: Campina Grande and João Pessoa. Campina Grande stands out for its potential for productive specialization in the "Custom software development", being responsible for 1.57% of the jobs of that class in the Northeast. In turn, João Pessoa presents potential for productive specialization in three classes: "Custom software development", "Development and licensing of customizable software" and "Technical support, maintenance and other information technology services". As shown in Table 4, the state capital has a relevant relative share in all classes in which it is classified as potential LPA, with special emphasis on the segment of "Custom software development", in which it concentrates almost 10% of the class jobs throughout the Northeast region.

Table 4 – Local productive arrangements in information technology in Paraíba: LQ, RS and establishments

Paraíba (PB)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Campina Grande	Custom software development	1.72	1.57%	24
João Pessoa	Custom software development	3.18	9.96%	45
	Development and licensing of customizable software	1.98	6.21%	32
	Technical support, maintenance and other information technology services	1.01	3.15%	52

Source: Prepared by the authors.

The state capital, standing out in three of the five classes of activities related to the Information Technology sector, has recognized the growing importance of this sector for its economy and for the improvement of efficiency in public administration. In 2023, João Pessoa city government, through the Municipal Information Technology Unit (UMTI), made an investment of R $ 21 million in a new Data Center, aiming to integrate data processing rooms. This investment reflects the recognition of the positive impact that IT investments can generate internally, contributing to the municipality's infrastructure. (PREFECTURE OF JOÃO PERSON, 2023)

In addition, the launch of the Farol Digital in João Pessoa, in 2022, by Sebrae Paraíba, also reflects the search for increased competitiveness of companies through the implementation of technological innovations in their production processes. The initiative brings together the government, companies, institutions for promotion and education, the Technological Park Horizons of Innovation, as well as several bodies, such as the City Hall. Together, these actors aim to highlight João Pessoa as a strategic technological hub of development and innovation, as well as contributing to the sustainable growth of the state as a whole. (SEBRAE PARIBA, 2023)

Campina Grande, in turn, houses the Fundação Parque Tecnológico da Paraíba (PaqTcPB), a non-profit institution dedicated to the scientific and technological development of Paraíba from the union between academia, companies and government. It is noted, therefore, that, as in João Pessoa, the existence of programs involving several private and public fronts, with the common objective of boosting the growth of the area of Information Technology locally, generating both local and state impacts, reinforces the importance of creating collaborative innovation ecosystems. Thus, Paraíba becomes an increasingly attractive state for companies that seek to work in the sector, and can benefit from agglomeration structures that promote technological development and innovation in collaborative and incentive environments.

4.5 Pernambuco

In Pernambuco, two municipalities were identified as potential PLAs: Olinda and Recife. In Olinda, the class with potential for productive specialization is that of “Custom software development”, with the municipality concentrating 2.29% of the class jobs throughout the Northeast region. Recife is configured as a potential LPA in three classes: “Custom software development”, “Development and licensing of customizable software” and “Development and licensing of non-customizable software”. Regarding the relative share of capital, there is a considerably high concentration of jobs in these classes, with Recife holding 18.83%, 38.13% and 37.88% of the jobs in the region, respectively. Thus, Recife not only presents potential for productive specialization in three of the five classes of the IT sector, but also represents a significant portion of employment in each of them, which puts the municipality in focus as a hub of concentration of the sector. Table 5 details these classes, presenting the respective relative values of the LQ, RS and the number of establishments.

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Table 5 – Local productive arrangements in information technology in Pernambuco: LQ, RS and establishments

Pernambuco (PE)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Olinda	Custom software development	4.48	2.29%	12
Recife	Custom software development	1.84	18.83 %	84
	Development and licensing of customizable software	3.72	38.13 %	95
	Development and licensing of non-customizable software	3.7	37.88 %	36

Source: Prepared by the authors.

The city of Recife consolidated itself as a reference in the IT sector, presenting continuous growth and generating considerable impacts on the local and state economy. Porto Digital, located in Recife, stands out as one of the most important technological poles in Brazil, with direct effects on the city's economy. Created in 2000, Porto Digital was designed and developed from the collaboration between three key actors for the advancement of productive agglomerations: the government, the private initiative and the academy. In addition, the technological pole is directly linked to educational institutions such as CESAR School (Centro de Estudos e Sistemas Advançadas do Recife), an institution of higher education recognized nationally in the area of Science and Technology. This internal dynamic, which unites education, innovation, entrepreneurship and public policies, has driven the constant growth of the pole and, consequently, of Recife itself. (DIGITALPORT, 2025)

According to Porto Digital (2025), the technological park experienced a growth of 14% in its revenue, with the revenue of its companies reaching the expressive mark of R$ 5.4 billion in the year 2023. These results reinforce the importance of the IT sector for the city of Recife, showing both the impact on economic growth and the positive externalities generated by the technological concentration in the city. Thus, when considering productive agglomerations with potential for specialization, Porto Digital appears as the highest reference in Recife. This is due to its scope and its capacity to attract innovative companies and skilled labor, consolidating it as a highly dynamic and innovative technological hub, which contributes considerably to the strengthening of the competitiveness of companies in the sector.

In addition, a differential that contributes to the highlight of Recife, as evidenced by its expressive participation in IT classes presented in Table 5, is its high geographical concentration of students in the Information Technology sector. As pointed out by Porto Digital

(2025), the systematization of data from the Higher Education Census 2023, conducted by the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep), reveals that Recife has the highest number of IT students per inhabitant, with 658 IT students for every 100,000 inhabitants. The presence of a large number of IT students in a municipality that already concentrates a large number of companies in the sector is an extremely positive indicator, since, in a context of increasing demands by qualified professionals, this proximity facilitates the absorption of this labor in the local market. This phenomenon results in a virtuous cycle, since the training and absorption of qualified professionals is directly linked to the growth and evolution of the Information Technology sector in the city.

Finally, according to the Secretariat of Economic Development of Recife (2025), the capital of Pernambuco also has specific tax incentives directed to information technology companies located in Porto Digital. According to this tax incentive program, companies and establishments linked to Porto Digital have a 60% reduction in the tax rate on the Service of Any Nature (ISSQN), resulting in a tax burden of 2%.

All these factors show how the integration of agents – such as the educational system, private initiative and public policies – is fundamental to the formation and strengthening of local productive arrangements (LPAs), which demonstrate continuous and sustainable growth. The formation of environments of this nature stimulate the dynamicity and competitiveness of the sectors involved, which results in local social and economic development.

4.6 Alagoas

In the state of Alagoas, only Maceió was identified as potential LPA. The class in which the municipality has potential for productive specialization is that of “Development and licensing of customizable software”, with relative share of 2.85% (as can be observed in Table 6).

Table 6 – Local productive arrangements in information technology in Alagoas: LQ, RS and establishments

Alagoas (AL)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Maceió	Development and licensing of customizable software	1.38	2.85%	13

Source: Prepared by the authors.

The recognition and use of IT sector LPAs in a municipality are fundamental, considering their transformative potential. Thus, the inclusion of policies that stimulate activities linked to a growing sector, such as IT, contributes directly to local economic development. In 2019, the Ordinary Law no. 6.902/2019 was sanctioned in Maceió, which establishes the Municipal Policy of Science, Technology and Innovation. This Law seeks to encourage innovation in the productive sector, promote a digital economy (through companies focused on research and technology), improve the technological infrastructure of the city and qualify the workforce to meet the demands of the digital market. To achieve these goals, the Law indicates several mechanisms for encouraging and promoting technology, innovation and science in Maceió, such as the Municipal Science, Technology and Innovation Fund (FMCTI) – that finance projects aligned with the purpose of the Law; granting financial, human, material or infrastructure resources; and the Inova Mcz Award, which recognizes innovative initiatives in the municipality that positively impact society and the local economy. (MACEIÓ, 2019) Incentive measures, such as the Law mentioned, are essential not only for the advancement of IT sector activities in which the municipality already stands out, such as the "Development and licensing of customizable software", but also to boost the diversification of the activities of this sector in Maceió. Support for the Information Technology PLAs is essential to enhance the local economy, as it increases the internal competitiveness of the market and fosters innovation, promoting continuous and sustainable growth for the municipality.

4.7 Sergipe

In Sergipe, the municipality identified as potential LPA was its capital, Aracaju, with potential for productive specialization in the classes "Custom software development" and "Development and licensing of customizable software". Table 7 shows the LQ, RS and the number of establishments in each prominent class of the municipality.

Table 7 – Local productive arrangements in information technology in Sergipe: LQ, RS and establishments

Sergipe (SE)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Aracaju	Custom software development	1.59	2.80%	30
	Development and licensing of customizable software	1.75	3.08%	16

Source: Prepared by the authors.

As already mentioned, collaboration between public and private actors plays a crucial role in the development of productive agglomerations, as it drives companies in the sector and encourages the entry of new businesses, promoting a dynamic and competitive environment. In the case of Aracaju, which has specialization potential in two of the five classes of activities related to the IT sector, this interaction is especially important, since it can take advantage of the emerging structure of the highlighted classes to attract new enterprises and diversify the activities of the sector. In 2022, for example, two important bodies were created to unite the private and public initiative in projects that aimed, among other projects, the development of the sector: the Municipal Secretariat of Economic Development and Innovation and the Municipal Council of Science, Technology and Innovation (CMCTI). The CMCTI, uniting companies, universities and municipal secretaries, aims to attract startups and develop technologies that highlight Aracaju nationally and contribute to local economic growth. (ARACAJU, 2024a)

In addition, the first innovation hub of Aracaju, the Caju Hub, was inaugurated in 2024. From the union of public and private initiatives, the hub offers training for young people in the Information Technology sector and incentives for entrepreneurship in the technology sector. In the same year, another training program was also created, the “Jovem Tech”, which will be a qualification program for 600 young people with the aim of inserting them in the labor market. Thus, it is observed that the municipality recognizes its potential in the sector and has been strategically investing in attractive environments that promote the productive agglomeration of companies in the technology sector, as well as empowering young people to meet the internal demand for skilled labor. Thus, from investments in infrastructure, training and incentives to the IT sector, Aracaju seeks to consolidate itself as an emerging pole of innovation and technology. (ARACAJU, 2024b)

4.8 Bahia

In the state of Bahia, there was only one potential LPA: Salvador. The state capital has considerable potential for productive specialization in the “Custom software development” class. With 67 establishments, Salvador concentrates almost 30% of the jobs of this class throughout the Northeast region, as can be seen in Table 8. In addition, the LQ of Salvador also stands out, reaching 3.51, which shows the high concentration of specialized activities in the city.

Table 8 – Local productive arrangements in information technology in Bahia: LQ, RS and establishments

Bahia (BA)				
Municipality	**Class**	**LQ**	**RS**	**No. of establishments**
Salvador	Custom software development	3.51	29.58 %	67

Source: Prepared by the authors.

With a significant relative share of jobs in the class in which he has productive specialization, Salvador has stood out within the IT sector. The city houses Bahia Technological Park, a strategic enterprise that brings together the productive sector, universities and government, in order to boost entrepreneurship and local technological and scientific development. The park aims to attract companies, strengthen production, disseminate knowledge, provide infrastructure and contribute to innovation in production processes. Thus, the objective is to increase the competitiveness of companies in the city, in order to contribute to the continuous and sustainable development of the state as a whole, given the relevance of the IT sector for regional economic growth. (Technological Park of Bahia, 2024)

In addition, the Information Technology sector in Salvador also has tax incentives provided by Municipal Innovation Law no. 9.534/2020. This legislation grants the reduction in the tax rate on Services (ISS), from 5% to 2%, in addition to the 50% reduction in the property tax and urban territorial (IPTU) for the properties that house IT activities. Such incentives play an essential role in the city's attractiveness for companies in the sector, which contributes to the strengthening of Information Technology LPAs in the region. (SEMIT, 2025)

Thus, considering the important role that Salvador plays in the class “Custom software development” and the measures to encourage the IT sector in the municipality, it is noted that the city is positioned as an emerging technological pole, which contributes to the attraction of companies in the sector, investments in the area and skilled labor. Taking into account its significant relative share in one of the five classes of activities related to the IT sector, it is observed that the continuity and expansion of incentives in the sector have the potential to further strengthen Salvador's prominence in the area. In addition, these measures are able to increase the influence of the municipality in the other classes of the sector, making its economy even more dynamic and competitive, besides promoting the diversification of local productive activities.

Final considerations

This study aimed to characterize the Information Technology sector and identify the municipalities in the Northeast that have potential for productive specialization in this sector. The identification of this potential was performed through the use of the Location Quotient, complemented by specific filters that enabled the definition of potential local productive arrangements in the region.

However, although there are limitations resulting from the underestimation of data, associated with the database used, the available information proved to be sufficient to provide solid and consistent results. This possible underestimation is the result of RAIS only considering formal self-declared bonds. In addition, many companies, although acting in the IT sector, do not categorize themselves as companies in this sector, since their main activity may be linked to another sector. This underestimation may result in underreporting of some municipalities as potential LPAs in the sector, even if they have characteristics that make them able to classify themselves as such. However, it is emphasized that the municipalities identified by the methodology and the available data are representative and, in fact, have a local productive agglomeration structure focused on the IT sector.

Therefore, it is concluded that the identification of municipalities with potential for productive specialization, in a sector as dynamic and strategic as that of IT, is fundamental to understand the internal structure of a region, in addition to indicating the potential for economic growth that can be driven from the recognition of these areas as LPAs. Thus, this study is expected to serve as a basis for future investigations into the internal dynamics of each of the municipalities identified as potential LPAs in the IT sector, promoting the development of effective public policies aimed at its development. In addition, the study can serve as a basis for investigations that measure the impact of the IT sector on the identified sites, as well as evaluating the sector's progress over the years. Thus, the objective is to take advantage of the potential of a sector so promising in municipalities that they are structurally fit and with growth prospects in it.

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