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How Recife turned existing computer-science talent and a declining historic port district into a technology ecosystem of more than 500 companies, through a nonprofit intermediary that kept government, universities and firms working on the same territory for 25 years.

Key insights

Coordination can be institutionalised

coordination can be institutionalized. NGPD created a permanent structure through which actors with different mandates could align priorities, mobilize resources, and respond to shared constraints.

A territory can carry regional goals

place-based economic development can use a specific territory to advance broader regional goals. Recife Antigo anchored the cluster, while urban regeneration remained an explicit part of a wider strategy to build firms, jobs, and innovation capacity in Pernambuco.

Durable intermediaries outlast the first constraint

durable intermediaries matter because constraints change over time. As Porto Digital matured, the same institutional architecture could be used to respond to new bottlenecks, including the shortage of skilled workers.

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At the end of the 1990s, Recife, the capital of Pernambuco and the center of a metropolitan region that today has more than 3.7 million residents, already had a strong base of computer science talent and research. But much of that talent was leaving Pernambuco in search of opportunities elsewhere, and Recife Antigo, the city's historic port district, had lost much of its former economic role. Twenty-five years later, the region is now home to hundreds of technology firms and more than 24,000 workers.

This transformation was not driven by a single tax incentive or by one anchor company. Porto Digital developed as a broader innovation district and ecosystem, while a separate nonprofit organization, the Núcleo de Gestão do Porto Digital (NGPD), was created to manage the initiative and coordinate the public, academic, and private actors involved in it. Rather than relying on temporary partnerships, NGPD provided a permanent structure for organizing these actors around a common strategy as the needs of the cluster changed. This turnaround is a story of how local capabilities can be turned into a place-based innovation strategy, through enduring institutional coordination mechanisms, rather than temporary partnerships.

Background: local capabilities, fragmentation and a declining center

Recife had a baseline asset that could support this transition. The city had built a strong base of knowledge in information technology around the Federal University of Pernambuco. Its Center for Informatics had trained professionals and developed research capabilities over several decades. CESAR (Recife Center for Advanced Studies and Systems), created in 1996 by professors linked to CIn, added a more applied dimension to this ecosystem. As a private nonprofit innovation center, it worked more directly with firms and helped translate academic knowledge into technology projects responding to market demand (Lima et al., 2022). But building a regional technology cluster required coordination across a wider set of actors and resources, including public policy, infrastructure, territorial investment, universities, and firms. These capabilities had not yet been articulated into a consolidated local innovation system.

At the same time, Recife faced a second challenge in its historic center. The Bairro do Recife, also known as Recife Antigo, contained historic buildings and infrastructure in an area that had lost part of its previous economic role. (Rapetti et al., 2022).

These two challenges came together in the design of Porto Digital. Recife had technical knowledge and institutions, but they were not yet generating a technology sector at the scale policymakers hoped to achieve. It also had a historic central district that could provide a physical base for a new cluster. The policy challenge was therefore not simply to attract technology firms. It was to connect existing capabilities, create stronger links with the market, and organize those efforts around a specific

territory. Porto Digital was created in 2000 as a public policy for the development of Pernambuco's information technology sector, with NGPD established to manage the initiative under a Triple Helix model.

Research on Porto Digital describes the articulation of a relationship between the state, CIn, CESAR, and private firms as an important institutional change in the development of Pernambuco's technology sector (Lima et al., 2022). Porto Digital would also go on to become part of a broader effort to reuse Recife's built environment and bring new economic activity into the center. This urban dimension became closely linked to the technological development strategy. The narrative around Porto Digital therefore treats the project not only as the development of an innovation cluster, but also as a process of urban, economic, social, and governance renewal (Rapetti et al. 2022).

The Intervention

Phase 1: Building on Existing Capabilities

By the late 1990s, Recife already had an important base of technical knowledge. The Federal University of Pernambuco (UFPE) had been training computer science professionals for decades, and its Center for Informatics (CIn) had developed strong research capabilities. But the local economy was not absorbing much of this talent. More than 70 percent of CIn graduates in 1992 had left Pernambuco or Brazil (Lima et al., 2022). The problem was therefore not simply a shortage of skills or the absence of research capacity, but a limited local market for turning that knowledge into firms, products, and careers.

One early attempt to close this gap came from the university itself. In 1996, professors linked to CIn created CESAR, a private nonprofit innovation center. One of its goals was to bring more complex technology projects to Pernambuco and create opportunities for local talent. CESAR attempted to change how research connected with the market. Instead of focusing mainly on technologies developed inside the university and then looking for applications, it worked more closely with firms and their needs. This helped strengthen links between researchers, businesses, and entrepreneurs before Porto Digital was formally created (Lima et al., 2022).

The remaining challenge was broader than connecting research to firms. Building a technology cluster required coordinating resources controlled by different institutions: the state could provide investment and infrastructure; the municipality controlled local policy instruments; universities supplied research and talent; and firms controlled investment and employment. No single actor could assemble these inputs on its own.

Porto Digital built on Recife's existing capabilities. In 2000, the Government of Pernambuco launched

the initiative together with UFPE and private sector actors. The state provided R$33 million for the initial infrastructure, using resources from the privatization of the state electricity company Celpe. Public investment alone, however, did not solve the coordination problem described above. NGPD's value was to give the initiative a management structure capable of working across institutional boundaries. Its cross-sector board created a recurring forum in which representatives from government, universities, firms, and civil society could set priorities, review results, and redirect strategy, while its management team translated those priorities into programs and projects and helped mobilize the resources needed to implement them (Melo, 2020; Oliveira & Silva, 2025). Rather than concentrating responsibility in a single public agency, the model allowed different institutions to retain control over their own resources while coordinating them around a shared strategy. This arrangement gave Porto Digital an institutional base for coordination. Therefore, the different actors retained distinct roles. The state provided investment, policy support, and infrastructure; UFPE supplied research and technical talent; CESAR connected knowledge to market demand; and private companies brought investment, projects, and jobs.

NGPD did not replace any of them. Its role was to keep these contributions aligned and to create a recurring mechanism for addressing problems that crossed organizational jurisdictions. In this sense, Porto Digital did not create Recife's technology capabilities from scratch. Its first contribution was to organize capabilities that were already present and connect them to a broader strategy for local economic development.

Phase 2: Combining economic and urban development

Once the institutional structure was in place, the next step was to give the emerging ecosystem a physical center. Porto Digital was established in Recife Antigo, the city's historic port district. The choice of Recife Antigo was deliberate. An alternative proposal would have concentrated new investment around the university campus, but the Government of Pernambuco instead tied its initial investment to locating the project in the deteriorated historic port area. The technology strategy was therefore linked from the outset to the regeneration of Recife's historic center (Zouain & Plonski, 2015). Porto Digital was conceived as an open urban district, with firms and innovation organizations occupying existing streets and historic buildings rather than a technology park separated from the city. Urban regeneration, however, was not the broader economic objective. Recife Antigo provided a territorial anchor for a strategy aimed at building technology firms, employment, and innovation capabilities in Recife and Pernambuco.

The territorial focus also shaped the policy instruments used to build the cluster. Public investment supported telecommunications and other infrastructure, while buildings in the historic center were adapted for new uses. Municipal policy created incentives for technology firms to locate inside the

Porto Digital area. Recife's incentive program eventually included a reduced municipal service tax for qualifying firms located within the designated territory. The legal framework tied these benefits to a specific part of the city rather than offering them to technology companies anywhere in Recife. Firms were encouraged to locate near other technology companies, research organizations, public agencies, and support institutions. The strategy also sought to create new firms rather than only attract existing ones. Porto Digital developed incubation and acceleration programs for technology ventures, building on the entrepreneurial pipeline that had emerged around CIn and CESAR. These programs provided early-stage firms with incubation, mentoring, business development support, and connections to the wider innovation ecosystem. Over time, Porto Digital developed dedicated structures for this work, including C.A.I.S. do Porto and later Jump Brasil, its entrepreneurship arm (Zouain & Plonski, 2015; Porto Digital, n.d.).

NGPD coordinated this process, but it did not carry it out alone. Municipal and state governments controlled policy instruments and public resources; firms decided whether to establish or expand operations in the district; universities and innovation organizations supplied talent and technical capabilities; and property owners controlled much of the built environment. NGPD's role was to align these separate decisions around the development of the district. In the real estate component, for example, NGPD worked with property owners and contractors to bring historic buildings back into use and developed financing arrangements to rehabilitate properties subject to heritage restrictions (Zouain & Plonski, 2015).

Over time, the strategy moved beyond attracting firms to the original area. The municipal framework expanded the geographic coverage of Porto Digital and later included parts of Santo Amaro and other areas of Recife's center. The range of activities also broadened beyond information and communication technology to include parts of the creative economy. Still, the basic logic remained territorial. Access to some incentives continued to depend on locating activities within the areas defined by the Porto Digital program. The territorial strategy therefore evolved with the ecosystem rather than remaining confined to the original historic district.

The physical transformation became increasingly visible as the ecosystem grew. Porto Digital reports that more than 230,000 m^2 of historic property have been brought back into use over the life of the project, although only around 30,000 m^2 were rehabilitated directly by NGPD. The distinction is important. Much of the urban recovery involved firms, property owners, governments, and other investors responding to the wider development of the district, rather than construction managed directly by Porto Digital itself.

The project was therefore more than a collection of technology incentives. It combined firm development, infrastructure, entrepreneurship support, and urban regeneration within a defined territory, while NGPD helped align the actors and resources behind each component.

Phase 3: Adapting to the Talent Bottleneck

By 2021, Porto Digital started facing a different problem. The ecosystem had grown so much that now firms were struggling to find enough qualified workers. At the time, Porto Digital reported more than 2,500 open positions across its 340 companies. This was despite the hiring of more than 1,700 workers during 2020. Firms were also expecting around 3,000 additional openings during 2021. The constraint was no longer only how to attract technology companies to Recife. It was also how to expand the local supply of workers able to fill the jobs those companies were creating.

The City of Recife and Porto Digital responded by launching Embarque Digital in September 2021. The municipality committed R$30 million to finance 2,000 places in technology degree programs through 2024. The program targeted Recife residents who had completed secondary school in the public education system. The first group included 200 students. The program also tried to connect education more closely to the needs of local firms. Students enrolled in degrees such as Systems Analysis and Development and Internet Systems at partner higher education institutions. A key part of the model is the Porto Digital Technological Residency. Students work on practical challenges proposed by participating companies, bringing training closer to the type of work available in the local technology sector.

Embarque Digital shows how the coordination model behind Porto Digital could be adapted when the main constraint changed. The municipality financed access to higher education, universities delivered the training, and firms provided information about skill needs and participated through the Technological Residency. Porto Digital helped connect these different inputs within a common program. The intervention also added an inclusion objective by directing public resources toward students from public schools rather than relying only on the existing pool of highly trained workers. Importantly, these relationships did not have to be built from scratch. By 2021, firms, government, and higher education institutions were already connected through an institutional network that had developed around Porto Digital over the previous two decades. Embarque Digital could therefore draw on an existing structure to combine resources across organizations and respond to a new market constraint, consistent with research on NGPD's adaptive governance model (Oliveira & Silva, 2025).

Stakeholder Roles

Porto Digital depended on several institutions that controlled different parts of the local innovation system. No single actor had the resources or authority to build the cluster alone. The state government controlled public investment and science and technology policy. The City of Recife controlled local tax incentives and important parts of the territorial and urban policy. UFPE and CESAR supplied research capabilities, technical knowledge, and talent. Firms brought investment, jobs, and information about

market and skill demand. NGPD sat between these actors and provided a permanent structure for coordination.

Role	Actor	Main function
Public sponsor and policy maker	Government of Pernambuco	Initial public investment, science and technology policy, infrastructure, and institutional support for Porto Digital
Local public partner	City of Recife	Territorial policy, municipal tax incentives, urban coordination, and later workforce programs such as Embarque Digital
System orchestrator	NGPD	Manages the district, connects government, firms, academia, and civil society, and coordinates programs and resources across the ecosystem
Knowledge and innovation base	UFPE/CIn and CESAR	Research, technical talent, applied innovation, and links between academic knowledge and market demand
Firms and startups	Technology companies	Investment, employment, innovation projects, and information about the needs of the local market
Capacity builders	Partner universities and training institutions	Technology education and work based training, particularly through Embarque Digital and the Technological Residency

NGPD's role was especially important because it coordinated resources it did not directly control. Board members acted as bridges to the institutions they represented, allowing problems identified within Porto Digital to be connected to public agencies, universities, or firms with the authority or resources to respond. This arrangement also appears to have helped build credibility over time. NGPD combined cross-sector representation with formal accountability and repeated implementation across institutional boundaries, while research on its governance identifies strong relationships of trust and cooperation among board members (Melo, 2020; Oliveira & Silva, 2025).

This division of roles helps explain the model. Porto Digital was not implemented by one agency

delivering a fixed package of support. It depended on an intermediary that could connect problems to actors with different mandates and mobilize their contributions as the needs of the cluster changed.

Results

Porto Digital has reached a scale that is very different from the technology ecosystem that existed at its launch. By 2020, the district included around 330 companies and other organizations and employed approximately 11,000 professionals. Firm revenue reached around R$2.3 billion in 2019. These figures show the scale Porto Digital had reached after two decades, compared with the more fragmented local technology system that preceded its creation (Lima et al., 2022; Rapetti et al., 2022).

Growth continued after that period. Porto Digital's latest annual survey reports that the ecosystem reached 541 companies and 24,079 workers in 2025, with combined annual revenue of R$7.4 billion. The business base now includes startups, local technology firms, national companies, and multinational firms. These figures come from Porto Digital's annual survey, conducted with local business associations and using municipal and fiscal information. They provide useful evidence on the scale and evolution of the district, but they should not be interpreted as a measure of causal impact.

The urban transformation has also been substantial. Porto Digital now covers 171 hectares across parts of Recife's historic center. It reports that more than 230,000 m^2 of historic property have been restored since the project began. Historic buildings in the district have been adapted to accommodate technology, innovation, and creative economy activities. The restoration figure includes investments made by a broader group of public and private actors, so it does not represent property rehabilitated directly by NGPD.

There are also early signs that the later workforce strategy is helping connect students to technology jobs. By the end of the first cycle of Embarque Digital in 2024, the program had supported 2,030 students. The City of Recife reported employment rates of around 60 percent among students in graduating cohorts. These results are relevant given the program's focus on public school graduates and its effort to connect training with firm demand. However, these are administrative program data. The research reviewed for this snapshot did not identify an independent impact evaluation that estimates how participants would have performed without the program.

Independent research provides a more cautious view of Porto Digital's broader economic results. Fernandes and Lacerda (2023) compare software employment in Recife with nine other Brazilian capitals and examine real estate data from Recife's historic center. They find that public policies helped produce an agglomeration of technology firms. At the same time, they find clearer evidence of property appreciation than of exceptional technological dynamism when Recife is compared with other Brazilian cities. Their findings suggest that the transformation of Recife Antigo cannot be understood

only through the growth of the technology sector. It also raises a broader distributional question for the case: who captures the gains when an innovation strategy also increases the value of urban land?

The available evidence supports a more limited conclusion than the headline growth figures might suggest. Porto Digital has built a large and durable concentration of firms and workers, and Recife Antigo has undergone a significant physical transformation. What the evidence cannot establish is how much of this growth would have happened without Porto Digital or how much can be attributed to any single part of the intervention. Rapetti et al. (2022) address this problem by tracing economic, urban, social, and governance indicators over the development of the district rather than treating its growth as the effect of one policy instrument.

Looking Ahead

Porto Digital's next challenge is less about proving that the cluster can grow and more about how that growth is governed and distributed. The governance model has created durable relationships between public, private, and academic actors. Research on the NGPD board finds strong ties of trust and cooperation among its members, but also suggests that the network could benefit from broader connections with actors outside the core group (Melo, 2020).

The urban side of the model also creates a distributional question. Fernandes and Lacerda (2023) find that Porto Digital helped produce an agglomeration of technology firms, but that real estate appreciation in Recife's historic center is more visible in the data than exceptional technological dynamism relative to other Brazilian capitals. As the district continues to expand, this raises questions about who benefits from the increase in land values and whether the wider gains from regeneration extend beyond firms and property owners.

Workforce inclusion is another area to watch. Embarque Digital has widened access to technology training for public school graduates and administrative data show that many graduates are entering employment. However, the available evidence still does not tell us how much the program changes employment or income compared with what would have happened without it.

These questions do not take away from Porto Digital's achievements. They point to the next stage of the model: sustaining growth while widening access to its benefits and keeping the governance structure open enough to respond to new actors and new constraints.

Conclusion

Porto Digital did not create Recife's technology capabilities from scratch. Its contribution was to

organize existing strengths through a durable institutional model, and to pivot appropriately as the labor market changed over time.

Three lessons stand out. First, coordination can be institutionalized. NGPD created a permanent structure through which actors with different mandates could align priorities, mobilize resources, and respond to shared constraints. Second, place-based economic development can use a specific territory to advance broader regional goals. Recife Antigo anchored the cluster, while urban regeneration remained an explicit part of a wider strategy to build firms, jobs, and innovation capacity in Pernambuco. Third, durable intermediaries matter because constraints change over time. As Porto Digital matured, the same institutional architecture could be used to respond to new bottlenecks, including the shortage of skilled workers.

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