IJSSR
International Journal of Social Service and Research

Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)
Vol. 6, No. 7, July 2026
*e*-ISSN: 2807-8691 | *p*-ISSN: 2807-839X

# Do Data Centres Create Jobs? Comparing Digital Infrastructure, Manufacturing, and Tourism in Batam, Indonesia

**Gracia Billy Mambrasar**
Politeknik Negeri Batam, Indonesia
Email: graciabillymambrasar@polibatam.ac.id

**Keywords:**
batam data centres; unemployment; manufacturing; tourism; digital infrastructure.

**Abstract**

Batam, Indonesia, has grown into a regional digital infrastructure hub, particularly through the development of data centers in Nongsa and other investment promotion initiatives. This article examines whether data center investment in Batam can reduce unemployment to the same extent as the manufacturing and tourism sectors. Through a comparative documentary analysis, this study draws on Batam's official labor market profiles, investment announcements, policy reports, and literature related to data centers, manufacturing, tourism, and employment multipliers. The results show that Batam's labor market challenges are broad-based and primarily related to medium-skilled employment. In 2025, Batam recorded 49,931 unemployed individuals and 29,710 job seekers, with most job seekers being senior secondary education graduates. In contrast, large-scale data center projects require substantial investment but generate relatively limited direct employment opportunities. For example, a US$5 billion AI data center project in Nongsa is projected to create only 700–800 professional jobs in 2025, representing approximately 1.4%–1.6% of Batam's unemployed population. Data centers, therefore, are expected to play an important role in long-term digital transformation, infrastructure development, and the creation of high-skilled employment; however, they are unlikely to become the primary driver of short-term employment growth. Manufacturing and tourism remain more viable short- and medium-term employment sectors, as they are better aligned with Batam's labor market structure and can generate broader direct, indirect, and induced employment opportunities. This article concludes that Batam should pursue a layered development strategy that integrates digital infrastructure investment with labor-intensive and service-oriented economic sectors.

## INTRODUCTION

Batam has played a unique role in Indonesia's regional development for decades. Since the establishment of a special economic institutional framework on the island in the 1970s, the national government has positioned Batam as one of the key hubs for industrialization, international trade, and investment-led development (Sutiyo et al., 2026). It subsequently developed into a bonded zone and later a Free Trade Zone and Free Port, which introduced relatively open regulatory and fiscal policies to attract foreign direct investment (FDI), encourage domestic investment, stimulate manufacturing activities, and strengthen Indonesia's participation in regional and global production networks (Kurniawan et al., 2017. Due to its industrial estates, foreign-owned enterprises, export-oriented activities, and supporting infrastructure development, Batam has become one of Indonesia's most important subnational centers of investment and industrial growth (Aritenang & Chandramidi, 2020).

Batam's institutional and economic orientation differs from that of many other Indonesian cities, which are primarily governed through local government structures with greater local autonomy and limited involvement from centralized administrative authorities. Since its establishment as a national industrial and investment zone, Batam has operated under a unique multi-authority governance structure involving the Batam City Government, the central government, and the Batam Free Trade Zone Authority (BP Batam). This governance arrangement has resulted in overlapping responsibilities in areas such as investment licensing, land administration, infrastructure development, and spatial planning, creating challenges for policy coordination and implementation (Indra & Fauzan, 2023; Situmeang et al., 2021; Sutiyo et al., 2026).

Therefore, Batam is better understood as a special-zone economy shaped by national development strategies rather than solely as a local municipality. Its development has been influenced by the interaction between decentralization policies, national development priorities, Free Trade Zone policies, and ongoing competition for regulatory authority between national and local institutions (Karim, 2019; Zaenuddin, 2025). In Batam, economic and employment outcomes are determined not only by local market conditions but also by national policies concerning trade, investment, industry, land management, and spatial development. Consequently, the success of Batam's Free Trade Zone depends on regulatory quality, institutional coordination, infrastructure readiness, investment facilitation, and collaboration between national and regional development planning frameworks (Kurniawan et al., 2017; Wahyuni et al., 2025).

Trade liberalization and foreign direct investment have promoted industrialization and participation in global production networks; however, the local benefits have depended on domestic firm capabilities, production linkages, and business institutions rather than occurring automatically. Government policies and special-zone strategies have also contributed to firm productivity and industrial performance in Batam (Aritenang & Chandramidi, 2020). These findings indicate that Batam's development trajectory, industrial structure, and employment-generating capacity are strongly influenced by policy decisions at multiple levels of government, particularly those related to investment, industrial location, land use, infrastructure, and regional economic integration. More recently, however, Batam's development agenda has gradually shifted from manufacturing and logistics toward digital and technology-oriented investment.

This transition is particularly evident in the development of Nongsa Digital Park, a policy-supported Special Economic Zone designed to position Batam as a regional digital hub due to its proximity to Singapore and the growing demand for data centers and digital businesses in Southeast Asia (Muzwardi et al., 2024). Batam's broader technological transformation is reflected in its efforts to support Industry 4.0 readiness, Internet of Things (IoT)-based infrastructure for smart manufacturing, and the digitalization of port operations (Fajrah et al., 2023; Nashiruddin & Winalisa, 2020; Sari & Pamadi, 2019). These developments suggest that Batam is being repositioned as a platform for digital infrastructure, technology-intensive industries, and smart logistics. However, current evidence more strongly supports the view that these initiatives represent a new policy direction and the formation of a digital ecosystem rather than the final stage of Batam's transformation from a regional digital economy hub into a regional digital infrastructure center. Digital infrastructure is increasingly

recognized as an important factor influencing regional competitiveness, economic growth, and investment attraction.

Evidence from Indonesia demonstrates that digital infrastructure development can contribute to provincial economic growth and generate spillover effects across administrative boundaries (Faisal et al., 2025). Digitalization may also strengthen the impact of FDI on regional economic performance; however, these effects depend on the interaction between ICT readiness, institutional capacity, infrastructure quality, and the availability of skilled human resources (Nafisah & Kusairi, 2026; Supriyanto et al., 2025). The development of Nongsa Digital Park reflects Batam's emergence as a regional digital center based on its strategic location near Singapore, investment-oriented development model, and future potential in data centers and digital services (Muzwardi et al., 2024). This direction aligns with Batam's strategic role as a Free Trade Zone and Free Port. Nevertheless, transforming digital infrastructure investment into long-term regional economic development and sustainable growth requires continued efforts to strengthen data center infrastructure and related supporting ecosystems.

Data center infrastructure also needs to be integrated with Batam's clean energy and energy security objectives, as the competitiveness of data centers is highly dependent on reliable power supply, renewable energy availability, grid capacity, and environmentally sustainable infrastructure (Muzwardi et al., 2025; Putri Utami et al., 2026). The literature suggests that Batam's digital infrastructure and data center ecosystem can serve as strategic investment assets to enhance regional growth, attract FDI, and contribute to economic structural transformation. However, these benefits are also conditional upon improvements in energy capacity, human capital development, regional industrial linkages, and institutional capacity.

BP Batam has also highlighted digital-sector investment as part of a broader transformation toward a digitally oriented and sustainable energy economy, in which data centers can become a new strategic pillar of Batam's investment strategy (BP Batam, 2026). This transformation could strengthen Batam's regional competitiveness, attract technology-oriented FDI, and reinforce the city's position within the Singapore–Johor–Batam economic corridor. However, the value of data center investment should not be assessed solely in terms of capital inflows, technological advancement, and infrastructure development. It should also be evaluated based on its capacity to create employment opportunities and distribute economic benefits within the local economy. Therefore, the main question of this article is not whether data centers are strategically important, but whether they are effective in reducing unemployment.

This question is particularly relevant given the persistent labor market pressures in Batam. In 2025, Batam's labor force reached 659,645 people, consisting of 609,714 employed individuals and 49,931 unemployed individuals, with an unemployment rate of 7.57% (BPS Kota Batam, 2026). In addition, there were 29,710 registered job seekers, most of whom were senior-secondary education graduates. These labor market characteristics indicate that Batam's employment challenge is not limited to the availability of highly skilled digital workers but also involves insufficient employment opportunities for medium- and secondary-educated workers. Therefore, although Batam's data center development strategy represents an important pathway for economic diversification and technological transformation, it is unlikely to reduce

unemployment to the same extent as manufacturing and tourism. The underlying reason is structural. Data centers are highly capital-intensive, operationally efficient, and selective in their demand for specialized technical skills. Although they can generate substantial investment value and create demand in construction, electricity, telecommunications, security, maintenance, and professional services, their direct employment effects after the construction phase are generally limited.

Manufacturing and tourism, in contrast, have broader employment bases, absorb workers with diverse skill levels, and create greater opportunities for local suppliers, small and medium-sized enterprises, and service businesses. This article therefore advances a policy-sequencing argument. Batam should maintain data centers as a complementary, high-productivity sector to strengthen digital connectivity, attract technology-intensive investment, and diversify the regional economy. However, if the immediate policy objective is rapid, inclusive, and broad-based employment creation, manufacturing and tourism should remain central pillars of Batam's development strategy. Rather than treating these sectors as separate alternatives, public policy should emphasize complementarities among digital infrastructure, manufacturing, tourism, energy development, workforce preparation, and local enterprise participation.

The remainder of this article is organized as follows. Section 2 reviews evidence regarding the employment impacts of data centers, manufacturing, and tourism. Section 3 describes the research design, data sources, and analytical approach. Section 4 presents the empirical findings, while Section 5 discusses the economic and policy implications of the research. Section 6 concludes by examining the implications of the findings for Batam's investment, employment, and regional development strategies.

Data centers have been the subject of considerable debate regarding their impact on local economies. They are often viewed as strategic infrastructure capable of attracting technology-intensive investment, enhancing digital connectivity, fostering innovation ecosystems, and positioning regions to participate in the digital economy (Lam et al., 2021; Li et al., 2025). However, their employment contribution is generally less significant compared with their investment value. Data center development can generate temporary construction employment and demand for specialized technical services, but operational facilities typically require fewer employees because they are capital-intensive, highly automated, and dependent on specialized expertise (Velkova & Plantin, 2023; Young, 2026).

Bahar and Wright (2026) also found that data centers can increase private employment and wages, although these impacts tend to occur gradually, with delayed effects and stronger outcomes in larger data center clusters compared with individual facilities. The economic benefits of data center investment also depend on the institutional and infrastructural capacity of the host region. Reliable electricity supply, cooling systems, land availability, grid capacity, environmental management, and effective governance are essential to sustain such facilities; otherwise, they may place significant pressure on local energy, water, and land resources (Monstadt & Saltzman, 2025; Mytton et al., 2023). This distinction is particularly important in the context of Batam. Data centers can become a strategic driver of economic diversification, digital connectivity, and Batam’s integration into regional technology ecosystems; however, they cannot be considered a mass employment solution. The primary policy risk lies in equating the monetary scale of investment with labor market impact, as billions of dollars in investment may not translate into sufficient permanent and highly specialized employment opportunities.

Manufacturing has historically played a central role in employment creation within industrializing economies. Labor-intensive manufacturing can absorb workers with secondary or vocational education, establish supplier linkages, and generate indirect employment through logistics, packaging, maintenance, food services, and household consumption. In Batam, manufacturing remains particularly important because the city's industrial history, workforce composition, and supplier ecosystem are already aligned with production-based employment.

However, the relationship between manufacturing investment and employment generation is not automatic. Indonesian manufacturing has become increasingly capital-intensive in several subsectors, and automation has reduced labor absorption in some industries (Nababan & Purba, 2023). Consequently, not all manufacturing investments generate substantial employment effects. Sectors such as electronics, shipbuilding, maintenance, light manufacturing, and precision assembly may differ significantly in their labor intensity.

Nevertheless, manufacturing remains more compatible with Batam's labor market profile than data centers. Registered job seekers and employment demand in Batam are heavily concentrated among senior-secondary education graduates (BPS Kota Batam, 2026). This indicates that employment strategies should continue supporting sectors capable of absorbing senior-secondary and vocational graduates, particularly through industrial upgrading strategies that preserve medium-skilled employment opportunities.

Tourism represents another sector with significant employment potential. Although tourism often provides lower wages and has a higher degree of informality compared with formal manufacturing, it generates employment across a wide range of occupations, including accommodation, food and beverage services, retail, transportation, local guiding, entertainment, creative industries, cleaning services, and micro-enterprises. Georgios (2022) argues that tourism generally has a positive effect on employment, although job quality varies across contexts. Tourism offers an important advantage for Batam because it can accommodate workers across different age groups and skill levels. Many tourism-related occupations do not require advanced tertiary qualifications, and employment opportunities can be expanded through improvements in training, service quality, language skills, and local enterprise support. Tourism can also facilitate broader income distribution among small businesses and local communities through food supply chains, transport operators, cultural industries, and micro, small, and medium enterprises. Nevertheless, tourism remains vulnerable to external shocks, seasonality, low wages, and informality. Therefore, tourism should not be viewed as a perfect employment solution. However, when the policy objective is rapid labor absorption, tourism is structurally more suitable than data centers because it generates a larger number of jobs across a broader service ecosystem.

This article compares data centers, manufacturing, and tourism using five employment-related mechanisms: (1) direct employment intensity, referring to the number of direct jobs created per unit of investment; (2) skill compatibility, referring to the alignment between sectoral labor demand and Batam's available workforce; (3) speed of job creation, referring to how quickly employment is generated after investment begins; (4) local value creation, referring to the extent to which wages, procurement, and expenditure remain within the local economy; and (5) multiplier potential, referring to the ability of each sector to generate indirect and induced employment.

Based on these mechanisms, this article expects data centers to perform strongly in strategic positioning and high-skilled employment creation but relatively weakly in mass labor absorption. Manufacturing is expected to perform strongly in medium-skilled employment generation and supplier linkages, while tourism is expected to perform strongly in distributed service-sector employment creation.

## METHOD

### Research design

This study employed a qualitative comparative documentary analysis approach. This approach was appropriate because the study did not aim to estimate a formal causal model but instead compared the employment potential of three sectors using available policy documents, official reports, investment announcements, and relevant literature. The objective was to assess whether Batam's data center strategy was likely to reduce unemployment as effectively as the manufacturing and tourism sectors.

The unit of analysis was the sectoral employment potential in Batam. The three sectors examined were data centers, manufacturing, and tourism. The main focus of the analysis was not the total investment value but the employment relevance of each sector, particularly its capacity to absorb Batam's unemployed population and job seekers.

### Data sources

The analysis uses four main categories of data. First, Batam labor-market data are drawn from BPS Kota Batam's 2025 labour-market and administrative tables, published in Kota Batam Dalam Angka 2026. These data include the labor force, employed workers, unemployed workers, registered job seekers, vacancies, placements, education levels, and the city minimum wage (BPS Kota Batam, 2026).

Second, data center and digital sector investment information is drawn from BP Batam and official news sources. These include reported digital-sector investment realization in Batam, job absorption in the Nongsa Special Economic Zone, and employment estimates for a major AI data centre project (ANTARA News, 2026a; BP Batam, 2026).

Third, the article uses secondary literature on employment effects in data centers, manufacturing, and tourism. These sources include Bahar and Wright (2026) on data-center employment effects, Nababan and Purba (2023) on labor absorption in Indonesian manufacturing, and Georgios (2022) on tourism and employment.

Fourth, the article uses contextual reporting on Batam's talent gap and digital-training ecosystem, especially in relation to Nongsa Digital Park and data-center development (ANTARA News, 2026b; Channel NewsAsia, 2026).

### Analytical strategy

The analysis proceeds in three stages. First, the article establishes Batam's labor-market baseline. This step identifies the size and structure of unemployment, with particular attention to education level and job-seeker profile.

Second, the article examines data-center employment intensity by comparing reported investment values with projected or reported employment figures. Where investment and employment values are available, the article calculates approximate direct jobs per US$1 million of investment.

Third, the article compares the three sectors using a decision-support framework based on employment intensity, skill compatibility, wage distribution, job-creation speed, and local value capture. Because Batam-specific input-output multipliers by sector were not available, the comparative estimates are presented as analytical ranges rather than precise statistical coefficients.

**Limitations**

This article has three limitations. First, it does not use a Batam-specific input-output table or social accounting matrix. Therefore, it cannot provide precise estimates of indirect and induced employment multipliers. Second, sectoral wage estimates are discussed in relative terms because robust Batam-specific average wage data by sector were not identified in the reviewed sources. Third, data-center employment projections may change as projects move from announcement to construction and operation. For this reason, the findings should be interpreted as a structured policy assessment rather than a definitive econometric measurement.

## RESULTS AND DISCUSSION

### Batam's labor-market baseline

Batam's labor-market profile shows that unemployment remains a significant policy challenge. In 2025, Batam had a labor force of 659,645 people, of whom 609,714 were employed and 49,931 were unemployed. The open unemployment rate was 7.57%, while registered job seekers reached 29,710 people (BPS Kota Batam, 2026).

The education profile of job seekers is particularly important. Of the registered job seekers, 25,825 had senior-secondary education. At the same time, 16,989 registered vacancies required senior-secondary education, and 13,884 placements were filled by senior-secondary graduates. This indicates that Batam's labour market remains strongly medium-skill oriented.

**Table 1 Batam Labour-Market Baseline, 2025**

| Batam Labour-Market Baseline 2024 | | | |
|---|---|---|---|
| **No** | **Indicator** | **Value** | **Interpretation** |
| 1 | Population | 1.2769 million | Large urban labour pool |
| 2 | Labour Force Participation Rate | 69,83% | High need for broad job creation |
| 3 | Labour Force | 646.871 | Main employment-policy denominator |
| 4 | Employed Workers | 606.492 | Large employment base |
| 5 | Unemployed Workers | 40.379 | Immediate unemployment stock |
| 6 | Open Unemployement Rate | 7,68% | levated unemployment challenge |
| 7 | Registered Job Seekers | 24.690 | Proxy for active job-search pressure |
| 8 | Registered Vacancies | 18.718 | Below registered job seekers |
| 9 | Recorded Placement | 17.583 | Existing labour market absorbs jobs at scale |
| 10 | Job Seekers with Senior-Secondary Education | 21.875 | Job-seeker pool is medium-skill dominated |
| 11 | Vacancies requiring Senior-Secondary Education | 16.324 | Demand also concentrated at medium-skill level |

| Batam Labour-Market Baseline 2024 | | | |
|---|---|---|---|
| **No** | **Indicator** | **Value** | **Interpretation** |
| 12 | Placements filled by Senior-Secondary Sraduates | 15.581 | Sectors matching this group are critical |
| 13 | Batam City Minimum Wage, 2025 | Rp 4,989,600 | Local wage baseline |

Source: ANTARA News (2026a); BP Batam (2026)

These figures establish the main policy benchmark. A sector that creates a small number of highly specialized professional jobs may be valuable for productivity, but it will not directly address Batam's main unemployment structure. Batam needs sectors that can absorb large numbers of senior-secondary and vocationally trained workers.

**Data-centre investment and direct employment intensity**

The strongest Batam-specific evidence suggests that data-centre employment intensity is limited. BP Batam reported Rp 8.557 trillion in digital-sector investment in 2025 and 836 jobs absorbed in the Nongsa Special Economic Zone in the fourth quarter of 2025 (BP Batam, 2026). Separately, a US$5 billion AI data-centre project in Nongsa was expected to create approximately 700–800 professional jobs (ANTARA News, 2026a).

**Table 2 Selected Data-Centre and Digital-Sector Employment Evidence in Batam**

| Batam City Manpower Office 2025 | | | | | |
|---|---|---|---|---|---|
| **No** | **Project or Investment Category** | **Investment Value** | **Reported or Projected Jobs** | **Approximate Direct Jobs per US$1 Million** | **Interpretation** |
| 1 | Batam digital-sector realization, 2025 | Rp 8.557 trillion | 836 | About 1.6 | Broader digital-cluster figure, not purely data-centre operations |
| 2 | AI data-centre project in Nongsa | US$5 billion | 700–800 | About 0.14–0.16 | Core project estimate; highly capital-intensive |

Source: Batam City Manpower Office (2025)

The policy implication is clear. Even at the high estimate of 800 jobs, the US$5 billion AI data-centre project would absorb only around 1.6% of Batam's 49,931 unemployed workers in 2025. This calculation assumes that all jobs are filled by unemployed Batam residents, which may not occur because many roles require specialized technical skills.

The skill mismatch is also significant. Reporting on Nongsa Digital Park highlights the need for global-standard skills, certifications, English-language ability, and multinational work readiness (Channel NewsAsia, 2026). This suggests that data-centre employment may benefit a narrow group of skilled workers rather than the broader pool of unemployed senior-secondary graduates.

**Comparative sectoral employment potential**

The comparison between data centres, manufacturing, and tourism shows that the sectors differ substantially in labour intensity, skill requirements, and local value capture.

**Table 3 Comparative Employment Potential of Data Centres, Manufacturing, and Tourism in Batam**

| Comparative Employment Potential of Data Centres, Manufacturing, and Tourism in Batam | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No** | **Sector** | **Direct Jobs per US$1 Million Investment** | **Typical Skill Profile** | **Wage Position** | **Capital Intensity** | **Speed of Job Creation** | **Local Value Capture** |
| 1 | Data centres | 0.1–1.6 | Diploma or degree; IT operations; electrical and mechanical engineering; certifications; English | Higher wages, but for a narrow group | Very high | Slow to medium; operational jobs remain lean | Narrow to moderate; utilities, security, maintenance, limited local services |
| 2 | Manufacturing | 0.6–3.0 | Senior-secondary, vocational, diploma; operators, technicians, welding, machining, electronics, logistics | Moderate; often near or above minimum wage | Medium to high | Medium; hiring begins during factory preparation and early operations | Moderate to high; supplier, logistics, food, transport, and household-spending linkages |
| 3 | Tourism | 3.0–8.0 | Secondary education upward; hospitality, food services, retail, transport, guides, creative services | Lower to moderate; variable in informal segments | Low to medium | Faster; hiring can begin before full operation | High and distributed; accommodation, food, transport, retail, MSMEs, local produce |

*Note: The data-centre range is anchored in Batam project evidence and broader data-centre employment literature. Manufacturing and tourism estimates are analytical ranges because Batam-specific sectoral multiplier data were not available.

The ranking is straightforward. Tourism is likely to generate the fastest and broadest headcount absorption. Manufacturing remains the strongest balanced option for medium-skill employment and supplier linkages. Data centers are the weakest option if the policy metric is jobs per unit of investment. However, data centers may outperform the other sectors in strategic positioning, productivity per worker, and digital ecosystem signaling.

The results show Batam should not use data centers as a primary unemployment-reduction strategy. That is not to say data centers are bad for jobs. Rather, it means that data centers should be evaluated according to the appropriate policy. Data centers are strategic infrastructure, not mass-employment engines. First, employment multipliers differ significantly between sectors. Data centers are designed to operate only with limited labor once construction and commissioning are done. Their employment gains are more likely to be driven by clusters, supplier development, and long-term ecosystem effects than by directly growing payrolls. Manufacturing and tourism, by contrast, create more labor demand at the manufacturing, logistics, services, maintenance, retail, and household level. Second, skill compatibility matters. The majority of job seekers are senior secondary graduates in Batam's labor market. Data-center jobs require more specialized technical skills, certifications, and professional readiness. This creates a mismatch between the jobs that are created and the workers who most need employment. Third, wage quality and employment breadth need to be distinguished. Data-center jobs may pay more than many tourism and production-floor jobs.

But if only a few hundred people obtain them, the overall unemployment effect is still small. Tourism and manufacturing may produce lower average wages in some jobs, but they generate work for a greater number of households.

Fourth, job-creation speed varies. Data centers require land preparation, power supply, cooling systems, environmental protection, construction, testing, and commissioning. Their operational workforce is small. Tourism and manufacturing can often generate employment earlier in the investment cycle, particularly with construction, services, factory operations, hospitality, transport, and local procurement. Fifth, local value capture is broader in manufacturing and tourism. A data center could generate utility demand, land revenue, security contracts, and maintenance work. But much of the high-value equipment, technology, and corporate surplus may be external to Batam. Manufacturing and tourism expand the opportunities for local suppliers, MSMEs, food services, logistics companies, and household spending. The policy implication is that Batam needs a layered development model. For long-term digital competitiveness, data centers should be built. Manufacturing should be upgraded to preserve medium-skill employment and productivity. Tourism should be expanded to create distributed service employment and local enterprise opportunities. These sectors need not be seen as substitutes for one another. They perform different economic functions.

## CONCLUSION

The results indicate that Batam should not rely on data centers as the primary strategy for reducing unemployment. This does not imply that data centers are detrimental to employment. Rather, data centers should be evaluated based on their appropriate economic and policy functions. Data centers represent strategic infrastructure rather than mass-employment generators. First, employment multipliers differ significantly across sectors. Data centers are designed to operate with relatively limited labor requirements once the construction and commissioning phases are completed. Their employment contributions are more likely to emerge through cluster development, supplier linkages, and long-term ecosystem effects rather than substantial direct employment growth. In contrast, manufacturing and tourism generate broader labor demand across production, logistics, services, maintenance, retail, and household consumption activities.

Second, skill compatibility is a critical consideration. Many job seekers in Batam's labor market are senior secondary education graduates. However, data center employment generally requires specialized technical skills, professional certifications, and specific occupational competencies. This creates a potential mismatch between the types of jobs generated and the skills of workers who are most in need of employment opportunities. Third, wage quality and employment scale must be considered separately. Data center jobs may provide higher wages compared with many tourism and production-level positions. However, if employment opportunities are limited to only a small number of workers, their overall impact on unemployment reduction remains limited. Conversely, manufacturing and tourism may offer lower average wages in certain occupations but can provide employment opportunities for a larger number of households.

Fourth, the speed of employment creation varies among sectors. Data center development requires land preparation, power infrastructure, cooling systems, environmental management, construction, testing, and commissioning before operations begin. Once

operational, the workforce requirements are relatively limited. Manufacturing and tourism can often generate employment earlier in the investment cycle through construction activities, factory operations, hospitality services, transportation, and local procurement networks. Fifth, local value capture is generally broader in manufacturing and tourism. Data centers can generate economic benefits through electricity demand, land revenues, security services, and maintenance activities. However, a significant portion of high-value equipment, technology inputs, and corporate profits may remain outside Batam. In contrast, manufacturing and tourism create wider opportunities for local suppliers, micro, small, and medium enterprises (MSMEs), food service providers, logistics companies, and household income generation.

The policy implication is that Batam requires a layered development model. To strengthen long-term digital competitiveness, data centers should continue to be developed as strategic infrastructure. Manufacturing should be upgraded to maintain medium-skilled employment opportunities and enhance productivity, while tourism should be expanded to create distributed service-sector employment and support local entrepreneurship. These sectors should not be viewed as competing alternatives but as complementary components of Batam's broader economic development strategy, as each sector performs different economic functions.

## REFERENCES


ANTARA News. (2026a, May 25). *BP Batam oversees US$5 billion investment in AI data center*. https://en.antaranews.com/news/416917/bp-batam-oversees-us5-billion-investment-in-ai-data-center

ANTARA News. (2026b, May 28). *Ministry prepares workforce for Batam AI data center investment*. https://en.antaranews.com/news/417132/ministry-prepares-workforce-for-batam-ai-data-center-investment

Aritenang, A. F., & Chandramidi, A. N. (2020). The impact of special economic zones and government intervention on firm productivity: The case of Batam, Indonesia. *Bulletin of Indonesian Economic Studies, 56*(2), 225–249. https://doi.org/10.1080/00074918.2019.1643005

Badan Pusat Statistik Kota Batam. (2026). *Kota Batam dalam angka 2026* (Vol. 13, Publication No. 21710.26002). BPS Kota Batam. https://batamkota.bps.go.id/id/publication/2026/02/27/f114fc2ec6b86e133422cd62/kota-batam-dalam-angka-2026.html

Bahar, D., & Wright, G. (2026, May 4). *New evidence on data center employment effects*. Brookings. https://www.brookings.edu/articles/new-evidence-on-data-center-employment-effects/

BP Batam. (2026, June 11). *Investasi Batam lampaui target, data centre jadi jantung baru ekonomi*. Pusat PTSP BP Batam. https://ptsp.bpbatam.go.id/investasi-batam-lampaui-target-data-centre-jadi-jantung-baru-ekonomi/

Channel NewsAsia. (2026). *Batam seeks to boost digital economy with data centres and IT training, but talent gap persists*. https://www.channelnewsasia.com/asia/indonesia-batam-digital-economy-nongsa-digital-park-talent-data-centres-environment-5929226

Faisal, M. G., Asfo, N. S., Reni, R., Putra, F. A., & Hamdallah, M. A. H. (2025). The effect of digital infrastructure development on regional economic growth in Indonesia: A spatial econometrics approach. *Daengku: Journal of Humanities and Social Sciences Innovation, 5*(6), 822–831. https://doi.org/10.35877/454RI.daengku4632

Fajrah, N., Ridho, M. R., & Salsabila, L. (2023). Evaluating government readiness for Industry 4.0: A case study of Batam City. *E3S Web of Conferences, 440*, Article 04014. https://doi.org/10.1051/e3sconf/202344004014

Georgios, G. (2022). *Preliminary results on the employment effect of tourism: A meta-analysis*. arXiv. https://arxiv.org/abs/2206.00174

Indra, M., & Fauzan, F. (2023). The importance of structuring relationships between local governments and business entities in the perspective of state administrative law in Batam City, Riau Islands. *Jurnal IUS Kajian Hukum dan Keadilan, 11*(1). https://doi.org/10.29303/ius.v11i1.1146

International Energy Agency. (2025). *Energy and AI*. https://www.iea.org/reports/energy-and-ai

Karim, M. F. (2019). State transformation and cross-border regionalism in Indonesia's periphery: Contesting the centre. *Third World Quarterly, 40*(8), 1554–1570. https://doi.org/10.1080/01436597.2019.1620598

Kurniawan, A. W., Budhi, M. K. S., Yasa, I. N. M., & Yasa, I. G. W. M. (2017). Investment analysis in Free Trade Zone Batam Island, Indonesia. *International Journal of Economic Research, 14*(17), 279–291.

Lam, P. T. I., Lai, D., Leung, C.-K., & Yang, W. (2021). Data centers as the backbone of smart cities: Principal considerations for the study of facility costs and benefits. *Facilities, 39*(7/8), 599–616. https://doi.org/10.1108/F-09-2019-0103

Li, C., He, W., & Cao, E. (2025). Impact of green data center pilots on digital economy development: An empirical study based on dual machine learning methods. *Computers & Industrial Engineering, 199*, 110914. https://doi.org/10.1016/j.cie.2025.110914

Monstadt, J., & Saltzman, K. (2025). How data centers have come to matter: Governing the spatial and environmental footprint of the "digital gateway to Europe." *International Journal of Urban and Regional Research*. Advance online publication. https://doi.org/10.1111/1468-2427.13316

Muzwardi, A., Riyadi, S. F., Wahyudi, H., Swastiwi, A. W., Akbar, D., Putri, R. A., & Gusriza, G. (2024). Analysis of the design planning for the Special Economic Zone: Nongsa Digital Park as a digital hub. *BIO Web of Conferences, 134*, Article 03004. https://doi.org/10.1051/bioconf/202413403004

Muzwardi, A., Wira, W., Kusasi, F., Fera, M., & Tamrin, M. (2025). Batam Free Port: Pathways to clean energy and blue economy sustainability. *IOP Conference Series: Earth and Environmental Science, 1559*(1), Article 012033. https://doi.org/10.1088/1755-1315/1559/1/012033

Mytton, D., Ashtine, M., Wheeler, S., & Wallom, D. (2023). Stretched grid? Managing data center energy demand and grid capacity. *Oxford Open Energy, 2*, oiad014. https://doi.org/10.1093/ooenergy/oiad014

Nababan, T. S., & Purba, E. F. (2023). *Labour absorption in manufacturing industry in Indonesia: Anomalous and regressive phenomena*. arXiv. https://arxiv.org/abs/2311.01787

Nafisah, L., & Kusairi, S. (2026). The impact of digitalisation and foreign direct investment on economic performance: Is the role of human capital important? In B. Alareeni, K. Hussainey, A. M. M. Nassar, & K. Alkayid (Eds.), *AI powered control systems in fintech* (pp. 745–754). Springer. https://doi.org/10.1007/978-3-032-13119-5_62

Nashiruddin, M. I., & Winalisa, S. (2020). Designing LoRaWAN Internet of Things network for smart manufacture in Batam Island. In *2020 8th International Conference on Information and Communication Technology (ICoICT)*. IEEE. https://doi.org/10.1109/ICoICT49345.2020.9166426

Putri Utami, D. M., Delfianti, R., Akhmad, K., Prawitasari, A., Nurliyanti, V., Nurdiana, E., Setiawan, E. A., Nugroho, A. C. D., Ramdani, D., Gusyairi, A., Wahid, L. O. M. A., Aryono, N. A., Yuniarti, N., Nusyura, F., & Harsito, C. (2026). Toward zero downtime sustainable data centers in tropical regions: A rooftop photovoltaic–battery hybrid approach with techno-economic and policy insights. *Engineered Science, 39*, Article 2011. https://doi.org/10.30919/es2011

Reuters. (2024, September 9). *Bali to ban building of some hotels to tackle over-development*. https://www.reuters.com/world/asia-pacific/indonesias-bali-wants-ban-building-hotels-villas-media-say-2024-09-09/

Sari, Y. A., & Pamadi, M. (2019). The smart port concept of Batu Ampar Port in Batam. *IOP Conference Series: Earth and Environmental Science, 343*, Article 012095. https://doi.org/10.1088/1755-1315/343/1/012095

Situmeang, A., Syarief, E., Tan, W., & Rachman, A. (2021). The problems and concepts of the land management rights improvement in Batam City. *Syariah: Jurnal Hukum dan Pemikiran, 21*(2). https://doi.org/10.18592/sjhp.v21i2.4036

Supriyanto, S., Widayani, H., Cornellia, R., Armin, R., & Kamal, I. (2025). The impact of foreign direct investment on economic growth in developing countries to acceleration in digitalization. *Daengku: Journal of Humanities and Social Sciences Innovation, 5*(3), 337–353. https://doi.org/10.35877/454RI.daengku3893

Sutiyo, S., Tjenreng, M. Z. B., & Nurhascaryani, P. (2026). Institutional conflict in regional development: Path dependence in the free trade zone and decentralization of Batam, Indonesia. *Regional & Federal Studies*. Advance online publication. https://doi.org/10.1080/13597566.2026.2656891

Velkova, J., & Plantin, J.-C. (2023). Where do we go from here? Data center infrastructure, labor, jobs, and work in economic development time and temporalities. *New Media & Society*. Advance online publication. https://doi.org/10.1177/14614448221149947

Wahyuni, S., Siregar, H., Rustiadi, E., & Pravitasari, A. E. (2025). Prioritizing regional development strategies of free trade zones using the analytical hierarchy process approach: A case study of Batam, Bintan, and Karimun, Riau Islands Province, Indonesia. *Decision Science Letters*. https://doi.org/10.5267/j.dsl.2025.7.008

World Bank. (2023). *World development report 2023: Migrants, refugees, and societies*. World Bank. https://www.worldbank.org/en/publication/wdr2023

World Travel & Tourism Council. (2024). *Economic impact research*. https://wttc.org/research/economic-impact

Young, C. (2026). Clouds on the horizon: An integrative review of data centers and local governance in the United States. *Oxford Open Energy*. Advance online publication. https://doi.org/10.1093/ooenergy/oiag006

Zaenuddin, M. (2025). How to achieve the integration from the dualism of institutional conflicts? Lesson learned from Batam, Indonesia. *SAGE Open*, *15*(3), 1–14. https://doi.org/10.1177/21582440251365467