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Curriculum Policy, Qualification Mismatch, and the Vocational Education Readiness Index in Batam's Free Trade Zone

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Abstract: The phenomenon of qualification mismatch among vocational high school graduates in Batam represents a paradox in the context of the free trade zone (FTZ), which demands skilled technical workers. This study evaluates the quality of vocational education policy and the relevance of vocational high school curricula to industry needs in Batam using an integrative secondary research mixed-methods approach. Administrative data from national and local agencies covering statistics, education, manpower, and professional certification were analyzed through six proxy variables (X1–X6) to construct the Vocational Education Readiness Index (IKPV). The IKPV stands at 0.787, placing it in the optimal category, yet a structural paradox emerges: the Participation dimension achieves a perfect score (1.000) while the Acceptability dimension reaches only 0.559. Only 39.86% of vocational high school graduates are employed in relevant industry sectors, while 52.58% experience vertical mismatch. Three core failures are identified: signaling, curriculum, and regulatory failures. The study recommends evidence-based policy reform—regional regulations compelling industries operating in the FTZ to engage in the vocational education ecosystem, mandatory synchronization of vocational curricula with national competency standards, and a universal competency certification system aligned with industry.

Keywords: free trade zone; qualification mismatch; vocational curriculum policy; vocational education readiness index.

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1. Introduction

The global labor market faces intense structural pressure due to the acceleration of technological change, industrial digitalization, and the restructuring of global value chains. One of the most evident manifestations of this pressure is the growing phenomenon of *qualification mismatch*—a condition in which workers' educational qualifications are not aligned with the actual requirements of their jobs. The International Labour Organization (2022) reports that many young workers in developing countries experience at least one form of education–job mismatch, both vertically and horizontally. This phenomenon is not temporary; rather, it reflects systemic dysfunction in education and training systems that fail to keep pace with industrial transformation.

OECD (2023) identifies qualification mismatch not merely as an individual problem but as an institutional coordination failure between the education system, the labor market, and public policy. On average, 36% of workers in OECD countries experience vertical overeducation or undereducation, while horizontal mismatch reaches 45% among higher education graduates. At the national level, Indonesia faces a complex labor paradox: a shortage of skilled workers in manufacturing and technology on one side, and rising educated unemployment on the other. BPS [Statistics Indonesia] (2026) records that vocational high school graduates have a *tingkat pengangguran terbuka* [open unemployment rate] (TPT) of 8.63%—the highest among all educational levels.

These data indicate a deep-seated structural flaw in which vocational education institutions, which are supposed to serve as a bridge to the workforce, are actually producing graduates who are not fully absorbed into the job market (Suharno et al., 2020). However, this mismatch cannot be viewed solely through the lens of national conditions. In global labor-market discussions, this phenomenon is most pronounced within the special economic zones (SEZs) of developing countries. These zones, which serve as hubs for foreign direct investment and global value chains, demand real-time skills upgrading, particularly to address automation and Industry 4.0 (Bamber et al., 2014). Unfortunately, this rapid growth in foreign investment often clashes with the capacity of local vocational institutions, which remain trapped in a cycle of standard bureaucratic procedures. A study by the Asian Development Bank (2021) in Southeast Asia confirms that SEZ ecosystems often fail to achieve *industrial upgrading* precisely because of the dysfunction of local technical and vocational education and training (TVET) systems, which are unable to supply the precise competencies required for upper-middle-skilled technical and managerial roles, creating a paradox in which industry lacks talent while local unemployment continues to rise. This structural failure becomes particularly evident in SEZs, where multinational enterprises and local vocational institutions must respond to rapidly changing skill requirements. Research on international VET transfer highlights the importance of contextual adaptation, enterprise involvement, and long-term planning in developing and transferring vocational education and training systems (Li & Pilz, 2023).

Aggarwal's (2022) study of the Indonesia–Malaysia–Thailand Growth Triangle (IMT-GT) highlights Penang, Malaysia, as a successful example of economic-zone development. Penang's Bayan Lepas and Prai Free Industrial Zones have supported the development of a strong electrical and electronics ecosystem, complemented by specialized industrial clusters and skilled labor. Aggarwal further emphasizes the importance of close linkages between skills-training centers and technical and vocational schools, colleges, and universities in meeting the workforce needs of

economic zones. In contrast, Batam—which was developed as a major industrial and free-trade zone and as a destination for Singapore-linked industrial investment—has exhibited persistent structural vulnerabilities. Hutchinson and Negara (2021) highlight that Batam faces a double burden: the demand for international-standard qualifications conflicts directly with the slow adaptation of local vocational education institutions constrained by institutional barriers. It is in this context that Batam can be positioned as an ideal laboratory.

As a free trade zone (FTZ) established under Peraturan Pemerintah Republik Indonesia Nomor 46 Tahun 2007 tentang Kawasan Perdagangan Bebas dan Pelabuhan Bebas Batam [Government Regulation of the Republic of Indonesia No. 46 of 2007 on the Batam Free Trade Zone and Free Port], Batam occupies a unique structural position. Its high-technology industrial cluster—encompassing electronics manufacturing, shipbuilding, international logistics, and offshore industries—demands a highly specific set of workforce qualifications. Yet Dinas Tenaga Kerja Kota Batam [Batam Manpower Office] (2023) reports that around 35% of the approximately 12,000 available vacancies in the manufacturing and shipyard sector remain unfilled because of applicant competency mismatches. This condition is exacerbated by the fact that vocational education capacity in Batam is quantitatively smaller than general education: 61 vocational high schools compared with 87 general senior high schools (Badan Pusat Statistik Kota Batam [Statistics Batam Municipality], 2025).

This study is grounded in three theoretical frameworks: human capital theory (Becker, 1964; Mincer, 1976), which views education as an investment generating productivity returns; the qualification mismatch framework (Allen & van der Velden, 2001), which distinguishes *vertical mismatch* (qualification level) from *horizontal mismatch* (field of study); and policy implementation theory (Mazmanian & Sabatier, 1983), which evaluates whether policy architecture effectively drives institutional behavior change. Chuan and Ibsen (2022) further warn that overly industry-controlled vocational systems may undermine long-term adaptability, while Damelang and Ruf (2023) show that overeducation is a persistent rather than transitory condition.

To our knowledge, the study's principal contribution is the construction of the Indeks Kesiapan Pendidikan Vokasi [Vocational Education Readiness Index] (IKPV)—a composite index modeled on the United Nations Development Programme's Human Development Index—designed to evaluate vocational education readiness in an FTZ context based on longitudinal administrative data. This approach addresses a gap identified in prior studies (Paramitasari et al., 2024; Saryadi et al., 2024) that relied on macro-spatial econometrics or single-school qualitative analyses without synthesizing quantitative indicators with policy document analysis. The research addresses two questions: (1) What is the quality of vocational education policy in promoting *link and match* between vocational education and industry needs in Batam? (2) What curriculum policy model is appropriate for addressing the labor needs of the FTZ industrial cluster?

2. Methods

This research employs an integrative secondary research (ISR) mixed-methods design (Creswell & Plano Clark, 2018; Johnston, 2014; Martins et al., 2018). This design represents a methodological shift from primary survey-based data collection toward comprehensive analysis of secondary administrative data. Conceptually, it is grounded in the wellbeing methodology framework proposed by Muktiono and

Table 1. Secondary Data Sources, Variables, and Observation Periods

Source Agency	Variables and Data Sources	Period
BPS Kota Batam	Vocational high school statistics by subdistrict; Batam Sakernas dataset	2016–2024
BPS Provinsi Kepulauan Riau	Open unemployment rate (TPT) by education level, used as a provincial proxy	2014–2024
Dapodik, Kemendikbudristek	Number and types of active vocational programs; teacher–student ratio; number of certified teachers; Teaching Factory status and LSP-P1 licensing status by school	2020–2024
BNS/LSP	Number of participants and pass rates for competency tests by vocational program for vocational high school graduates in Batam	2020–2024
Disnaker Kota Batam	Job-vacancy statistics by sector; labor-placement rates; competency-based training data; AKAD profile	2021–2024

Source: BPS Kota Batam, Dapodik, BNSP, and Disnaker Kota Batam; data processed by the authors (2026). Kemendikbudristek = Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (Ministry of Education, Culture, Research, and Technology); LSP = Lembaga Sertifikasi Profesi (Professional Certification Body); LSP-P1 = first-party LSP; AKAD = Antar Kerja Antar Daerah (Inter-Regional Employment Placement).

Suriadi (2021), wherein the variable Xi(θ)—representing scientific rationality (Xi) and societal wellbeing value (θ)—is operationalized through proxy indicators drawn from official administrative data rather than perceptions obtained from survey respondents.

The ISR design comprises two parallel analytical tracks. Track A (administrative data analysis) focuses on quantitative analysis of numerical data to characterize the mismatch phenomenon statistically. Data were compiled from Survei Angkatan Kerja Nasional [National Labor Force Survey] (Sakernas), BPS Kota Batam, Data Pokok Pendidikan [Education Master Data] (Dapodik), Badan Nasional Sertifikasi Profesi [National Professional Certification Agency] (BNSP), Disnaker Kota Batam, Badan Pengusahaan Batam [Batam Indonesia Free Zone Authority] (BP Batam), and Badan Akreditasi Nasional Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Pendidikan Menengah [National Accreditation Board for Early Childhood, Primary, and Secondary Education] (BAN-PDM) covering the period 2016–2024. Track B (policy document analysis) follows the document-analysis framework of Bowen (2009) and Morgan (2022) to evaluate four layers of policy documents: (1) national regulations (policy intent), (2) local regulations (policy translation), (3) implementation documents (policy operation), and (4) competency standards (policy standards). Track A identifies patterns in the labor market, while Track B contextualizes these patterns through policy document analysis.

The research variables are operationalized as proxy indicators (Table 2), representing three dimensions of the wellbeing methodology: Quality (P), Participation (Par), and Acceptability (A). Following a single-case design (Yin, 2018), the study location is Batam, selected based on three substantive considerations: the

Table 2. Research Variable Matrix and Administrative Proxy Indicators

Dimension (WM)	Proxy Variable	Operational Definition and Measurement Parameters	Data Source
Quality (P)	X1. Link-and-match infrastructure	Percentage of vocational high schools actively operating a Teaching Factory or holding an LSP-P1 license	Dapodik
Quality (P)	X2. Quality of vocational educators	Ratio of certified vocational teachers with industry-relevant competencies to the total number of vocational teachers	Dapodik
Participation (Par)	X3. Access to vocational education	Combined upper-secondary gross enrollment ratio (GER) for SMA/MA/SMK in Batam	BPS Kota Batam/Dapodik
Acceptability (A)	X4. Labor-market absorption	Percentage of vocational high school graduates who are employed, calculated as 1 minus the unemployment rate specific to vocational high school graduates	BPS Kota Batam (Sakernas)
Acceptability (A)	X5. Vertical mismatch	Proportion of vocational high school graduates employed in the informal sector or in unskilled jobs that do not require a technical vocational diploma	BPS Kota Batam (Sakernas)
Acceptability (A)	X6. Sectoral absorption capacity	Share of employment in the processing/manufacturing sector relative to the total active workforce in Batam	BPS Kota Batam

Source: Processed by the authors (2026). WM = wellbeing methodology; GER = gross enrollment ratio; Sakernas = Survei Angkatan Kerja Nasional (National Labor Force Survey); LSP-P1 = first-party Lembaga Sertifikasi Profesi (Professional Certification Body).

complexity of its labor market, the availability of strong administrative data systems (BPS Kota Batam, Dapodik, Disnaker, BP Batam), and the urgency of systematic mismatch mitigation in an FTZ context.

Data analysis proceeds through three interconnected stages. First, quantitative composite-index analysis begins by normalizing all proxy indicators (X1–X6) to a 0–1 scale using min–max normalization, then aggregates them using a geometric mean to construct the IKPV. This less-compensatory aggregation method gives greater weight to low-performing dimensions and penalizes large disparities among dimensions.

3. Results and Discussion

3.1. Supply-Side Vocational Education Readiness (2015–2025)

Analysis of administrative data over the period 2015–2025 reveals a pronounced spatial concentration of vocational education provision in Batam. Three subdistricts—Batam Kota, Sagulung, and Batu Aji—together account for approximately 60–65% of all vocational high schools. However, this concentration does not necessarily correspond to the spatial distribution of upper-secondary students or the location of industrial employment opportunities, suggesting a potential spatial mismatch between vocational education supply and local demand. The mismatch is particularly relevant in Batam, where industrial activity is concentrated in areas with substantial demand for technically skilled workers, while access to vocational education remains uneven across subdistricts.

Between 2019 and 2022, the number of vocational high schools in Batam increased from 70 to 75. However, this expansion was not evenly distributed across the city, suggesting that the growth of vocational education provision did not fully respond to the spatial distribution of educational and labor-market demand. This pattern is consistent with Maulina and Yoenanto's (2022) observation that effective link-and-match implementation requires substantive alignment between vocational education and industry needs, including curriculum alignment and industry cooperation.

More critically, Batam subsequently experienced a sharp decline in the number of vocational high schools, from 75 in 2022 to 65 in 2025, occurring simultaneously with intensifying competency demands from the FTZ industrial sector. Viewed through the Mazmanian and Sabatier (1983) framework, this contraction raises concerns about the effectiveness of policy implementation, particularly the capacity of the regulatory system to sustain vocational education provision in line with policy objectives. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 50 Tahun 2020 tentang Praktik Kerja Lapangan bagi Peserta Didik [Minister of Education and Culture Regulation of the Republic of Indonesia No. 50 of 2020 on Field Work Practice for Students] establishes field-work practice as a mechanism for strengthening connections between vocational education and the workplace, while Peraturan Presiden Republik Indonesia Nomor 68 Tahun 2022 tentang Revitalisasi Pendidikan Vokasi dan Pelatihan Vokasi [Presidential Regulation of the Republic of Indonesia No. 68 of 2022 on the Revitalization of Vocational Education and Vocational Training] provides a broader framework for aligning vocational education and training with labor-market needs. Although these regulations provide a formal basis for strengthening vocational education and its links with industry, the decline in vocational school capacity suggests that policy implementation has not yet fully translated into sustained vocational education provision in Batam.

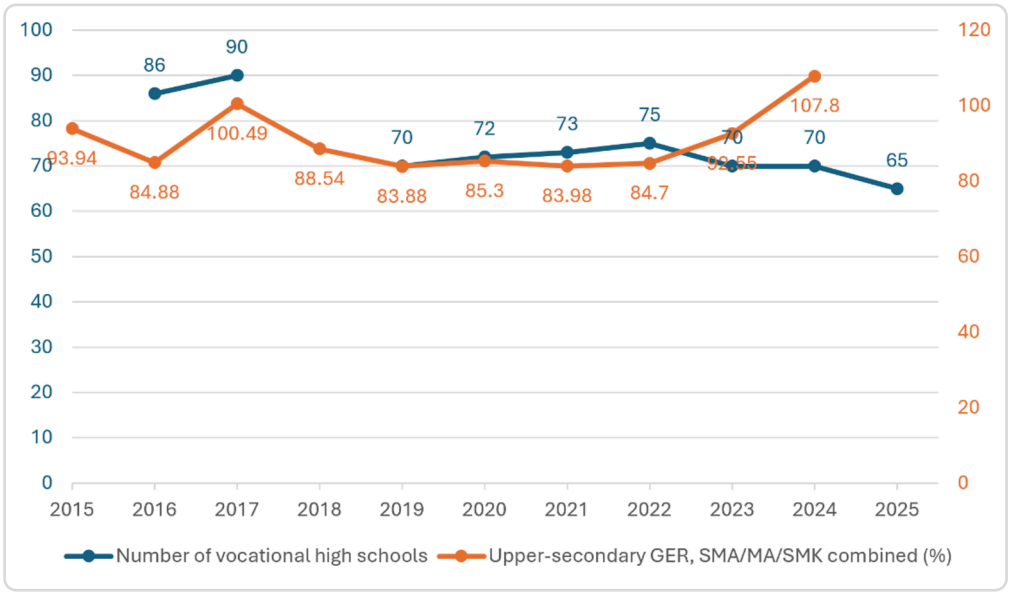

Figure 1. Comparison of the Number of Vocational High Schools and the Upper-Secondary Gross Enrollment Ratio, SMA/MA/SMK Combined (2015–2025)

Source: *Badan Pusat Statistik Kota Batam [Statistics Batam Municipality] (number of schools) and Badan Pusat Statistik Provinsi Kepulauan Riau [Statistics Riau Islands Province] (gross enrollment ratio); data processed (2026).*

Simultaneously, the upper-secondary gross enrollment ratio (GER)—which combines general, Islamic, and vocational senior secondary schools (SMA/MA/SMK), the level at which official statistics are published—continued to rise, reaching 107.80% in 2024. The opposing trends in these two variables constitute what this study terms a structural divergence between upper-secondary demand pressure and vocational supply capacity. Figure 1 illustrates what this study terms a scissors effect, characterized by the declining number of vocational high schools alongside the rising upper-secondary GER. This pattern is consistent with Brunello and Wruuck's (2021) crowding-out mechanism: when the student–school and student–teacher ratios increase substantially, the time and attention available for practical technical learning are systematically reduced.

Analysis of teacher data reveals potential pressure on the teacher–student ratio. While participation in upper-secondary education as a whole surged after the pandemic, the total number of vocational high school teachers (both public and private) stagnated. In vocational education, this ratio is particularly critical because close, hands-on mentoring in workshops and laboratories cannot be effectively conveyed through lectures alone. Through the lens of human capital theory (Becker, 1964), stagnating teacher numbers alongside sustained upper-secondary participation may push institutions toward more theoretical pedagogy, producing graduates who understand technical theories but lack sufficient practical hours for assembly and repair. This may contribute to both horizontal and vertical mismatch in Batam's labor market.

As shown in Figure 1, the drastic decline in the number of institutions amid rising upper-secondary participation raises concerns about a potential educational market failure. Unlike general education, vocational education is a capital-intensive sector requiring significant investment in modern laboratory infrastructure, standardized machinery, and industry certification (Tanaka et al., 2024). As per-student operational costs rise because of increasing costs associated with industrial technology in the FTZ region, the private sector, which dominates vocational high school provision in Batam, struggles to sustain operations without adequate government subsidies. Through the lens of market-failure theory in TVET, the limited

ability of private providers to deliver high-quality services amid strong social demand can be attributed to asymmetric information and high investment risk. Gleeson and Knights (2008) caution, however, that treating education as a commodity requiring state intervention can itself breed hyper-managerialism and bureaucracy in further and vocational education. Consequently, the period has been marked by institutional closures and consolidations, with the number of institutions declining from 75 to 65, increasing pressure on the remaining schools.

Furthermore, this paradox reflects the fragility of governance capacity in developing countries when responding to the dynamics of SEZ development. The decentralization of vocational school governance to the provincial level (pursuant to Undang-Undang Republik Indonesia Nomor 23 Tahun 2014 tentang Pemerintahan Daerah [Law of the Republic of Indonesia No. 23 of 2014 on Regional Government]) has created bureaucratic distance and institutional barriers that may constrain Batam's capacity as an SEZ. The Riau Islands Provincial Government faces fiscal and administrative capacity constraints in expanding vocational school infrastructure at the pace required by industrial growth driven by BP Batam and foreign investment (Hutchinson & Negara, 2021). Weak policy synchronization between the authority responsible for managing the zone (BP Batam), which responds to global-market dynamics, and Dinas Pendidikan [the provincial Education Office], which operates within the slower pace of local bureaucracy, undermines the capacity of local educational infrastructure (Jovanović, 2015; OECD, 2019).

3.2. Labor Market Paradox (2014–2024)

Analysis of the TPT from 2014 to 2024 shows a substantial declining trend in unemployment among general and vocational senior high school graduates. After reaching a critical peak of 14.09% during the 2020 pandemic, the rate fell to 7.56% in 2024. However, declining unemployment does not necessarily imply successful vocational absorption. Through the lens of human capital theory (Becker, 1964), this decline does not automatically indicate improved productivity or better labor-market matching. The declining TPT among vocational high school graduates in Batam may

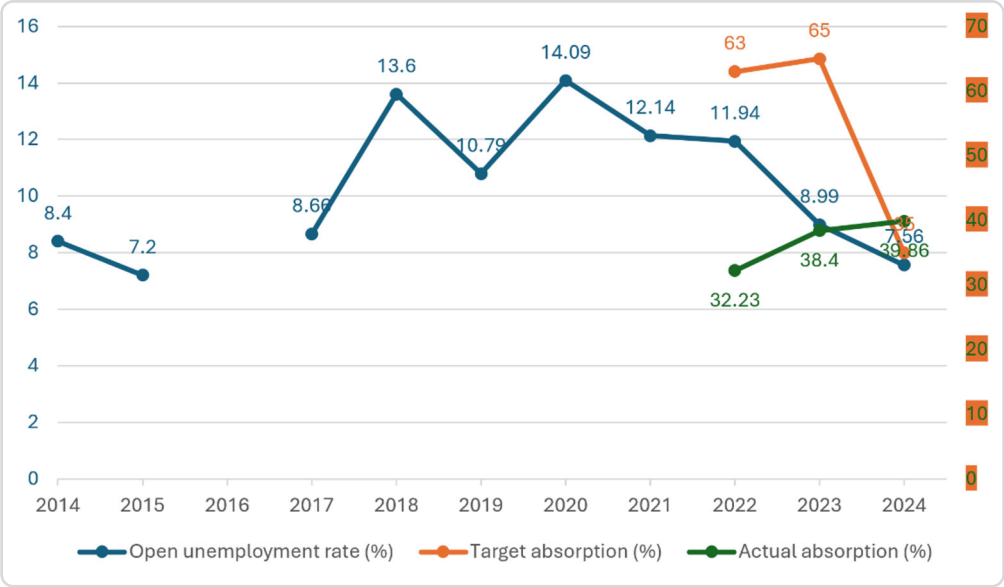

Figure 2. Comparison of Open Unemployment Rates for Senior Secondary Graduates (SMA/MA/SMK, Riau Islands Province) and Formal Industry Absorption Rates of Vocational High School Graduates in Batam (2014–2024)

Source: *Badan Pusat Statistik Provinsi Kepulauan Riau [Statistics Riau Islands Province] (open unemployment rate, used as a provincial proxy) and regional administrative records supplied by the authors (formal industry absorption); data processed by the authors (2026). The open unemployment rate uses Riau Islands province-level data as a proxy, as unemployment by education level is not published at the Batam municipal level.*

therefore present a potentially misleading picture of labor-market absorption: graduates may be employed but remain in jobs that do not fully utilize their qualifications or vocational competencies.

This becomes evident when TPT data are compared with formal-industry absorption data. Over the three most recent years (2022–2024), the proportion of vocational high school graduates absorbed into formal industry sectors never exceeded 40%. This pattern indicates a substantial gap between employment and formal-industry absorption and is consistent with the presence of qualification mismatch, including potential vertical mismatch (Putranto et al., 2024). Following Wicaksono et al.'s (2023) framework, such misalignment is associated with wage penalties, particularly when workers with higher educational qualifications are employed in jobs requiring lower levels of education. In Batam, vocational graduates may consequently enter lower-skilled or informal-sector occupations that do not fully utilize the technical competencies associated with their qualifications, supporting the possibility of persistent overeducation (Damelang & Ruf, 2023).

The scissors effect visible in the data is striking: the complement of the vocational graduate unemployment rate reached 92.44% in 2024, while the proportion absorbed by formal industry sectors remained below 40%. The widening gap between these two lines—which this study terms the area paradox—likely represents a substantial number of vocational high school graduates in Batam who are statistically classified as employed yet may remain in informal-sector, lower-skilled, or otherwise unrelated occupations that do not fully utilize their vocational competencies.

This interpretation is consistent with Paramitasari et al. (2024), who found, using spatial econometric analysis, that 61.58% of vocational high school graduates in Indonesia experience horizontal mismatch, working in fields unrelated to their program of study. In Batam's context, where industrial clusters are highly technical (electronics manufacturing, shipyards, logistics), horizontal mismatch may have more serious consequences (Schweri et al., 2020): graduates working outside their field of study may not only experience wage penalties but also contribute less effectively to productivity growth in the sectors that underpin the city's economy.

This labor paradox emerges from the convergence of three mutually reinforcing failures. First, signaling failure: vocational high school graduates cannot provide credible competency signals to employers because of the absence of a universally recognized certification mechanism across FTZ industries, which may lead employers to rely on other recruitment sources or leave positions vacant. Second, curriculum failure: the content taught in vocational high schools is insufficiently aligned with current industry needs and the minimum competency standards required by industry, producing what Kurniati et al. (2023) call an "extreme gap" that leaves graduates poorly aligned with the workforce needs of their target sectors. Third, regulatory failure: the absence of local regulations requiring FTZ industries to engage in the vocational education ecosystem—through fiscal incentives, structured internship obligations, or absorption commitments—creates an implementation and enforcement gap in the link-and-match policy (Khomsah et al., 2025).

3.3. IKPV Construction and Analytical Interpretation

To measure the effectiveness and readiness of Batam's vocational education ecosystem comprehensively, this study constructs the IKPV, adapting the wellbeing methodology framework (Muktiono & Suriadi, 2021) across three dimensions: Quality (P), Participation (Par), and Acceptability (A). Computation proceeds through

Table 3. IKPV Computation Results, Batam City (2024 Base Year)

Dimension	Variable	Actual Value	Min/Max	Index Score	Dimensional Sub-Index
Quality (P)	X1. Link-and-match infrastructure (vocational high schools)	70 schools	0/90	0.777	IP = 0.873
	X2. Quality of educators (teacher ratio)	1,418 teachers	0/1,445	0.981	
Participation (Par)	X3. Access/GER, upper secondary (SMA/MA/SMK combined)	107.80% (capped at 100%)	0/100	1.000	IPar = 1.000
Acceptability (A)	X4. Labor-market absorption (formal industry)	39.86%	0/100	0.398	IA = 0.559
	X5. Vertical mismatch (negative indicator)	52.58%	0/100	0.474	
	X6. Overall absorption capacity	92.44%	0/100	0.924	
IKPV (final)				0.787	

Source: *Processed by the authors (2026). For the negative indicator X5, the normalized score is inverted so that higher index scores consistently represent better performance.*

three methodological stages: operationalization and goalpost setting, min–max normalization, and geometric aggregation.

The geometric aggregation method is deliberately selected because it is less compensatory than arithmetic aggregation: an extreme weakness in one indicator cannot be fully offset by high performance on another. This reduces the possibility that strong performance in one dimension will mask critical weaknesses in another, thereby limiting the kind of aggregate-score distortion that could allow high enrollment rates to obscure poor labor-market outcomes.

Based on the composite-index categorization matrix—where 0.00–0.49 is *critical* (low), 0.50–0.74 is *transitional* (medium), and 0.75–1.00 is *optimal* (high)—Batam's IKPV score of 0.787 places its vocational education system in the optimal category. However, dimensional disaggregation reveals a sharp structural paradox.

On the supply side (input), the local government appears highly successful: the Participation dimension achieves a perfect score (1.000), and the Quality dimension (infrastructure and teacher numbers) reaches a strong 0.873. From a supply perspective, school access is relatively strong, and teacher availability remains close to its historical peak. Yet this upstream strength contrasts sharply with downstream outcomes. The Acceptability dimension—the fundamental outcome dimension of vocational education—falls to only 0.559. This indicates that, despite strong input indicators in terms of enrollment and teacher availability, the resulting labor-market outcomes remain poorly aligned with industrial needs.

The geometric aggregation in the IKPV highlights a key relationship: a high quantity of vocational high school teachers and educational facilities does not translate proportionately into higher formal-industry absorption; instead, substantial qualification mismatch persists in the labor market. Vocational high school graduates in Batam may be administratively classified as employed while substantively experiencing weak labor-market acceptability, including employment in informal-sector occupations or work outside their vocational specialization. This operationalization suggests that, without strategic intervention to align input quality with specific industry needs through genuine link and match, expanding vocational participation in Batam may continue to produce structurally mismatched labor-market outcomes.

4. Conclusion

This study finds that Batam's vocational education system faces a profound structural paradox. While the IKPV composite score of 0.787 places the system in

the optimal category overall, dimensional analysis reveals a sharp structural divergence: strong upstream performance (Participation: 1.000; Quality: 0.873) does not translate into comparable downstream outcomes (Acceptability: 0.559). Only 39.86% of vocational high school graduates are employed in formal industry sectors relevant to their vocational qualifications, while 52.58% experience vertical mismatch, working in occupations that require lower qualification levels than those they possess. The findings point to three converging institutional failures underlying this paradox: signaling failure, curriculum failure, and regulatory failure.

This study recommends three evidence-based policy interventions: (1) enacting local regulations that require FTZ industries to establish structured internship programs and vocational high school graduate absorption targets (Katz et al., 2022); (2) establishing a mandatory curriculum-reform mechanism requiring annual alignment of vocational high schools' Kurikulum Operasional Satuan Pendidikan [Educational-Unit Operational Curriculum] with the Standar Kompetensi Kerja Nasional Indonesia [Indonesian National Work Competency Standards] relevant to Batam's dominant industrial clusters (Hertanto, 2026); and (3) introducing a universal competency-certification system aligned with FTZ industry standards that integrates and standardizes existing Lembaga Sertifikasi Profesi Pihak Pertama [First-Party Professional Certification Body] mechanisms. Future research should validate these findings through triangulation with primary data, including tracer studies and industry competency surveys, and extend the IKPV framework to other FTZ contexts in Indonesia.

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DECLARATIONS

AI Use Statement

Artificial intelligence tools were used solely as aids during the drafting of this manuscript, specifically for language refinement, grammar checking, and improving the clarity and structure of the text. All substantive decisions regarding the research design, data analysis, interpretation of findings, and conclusions were made by the authors. The authors have reviewed and verified all results generated with the help of AI and remain fully responsible for the content, accuracy, and integrity of this manuscript.

Author Contributions

The authors contributed to the preparation of this manuscript in the following roles:

Advisor/Supervisor: Provided academic and methodological guidance, strengthened the research methodology, and contributed to the analysis and interpretation of data.

Authors: Conducted research activities, collected and processed data, drafted the manuscript, and contributed to the analysis, interpretation, and revision of the manuscript.

All authors have reviewed and approved the final version of the manuscript and agree to take responsibility for all aspects of this work.

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Competing Interests

The authors declare that there are no conflicts of interest or competing interests regarding the research, writing, or publication of this manuscript. There are no financial, personal, or institutional relationships that influenced the conduct of the research or the preparation of this manuscript.

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