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Digital Carbon Markets in Indonesia: Business Strategies and Market Mechanisms

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Abstract. Indonesia has built one of the most ambitious carbon market architectures in Southeast Asia, yet its organised market remains small, thinly traded, and weakly priced. This paper analyses the design of Indonesia's digital carbon market and the business strategies it induces, using a literature review combined with policy and market analysis of publicly available data. The institutional foundations are Presidential Regulation No. 98 of 2021 on Carbon Economic Value, substantially replaced by Presidential Regulation No. 110 of 2025, the power sector emissions trading scheme operating since February 2023, and IDXCarbon, the carbon exchange launched by the Indonesia Stock Exchange on 26 September 2023 under the supervision of the Financial Services Authority (OJK) through OJK Regulation No. 14 of 2023. The analysis shows that Indonesia operates a hybrid system in which intensity based cap and trade for power generation, organised around technical emission ceiling approvals (PTBAE-PU), coexists with project based offset crediting through greenhouse gas emission reduction certificates (SPE-GRK), both recorded in the national registry SRN PPI. This hybridity fragments supply and complicates price formation. The digital layer of registry, measurement, reporting and verification, and exchange infrastructure improves traceability, but the second registry introduced in 2025 raises reconciliation questions, and tokenisation remains a debate rather than a practice. Drawing on figures published by the exchange and compiled by independent analysts, the paper shows that cumulative trading value on IDXCarbon reached only about IDR 78 billion in its first two years, with average prices far below international benchmarks. Business strategies therefore diverge sharply: compliance driven hedging by emitters, supply creation by project developers, and intermediation by brokers and verifiers. Integrity risks, including double counting, weak additionality, and greenwashing, condition every strategy. The paper closes with recommendations on cap tightening, price stabilisation, registry interoperability, and integrity safeguards.

Keywords: carbon market; IDXCarbon; carbon economic value; emissions trading system; measurement, reporting and verification; Indonesia

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INTRODUCTION

Carbon pricing has moved from the margins of climate policy to its centre. The World Bank records 80 carbon pricing instruments in operation worldwide in 2025, covering about 28 percent of global greenhouse gas emissions and generating revenues above USD 100 billion for the second consecutive year [1]. Emissions trading systems form the largest part of this landscape, and comparative reviews show that their performance depends less on the elegance of the textbook model than on cap stringency, allocation

rules, and institutional credibility [2]. Three decades of experience with cap and trade teach a consistent lesson: markets deliver cost effective abatement only when the cap binds, when prices are allowed to signal scarcity, and when the rules survive contact with politics [3]. For a digital business journal, carbon markets are doubly interesting, because a modern carbon market is not only an environmental instrument but also a piece of digital market infrastructure, complete with electronic registries, verified data flows, trading platforms, and new classes of intermediaries.

Indonesia is a critical test case. It is among the largest emitters in the developing world, with emissions driven by coal fired power generation, deforestation and peatland degradation, and a fast growing industrial base, and it has committed in its Enhanced Nationally Determined Contribution to reduce emissions by 31.89 percent unconditionally and by 43.20 percent conditionally below the business as usual trajectory by 2030, with net zero emissions targeted by 2060 [4]. To finance and discipline this transition, Presidential Regulation No. 98 of 2021 established the Carbon Economic Value framework, known in Indonesian as Nilai Ekonomi Karbon, which combined carbon trading, result based payments, and a carbon levy within a single architecture anchored in the national registry SRN PPI [5]. In October 2025 this framework was substantially replaced by Presidential Regulation No. 110 of 2025, which reorganised the instruments, introduced a second registry, and reopened the door to international transfers of Indonesian carbon units [6].

The organised marketplace at the centre of this architecture is IDXCarbon, launched on 26 September 2023 by the Indonesia Stock Exchange under the supervision of the Financial Services Authority, the Otoritas Jasa Keuangan or OJK, whose Regulation No. 14 of 2023 governs carbon trading through a carbon exchange [7]. In parallel, the Ministry of Energy and Mineral Resources has operated an emissions trading scheme for coal fired power plants since February 2023. The early record of these markets, however, is sobering: independent analysis of exchange data finds cumulative trading value of only about IDR 78 billion, roughly USD 4.9 million, in the first two years of IDXCarbon, with few listed projects and falling average prices [8]. Indonesia therefore presents a puzzle that this paper addresses. Why has a country with enormous mitigation potential, a complete legal architecture, and a functioning digital exchange produced such a thin market, and what strategies should businesses, market operators, and regulators adopt in response?

The paper pursues three questions. First, how do the mechanism design choices embedded in Indonesian regulation, in particular the coexistence of cap and trade allowances and offset credits, shape market behaviour? Second, what does the digital layer of registries, measurement, reporting and verification systems, exchange platforms, and possible tokenisation contribute, and where does it fall short? Third, what business strategies are rational for emitters, project developers, and intermediaries under current conditions, and what integrity risks discipline those strategies? The contribution is twofold. For scholarship, the paper connects the classic carbon market design literature to the digital business literature through the Indonesian case. For practice, it offers an evidence based map of a young market in which first mover advantages remain available but integrity failures could destroy value quickly.

METHODS

This study uses a literature review combined with policy analysis and market analysis based exclusively on publicly available data. No primary data were collected, no

interviews were conducted, and no proprietary trading data were used; where the paper reports volumes, prices, or participation figures, they are taken from public releases of the Indonesia Stock Exchange, the OJK, and Indonesian ministries, or from independent analyst compilations of those releases, and are attributed to their sources in the text. The scholarly literature was assembled from journals and books published by major international publishers, covering the economics of instrument choice, the empirical record of emissions trading in Europe and elsewhere, the politics of carbon markets, the integrity literature on offsets and additionality, and the emerging literature on digital technologies, including blockchain, in carbon and energy markets. The policy analysis works through the hierarchy of Indonesian instruments, from the Harmonisation of Tax Regulations Law and the Financial Sector Development and Strengthening Law to Presidential Regulations No. 98 of 2021 and No. 110 of 2025, OJK Regulation No. 14 of 2023, and the energy ministry regulation governing carbon trading in the power generation subsector. The market analysis examines the design of the power sector scheme and of IDXCarbon, the trading mechanisms offered by the exchange, and the publicly reported evolution of volumes, prices, and participation during the first two years of operation [1], [8]. Findings from the three strands are triangulated in the discussion: a design feature is treated as consequential only when the legal text creates it, the literature predicts its effect, and the observed market record is consistent with that prediction. The main limitation is that Indonesian carbon trading data are published irregularly and in aggregate form, so the analysis of liquidity and prices relies on the figures that public sources make available rather than on transaction level records. A second limitation is that the 2025 regulatory reform is recent, and some of its implementing rules were still being prepared when this analysis was conducted, so statements about its effects are necessarily prospective. The market data used here deserve a final note on provenance. The Indonesia Stock Exchange publishes aggregate trading statistics for IDXCarbon, and the OJK reports licensing and supervision milestones, but neither source releases a continuous public time series of daily volumes and prices. The figures analysed in this paper are therefore drawn from the most complete public compilation available, the September 2025 assessment by the Institute for Energy Economics and Financial Analysis, which aggregates exchange reported data for the period from the September 2023 launch to mid 2025 [8], cross checked against the global benchmarks in the World Bank's annual carbon pricing assessment [1]. Where press reporting is the only source for a specific transaction, notably the first international trades of January 2025, the paper says so in the text and treats the figures as reported rather than official. This conservative sourcing rule means that some trades executed through negotiated or off exchange channels may be undercounted in the analysis, a bias that, if anything, understates the market's activity but does not alter its order of magnitude.

RESULT AND DISCUSSION

1. Market Mechanism Design: Cap and Trade, Offset Crediting, and the Indonesian Hybrid

The foundational choice in carbon market design is between fixing the quantity of emissions and letting the price adjust, or fixing the price and letting quantity adjust. The instrument choice literature shows that this choice should turn on the relative slopes of marginal abatement cost and marginal damage curves, and that under uncertainty the two instruments are not equivalent [9]. Indonesia has declined to choose. Its Carbon Economic

Value framework combines a quantity instrument for the power sector, a project based crediting instrument for mitigation actions across the economy, a legislated carbon tax that has been repeatedly postponed, and result based payments for forestry outcomes, all under one regulatory roof [5]. The result is a hybrid whose behaviour differs systematically from the single instrument markets that dominate the textbook literature.

Within the trading pillar, two different units circulate. The first is the allowance created by the power sector scheme, in which each covered installation receives a technical approval of its emission ceiling, the Persetujuan Teknis Batas Atas Emisi bagi Pelaku Usaha or PTBAE-PU, expressed as an emissions intensity benchmark per unit of electricity generated [10]. Installations that emit below their approved intensity hold a surplus they may sell; installations above it must acquire units. The second unit is the offset credit, the Sertifikat Pengurangan Emisi Gas Rumah Kaca or SPE-GRK, issued to mitigation projects whose emission reductions have been measured, reported, and verified, and recorded in the national registry [5]. Both units represent one tonne of carbon dioxide equivalent, but they are not the same economic object. The PTBAE-PU is a compliance allowance inside a closed sectoral system whose scarcity is set administratively, while the SPE-GRK is a credit whose supply expands with project development. Economic theory predicts friction when such units meet in one marketplace, because buyers cannot treat them as perfect substitutes and sellers face different cost structures [11].

Indonesia's exchange design acknowledges this duality. IDXCarbon admits both unit types for trading, but the compliance demand that would anchor prices is confined to the power sector, whose participants have historically traded through a separate ministry platform, while the exchange has so far listed mostly project based credits [7], [8]. The European experience warns what happens when allowance supply outruns demand. Studies of the European Union Emissions Trading System show that prices collapsed after 2008 not primarily because of the recession but because caps were set against emissions that never materialised and because imported credits flooded the market, leaving most price variation unexplained by abatement fundamentals [12], [13]. Reforms that later allowed surplus allowances to be cancelled only temporarily restored scarcity, a reminder that quantity based stabilisers work slowly and imperfectly [14]. Price formation in the first phase of the European scheme was likewise dominated by regulatory announcements and weather driven demand rather than by smooth scarcity signals [15]. Indonesia has reproduced the preconditions of the European price collapse in compressed form: sectoral ceilings set generously enough that few installations face a binding constraint, free allocation that removes purchase pressure, and a credit supply pipeline encouraged by policy while compliance demand remains narrow [8], [10].

Two statutory decisions frame this design. The Financial Sector Development and Strengthening Law of 2023 classified carbon units as securities, which placed the exchange and its participants inside the capital market regulatory perimeter supervised by the OJK [16]. This classification gives carbon units a legal certainty that project credits in many jurisdictions lack, and it imports familiar disciplines of disclosure, market conduct, and settlement into a young environmental market. The postponed carbon tax points the other way. The Harmonisation of Tax Regulations Law of 2021 set a minimum carbon tax rate of IDR 30,000 per tonne of carbon dioxide equivalent, about USD 2, initially for coal fired generation in a cap and tax arrangement [17]. Repeated postponement since 2022 has deprived the market of the price floor that a tax would provide and has signalled to investors that the state is reluctant to let carbon carry a meaningful price. A hybrid system

can work, but only if its components are calibrated against one another. In Indonesia the calibration currently produces an allowance market without scarcity, a credit market without anchor demand, and a tax that exists only on paper.

2. The Digital Layer: Registries, MRV, the Exchange Platform, and the Tokenisation Debate

A carbon unit is a digital object before it is a financial one. It exists because a registry entry says it exists, and its value rests on a chain of data: a baseline, a monitoring report, a verification statement, an issuance entry, and a retirement entry. The quality of a carbon market is therefore the quality of its information systems, which is why the digital layer deserves analysis as business infrastructure and not as administrative plumbing. Indonesia's core system is the Sistem Registri Nasional Pengendalian Perubahan Iklim, the SRN PPI, operated by the environment ministry, in which mitigation actions, units, and transfers must be recorded [5]. Registration in the SRN PPI is a precondition for units to trade on IDXCarbon, so the registry functions as the single source of truth that the exchange, the OJK, and the sectoral ministries all read from [7].

Digital registries solve real problems. They prevent the same tonne from being sold twice within one system, they make holdings and retirements auditable, and they lower the transaction costs that historically confined carbon trading to large bilateral deals. Yet the research on carbon governance cautions that registry politics are still politics. Studies of forest carbon governance in Indonesia show that decisions about who may register projects, whose land and carbon rights are recognised, and which methodologies are approved distribute value long before any trade occurs [18]. Multi level governance research on Indonesia similarly finds that national level control of information systems can marginalise provincial and local actors whose cooperation project developers need on the ground [19]. A registry is thus simultaneously a transparency device and a gatekeeper, and developers experience it as both.

On top of the registry sits measurement, reporting, and verification, the MRV chain through which emissions and reductions become numbers that a registry may certify. Digital MRV, including satellite monitoring of land use, sensor based reporting in energy, and standardised electronic reporting formats, promises lower verification costs and faster issuance. The promise matters for Indonesia because MRV cost is a fixed cost that falls hardest on the small and medium projects that dominate its land based mitigation potential. The exchange platform is the third digital component. IDXCarbon offers auction, regular trading, negotiated trading, and marketplace mechanisms, borrowing the market microstructure of the stock exchange, with delivery versus payment settlement and units held in registry accounts [7]. Treating carbon as a security traded on exchange infrastructure [16] gives Indonesia standardised contracts and surveillance from the first day, advantages that older offset markets built on bilateral contracting never had.

The fourth component, tokenisation, remains largely a debate. Enthusiasts argue that representing credits as tokens on a blockchain would open carbon markets to global retail demand, automate retirement, and embed provenance in the asset itself. The scholarly record is more cautious. Reviews of blockchain in the energy sector find many pilots and few production systems, with scalability, governance, and legal recognition unresolved [20]. Work on blockchain based forest carbon is sharper still: putting a credit on a chain does not verify the forest, and the oracle problem of connecting digital tokens to physical carbon simply relocates trust to whoever feeds data into the system [21]. Ethnographic

research on cryptographically marketed forest carbon concludes that the technology can obscure, as easily as reveal, the social and ecological relations behind a credit [22]. Indonesia's regulators have so far kept the official market on conventional registry and exchange infrastructure, with units as book entries rather than tokens, and the analysis here supports that caution. The priority is interoperable registries and credible MRV, not tokenised wrappers around unverified tonnes. This priority became more urgent in 2025, when Presidential Regulation No. 110 of 2025 introduced a second registry, the Carbon Unit Registry System or SRUK, to operate alongside the SRN PPI for certain instruments and international transfers [6]. Two registries can be reconciled through application programming interfaces and shared identifiers, but until that reconciliation is demonstrated, the reform adds a reconciliation risk at exactly the layer where the market can least afford ambiguity.

3. Liquidity and Price Formation in the Early IDXCarbon Market

By international standards the early IDXCarbon market is exceptionally thin. Independent compilation of exchange data reports trading value of about IDR 31 billion and volume of 494,254 tonnes of carbon dioxide equivalent in the launch months of 2023, followed by about IDR 20 billion and 413,764 tonnes in 2024, for a cumulative value of roughly IDR 78 billion, about USD 4.9 million, across the first two years [8]. The same compilation counts 132 registered participants and only 8 listed projects, and records at least one month, February 2024, with no transactions at all [8]. Average transaction prices declined from about IDR 62,533 per tonne in 2023 to about IDR 55,985 per tonne in December 2024, equivalent to roughly USD 4 per tonne [8]. The comparison embedded in that analysis is stark: the European market that Indonesian policymakers cite as a model supports more than 11,000 participants and prices around USD 70 per tonne [8]. A market with eight sellers, sporadic trading days, and a price below the cost of rigorous verification is not yet performing the allocative function that justifies emissions trading in theory [2], [9].

The causes are design features rather than mysteries, and the European literature names them. Prices are low because scarcity is low: power sector ceilings were set at levels that few installations exceed, so surplus PTBAE-PU units chase limited compliance demand [12], [10]. Prices are unstable in thin markets because a single bilateral deal can set the reference price for weeks, reproducing the announcement driven volatility documented in the early European phases [15]. The unexplained component of price movements, which European econometrics found to dominate even in a deep market [13], is larger still where trading is episodic and disclosure is aggregated. Two Indonesian specific factors compound the problem. First, the compliance obligation that generates recurring demand is confined to one subsector and has been administered largely through a ministry channel rather than the exchange, so IDXCarbon functions mainly as a voluntary and offset marketplace whose buyers are discretionary and price sensitive [7], [10]. Second, the shelved carbon tax removes the floor that would otherwise anchor expectations; with a tax of IDR 30,000 per tonne legislated but not collected [17], market prices only modestly above that level carry little information about future policy.

One episode illuminates both the potential and the fragility of price formation. When IDXCarbon opened to international buyers in January 2025, press reporting recorded the sale of 41,822 tonnes from state electricity company energy projects at IDR 96,000 per tonne for energy efficiency credits and IDR 114,000 per tonne for renewable mini hydro credits, prices roughly double the prevailing domestic average [8]. Foreign demand, it

appears, will pay a premium for Indonesian units that carry credible documentation, which supports the international opening written into the 2025 reform [6]. The same episode drew analyst criticism that the credits sold lacked letters of authorisation clarifying their status under the Paris Agreement accounting rules, which is precisely the kind of ambiguity that discounts prices over time [8]. The technology dimension of the carbon price problem should not be forgotten. A carbon price performs two functions: it reallocates emissions among existing technologies, and it induces investment in new ones. Where the price is near USD 4, the second function fails, because the price signal cannot cover the risk premium on innovation, a failure compounded by the knowledge spillovers that make private returns to clean technology systematically lower than social returns [23]. Indonesia's low prices are therefore not merely a market curiosity; they postpone the investment response that the entire framework exists to provoke [4].

4. Business Strategies for Emitters, Project Developers, and Intermediaries

A thin and evolving market rewards actors who read its design correctly. The politics of carbon markets literature shows that firms never merely respond to carbon prices; they organise around them, lobby over allocation, build trading capabilities, and convert market participation into reputational assets [24], [25]. Three broad actor groups face distinct strategic problems in Indonesia.

For emitters, principally power generators covered by the sectoral scheme and energy intensive manufacturers anticipating wider coverage, the rational strategy is staged compliance at lowest expected cost. Because ceilings are intensity based and allocation is free, the immediate task is measurement: installations that cannot measure their emissions intensity against the PTBAE-PU benchmark cannot know whether they are long or short [10]. Beyond measurement, emitters should build a portfolio position, banking surplus units while prices are low, contracting forward for expected shortfalls, and treating efficiency investment as a hedge whose payoff rises with every future tightening of ceilings. The strategic error to avoid is complacency. A critical strand of the literature warns that firms which treat carbon markets as a compliance afterthought, or as a public relations exercise, systematically underestimate regulatory ratchets, because caps in every mature system have tightened over time [26]. Indonesian emitters should also watch the boundary between the power scheme and the exchange: as more sectors are brought into trading under the 2025 framework [6], entities that already possess MRV capability, trading accounts, and registry literacy will comply at a fraction of the cost borne by late movers.

For project developers, the market is a supply creation business whose binding constraints are methodology approval, MRV cost, and time to issuance. Developers of forestry, peatland, renewable energy, and energy efficiency projects must carry projects through validation, registration in the SRN PPI, verification, and issuance of SPE-GRK units before any revenue arrives [5]. Strategy follows from that cash flow profile. Portfolio diversification across project types spreads methodology and policy risk; aggregation of small projects under programme designs spreads fixed MRV costs; and forward sales to credible buyers, including the foreign buyers who appeared in January 2025, convert uncertain spot prices into financeable revenue [8]. Developers must also price the 2025 reform. Recognition of international standards and the possibility of authorised international transfers under Presidential Regulation No. 110 of 2025 [6] raise the value of projects that can meet both Indonesian and international requirements, because such projects hold an option on two markets. The developers who will capture that option value

are those who document baselines, tenure, and benefit sharing to the standard that international buyers and their auditors already demand.

For intermediaries, including brokers, aggregators, verifiers, consultants, and the exchange itself, the opportunity is to sell the trust that a young market cannot yet supply on its own. Verification bodies occupy the pivotal position, because every unit's credibility passes through their audits, and the OJK's supervision of the exchange extends the perimeter of regulated conduct to market participants [7]. Brokerage and advisory firms can profit from information asymmetry between project rich regions and capital rich buyers, but the literature on corporate environmental communication sets the boundary of legitimate intermediation. Greenwash research shows that misleading environmental claims flourish where regulation is limited and verification is weak, and that they destroy value for the whole category once exposed [27], [28]. Intermediaries whose business model depends on opaque markups and exaggerated claims are therefore shorting the market they serve. The durable intermediary strategies are boring by design: transparent fees, registry native settlement, documented chain of custody for every unit, and marketing that distinguishes a retired authorised unit from an unretired credit. In a market whose scarcest asset is credibility, trust is not a constraint on strategy; it is the strategy.

5. Integrity Risks: Double Counting, Additionality, and Greenwashing

Every weakness in a carbon market eventually expresses itself as an integrity problem, and the Indonesian framework concentrates the three classic risks. The first is double counting, in which one emission reduction is claimed by two parties: by the host country toward its nationally determined contribution and by a foreign buyer toward its own target or offset claim, or twice within overlapping domestic schemes. The Paris Agreement answers this risk with the corresponding adjustment, under which the host country adds the transferred amount back to its own emissions balance [29]. Indonesia's earlier framework made international transfers conditional on first meeting national targets, which suppressed double counting by suppressing trade [5]. The 2025 regulation distinguishes authorised transfers, which carry a corresponding adjustment, from non authorised transfers, which do not, and recognises international standards alongside the national system [6]. This distinction is workable only if registries record the authorisation status of every unit at issuance and preserve it through every transfer. With two registries now in operation [6], and units also visible on the exchange, the technical burden of preventing double issuance, double sale, and double claiming has risen sharply. The scholarly guidance is unambiguous: environmental integrity in international markets is an accounting property before it is a political one, and it fails quietly, in ledger design, long before it fails publicly [29].

The second risk is non additionality, the issuance of credits for reductions that would have happened anyway. Additionality assessment was the most contested technical practice of the Kyoto era, and the lessons are directly transferable: investment analysis is manipulable, common practice tests lag technology diffusion, and project by project judgement invites inconsistency [30]. The Paris era reformulation argues that additionality testing remains necessary but should be standardised, conservative, and focused on activity types with systematic over crediting risk [31]. Empirical work since then has strengthened the warning. Analysis of California's forest offset programme found systematic over crediting of about 29 percent arising from baseline rules that developers could game [32]. A systematic assessment of more than two thousand crediting projects found that less than 16 percent of issued credits corresponded to real emission reductions

[33]. A market in which most credits are doubted cannot sustain prices, because rational buyers discount every unit for the average failure rate, which is one mechanism behind the low prices documented on IDXCarbon [8], [33].

The third risk is greenwashing, the use of carbon purchases and market participation to construct an environmental image that performance does not support. Demand side research shows that major companies have historically retired large volumes of low quality offsets, with one study classifying 87 percent of the retired offsets of the twenty largest corporate users as high risk [34]. The conceptual literature explains why this persists: offsetting allows a firm to purchase a narrative of equivalence between its emissions and distant reductions whose permanence, leakage, and social effects it does not control [35]. Critical scholarship adds that carbon markets can function politically to defer the restructuring of carbon intensive business models, converting a transformation problem into a procurement problem [36]. For Indonesian sellers and the exchange, these risks are commercial as well as ethical. A market that acquires a greenwashing reputation loses exactly the premium foreign buyers who demonstrated willingness to pay above domestic prices [8], and it exposes Indonesian corporates to the disclosure regimes of export markets. Integrity is therefore not a compliance annex to market development; it is the asset on which the price level, the international opening, and the political survival of the framework all depend.

6. Strategy and Policy Recommendations

The analysis supports recommendations at three levels. For regulators, the first priority is scarcity. Ceilings under the power scheme should be tightened on a published schedule so that a predictable share of installations faces a genuine purchase obligation, and coverage should extend to additional sectors as the 2025 framework envisages [6], [10]. The European record shows that markets forgive early generosity only when a credible correction mechanism follows [12], [14]. Second, Indonesia should install a price stabilisation device, whether an auction reserve price, a market stability reserve adapted to a small market, or activation of the legislated carbon tax as a floor [17]. A floor converts the tax from an embarrassment into the market's anchor and directly serves the innovation function of the price [23]. Third, the two registries must be made interoperable with a single unit identifier and a public reconciliation protocol, so that the digital layer remains a source of trust rather than a new locus of double counting risk [5], [6], [29]. Fourth, integrity rules should be hardened before volumes grow: conservative standardised baselines for high risk project types, transparent additionality tools, and public retirement records that show which entity claims which unit for which purpose [30], [31], [33]. The OJK's continuing development of supervisory guidance and market education, including its 2025 carbon exchange booklet for market participants [37], should be matched by equally public integrity reporting from the environment ministry as registry operator.

For market participants, the strategic recommendations mirror the regulatory ones. Emitters should invest in MRV capability now, while the cost of learning is low, and should treat today's surplus units and low prices as a hedging opportunity rather than evidence that carbon will stay cheap [10], [24]. Project developers should build to the highest standard they might plausibly need to meet, documenting additionality, tenure, and safeguards to international audit quality, because the price premium observed in the January 2025 international trades accrued to documented units [8], [31]. Intermediaries and the exchange should compete on verification quality and transparency rather than on claim inflation, since the greenwash literature predicts, and the offset quality literature

confirms, that reputational contagion punishes entire markets for individual failures [27], [34]. For researchers, finally, Indonesia offers a rare natural experiment in hybrid market design under a mid stream regulatory replacement. Priority questions include the price elasticity of domestic offset demand, the distributional effects of registry gatekeeping on community based projects [18], [19], and whether the dual registry architecture can maintain accounting integrity in practice [29]. Answering them with public data, as this paper has attempted, is itself part of the market's transparency infrastructure.

CONCLUSION

Indonesia has assembled the legal and digital components of a carbon market faster than almost any comparable economy, moving from the Carbon Economic Value framework of Presidential Regulation No. 98 of 2021 through the launch of IDXCarbon in September 2023 to the reorganised architecture of Presidential Regulation No. 110 of 2025, yet the market these components support remains thin, cheap, and dependent on a small number of participants and projects [5], [6], [8]. This paper has argued that the constraint is not technological and not primarily financial; it is a calibration problem in which generous sectoral ceilings, a postponed carbon tax, segmented unit types, and unresolved registry and integrity questions combine to suppress the scarcity on which carbon prices and business strategies depend [9], [12], [17]. The remedies follow from the diagnosis: tighten ceilings on a published schedule, anchor prices with a floor, unify the registry layer in practice, and enforce integrity standards strict enough that Indonesian units command the premium that foreign buyers have already shown they will pay for documented tonnes [8], [29]. For businesses, the strategic implication is symmetrical: emitters should build measurement and hedging capability before scarcity arrives, developers should build projects to international audit quality, and intermediaries should sell verifiable trust rather than narrative. Carbon markets fail when participants treat them as public relations instruments and succeed when the unit being traded is boringly real; Indonesia's framework gives its firms the chance, still open but not permanently so, to build the second kind of market.

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