Bit by Bit at the Berth: Can Container Terminal Operators Embrace Cryptocurrency?

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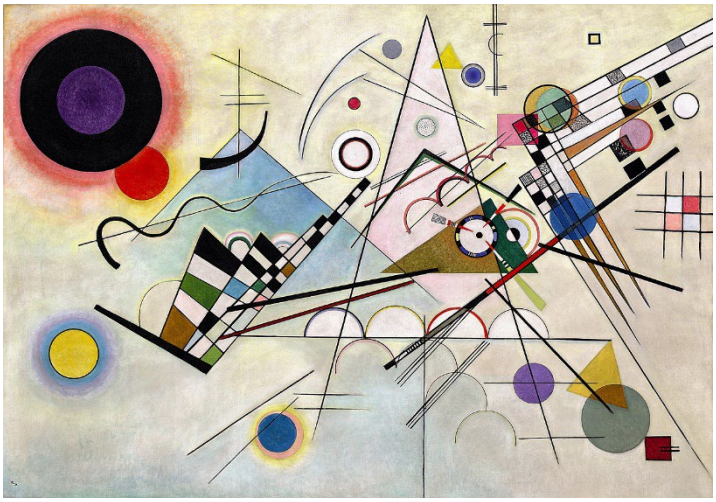
1. Introduction: A Digital Twist on Dockside Payments

As in Kandinsky's *Composition 8*, the overlapping patterns of trade, technology, and finance form a structured but abstract landscape. The possibility of cryptocurrency's entry into marine terminal payments introduces new shapes and rhythms into that composition. It is an abstract depiction of order within complexity—mirroring the interplay of blockchain architecture and terminal workflows. What at first appears chaotic may, in fact, follow a deeper logic of transformation.

Figure 1. A Visual Metaphor for the Structured Complexity of Trade, Technology, and Finance



Source. Guggenheim Museums and Foundation, New York. Vasily Kandinsky, *Composition 8 (Komposition 8)*, 1924 (https://www.guggenheim.org/artwork/1924).

Cryptocurrency has matured well beyond its speculative roots. Today, stablecoins like USDT and USDC enable near-instant cross-border payments[2], while Bitcoin is increasingly recognized as an institutional asset, and governments are recalibrating tax policies to respond to digital financial trends. The global logistics and infrastructure sectors—long reliant on hard currency and conservative finance—are beginning to take notice.

Recent national policy changes underscore this momentum. Thailand has announced a five-year capital gains tax exemption on crypto asset transactions conducted through licensed exchanges, part of a broader strategy to become a digital asset hub (Cointelegraph, 2025a). Brazil, in contrast, is tightening regulation by ending tax exemptions on offshore-held crypto assets, seeking stronger compliance and revenue oversight (Cointelegraph, 2025b). Meanwhile, though El Salvador has walked back its promotion of Bitcoin as legal tender, the country continues to promote itself as a hub for crypto innovation, actively encouraging blockchain-based financial services and investment.[3]

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[2] Stablecoins are cryptocurrencies that are designed to maintain a stable value by being pegged to a reserve asset, such as a fiat currency (e.g., USD) or a commodity (e.g., gold). Stablecoins, like USDT (Tether) and USDC, aim to offer the transactional advantages of crypto—like speed and borderless transfer—without the high volatility typically associated with assets like Bitcoin or Ethereum. See Bank for International Settlements, "Stablecoins: risks, potential and regulation", BIS Working Papers No. 905, November 2020, available at https://www.bis.org/publ/work905.pdf.

[3] The government repealed Bitcoin's legal tender status due to conditions set by the International Monetary Fund (IMF) as part of a $1.4 billion financial assistance program. See *Americas Quarterly*, "In El Salvador, Bitcoin's Retreat Left Valuable Lessons", 17 March 2025, available at https://www.americasquarterly.org/article/in-el-salvador-bitcoins-retreat-left-valuable-lessons/.

The market is responding, too. Crypto trading platforms are acquiring licenses and opening local subsidiaries, fintech innovators are merging traditional trade finance with blockchain infrastructure, and early signs of tokenized trade assets—from bills of lading to warehouse receipts—are surfacing.

Moreover, blockchain is increasingly regarded as a general-purpose technology (GPT), akin to electricity or the internet, with the potential to transform industries through transparency, decentralization, and smart automation (Catalini & Gans, 2016; Böhme et al., 2015). In logistics, its applications—particularly through permissioned ledgers—are gaining ground (Rejeb et al., 2023). These same features—secure traceability, immutability, and distributed control—are precisely what make crypto-based payment systems both technically feasible and operationally attractive.

These examples show that while crypto is not yet common in logistics, its ecosystem is developing—and elements of it are already functional. As adjacent actors in the trade chain experiment with crypto payments and blockchain records, container terminal operators may soon face growing expectations to integrate with this new financial layer.

At its core, blockchain is a type of distributed ledger technology (DLT) that records transactions across a decentralized network of computers. Each transaction is grouped into a block and linked to previous blocks, forming a secure, time-stamped chain of data. This structure makes tampering nearly impossible and provides a transparent, auditable trail of transactions.

Blockchain systems are designed to reveal only the necessary information to each user—a form of secure visibility often described as "need-to-know transparency." In logistics, this feature makes blockchain useful for tracking cargo, verifying documentation, or executing smart contracts. This real-time traceability is already showing value in supply chain use cases, and many of these same principles—especially immutability and transparency—make blockchain an appealing backbone for crypto-based financial settlements.

Against this backdrop, it’s worth asking: could container terminal operators—key players in global trade—begin accepting payment in cryptocurrency? Could the digital transformation of logistics extend to the way terminals are paid for vessel handling, storage, and cargo movement?

As explored in the case of Maria, the CEO of Eastern Siam Container Terminal, container terminals may one day face the decision to accept crypto payments from clients. In her case, a structured evaluation using multicriteria analysis (MCA) was used to weigh the risks and benefits of a crypto pilot program, illustrating how decision-support tools used by terminal managers can guide implementation strategies in a range of activities, from marine terminal planning and operations to equipment selection and IT systems development. As crypto matures and its relevance to logistics grows, such frameworks may prove a necessity to navigating new terrain without losing one’s financial bearings.

2. What Makes Container Terminals Unique in Payment Flows?

Container terminal operators occupy a distinct position in the logistics chain. Their services are high-value, tightly scheduled, and often governed by long-term contractual relationships. Unlike last-mile or freight forwarding segments that cater to individual consumers, terminals typically bill large-scale customers, such as shipping lines, NVOCCs, or major retailers.

This structure affects the feasibility of crypto adoption. Terminals process fewer, larger transactions—typically not high-frequency microtransactions. Their customers may also have complex treasury rules and regulatory compliance requirements. This makes any transition to cryptocurrency more deliberate and dependent on reliability, scalability, and clear accounting pathways.

Adding to this complexity is the role of Terminal Operating Systems (TOS) and, in some cases, Port Community Systems (PCS), which serve as the backbone of digital port operations. While few of these systems are currently built with crypto functionality in mind, their modular architecture could facilitate future integration. For example:

- PCS platforms could develop modules for identity-verified crypto wallets tied to trade transactions.
- TOS software may need plugins to integrate stablecoin payment APIs or smart contract execution.
- Compliance modules would be needed for AML/KYC vetting and tax documentation.[4]

In effect, crypto could become one layer in the broader evolution toward modular, API-driven port systems—especially if anchored in blockchain-backed documentation ecosystems.

A country's crypto tax policy may also play a role in shaping terminal-level decisions. Thailand's five-year capital gains tax exemption for crypto transactions through licensed exchanges is a signal to financial markets that crypto is in Thailand to stay (at least in the next five years). While primarily targeting fintechs and retail investors, this move could have indirect effects on trade and logistics. For example, shipping companies or terminal users based in Thailand may become more inclined to experiment with crypto-based payments. In this way, national crypto policies could emerge as competitive differentiators for port clusters.

3. Blockchain as an Enabler of Crypto in Maritime and Logistics

Many in the maritime industry are already familiar with how blockchain has supported digital transformation—especially in cargo tracking and contract automation. Systems like TradeLens (developed by Maersk and IBM) demonstrated how blockchain can create trusted, real-time views of shipping and customs events across multiple actors. Similarly, CargoX offers blockchain-secured electronic bills of lading, enabling secure, verifiable digital documentation that reduces courier costs and fraud risk.

Blockchain is also the foundational technology behind most cryptocurrencies. It is a decentralized, distributed ledger that records transactions across multiple nodes, ensuring transparency, security, and immutability. Cryptocurrency—such as Bitcoin, Ethereum, and stablecoins—leverages these features to enable peer-to-peer payments without intermediaries. While not all blockchain applications require cryptocurrency, most crypto transactions depend on blockchain for security and transparency. Understanding this relationship is important: cryptocurrency often draws scrutiny for its volatility and regulatory uncertainty, while blockchain itself is broadly embraced across industries—including ports and logistics (Rejeb et al., 2019).

[4] AML (Anti-Money Laundering) and KYC (Know Your Customer) are regulatory processes designed to prevent financial crimes such as money laundering, terrorism financing, and fraud. AML procedures involve monitoring and reporting suspicious transactions, while KYC requires institutions to verify the identity, source of funds, and risk profile of their clients. In the context of crypto transactions, these measures are increasingly important to ensure regulatory compliance and build trust with authorities. Tax documentation becomes more complex when crypto assets are involved, especially regarding capital gains and cross-border transfers.

Recent news illustrate how crypto applications are growing in the maritime sector. Maritime operators are exploring digital currency not only for port charges, but also for paying crew wages, settling cargo insurance, and executing smart contracts tied to logistics milestones. Trucking apps like TruckPay support crypto-based payments for independent haulers (AITHORITY, 2021), while e-commerce company Rakuten (Milkroad, 2023) and Sino-Global Shipping (FINBOLD, 2021) have piloted crypto transactions using Bitcoin or stablecoins. Further, the mayor of Panama City, Panama has suggested the Panama Canal Authority accept Bitcoin payments from shipping lines to gain priority access to the Panama Canal (Coin Insider, 2025).

To reduce volatility risk, some companies utilize crypto-fiat gateways[5] like CoinGate or Stripe, which enable them to accept crypto while settling in local currency. These tools help logistics firms expand payment flexibility without changing internal financial practices. The benefits include streamlined cross-border remittances, lower transaction fees, and enhanced compatibility with digital supply chains.

Some industry reports further extol crypto's potential to reduce paperwork, cut transaction delays, and enable automated, tamper-resistant records through smart contracts. However, challenges remain—regulatory ambiguity, limited adoption, cybersecurity risks, and price volatility all continue to temper enthusiasm. Nonetheless, as blockchain-backed systems grow more common in ports, logistics, and customs ecosystems, crypto may emerge not just as a financial curiosity—but as a practical tool woven into broader maritime digitalization efforts.

4. What Drives or Delays Crypto Acceptance? Lessons from User Behavior Studies

While much attention is paid to the technological features of cryptocurrency, the human factor—trust, familiarity, perceived usefulness—is also important. A recent study explored what determines whether users accept crypto-based systems, particularly those linked to large digital platforms or institutional sponsors (Nashaat, M. et al, 2024). The findings have implications for container terminal operators considering whether to accept crypto payments from customers or stakeholders.

Key takeaways from the study include:

- **Perceived Usefulness and Ease of Use**: These were strong predictors of whether users were willing to try crypto payments. If terminal clients (e.g., shipping lines or forwarders) see crypto as faster, cheaper, and easier than bank transfers, adoption becomes more likely.
- **Trust and Platform Credibility**: Users were more inclined to adopt cryptocurrencies when they were associated with established platforms or institutions. For port operators, this suggests that using regulated, reputable stablecoins (rather than volatile or obscure tokens) could mitigate concerns and encourage uptake.
- **Social Influence and Network Effects**: When peers or other companies in the same industry adopt crypto payments, others are more likely to follow. Terminal operators might monitor peer initiatives—for example, if a leading operator or alliance starts accepting crypto, others may face pressure to follow suit.

[5] A crypto-fiat gateway is a service or platform that allows users to convert between cryptocurrencies and traditional (fiat) currencies. Fiat currencies are government-issued currency that is not backed by a physical commodity like gold or silver, but rather by the government that issues it, like USD, EUR, or JPY.

- **Perceived Risk and Regulatory Assurance**: Concerns about security, volatility, and lack of clear rules suppressed adoption. Therefore, efforts to accept crypto must be paired with robust risk mitigation strategies, including payment gateways, fiat conversion options, and clear regulatory alignment.

These behavioral insights suggest that for container terminals, technological feasibility is not enough. Successful implementation will require client education, credible partners, risk controls, and—perhaps most importantly—timing. These same insights can help explain the decision process used by Maria and her team at the Eastern Siam Container Terminal.

5. A Hypothetical Case: Eastern Siam Container Terminal (ESCT)

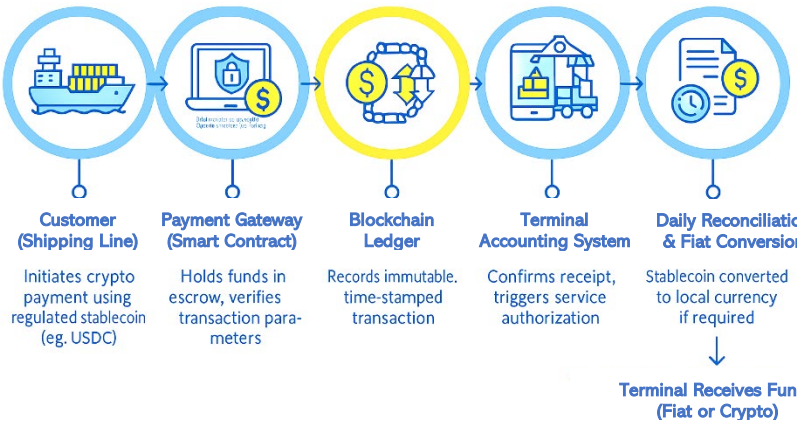
Imagine a medium-sized Thai container terminal—Eastern Siam Container Terminal (ESCT)—located in a SEZ where regulatory sandbox exemptions allow fintech experimentation. A major global shipping line, known for its recent adoption of blockchain in trade documentation and supply chain visibility, proposes to prepay a block of container moves in stablecoin using an escrow-backed smart contract[6].

Maria, the CEO of ESCT, who still hasn't forgiven her nephew for explaining NFTs (Non-Fungible Tokens) over an entire dinner, isn't exactly a crypto evangelist. But she knows enough to recognize that when a major customer offers to pay in stablecoin, it's worth more than a polite "we'll get back to you."

Maria faces key decisions:

- Should the terminal accept stablecoins directly or through a payment gateway?
- What risk controls should be in place (e.g., volatility buffers, real-time fiat conversion)?
- Can the terminal's TOS or accounting system handle crypto receipts?
- Will regulators view this as a financial activity subject to licensing?

Figure 2. Crypto Payment Flow for Vessel Handling Services



Maria convenes a team drawn from finance, legal, compliance, accounting, operations, customer service, marketing, and IT to assess readiness (and willingness) to proceed with a cryptocurrency payment system. To support internal discussions, Maria's team prepared a simplified schematic (Figure 2) illustrating how a crypto payment might flow through the terminal's systems—from the customer's stablecoin transaction to final receipt and

[6] An escrow-backed smart contract is a self-executing digital agreement that holds funds or assets in escrow until certain predefined conditions are met. It combines the traditional concept of escrow with the automation and transparency of blockchain-based smart contracts. A smart contract is a program stored on a blockchain that runs when specific conditions are met, automating the execution of an agreement without intermediaries.

reconciliation. This diagram helped align departments around technical needs and compliance checkpoints that would require attention if the decision is made to proceed with a crypto currency payment system.

To guide her decision, Maria's team develops a weighted risk-benefit matrix evaluating factors like volatility risk, regulatory uncertainty, client demand, system readiness, reputational impact, and cost savings. Each factor is scored 1–5 and weighted by strategic priority. This multicriteria analysis (MCA) clarifies which option offers the best risk-adjusted outcome.[7] The matrix (Table 1) is included below for reference and can represent a practical approach to preliminary analysis that can inform decision making.

Table 1. MCA Decision Support Matrix

Factor	Weight	Risk Score	Weighted Risk	Benefit Score	Weighted Benefit
Volatility Risk	0.2	4	0.8	2	0.4
Regulatory Uncertainty	0.25	5	1.25	1	0.25
Client Demand	0.15	2	0.3	5	0.75
System Readiness	0.2	3	0.6	4	0.8
Reputational Impact	0.1	3	0.3	3	0.3
Cost Savings	0.1	2	0.2	4	0.4
Total	**1.0**		**3.45**		**2.9**

Based on this matrix, Maria and her team conclude that while benefits are promising, risk remains significant. They decide to proceed cautiously with a limited pilot. The six-month pilot will allow only prepaid transactions from one selected client using a regulated stablecoin via a licensed payment gateway. Smart contracts will govern the escrow process, with real-time fiat conversion and daily transaction caps to manage volatility exposure. Integration within the terminal's accounting system will be limited to a parallel test system to avoid disrupting the terminal's core platforms.

The team also outlines KPIs—including transaction time, error rate, reconciliation effort, and client satisfaction—to evaluate pilot performance. Communications will be kept internal, with no public announcement until results are reviewed. A formal evaluation at the end of the pilot will determine whether to expand the program, redesign it, or discontinue. Maria's team also recognizes that the behavioral factors influencing user acceptance—trust, perceived usefulness, and social influence—can be just as critical as technical readiness. Integrating these soft dimensions into the analysis reinforces the value of a multidisciplinary approach.

If successful, the pilot would serve not only as proof of concept, but also as a foundation for scaling. Maria's team outlines a phased roadmap in anticipation of positive results. In Phase 1, they would expand stablecoin

[7] Multi-criteria analysis (MCA) has been applied in financial decision-making, including cryptocurrency portfolio selection, fintech adoption, and risk assessment, supporting its relevance for evaluating crypto payment systems at marine terminals. See Zdravka Aljinovic, Branka Marasovic, and Tea Sestanovic, "Cryptocurrency Portfolio Selection—A Multicriteria Approach", Mathematics 2021 9(14), 16 July 2021, available at https://www.mdpi.com/2227-7390/9/14/1677 and J. Spronk, R.E. Steuer, and C. Zopounidis. "Multicriteria Decision Aid/Analysis in Finance" in *Multiple Criteria Decision Analysis: State of the Art Surveys*, International Series in Operations Research & Management Science, vol 78. Springer, New York, NY, 2005.

acceptance to additional customers, gradually integrating crypto receipts into the live accounting environment. Phase 2 would explore extending crypto settlement to charges to shippers, while ensuring compliance with any updated regulatory guidance. Insights from the pilot—such as client preferences, volatility patterns, and system bottlenecks—would directly inform system refinements and staff training needs. By building on validated lessons and minimizing early missteps, ESCT could position itself as a regional leader in digital payment innovation—ready to scale further as crypto acceptance becomes more mainstream across global supply chains.

6. Conclusion: Experimentation, Not Transformation (Yet)

As Maria's team at ESCT discovered, crypto payments are not a one-size-fits-all solution. But they are no longer unthinkable. For certain ports, services, or user groups, crypto may offer a compelling value proposition. For others, the risks may still outweigh the benefits. Either way, the direction of travel is clear: digital currencies are entering the maritime economy. It's not a question of if, but when—and how. The evolution will likely be incremental—beginning with limited pilots, niche applications, and stablecoins—before expanding into broader systems integration and stakeholder adoption. Terminal operators that experiment early, learn quickly, and adapt accordingly may find themselves well-positioned to lead—not follow—as the next wave of financial innovation rolls in.

Cryptocurrency represents one more twist in the never-ending dance between logistics and innovation. From the first shipping container to the smart seal, every disruption starts small—bit by bit—until it reshapes the landscape. Who knows? In a few years, we might be nostalgically explaining to interns how we used to wait three whole days for cross-border wire transfers—and they'll look at us the way we looked at people who faxed cargo manifests.

For ports and terminals, crypto may not be the next big wave, but it may well be the ripple that signals the coming tide.

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