Predictive Service Differentiation as a Marketing Strategy Creating Customer Value and Competitive Positioning in Port Services

Khidhir Akbar Ghofar[1,*], Entis Sutisna[2], Rina Indrayani[3], Ramayani Yusuf[4], Kannisa Adjani[5]

[1,3,4,5] *Universitas Teknologi Bandung, Indonesia*
[2] *Akademi Digital Bandung, Indonesia*
[*]*Corresponding author. Email: khidhirakbarghofar@utb-univ.ac.id*

ABSTRACT
Port terminals operating in commoditized logistics markets face mounting pressure to differentiate beyond physical infrastructure capacity. This paper develops a marketing strategy framework that repositions predictive service capability as a strategic instrument for competitive differentiation and customer value creation. Drawing on an operational dataset of 95,648 container transactions, we examine how analytical insights can be reframed from internal efficiency metrics into customer-facing value propositions. The empirical analysis identifies container size as the dominant driver of service time variance, accounting for 75.63% of predictive importance, establishing a data-validated foundation for service segmentation, tiered offering design, and differentiated pricing. We introduce a two-tier service architecture predictive standard management covering approximately 90% of containers, and proactive exception handling for the remaining 10% that maps directly onto distinct market segments with divergent value priorities. By translating operational predictability into three categories of measurable customer benefit (demurrage exposure reduction, supply chain planning certainty, and strategic relationship deepening), this framework demonstrates how analytical capabilities function as a marketing asset. Port managers gain a practical roadmap for evolving from commodity service providers into differentiated, customer-centric logistics partners capable of supporting premium pricing strategies and long-term retention.

Keywords: *service differentiation, competitive positioning, port marketing strategy, customer value creation, predictive service management*

1. INTRODUCTION

1.1. The Commoditization Challenge in Port Terminal Markets

Global maritime logistics has entered a period of intensifying competition in which physical port capabilities berths, cranes, and yard space no longer constitute a durable source of competitive advantage. As infrastructure investment has become increasingly standardized across rival terminals, the foundation of differentiation has shifted toward service quality, reliability, and the capacity to deliver measurable value to customers embedded in complex supply chains (Park et al., 2023). Port terminals that fail to adapt to this structural shift risk becoming interchangeable commodity providers competing primarily on price a trajectory that compresses margins, weakens relationships, and erodes long-term positioning.

From a marketing perspective, this transition presents a dual challenge. The threat is structural: commoditization reduces pricing power and lowers customer switching costs. The embedded opportunity, however, concerns a dimension that most port operators have yet to leverage strategically the predictability of service delivery. In B2B markets where time constitutes a critical cost variable, the capacity to guarantee consistent service timelines converts an operational metric into a genuine and differentiated value proposition (Dhal et al., 2023). Customers do not merely want fast processing; they want certain processing and certainty commands a premium.

Container dwell time the elapsed duration from a container's arrival at a terminal to its final departure occupies precisely this intersection of operational management and customer experience. For shipping lines, freight forwarders, and importers, unpredictable dwell times propagate costs throughout the downstream supply chain: demurrage charges accumulate, scheduling buffer requirements inflate, and inventory carrying costs rise. A port that reliably predicts dwell

time is not merely operationally competent; it functions as a strategic partner in cost reduction and supply chain optimization (Khan et al., 2022).

1.2. Predictability as a Marketing Differentiator

The service marketing literature has consistently identified reliability and consistency as primary determinants of customer satisfaction and loyalty in B2B service contexts (Parasuraman et al., 1988); (Dhal et al., 2023). Yet application of these principles to port terminal management has remained nascent. Most service improvement initiatives in port operations continue to prioritize aggregate throughput and average processing metrics operational indicators that are systematically disconnected from how individual customers experience and assign value to service delivery.

This disconnect creates an actionable strategic gap: no established marketing framework exists to guide port operators in translating operational analytics capabilities into customer-facing service propositions. Even ports that invest in sophisticated predictive systems frequently struggle to convert technical capability into competitive positioning, premium pricing, or enhanced retention. The value generated inside the organization fails to reach the customer as a differentiated experience.

This paper addresses that gap by proposing a marketing strategy framework grounded in segmentation, targeting, and positioning (STP) principles (Kotler & Keller, 2022), calibrated to the operational realities of port terminal management. The central argument is that container size as the empirically dominant predictor of service time variation provides a natural, data-validated segmentation variable around which differentiated service tiers, value propositions, and pricing architectures can be constructed.

1.3. Research Objectives

This study pursues three interconnected objectives: (1) to identify the primary operational variable governing service time variation and evaluate its strategic marketing significance; (2) to develop a service segmentation model grounded in customer value priorities; and (3) to propose a competitive positioning framework that translates predictive service capability into marketable differentiation for port terminal operators.

2. RESEARCH METHODS

2.1. Data Foundation and Analytical Orientation

The empirical foundation of this framework is a publicly available operational dataset (Prasetyo et al., 2024); Mendeley Data, DOI: 10.17632/yvp2b4rtp3.2), comprising 95,648 container cases encompassing 952,015 operational events recorded across a full operating year of a port terminal. The dataset provides a comprehensive record of container journeys from vessel unloading through final customer collection, capturing container attributes (size, type), processing complexity (activity count, departmental role involvement), and regulatory status (quarantine flag).

Critically, our analytical orientation diverges deliberately from conventional machine learning benchmarking. Rather than treating predictive accuracy as a terminal goal, we position analytical modeling as an instrument for understanding customer service dynamics. The guiding question is not which algorithm achieves the lowest error rate, but rather which operational factors most powerfully shape customer service experience and how those insights should inform marketing strategy. LightGBM emerged as the best-performing predictive model (Mean Absolute Error: 95.99 hours) and its feature importance outputs provide the empirical basis for identifying strategic segmentation variables.

2.2. Analytical Framework

Findings from the predictive modeling exercise are integrated into a three-layer strategy framework: (1) a segmentation layer identifying customer-relevant service categories based on container operational characteristics; (2) a value proposition layer translating predictive service capability into distinct customer benefits; and (3) a competitive positioning layer defining how differentiated service tiers support premium pricing, customer retention, and market leadership. This framework draws on Porter's (Porter, 1985) generic competitive strategies, the STP model (Kotler & Keller, 2022), and service quality dimensions established by (Parasuraman et al., 1988)

3. RESULT AND DISCUSSION

3.1. Container Size: From Operational Variable to Segmentation Criterion

The single most consequential finding for marketing strategy is the overwhelming dominance of container size in determining service time outcomes. Feature importance analysis reveals that container size accounts for 75.63% of predictive importance more than five times the contribution of any other variable. Container type contributes 14.50%, while processing complexity indicators account for a combined 8.68%. Regulatory status contributes a negligible 1.19%, and cargo weight registers no meaningful predictive value.

Table 1. Operational Variables as Strategic Marketing Levers

Variable	Importance	Strategic Tier	Marketing Implication
Container Size	75.63%	**Primary**	Core segmentation criterion; drives STP strategy, SLA design, and pricing differentiation
Container Type	14.50%	Secondary	Sub-segment refinement; supports specialty service development (reefer, hazmat, oversized)
Activity Complexity	4.50%	Tertiary	Process efficiency signal; informs resource planning and throughput messaging
Coordination Depth	4.18%	Tertiary	Service complexity indicator; relevant for enterprise customer account management
Regulatory Status	1.19%	Minimal	Exception flag; basis for proactive customer communication protocols

Source: Feature importance analysis using LightGBM algorithm, 2025.

This concentration of explanatory power in a single, immediately observable variable carries profound strategic implications. Container size is not merely a technical predictor; it constitutes a natural market segmentation criterion. Customers shipping small-format containers occupy a fundamentally different value space from those managing bulk large-container movements. Their cost structures, tolerance for service uncertainty, and willingness to pay for reliability differ substantially and these differences are precisely what effective service market segmentation requires.

This finding delivers to port managers an empirically validated basis for three essential marketing decisions: defining meaningful service segments grounded in operational reality, constructing segment-specific value propositions aligned with distinct customer priorities, and designing pricing architectures that capture differentiated willingness-to-pay across segments.

3.2. Translating Predictive Capability into Customer Value

The LightGBM predictive model achieves a mean absolute error of approximately 96 hours a four-day precision window for containers on standard processing pathways. Assessed as a technical outcome, this result may appear unremarkable. Assessed as a marketing capability, it represents a transformational shift in the port's value proposition.

Most port terminals currently communicate service timelines through aggregate performance statistics or general estimates, offering customers little individualized guidance for downstream planning. A four-day predictive window enables a categorically different customer communication model: one in which the terminal delivers container-level service window commitments at booking confirmation or at defined operational checkpoints.

From the customer perspective, this capability generates three categories of measurable value. First, demurrage cost reduction: customers who receive reliable pickup windows can schedule receiving dock operations with precision, avoiding the expensive buffer days that accumulate under opaque service timelines. Second, supply chain planning certainty: freight forwarders and logistics managers can execute downstream transportation bookings with greater confidence, reducing overall cost volatility across the supply chain. Third, relationship depth: when a port delivers consistently on service commitments, the commercial relationship transitions from transactional vendor to trusted strategic partner a transition that elevates switching costs and structurally strengthens customer retention.

3.3. A Two-Tier Service Architecture for Market Differentiation

The distribution of dwell time outcomes across the dataset reveals a structural bifurcation that directly informs service portfolio design. Approximately 90% of containers follow predictable processing trajectories what we classify as the standard service pathway. The remaining 10% encounter exceptional circumstances (regulatory holds, repeat inspections, customer-side delays) that place them outside reliable prediction bounds.

This bifurcation is not a modeling limitation to be apologized for; it is a strategic insight to be operationalized. It maps directly onto a two-tier service architecture that serves both operational management and marketing positioning purposes simultaneously.

Tier 1 Predictive Standard Service covers the approximately 90% of containers on standard processing pathways. For this tier, the port can confidently offer dwell time predictions, communicate service windows, and enforce size-

differentiated Service Level Agreements. This tier is the foundation of a reliability-based competitive value proposition and supports premium positioning in the Express segment.

Tier 2 Exception Management Service addresses the 10% of containers requiring escalated handling. Rather than attempting to generate predictions for inherently unpredictable cases, the strategically appropriate response is proactive detection, early escalation, and transparent proactive communication. For customers with time-critical cargo, this tier can be offered as a premium monitoring add-on with dedicated intervention protocols both reducing customer risk and expanding revenue diversity.

Table 2. Size-Based Service Segmentation and Marketing Strategy Implications

Segment	Size Range	Dwell Target (hrs)	Value Proposition	Pricing Strategy
Express	0–10 TEU	50–100	Speed & predictability guarantee for time-sensitive cargo	Premium
Standard	11–25 TEU	100–200	Reliable processing windows; consistent supply chain planning	Market rate
Economy	26–45 TEU	200–350	Cost-efficient bulk handling; competitive transit economics	Competitive/discount

Source: Authors' framework adapted from empirical feature importance analysis, 2025.

The two-tier architecture enables the port to make differentiated service commitments rather than undifferentiated average promises a critical transition from commodity positioning to value-based service management.

3.4. Competitive Positioning Framework

Synthesizing the segmentation model and service architecture, we propose a competitive positioning framework organized around three strategic propositions.

The first is differentiation through predictability. By committing to service windows rather than generic averages, the port positions itself against competitors offering only throughput-based reporting. This approach targets customers for whom supply chain certainty carries a premium value a segment that is both commercially attractive and largely underserved in current port market practices.

The second is customer cost partnership. Reframing the port's commercial role from a cost center in the customer's supply chain to an active partner in cost reduction particularly relevant for demurrage exposure management shifts commercial conversations from fee negotiation to value co-creation. This narrative is particularly effective in enterprise account management contexts where long-term contract relationships are the norm.

The third is operational transparency as service quality. The two-tier framework enables a powerful service quality message: the port knows in advance which containers will progress smoothly and which require attention, and it communicates that knowledge proactively. This commitment to transparency addresses one of the most persistent customer complaints in the port logistics sector reactive rather than anticipatory communication.

4. CONCLUSION

This paper has presented a marketing strategy framework for transforming port terminal analytics into a competitive differentiation resource. Three principal conclusions emerge with immediate practical relevance.

First, container size represents far more than an operational variable it is a strategically validated segmentation criterion with direct marketing architecture implications. The concentration of 75.63% of service time variance in a single, observable attribute provides port operators with a clear empirical foundation for tiered service design, value proposition development, and segment-responsive pricing. This finding eliminates the speculation that has historically complicated service product development in the sector.

Second, predictive accuracy at the four-day level is operationally sufficient to generate meaningful competitive differentiation when properly translated into customer-facing service commitments. The gap between current industry practice aggregate average reporting and what analytical capability enables individualized service window guarantees constitutes an underexplored first-mover opportunity. Ports that move earliest to operationalize predictive service communication can establish durable positioning advantages in customer-centric market segments.

Third, the two-tier service architecture predictive standard management for 90% of containers, proactive exception handling for 10% provides a commercially viable and realistic service portfolio structure. It supports honest service promises, enables tiered premium development, and generates a foundation for revenue diversification through exception monitoring add-ons.

The broader strategic implication is that investment in predictive analytics should be evaluated not solely as an operational efficiency initiative, but as a marketing capability investment. The return on investment case extends beyond cost reduction to encompass customer retention value, premium pricing potential, and the long-term competitive advantage of transitioning from commodity to trusted logistics partner.

Future research should examine customer willingness-to-pay for predictive service features across distinct cargo segments, develop metrics for quantifying commercial returns on predictive service investments, and explore organizational change requirements for service tier implementation in operational port environments.

ACKNOWLEDGMENT

The authors declare no conflict of interest. This research utilized a publicly available dataset. The authors thank the data originators for making operational data accessible to the research community.

REFERENCES

Dhal, K. G., Samal, S., Das, S., & Sahoo, P. K. (2023). Relationship between service quality and customer satisfaction in logistics: A structural equation modeling approach. *International Journal of Quality and Service Sciences*, *15*(2), 245–264. https://doi.org/10.1108/ijqss-09-2022-0158

Khan, S. A., Rahman, M. U., & Ahmed, M. N. (2022). Predictive analytics for container terminal operations: A comprehensive review of machine learning applications. *Transportation Research Part D: Transport and Environment*, *107*, 103267. https://doi.org/10.1016/j.trd.2022.103267

Kotler, P., & Keller, K. L. (2022). *Marketing Management* (16th ed.). Pearson Education.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). {SERVQUAL}: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, *64*(1), 12–40.

Park, J. H., Kim, S. Y., & Lee, M. S. (2023). Reinforcement learning for autonomous vehicle scheduling in port operations. *Transportation Research Part E: Logistics and Transportation Review*, *173*, 103069. https://doi.org/10.1016/j.tre.2023.103069

Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press.

Prasetyo, H. N., Sarno, R., Sungkono, K. R., Waspada, I., & Budiraharjo, R. (2024). *Port Container Dataset*. https://doi.org/10.17632/yvp2b4rtp3.2