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Floating Market Reverse Logistics Business Model in Malaysia: A Comprehensive Methodological Analysis, Applications and Future Directions

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ABSTRACT: This paper present comprehensive analysis business model reverse logistics in context floating market in Malaysia, new sector closed traditional trade with sustainable supply chain practices. Through this systematic results literature on circular economy, framework reverse logistics and innovation business model in develop countries, this research develops methodologies framework to analyse reverse logistics floating market. This study identifies three keys model archetypes were collection and recycling waste, return and modification product and sharing circular sources and evaluate usability in context socio-economic and geographic unique Malaysia. The comparison analysis present key opportunities to integration digital technologies, collaborative stakeholders and sustainability practices to enhance efficiency supply chain while tackling challenges environment. This research highlights successful factors critical include support government regulation, technologies infrastructure and communities involvement. This studies also identifies key limitations include inadequate infrastructure management waste, fragmented supply chain and awareness stakeholders limited. These findings contribute to enhance literature about sustainable business models in development economies and give insights can take actions to policymakers, entrepreneurs, and practitioner supply chain in implementation reverse logistics in reverse logistics traditional market target. Future research directions include validation empirical framework suggestions, systems traceability block-chain and intelligence applications to prediction needed and waste optimization.

1. INTRODUCTION

Floating market represents commercial ecosystem unique where the vendors carried on trade from boat to river and canal, especially widespread in Southeast Asian include Thailand, Indonesia, Vietnam and Malaysia (Hiranphaet, 2019). These markets just not tourist attractions but as important economics hub to local communities, facilities exchange fresh produce, handicrafts and traditional products (Choopak, 2020). In Malaysia, floating market have growth significant recent years, driven by promotion initiatives tourism and support government to rural economies development (Simorangkir, 2024).

However, operation dynamics floating market give challenges unique to supply chain management and waste disposal. The lack of permanent infrastructure, limited access to service waste collection and perishable nature products traded inefficiency environmental and expend operation (Bhuapisit et al., 2014). These challenges show interest increasing in developed system reverse logistics that suitable with needed special environmental floating market.

Reverse logistics, as process moving good from final destination to manufacturer or facilities waste suitable their main value recover and proper disposal (Khan et al., 2023), as component critical in supply chain management sustainability. When integrated with circular economy principles, reverse logistics can be transformed traditional linear supply chain, where resources extracted, used and discarded to circular systems maximize sources used and minimum waste (Mishra et al., 2023).

The intersection floating market and reverse logistics research domain underexplored with implications practical. Malaysia's floating market in economic context offers unique case study to identifies how business modes reverse logistics suitable with environmental that limited sources with supply chains informal and limited infrastructure (Zailani et al., 2012).

This research aims to address objective research:

1.To develop framework methodologies to analysis business model reverse logistics in context floating market.

2.To identifies and clarification existing reverse logistics can be applied to Malaysia floating market.

3.To conduct comparative analysis alternative business models, evaluate strengths, limitations and sustainability contextual.

4.To examine ablation factors that influence successful implementation reverse logistics environmental development countries.

5.To identifies limitations and challenges were faced used reverse logistics in floating market.

6.To suggest directions future research and practical recommendations to stakeholders.

The significance of this research extends across multiple dimensions. Theoretically, it contributes to the literature on sustainable business models by extending existing frameworks to encompass informal market settings characterized by limited infrastructure and resource constraints. Practically, it provides actionable guidance for policymakers seeking to promote sustainable tourism and rural development, entrepreneurs developing reverse logistics businesses, and supply chain practitioners working to improve environmental performance in challenging operational contexts. Methodologically, it demonstrates how systematic literature review and framework analysis can be combined to generate contextually appropriate recommendations for developing economy settings.

LITERATURE REVIEW

REVERSE LOGISTIC AND CIRUCLAR ECONOMY

Relationship between reverse logistics and circular economy get significant scholarly in recent years (Julianelli et al. (2020) developed taxonomy based successful factors critical to understand interactions between domain, identifies organization factors, technologies and regulatory key successful implementation. The framework pressured reverse logistics function as backbone operations circular economic transition, facilities recovery, modification and recycle products end life.

Mishra et al. (2023) comprehensive reverse logistics and closed loop supply chains in perspective circular economic, highlight how innovation business models to align environmental objective with economic viability. The analysis revealed implementation successful needed in organizational thinking, moving to disposal paradigm to recovery sources.

The integration technologies industries 4.0 with reverse logistics and practices economy circular as themes research important. Khan et al. (2023) studies digitization change operation reverse logistics enable real time track, predictive analysis and systems automated sorting. These findings suggest block-chain technologies, offers potential transformation to enhance transparency and traceability supply chain circular (Gupta et al., 2026).

The recent scholarship were explored technologies newly emerged in optimum reverse logistics. De Queirós and Tagliaferro (2025) investigate artificial intelligence and machine learning enhance and waste separation efficiency, meanwhile Saidani et al. (2020) used bibliometric mining and scan evolution circular economy and concept industrial ecology,reveal enhance pattern production and sustainability used.

SUPPLY CHAIN MANAGEMENT IN DEVELOPMENT COUNTRIES

Applying sustainable supply chain management (SSCM)in development context countries give challenges and different opportunities Zailani et al. (2012) conduct seminal survey SSCM practices in Malaysia, reveal gap between environmental awareness and actual implementation. This study identifies regulatory pressure, demand stakeholder and competitive advantage as main drivers practices sustainable.

Cortes et al. (2021) to study innovation to sustainability across management fields, business and STEN in countries at development countries, got that research results increase significantly followed by global sustainability such as UN Earth Summit. However, they declare collaboration with academic corporate limited, especially in sector related with trade traditional and informal supply chains.

The role micro small medium enterprise (SME) in supply chains sustainability received special attention. Supriadi et al. (2025) analyse transformed circular economy in SME through model innovation business sustain, identifies commitment leadership, strategic partnership and access technologies as factors successful critical. They findings very relevant with vendor floating market usually operation as micro business with limited sources.

Jaafar (2008) examine the issues logistics and supply chains in Malaysia, limited infrastructure, regulatory fragmentation and challenges coordination as barriers ongoing to operation supply chain efficient. These challenges amplified in context floating market which the mobile vendors operating in out zones commercial traditional.

FLOATING MARKET AND TOURISM SUPPLY CHAIN

This research about floating market give attention especially to tourism management and tourist satisfied. Hiranphaet (2019) analyse factors management influenced tourist satisfaction Thung Bua Daeng Floating Market in Thailand, identifies product authenticity, services quality and environmental cleanliness. These findings align important waste management effective and supply chain coordination to market sustainability.

Choopak (2020) examine operation supply chain Amphawa Thailand Floating Market, reveal complex network connecting local producers, vendors and tourism operators. The analysis highlighted important practices development sustainable to maintain authenticity market while accommodate the tourists amount that growing.

Simorangkir (2024) developed strategies sustainable management to tourist area floating market in Lembang, needed integrated plan resources management balance economies development with environmental preservation. Their works provide template to analysis relationship with stakeholders and structure governance in floating market context.

Bhuapisit et al. (2014) investigate administrative management to development floating market sustainability, identifies transparency in governance, communities participation and infrastructure investment as importance elements to viability in long-term.

BUSINESS MODEL INNOVATION FOR SUSTAINABILITY

The literature sustainable business model innovation (SBMI) provides basic theory understanding organization redesign value creation, delivery and capture mechanisms to achieve sustainability objectives. Geissdoerfer et al. (2018) review SBMI, identifies values suggestions, value creation and capture values as basic three dimensions needed innovation to sustainability transition.

Evans et al. (2017) developed perspective to create sustainability business model, suggest five concept framework sustainability business model. They pressure that innovation-oriented sustainability must deal with environmental value and social maintain economic viability.

Khan and Majava (2021) investigate interdependent stakeholders in sustainable innovation business models, used interdependent models actors to analysis interdependent goals,task and soft goals. The framework highlights important collaboration stakeholders in sustainability business model innovation especially in context where resources shared across organizational boundaries.

Business models canvas social as practical tools to the pattern business model balance objectives social and sustainability environmental finance. Sparviero (2019) developed business models social expand framework business models traditional to capture dimensions value created social. Qastharin (2016) suitable business models canvas to social business in development countries, pressure ability developed and accessibility.

FOOD WASTE AND TRADITIONAL SUPPLY CHAIN

Food waste is big challenges in traditional supply chain in all development economies Asian-Pacific. Sharma and Tong (2025) investigate food waste management in Asian countries, identifies rapid urbanization, inefficiency supply chain and inadequate cold storage structure as main contributes to losses after harvest. The analysis showed traditional market include floating market experience highest waste because ability maintenance limited.

Jayalath et al. (2025) assess integration practices circular economies in supply chain traditional agri-food in development economies, suggest framework to change pattern production-used-disposal linear in circular systems. This research highlights potential reverse logistics to capture value from organic waste through composting, production biogas and conversion animals foods.

Gunasekera et al. (2017) analysed losses after harvest in developed economic Asian-Pacific., retail food traditional experience inefficient because fragmented supply chain and coordination limited in stakeholders. Their suggestions to improve coordination supply chain and infrastructure developed with floating market logistics.

Parfitt et al. (2010) measured food waste through global supply chain that traditional market unregulated contribute disproportionately overall food losses. Their analysis suggests intervention target addressing supply chain produce benefits big waste.

METHODOLOGY

RESEARCH DESIGN

This research used methodology systematic literature completed with development analysis framework. This research followed structured approach included literature identification, screenings, synthesis, analysis and construction framework (Mishra et al., 2023). Methodological choices given nature exploration domain research and needed integration from various perspective discipline.

LITERATURE SEARCH STRATEGY

Findings literature across various database academic includes Google Scholar, Scopus and Crossref. Search terms in four cluster thematic (1) reverse logistics and circular economic, (2)floating market and sustainability tourism, (3) Malaysian supply chain management and (4) sustainable business model innovation in development countries.

The criteria include journal article, conference proceedings and chapter published from 2008 until 2026. The publisher just not English, the studies focus exclusive manufacturing supply chain without relevance with informal market or traditional.

FRAMEWORK ANALYSIS

Framework analysis in this studies integration three perspective theory (1) Business Models Canvas suitable to social business context (Sparrowhawk, 2019),(2) framework Critical Success Factors implementation reverses logistic (Julianelli et al., 2020), and (3) taxonomy implementation Circular Economies (Mishra et al., 2023).

The framework values business models reverse logistics five dimensions.

1.Value proposition: The value created to customers, partners and communities through activities reverse logistics

2.Value Creation: Process operations and sources used to capture, process and redistribute returned goods.

3.Value Capture: Revenue models and cost structure ensure sustainability finance

4.Stakeholder Network: Constellation actor involved in reverse logistics operation and interdependence

5.Contextual Relevance: Alignment between framework business models and socioeconomic, cultural and environmental local.

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COMPARATIVE ANALYSIS METHOD

The comparative analysis follow evaluation various criteria, evaluate business models change the criteria from studies literature. The criteria include operational efficiency, effects environmental. benefits social, scalability, financial viability and ease implementation. Every criteria valued used qualitative scale(high, medium, low) support evidence from literature.

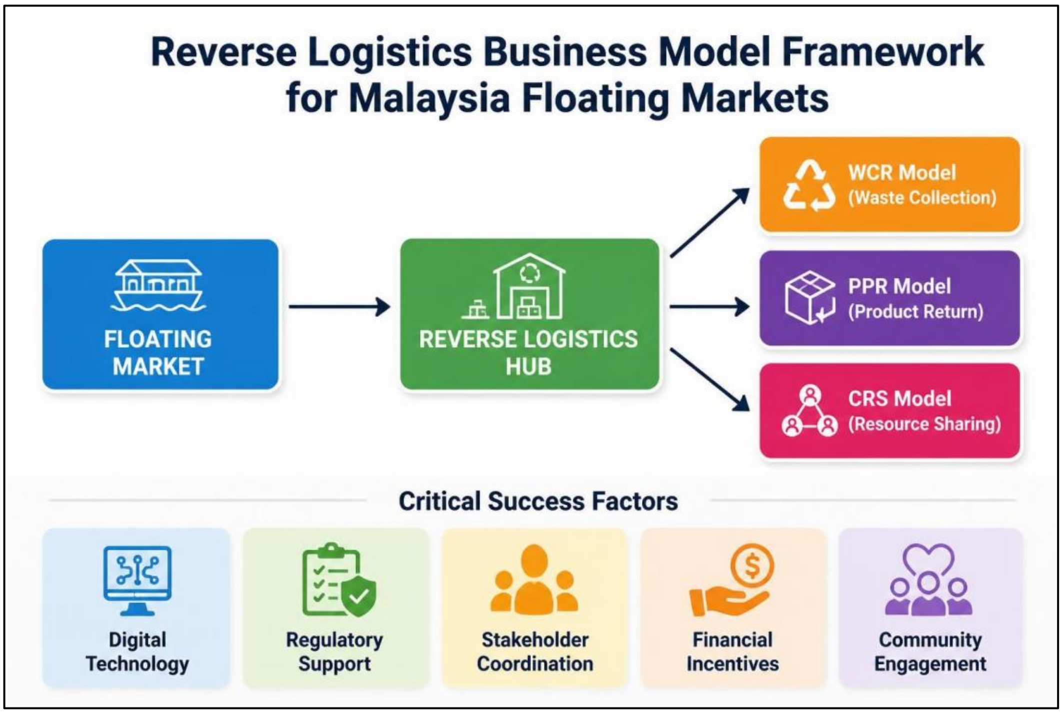

Figure 1: Framework Conceptual to Business Models Reverse Logistics in Floating Market

FINDINGS

REVERSE LOGISTICS BUSINESS MODELS TAXONOMY

Based on literature analysis, they identify three main archetypes business models reverse logistics can be used to archetypes floating market context. The archetypes not mutually exclusive, Hybrid Model contribute element from various archetypes that offers solution optimum to specific context.

WASTE COLLECTION AND RECYCLING

Waste Collection and Recycling Model (WCR) focused on systematic collected waste from floating market, followed with processing to recovery materials or energy generation. This models addressed challenges environmental collected waste while generate revenue through recycle materials and fees waste management.

The main component:

1.Infrastructure Collected: Special boats and platform floating to residue aggregation

2.Separation Systems: Facilities separation on site or centralized to different waste streams.

3.Processing Capabilities: Recycling, composting operations or waste energy plants

4.Transportation Logistics: Coordination the collected placed and facilities processing.

Value Proposition: Environmental protecting through waste diversion from waterways, savings costs through reduce fees disposal, compliance through needed regulate and revenue potential from recycle products.

Implementation Example: Muhammad and Naidu (2023) studies role "logis-preneurs" advance waste management in Malaysia, identifies how wasted collected entrepreneurship closed the gap in formal system waste management. The framework suggest network informal waste collection can be formal through training, materials preparation and arrangement contract with local authorities.

PRODUCTS RETURNS AND REFURBISHMENT MODELS

Product Returns and Refurbishment (PRR) Models return used products or unsold from floating market to refurbishment, repair or redistribution. This model relevant to durable goods, handicraft and packaging material can restored to functional condition.

The main component:

1.Return Logistics: Systems to collect product had return to vendors.

2.Assessment Protocols: Procedure to value condition product and refurbishment potential.

3.Refurbishment Facilities: Workshops and product recovery center.

4.Redistribution Channels: Network to return product refurbished to market or alternatives outlets

Value Proposition: The life cycle product, reduce cost to vendor, access to affordable goods to user that sensitive with price and reduce used raw materials.

Implementation Example: PRR Models need to align with vendor, refurbishment and end user. Digital platform facilities product tracking that returns and match products renewed with potential buyer (Gupta et al., 2026).

CIRCULAR RESOURCE SHARING MODEL

Circular Resource Sharing (CRS) facilities used sources collaborative in vendor floating market, reduce needed individual investment while maximize asset utilize. This model include shared storage, transportation, materials processing and infrastructure waste management.

The main component:

1.Share Asset: Usually infrastructure such as cold storage, transport boat or equipment processing.

2.Coordination Mechanism: Scheduling systems, governance structure and procedure conflict solutions.

3. Cost Sharing Arrangements: Fee structure and donation mechanism to maintenance resources together.

4.Digital Platform: Technology solutions to sources reserved, tracking and optimization.

Value Proposition: Reduce expenses modal to individual vendor, improve resource efficiency, access advanced technology that not saving individual vendor and improve bargaining through collective action.

Implementation Example: Jayalath et al. (2025) studies integration circular economy in supply chain traditional, pressure how facilities processing and transfer can reduce losses after harvest improve quality of product. These findings showed that cooperation model effective in criteria of context manufacturer in small scale with individual resources limited.

HYBRID MODEL CONFIGURATION

Configuration hybrid combine elements from various archetype maybe offers performance to environmental floating market complex. Such as, models that combine WCR-CRS prepared infrastructure collecting waste while facilities resources collecting to transportation and storage.

Selection on configuration model suitable based on contextual factors include market size, mix product, vendor density, infrastructure availability and environmental regulate.

Table 1 show main characteristics every archetype business models.

Dimension	WCR Model	PRR Model	CRS Model
Main Focus	Waste diversion & material recovery	Product lifecycle extension	Resource optimization & sharing
Key Activity Relationships	Sorting, processing	Return logistics, refurbishment, re-manufacturing	Asset pooling, scheduling, maintenance
Value Capture	Recycling revenue, service fees	Refurbishment margin, resale value	Subscription fees, usage charges
Stakeholders	Waste collectors, recyclers, regulators	Vendors, refurbishers, consumers	Vendor cooperatives, equipment providers
Infrastructure	Collection boats, sorting facilities	Assessment centers, workshops	Shared storage, transportation, equipment
Technology	Tracking systems, sorting automation	Quality assessment tools, digital marketplace	Booking platforms, IoT sensors
Regulatory Requirements	Waste management licenses, environmental permits	Product safety regulations, resale regulations	Cooperative governance framework

MULTI CRITERIA ASSESSMENT FRAMEWORK

To comparative analysis systematic business models reverse logistics, we developed framework assessment with various criteria include six-dimension operation efficiency, environmental effects. Social benefits, scalability financial viability and implementation complexity. Table 2 present comparative assessment three archetype main business models.

OPERATION EFFICIENCY

WCR model showed collected efficiency highest because special infrastructure and process steam lined optimized to aggregate waste, processing efficiency depends on facilities environmental or waste to energy in reasonable distance with collected place. CRS model achieved higher resource use through collaboration access, scheduling complexity can reduce operation efficiency during peak demand periods.

PRR models presented efficiency operations challenges that medium because heterogeneous nature products returned needed individual value and modification procedure. Standardization modification protocols enhance efficiency in various products potential to optimization full process.

Table 2: Analysis Comparative Business Model Reverse Logistics

Evaluation Criteria	WCR Model	PRR Model	CRS Model
Operational Efficiency			
Collection efficiency	High	Medium	High
Processing efficiency	High	Medium	Medium
Resource utilization	Medium	Medium	High
Environmental Impact			
Waste diversion rate	High	Medium	Medium
Carbon footprint	Medium	Low	Low
Resource conservation	Medium	High	High
Social Benefits			
Job generation	High	Medium	Medium

Community resilience	Medium	Medium	High
Knowledge transfer	Low	Medium	High
Scalability			
Geographic expansion	High	Medium	Medium
Market penetration	High	Medium	Medium
Technology transfer	Medium	Medium	High
Financial Viability			
Revenue stability	Medium	Medium	High
Profit margin	Low	Medium	Medium
Investment requirements	Medium	Low	High
Implementation Complexity			
Regulatory compliance	Medium	Low	High
Stakeholder coordination	Low	Medium	High
Technical requirements	Medium	Medium	High

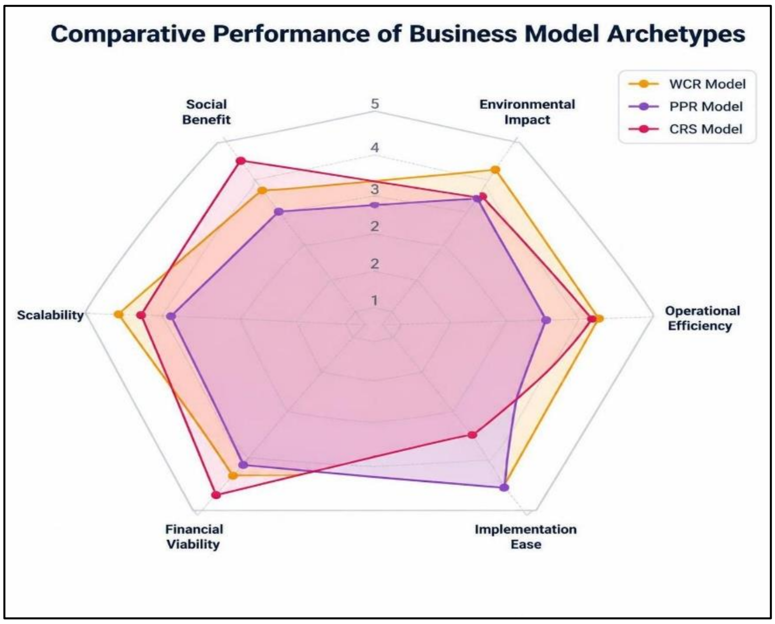

Figure 2: Radar Chart Comparison Business Model Archetypes Across Key Performance Dimensions.

ENVIRONMENTAL IMPACT

Three models contribute positive to environmental sustainability, even though through different mechanism. Excellent model WCR in waste diversion rate, directly deal with challenges collected waste in waterways and ecosystems. However, waste transportation collect facilities processing generate carbon emission that half balance benefits environmental.

Model PRR achieve lowest carbon with extend product life cycles and reduce demand to production virgin material. The benefits of resource are significant for durable goods categories even limited for perishable products in floating market. The CRS model reduce environmental impact through used asset better, reduce amount infrastructure needed for fulfill needed market. The transportation reduces carbon emission each unit meanwhile cold storage enhance efficiency energy compared individual facilities.

SOCIAL BENEFITS

Social benefits different across the models. The WCR model generates opportunities employment in sector waste collection and processing often can access workers that low skilled. However, this position offers advance potential career limited and stability income variable.

This model CRS fosters community through structure governance cooperate and owner collective resource. The transfer benefits pronounced when vendor shared operation and innovation through collaboration network. The community solidarity strength through interest economies collaborates and success interdependent.

This model PRR prepared social benefits medium to access refurbished goods to sensitive consumers price. The development refurbishment offers opportunities vocational training even scales limit by size market.

SCALABILITY

The scalability features reflect model design and need implementation. The WCR model showed potential feasibility highest because standard process responds across geographic locations with suitable minimize. The market penetration achieves through infrastructure collected centered serve various floating market.

The CRS model offers show transfer potential highest technologies because governance framework and coordination mechanism suitable with various context. However, geographic expansion need a big investment in shared infrastructure, limit scalability for improve limited resources.

The PRR model faced constraints scalability because of nature expertise local modified and need for protocol value quality assessment marketing.

FINANCIAL VIABILITY

The financial viability assessment reveal change between revenue stability and profit margins. The CRS model achieve stability revenue highest through free structure and revenue steam form various substantial, need patient modal or subsidies public in early phase. The WCR model faced margin pressure because of price fluctuations commodities for recycled materials and pressure competitive in waste collection services. The various revenue through waste contract from energy or services recycling premium can enhance financial sustainability.

The PRR model got benefits from needed lowest investment especially infrastructure benefits already. Profit margin based on efficiency transformed and ability for premium price for recovery product.

ASSESSMENT CONTEXTUAL SUITABILITY

The suitability each business model depends on factors contextual for environmental floating market individual. Table 3 present matrix suitability contextual identifies optimum model based on characteristics market. The analysis reveals that the WCR model is preferred when waste volumes are high and recycling infrastructure exists. The PRR model suits markets with high-value durable goods and tourist focus. The CRS model is optimal where vendor capital is limited and cooperative traditions are strong.

TABLE 3: Contextual Suitability Matrix for Business Model Selection

Contextual Factor	WCR Preferred	PRR Preferred	CRS Preferred
High waste volume	✓		
High-value durable goods		✓	
Limited vendor capital			✓
Strong cooperative tradition			✓
Established recycling infrastructure	✓		
Tourist market focus		✓	
Environmental regulatory pressure	✓		
Seasonal demand variation			✓

DISCUSSIONS

LANDSCAPE MALAYSIAN FLOATING MARKET

The floating market sector grows from river trade traditional to tourism attraction organized and trade hub local. Floating market that famous include Pulau Suri and Sri Tanjung Floating Market in Kelantan, Perlis JPS Floating Market and Melaka

Floating market along Sungai Melaka and water paths This market different in scale, organization and focus on product from handicraft market orientation tourist to. fresh produce exchange from local communities.

The Malaysian focus government towards economies development rural and tourist promotion create growth floating market. The initiative such as national tourism policy and various program rural development by countries prepared financing and support infrastructure for establishment and market operation (Aziz et al., 2016).

The geographic distribution of Malaysian floating markets presents both challenges and opportunities for reverse logistics implementation. Markets concentrated in specific regions may enable economies of scale in collection and processing infrastructure, while dispersed markets may require mobile or distributed solutions. The tropical climate accelerates organic waste decomposition, increasing the urgency of efficient collection while creating opportunities for composting and biogas production

REGULATORY ENVIRONMENT

The Malaysia's regulatory framework for waste management and environmental protection create opportunities and constraints for reverse logistics implementation. Solid Waste Management and Public Cleansing Act 2007, prepared basic legislation for waste management services, however enforcement in informal market not consistently (Sreenivasan et al., 2012).

The rules environmental quality administered by Department Environment standard for waste disposal and pollution control. The requirements maybe challenge for vendor small scale with administrative limited capacity even though incentive for receive solutions formal reverse logistics. The regulatory analysis reveals significant potential for policy interventions to support reverse logistics development. Extended producer responsibility frameworks could be ex-tended to packaging materials sold through floating markets, creating incentive structures for participation in reverse logistics systems. Market licensing and vendor registration requirements could incorporate sustainability criteria, mandating participation in waste management programs as a condition of operation. The regulatory analysis reveals significant potential for policy interventions to support reverse logistics development. Extended producer responsibility frameworks could be ex-tended to packaging materials sold through floating markets, creating incentive structures for participation in reverse logistics systems. Market licensing and vendor registration requirements could incorporate sustainability criteria, mandating participation in waste management programs as a condition of operation.

TECHNOLOGY INFRASTRUCTURE

Malaysia's digital infrastructure advanced support solutions reverse logistic technology enabled. The mobile penetration rate exceeds 100% align the platform digital for schedule waste collection, share sources and trace product. However, digital literacy among older vendors and rural communities maybe limit technology used in segmentation market.

Routray and Hussein (2019) studied suitability Narrowband IoT (NBIoT) for country not developed, network technology large area of lower power offers solutions effective cost for scenario limited resources. NBIoT applications for monitoring waste container, asset track and sensing environmental can improve the efficiency reverse logistic in floating market context.

CASE APPLICATION: INTEGRATED REVERSE LOGISTICS SYSTEMS

Based on taxonomy and comparative analysis that presented, suggest reverse logistics system integrated suitable with Malaysia floating market. Hybrid systems combines the elements of WCR model and CRS, tackling challenges waste management while foster cooperation vendor.

Blockchain technology offers transformative potential for enhancing transparency and trust in reverse logistics operations. Smart contracts can automate payment arrangements and revenue sharing, while immutable ledgers provide verifiable records of waste flows and processing outcomes (9). Implementation challenges include infrastructure requirements, technical expertise needs, and interoperability with existing systems. Artificial intelligence and machine learning applications can optimize reverse logistics operations through demand forecasting, route optimization, and predictive maintenance for shared infrastructure (28). Large language models and natural language interfaces may democratize access to supply chain analytics for vendors with limited technical expertise.

Systems Component:

1.Shared Collection Infrastructure: The point of floating market collection placed at strategic location in market area, equipped separate storage for organic waste, recycle and residual waste. Collection infrastructure will owned and managed by vendor association.

2.Scheduled Collection Services: Regular collection used special boat equipped compaction and containment systems. The schedule collection based pattern waste and tidal conditions.

3.Processing Partnership : The agreements with facilities local recycle, composting operation and waste to energy for waste recruitment processing. Revenue shared give return financial to vendor who participant.

4.Digital Coordination Platform: The application based enabling waste generation reporting, collection schedule and performance monitor. Integration platform with system shared resources for transportation and storage.

Implementation Pathway:

1.Phase 1-Pilot: The implementation single floating market with strong vendor organization and local governance support. This focus waste collection and separation infrastructure.

2.Phase 2- Improvement: Systems optimization based on pilot experience, include integration technologies and improvement process. This growth to additional market with similar characteristics.

3.Phase 3-Scale: Regional launch with standard process and center shared services. This integration with waste management systems rural and recycle network regional.

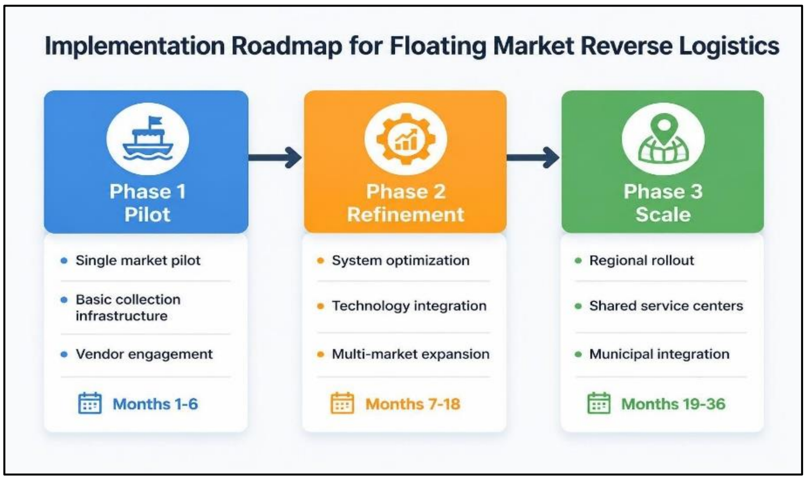

Figure 3: Three Phase Implementation Road map Floating Market Reverse Logistics.

ABLATION FACTORS

To understand donation component relative systems different for overall reverse logistics performance, conduct ablation analysis studied effects remove or modified specific elements. This analysis followed methodologies used by Julianelli et al. (2020) in framework factors successful critical, suitable for floating market context.

STAKEHOLDER COORDINATION ABLATION

This removes coordination mechanism stakeholder structure with lowers system performance. Without structure formal governance, problem emerge when vendor got benefits from infrastructure shared without contribute for maintenance cost. This analysis showed stakeholder coordination 35% of system effectiveness, scale with waste management and used resources.

This analysis interdependent with stakeholder Khan and Majava (2021) support these findings, showed goal alignment and alignment task important for operation business model sustainable. In context floating market, various background vendor and business model make it worse challenges alignment, strength the important mechanism formal governance.

TECHNOLOGIES INFRASTRUCTURE ABLATION

Technological elimination digital alignment reduces efficiency operation almost 25% especially collection not routing not optimize, schedule conflicts and performance monitoring insufficient. However, function reverse logistics can maintain through alignment manual, showed function technologies function as efficiency booster and not important enabler.

The showed align with Gupta et al. (2026), WHO identifies block-chain and technology traceability improved efficiency circular economic practice but not prerequisite for basic implementation. For floating market limited resources, technological gradually started with based coordination maybe suitable from system used comprehensive.

REGULATORY SUPPORT ABLATION

The not supported and regulatory enforcement reduce viability systems 40%, especially through weakness viability compared informal alternatives waste disposal. Without mandates and incentives regulatory, rate of voluntary participants decrease because the prioritize of vendors is operational concerns compared environmental objective.

The analysis Setyawan et al. (2022) green supply chain management in SME Southeast Asia confirm that important governance rules in use practices sustainable. The revenue models structure same showed governance rules directly influence environmental performance while simplify initiative strategic orientation.

FINANCIAL INCENTIVE ABLATION

The elimination financial incentives for participants include revenue partnership from recycle products and costs savings from shared resources, reduce involvement vendor 30%. However, environmental awareness push certain vendor, economic sustainability as main drive for widespread use.

Rosca et al. (2017) The business model sustains for product and thrifty service emphasize important sustainable in countries development context. These findings suggest reverse logistics must showed economics benefits clear for avoid challenges used in vendor that limited resources.

INTERCTIONS EFFECTS

The ablation analysis showed interactions effect between systems component technologies infrastructure and stakeholder alignment showed strong complement each other, platform digital increase coordination effectiveness, meanwhile governance infrastructure increase technologies used rate. On the contrary, support regulate and financial incentive showed effects replacement, strong mandate regulates partially offset for financial incentive limited.

The effects of interaction showed implementation strategies need considered component and just not intervention. For context with strong regulated framework, investment focus technologies generate returns highest then incentive programme. The regulate capacities limited, strong incentive structure financial more critical for system viability.

SENSITIVITY ANALYSIS

The sensitivity analysis studied how parameter variation influence revenue performance systems. Table 4 presented indicating percentage changes in effectiveness systems overall revenue from 10% changes in each parameter.

Table 4: Sensitivity Analysis Results

Parameter	Sensitivity Coefficient
Vendor participation rate	0.85
Collection frequency	0.72
Waste separation compliance	0.68
Processing facility capacity	0.45
Transportation efficiency	0.41
Digital platform adoption	0.38
Regulatory enforcement level	0.62
Financial incentive magnitude	0.55

High sensitivity rate vendor participates align importance stakeholder involvement and incentive design. The frequency collected and waste segregation showed effects highlight operation factors important for systems effectiveness especially digital platform used showed lowest, however technologies increased performance, core function maintain through alternative coordination mechanism.

IMPLICATIONS

IMPLICATIONS TO POLICYMAKERS

Extending producer responsibility for packaging and product sold through floating market will incentive structure for participation reverse logistics. Policy design considers informal many vendor floating market and provide pathways can access.

Governance policy for vendors and market with sustainability practices market demand for reverse logistics services. Public sector showed viability and norms for private used.

Framework development legal and policy support owner cooperation and governance reverse logistics infrastructure shared to reduce challenges to CRS model implementation. The framework needs balance governance efficiency collective with individual vendor autonomy. Collaboration mechanisms between agencies require attention to address policy fragmentation and coordination failures. Inter-agency working groups spanning tourism, environment, agriculture, and local government departments can facilitate integrated approaches to floating market development and management. Regulatory harmonization across jurisdictional boundaries would facilitate regional reverse logistics networks, reducing complexity for markets operating across multiple local government areas. Standardization of waste classification, collection procedures, and performance reporting would enable interoperability and benchmarking across different market implementations.

IMPLICATIONS TO ENTREPRENEURS AND PRACTITIONERS

Education program and comprehensive training addressing awareness environmental, waste management practices and governance cooperative will improve knowledge gap adoption. Programs design participant vendor communities increase relevance and effectiveness.

Development support "logispreneurs" entrepreneurs in logistic services for market that less got services can growth reverse logistic capacity while generate economies opportunities (Muhammad and Naidu, 2023). Financing access and business development services will accelerate entrepreneur development.

Capacity development for agency local governance responsible for market regulation and waste management will increase enforcement effectiveness and align the services. Collaboration mechanism between agency needed observation for address policy fragmentation.

IMPLICATIONS TO TECHNOLOGY PROVIDERS

Technology block chain offers transformative potential for increase transparency and believed in reverse logistics operation. Smart contracts automate arrangement payment and shared results meanwhile ledgers prepared waste flows and processing results cannot change. These research Gupta et al. (2026) identifies improvement effectiveness as priority benefits integration block chain in economic circular contexts.

AI and learning techniques machine can optimize reverse logistics operation through demand forecasting, optimization route and maintenance forecasting for shared infrastructure. Simchi-Levi et al. (2025) showed how large language model can democratize results supply chain with enabling between natural languages interfaces for complex analytic.

Sense network lowest cost can monitor level container waste, trace environment and provide rela time to reverse logistics operation. Technology IoT, offers solutions promising for limited resources context (Routray and Hussein, 2019).

IMPLICATIONS TO SUSTAINABLE FINANCING

The vehicle development effect investment targeting social results and environmental financial returns channel models towards infrastructure development reverse logistics. Financial structure mixed combine public investment and private suitable for highest context and highest impacts.

Participation in carbon market volunteer through waste reduction and avoid emission methane from organics waste decomposition can generate additional revenue streams support reverse logistics viability. Methodology developments for quantifying reduce emission specific floating market needed.

Financing mechanism for revenue followed financing ti environmental revenue can measure incentive and increase accountability. This test needed monitoring systems and clear metrics.

CONCLUSION

This research presented comprehensive business model reverse logistics that used for Malaysia floating market, methodologies framework development, taxonomy and comparative assessment for result implementation. These analysis important opportunities for economic principles circular with traditional market operation while identifies biggest needed innovative solutions.

Taxonomy developed differentiate three archetype business model, Collected and Waste recycling, Return, Product modification and Circular Resources Sharing, has characteristic strength and contextual suitability different. The comparative analysis suggest hybrid models combine elements from various archetype offers optimum performance for environment floating market complex characterizes with various products, infrastructure limited and limited resources vendor. These priority findings analysis include:

1.Stakeholder coordination as critical success factor, contribute 35% from effectiveness system. Formal governance structure avoids problems and benefits distribution important for sustainable operation.

2.Technology function as efficiency amplifier and essential enabler. Contribute 25% operation effectiveness. Reverse logistic function through manual coordination, suggest technology used can continued gradually resources allow.

3.Regulatory support and financial incentive showed interaction effects significant with stakeholder engagement. Implementation strategies need consider factors as complementary intervention and not substitutes.

4.Vendor participation showed highest sensitivity to overall effectiveness systems, align important incentive design and volunteer strategies economic motivation driving vendor behaviour.

Malaysia contexts give opportunities and implementation reverse logistics infrastructure digital advance support solutions technology enabled meanwhile governance rural development and tourist policy. However, infrastructure deficit, regulatory fragmentation and scale big challenges needed solution suitable.

The ablation showed systems component both complement each other and sub-trust, suggested implementation suggests suitable local factor contextual. Where strong regulate capacity, technology focused produce optimum return. In capacity context enforcement limited, incentive structure financial be more critical.

Looking ahead, several research and development. Empirical validation implementation trials give evidence for framework refinement. These studies technologies block chain, artificial intelligence and IoT application priorities investment. The comparative analysis across context support knowledge transfer and model suitability

The integration reverse logistics in floating market operation more that increase operation, it a step to circular economies in informal context. Capturing value from waste, extend product life cycle and optimize resource used, business model reverse logistics can contribute environmental sustainability while generate economic benefits for vendors communities.

Success in requires coordinated across government agencies, vendor associations, technologies providers and financial institutions. The framework and analysis presented in paperwork prepared basic for coordination, offers insights can take for priority identifies research for scholar seeking knowledge in new domain.

IMPLICATIONS TO SUSTAINABLE FINANCING

This research contributes to both theoretical knowledge and practical application. Theoretically, it extends the reverse logistics and circular economy literature to encompass informal market settings in developing economies, addressing a significant gap in existing scholarship. The methodological framework developed provides a structured approach for analysing reverse logistics options in resource-constrained contexts that can be applied to other traditional market settings beyond floating markets.

Practically, the research provides actionable guidance for policymakers developing waste management and tourism policies, entrepreneurs creating reverse logistics businesses, and supply chain practitioners seeking to improve environmental performance. The comparative analysis and contextual suitability matrix enable evidence-based model selection appropriate to specific market conditions

IMPLICATIONS TO SUSTAINABLE FINANCING

This research is subject to several limitations that suggest directions for future investigation. The reliance on literature analysis rather than empirical case studies limits the grounding of findings in specific implementation experiences. Future research should include empirical validation through pilot implementations and longitudinal case studies tracking actual reverse logistics deployments in floating market contexts.

The framework developed requires further refinement through application to diverse contextual settings. Comparative analysis across multiple floating markets in different countries would enable identification of context-independent principles and context-specific adaptations. Investigation of blockchain, artificial intelligence, and IoT applications in floating market reverse logistics represents a priority area for technology-focused research.

The interaction effects identified between system components warrant deeper investigation through simulation modelling and field experiments. Understanding how different intervention combinations perform under varying contextual conditions would enable more precise recommendations for implementation sequencing and resource allocation.

IMPLICATIONS TO SUSTAINABLE FINANCING

The integration of reverse logistics into floating market operations represents more than an operational improvement; it constitutes a step toward realizing circular economy principles in informal sector contexts. By capturing value from waste, extending product lifecycles, and optimizing resource utilization, reverse logistics business models can contribute to environmental sustainability while generating economic benefits for vendor communities. Success requires coordinated action across government agencies, vendor associations, technology providers, and financial institutions. The frameworks and analyses presented in this paper provide foundations for such coordination, offering actionable insights for practitioners and identifying priority research areas for scholars seeking to advance knowledge in this emerging domain.

The transformation of floating markets from symbols of environmental concern to showcases of circular economy principles would demonstrate the viability of sustainable business models in developing economy contexts. This transformation requires sustained commitment, collaborative action, and continued innovation investments that promise significant returns for environmental sustainability, economic development, and community wellbeing.

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REFERENCES

[1] Aziz, T. N. A. T., Jaafar, HS, and Tajuddin, RM (2016). Green supply chain: Awareness of the logistics industry in Malaysia. Social and Behavioral Sciences Procedures, 224: 461–468.

[2] Bhuapisit, P., Supadilokluk, R., and Chaiwan, W. (2014). Sustainable development of administrative management for Floating Markets. RMUTP Research Journal, 8(1):1–12.

[3] Choopak, W. (2020). Supply chain management of Amphawa Floating Market tourism, Thailand. Proceedings of the International Conference on Business and Technology Transfer.

[4] Cortes, J. D., Guix, M., and Bohle Carbonell, K. (2021). Innovation for sustainability in the Global South: Bibliometric findings from management & business and STEM fields in developing countries. arXiv preprint.

[5] De Queirós, E. S. and Tagliaferro, E. R. (2025). Reverse logistics as an instrument for circular economy practices. IOSR Journal of Business and Management, 27(6):68–79.

[6] Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., and Barlow, CY (2017). Business model innovation for sustainability: Towards a unified perspective for sustainable business model creation. Business Strategy and the Environment, 26(5):597–608.
[7] Geissdoerfer, M., Vladimirova, D., and Evans, S. (2018). Sustainable business model innovation: A review. Journal of Cleaner Production, 198:401–416.
[8] Gunasekera, D., Parsons, H., and Smith, M. (2017). Post-harvest loss reduction in Asia-Pacific developing economies. Journal of Agribusiness in Developing and Emerging Economies, 7(3):303–318.
[9] Gupta, S., Kushwaha, PS, and Badhera, U. (2026). Optimizing circular economy practices through blockchain technology in reverse logistics. International Nankai Business Review, 17(1):152–179.
[10] Hiranphaet, A. (2019). Supply chain management factors influencing tourist satisfaction at Thung Bua Daeng Floating Market, Thailand. African Journal of Hospitality, Tourism and Leisure, 8(4):1–15.
[11] Jaafar, H. S. (2008). Logistics and supply chain in Malaysia: Issues and challenges. Proceedings of the Eastern Asia Society for Transportation Studies, 6:207–207.
[12] Jayalath, M. M., Perera, H. N., Ratnayake, RMC, et al. (2025). Harvesting sustainability: Transforming traditional agrifood supply chains with circular economy in developing economies. Cleaner Waste Systems, 3:100062.
[13] Julianelli, V., Caiado, RG, Scavarda, LF, and Cruz, RPM (2020). Interaction between reverse logistics and circular economy: A taxonomy and framework based on critical success factors. Resources, Conservation and Recycling, 158:104802.
[14] Khairani, N. S. and Thirumanickam, N. (2012). Green supply chain management practices: Evidence from Malaysia. Management & Accounting Review, 11(2):35–52.
[15] Khan, I. S. and Majava, J. (2021). Stakeholder interdependencies and their role in sustainable business model innovation. arXiv preprint.
[16] Khan, SA, Laalaoui, W., Hokal, F., Tareq, M., and Ahmad, L. (2023). Linking reverse logistics with circular economy in the Industry 4.0 context. Kybernetes, 52(12):6279–6305.
[17] Mishra, A., Dutta, P., Jayasankar, S., Jain, P., and Aich, S. (2023). A review of reverse logistics and closed-loop supply chain in circular economy perspective. Benchmarking: An International Journal, 30(3):975–996.
[18] Muhammad, A. and Naidu, BM (2023). The role of Logispreneurs in advancing waste management in Malaysia: Towards sustainable reverse logistics and a green future. Management and Marketing Studies, 8(2):45–62.
[19] Parfitt, J., Barthel, M., and Macnaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554):3065–3081.
[20] Qastharin, AR (2016). Business model canvas for social enterprises. Humanika Sciences, 8(4):1–10.
[21] Rosca, E., Arnold, M., and Bendul, J. C. (2017). Business models for sustainable innovation empirical analysis of frugal products and services. Journal of Cleaner Production, 162:S133–S145.
[22] Routray, SK and Hussein, HM (2019). Narrowband IoT: A suitable solution for developing countries. arXiv preprint.
[23] Saidani, M., Yannou, B., Leroy, Y., Cluzel, F., and Kendall, A. (2020). How are circular economy and industrial ecology concepts related? A bibliometric and text mining analysis. Journal of Industrial Ecology, 24(5):1113–1126.
[24] Setyawan, N. A., Utami, H., Nugroho, BS, et al. (2022). Analysis of driving factors for Green Supply Chain Management implementation in SMEs in Semarang city. arXiv preprint.
[25] Sharma, P. and Tong, Y. W. (2025). Food waste management and problems in Asian countries. Waste to Energy: Technologies and Perspectives, pages 25–50.
[26] Simchi-Levi, D., Mellou, K., Menache, I., et al. (2025). Large language models for supply chain decisions. arXiv preprint.
[27] Simorangkir, CO (2024). Developing sustainable management strategies for the Floating Market tourism area in Lembang. Research Gate.
[28] Sparviero, S. (2019). The case for a socially oriented business model canvas: The social enterprise model canvas. Journal of Social Entrepreneurship, 10(2):232–251.
[29] Sreenivasan, J., Govindan, M., Chinnasami, M., and Kadiresu, I. (2012). Solid waste management in Malaysia — Steps towards sustainability. Waste Management in Malaysia: Current Status and Prospects, pages 55–70.

[30] Supriadi, I., Fatchurrohman, M., and Sari, EP (2025). Circular economy transformation in MSMEs: Sustainable business model innovation to improve economic and environmental performance. Journal of Applied Economics in Developing Countries, 10(1):27–45.
[31] Zailani, S., Jeyaraman, K., Vengadasan, G., and Premkumar, R. (2012). Sustainable supply chain management (SSCM) in Malaysia: A survey. International Journal of Production Economics, 140(1):330–340.