COMMERCIALISATION PATHWAYS FOR EU R&D: A PRACTICAL GUIDE TO BUSINESS MODELLING, VALIDATION, AND SCALE - BASED ON THE FOR-FREIGHT PILOTS

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Executive Summary

This paper examines how EU transport R&D results can move from pilots to sustained market uptake in European multimodal logistics. It argues that commercialisation is constrained by the ecosystem nature of freight networks, where value losses cluster at organisational interfaces due to misaligned identifiers, fragmented event data, and limited interoperability across proprietary systems. Drawing on the FOR-FREIGHT project, the paper synthesises evidence from three pilots that represent distinct corridor and maturity profiles: (i) Spain, combining port-side planning and document digitalisation with a quantified metro-based last-mile alternative, (ii) Greece, targeting port-to-airport coordination with defined baselines and improvement targets for idle time, customs processes, errors, storage efficiency, and capacity, and (iii) Romania, addressing inland port to rail transshipment fragmentation through IoT-enabled visibility, planning support, and carbon footprint assessment. The analysis shows that uptake depends on the joint maturity of technology, governance, and delivery capability, and that pilots must function as market experiments that generate measurable value proof. It concludes that modular service packaging, governance-by-design, and iterative business modelling reduce adoption risk, enable staged procurement, and increase the likelihood that project outputs persist beyond the funding period, while aligning efficiency gains with sustainability and regulatory drivers.

1. Commercialisation challenge in European multimodal logistics

Multimodal freight markets function as interdependent ecosystems. Value losses concentrate at organisational boundaries, where handovers require aligned identifiers, shared event timelines, and interoperable data structures. In practice, each organisation optimises locally. Each organisation also runs proprietary systems and maintains partial datasets, which produces duplicated records and inconsistent "truth" about the same shipment. Evidence from European logistics data-sharing work describes this fragmentation as a recurring barrier, reinforced by inconsistent formats, processes, and limited trust in how partners handle shared data.

This pattern appears in maritime trade through Port Community Systems. PCS implementations aim to improve the exchange of timely information between port stakeholders such as carriers, terminal operators, freight forwarders, customs, and port authorities. Yet large efficiency gains require interoperability across PCS, border management systems, and private visibility platforms, not only within a single port community. Global guidance on PCS highlights that interoperability principles, semantic standards, openness, and a clearly defined operating and governance model are prerequisites for sustained impact [1].

Comparable dynamics exist in air cargo. The sector historically relied on message-based exchange across many bilateral connections, which creates redundant data replication and inconsistent shipment states. IATA's ONE Record standard explicitly addresses this problem by defining a common data model and API-based exchange intended to create a single record view of the shipment and clarify data ownership at the source. This direction illustrates how identifier fragmentation and asynchronous updates become commercial barriers, not only technical issues, because buyers associate them with operational risk and liability exposure [2].

Maritime documentation provides another clear example. Bills of lading remain central to commercial and legal processes, yet paper and non-interoperable digital systems block straight-through processing across actors. Industry initiatives have moved toward open standards and interoperability for electronic bills of lading, including a documented milestone of standards-based interoperable eBL transactions and published specifications intended to support platform-to-platform exchange. These efforts show the scale of the coordination problem. A market-ready solution must fit into a multi-provider environment and avoid lock-in assumptions, because trade ecosystems rarely converge on a single platform [3].

This ecosystem structure shifts the commercialisation problem. Adoption depends on collective feasibility, which includes integration effort, governance clarity, and credible performance evidence across stakeholders. A purely technical demonstration is insufficient when operational gains require shared participation but costs fall unevenly across organisations. The experience of large-scale visibility platforms illustrates this barrier. TradeLens, a blockchain-enabled trade platform, was discontinued after failing to reach the level of industry collaboration required for commercial sustainability, despite technical capability and high-profile backing. This outcome

[1] https://sustainableworldports.org/wp-content/uploads/Executive-Summary-WB-IAPH-Port-Community-Systems.pdf
[2] https://www.iata.org/en/programs/cargo/e/one-record/
[3] https://dcsa.org/newsroom/ebl-interoperability-milestone

underlines a consistent lesson. Network solutions fail commercially when governance and participation incentives do not overcome confidentiality concerns, competitive tensions, and integration burden [4].

Regulatory change strengthens the need for commercialisation methods that explicitly address governance and interoperability. The EU's electronic freight transport information framework creates a legal basis for sharing regulatory information electronically with competent authorities. This improves the regulatory interface, yet it does not automatically resolve B2B data-sharing and operational coordination across private actors. Commercial uptake therefore still depends on viable operating models, trusted intermediaries where needed, and standardised semantics that allow reuse across corridors and modes [5].

Significance for the topic emerges at the level of method. European transport R&D benefits from commercialisation approaches that treat pilots as market experiments. The primary output becomes evidence that a service can be delivered repeatedly under real institutional constraints, with measurable outcomes and workable governance, including clearly defined roles such as data holders, data users, and platform operators, and explicit accountability for access rights and compliance. European logistics forum work on data-sharing roles and platform governance provides structured role models that can be used to translate pilots into procurement-ready offerings [6].

2. Pilot environments as commercialisation testbeds

FOR-FREIGHT operationalised commercialisation learning through three pilots, each representing a distinct corridor and maturity profile.

Spain pilot: Valencia Port to DHL warehouse, plus metro-based last-mile distribution in Madrid

The Spain pilot combined port-side optimisation with a city logistics innovation.

Scenario 1 focused on the vessel to truck interface for containerised import traffic. The aim was to improve information flow through real-time exchange and document digitalisation, improve truck planning and reduce truck staying time at the port and terminal, and reduce congestion and related emissions. Blockchain and Digital Twins were positioned as enabling technologies for simulation and decision support.

Baseline metrics included terminal loading and unloading time of about 1 to 2 hours, dispute-related errors at 18 percent, truck waiting time at terminals of about 2 hours, on-time delivery around 60 percent, and long container dwell times in port, including 19 days for 20GP containers and 46.2 days for 40GP containers. Target KPIs included over 15 percent improvement in

[4] https://www.maersk.com/news/articles/2022/11/29/maersk-and-ibm-to-discontinue-tradelens
[5] https://eur-lex.europa.eu/eli/reg/2020/1056/oj/eng
[6] https://transport.ec.europa.eu/system/files/2022-04/DTLFII_SG2_Interim_Report.pdf

forecast planning, over 20 percent increase in document digitalisation, over 15 percent reduction in container staying time at port, and over 15 percent reduction in GHG emissions.

Scenario 2 tested a Subway-Based Network as a sustainable last-mile alternative. Containers were moved from the port to a warehouse, then to a metro depot outside the city. Parcels were disaggregated at the depot and transferred to metro trains, then unloaded at metro stations and placed into parcel lockers. Average parcel weight was 1.5 to 3 kilograms, enabling manual handling between depot, trains, and stations. Operations leveraged low passenger periods from midnight until network closing at around 2 a.m., using existing suitcase spaces rather than dedicating a full wagon.

Baseline KPIs for the urban delivery comparison included around 50 stops per route, missed deliveries around 10 percent, emissions around 0.88 kilograms per stop, and operational cost of 1.97 euros per parcel. Targets included more than 10 percent reduction in transport time and more than 12 percent reduction in operational costs, alongside more than 80 percent reduction in external cost.

Commercial significance: the Spain pilot demonstrated a dual value proposition. It paired operational efficiency inside the port interface with a visible sustainability and congestion-reduction narrative in the last mile. This combination supports procurement discussions where public objectives and city logistics constraints influence adoption.

Greece pilot: Port-to-Airport multimodal freight transport, end-to-end optimisation with DSS and real-time monitoring

The Greece pilot targeted the operational chain between Piraeus and Athens International Airport. The current process was characterised by manual coordination, fragmented legacy systems, multiple cargo IDs, and delays linked to manual data entry and spreadsheet-based dissemination.

The solution concept aggregated information from multiple management systems and added real-time monitoring, sensor inputs, and analytics. A Decision Support System recommended the quantity and timing of resources to be available at the port terminal and at the airport cargo handler, aligned with live updates from port, road, and air traffic data. A unique cargo ID based on the Bill of Lading number supported end-to-end traceability and shared situational awareness across stakeholders.

Baseline performance metrics were specified to enable measurable validation. Container idle time at port was 2 to 3 working days. Container idle time at the airport was 4 to 6 hours. Customs clearance time was 6 to 8 hours. Truck waiting time at terminal was 6 to 8 hours. Truck transport time from port to airport was 1.5 to 2 hours. Airport cargo handling capacity was about 40,000 tonnes per year. Mishandling errors were around 40 per year, with 5 to 6 additional delay-causing incidents per month.

Target KPIs included 25 percent reductions in idle time at port and airport, 20 percent reduction in customs clearance time, 20 percent reduction in errors, 15 percent increase in storage

efficiency, and 20 percent increase in end-to-end capacity through optimisation of resource utilisation.

Commercial significance: the Greece pilot produced a clear value logic for willingness-to-pay discussions. Idle time reduction, error reduction, and storage efficiency translate directly into capacity and cost outcomes, strengthening the case for subscription and licensing models complemented by integration services.

Romania pilot: Galati Port, river port to warehouse hub via railway network

The Romania pilot addressed a river port where transshipment to rail is a major activity. The baseline problem was structural fragmentation. The transfer from seagoing vessels to rail was described as a fragmented process pursued by independent operational systems, leading to non-synchronisations, loss of time, uneconomical resource use, railway schedule delays, additional fees, and delivery delays. Real-time tracking was absent, enabling unauthorised transfers. Low digitalisation and limited historical data prevented a real-time common operational picture.

The solution concept integrated information from stakeholder systems and added IoT and data processing capabilities, including 5G connectivity and Internet of Containers. It aimed to enable fluent access to transport flow information, support prior planning and resource optimisation, and monitor activities to avoid congestion. A sustainable port-rail mobility plan and carbon footprint assessment were included to reduce GHG emissions. Real-time positioning and environmental parameter monitoring of intermodal units were part of the functionality set.

Commercial significance: the Romania pilot highlighted a common scaling barrier in lower-maturity nodes. Adoption depends on capability-building as much as on software features. Training, technical support, and phased deployment become part of the product offer, not an optional implementation detail.

3. The commercialisation pathway

3.1. Business modelling as a living process

Business models in European multimodal logistics rarely stabilise early. The market involves multiple actors, uneven benefit distribution, and strong dependencies on interoperability and governance. Under these conditions, a static plan written once is unlikely to remain valid after pilots, stakeholder engagement, and integration work reveal real constraints. European guidance on dissemination and exploitation treats planning as an ongoing activity that supports impact and uptake, rather than as a one-off reporting product [7].

A “living” business model has a clear procedural meaning. It is reviewed and updated at defined moments in the project lifecycle, for example after each pilot milestone, after each major integration step, and after structured stakeholder feedback. Many Horizon projects explicitly

[7] https://rea.ec.europa.eu/dissemination-and-exploitation_en

frame dissemination and exploitation planning as a living document that is updated through the project lifecycle, with revisions triggered by results and reviews [8].

A practical way to implement this approach is to maintain a portfolio of Key Exploitable Results and link each result to explicit commercial hypotheses. These hypotheses typically cover the buyer and decision authority, the value mechanism and measurable KPI, the delivery and integration scope, the governance and access-rights design, and the pricing logic. The Innovation Radar framework provides a comparable maturity logic by distinguishing technology progress from business preparation and by recognising that market-oriented assets, such as market studies, business plans, and end-user engagement, must advance alongside piloting and demonstration [9].

Within this living approach, Business Model Canvas, PESTEL, and SWOT serve different functions at different times. Business Model Canvas supports structured alignment on who creates value, who pays, what channels are feasible, and what partners are required, then it is revised when pilots reveal bottlenecks or when stakeholder roles shift. PESTEL becomes most useful when external constraints change, such as regulatory requirements, data-sharing rules, or sustainability-related procurement drivers, because these changes can alter the feasible market entry route. SWOT becomes most useful when comparative positioning becomes clearer, for example when integration costs or operational adoption barriers become visible and must be treated as primary risks. Evidence and feedback determine when each tool needs to be revisited, rather than a fixed deliverable schedule [10].

This process orientation aligns with how the European innovation support ecosystem operationalises uptake. Services such as the Horizon Results Booster, now presented as the Booster, provide structured coaching to help beneficiaries mature exploitable results, develop business plans, and build go-to-market strategies. The existence and design of such services reflect an underlying assumption that business modelling requires iteration, refinement, and de-risking based on evidence, not only planning [11].

A living model also reduces late-stage exploitation failures caused by unresolved ownership and access-rights questions. EU IP management guidance stresses that IP handling during project implementation is central because ownership, access rights, and protection strategies form the basis for future exploitation and are difficult to retrofit after external engagement begins. This becomes commercially decisive in platform settings where multiple stakeholders require role-based access, confidentiality assurances, and clear allocation of responsibilities [12].

Examples outside FOR-FREIGHT show the same pattern of iterative commercial reasoning embedded in project practice. Communication, dissemination, and exploitation plans in unrelated Horizon projects explicitly describe continuous monitoring and lifecycle updates, often tied to standardisation activities and stakeholder engagement cycles. These documents

[8] https://www.horizoncodecs.eu/wp-content/uploads/2023/12/DEL_DECO-Strategy_31032023-1.pdf
[9] https://innovation-radar.ec.europa.eu/methodology
[10] https://rea.ec.europa.eu/dissemination-and-exploitation_en
[11] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/d-e-booster
[12] https://www.unav.edu/documents/10162/32810280/EU-IPR-IP-Guide.pdf/d09132dd-6e32-df99-7d40-3650153586e8?t=1621355024160

operationalise "living" planning through evolving activity lists, periodic reassessment, and iterative prioritisation of exploitable results [13].

Within FOR-FREIGHT, this living orientation was operationalised by framing the offer as a platform that integrates legacy management systems, sensors and devices, and ML and analytics functions, then translating these capabilities into stakeholder-specific value and revenue logic across pilots. The platform framing supports iterative business modelling because modules can be packaged, priced, and governed differently depending on corridor type, digital maturity, and procurement constraints, while still preserving a common technical core.

3.2. Value propositions grounded in validated KPIs

Value propositions were articulated through measurable operational improvements and sustainability outcomes. Spain defined baseline and target KPIs for port efficiency and document digitalisation, and it defined a quantified comparison between courier delivery and a mixed truck plus metro model.

Greece defined baselines and targets for idle time, customs clearance time, errors, storage efficiency, and end-to-end capacity.

Romania defined operational problems that translate into commercial value through reduced delays, reduced fees, reduced security risk, and improved resource utilisation enabled by integrated data and IoT monitoring.

This KPI grounding matters commercially because it enables value-based pricing and reduces information asymmetry for buyers and investors. It also supports replication, because KPI definitions can be reused as onboarding scorecards in new sites.

3.3. Segmentation and the identification of entry buyers

Segmentation in FOR-FREIGHT followed a node-and-governance logic rather than a generic "logistics market" logic. The business modelling framed customer groups by (a) where decisions are taken, (b) who controls operational data and system interfaces, and (c) who carries compliance and service-level responsibility. This approach appears consistently in the business model canvases and commercialisation plans, where customer segments are listed alongside

[13] https://horizon-connect.eu/wp-content/uploads/2024/04/CONNECT-D7.1-PU-M06.pdf

key partners, channels, and relationship mechanisms, which makes segmentation inseparable from delivery feasibility.

Greece pilot segmentation: port-to-airport corridor actors and operational decision owners

The Greece business model canvas defined customer segments that reflect the governance of a sea-air corridor: port authorities, airport authorities, customs agencies, logistics operators, cargo handlers, and end-users such as shippers and consignees.

This segmentation matches the operational problem statement. Coordination can involve multiple stakeholders and manual exchanges, while proprietary systems and duplicated identifiers prevent an end-to-end operational picture.

The commercial logic implicitly separates “integration gatekeepers” from “benefit recipients.” Authorities and cargo handlers can unblock integration, access rights, and process standardisation, while shippers and consignees benefit through reliability and visibility. The exploitation-oriented stakeholder notes reinforce this structure. One stakeholder description emphasised shipment visibility and reliability and the reduction of manual email and phone coordination as the core buyer-relevant value. Another positioned sea-air standardisation, automation of procedures, real-time monitoring, early arrival notice, and proactive planning as adoption drivers for the airport cargo community.

Entry buyer implications become clearer when linked to the solution offer. The proposed offering in the Greece corridor included end-to-end visibility, container tracking, automated ETA updates, differentiated access levels, and resource reservation recommendations for the cargo handler, which aligns strongly with airport-side operational control points such as storage preparation and staffing.

This makes a credible entry-buyer hypothesis: an airport-side cargo handler or airport authority can act as an anchor buyer for an initial “visibility and coordination” module, while customs agencies and port stakeholders join as enabling partners once shared IDs, access control, and integration patterns prove workable.

Romania pilot segmentation: broader coalition requirements in an inland port to rail ecosystem

The Romania business model canvas listed a wider and more infrastructure-centric coalition: suppliers, shipping agents, port authorities, terminal operators, warehouses, railway operators, beneficiaries, and also sustainability-focused organisations and smart mobility providers.

This broader segmentation reflects the baseline constraints described for the Galati environment, where transshipment is fragmented across independent operational systems, real-time tracking is limited, and coordination failures lead to delays, additional fees, and delivery disruptions.

The inclusion of sustainability-focused organisations is not decorative. The value proposition includes carbon footprint reduction and a sustainable port-rail mobility plan, and the service

concept includes real-time positioning and environmental monitoring of intermodal transport units.

This introduces additional adoption pathways beyond pure operational efficiency. Stakeholders that influence sustainability reporting, green investment, and port climate planning can become indirect buyers, co-funders, or procurement sponsors for the sustainability modules, especially where operational buyers face budget constraints.

Entry buyer identification in this pilot relies on control of the physical and digital interfaces. Port authorities, terminal operators, and railway operators typically govern access to operational systems and on-site deployment of IoT infrastructure. The canvas therefore positions these actors as primary segments, while suppliers, shipping agents, and beneficiaries join through shared visibility and planning benefits.

A credible entry workflow in this environment is an "integrated flow visibility and transshipment coordination" service, packaged with implementation support, because the SWOT notes explicitly anticipate adoption challenges linked to initial costs, compatibility, and resistance to change.

Spain pilot segmentation: two distinct markets in one pilot design

The Spain pilot effectively contains two segmentation problems, because it combines a port-to-warehouse corridor with a metro-based last-mile concept.

For the port-to-warehouse scenario, the stakeholder framing describes end customers as part of a port cluster, including public bodies and private companies, and highlights port terminals as an important link in global logistics chains.

This implies segmentation by port ecosystem role rather than by company type. Port authorities and terminal operators function as governance and integration gatekeepers, while logistics operators and solution providers function as delivery partners and adopters. The business model canvas that includes metro operators among key partners and customer segments reinforces that segmentation must follow control of operational interfaces and data exchange points.

For the metro-based last mile scenario, segmentation expands to urban infrastructure gatekeepers and citizen-facing users. The description identifies Metro de Madrid's intent to use low-passenger periods, roughly from midnight until network closing around 2 a.m., and to use existing luggage spaces on airport-line trains for small shipments, supported by parcel lockers at stations.

Potential end customers include residents near metro stations and commuters, while public administrations and logistics operators appear as interested stakeholders in demonstration outcomes.

This introduces procurement and decision complexity that differs from the port scenario. Metro operators and public authorities become operational gatekeepers because they control access windows, safety and security procedures, station infrastructure, and service rules. Logistics

operators become service orchestrators who can convert the concept into contracted service volumes.

Entry buyer implications therefore differ by scenario. In the metro context, a metro operator or public authority can act as an enabling buyer or sponsor, because the concept's value is partly externalised through congestion and emissions reduction, while a logistics operator can act as the commercial aggregator that buys capacity and sells delivery services.

Why entry buyers matter in fragmented demand environments

Across the three pilots, segmentation serves one central purpose: it converts fragmented demand into an adoptable sequence. The business model canvases consistently pair customer segments with channels such as API integration with existing management systems, web-based access to real-time information, and training and support mechanisms.

This pairing implies that an entry buyer must be able to authorise integration, accept governance terms, and host operational change.

In that context, "visibility and coordination" functions form a realistic entry workflow. In Greece, the initial offering included real-time end-to-end visibility, automated ETA updates, role-based

access, and notification and reservation recommendations, which can reduce manual coordination without forcing immediate redesign of all stakeholder processes.

In Romania, an integrated flow picture and real-time monitoring supports prior planning and resource optimisation, which addresses fragmentation while allowing phased onboarding of actors.

In Spain, the port scenario targets document digitalisation and improved planning, while the metro scenario targets a controlled pilot service with defined operational steps and measurable baselines, which enables a staged move from feasibility proof to service contracting.

This segmentation logic increases commercial readiness because it clarifies who can buy first, what must be delivered first, and which partners must be aligned before broader ecosystem adoption becomes feasible.

3.4. Pricing, monetisation, and packaging

FOR-FREIGHT business modelling emphasised flexible monetisation to match heterogeneous procurement cultures. Revenue streams included subscription fees, licensing fees, revenue-sharing agreements for value-added services, and consulting and customisation services.

In Romania, sustainable mobility planning services were explicitly listed as an additional stream, consistent with the inclusion of carbon footprint assessment and mobility planning in the functionality set.

For sustainability tooling, licensing pathways were articulated through SaaS subscriptions, tiered pricing, integration with existing systems, white labelling, and API licensing.

Packaging significance: modular pricing enables staged adoption. It lowers barriers for initial buyers and reduces the risk of platform-wide “all-or-nothing” procurement.

3.5. Delivery channels, partnerships, and integration as a product component

Channels in the Greece use case were framed around APIs and integration with existing management systems, a web-based platform for real-time access, training sessions, and targeted marketing activities.

For Romania, channels included IoT infrastructure deployment and integration with stakeholder systems, web access, training, and ongoing support.

Integration significance: in all pilots, integration capability was treated as a critical commercial requirement. Data security and privacy, scalability, interoperability with diverse data formats, and training and support were repeatedly identified as conditions for successful adoption.

4. Common hurdles and practical responses

Fragmented demand and unclear budget ownership remain structural barriers. The operational evidence from the Greece and Romania pilots indicates that value accrues across the ecosystem, while responsibilities and systems remain distributed. The practical response is coalition-based

adoption, anchored by node authorities or dominant operators, supported by modular entry services such as tracking and shared ETA events.

Unclear data ownership and trust barriers often delay uptake. The project response combined role-based access, differentiated authorisation levels, and integrated data exchange mechanisms designed to reduce errors and improve transparency.

Limited willingness-to-pay evidence is common in multi-actor settings. The practical response is KPI-based value proof and tiered offerings. For example, Greece defined measurable baseline delays and explicit improvement targets that can be translated into throughput and cost narratives for pricing discussions.

5. Performance tracking for adoption readiness

Commercialisation requires metrics that link pilot outcomes to market readiness. Business tracking metrics included active users and subscribers, customer satisfaction ratings, adoption rates in target segments, revenue growth and profitability, successful cargo deliveries, and reductions in process time and costs.

Sustainability tracking included carbon footprint and GHG reductions and resource utilisation improvements.

Significance: a shared KPI framework supports replication across new nodes by providing an onboarding scorecard, a performance contract basis, and a credible evidence package for procurement and investment decisions.

6. Conclusions and implications for commercial uptake after FOR-FREIGHT

The FOR-FREIGHT pilots support a clear claim. Commercial uptake in multimodal logistics depends on the combined readiness of three layers: the technology layer, the governance layer, and the delivery layer. The pilots show that progress in only one layer does not remove adoption risk. A working prototype does not guarantee uptake if stakeholders cannot share data safely, cannot integrate with existing systems, or cannot run the service with clear roles and support arrangements.

6.1. Pilot evidence converts "pilot success" into a market argument

The pilots demonstrate why measured baselines and targets matter. They shift evaluation from "it works" to "it delivers value at scale." They also allow a buyer to link operational gains to budget logic.

In Spain, the port-side scenario defined concrete baselines such as terminal loading and unloading time of about 1 to 2 hours, dispute and error levels at 18 percent, truck waiting time at terminals around 2 hours, on-time delivery around 60 percent, and long container dwell times in port, including 19 days for 20GP and 46.2 days for 40GP containers. Targets included over 15 percent improvement in forecast planning, over 20 percent increase in document digitalisation,

over 15 percent reduction in container staying time at port, and over 15 percent reduction in GHG emissions.

These metrics support a procurement argument that links platform deployment to measurable time and emissions outcomes, and they support a contract structure based on performance indicators rather than generic “digitalisation” claims.

Spain also quantified a last-mile alternative using metro operations. The scenario specified operational design and baseline metrics, including around 50 stops per route, missed deliveries around 10 percent, emissions around 0.88 kilograms per stop, and operational cost of 1.97 euros per parcel, with targets such as more than 10 percent reduction in transport time, more than 12 percent reduction in operational costs, and more than 80 percent reduction in external cost.

This creates a stronger adoption case than a generic sustainability narrative, because it provides a comparable “before and after” frame that both city authorities and logistics operators can use.

In Greece, the pilot established a detailed baseline picture of delay and error sources that are commercially meaningful. Baselines included container idle time at port of 2 to 3 working days, idle time at the airport of 4 to 6 hours, customs clearance time of 6 to 8 hours, truck waiting time at terminal of 6 to 8 hours, and mishandling errors around 40 per year, with additional incidents per month causing delays. Targets included 25 percent reductions in idle times, 20 percent reductions in customs time and errors, a 15 percent increase in storage efficiency, and a 20 percent increase in end-to-end capacity through resource optimisation.

These numbers translate directly into throughput, staffing, and storage capacity decisions. That link is central for uptake because it allows buyers to justify subscription or licensing costs as an operational investment rather than an R&D experiment.

In Romania, the pilot framed adoption around structural fragmentation and risk. The baseline problem statement described fragmented operational systems, non-synchronisation between unloading and loading, time loss, resource inefficiency, rail schedule delays, extra fees, delivery delays, and a lack of real-time tracking that enables unauthorised transfers.

This framing matters because it expands the value case beyond time savings. It includes security and integrity of operations, which can influence adoption by port authorities and rail operators who face liability and compliance expectations.

Impact and benefit: quantified baselines and targets turn pilots into credible evidence packages. They reduce uncertainty for buyers, funders, and investors. They also enable staged contracts, where initial scope focuses on measurable quick wins and later scope expands to optimisation.

6.2. Modular service design lowers coordination cost and enables staged uptake

The pilots also show that modularisation is not only a technical architecture choice. It is a market entry strategy in multi-actor systems.

In Greece, the proposed solution combined end-to-end visibility, tracking and monitoring, automated ETA updates, integration of legacy systems, and role-based access.

This set of functions can act as a first "entry package" because it reduces the immediate coordination burden, which was described as manual exchanges and fragmented identifiers. It improves situational awareness without forcing all actors to change their internal systems at once.

In Romania, the logic of an integrated flow view, real-time monitoring, and planning support provides a similar entry package, while leaving advanced automation and wider ecosystem functions for later phases. The SWOT analysis pointed to threats such as resistance to change and compatibility issues, which strengthens the case for phased, modular rollout.

In Spain, modularity supports a dual market. Port-side modules address document digitalisation and planning. City logistics modules address last-mile flows and station-based delivery steps. A shared platform core can support both, but procurement and governance differ, so modular packaging allows different buyers to adopt different parts under different terms.

Impact and benefit: modular services allow staged procurement and staged governance. They reduce the "all actors must commit now" barrier. They also create early revenue and operational learning, which improves the chance that the service continues after project end.

6.3. Governance-by-design is a commercial requirement, not a compliance add-on

The pilots repeatedly show that data sharing and system integration depend on trust, access control, and clear responsibilities. In Greece, the solution concept explicitly required differentiated information access by authorisation level and an end-to-end traceability approach that supports shared situational awareness.

The baseline issue of multiple cargo IDs and proprietary systems illustrates why governance is commercial. Without shared identifiers and agreed access rights, visibility services cannot function reliably, and buyers will not commit operational decisions to the platform.

Romania adds a governance angle through risk. The lack of real-time tracking and the possibility of unauthorised transfers shift attention to accountability and auditability, which can be decisive for institutional buyers.

Impact and benefit: governance-by-design lowers perceived operational risk. It also makes multi-party participation feasible, which is necessary for capturing corridor-level value rather than isolated local gains.

6.4. Sustainability strengthens uptake when tied to operations and contracts

Sustainability claims often fail commercially when they sit outside daily operations. The pilots show a stronger approach. Emissions reduction is framed as a result of changed processes and better planning.

The Spain metro last-mile concept linked sustainability to a concrete operating model with measurable baselines and targets, including emissions and external cost reductions.

Romania embedded sustainability through carbon footprint assessment and a sustainable port-rail mobility plan linked to how freight moves and how resources are scheduled.

Impact and benefit: this approach improves adoption when public value matters, for example in city logistics or port governance, because it provides measurable outcomes that can support procurement criteria, policy targets, and funding eligibility.

6.5. Overall implication for uptake after FOR-FREIGHT

FOR-FREIGHT indicates that commercialisation pathways in EU transport R&D work best when they are built around four principles.

Iterative business modelling: Business models need revision after each pilot learning cycle, because segments, partners, and cost drivers change with integration reality.

Pilot-based value proof: Baselines and targets create credible economic arguments and allow performance-based adoption pathways.

Governance-by-design: Access rights, shared identifiers, and accountability structures determine whether corridor-wide visibility is feasible.

Service modularity: Entry packages such as visibility, tracking, ETA updates, and shared event views reduce coordination costs and enable staged procurement.

Taken together, these elements reduce adoption risk, support phased contracting, and increase the likelihood that project outputs persist as operational services beyond the project lifecycle, especially in environments where many actors must cooperate for value to materialise.

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