ReMuNet

Pioneering resilient and adaptive multimodal transport networks

D3.4

ReMuNet's Operator Model and its coherent Business Model

FIR at RWTH Aachen University

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ABBREVIATIONS

AI	Artificial Intelligence
API	Application Programming Interface
B2B	Business to Business
B2C	Business to Customer
C2C	Customer to Customer
DSR	Design Science Research
FMEA	Failure Mode and Effects Analysis
IoT	Internet of Things
IoS	Internet of Services
IT	Information Technology
KPI	Key Performance Indicator
OCAP	Out of Control Action Plan
P2P	Peer to Peer
PBMC	Platform Business Model Canvas
ROI	Return on Invest
SaaS	Software as a Service
SBM	Sustainable Business Model
SBM	Sustainable Business Model
SD	System Dynamics
SME	Small and Medium Enterprises
SRBMC	Sustainable ReMuNet Business Model Canvas
SROMC	Sustainable ReMuNet Operator Mode Canvas
TMS	Transport Management System

1. Introduction

ReMuNet - Resilient Multimodal Freight Transport Network - is financed by the European Commission through the European Union's Horizon Europe research and innovation program under Grant Agreement No 101104072. It has been proposed by a consortium of 15 beneficiaries coordinated by FIR an der RWTH Aachen and will be lasting 36 months, having started in July 2023. The content of the project and the aim of the Deliverable will be presented in the following.

1.1 Project Background

ReMuNet is tasked with identifying and signalling disruptive events while assessing their impact on transport corridors. By communicating alternative multimodal transport routes to logistics operators and subsequently to truck drivers, train drivers, and barge captains, it facilitates a more rapid network response. Furthermore, ReMuNet orchestrates route and capacity utilisation and enables synchromodal relay transport.

Additionally, ReMuNet is responsible for establishing comprehensive standards for the transnational description of multimodal nodes and transport routes, including infrastructure elements and their parameters. This forms the basis for a unified modelling language. To ensure maximum practical applicability and acceptance, these standards are developed by evaluating and consolidating existing description standards, supplementing technical and sustainability related descriptive attributes, and engaging in close collaboration with European transport companies, associations, and institutions.

ReMuNet's collaborative platform reduces entry barriers for regional transport companies, encouraging participation in multimodal transport, known for its lower average emissions compared to road freight transport. Intelligent routing algorithms prioritise low emission routes and modes of transport, enhancing transport efficiency and significantly cutting emissions. ReMuNet explores the integration of alternative drives to further support sustainability goals, aiding political and economic decision-makers in expanding and maintaining vital transport infrastructure.

ReMuNet's algorithm considers the impacts of disruptive events and strategically plans route distribution to maximise the efficiency of the multimodal transport network. Within the project a comprehensive Transport Failure Mode and Effects Analysis (FMEA) is conducted, including detailed risk analysis of disruptive events and potential transport disruptions, to transparently assess short and long-term effects on the multimodal transport infrastructure. ReMuNet's data pool expedites internal decision-making, supporting the development of business capabilities necessary to manage disruptions.

ReMuNet maintains a catalogue of transport Out of Control Action Plans (OCAP), containing quick reaction strategies to respond to potential transport collapses. Synchromodal relay transport is tested as the preferred transport mode to bridge failed transport routes. ReMuNet's algorithm provides real-time status updates on functioning transport nodes and edges, enabling flexible route adjustments. The algorithm calculates failure probabilities for transport routes and minimises congestion on alternative routes through intelligent distribution.

ReMuNet's collaborative platform treats small and large companies equally, aiming to integrate local players and connecting freight forwarders, carriers, terminal operators, and other key players in the multimodal transport sector. It enables the digitalisation of communication, contracts, handover protocols, and booking processes, and orchestration of synchromodal relay transport. Continuous interactive improvement is achieved through algorithm testing and validation using historical disruptive event data. The platform provides transparent and user-friendly access for small and medium enterprises (SME) to route network structures, scheduling, operators, and capacity booking in road, rail, and barge transport.

The platform's infrastructure includes basic backend functionalities, such as master data management, user administration, roles, rights, and user-friendly application programming interfaces (API) and interfaces to existing systems and data sources. ReMuNet provides an AI-supported transport system model capable of depicting the effects and impact intensities of various disruptive events on the transport infrastructure, recognising patterns, deriving failure probabilities, identifying bottlenecks, and evaluating alternative courses of action, thus reducing reaction time, and offering sustainable, event-based route alternatives and scenarios.

ReMuNet strives to integrate civil protection organisations into the collaborative platform, matching them with freight transporters, and using real-time data to display the status of functioning and failing transport infrastructure, enabling faster and more targeted aid transportation.

By integrating all relevant stakeholders via interfaces into ReMuNet, a wide variety of anonymous planning data is refined to create the necessary basis for decision-making. Clear data governance structures and data handling processes that comply with privacy policy specifications ensure secure and trusted information exchange. External data inputs are obtained through APIs and interfaces from multiple sources, enabling participatory planning.

1.2 Key Objectives of the ReMuNet Project

The concept of the Physical Internet foresees a seamless network where resources and assets can be shared openly and efficiently. ReMuNet's main objective is to support the achievement of this vision by giving the transport network the ability to prepare, respond, and adapt to disruptive events.

In practice, ReMuNet uses digital technologies to holistically improve the resilience of the logistics and freight transport network. This includes making planning more robust and secure, reducing response times, and speeding up system recovery. ReMuNet also takes environmental aspects into account and aims to provide synchromodal transport options with the lowest emissions. This contributes to the implementation of the Physical Internet and helps to reduce the environmental impact of freight transport.

ReMuNet's key objectives are to:

Lay the foundation for a common standard to describe sustainable European multimodal transport networks for all stakeholders: ReMuNet creates comprehensive standards for the transnational description of multimodal nodes and transport routes including

infrastructure elements and their parameters. This will lay the foundation for a uniform modelling language. To ensure maximum practice orientation and acceptance, the standards are developed by evaluating and consolidating existing description standards, supplementing technical and sustainability relevant descriptive attributes, and closely collaborating with European transport companies, associations, and institutions.

Reduce European inland transport emissions on the main run by over 50 % in the long term: ReMuNet's collaborative platform lowers entry barriers for regional transport companies to participate in multimodal transport, thus facilitating combined transport which on average produces fewer emissions than road freight transport. Intelligent routing algorithms prefer low emission routes and modes of transport and increase transport efficiency, in turn significantly reducing emissions. To further contribute to sustainability goals, possibilities to integrate alternative drives are explored. Insights support political and economic decision-makers in expanding and maintaining the necessary transport infrastructures.

Enable the multimodal freight network to react and respond 20 % more quickly to disruptive events until 2026 (in comparison to 2021): The algorithm considers the impacts of disruptive events and plans a robust route distribution to maximise the efficiency of multimodal transport system utilisation. Transport FMEA including risk analysis of disruptive events and potential transport collapses is conducted to make the short and long-term effects of disruptive events on the multimodal transport infrastructure transparent. A shared data pool accelerates internal decision-making and supports the development of business capabilities necessary to cope with disruptions. Catalogue of transport OCAPs containing quick reaction strategies to (upcoming) transport collapses ensure the ability to (re-)act. Synchromodal relay transport will be tested as the preferred type of transport mode to bridge failed transport routes.

Provide 50 % more alternative transport routes in the face of disruptive events and make multimodal route planning 10-20 % more accurate and efficient until 2026 (in comparison to 2021): The algorithm displaying the real-time status of functioning transport nodes and edges allows for flexible adjustment of route suggestions. Routes are calculated and forwarded to freight forwarders and navigation systems to ensure communication with drivers and barge captains. The algorithm determines failure probabilities of transport ways and minimises congestion on alternative routes via intelligent route distribution. A collaborative platform connects freight forwarders, carriers, and terminal operators, as well as other key players in the multimodal transport sector to gather real-time data and digitalise communication, contracts, handover protocols, and booking processes and orchestrate synchromodal relay transport. Continuous interactive improvement will be achieved by simulative algorithm testing and validation with historical data of disruptive events.

Create new approaches for benefit-sharing cost-efficient business models and integrate 30 % more companies (>50 % SMEs) into the multimodal freight transport ecosystem: ReMuNet offers an open collaborative data platform, which does not differentiate between small and large companies and integrates local players. The platform provides user-friendly access for SMEs to route network structures, scheduling, operators, and capacity booking in road, rail, and barge transport. The platform infrastructure includes basic backend functionalities, e.g., master data management, user administration, roles, and

rights as well as user-friendly APIs and interfaces that connect the platform to other systems and data sources.

Predict the impact of disruptive events on multimodal transport corridors with a 90 % higher accuracy until 2026 (in comparison to 2021): ReMuNet provides an AI-supported transport system model able to depict the effects and impact intensities of various disruptive events on the transport infrastructure, recognise patterns, derive failure probabilities, identify bottlenecks, and evaluate alternative courses of action. This will lead to shortening reaction time by offering sustainable, event-based route alternatives and scenarios.

Enable civil protection organisations to set up aid delivery logistics for crisis areas 25 % faster in 2026 (in comparison to 2021): ReMuNet integrates civil protection organisations into the collaborative platform and matches them with freight transport companies. The network status will stay updated by using real-time to display functioning and failing transport infrastructure while taking new makeshift transport ways into account. This approach will enabling a faster and more focused aid transportation into crisis areas.

Create a unified data pool that portrays the real-time utilisation of multi-modal European transport infrastructure in compliance with data protection regulations: By integrating all relevant stakeholders via interfaces into the ReMuNet, a wide variety of anonymous planning data will be refined to create the necessary base for decision making. Clear data governance structures and secure data handling processes will be implemented to meet privacy policy specifications. External data input is pulled via APIs and interfaces from multiple different sources enabling participatory planning.

1.3 Objective of Deliverable 3.4

The objective of Task 3.3 is to develop a sustainable operator model and a robust business model for the ReMuNet platform, ensuring its long-term viability and scalability within the European multimodal transport ecosystem. Building on the insights generated in previous deliverables 3.2 and 3.3, this work focuses exclusively on defining how ReMuNet should be operated, governed, and monetised.

Deliverable 3.4 proposes the ReMuNet business model, including its value proposition, service offering, monetisation strategy, and cost model. The business model uses a business model canvas derived from recognised conceptual models in the literature. It builds directly on the requirements identified in D3.2 and the platform architecture described in D3.3.

Furthermore, Deliverable 3.4 encompasses an assessment of possible operator configurations. Governance structures are outlined to define rules for data exchange, service provision, and decision-making, ensuring trust and transparency across the ecosystem. The interests of platform participants and potential operators are analysed and consolidated in an evaluation matrix, clarifying the operational consequences of each option. On this basis, several operator scenarios are compared, and strategic recommendations are derived.

To address platform scaling, a system dynamics approach is applied to model interdependencies and network effects. This analysis supports the development of effective scaling strategies and identifies incentives that foster adoption and sustained growth. The outcomes of Task 3.3 result in clear strategic recommendations for the implementation and long-term

expansion of the ReMuNet business model, providing a structured basis for future deployment across additional corridors.

1.4 From Deliverable 3.3 to 3.4

Deliverable 3.3 builds on the findings of D3.2 and introduces the ReMuNet platform architecture addressing the requirements identified in D3.2. This architecture forms the central aspect of the newly designed multimodal freight transport ecosystem integrating ReMuNet. Further, D3.3 builds on the identified existing ecosystem and designs the coopetitive ReMuNet ecosystem, including the actors' potential sustainable business models and new value streams.

Deliverable 3.4 develops the formal description of the business and operator model for the digital ReMuNet platform architecture as proposed in D3.3. Description for service and data interrelationships from the digital architecture are formalised and enriched with possibilities for scaling and monetising. Especially value capture and governance concepts are shaped by requirements from D3.2.

1.5 Structure of Deliverable 3.4

Chapter 2 introduces fundamental theoretical concepts on business model and operator model research. The definition and functions of a business model are enriched with a literature review on sustainability in the context of business models. The concept of an platform operator model is described in the subsequent chapter including insights from industry examples and platforms. The theoretical background concludes with possible scaling strategies for digital platforms and how a system dynamics approach may assist in analysing the effects of scaling strategies on elements of a digital platform.

Chapter 3 summarises the research design and data collection for this Deliverable. Theoretical groundings are derived from desk research and literature review. The contents of the business and operator model are part of a survey and an expert interview.

Chapter 4 presents the survey results for the ReMuNet business and operator model.

Chapter 5 describes the final ReMuNet business model and its contents based on the canvas proposed in chapter 2.1.4. This includes the value proposition, value creation and delivery mechanisms, and value capture strategies.

Chapter 6 describes the final ReMuNet operator model and its contents based on the canvas proposed in chapter 2.2.2. With an evaluation matrix possible operator scenarios are analysed, and strategic recommendations are derived. The analysis encompasses interests and requirements of multiple interest groups of the freight transport ecosystem.

Chapter 7 concludes this Deliverable with the system dynamics analysis of possible scaling strategies fostering positive network effects. Within the analysis the chain of effects of each strategy on elements of the digital platform is analysed whether it has a positive or a negative impact on network effects.

2. Theoretical Background

This chapter covers the theoretical groundings for business models and operator models of digital platforms as well as the development of the Sustainable ReMuNet Business Model Canvas (SRBMC) and the Sustainable ReMuNet Operator Model Canvas (SROMC).

Additionally, common scaling strategies for digital platforms are introduced. The concept of System Dynamics (SD) enables the subsequent evaluation of possible strategies within the context of the ReMuNet project.

2.1 Business Model

In this section, the origins and definitions of business models are outlined, followed by their key functions and the role of sustainability in contemporary business model design. Building on this foundation, a sustainable ReMuNet Business Model Canvas is developed.

2.1.1 *Definition and Origin*

The term business model first appeared in scientific literature in 1957 in Bellman et al.'s paper on the development of a multi-stage, multi-person business game for management training (Bellman et al., 1957; DaSilva & Trkman, 2014). After this initial mention, the term was rarely used until the mid-1990s (DaSilva & Trkman, 2014; Osterwalder et al., 2005).

Since then, numerous definitions have emerged, reflecting both theoretical and practical perspectives. Over time, the focus has shifted from defining the concept to applying it in practice (Osterwalder et al., 2005). Research has explored different dimensions of business models: Snihur and Markman (2023) as well as Amit and Zott (2010) examined their innovation potential, Cozzolino et al. (2018) analysed how established firms respond to business model disruptions and platform-based transformations, and Zeng et al. (2023) emphasised that platform-based business models derive their value from ecosystem interactions among diverse actors.

Business models are commonly structured around four core elements: value proposition, supply chain or infrastructure, customer interface, and financial model (Boons & Lüdeke-Freund, 2013; Osterwalder & Pigneur, 2010).

Despite differing emphases, most definitions share a common understanding: a business model describes how an organisation creates, delivers, and captures value (table 1). While earlier approaches focused on structural and strategic dimensions, more recent perspectives highlight dynamic, digital, and sustainability-oriented aspects.

Table 1: Definitions of business models derived from literature

Definitions	Authors
"[A business model] describes the logic of a 'business system' for creating value that lies behind the actual processes."	Petrovic et al., 2001, p. 2
"A business model describes the rationale of how an organisation creates, delivers, and captures value."	Osterwalder & Pigneur, 2010, p. 14
"We define a business model as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network."	Shafer et al., 2005, p. 202
"We define a business model as the bundle of specific activities that are conducted to satisfy the perceived needs of the market, including the specification of the parties that conduct these activities […], and how these activities are linked to each other."	Amit & Zott, 2010, p. 2
"In sum, a business model defines who your customers are, what you are selling, how you produce your offering, and why your business is profitable. Who-what-how-why describes a business model of which the first two (who and what) address its external aspects and the second two (how and why) address its internal dimensions."	Gassmann et al., 2014, p. 7
"A business model is the representation of a given firm's market strategy which, in the image of a sketch, specifies how the firm organizes its human, physical, and financial resources to create, capture, and deliver value relative to the choice of stakeholders made."	Desmarteau et al., 2018
"A business model defines the rationale by which a firm creates and captures value"	Allweins et al., 2021, p. 457
"A business model refers to an open-system model of interrelated value creation, delivery, and capture activities within the focal firm and its ecosystem, continuously transforming resources (input) into value (output) in alignment with the value proposition to meet evolving stakeholders' needs."	Chen & Thapa, 2025, p. 18
"A business model for sustainability refers to how an organization proposes, delivers, captures, maintains, unlocks, and shares value with and for its stakeholders."	Lüdeke-Freund et al., 2024, p. 16

In this context, **ReMuNet uses the following aggregated definition**:

> A *sustainable platform business model* is the underlying logic and structure through which a digital platform creates, delivers, captures, and shares value within its ecosystem in ways that maintain and enhance economic, social, and environmental well-being for all stakeholders over time.

2.1.2 *Functions*

In addition to describing how an organisation operates, a clearly defined business model performs several derived functions. Osterwalder et al. (2005) highlighted five categories of

functions, including understanding and sharing, analysing, managing, prospects, and patenting of business models, to illustrate the various ways in which business models support organisational performance (table 2).

In addition, sustainability has emerged as an overarching function, extending the model's benefits by integrating environmental and social considerations alongside economic objectives (Brenner & Drdla, 2023; Lüdeke-Freund et al., 2024).

Table 2: Functions of a business model (based on Brenner & Drdla, 2023; Lüdeke-Freund et al., 2024; Osterwalder et al., 2005)

Function	Description	Source
Understanding & Sharing	An explicit description of the company supports the identification of key components and fosters a shared organisational understanding. It also enables management to communicate strategic decisions more effectively, while the articulation of the value proposition further enhances conceptual clarity.	Osterwalder et al. (2005); Osterwalder and Pigneur (2010); Shafer et al. (2005); Chesbrough (2007); Strahonja and Musulin (2018)
Analysing	A business model supports the identification of key components, the development of performance metrics, and cross-industry comparison. It also enables the systematic articulation of the value chain and revenue model, thereby facilitating the analysis of strategic decisions.	Osterwalder et al. (2005); Shafer et al. (2005); Chesbrough (2007); Strahonja and Musulin (2018)
Managing	Companies with a clearly defined business model are better able to adapt to change and maintain an explicit understanding of their organisational structure. This clarity enables managers to align the organisation's individual components more effectively.	Osterwalder et al. (2005); Strahonja and Musulin (2018)
Prospects	Business models provide designers with structured components for experimentation and the development of innovative strategies. They also enable managers to simulate organisational changes without disrupting day-to-day operations.	Osterwalder et al. (2005); Strahonja and Musulin (2018)
Patenting of business models	In the digital economy, patenting business processes offers companies a potential means of safeguarding innovation, with the business model serving as an important framework for structuring and securing such legal protection.	Osterwalder et al. (2005); Strahonja and Musulin (2018)
Sustainability	Business models can support the integration of sustainability within companies and society by facilitating the adoption of more sustainable practices. This has become increasingly important as traditional business activities place growing pressure on environmental boundaries, prompting widespread interest in sustainable business models (SBMs) that embed environmental and social considerations alongside economic goals.	Snihur and Markman (2023); Brenner and Drdla (2023)

2.1.3 *Sustainability in Business Model Research*

Building on the functional understanding of business models, sustainability has become an increasingly important dimension of business models that extends their traditional economic focus to include environmental and social value creation (Li et al., 2023). This development has led to the emergence of Sustainable Business Models (SBMs) building on the triple-bottom-line framework (Elkington, 1994). SBMs are management systems of the company's business structure, meaning they actively coordinate and guide how economic, social, and environmental value is created, delivered, and captured, while distributing it among customers, investors, employees, suppliers, the environment, and society (N. Bocken et al., 2019; N. M. P. Bocken et al., 2021; Li et al., 2023).

Sustainability in business model research can be categorised into three main focus areas: technological, organisational, and social (Boons & Lüdeke-Freund, 2013). The technological dimension includes digitalisation, the Internet of Things and Services (IoT/IoS), and digital twins, which foster resource efficiency, circularity, and operational transparency (Reim et al., 2021; Werner et al., 2024). The organisational perspective involves integrating corporate social responsibility and value-based management, balancing stakeholder and shareholder interests, and implementing sustainable governance mechanisms (Jabłoński & Jabłoński, 2016). The social perspective emphasises customer engagement and user-centric design as key drivers of sustainable value creation (Brenner, 2018; Vidmar et al., 2021).

Across the key business model dimensions, digital technologies serve as concrete enablers of sustainability. For instance, within the value proposition, digital twins support resource efficiency and circularity while maintaining competitiveness. They also enable the use of sustainability indicators within value networks, opening new opportunities for sustainable business models (Werner et al., 2024). Further, at the customer interface, data-driven and AI-based systems optimise resource utilisation and facilitate personalised, customer-centric offerings (Kammler et al., 2021). In infrastructure management, AI-supported lifecycle management and modular product architectures enhance product longevity, resource efficiency, and closed-loop systems (Schrader et al., 2023). Within the financial dimension, sustainability indicators can evolve into new sources of value, through monetisation within value networks or via circular economy practices that deliver customer benefits, reduce resource consumption, and remain economically viable (Kammler et al., 2021; Werner et al., 2024).

Despite these advances, significant gaps remain in the design and implementation of sustainable platform business models. Many companies lack a comprehensive understanding of their ecosystems and the capabilities required to achieve sustainable transformations (Brunner et al., 2025). Furthermore, current research has only partially addressed the integration of information technology and customer or social needs into SBMs (Vidmar et al., 2021).

2.1.4 *Sustainable ReMuNet Business Model Canvas*

Building on the growing relevance of sustainability and digitalisation in business model research, several frameworks have been developed to conceptualise how firms create, deliver, and capture value. Two of the most widely recognised frameworks are those proposed

by Gassmann et al. (2013) and Osterwalder and Pigneur (2010). Both address similar core elements but differ in structure and emphasis.

Gassmann et al.'s (2013) business model framework is based on four key dimensions:

- Target Customers,
- Value Proposition,
- Value Creation,
- and Profit Mechanism,

forming the so-called Magic Triangle, represented by the questions Who?, What?, How?, and Why? (Gassmann et al., 2013).

Osterwalder and Pigneur's (2010) Business Model Canvas follows a similar logic but expands it into nine building blocks grouped into four overarching areas:

- the product dimension as expressed through the value proposition,
- the customer interface comprising target customers, distribution channels, and customer relationships,
- infrastructure management including value configuration, core competencies, and partner network, and
- the financial dimension consisting of cost structure and revenue streams.
- Despite structural differences, both frameworks offer systematic approaches for analysing, innovating, and implementing business models (Steinhöfel et al., 2016).

Building on these business model foundations, platform-specific frameworks emerged to capture the dynamics of digital ecosystems characterised by multi-actor interactions rather than linear value chains. The Platform Business Model Canvas (PBMC) extends traditional frameworks to twelve building blocks. It differentiates between consumer and producer segments, their respective value propositions, and the interactions that enable exchanges between them. Facilitation mechanisms, comprising technologies and governance structures, regulate these interactions. The PBMC also includes elements such as participant acquisition and engagement, substitutes on both sides of the market, monetisation mechanisms, cost structure, and performance metrics (Allweins et al., 2021).

While Gassmann et al.'s and Osterwalder and Pigneur's frameworks primarily address one-sided markets with linear value flows, platform models depend on network effects, where value for each participant increases with the number of other users. Unlike the traditional business model frameworks, which assume self-contained value delivery, platform frameworks therefore explicitly account for competition, substitutes, and participant stimulation, which is essential for multi-sided ecosystems (Allweins et al., 2021; Mody et al., 2020).

The evolution from traditional to platform-based models has also paved the way for sustainable business model frameworks. These integrate economic, social, and environmental objectives (the "triple bottom line") to enable long-term value creation beyond short-term profit (Elkington, 1994; Lüdeke-Freund et al., 2024).

As the structural foundation for the sustainable ReMuNet business model canvas (SRBMC) the Business Model Canvas by Osterwalder and Pigneur (2010) was selected. To enhance

conceptual clarity, the Magic Triangle by Gassmann et al. (2013) was incorporated as a guiding logic, structuring the SRBMC around the four core principles of a business model: value proposition, value creation, value delivery, and value capture.

Given that ReMuNet is designed as a digital platform, its value proposition follows the platform logic outlined by (Allweins et al., 2021), focusing on interaction and facilitation as primary sources of value creation. Furthermore, the performance measurement approach proposed by Allweins et al. (2021) was integrated into the canvas to capture platform-specific dynamics.

To embed sustainability, the sustainable design themes developed by Lüdeke-Freund et al. (2024) were incorporated into the value creation dimension of the SRBMC. These themes enable the systematic integration of ecological and social criteria into the design process. In addition, the performance measurement framework was aligned with Elkington's (1994) Triple Bottom Line, distinguishing three core dimensions of sustainability: economic viability, environmental responsibility, and social equity.

Similar to other business model frameworks, the SRBMC does not explicitly include the external environment of the organisation (Allweins et al., 2021; Ching & Fauvel, 2014). The external ecosystem surrounding the ReMuNet platform, such as stakeholders, partners, and regulatory context, was addressed in the previous Deliverables 3.2 and 3.3 and is therefore not covered here.

<table>
<tr><th colspan="2">Value creation</th><th>Value proposition</th><th>Platform participants</th></tr>
<tr><td>Partners</td><td>Resources</td><td>Interaction</td><td>Enabler</td></tr>
<tr><td>Services</td><td>Sustainable themes</td><td>Facilitation</td><td>Customer segments</td></tr>
<tr><th colspan="4">Value capture</th></tr>
<tr><td colspan="2">Cost structure</td><td colspan="2">Value capture</td></tr>
</table>

Figure 1: Sustainable ReMuNet Model Canvas (based on Allweins et al., 2021; Gassmann et al., 2013; Lüdeke-Freund et al., 2024; Osterwalder & Pigneur, 2010)

2.2 Operator Model

2.2.1 *Definition and Origin*

Many companies are still unsure how to set up the processes needed to bring new services to the market effectively. Even though services are intangible, they are expected to be developed and marketed much like physical products or software (Bullinger et al. 2004). This lack of clarity shows that organisations need clearer ways to structure and manage their offerings. Operator models respond to this need.

The concept of operator models originates from the mechanical engineering sector, where it was used to focus on the development and marketing of products (Bullinger et al., 2004). These models are guided by customer requirements and evolve continuously to reflect changing needs. Essentially, they can be seen as an extended form of project financing models, ensuring that systems operate effectively and efficiently from both a technical and economic perspective (Bullinger et al., 2004).

As the nature of value creation has shifted towards services and digital offerings, coordinating such systems requires a structured approach to processes, roles, and responsibilities (Wortmann et al., 2022).

Platforms must balance several objectives: meeting user needs, developing sustainable monetisation strategies that preserve network effects, enabling growth, and maintaining long-term value creation (Wortmann et al., 2022). Effective platform operation therefore includes managing the customer journey, fostering innovation and co-creation, anticipating regulatory and competitive developments, ensuring trust and data security, and continuously monitoring performance to maintain sustainable growth (Wortmann et al., 2022).

Understanding operator models is key to structuring and managing digital platforms. This overview first defines the concept and traces its origins, introduces the Sustainable ReMuNet Operator Model Canvas (SROMC) with its three dimensions, and then examines industry examples to show how these models are applied in practice.

2.2.2 *Sustainable ReMuNet Operator Model Canvas*

The Sustainable ReMuNet Operator Model Canvas (SROMC) builds on the concept of operator models introduced above. It translates the theoretical framework into a practical tool for the ReMuNet platform, aligning with the core value proposition defined in Deliverables 3.3 and 3.4. The SROMC describes how the platform is owned, governed, and operated to ensure sustainable and efficient value creation within the ecosystem.

Following the principle of “grow first, monetise second” (Wortmann et al., 2022) the SROMC focuses on scaling the platform, building network effects, and fostering user engagement first. By monitoring performance and network effects from the inside out, the platform can spot the best growth opportunities and create a solid foundation for monetisation later, avoiding early actions that could slow expansion or reduce participation (Wortmann et al., 2022).

Based on these considerations, the digital ReMuNet platform applies an operator model to structure and coordinate its ecosystem, building on the Platform Navigator by Wortmann et al. (2022). Within ReMuNet, the operator model is defined as a framework that defines three key dimensions:

- **Operating Model**: how services are developed, managed, and delivered
- **Ownership Model**: who controls the platform and how strategic decisions are made
- **Governance**: the rules for participation, coordination, and interaction between stakeholders

Similar to the SRBMC, the performance of the SROMC is measured and assessed with regards to the triple bottom line of Elkington (1994). The SROMC is depicted in figure 2.

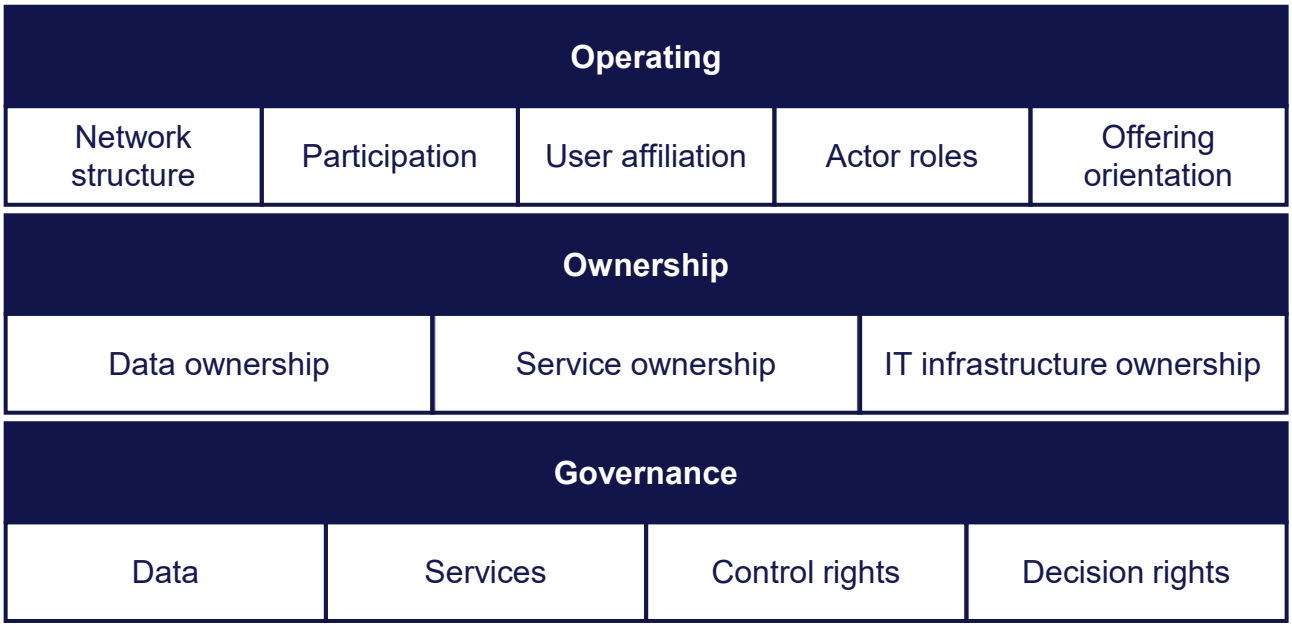

Figure 2: Sustainable ReMuNet Operator Model
(Derave et al., 2024; Goertler et al., 2025; Springer et al., 2025; Tura et al., 2018; based on Wortmann et al., 2022)

Operating Model

The operating model defines how the platform is managed (Derave et al., 2024; Springer et al., 2025), how governance and network structures are organised (Springer et al., 2025), and how user affiliation, participation, and offering orientation are implemented (Derave et al., 2024) to create and deliver value to users and partners. It also includes the distinct actor roles that participants and stakeholders can take on, which may evolve over time and are essential for enabling the platform to create value as intended (Tura et al., 2018). Two primary types can be distinguished:

- **Transaction platforms**, which enable exchanges such as buying, selling, or sharing goods, services, or information.
- **Innovation platforms**, which provide a foundation for third parties to develop and distribute complementary products or services, thus expanding the ecosystem through co-creation.

The operating model also specifies platform dimensions that shape how value is created and exchanged (Derave et al., 2024; Springer et al., 2025):

- **Market sides**: one-, two-, or multi-sided.
- **User affiliation**: from registration to transactional interaction or investment.
- **Centralisation**: degree of control over data, services, and decision rights.
- **Participation**: modes of interaction such as peer-to-peer (P2P), business-to-business (B2B), business-to-customer (B2C), or customer-to-customer (C2C).
- **Offering orientation**: focus on products, outcomes, or user needs.

Participants and stakeholders can take on one or several distinct actor roles that may evolve over time, enabling the platform to create value as intended (Tura et al., 2018).

In addition, the operating model defines strategies for scaling and ecosystem growth, such as attracting key user groups, leveraging existing assets, and strengthening both sides of the market (Wortmann et al., 2022). Key structural design activities include integrating complementors, creating participation incentives, establishing trust mechanisms, defining governance and data management rules, and ensuring ecosystem resilience (Goertler et al., 2023, 2025).

Ownership Model

The ownership model determines who controls the platform and how authority is distributed within the ecosystem. In digital platforms, ownership typically relates to three core components of a digital platform: data, services, and IT infrastructure (D3.3; Wortmann et al., 2022):

- **Data ownership** defines how data is provided, who has access, and who controls it once generated or uploaded
- **Service ownership** regulates how core services are developed, updated, and maintained, including decisions on new features and changes
- **IT infrastructure ownership** covers governance and responsibility for system operation, maintenance, and security

Each of these ownership dimensions can be characterised by its degree of centralisation, which determines how control and decision-making authority are distributed across the platform (Bakos & Katsamakas, 2008; Hein et al., 2020; Tiwana et al., 2010):

- **Centralised** platforms are controlled by a single owner with full decision authority
- **Decentralised** platforms are governed by peer-to-peer communities rather than by a single owner or consortium, where users directly participate in shaping the ecosystem
- **Consortium-based** platforms distribute control among several actors who jointly govern the system

Governance Model

Governance defines how decisions are made and which actors are involved (Tura et al., 2018). It encompasses decisions on whom to grant access to the platform (control rights) and how assets related to joint value creation and capture can be utilised (decision rights) (Springer et al., 2025). Control rights regulate the operative aspects of the platform owner regarding pricing structures and technological interface standards, while decision rights define participants' rights to interact with the platform, provide assets, and contribute complementary offerings (Springer et al., 2025).

2.2.3 *Examples from Industry*

In order to obtain real information about operator models, the platforms identified in D3.3 were analysed with regard to their industry practices. The findings from this analysis support the development process of the operator model for the ReMuNet platform, which should be based on best practices and common patterns in the industry. The sources of the following tables are provided in Annex 3.

Table 3 depicts the used categories and the types used for the analysis. The possible configurations build on the developed SROMC.

Table 3: Digital platform configuration matrix

Market sides	One-sided	Two-sided	Multi-sided	-
Participation	B2C	B2B	P2P	C2C
Affiliation	Registration	Non-transaction	Subscription	Investment
Offering orientation	Product-oriented	Result-oriented	User-oriented	-
Transaction	Product	Services	Information or data	-
Actor Roles	-	-	-	-
Data Ownership	Centralised	Decentralised	Consortium-based	-
Service Ownership	Centralised	Decentralised	Consortium-based	-
IT Infrastructure Ownership	Centralised	Decentralised	Consortium-based	-

Table 4 depicts the result form the industry analysis with regards to operating dimension of the operator model.

Table 4: Operating model classification of industry examples

Digital Plattform	Market sides	Participa-tion	Affiliation	Offering orientation
FEDeRATED	Multi-sided	B2B	Registration	Result-oriented/ User-oriented
Clusters 2.0	Multi-sided	B2B	Registration	Result-oriented/ User-oriented
SETO	Two-sided	B2B	Registration	Result-oriented
Transporeon	Multi-sided	B2B	Registration/ Subscription	User-oriented
Uber Freight	Two-sided	B2B	Registration	Result-oriented/ User-oriented
Convoy	Two-sided	B2B	Registration	Result-oriented
Flexport	Multi-sided	B2B	Registration	Result-oriented
Loadsmart	Multi-sided	B2B	Registration/ Subscription	Result-oriented
Sennder	Two-sided	B2B	Registration	Result-oriented/ User-oriented
DSV A/S	Multi-sided	B2B	Registration	Result-oriented

Amazon Fulfillment Network	Multi-sided	B2B/ B2C	Registration	User-oriented
Shopify Fulfillment Network	Multi-sided	B2B/ B2C	Registration/ Subscription	User-oriented
TradeLens	Multi-sided	B2B	Registration	User-oriented
Shippeo	Multi-sided	B2B	Registration/ Subscription	User-oriented

Table 5 depicts the results from the industry analysis with regards to transaction types and actor roles as a zoom in to the operating dimension.

Table 5: Transaction pattern and actor roles of industry examples

Digital Plattform	Transaction	Actor Roles
FEDeRATED	Information	identity provider, broker or service registry, monitor manager or clearing house, index manager, software tools & service provider public authorities, logistic chain operators, external parties involved, any actors within EU member states
Clusters 2.0	Services/ Information	shippers, orchestrator, cluster manager, drivers, LSPs, terminal operators, railway operators, value added service providers, PTN Manager
SETO	Information	stakeholder networks, advisory boards, industry, policy-makers, governmental authorities, and the public transportation and logistics operator, economic operators, civil society organisations, infrastructure managers, public authorities.
Transporeon	Services/ Information	No information
Uber Freight	Services	dispatcher, driver, driver-dispatcher
Convoy	Services	No information
Flexport	Services/ Information	No information
Loadsmart	Services	shippers / shipper solutions, carriers / carrier solutions carrier guide und carrier loadboard
Sennder	Services/ Information	shippers and freight forwarders
DSV A/S	Services	No information

Amazon Fulfillment Network	Services	Amazon fulfillment, Amazon warehousing and distribution, brand analytics, buyer communication, buyer solicitation, direct-to-consumer shipping, finance and accounting, inventory and order tracking, notifications in seller central, payment initiation service provider, pricing role, product listing, professional services, selling partner insights, tax invoicing, tax remittance
Shopify Fulfillment Network	Services	No information
TradeLens	Information	No information
Shippeo	Information	carrier, shipper, customer

Table 6 depicts the results from the analysis of the ownership dimension of the ReMuNet Operator Model.

Table 6: Ownership model classification of industry examples

Digital Platform	Data	Services	IT Infrastructure
FEDeRATED	Decentralised	Consortium-based	Consortium-based
Clusters 2.0	Centralised	Consortium-based	Consortium-based
SETO	Centralised	Consortium-based	Consortium-based
Transporeon	Centralised	Centralised	Centralised
Uber Freight	Centralised	Centralised	Centralised
Convoy	Centralised	Centralised	Centralised
Flexport	Centralised	Centralised	Centralised
Loadsmart	Centralised	Centralised	Centralised
Sennder	Centralised	Centralised	Centralised
DSV A/S	Centralised	Centralised	Centralised
Amazon Fulfillment Network	Centralised	Centralised	Centralised
Shopify Fulfillment Network	Centralised/ Consortium-based	Centralised/ Consortium-based	Centralised/ Consortium-based
TradeLens	Decentralised	Consortium-based	Consortium-based
Shippeo	Centralised	Centralised	Centralised

Most of the systems considered operate as multi-sided markets that connect several groups of participants. A typical combination includes shippers, carriers, freight forwarders, and

warehouse operators. A smaller number, including Uber Freight, Convoy, Sennder and SETO, on the other hand, feature a two-sided market model that focuses on mediation between shippers and transport service providers.

A key distinguishing feature lies in the ownership and governance structures. Most commercial platforms are highly centralised. Which results in data, services and IT infrastructure being completely controlled by the platform operator. Consortium or federated models, such as TradeLens, FEDeRATED or Clusters 2.0, on the other hand, feature shared governance, with data storage and service operations distributed among several partners. Hybrid structures such as the Shopify Fulfillment Network combine centralised platform control with semi-autonomous fulfilment partners and are therefore an exception.

Almost all platforms are based on a registration model in which participants access the ecosystem via digital means. Only in individual cases such as Loadsmart, Transporeon or Shopify Fulfillment Network is this supplemented by subscription components based on Software-as-a-Service (SaaS) licences or premium features.

The analysis of the platforms examined shows that current operator models in the field of digital logistics and data platforms can be classified into clearly recognisable structures. Consistent patterns can be identified, particularly with regard to market sides, participation, affiliation, orientation of the service offering and ownership structures with regards to data, services and IT infrastructure.

2.3 Scaling Strategies for Digital Platforms

In general, user value increases as more people of a network use a product or service (Große Holtforth et al., 2020; Katz & Shapiro, 1985). In contrast to traditional business models, platforms must simultaneously attract multiple market sides to enable value creating interactions. Achieving a critical mass of users is essential, as it activates positive network effects that lead to self-reinforcing growth (Büge & Ozcan, 2021; Große Holtforth et al., 2020; Steur, 2022; Wortmann et al., 2022). This interdependence, often referred to as the “chicken-and-egg problem”, requires platforms to determine which user group to prioritise first (Ruutu et al., 2017; Steur, 2022).

To address these challenges, different scaling strategies can be employed (Große Holtforth et al., 2020; Steur, 2022; Wortmann et al., 2022) (table 7).

Table 7: Scaling strategies for digital platforms

Cate-gory	Strategy	Description
Unilateral strategies		*Target one market side initially and expand later as network effects emerge*
	Supply-side focus	Attracting key providers who bring their customers to the platform
	Complementor strategy	Engaging one market side first, such as developers or partners, before opening to others
	Self-supply strat-egy	Simulating initial supply and demand internally to demonstrate value
Multilateral strategies		*Engage multiple user groups simultaneously to accelerate adoption*
	Expansion strategy	Gradual integration of user groups through organic growth and referrals
	Impulse strategy	Intensive marketing campaigns and media promotion to trigger rapid growth
	Niche market strat-egy	Starting within a specific sector or region before broadening the scope
Hybrid strategies		*Combine both approaches to enhance flexibility and speed of scaling*
	Incentive strategy	Offering financial or non-financial incentives to motivate early user partic-ipation
	Piggyback strategy	Partnering with existing platforms to leverage their user base and strengthen network effects
Other		
	Internationalisation	Expanding platform operations into new geographic markets.
	Fulfilment	Offering operational capacities to third parties when own resources are underused.
	Price Leadership	Competing primarily through lower prices to gain market share.
	Excellence Leader-ship	Focusing on superior user experience, service quality, and innovation.

Büge and Ozcan (2021) argue that digital platforms should adapt their scaling strategies to the regulatory environment rather than pursuing growth at any cost. While fast scaling helps activate network, data, and capital loops in low-risk settings, it can backfire in highly regulated or uncertain markets. Slow scaling works by gradually expanding a platform through careful risk management, regulatory alignment and trust building to ensure sustainable growth in complex or high-risk environments (Büge & Ozcan, 2021).

2.3.1 *System Dynamics of digital Platform Scaling Strategies*

System dynamics (SD), originally introduced by Forrester (1965) under the term ‘industrial dynamics’, provides a framework for visualising and describing complex systemic relationships in a clear and structured form (Forrester, 1965; Rosner & Pongratz, 2020; Schallmo et al., 2024). It employs graphical modelling elements and logical parameters to analyse and simulate how systems behave and evolve over time (Ruutu et al., 2017; Schallmo et al., 2024).

In the context of digital platforms, SD enables the analysis of different approaches and strategies for the further development and scaling of platform ecosystems (Ruutu et al., 2017).

By examining the interrelationships of platform participants, revenue, and platform development among other things, SD uses reinforcing and balancing feedback-loops to analyse effects of different strategies and scenarios on the system elements (Anderson et al., 2023; Ruutu et al., 2017).

To use SD for analysing purposes, a model of the system under investigation needs to be developed (Schallmo et al., 2024). The model needs to be able to represent a status-quo and an advanced status to investigate what effect a change has on the system (Schallmo et al., 2024). The model is then enriched with values and parameters to characterise the interrelationship among the system's elements (Schallmo et al., 2024). Feedback-loops visualise whether a system change has a positive or a negative impact on the system behaviour (Schallmo et al., 2024).

3. Research Design and Data Collection

The goal of this Deliverable is to develop the ReMuNet operator model and its coherent business model. With the business and operator model canvases described in chapter 2.1.4 and 2.2, this chapter lines out how the models are sequentially developed following the Design Science Research (DSR) approach by Peffers et al. (2007).

3.1 Overarching Methodology

The overarching methodology is based on the DSR methodology by Peffers et al. (2007). DSR consists of six sequential steps with iterations (Peffers et al., 2007):

Table 8: DSR approach (based on Peffers et al., 2007)

Phase	Description	ReMuNet
Problem identification and motivation	Understanding the underlying problem lays the foundation for the solution, which aims to address the identified issue. Additionally, relevance of the research topic increases with a concise problem statement and motivation to improve the current state.	Disruptions cause economic damage in the logistics industry. A digital platform increases resilience and efficiency of the multimodal freight transport ecosystem.
Define the objectives for a solution	Based on the problem statement, the quantitative or qualitive goals of the solution are defined. The goals should fit the right scope of aspects that the solution encompasses.	The architecture of the digital platform has already been described in D3.3. This deliverable aims to introduce the platform operator and its coherent business model.
Design and development	Following the defined objectives, the solution is designed and subsequently developed ranging from programmes to concepts.	The design will be based on adapted standard frameworks described in chapters 2.1 and 2.2. The development of the ReMuNet business and operator model will be described in the following chapters.
Demonstration	A proof-of-concept checks whether the developed solution achieves its defined objectives. This confirms that the designed attributes are valid in the described context.	The result of this deliverable is a visualisation of the operator model and its coherent business model. The proof-of-concept in the two focus corridors North Sea-Baltic and Rhine-Danube will be part of a later stage of the project.
Evaluation	The developed solution is examined for how well it solves the defined problem. This evaluation checks whether the solution design must be adjusted or if it is sufficient for achieving all its defined objectives.	The evaluation of business and operator model will be part of a later stage of the project.

Communication	Finally, all outcomes of this process, their innovation, performance and usefulness are communicated to all relevant stakeholders.	The process of problem identification, design and development is described and published in this deliverable. The concluding phases will be part of a later stage of the project.

3.2 Business Model Development

As described in chapter 2.1.4,the outlining structure for the platform business model is based on frameworks proposed by Allweins et al. (2021), Gassmann et al. (2014), Lüdeke-Freund et al. (2024) and Osterwalder et al. (2005). A literature review put a dedicated focus on sustainability to take ecological, economic and social aspects into account.

3.3 Operator Model Development

As described in chapter 2.2.2,the operator model is theoretically based on Wortmann et al. (2022) as a combination of the operating model, the ownership model and governance aspects of a digital platform. The outlining structure results from desk research and its contents are enriched by an analysis of operator model aspects of digital platforms used in the industry.

3.4 Self-completion Questionnaire

For the configuration and in-depth content of the outlining structures of the business and the operator model, a self-completion questionnaire was conducted. Questions and contents of the questionnaire were developed iteratively in an internal workshop, following the developed structures and based on the requirements identified in D3.2. The survey used free text and single-choice questions. It was conducted using Microsoft Forms internally by the ReMuNet project research consortium, as the project partners have both extensive expertise in the industry and in-depth knowledge of the project content. The questionnaire was open for responses for three weeks and gathered nine responses.

After completion, the results were thematically analysed according to the developed structures for the business and operator model. Different configurations were considered, favouring the most suitable in accordance with the project outline. Harmonising and conflicting aspects are discussed and evaluated in chapter 6.

The final business and operator model were sent to the consortium for validation purposes. Additionally, a 60-minute semi-structured interview with the platform developer was conducted to verify central aspects of the governance structure of the platform. This ensures alignment between theory and practical development of the digital platform.

3.5 Expert interview

To validate the ReMuNet business and operator model, a semi-structured interview was conducted with an industry expert for digital logistics platforms. Based on the answers from the questionnaire and the derived models, interview questions were developed. An interview guide is provided in Annex 2.

The interview was conducted over a time period of one hour. Before the interview started, the interviewee was informed about the intent and the way their answers were processed as part of the research results. Furthermore, the interviewee was informed about the recording of the interview, and his/her consent was obtained. The recording was done via the Microsoft Teams transcription mode. The transcript was then refined and corrected by the interviewers to enhance understanding. The transcript was thematically analysed, and its results were integrated into the conceptualisation of the business and operator model.

4. Survey Results

In the following, the results from the consortium-intern survey are presented. Nine partners from eight institutions participated. The first part of the chapter focuses on the business model and the second part on the operator model, both being theoretically introduced in chapters 2.1.4 and 2.2.2. This part concludes with survey results on the performance measurement affecting both business and operator model. The questions of the survey took designing aspects, restrictions and interrelationships into account (Appendix 1).

Each subchapter presents summarised aspects of each framework dimension in tabular form representing various scenarios for the business model and the operator model. This may include contradictory characteristics. Those will be discussed and evaluated in chapters 5 and 6 with regard to the interests and requirements of key stakeholders as identified in D3.2 resulting in strategic design recommendations.

4.1 Business Model

The ReMuNet business model represents the “underlying logic and structure through which a digital platform creates, delivers, captures, and shares value within its ecosystem in ways that maintain and enhance economic, social, and environmental well-being for all stakeholders over time” (chapter 2.1.1). The survey results for the business model are structured below according to the model’s dimensions as proposed in chapter 2.1.4.

4.1.1 *Value Proposition*

A value proposition defines the benefits that a business offers its customers and explains how it is better than alternatives (chapter 2.1). The survey results describe ReMuNet’s value proposition as follows: ReMuNet creates value by integrating and optimising the transportation of goods across multiple modes of transport. As a digital platform, it connects key stakeholders of the multimodal freight transport ecosystem and allows improving the efficiency, sustainability, and resilience by providing real-time data and intelligent rerouting options for faster disruption management. Through advanced analytics and routing algorithms, users can reduce costs, time losses, and resource consumption while improving operational efficiency and tracking CO_2 emissions. The platform fosters collaboration and shared value creation within the transport ecosystem, supports seamless integration with existing management systems via APIs, and ensures ease of use, secure data handling, and transparent governance (table 9).

Table 9: Summarised survey results for the value proposition

Value created	Description
Resilience and Flexibility	ReMuNet provides rerouting options that enable the faster handling of disruptions. By handling disruptions faster and providing more possible routes the platform participants profit from higher resilience and flexibility.
Transparency and Insight	The platform provides real-time data to its users. This data enables platform participants to get a better understanding of the transport ecosystem.
Efficiency and Optimisation	With the value provided by the platform, participants can reduce their costs and time loss in case of disruptive events. Furthermore, based on real-time data users can use analytics to increase their overall operational efficiency.
Sustainability and Responsibility	The ReMuNet platform enables its users to track and reduce CO_2 emissions. In addition, by providing an advanced routing algorithm the platform participants can reduces their resource consumption.
Collaboration and Co-Creation	The platform improves collaboration of transport ecosystem participants. By doing so the shared value creation within the ecosystem can be improved.
Integration and Interoperability	The ReMuNet platform can be integrated into transport management systems, enterprise resources planning systems and supply chain management systems via application programming interfaces (API). This enables easy integration into existing systems without the need to change legacy systems.
Accessibility and Empowerment	The platform can be easily integrated into existing systems. Furthermore, the platform itself is easy to use and understand.
Knowledge and Learning	The ReMuNet platform enables the participants to continuously improve their operations as well as knowledge sharing between participants.
Trust and Security	The platform has public and reliable governance and ownerships structures. Furthermore, it has secure data handling practices.

Interaction can be facilitated by providing a secure and user-friendly digital platform that supports transparent communication, collaboration, and data exchange. ReMuNet needs to enable stakeholders to send updates on routes and journeys, share information selectively, and collaborate through standardised interfaces that connect with different transport management systems (TMS). The facilitation of interaction between the platform participants aids the later discussed scaling strategies for the digital ReMuNet platform.

4.1.2 *Value Creation*

The value chain includes all services, resources and partners the platform needs to create value for its participants (chapter 2.1). Additionally, ReMuNet aims to recognise activities and patterns to promote sustainability in its business model.

Services

The survey results propose multiple services to be offered. ReMuNet should integrate several modules to improve efficiency and collaboration in multimodal transport. Its disruption module should detect disruptions and alerts users, while an advanced routing algorithm

generates alternative routes based on traffic, emissions, and operational data such as capacity and capability. Users may filter and book routes via a dedicated booking module and communicate via an integrated interface to improve coordination. The platform should offer API and web access for seamless integration of external services, support analytics for operational forecasting and performance evaluation, and enable emission tracking and knowledge sharing (table 10).

Table 10: Summarised survey results for the services offered by ReMuNet

Service	Description
Disruption Management	The platform utilises a disruption module which detects disruptions. The platform participants are then informed via an alert about the disruption.
Routing	The ReMuNet platform uses a routing algorithm which incorporates traffic data, disruptions emissions data as well as operational plans from platform participants to generate new alternative routes.
Booking	To book the routes ReMuNet provides a booking module in which the route can be filtered and booked.
Communication Interface	A communication interface that enables platform participants to communicate with each other. This improves coordination between users.
External access	The ReMuNet platform can be integrated via APIs. Additionally, the platform can be accessed externally via a website.
Analytics	The Analytics module enables the platform participants to analyse their routing plans and predict future operational aspects. Furthermore, the usage of alternative routes provided by the routing algorithm can be analysed regarding their impact on the users' operations.
Knowledge	ReMuNet enables knowledge sharing between platform participants.
Sustainability Monitoring	The platform enables the users to track the emissions of their operations and routes.
Onboarding	New platform participants can easily be onboarded and integrate the ReMuNet platform into their operations.

Resources

The survey results insist, that the ReMuNet platform relies on diverse data inputs and a robust IT infrastructure with high data security to function effectively. It requires advanced multimodal routing algorithms, real-time monitoring, and analysis tools to deliver value. In addition, highly skilled personnel in the areas of big data, AI, software architecture, and system integration are essential for its further development and operation, supported by modular, easily upgradeable system architectures (table 11).

Table 11: Summarised survey results for the resources needed for value creation

Resource	Description
Data and Connectivity	The platform needs data to operate. This data includes traffic and infrastructure data, real-time data, emissions data, disruption information and capacity and routing plans.
Infrastructure and Security	The ReMuNet platform needs infrastructure to operate. IT infrastructure is the core infrastructure needed. In addition, the data security has to be ensured.
Intelligence and Algorithms	The ReMuNet platform needs advanced algorithms incorporating route optimisation over multiple transport modes, emissions and disruptions.
Innovation and Advanced Technologies	Advanced analytical tools and real-time monitoring are needed to provide the value proposition.
Expertise	Highly skilled personal in areas like big-data, artificial intelligence, Software architects, Integrations specialists are need for operating and implementing the ReMuNet platform.
Efficiency and Sustainability	ReMuNet needs to deploy modular systems that can be easily upgraded and maintained.

Partners

ReMuNet partners should be diverse and complementary, representing the entire multimodal transport ecosystem to meet all participants' needs. They must be open to data sharing and collaboration in order to improve platform functionality, supported by clear rules on data integrity and governance frameworks that promote trust. Partners should contribute technological expertise in areas such as routing, IT infrastructure, and implementation, while also being strongly committed to sustainability, reliability, and the long-term success of the platform. Transparent governance agreements ensure fair participation and mutual trust between all stakeholders (table 12).

Table 12: Summarised survey results for the partners needed for ReMuNet

Partner characteristics	Description
Diverse and Complementary	The different partners of the ReMuNet platform should be divers and complementary. They should cover all aspects of the multimodal transport ecosystem to enable the platform to cover the needs of all participants.
Openness and Collaboration	The partners of the ReMuNet platform should be open to share their data. Furthermore, they should be willing to work together to improve the platforms capabilities.
Trust and Data Integrity	Clear data integrity rules and governance frameworks enable partners to trust each other with their data.
Innovation and Technological Capability	Partners technological knowledge and capabilities for the platform. This can include routing algorithms, IT infrastructure or implementing capabilities.
Sustainability and Responsibility	Partners of the ReMuNet platform should be sustainable and responsible or have the goal to improve their sustainability.

Reliability and Commitment	The partners of the ReMuNet platform should be reliable and committed to the platform's success.
Governance and Alignment	Clear governance agreements between the platform and its partners and the partners themselves ensure trust and fair participation.

Sustainable Design Themes

As the survey results show, ReMuNet should address sustainability by using digital technologies to optimise resource use, minimise environmental impact and promote environmentally friendly practices in multimodal transport. Through real-time data analysis and optimisation algorithms, it may reduce inefficiencies such as empty runs and unnecessary fuel consumption, thereby directly reducing emissions. The platform should also promote collaboration between stakeholders to jointly introduce sustainable technologies and practices (table 13). In addition, improved transparency and reporting enable carbon tracking and informed decision-making, supporting a broader shift towards greater environmental responsibility in the transport industry (D1.1).

Table 13: Summarised survey results for the sustainable design themes

Sustainability aspect	Description
Efficiency and Decarbonisation	The ReMuNet platform increases efficiency in the multimodal transport ecosystem. Therefore, resource consumption and emissions are reduced.
Circularity and Resource Efficiency	Through the reuse of assets and the sharing of infrastructure resources can be used more efficiently.
Transparency and Accountability	Through the usage of real-time data emissions becomes transparent.
Collaboration and Shared Value	The cooperation between platform participants leads to cost reductions and long-term value creation for all users.
Fairness	ReMuNet promotes equality among its participants including small actors in the multimodal transport ecosystem.
Resilience and Long-Term Viability	The ReMuNet platform combines resilience and long-term financial viability

4.1.3 *Platform Participants*

Digital platforms create value by enabling the interchange of information, services and products among the platform participants. Needs and requirements formulated by users define the characteristics of the services offered and the resources and partners need to realise the proposed value. The definition of the right customer segments and enabling actors determines the success of the platform and enable positive network effects fostering scaling effects.

Customer Segments

As described in D3.3 and supported by the survey, ReMuNet's key stakeholders include operational actors such as carriers, freight forwarders, logistics service providers, and multimodal transport operators; infrastructure-related entities like terminals, infrastructure owners, and IT service providers; and public actors including regulators, research institutions, and public authorities that support and oversee the multimodal transport ecosystem (table 14).

Future customer segments can be integrated by expanding ReMuNet's scope to neighbouring sectors such as sustainability, technology and logistics services. Partnerships with players in the fields of research, energy, and finance can promote innovation and data-driven value creation while expanding collaboration across the entire transport and supply chain ecosystem. Potential additions include humanitarian organisations and disaster response actors that could leverage ReMuNet's disruption management capabilities.

Table 14: Summarised survey results for the customer segments of ReMuNet

Customer segment	Description
Operators and Orchestrators	Actors that operate within the multimodal transport ecosystem. These include carriers, freight forwarder, logistics service providers, multimodal transport operators.
Enablers and Integrators	Entities that act as nodes or provide infrastructure within the multimodal transport ecosystem, e. g. Terminals, Infrastructure providers or IT-Service providers.
Regulators and Facilitators	Public actors like regulators, research institutes or public authorities.

Enabler

Unlike strategic partners, which provide data and platform services, enablers offer infrastructure or third-party services that realise the transport operations made possible by the digital platform.

The enabling actors of the ReMuNet digital platform should include providers of physical transport infrastructure, IT, and cloud service providers, public authorities and regulators, standardisation and certification bodies, knowledge contributors for innovation, collaboration facilitators, and performance analysts who certify the platform (table 15).

Table 15: Summarised survey results for the enablers of the ReMuNet platform

Enabler	Description
Infrastructure and operations	Actors that provide the physical infrastructure for the transport operations as well as entities that operate within the multimodal transport ecosystem
Technology and Integration	Actors that enable the ReMuNet platform to operate and provide the value proposition, e.g. IT-service provider, cloud operators or system integrators.
Governance and Regulation	Public authorities and regulatory bodies that enable the ReMuNet platform.

Standardisation and Certification	Entities that standardise regulations and communication formats as well as certification entities that certify specific aspects like sustainability.
Knowledge and Innovation	Actors that provide their knowledge about the multimodal transport ecosystem and therefore help the platform to continuously innovate.
Collaboration and Mediation	Entities that foster collaboration and can mediate if differences occur.
Credibility and Sustainability	Entities that provide credible analyses about the platforms performance and are able to certify it.

4.1.4 *Value Capture*

Cost structure

The survey results describe ReMuNet's cost structure including expenses for the development, maintenance, and continuous improvement of the platform, as well as for the acquisition of infrastructure and operating costs (table 16). Additional expenses may arise from compliance with legal regulations, risk management, and ensuring the reliability of the platform. The platform may also incur costs for innovation, the development of new services, stakeholder engagement, marketing, customer acquisition, and scaling measures, as well as for maintaining its strategic focus on its overall objectives. Despite striving for a non-profit model, these inevitable costs need to be covered in order to operate economically sustainable.

Table 16: Summarised survey results for the cost structure of ReMuNet

Cost type	Description
Development and Maintenance	Costs for developing and maintaining the platform as well as continuously improving it.
Infrastructure and Operations	The cost for acquiring/accessing the needed infrastructure and general operations.
Compliance and Security	Expenditure for being compliant with regulations such as General Data Protection Regulation.
Risk and Resilience	Cost for risk management and resilience of the platform itself like backup systems.
Research and Innovation	Costs for innovation and creation of new Services
Engagement and Coordination	Costs for including stakeholder in the platform development and improvement process.
Marketing and Growth	Costs for marketing, implementation of network effects, customer acquisition and scaling.
Governance and Sustainability	General strategic alignment costs with the overarching platform goals.

Revenue streams

ReMuNet's revenue streams may include recurring subscription fees for platform access and usage-based fees for specific capabilities, complemented by a freemium model where basic analytics are free and advanced features are monetised (table 17). Additional funding can come from public grants, partnerships, and direct public support. Operational revenues cover running costs, with surplus funds reinvested in platform improvement. Transparent communication of fees and funding fosters trust, while pricing is tailored to reflect the value created for each ecosystem participant.

As described in chapter 2.3, monetisation can conflict with scaling strategies. On the other hand, the costs mentioned in the previous chapter must be covered for the platform to remain viable in the long term. The effects of different monetisation strategies on platform incentives and their scaling strategies regarding network effects are discussed in chapter 7.

Table 17: Summarised survey results for the revenue streams of ReMuNet

Revenue stream	Description
Subscription Fees	Recurring fees on a constant timeframe to access the ReMuNet platform. Once the users subscribed there is no disincentive to use the platform.
Usage-Based Fees	Fees for the actual usage of the provided capabilities of the ReMuNet platform. Users have a constant disincentive to use the platform in form of payments.
Premium Analytics Monetisation	Basic analytics are usable for free. Advanced capabilities are monetised.
Partnership and Funding	The ReMuNet platform is funded via public grants, partnerships direct public funding
Cost-Covering Reinvestment	Revenue from operations is used to cover operational cost. The remaining surplus is used for the improvement of the ReMuNet platform.
Shared Value Creation	Fees need to be individually aligned with the value created by the platform for the ecosystem participants.

4.2 Operator Model

ReMuNet's operator model defines the overall platform configuration and the governance and ownership of its data and IT assets. The survey covered possible configuration scenarios for the operator model. Conflicting scenarios will be evaluated and discussed in chapter 6. The survey results for the operator model are structured below according to the model's dimensions as proposed in chapter 2.2.2.

4.2.1 *Operation*

Network structure

ReMuNet connects various stakeholders including transport companies, logistics service providers, infrastructure operators, technology partners, research institutions, and public authorities and facilitates data exchange and collaboration to improve resilience (chapter

4.1.3). The diversity of different user groups clearly favours a multi-sided approach, as confirmed by the survey (table 18).

Table 18: Summarised survey results for the network structure of the ReMuNet platform

Network structure	Survey result
One-sided	0%
Two-sided	0%
Multi-sided	89%
No preference	11%

Participation

ReMuNet's main users will be registered companies and institutional entities, not individual consumers, and its services, such as route optimisation, incident information, and operational coordination, will be designed to support professional collaboration and data exchange within the transport and logistics sector. This is supported by the survey as two thirds of the participants indicated ReMuNet as a B2B platform (table 19).

Table 19: Summarised survey results for the user participation in the ReMuNet platform

Participation	Survey result
P2P	0%
C2C	0%
B2C	22%
B2B	67%
No preference	11%

User affiliation

A user's affiliation with a digital platform refers to the nature and intensity of their interaction or relationship with that platform and defines how they participate, interact and create value within its ecosystem (table 20). Registration users who establish an account, non-transaction users who engage without financial activity, Transaction users who conduct monetary operations, and Investment users who allocate capital to platform-based financial products. The survey results clearly suggest an affiliation by regstration but are indifferent in terms of transaction.

Table 20: Summarised results for the user affiliation in the ReMuNet platform

User affiliation	Survey result
Registration	78%
Non-transaction	33%
Transaction	56%
Investment	11%
No preference	11%

Actor roles

Actor roles need to be well defined and distinguished as the actor role directly corresponds with the decision and access rights a user has. Furthermore, responsibilities and governance aspects are defined by the role that a user assumes. The survey results propose that data providers should be able to upload operational data and control access to it. Service users may access routing, disruption management. and analysis tools. Governance actors should monitor policy setting and compliance. Technology providers should be able to manage API integration and technical support. Researchers may use anonymised data sets (table 21).

Table 21: Summarised survey results for the actor roles of the ReMuNet platform

Actor role	Description
Data Provider	Actors who supply the ReMuNet platform real-time and planning data.
Service Users	Actors who consume the services provided by the ReMuNet platform.
Platform Administrators	Actors who are responsible for the operation of the ReMuNet platform.
Technology Enablers	Actors who provide the technological expertise and Infrastructure.
Analytics and Innovation Partners	Partners who provide analytical competencies and further innovate the ReMuNet platform
Disruption Managers	Actors responsible for monitoring the transport ecosystem regarding disruptions and coordinate the integration into the routing algorithm.
Regulators and Researchers	Actors ensuring compliance or using the platform for non-profit purposes like crisis area management.

Offering orientation

The offering orientation defines the focus of the digital platform, whether it is product-oriented, result-oriented, or user-oriented. Since ReMuNet aims to optimise multimodal freight transport networks, the survey clearly indicates a result-oriented offering (table 22). These results may be route alternatives, emission tracking and calculation, or data transparency related to transport processes and disruption management.

Table 22: Summarised survey results for the offering orientation of ReMuNet

Offering	Survey result
Product	22%
Result	56%
User	22%
No preference	0%

4.2.2 Ownership

Data

The survey suggests that data ownership on the ReMuNet platform should follow a consortium-based model that ensures shared responsibility, transparency, and trust between stakeholders such as transport operators, logistics service providers, infrastructure operators, and authorities that provide operational and environmental data (table 23). In this model, the original data providers retain ownership of their data, while aggregated or derived data can be jointly managed under consortium agreements. This approach is consistent with the cooperative and non-profit nature of ReMuNet, promotes interoperability and avoids monopolisation. However, challenges include ensuring GDPR compliance, managing data protection and access rights, addressing legal and copyright complexities, and maintaining trust between the various participants.

Centralised models would promote the consolidation of all data within the platform with the platform operator having full control and responsibility of the data and its management and use. In a decentralised model each participant would have full control over its own share of data. This carries the risk of data loss in case data owners leave the platform.

Table 23: Summarised survey results for the data ownership for the ReMuNet platform

Data ownership model	Survey result
Centralised	33%
Decentralised	11%
Consortium-based	56%
No preference	0%

Service

The survey suggests that the ownership of the services on the ReMuNet platform should follow a consortium-based model that promotes shared responsibility, neutrality and transparency among the stakeholders involved (table 24). The development and management of services should be undertaken by technical partners and research institutions within the consortium, supported by industry players, while decisions on new features and updates should be made by a governing board representing key stakeholders. This approach ensures fairness, alignment with participants' needs and collaborative innovation. However, challenges include coordinating the diverse interests of stakeholders, maintaining technical compatibility, ensuring sufficient resources, and managing consensus and timelines in a multi-partner environment.

A centralised service ownership model would mean that a single organisation develops, manages and controls all core services, updates and decisions. This ensures clear responsibilities and optimised decision-making but limits joint input and influence from stakeholders. A decentralised model would involve multiple actors managing their own services. However, this approach requires close collaboration and governance to ensure technical compatibility, alignment with stakeholder needs and fair decision-making.

Table 24: Summarised survey results for the service ownership for the ReMuNet platform

Service ownership model	Survey results
Centralised	22%
Decentralised	22%
Consortium-based	44%
No preference	11%

IT Infrastructure

Ownership of the IT infrastructure within the ReMuNet platform can be centralised, decentralised or consortium-based, with the consortium-based model being preferred as suggested by the survey (table 25). In this model, the key stakeholders share responsibility and oversight, promoting transparency, trust and fair cost allocation while ensuring reliability and compliance. In a centralised approach, the full control would lie with a single entity, ensuring clear accountability and optimised processes, while in a decentralised model, responsibilities would be distributed among multiple partners, increasing resilience but requiring greater coordination and governance.

Table 25: Summarised survey results for the IT infrastructure ownership for the ReMuNet platform

Ownership model	Survey results
Centralised	22%
Decentralised	22%
Consortium-based	33%
No preference	22%

Governance

Data

ReMuNet requires various types of data, including operational transport data, infrastructure and capacity data, timetables, disruption reports, environmental data and derived analyses (table 26). This data should be stored securely in cloud environments or on the consortium's servers in the EU, using standardised, machine-readable formats such as JSON, XML, CSV and interoperable logistics standards such as DATEX II or UN/EDIFACT. Access to the data should be role- and data type-dependent, with sensitive or protected information being restricted, while aggregated or anonymised data can be shared more widely between authorised consortium members, registered users and competent authorities.

Table 26: Summarised survey results for the data governance for the ReMuNet platform

Data governance	Description
Comprehensive Operational Data	Data of the operation within the multimodal transport ecosystem provided by partners.
Environmental and Regulatory Data	Data of emissions and regulatory framework impacting the ReMuNet platform.
Derived Analytics and Insights	Information derived from analytical tools.
Standardised Data Formats	Formats like JSON, XML, CSV, DATEX II and EDIFACT.
Secure Cloud Storage	Encrypted could storage based in the European Union.
Role-Based Access Control	Access rights are based on the roles of the actors.
Data Type-Specific Permissions	Different types of data with different levels of sensitivity have different access permissions.
Trust and Compliance Assurance	Regulatory compliance and transparent communications of data handling.

Services

The governance of the platform services in ReMuNet includes decision-making rules, service quality standards, approval processes for updates, compliance, security, and mechanisms for transparency, conflict resolution, and alignment with user needs to ensure balanced oversight and consistent platform performance (table 27).

Table 27: Summarised survey results for the service governance for the ReMuNet platform

Service governance	Description
Consortium Governance Board	The Consortium will employ a governance board overseeing the platform operations.
Platform Operator and Technical Committee	A technical committee will develop standards for technical operations.
Community Participation	The platform stakeholders can give input for future developments.
Decision-Making Framework	There are clearly communicated rules for decisions made regarding services in the consortium.
Service Quality Assurance	The quality and performance of the services offered are monitored.
Data and Security Governance	There are policies for accessing and protecting data when deploying a service.
Innovation and Sustainability Oversight	The development and evolution of services must align with the platform's goals.
Conflict Resolution Mechanisms	There are procedures to solve disagreements between stakeholders.

Control Rights

The platform operator in ReMuNet should have moderate to high powers, propose adjustments to value extraction mechanisms, establish basic technical and procedural criteria for the admission or integration of partners, and manage the implementation of technical standards (table 28). The design, maintenance and further development of technological standards should be overseen by a technical committee or central technology partners in cooperation with the operator to ensure interoperability and long-term compatibility. Service and data management, including access rights, should be managed by a joint management structure involving the operator, the consortium and data providers, balancing authority, transparency, compliance and fairness for all parties involved.

Table 28: Summarised survey results for the control rights for the ReMuNet platform

Control rights	Description
Platform Operator Authority	The entity within the consortium that operates the platform.
Technical Standards Committee	Team that maintains and develops standards for technical interoperability.
Onboarding and Integration Guidelines	There are guidelines for integrating the ReMuNet platform into other systems as well as onboarding new partners.
Service and Data Governance Team	Team that manages access rights to data and services.
Roles-Based Access Control	Access to data and services is based on the roles of the partners.
Joint Governance Structure	The operator, the individual teams and the consortium are integrated in a joint governing structure.
Transparency and Compliance	Procedures for auditability, adherence to rules, and conflict mitigation in operational decisions.

Decision rights

Participants in the ReMuNet platform should have transparent and flexible rights to join, leave or change their roles within predefined governance rules to ensure fairness and continuity (table 29). They should have a high degree of autonomy in setting the terms and conditions for their interactions, transactions and the presentation of content, products or services, as long as they comply with the platform's guidelines, technical standards and interoperability requirements. Decisions on fundamental technological upgrades, functional changes or algorithmic modifications should be made jointly by the platform operator, technical experts and the consortium's governance body, taking into account the contributions of stakeholders, technical assessment and the integrity of the platform in a balanced manner.

Table 29: Summarised survey results for the decision rights for the ReMuNet platform

Decision rights	Description
Participant Role Flexibility	Rights for users to join, leave, or change roles under predefined, transparent governance rules.
Interaction Autonomy	Degree of freedom participants have over pricing, matching, collaboration, and transaction terms within platform rules.
Content & Service Autonomy	Participants' authority to create, modify, and present their own content, products, or services, adhering to technical standards.
Core Technology Decision Authority	Responsibility for deciding on platform-wide upgrades, feature changes, or algorithmic modifications; typically shared between the operator, governance board, and technical committees.
Stakeholder Feedback Integration	Mechanism to incorporate participant input into decision-making for features, roles, or policies.
Framework Compliance	Ensures that all autonomy and rights exercised by participants respect technical, operational, and regulatory standards.

4.3 Performance measurement

To ensure the sustainable character of both business and operator model, the performance of the platform and its contents must be measured and evaluated in accordance with sustainable principles. Key Performance Indicators (KPIs) that follow the SMART principle should be used for this purpose. KPIs are SMART if they are **s**pecific, **m**easurable, **a**chievable, **r**elevant, and **t**ime bound (Doran, 1981).

Key environmental indicators include CO_2 emissions per transport unit, energy consumption, use of renewable energy, modal shift rate, and waste reduction, promoting greener operations. Economic KPIs focus on cost savings, transport capacity utilization, network efficiency, platform adoption, and Return on Invest (ROI), supporting long-term financial viability. Social indicators cover stakeholder satisfaction, job quality, inclusiveness, equitable access, training, and community connectivity, fostering a responsible and resilient ecosystem.

Additionally, performance measurement for resilience should cover at least the time needed to recover and the impact a disruptive event causes to evaluate the effectiveness of mitigating strategies enabled by the ReMuNet platform. This addresses the objectives and characteristics of resilience as described in D1.1.

These KPIs should be measured using automated platform data, partner reports, IoT sensors, surveys and standardised reporting frameworks, and evaluated quarterly in terms of operational metrics and annually in terms of strategic sustainability and impact assessments to ensure continuous alignment with sustainable business practices.

5. ReMuNet's sustainable Business Model

"ReMuNet aims to be a digital, AI-powered, open und collaborative platform that strengthens the sustainability, efficiency and resilience of multimodal European freight transport networks against disruptive events" (Dicks et al., 2025). Building on this core value proposition, ReMuNet's business model describes all components necessary to realise the value creation and delivery within the digital platform ecosystem as described in D3.3.

The business model was developed using the SRBMC as described in chapter 2.1.4. Its contents are derived from the consortium intern survey (chapter 3.4) and enriched by insights from an expert interview with a platform developer (chapter 3.5).

In the following the survey results presented in chapter 4.1 will be discussed and strategic recommendations for the ReMuNet business model will be derived. Figure 3 depicts the final business model, which will be described according to the dimensions in the following subchapters.

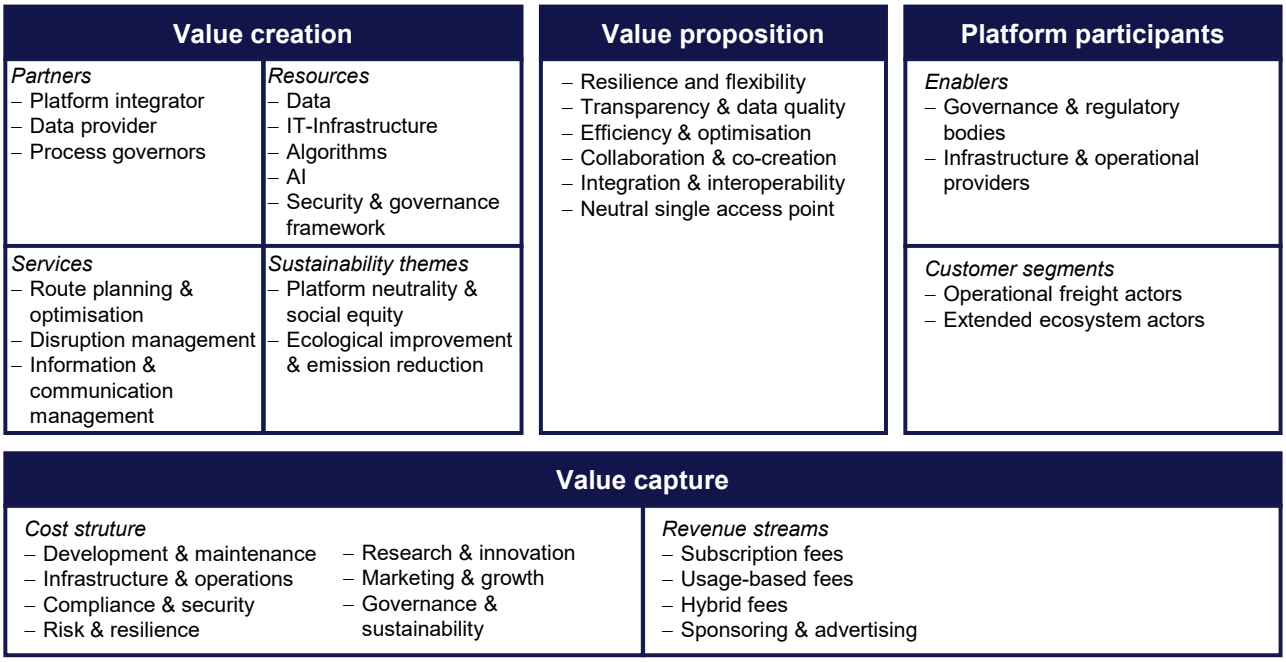

Figure 3: Sustainable ReMuNet business model

5.1 Value Proposition

The current logistics ecosystem lacks cooperation and effective disruption management due to insufficient system interoperability, low data quality, and limiting regulatory factors (D3.2). This results in economic losses and ecological harm due to empty runs and transport delays.

The overarching goal of the ReMuNet project is to improve the efficiency, resilience, and sustainability of the European multimodal freight transport ecosystem to address these shortcomings. The value proposed by its digital platform aids this ambition by enabling information transparency and availability, system integration and interoperability, and stakeholder collaboration and value co-creation.

Standards to describe the multimodal transport network foster data quality and information completeness by industry guidelines on contents and formats. A common understanding improves the exchange of information especially in the case of a disruptive event which leads to faster disruption handling and more flexible routing alternatives. Additionally, standards improve the interoperability of systems and workflows leading to higher overall operational efficiency.

With standards in place, routing algorithms improve transport orchestration integrating all modes of transport. The capabilities of the algorithms will be described in detail in the corresponding resources section in chapter 5.2.

The value proposed will be realised and delivered through a digital platform. The platform forms the centrepiece of collaboration and communication. It enables the exchange of information based on defined standards and integrates all stakeholders of the freight transport ecosystem. It serves as a hub for transport orchestration, capacity allocation, and disruption management. Its uniqueness lies in its cross-operator data integration as a neutral public solution via a single point of access. Furthermore, the aim of overall network optimisation, taking into account sustainability and resilience, represents a novelty.

5.2 Value Creation

To create value services are offered enabling the interaction of platform participants. Services and resources both need to be supported by strategic partners within the platform network. Additionally, sustainable activities and aspects are considered to meet the overarching goal of improving sustainability on a network level.

5.2.1 *Services*

Routing algorithms determine the optimal route based on influencing factors such as traffic, disrupted infrastructure segments, and available capacity allowing network optimisation, reallocation of assets and rerouting of transports. The algorithms offer multiple routing options filterable by costs, emissions, duration, and modes of transport. Route planning considers multimodal options on roads, railways, inland waterways and short sea shipping routes, as well as synchromodal relay transport by truck. All information and communication will be managed by the digital platform connecting all partners involved especially in cases of disruptions using alerts and updates.

Possible extensions in the future may be the use of artificial intelligence models to foster learning and prediction of disruption and allow optimisation of the whole freight transport network. Other possible scaling opportunities will be covered in chapter 7.

5.2.2 *Resources*

Resources needed to provide the described service can generally be categorised in data, IT infrastructure and intangibles. Data and information needed to calculate route alternatives are described in D2.2 and encompass:

- available vehicles and trailers
- vehicle parameters
- time restrictions

- possible depots
- transport exchange nodes
- timetables
- connections
- transfer duration and cost

Details on information and data needed for handover protocols especially for the realisation of synchromodal relay transport are described in D3.6. Additional data especially for disruption management relate to traffic, weather, infrastructure capacity and condition, and real-time asset tracking. Also, the algorithms and future reinforcement learning models are part of the IT resources. Necessary IT infrastructure encompasses servers to store databases and the IT components relevant to the digital platform. Intangible assets describe expertise and knowledge on the functionalities and methods of the platform critical for future development and extension. Also, the data governance model and network and industry knowledge form vital intangible assets for the success of the platform. Future expansion may include certificates for several aspects such as IT security.

5.2.3 *Partners*

Strategic partners within the platform ecosystem provide necessary data and expertise in the development of the platform architecture and its services. Partners should combine the following characteristics: trust and data Integrity, reliability, commitment, and industry knowledge. The digital platform requires four types of partners to operate: the integrator provides the web portal as an access point to the platform, partners responsible for backend functions, particularly with regard to routing and optimisation, process governance experts who ensure compliance with and further development of industry and platform standards and procedures, and data providers who supply the critical mass of input data required for the basic operation of the platform.

Central partners of ReMuNet regarding the platform conceptualization and development are PTV Planung Transport Verkehr GmbH, 4PL Intermodal GmbH, MANSIO GmbH, Vediafi Oy, Fraunhofer Austria Research GmbH, and FIR an der RWTH Aachen. Responsibilities and decision and access rights are part of the data governance within the operator model (chapter 6.2).

5.2.4 *Sustainable Design Themes*

The consideration of sustainable design themes ensures not only alignment with ReMuNet's overarching goal of improving the sustainability of the whole freight transport network but also contributing to ReMuNet's own sustainability. The neutrality of the digital platform in terms of equality of all participants implements socially sustainable principles taking issues like the labour market situation and demographics into account. A cost-covering revenue model contributes to the economic sustainability of the entire platform allowing further investments for development and innovation, which are essential for continuous improvement of the platform and its services contributing to ecological sustainability goals like reducing emissions.

5.3 Platform Participants

Platform participants are the customer segments and enablers of the platform and are not involved in operating the ReMuNet platform (see chapter 2.1.4). They form the customer base and include enabling actors (table 30).

The digital platform is conceptualised as minimal viable product (MVP) for demonstration and validation purposes as part of work package five of the ReMuNet project. Customer segments are therefore divided according to whether they belong to the platform pilot's core customer base or whether they are considered to be expanded in terms of scaling the platform in the future. The core customer base is formed by freight transport actors involved in the operational handling of shipments as described in D3.3.

Platform enablers are characterised on the one hand by the fact that they are not directly involved in the platform business. They act as controlling body building the framework around the platform ecosystem and guiding the operational logistics processes with regulations, directives, and proposals. This may be governmental entities, industry associations, or research institutions. On the other hand, enablers realise the value created by the platform with their physical infrastructure, assets and operations. Terminal operators for example enable the transshipment of containers from one mode of transport to another planned by the routing algorithm of the platform. This means that some actors can take on both the role of customer and enabler.

Table 30: ReMuNet's platform participants

Core customer segments	Expandable customer segments	Enablers
Multimodal transport operators	Manufacturers	Governmental entitites
Freight forwarders	Software providers and consulting	Industry associations
Carriers	Regulatory and public authorities	Research institutions
Terminal operators	Non-governmental and humanitarian organisations	Multimodal transport operators
Logistics service providers	Research institutes	Freight forwarders
Infrastructure operators and managers		Carriers
Corridor coordinators		Terminal operators

5.4 Value Capture

Each business that creates value faces costs which need to be covered by revenue streams. These two characteristics are summarised under the dimension of value capture.

ReMuNet faces costs arising from developing platform services, maintaining IT infrastructure, licensing fees from third-party software, and costs for compliance and IT security. Additional cost may arise for further innovation and research as well as for marketing purposes.

Monetisation strategies must be developed to cover these costs. Examples are a subscription fee, usage-based fees, add-on fees, one-time fees, or hybrid models. Other possibilities could include sponsoring or revenue from advertising on the platform.

Subscription fees are fixed, recurring payments granting users access to a platform’s services, while usage-based fees charge according to the extent of service usage. Add-on fees

provide optional access to supplementary features, and hybrid models combine multiple monetisation approaches within a single pricing structure. Sponsoring involves external organisations and institutions offering financial support in return for visibility or association with the platform, whereas advertising revenue arises from displaying paid promotional content to users.

As the monetisation strategy directly impacts the incentivation and scaling of the platform, this issue will be discussed in detail in chapter 7.

6. ReMuNet's suatainable Operator Model

As the business model describes how ReMuNet and its digital platform does business, or more detailed, how it creates and delivers value to all stakeholders of the multimodal freight transport ecosystem, the operator model defines the technical configuration, governance, and ownership of the platform and its assets.

The conducted survey covered theoretically possible scenarios, which can lead to contradictory statements regarding the overarching goal and project outline of ReMuNet. These conflicting scenarios will be identified and discussed in the following subchapters using an evaluation matrix and scenario analysis. Figure 4 depicts the most suitable scenario.

Operating				
Network structure	*Participation*	*User affiliation*	*Actor roles*	*Offering orientation*
Multi-sided network structure	B2B participation	- Public access & Registered access - Potential paid affiliation	- Neutral community manager - Service & data providers - Customers (solution providers & receivers)	- Result oriented - Neutral platform operation

Ownership		
Data ownership	*Service ownership*	*IT infrastructure ownership*
- Decentralised & consortium-based data control - Neutrality	- Consortium-based service control & responsibility - Neutrality	- Consortium-based IT operation & responsibility - Neutrality

Governance			
Data	*Services*	*Control rights*	*Decision rights*
- Consortium rules - Provider responsibility - Neutrality	- Consortium rules - Provider responsibility - Neutrality	- Consortium-based control & compliance - Independent access management	- Consortium-based - Joint decision making

Figure 4: Sustainable ReMuNet opertaor model

In the following, chapter 6.1 proposes the evaluation depicting the operator model dimensions and their impact on the interest of platform participants represented by the requirements identified in D3.2. In subsequent subchapters each operator model dimension and its possible configuration scenarios will be discussed based on the survey results described in chapter 4.2 and insights from the expert interviews. Each subchapter concludes with strategic recommendations for the design of the ReMuNet operator model.

6.1 Evaluation Matrix

ReMuNet's operator model needs to consider individual interests of both platform participants and the platform operator represented by the identified requirements in D3.2. Distinct

platform configurations result in different platform operator model scenarios impacting the interests of participants in various ways.

The following table 31 visualises the impact of the operator model dimensions on the requirements representing the interests of platform participants with harvey-balls. The colour scheme emphasises operator model dimensions with mutually exclusive configuration options.

Mutually inclusive configuration options imply aspects which do not contradict if multiple options are planned to be realised. Mutually exclusive options on the other hand contradict each other in some way. For example, the network configuration can only be either one-sided or multi-sided.

Table 31: Evaluation matrix for platform operator model scenarios

ReMuNet operator model		Requirements identified in D3.2									
		Address sustainability	Protect sensitive data	Neutral non-profit operator model	Standards for transport documents	Handle double bookings	Easy integration for SMEs and "big players"	Enable real-time network data tracking	Integrate alternative routing tools	Disruption signaling policy/system integration	Process and responsibilities in case of disruption
Operation	Network structure	○	○	○	○	○	●	●	●	○	●
	Participation	○	○	○	○	○	○	○	○	○	○
	User affiliation	○	◑	●	○	○	●	○	○	○	○
	Actor roles	○	◑	●	○	○	◑	○	○	○	●
	Offering orientation	○	○	●	○	◑	◑	◑	◑	◑	◑
Ownership	Data	○	●	◑	○	○	◑	◑	◑	○	◑
	Services	○	●	◑	○	○	◑	◑	◑	○	◑
	IT infrastructure	○	●	◑	○	○	◑	◑	◑	○	◑
Governance	Data	○	●	◑	○	○	◑	◑	◑	○	◑
	Services	○	●	◑	○	○	◑	◑	◑	○	◑
	Control rights	○	●	●	○	○	◑	◑	◑	◑	◑
	Decision rights	○	●	●	○	○	◑	◑	◑	◑	◑

○ No correlation between operator model dimension and requirement
◑ Moderate correlation between operator model dimension and requirement
● High correlation between operator model dimension and requirement
■ Mutually exclusive configuration options
■ Mutually inclusive configuration options

6.2 Operator Model Scenarios

In the following, various scenarios for mutually exclusive configuration options are analysed with regard to the corresponding requirements depicted in table 31. This analysis leads to strategic recommendations for the operating model and its development for the digital ReMuNet platform. The mutually inclusive aspects will be described based on the insights from the consortium-intern survey presented in chapter 4.2 and from the expert interview.

Network Structure

The network structure of a digital platform determines how many different market sides are connected with the platform. One-sided networks allow value delivery from the platform to one kind of user. Respectively, a two-sided network enables the exchanged interaction among two different kinds of actors.

ReMuNet aims to connect various players in the multimodal freight transport ecosystem. In order to achieve real-time transparency along the entire supply chain, as well as effective disruption management and rerouting, various network actors must be integrated into the platform to exchange information, capacities and other resources. A one-sided or two-sided network structure might not provide the necessary setup to meet these requirements.

The results of the survey and the expert interview suggest that a multi-sided network configuration should be established for the digital platform to integrate various stakeholders to cover the whole spectrum from small businesses to key industry players of different roles. This requires clearly defined processes and responsibilities among the various platform participants.

Participation

The different scenarios of user participation imply different requirements for how the ReMuNet platform would need to be structured.

A consumer-oriented form of participation, such as B2C and C2C would require integration and interaction with end-consumers. ReMuNet focuses on digital services for multimodal transport actors as registered companies and institutional entities. Thus, the market sides connected by the platform are dominated by businesses contradict the principles of B2C and C2C platforms. The integration of end-consumers might be a possible extension of ReMuNet's value proposition in future scaling efforts.

P2P participation would involve direct user to user interaction, which will be not possible with the developed platform pilot. This might be included in the future as part of scaling initiatives.

The B2B model of participation is the only configuration that fits the platform's intended purpose, a conclusion reinforced by survey findings and expert interviews.

User affiliation

The user affiliation is generally discussed in the platform architecture in D3.3. Users of the ReMuNet platform will be able to use basic features through a publicly available and open website. For using advanced services and functionalities, a registration is required.

If a service requires an affiliation by transaction or not is determined by the fact, if the service is monetised or not and if it requires input data of the resources or not. This distinction defines the deeper cost and revenue structure of the platform. As described in chapter 2.3, the operator model should initially focus on scaling possibilities and at a later stage on monetisation strategies.

User affiliation by investment will not be part of the initial platform pilot but might form a possibility for scaling the platform and acquire monetary resources in the future.

Actor Roles

Actor roles were described in the platform architecture of D3.3 and confirmed by the expert interview. ReMuNet recognises three general types of actor roles within its platform:

- A neutral community manager
- Suppliers of services and data
- Customers using the services and data, which might be distinguished in providing and receiving entities

Further actor role scenarios might be developed as part of scaling strategies. Since they have only minor impact on the requirements on the platform, they will not be further discussed. As part of the platform governance, rights and responsibilities affecting the actor roles will be discussed in the governance section.

Offering orientation

The different possibilities of offering orientation imply distinct strategic directions for the platform and should not be pursued simultaneously. A product-oriented focus would emphasise expanding and enhancing the platform's tools and functionalities, while a result-oriented focus would prioritise optimising the whole network of the multimodal transport ecosystem. A user-oriented focus, in turn, would centre on improving the user experience and delivering the capabilities users request most. Given that ReMuNet aims to optimise multimodal freight transport networks, the survey findings combined with the expert interviews suggest a result-oriented approach, with the platform's core outputs aligning with this orientation.

Improvements of other orientational focuses might be part of future scaling initiatives. Ultimately the offering orientation should emphasise a neutral operating model for the digital platform in order to integrate key stakeholders of the freight transport network. A clear formulated result-oriented offering orientation would promote the value proposition and aid the platform's network effects motivating both small companies and big players to participate.

Ownership

As the survey and expert interviews show, there are no significant differences suggesting that data, services, and IT infrastructure should have different ownership models. Therefore, ownership as a whole will be discussed below.

Ownership of platform assets can generally follow one of three mutually exclusive scenarios: centralised, decentralised, or consortium based. A centralised model places full ownership and control with a single entity, which enables coherent development, consistent standards

and clear responsibilities but also requires participants to trust this entity with sensitive resources and limits the use of distributed expertise. A decentralised model allows each contributor to retain ownership of its assets, supporting specialisation and autonomy but creating risks regarding interoperability, uneven quality, unclear rights to derived outputs and misalignment with platform-wide objectives. A consortium-based model keeps original ownership with contributors while establishing joint governance for shared assets and collectively derived outputs. This approach promotes fairness, distributes control and supports neutrality, but requires robust coordination mechanisms to maintain consistency and ensure smooth technical and organisational integration.

ReMuNet as a digital platform aims to connect key stakeholders of the multimodal freight transport ecosystem. One of the biggest concerns of logistics companies is data privacy and security (D3.2). A lack of willingness to collaborate may stem from reluctance of loosing the ownership of data and the fear of resulting revenue losses.

An incentive to participate should be the neutrality of the platform. This includes at least a decentralised ownership model, which allows participants to keep ownership of the data they provide to the platform. To improve neutrality even further, a consortium-based model should be established. This ensures trust in the platform regarding data protection and security, as well as neutrality through the equal treatment of all consortium partners.

Governance

As the survey and expert interviews show, there are no significant differences suggesting that data, services, and IT infrastructure should have different governance models. Therefore, governance as a whole will be discussed below.

Similar to the ownership model, the governance model can be designed as centralised, decentralised, or consortium-based configuration with the same characteristics as the ownership model. Governance is the structured set of rules, processes, and decision and control rights that determines how a digital platform is managed and regulated.

The main goal of ReMuNet's governance model should be to establish fair rules and equality for all platform participants and partners. ReMuNet should implement a consortium-based governance model as indicated by the survey and the expert interview. This means that especially the decision and control rights need to consider neutrality among the consortium partners. No partner and corresponding service or dataset should be favoured over another. It needs clear terms and conditions regulating how neutrality is ensured in the platform consortium.

An independent entity needs to govern the access rights for users. The consortium as a whole needs to decide on a set of rules and requirements all service and data owner within the platform ecosystem must meet. All suppliers should be responsible for the quality of the data and services they provide. Changes on any agreements have to be done jointly.

In terms of access rights for users, the platform should offer a public section for accessing free contents and services and a restricted section for advanced features. The functionalities and contents of public and private modes of the platform have already been described in D3.3 as part of the platform architecture.

Ultimately, governance structures need to ensure regulatory compliance with data security and privacy acts such as GDPR. This contributes to the overall trust in the platform and encourages new partners and customers to join in order to scale the platform. Additionally, compliance efforts may lead to certification in various aspects further improving the platform's incentive mechanisms.

7. Scaling Strategies for the ReMuNet Platform

As described in chapter 2.3, the more participants use a digital platform, the more value is created. Therefore, scaling strategies are required to make use of positive reinforcing network effects further increasing the platform's value. Various possibilities for the expansion of the ReMuNet ecosystem and its platform were discussed in the consortium-intern survey and the expert interview.

The platform and its network could be expanded to include new logistics players, SMEs, technology providers, and transport companies through partnerships, open APIs, and pilot programmes in additional corridors, supported by closer links to the EU's transport and innovation networks. Future expansion of services could focus on the integration of predictive analytics, AI-supported decision support, sustainability tracking and marketplace functions, while ensuring open APIs and sustainable business models. Data expansion may include new real-time, environmental and operational data sources enabled by data sharing agreements, sensor integration and interoperability with other EU platforms. Ownership could be expanded by including new consortium members as well as private and public stakeholders, and through co-investment or joint venture models to ensure shared governance and long-term growth.

This translates into three scaling strategies as presented in chapter 2.3:

- Expansion strategy
- Piggyback strategy
- Internationalisation

The three possible strategies will be discussed and analysed in the subsequent chapters using the system dynamics approach proposed in chapter 2.3.1. The graphs in each subchapter visualise the changing effect of operator and business model aspects and the resulting impact on customer segments and partners representing the main drivers for positive network effects for digital platforms.

7.1 Expansion Strategy

The expansion strategy focuses on extending a platform's resources. ReMuNet and its platform rely on many different databases provided by partners as described in chapter 5 and 6. They cover information on traffic, weather, infrastructure conditions, asset capacities, timetables, and others. As the expert interviewee states, datasets must be continuously maintained and can be gradually expanded in the process. Having more data available generally results in more accurate calculations directly improving the offered services in regard to route planning. Also, more information means higher transparency especially in the event of disruptions, which directly improves key features of resilient networks like reaction times and flexibility.

Besides the positive effects, more data cause slightly higher operational and maintenance costs. These should be compensated by the positive effects but need to be considered, nonetheless.

In summary, it can be assumed that the expansion of ReMuNet's data sets lead to the chain of effects visualised in figure 5 and has a positive impact on user numbers and thus generates positive network effects.

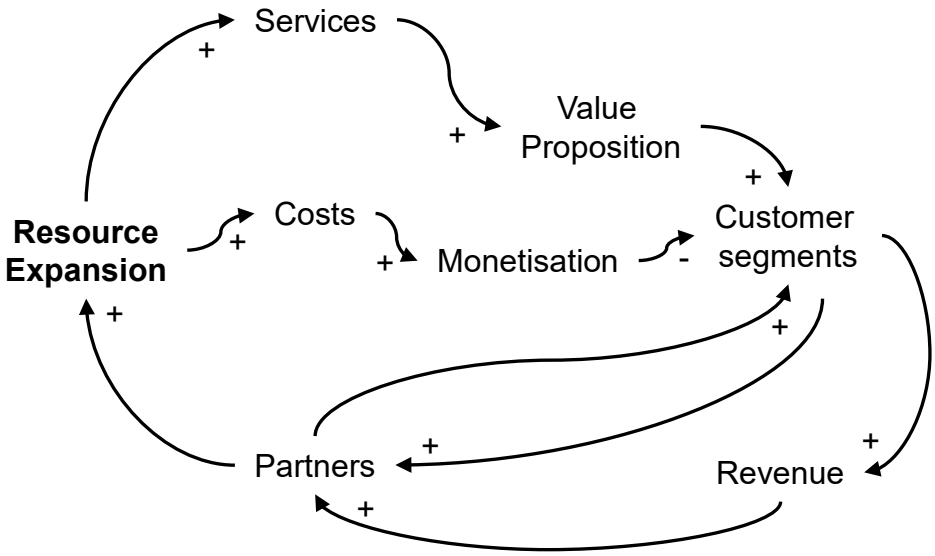

Figure 5: System dynamics of the resource expansion strategy

7.2 Piggyback and Collaboration Strategy

Collaboration with similar projects and platforms can create opportunities to exploit synergies and generate shared value. The participating platforms could share partners and resources and, by combining the network effects as depicted in figure 6 of both platforms, gain opportunities to expand their customer base. As described in the expansion strategy, similar effects occur by collaboration with other platforms. If differing databases and services can be shared collaborativley across platforms, the overall quality of results given to the customer increases and thereby improve the value proposed by each platform.

Trust and interoperability are key prerequisites for successful cooperation between different platforms. Terms of use govern the shared use of resources and capacities. If the security and integrity of shared resources cannot be guaranteed, cooperation will not be able to reach its maximum potential. If systems and data are not interoperable, the proposed added value cannot be realised, which could have a negative impact on customer satisfaction.

Furthermore, successful collaboration requires a clear governance framework that defines data ownership, responsibilities and decision-making processes. Aligning strategic goals and ensuring that both parties benefit equally helps to maintain a balanced partnership. Establishing common quality standards and contingency plans further reduces dependency risks and supports a consistent user experience as both platforms scale.

In summary, it can be assumed that the collaboration with other platforms lead to the chain of effects visualised in figure 6 and has a positive impact on user numbers and thus generates positive network effects.

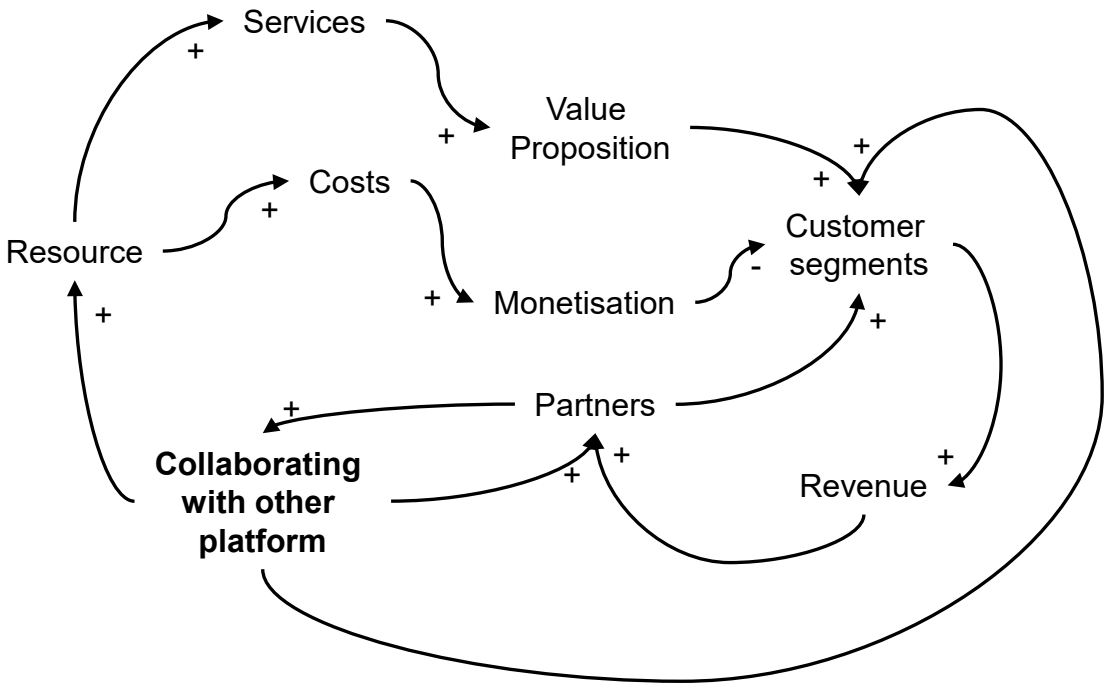

Figure 6: System dynamics of collaboration with other platforms

7.3 Internationalisation

The internationalisation strategy aims on expanding the geographical area of influence of the platform. ReMuNet integrates the European TEN-T concept and will be piloted in the Rhine-Danube and the North Sea-Baltic corridors. Expanding the platform's geographical area of influence would result in a first instance in the acquisition of further TEN-T corridors before expanding beyond European networks.

Geographical expansion offers the opportunity to integrate new customers and partners into the platform. While large industry players operate in multiple corridors, small and medium-sized enterprises typically specialise in specific regions. It is therefore essential to ensure the smooth integration of these smaller players. An important prerequisite for expansion is the availability of data for the target corridor. This means that the platform must first attract relevant partners – especially data providers – before it can tap into new customer segments in this area. In addition, services may need to be slightly adapted to take account of local conditions, such as different regulatory requirements.

Overall, geographical expansion mainly increases the number of platform partners and thereby expanding the platform's resources with additional data improving the services and ultimately the value proposition similar to the expansion strategy as visualised in figure 7.

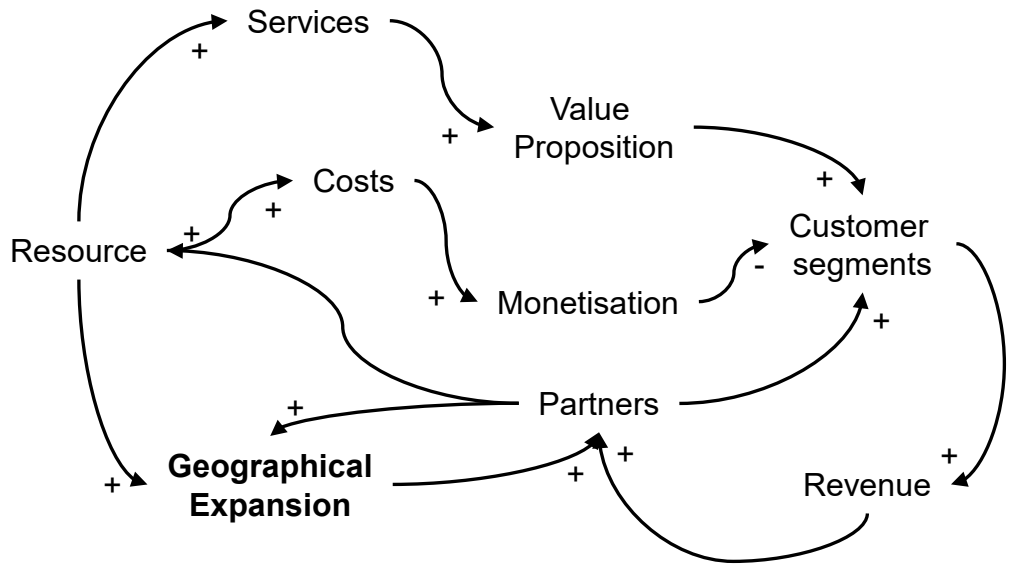

Figure 7: System dynamics of the geographical expansion strategy

7.4 Further Considerations

7.4.1 *Monetisation's impact on scaling a platform*

Monetisation can significantly influence the scalability of a digital platform, as it may reduce users' incentives to access the platform's value. Paywalls and fees undermine the transparency central to ReMuNet's business model, which requires rapid and unrestricted access to services and data. Usage-based fees, in particular, risk discouraging effective platform use. Most use cases within the ReMuNet ecosystem rely on comprehensive access to datasets that compare rerouting options or assess the impacts of disruptions, and the monetisation strategy must not impede these capabilities. Moreover, monetisation mechanisms that privilege certain features or services could advantage specific partners within the consortium, thereby compromising the neutrality that is essential for equitable participation. The monetisation strategy must therefore safeguard neutrality, equality of access, and unrestricted service use to support scaling and the development of network effects.

Given their characteristics, subscription fees are the most suitable model to promote scaling while ensuring cost coverage. They provide predictable revenue without discouraging usage, thereby preserving the unrestricted access needed for strong network effects. Usage-based and add-on fees risk limiting engagement, hybrid models introduce complexity that may similarly impede use and sponsoring or advertising offer supplementary rather than reliable primary income streams.

The monetisation strategy might be adjusted based on future development of the platform and its services, which may include advanced premium features such as reinforcement learning models that could be monetised separately. In any case, the monetisation strategy has to be aligned with the scaling strategy's goals.

7.4.2 *Other scaling strategies*

In addition to the scaling strategies analysed in this chapter, two further strategies could have been considered: the self-supply strategy and the excellence leadership.

The self-supply strategy focuses on the simulation of test data to validate the value created by the platform. The simulation and validation of the ReMuNet platform and its functions and components will be part of work package five of the research project. In pilot corridors, the platform will handle various use cases to validate the functionality of the platform's rerouting and disruption management features. Therefore, the simulation is already part of the development process and no further scaling strategy.

Excellence in leadership as a scaling strategy for digital platforms means driving growth through a culture of innovation, high performance and continuous improvement that sets industry standards and attracts partners and users alike. ReMuNet already takes in a role as pioneer revolutionising the multimodal freight transport ecosystem. The developed platform will be the first neutral and publicly accessible orchestrator integrating key stakeholders in the logistics sector with complete transparency and interoperability of data and information.

Finally, there remains the option of selling the platform to a major player. This could be considered scaling the platform, as all aspects would be expanded with the resources provided by the buyer. However, as this option is outside the scope of the project, it will not be discussed in detail at this point.

8. Conclusion and Outlook

This deliverable aims to propose ReMuNet's operator model and its coherent business model. Therefore, from desk research and literature review two canvases were developed and described in chapters 2.1.4 and 2.2.2. These were used as part of a consortium intern survey and expert interviews to design the business and operator model.

The sustainable ReMuNet business model encompasses four main dimensions to describe ReMuNet' business model. The value proposition defines which value is created and delivered by ReMuNet. It focuses on the uniqueness of a business and emphasizes the interaction and facilitation of a digital platform. ReMuNet's vision is to improve efficiency, sustainability, and resilience of the European multimodal freight transport ecosystem. A digital platform developed based on the described business model could enable the cross-operator transport orchestration in multimodal logistics. Integrating different actors on a single platform and neutral network optimisation fosters collaboration and would be a novelty in the industry.

Value creation covers four subdimensions to describe what is needed to create value: services, resources, partners, and sustainability design themes. The latter recognises sustainable aspects of value creation aiming for an improved sustainability in the whole freight transport network. Services offered by the digital ReMuNet platform were already described in D3.3 and include transport route planning and optimisation and disruption management allowing for multimodal rerouting based. These services as part of the project's pilot might be extended by reinforcement learning features enabling optimisation on a network level and prediction of disruptions and their impacts. Resources needed to realise these services encompass transport data, disruption data, and the algorithms necessary to calculate and optimise routes in real-time conditions. Additionally, IT infrastructure and basic resources for the operation of a digital platform need to be considered. Services and resources are provided by platform partners, which can be distinguished as integrators, data providers, and process governors.

Created value is delivered to platform participants including platform enablers and customer segments. Customer segments of ReMuNet encompass logistics companies that organise and plan freight transports. This includes primarily multimodal transport operators, freight forwarders, and carriers. Enablers for the platform provide transport operations, expertise, and governance structures to realise the platform's created value. This includes among others terminal operators, carriers, governmental entities, and industry associations as well as research institutions.

The last dimension covers value capture mechanisms in the form of revenue streams to cover costs arising from the platform activities. ReMuNet's cost structure includes operational costs for IT infrastructure and services. Also, development costs for future platform extensions and marketing and acquisition expanses need to be considered and covered by revenue streams. Monetisation of a neutral and non-profit oriented platform must not harm the scaling strategy by contradicting incentives for participation. This would have a negative impact on network effects which require a critical mass of users and would endanger the platform's economic viability. Possible monetisation strategies encompass subscription-

based fees, usage-based fees, or hybrid models. Future projects, sponsorships, or partnerships might also be considered.

ReMuNet's operator model defines the overall technical configuration of the platform and the ownership and governance of platform services, data, and IT infrastructure. Various scenarios were discussed in chapter 6 and strategic recommendations were derived.

Based on the survey and the expert interview, ReMuNet will most likely implement a multi-sided network structure enabling B2B participation. Basic solutions provided by the platform are open accessible. Registration and transaction might be necessary for advanced features and future extensions. Actor roles of the digital platform include a neutral community manager, suppliers of services and data, and customers using the services and data, which might be distinguished in providing and receiving entities.

Ownership and governance of services, data, and IT infrastructure should be organised with a consortium-based concept. Every partner should keep authority other their provided service or dataset. A consortium organises regulating aspects of ownership and governance. The consortium and its leader need to ensure neutrality and fair decision-making. Control rights need to respect the autonomy of each partner in the interest of the platform while ensuring resilience in the case of partners leaving the consortium.

Chapter 7 introduces and analyses possible scaling strategies for the digital ReMuNet platform to make use of positive network effects by integrating additional customer segments. The expansion strategy focuses on expanding ReMuNet's database, which improves value creation with more accurate service results and higher quality in route orchestration and disruption management resulting in increasing user numbers. Collaborating with similar platforms or projects might enable the integration of new partners and their databases and services, which would also result in improved value creation and expanded service variety for new customer segments. As ReMuNet focuses on the two TEN-T corridors Rhine-Danube and North Sea-Baltic, internationalisation would enable new customer segments and new possible partners from other TEN-T corridors.

The next steps in the ReMuNet project include the development of the platform pilot and the experimental piloting of the effectiveness of the platform regarding the improvement of efficiency, sustainability, and resilience of the multimodal freight transport ecosystem.

References

Allweins, M. M., Proesch, M., & Ladd, T. (2021). The Platform Canvas—Conceptualization of a Design Framework for Multi-Sided Platform Businesses. Entrepreneurship Education and Pedagogy, 4(3), 455–477. https://doi.org/10.1177/2515127420959051

Amazon. (2023). *Fulfillment by Amazon: How improving delivery fueled independent seller growth and success*. https://www.aboutamazon.com/news/small-business/fulfillment-by-amazon-how-improving-delivery-fueled-independent-seller-growth-and-success

Amazon. (2025). *Amazon FBA for beginners*. https://sell.amazon.com/blog/amazon-fba-for-beginners

Amazon. (2025). *Selling Partner API Roles*. https://developer-docs.amazon.com/sp-api/lang-en_EN/docs/roles-in-the-selling-partner-api

Amit, R. H., & Zott, C. (2010). Business Model Innovation: Creating Value in Times of Change. *SSRN Electronic Journal.* Advance online publication. https://doi.org/10.2139/ssrn.1701660

Anderson, E. G., Parker, G. G., & Tan, B. (2023). Strategic Investments for Platform Launch and Ecosystem Growth: A Dynamic Analysis. *Journal of Management Information Systems*, *40*(3), 807–839. https://doi.org/10.1080/07421222.2023.2229125

Bakos, Y., & Katsamakas, E. (2008). Design and Ownership of Two-Sided Networks: Implications for Internet Platforms. *Journal of Management Information Systems*, *25*(2), 171–202. https://doi.org/10.2753/MIS0742-1222250208

Bellman, R., Clark, C. E., Malcom, D. G., Craft, C. J., & Ricciardi, F. M. (1957). On the Construction of a Multi-Stage, Multi-Person Business Game. *Operations Research*, *5*(4). https://doi.org/10.1287/opre.5.4.469

Bocken, N., Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. *Journal of Cleaner Production*, *208*, 1498–1512. https://doi.org/10.1016/j.jclepro.2018.10.159

Bocken, N. M. P., Weissbrod, I., & Antikainen, M. (2021). Business Model Experimentation for the Circular Economy: Definition and Approaches. *Circular Economy and Sustainability*, *1*(1), 49–81. https://doi.org/10.1007/s43615-021-00026-z

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, *45*, 9–19. https://doi.org/10.1016/j.jclepro.2012.07.007

Brenner, B. (2018). Transformative Sustainable Business Models in the Light of the Digital Imperative—A Global Business Economics Perspective. *Sustainability*, *10*(12), 4428. https://doi.org/10.3390/su10124428

Brenner, B., & Drdla, D. (2023). Business Model Innovation toward Sustainability and Circularity—A Systematic Review of Innovation Types. *Sustainability*, *15*(15), 11625. https://doi.org/10.3390/su151511625

Brunner, M., Gundolf, K., & Guieu, G. (2025). From a conventional to a sustainable business model – a review on transformation actions and indicators. *Cleaner Logistics and Supply Chain*, *16*, 100258. https://doi.org/10.1016/j.clscn.2025.100258

Büge, M., & Ozcan, P. (2021). Platform Scaling, Fast and Slow. *MIT Sloan Management Review*(3), 40–46. https://sloanreview.mit.edu/article/platform-scaling-fast-and-slow/

Bullinger, H. J., Spath, D., Schuster, E., & Meiren, T. (2004). Operator Models: A More Advanced Form of Service Model. *Economic Bulletin*, *41*(3), 103–106. https://doi.org/10.1007/s10160-004-0261-2

Chen, X., & Thapa, D. (2025). Clarifying the business model construct: a theory-driven integrative literature review through ecosystems and open systems perspectives. *Review of Managerial Science.* Advance online publication. https://doi.org/10.1007/s11846-025-00917-7

Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & Leadership*, *35*(6), 12–17. https://doi.org/10.1108/10878570710833714

Ching, H. Y., & Fauvel, C. (2014). Criticisms, variations and experiences with business model canvas. *International Journal of Small Business and Entrepreneurship Research*, *1*(4). https://www.researchgate.net/publication/262934820_CRITICISMS_VARIATIONS_AND_EXPERIENCES_WITH_BUSINESS_MODEL_CANVAS

Cluster 2.0. (2019, September 6). *D.2.5 Handbook for Smart Clusters Development*. http://www.clusters20.eu/wp-content/uploads/2019/09/Clusters_2.0_D2.5-Handbook-for-Smart-Clusters-Development-FINAL-VERSION_IBI-20190829-1.pdf

Cluster2.0. (2025, October 16). *The background*. http://www.clusters20.eu/the-project/

Convoy. *Convoy Platform*. https://convoy.com/

Convoy. (2025, July 28). *DAT to acquire the Convoy Platform from Flexport*. https://www.dat.com/company/news-events/news-releases/dat-to-acquire-convoy-platform-from-flexport

Convoy. (2025, October 15). *Earn more with less hassle*. https://convoy.com/carriers

Convoy. (2025, October 15). *ELEVATE YOUR BROKERAGE*. https://convoy.com/brokers/

Convoy (2025, October). SUPPLY CHAIN VISIBILITY AND THE DIGITAL FREIGHT NETWORK.

CORDIS - EU research results. (2025). *Periodic Reporting for period 1 - SETO (Smart Enforcement of Transport Operations)*. https://cordis.europa.eu/project/id/101103695/reporting

CORDIS - Forschungsergebnisse der EU. (2023, April 17). *Logistische Clusterlösungen für ein nachhaltiges und vollständig integriertes Verkehrssystem*. https://cordis.europa.eu/article/id/413524-logistics-clusters-solutions-for-a-sustainable-and-fully-integrated-transport-system/de

Cozzolino, A., Verona, G., & Rothaermel, F. T. (2018). Unpacking the Disruption Process: New Technology, Business Models, and Incumbent Adaptation. *Journal of Management Studies*, *55*(7), 1166–1202. https://doi.org/10.1111/joms.12352

Crivelli, F., & FEDeRATED (2020, August). FEDERATED_Discussion_Paper_Semantics_-_Reference_Model_-_August_2020.

DaSilva, C. M., & Trkman, P. (2014). Business Model: What It Is and What It Is Not. *Long Range Planning*, *47*(6), 379–389. https://doi.org/10.1016/j.lrp.2013.08.004

Derave, T., Gailly, F., Sales, T. P., & Poels, G. (2024). A taxonomy and ontology for digital platforms. *Information Systems*, *120*, 102293. https://doi.org/10.1016/j.is.2023.102293

Desmarteau, R. H., Saives, A.-L., & Holford, W. D. (2018). Business Model. In *Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship* (pp. 1–7). Springer New York. https://doi.org/10.1007/978-1-4614-6616-1_197-2

Dicks et al. (2025). *ReMuNet Ecosystem Design and a Catalogue of sustainable Business Models for key Actors.* FIR an der RWTH Aachen. https://remunet-project.eu/wp-content/uploads/2025/10/D3.3-ReMuNet-Ecosystem-Design-and-a-Catalogue-of-sustainable-Business-Models-for-key-Actors_FIR.pdf

Doran, G. T. (1981). There's a S.M.A.R.T. way to write managements's goals and objectives. *Management Review*, *70*(11), 35–36. https://research.ebsco.com/c/niximb/viewer/pdf/jea4ppm7cn

DSV. (2025, October 15). *Company structure*. https://www.dsv.com/en/about-dsv/company-structure

DSV. (2025, October 15). *DSV Self Services*. https://www.dsv.com/de-de/hilfe/self-services

DSV. (2025, October 15). *HALF-YEAR 2022 RESULTS*. https://investor.dsv.com/static-files/b0548080-9163-4767-9ae9-6a334ab36f51

DSV. (2025, October 15). *Lösungen für Technologie- und Elektronik-Logistik*. https://www.dsv.com/de-de/unsere-loesungen/branchenloesungen/technologielogistik

DSV. (2025, October 15). *myDSV*. https://www.dsv.com/de-de/warum-dsv/connectivity/mydsv

DSV. (2025, October 15). *Warum DSV das Transport- und Logistikunternehmen der Wahl sein sollte*. https://www.dsv.com/de-de/warum-dsv

Elkington, J. (1994). Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, *36*(2), 90–100. https://doi.org/10.2307/41165746

FEDeRATED. (2022, August 29). *The FEDeRATED proposition*. https://www.federatedplatforms.eu/index.php/the-federated-proposition

FEDeRATED. (2024). *FEDeRATED Reference Model*. https://federatedplatforms.eu/images/Library/Activity2/FEDeRATED_Reference_Architecture.pdf

FEDeRATED. (2024, March 5). *FEDeRATED Masterplan to support supply chain growth engineering*. www.federatedplatforms.eu/index.php/news/78-federated-masterplan-available-to-support-supply-chain-growth-engineering

FEDeRATED. (2024, April 17). *FEDeRATED Consultation Panel Report 2022 MILESTONE 11*. https://www.federatedplatforms.eu/index.php/library/item/11-consultation-panel-report-2022-milestone-11

FEDeRATED. (2025). *Library*. https://www.federatedplatforms.eu/index.php/library

Flexport. (2025, September 28). *ShipperGuide TMS Software Review 2025: Features, Integrations, Pros & Cons*. https://www.capterra.com/p/207128/Loadsmart

Flexport. (2025, October 15). https://moge.ai/de/product/flexport

Flexport. (2025, October 15). https://www.flexport.com/company/about-us/

Flexport, & Vivek Kishore. (2025, May 25). *Supply Ecosystem Integrations that are Powering Flexport Platform to Make Global Trade Easy*. https://flexport.engineering/supply-ecosystem-integrations-that-are-powering-flexport-platform-to-make-global-trade-easy-846a91fa94ef

Forrester, J. W. (1965). *Industrial Dynamics* (Fourth printing). MIT Press.

Gartner, Inc. (2025). *Shippeo Platform Reviews, Ratings & Features 2025 | Gartner Peer Insights*. https://www.gartner.com/reviews/market/real-time-transportation-visibility-platforms/vendor/shippeo/product/shippeo-platform

Gassmann, O [Oliver], Frankenberger, K., & Choudury, M. (2013). *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator*. Hanser.

Gassmann, O [Oliver], Frankenberger, K., & Choudury, M. (2014). *The business model navigator: 55 models that will revolutionise your business*. Pearson.

Gert Nuyts, & Transporeon. (2025, July 16). *Setting up your users*. https://intercom.help/transportoperations/en/articles/5559242-setting-up-your-users

Goertler, T., Papert, M., Fischer, I., & Schmidt, M. (2023). *Designing digital platform ecosystems: A synthetization of relevant design topics for ecosystems from a literature review*. https://www.researchgate.net/publication/371576799_Designing_Digital_Platform_Ecosystems_A_Synthetization_of_Relevant_Design_Topics_for_Ecosystems_from_a_Literature_Review

Goertler, T., Papert, M., Fischer, I., & Schmidt, M. (2025). Building digital platform ecosystems: A synthetization of fundamental design topics from a literature review. *Digital Business*, *5*(1), 100109. https://doi.org/10.1016/j.digbus.2025.100109

Große Holtforth, D., Geibel, R., & Kracht, R. (2020). *Schlüsselfaktoren im E-Commerce: Innovationen, Skaleneffekte, Datenorientierung und Kundenzentrierung* (2., überarbeitete Auflage). *essentials*. Springer Gabler.

Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., & Krcmar, H. (2020). Digital platform ecosystems. *Electronic Markets*, *30*(1), 87–98. https://doi.org/10.1007/s12525-019-00377-4

International Container Terminal Services, Inc. (2020). *ICTSI connecting its global network of terminals to TradeLens Blockchain network*. https://www.ictsi.com/press-releases/ictsi-connecting-its-global-network-terminals-tradelens-blockchain-network

Jabłoński, A., & Jabłoński, M. (2016). Research on Business Models in their Life Cycle. *Sustainability*, *8*(5), 430. https://doi.org/10.3390/su8050430

Kammler, F., Gembarski, P. C., Schoormann, T., & Hagen, S. (2021). Workshop: Data-driven business models for sustainable value creation systems (NaWerSys). An introduction. In Gesellschaft für Informatik e.V. (Chair), *INFORMATIK 2021 - 51st Annual Conference of the German Informatics Society,* Berlin. https://www.scopus.com/pages/publications/85127417681

Katz, M. L., & Shapiro, C. (1985). Network Externalities, Competition, and Compatibility. *The American Economic Review*, *75*(3), 424–440. http://www.jstor.org/stable/1814809

Krause, F. (2019). *TradeLens | Maersk und IBM Supply Chain*. https://blockchainwelt.de/tradelens-maersk-ibm-supply-chain/

Li, X., Zhang, L., & Cao, J. (2023). Research on the mechanism of sustainable business model innovation driven by the digital platform ecosystem. *Journal of Engineering and Technology Management*, *68*, 101738. https://doi.org/10.1016/j.jengtecman.2023.101738

Loadsmart. (2021, July 16). *Loadsmart Launches Data Insights Product to Strengthen Shipper Operations*. https://loadsmart.com/about

Loadsmart. (2025, October 15). *240424 [ONE PAGER] Security, Compliance, and Trust at Loadsmart.pdf*.

Loadsmart. (2025, October 15). *Everything you need to move more with less, in one place*. https://loadsmart.com/login/

Loadsmart. (2025, October 15). *Loadsmart's Next-Gen Transportation & Logistics Solutions*. https://lp.loadsmart.com/loadsmarts-next-gen-transportation-logistics-solutions?_gl=1*1xe7xiu*_gcl_au*MTcyMTczMzgxNC4xNzU4NjIwMTc2*_ga*OTUwNzU0OTY2LjE3NTg2MjAxNzY.*_ga_JFPJ1FMNWM*czE3NTg2MjAxNzYkbzEkZzEkdDE3NTg2MjA3NjYkajM2JGwwJGgw

Loadsmart. (2025, October 15). *Optimize shipping operations with our next generation Transportation Management System*. https://loadsmart.com/shipper/shipperguide

Loadsmart. (2025, October 15). *We are Loadsmart. We are the future of freight.* https://loadsmart.com/about

Lüdeke-Freund, F., Froese, T., Dembek, K., Rosati, F., & Massa, L. (2024). What Makes a Business Model Sustainable? Activities, Design Themes, and Value Functions. *Organization & Environment*, *37*(2), 194–220. https://doi.org/10.1177/10860266241235212

MAERSK. (2020). *Amid surging use of digital solutions, TradeLens gets boost as major carriers finalize data integration*. https://www.maersk.com/news/articles/2020/10/15/tradelens-amid-surging-use-of-digital-solutions

Mody, M., Wirtz, J., Fung So, K. K., Chun, H. H., & Liu, S. Q. (2020). Two-directional convergence of platform and pipeline business models. *Journal of Service Management*, *31*(4), 693–721. https://doi.org/10.1108/JOSM-11-2019-0351

Neubecker, H. (2018). *FBA – Fulfillment by Amazon – Verkauf und Versand für Händler*. https://www.microtech.de/blog/fba-fulfillment-by-amazon/#elementor-toc__heading-anchor-3

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (1., Auflage). Wiley, J.

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying Business Models: Origins, Present, and Future of the Concept. *Communications of the Association for Information Systems*, *16*, Article 1. https://doi.org/10.17705/1CAIS.01601

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Petrovic, O., Kittl, C., & Teksten, R. D. (2001). Developing Business Models for Ebusiness. *SSRN Electronic Journal.* Advance online publication. https://doi.org/10.2139/ssrn.1658505

Reim, W., Parida, V., & Sjödin, D. (2021). Digital Business Model Innovation for Product-Service Systems. In M. Kohtamäki, T. Baines, R. Rabetino, A. Z. Bigdeli, C. Kowalkowski, R. Oliva, & V. Parida (Eds.), *The Palgrave Handbook of Servitization* (pp. 89–101). Springer International Publishing. https://doi.org/10.1007/978-3-030-75771-7_6

Rosner, S., & Pongratz, H. J. (2020). *System Dynamics: Komplexe Sozialsysteme und ihren Wandel begreifen und gestalten* (1. Auflage). *Systemische Organisationsberatung und Aktionsforschung: Band 5*. Rainer Hampp Verlag.

Ruutu, S., Casey, T., & Kotovirta, V. (2017). Development and competition of digital service platforms: A system dynamics approach. *Technological Forecasting and Social Change*, *117*, 119–130. https://doi.org/10.1016/j.techfore.2016.12.011

Schallmo, D., Kundisch, D., Lang, K., & Hasler, D. (Eds.). (2024). *Schwerpunkt Business Model Innovation*. *Digitale Plattformen und Ökosysteme im B2B-Bereich: Fallstudien, Ansätze, Technologien und Tools*. Springer Gabler. https://link.springer.com/978-3-658-43129-7

Schrader, P., Gross, E., Bauernhansl, T., & Hoeborn, G. (2023). Digitale und nachhaltige Organisationen/Systematic literature review on modes of organizational ambidexterity – Digital and sustainable organizations. *Wt Werkstattstechnik Online*, *113*(11-12), 518–524. https://doi.org/10.37544/1436-4980-2023-11-12-54

Sennder. (15.102025). *EST-GESCHÄFT VON C.H. ROBINSON SCHLIEßT SICH SENNDER AN JETZT UNTER DEN TOP 5 DER KOMPLETTLADUNGSANBIETER IN EUROPA*. https://www.sennder.com/de

Sennder. (15.102025). *Frachtführer*. https://www.sennder.com/de/frachtfuehrer

Sennder. (2021, February 11). *sennder licenses SaaS platform to Zeitfracht, as part of a new strategic partnership*. https://www.sennder.com/press/sennder-licenses-saas-platform-to-zeitfracht-as-part-of-a-new-strategic-partnership

Sennder. (2025, October 15). *Terms & Conditions for orcas*. https://www.sennder.com/lv/terms-conditions-orcas

Sennder. (2025, October 15). *Verlader*. https://www.sennder.com/de/versender

SETO (2023, June). D5.4 - Engagement Strategy and Action Plan, including stakeholder mapping and community analysis.

SETO. (2025, October 16). *About*. https://setoproject.eu/about

SETO. (2025, October 16). *Smart enforcement of transport operations*. https://setoproject.eu/

Shafer, S. M., Smith, H. J., & Linder, J. C. (2005). The power of business models. *Business Horizons*, *48*(3), 199–207. https://doi.org/10.1016/j.bushor.2004.10.014

Shippeo. (2022). *Shippeo introduces Carbon Visibility, enhances Ocean and Road Visibili - Press releases*. https://www.shippeo.com/press-releases/shippeo-introduces-carbon-visibility-and-brings-powerful-new-features-to-ocean-and-road-visibility

Shippeo. (2025). *Login | Shippeo*. https://auth.shippeo.com/auth/main/login/identifier?response_type=code&client_id=cbe7ef40-199b-49fc-a7ef-40199b49fc48&state=X3RDQ1FGUVNiMWRIZmR3aDJTQ1NnSTZ-fZVdzSEVMTnhmRV9qNGJ-MUpBRElNsemicolon%2Fredirect-home&redirect_uri=https%3A%2F%2Fweb.shippeo.com%2F&scope=openid+profile+offline_access+full_profile+termsOfUse%3A1.0&code_challenge=ISDumTGu-W8tT578yfp1oLiSY3-h8UcBJ1AFBgVTX8Q&code_challenge_method=S256&nonce=X3RDQ1FGUVNiMWRIZmR3aDJTQ1NnSTZfZVdzSEVMTnhmRV9qNGJ-MUpBRElN

Shippeo. (2025). *Our Network | Shippeo*. https://www.shippeo.com/en/platform/our-network

Shippeo. (2025). *Über uns | Shippeo*. https://www.shippeo.com/de/company/about-us

Shippeo. (2025). *Der weltweit meist empfohlene Anbieter für Transporttransparenz*. https://www.shippeo.com/de

Shopify. (2025). *Fulfillment Network*. https://help.shopify.com/en/manual/fulfillment/shopify-fulfillment-network

Shopify. (2025). *Outsource fulfillment with Shopify Fulfillment Network*. https://www.shopify.com/fulfillment

Shopify. (2025). *Registrieren – Shopify*. https://accounts.shopify.com/signup?rid=b4833b81-f1e5-4cf6-a7ae-193942cd2b45

Shopify. (2025). *Shopify – Pläne und Preisgestaltung*. https://www.shopify.com/de/preise

Snihur, Y., & Markman, G. (2023). Business Model Research: Past, Present, and Future. *Journal of Management Studies*, *60*(8). https://doi.org/10.1111/joms.12928

Springer, V., Randhawa, K., Jovanović, M., Ritala, P., & Piller, F. T. (2025). Platform design and governance in industrial markets: Charting the meta-organizational logic. *Research Policy*, *54*(6), Article 105236, 1–18. https://doi.org/10.1016/j.respol.2025.105236

Steinhöfel, E., Kohl, H., & Orth, R. (2016). Business Model Innovation: A Comparative Analysis. In M. Tunkkari-Eskalinen & I. Aaltio (Eds.), *11th European Conference on Innovation and Entrepreneurship.* Academic Conferences and Publishing International.

Steur, A. (2022). Phase 2: Skalierung. In A. Steur (Ed.), *Schwerpunkt Business Model Innovation. Digitale Plattformen erfolgreich aufbauen und steuern* (pp. 33–49). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-38202-5_4

Strahonja, V., & Musulin, J. (2018). Business Model Grounds and Links. *Journal of Information and Organizational Sciences*, *42*(2), 241–269. https://doi.org/10.31341/jios.42.2.6

Tiwana, A., Konsynski, B., & Bush, A. A. (2010). Research Commentary —Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Information Systems Research*, *21*(4), 675–687. https://doi.org/10.1287/isre.1100.0323

Transporeon. (2025). *Transporeon-Web*. https://login.transporeon.com/login/?return=https%3A%2F%2Flogin.transporeon.com%2F

Transporeon. (2025). *Transport Execution Hub*. https://www.transporeon.com/de/plattform/transport-execution-hub

Transporeon. (2025, October 16). *Intelligenter und effizienter Frachteinkauf*. https://www.transporeon.com/de/plattform/freight-sourcing-hub

Transporeon. (2025, October 16). *Kontakte zu Verladern knüpfen und mehr Aufträge erhalten*. https://www.transporeon.com/de/plattform/freight-sourcing-hub/spediteur-logistikdienstleister/carrier-premium-account

Transporeon. (2025, October 16). *Transporeon macht den Gütertransport so einfach wie möglich.* https://www.transporeon.com/de

Trimble. (2023, April 3). *Trimble Completes Transporeon Acquisition*. https://www.prnewswire.com/news-releases/trimble-completes-transporeon-acquisition-301788152.html

Trimble. (2025, October 16). *Trimble to Acquire Transporeon to Strengthen and Accelerate Connect & Scale Strategy*. https://news.trimble.com/2022-12-12-Trimble-to-Acquire-Transporeon-to-Strengthen-and-Accelerate-Connect-Scale-Strategy

Tura, N., Kutvonen, A., & Ritala, P. (2018). Platform design framework: conceptualisation and application. *Technology Analysis & Strategic Management*, *30*(8), 881–894. https://doi.org/10.1080/09537325.2017.1390220

Uberfreight. (2020, January 24). *Introducing an improved web portal for carriers and dispatchers*. https://www.uberfreight.com/blog/how-to-use-the-uber-freight-web-portal

Uberfreight. (2024, September 10). *Uber Freight Advances End-to-End Logistics with Platform Enhancements, Generative AI-Powered Tech and Expanded Final Mile Offerings*. https://rss.globenewswire.com/de/news-release/2024/09/10/2943797/0/en/Uber-Freight-Advances-End-to-End-Logistics-with-Platform-Enhancements-Generative-AI-Powered-Tech-and-Expanded-Final-Mile-Offerings.html

Uberfreight. (2025, October 15). *About us*. https://www.uberfreight.com/about-us/

Uberfreight. (2025, October 15). *Join one of the industry's largest carrier networks*. https://www.uberfreight.com/carrier/

Uberfreight. (2025, October 15). *Powering intelligent logistics*. https://www.uberfreight.com/

Uberfreight. (2025, October 15). *Uber Freight Logins*. https://www.uberfreight.com/login/

Uberfreight. (2025, October 15). *Willkommen beim Uber Freight Support*. https://help.uber.com/freight

Vaske, H., & Trueman, C. (2022). *Aus für TradeLens-Plattform: IBM und Maersk stellen Blockchain-Projekt ein*. https://www.computerwoche.de/article/2818818/ibm-und-maersk-stellen-blockchain-projekt-ein.html

Vidmar, D., Marolt, M., & Pucihar, A. (2021). Information Technology for Business Sustainability: A Literature Review with Automated Content Analysis. *Sustainability*, *13*(3), 1192. https://doi.org/10.3390/su13031192

Warehousing1. (2025). *Was ist Fulfillment by Amazon? Definition FBA | Logistik-Lexikon*. https://warehousing1.com/blog/glossar/fulfillment-by-amazon-fba/

Werner, A., Schuseil, F., Zimmermann, N., Hämmerle, M., & Riedel, O. (2024). Nachhaltige Geschäftsmodelle durch digitale Zwillinge/Sustainable Business Models through Digital Twins. *Wt Werkstattstechnik Online*, *114*(06), 276–284. https://doi.org/10.37544/1436-4980-2024-06-28

Wortmann, F., Jung, S., Bronner, W., & Gassmann, O [O.]. (2022). *The platform navigator: 88 patterns to design and implement platform business models.* Univ. https://www.alexandria.unisg.ch/entities/publication/7aaa5331-27c6-4781-9f19-68b0a5fb8c34

Zeng, J., Yang, Y., & Lee, S. H. (2023). Resource Orchestration and Scaling-up of Platform-Based Entrepreneurial Firms: The Logic of Dialectic Tuning. *Journal of Management Studies*, *60*(3), 605–638. https://doi.org/10.1111/joms.12854

Appendix

A1: Consortium-intern survey

Personal information

	Personal information
1	Please enter your name
2	Please enter your e-mail
3	Please enter your organisation

Sustainable ReMuNet Business Model

	Business Model – Value Proposition (What?)
4	What value does ReMuNet provide to its users?
5	How can interactions between stakeholders create additional value?
6	How can ReMuNet facilitate the interactions between stakeholders via the platform?
7	Which other types of interactions between participants should ReMuNet enable, beyond service offerings and information?
8	Which stakeholders must be integrated for the platform to succeed?
9	Which incentives would motivate stakeholders to actively participate?

	Business Model – Value Creation (How?) – Services
10	Which services must ReMuNet offer as core services?
11	Which complementary services would add value to the ReMuNet platform?
12	Which additional services could ReMuNet offer?
13	What specific services are essential for ReMuNet to effectively manage disruptions?
14	How can services be designed and improved to support sustainability?

	Business Model – Value Creation (How?) – Resources
15	Which data resources does ReMuNet need to offer its services?
16	Which IT infrastructure resources does ReMuNet need to offer its services?
17	How can ReMuNet facilitate the interactions between stakeholders via the platform?
18	Which algorithms does ReMuNet need to offer its services?
19	Which resources does ReMuNet need for effective disruption management?
20	Does ReMuNet currently lack resources in any of the previously mentioned resource types?
21	How can ReMuNet ensure that its resources are used efficiently and sustainably?

	Business Model – Value Creation (How?) – Services
22	Which ecosystem partners are essential for ReMuNet?
23	Why does ReMuNet need these partners?
24	What are key characteristics partners should have to ensure value creation?

25	Which complementary actors increase the benefits for all platform participants?
26	Which risks exist in the choice of partners?
27	How does data sharing influence the willingness to join the ReMuNet platform as partner?
28	How can sustainability be ensured in the selection of partners?

	Business Model – Value Creation (How?) – Sustainable Design Themes
29	Which ecological principles can be embedded into ReMuNet's value creation?
30	Which economical principles can be embedded into ReMuNet's value creation?
31	Which social principles can be embedded into ReMuNet's value creation?
32	Which sustainability aspects are most important?
33	Which business model patterns strengthen sustainability for ReMuNet?

	Business Model – Platform Participants (Who?) – Customer Segments
34	Which customer segments benefit from ReMuNet?
35	Within these segments, which specific roles gain the greatest value from the platform?
36	How can ReMuNet expand its customer base?
37	Beyond the customer segments already considered, which others could additionally gain value from ReMuNet in the long term?
38	How does data sharing influence the willingness to join the ReMuNet platform as customer?
39	How does ReMuNet manage customer relationship?
40	Which channels does ReMuNet use to interact with customers?

	Business Model – Platform Participants (Who?) – Enablers
41	Which stakeholders enable the ReMuNet platform ecosystem to function effectively?
42	Are there additional intermediary actors between ReMuNet and its users whose participation could enhance the platform's value creation?
43	Which governmental entities (regulatory authorities) are most relevant for collaboration? Why?
44	How should ReMuNet cooperate with them?
45	Which external roles strengthen the credibility and sustainability of the ecosystem?

	Business Model – Value Capture (Why?) – Cost Structure
46	Which types of costs does ReMuNet expect to incur?
47	Which investments are necessary to innovate and further develop the platform over time?
48	Which costs are fixed or recurring regardless of platform usage?
49	Which operational or variable costs fluctuate with platform activity?
50	Which compliance or regulatory costs are critical for ReMuNet?
51	Which risk-related costs should be anticipated to maintain platform resilience?
52	Are there additional costs or intangible resources that should be considered in planning?
53	How can understanding and managing these costs support ReMuNet's value capture, sustainability, and platform growth?

	Business Model – Value Capture (Why?) – Value Capture
54	Which direct monetization strategies fit best for ReMuNet?
55	Which indirect monetization strategies fit best for ReMuNet?
56	Which services can be monetised most effectively?
57	How could monetisation be structured to be cost-covering while remaining nonprofit?
58	How can value capturing strategies be communicated to the customer transparently?
59	How can ReMuNet generate revenue without undermining network effects or trust?

Sustainable ReMuNet Operator Model

	Operator Model – Operation
60	What describes ReMuNet's network structure best? a. One-sided b. Two-sided c. Multi-sided d. I don't know
61	Why did you choose this network structure?
62	What describes the user participation best? a. P2P (Peer-to-Peer) b. C2C (Customer-to-Customer) c. B2C (Business-to-Customer) d. B2B (Business-to-Business) e. I don't know
63	Why did you choose this user participation design?
64	How may users be affiliated with the platform? a. Registration b. Non-transaction c. Transaction d. Investment e. I don't know
65	Which actor roles are necessary within the ReMuNet platform for the different services and functions?
66	Should stakeholders be able to take on multiple actor roles?
67	Which access rights correlate with the actor roles?
68	What is the offering orientation of the ReMuNet platform? a. Product b. Result c. User d. I don’t know

	Operator Model – Ownership – Data
69	How should data ownership be designed within the ReMuNet platform? a. centralised (single owner) b. decentralised (peer-to-peer-community) c. consortium-based

70	Why should data ownership be designed this way?
71	Who provides the data that ReMuNet relies on?
72	Who should own the data once it is uploaded or generated within the ReMuNet platform?
73	What challenges do you see when it comes to data ownership in ReMuNet?

	Operator Model – Ownership – Services
74	How should service ownership be designed within the ReMuNet platform? a. centralised (single owner) b. decentralised (peer-to-peer-community) c. consortium-based d. I don't know
75	Why should service ownership be designed this way?
76	Who should take care of developing and managing ReMuNet's main services?
77	Who should decide which new services or features are added to ReMuNet?
78	How should updates or changes to ReMuNet's services be planned and approved?
79	What challenges do you see in coordinating service development and management within ReMuNet?

	Operator Model – Ownership – IT Infrastructure
80	How should IT infrastructure ownership be designed within the ReMuNet platform? a. centralised (single owner) b. decentralised (peer-to-peer-community) c. consortium-based d. I don't know
81	Why should IT infrastructure ownership be designed this way?
82	Who should own or manage the technical infrastructure behind the ReMuNet platform?
83	Who should be responsible for maintaining and operating ReMuNet's technical infrastructure?
84	How should IT security be handled within ReMuNet, and who should be in charge of it?

	Operator Model – Governance – Data
85	Which types of data does ReMuNet need to use?
86	Which data formats does ReMuNet need to use?
87	How and where should ReMuNet store data?
88	Who should have access to platform data?
89	Does the data access right depend on the data type?
90	Does the data access right depend on the actor role?

	Operator Model – Governance – Services
91	Who should be responsible for platform service governance?
92	What should the governance of platform services encompass?

	Operator Model – Governance – Control Rights

93	What level of authority should the platform operator hold over defining and adjusting the value capture mechanisms of the platform?
94	Who should control the design, maintenance, and evolution of the platform's technological standards?
95	To what extent should the platform operator determine the technical and procedural criteria for onboarding, integrating, or delisting third-party participants or partners?
96	Who should control service and data governance and access rights to data and services?
97	What rights should different participant groups have to join, leave, or change their roles within the platform ecosystem?
98	To what extent should participants be able to freely determine the terms of their interactions or transactions (e.g., pricing, matching, or collaboration) without operator intervention?
99	How much autonomy should participants have over creating, modifying, and presenting their content, products, or services on the platform?
100	Who should decide on implementing core technological upgrades, feature changes, or algorithmic modifications?

	Operator Model – Scaling Strategy
101	How could the platform network and its users be expanded in the future?
102	How could the platform services be expanded in the future?
103	How could the platform data be expanded in the future?
104	How could the platform ownership be expanded in the future?

	Performance Measurement
105	Which environmental KPIs should be most relevant for assessing ReMuNet?
106	Which economic or financial indicators should be most relevant for assessing ReMuNet?
107	Which social indicators should be most relevant for assessing ReMuNet?
108	How should these KPIs be measured or collected?
109	How frequently should KPIs be recorded and evaluated?

A2: Semi-structured Interview Guide

Preparing the Interview

As part of pre-interview exercises, the following aspects of data protection are considered:

1. The interviews will be conducted online using MS Teams and Microsoft Excel sheets.
2. The excel sheets will be processed and summarised reports will be made publicly available as part of project reports without individual identifiers. Interviewee consent will be sought before beginning the interview. The content developed in the interview is worked out together in Microsoft Excel. All records with identifiers will be stored in secure locations at FIR, accessible only to the team. These records will be available for up to 1 year after completion of the project. Results will be published anonymously and consolidated.
3. The terms of confidentiality and the format of the interview will be explained at the start of the interview. The interviewee will be given the opportunity to ask clarifying questions.
4. The meeting will be recorded using MS Teams and written notes in Microsoft Excel. The in-built transcription tool will be used to create first version of the transcript. This will be revised by the interviewers by listening to the recording

List of Interview Questions:

#	Guiding questions business model
1	How does ReMuNet create value for its users, and which resources, data, and partners are essential to enable this value?
2	How can ReMuNet develop a cost-covering, trust-preserving monetisation model that supports long-term scalability without undermining neutrality or network effects?

#	Guiding questions Operator model
3	Which ecosystem roles and responsibilities are required for ReMuNet, and how should access rights, data quality, and service accountability be allocated?
4	How should governance, ownership, and decision-making be structured to ensure ReMuNet is operated in a neutral, reliable, and scalable way?

A3: Sources of industry examples

Digital Plat-form	Quelle
FED-eR-ATEFEDD	FEDeRATED. (2024). *FEDeRATED Reference Model*. https://federatedplatforms.eu/images/Library/Activity2/FEDeRATED_Reference_Architecture.pdf FEDeRATED. (2022, August 29). *The FEDeRATED proposition*. https://www.federatedplatforms.eu/index.php/the-federated-proposition FEDeRATED. (2024, March 5). *FEDeRATED Masterplan to support supply chain growth engineering*. www.federatedplatforms.eu/index.php/news/78-federated-masterplan-available-to-support-supply-chain-growth-engineering FEDeRATED. (2024, April 17). *FEDeRATED Consultation Panel Report 2022 MILESTONE 11*. https://www.federatedplatforms.eu/index.php/library/item/11-consultation-panel-report-2022-milestone-11 FEDeRATED. (2025). *Library*. https://www.federatedplatforms.eu/index.php/libraryCrivelli, F., & FEDeRATED (2020, August). FEDERATED_Discussion_Paper_Semantics_-_Reference_Model_-_August_2020.
Clusters 2.0	CORDIS - Forschungsergebnisse der EU. (2023, April 17). *Logistische Clusterlösungen für ein nachhaltiges und vollständig integriertes Verkehrssystem*. https://cordis.europa.eu/article/id/413524-logistics-clusters-solutions-for-a-sustainable-and-fully-integrated-transport-system/de Cluster2.0. (2025, October 16). *The background*. http://www.clusters20.eu/the-project/ Cluster 2.0. (2019, September 6). *D.2.5 Handbook for Smart Clusters Development*. http://www.clusters20.eu/wp-content/uploads/2019/09/Clusters_2.0_D2.5-Handbook-for-Smart-Clusters-Development-FINAL-VERSION_IBI-20190829-1.pdf
SETO	SETO. (2025, October 16). *Smart enforcement of transport operations*. https://setoproject.eu/ SETO. (2025, October 16). *About*. https://setoproject.eu/about SETO (2023, June). D5.4 - Engagement Strategy and Action Plan, including stakeholder mapping and community analysis. CORDIS - EU research results. (2025). *Periodic Reporting for period 1 - SETO (Smart Enforcement of Transport Operations)*. https://cordis.europa.eu/project/id/101103695/reporting
Transporeon	Transporeon. (2025). *Transporeon-Web*. https://login.transporeon.com/login/?return=https%3A%2F%2Flogin.transporeon.com%2F Transporeon. (2025). *Transport Execution Hub*. https://www.transporeon.com/de/platform/transport-execution-hub Trimble. (2025, October 16). *Trimble to Acquire Transporeon to Strengthen and Accelerate Connect & Scale Strategy*. https://news.trimble.com/2022-12-12-Trimble-to-Acquire-Transporeon-to-Strengthen-and-Accelerate-Connect-Scale-Strategy Trimble. (2023, April 3). *Trimble Completes Transporeon Acquisition*. https://www.prnewswire.com/news-releases/trimble-completes-transporeon-acquisition-301788152.html Transporeon. (2025, October 16). *Transporeon macht den Gütertransport so einfach wie möglich.* https://www.transporeon.com/de

	Transporeon. (2025, October 16). *Kontakte zu Verladern knüpfen und mehr Aufträge erhalten*. https://www.transporeon.com/de/plattform/freight-sourcing-hub/spediteur-logistikdienstleister/carrier-premium-account Transporeon. (2025, October 16). *Intelligenter und effizienter Frachteinkauf*. https://www.transporeon.com/de/plattform/freight-sourcing-hub Transporeon (2025): Herausfordernde Zeiten erfordern anpassungsfähige Lösungen! Available online at https://www.transporeon.com/de/plattform. Gert Nuyts, & Transporeon. (2025, July 16). *Setting up your users*. https://intercom.help/transportoperations/en/articles/5559242-setting-up-your-users
Uber Freight	Uberfreight. (2025, October 15). *Willkommen beim Uber Freight Support*. https://help.uber.com/freight Uberfreight. (2025, October 15). *Uber Freight Logins*. https://www.uberfreight.com/login/ Uberfreight. (2025, October 15). *Powering intelligent logistics*. https://www.uberfreight.com/ Uberfreight. (2025, October 15). *Join one of the industry's largest carrier networks*. https://www.uberfreight.com/carrier/ Uberfreight. (2025, October 15). *About us*. https://www.uberfreight.com/about-us/ Uberfreight. (2024, September 10). *Uber Freight Advances End-to-End Logistics with Platform Enhancements, Generative AI-Powered Tech and Expanded Final Mile Offerings*. https://rss.globenewswire.com/de/news-release/2024/09/10/2943797/0/en/Uber-Freight-Advances-End-to-End-Logistics-with-Platform-Enhancements-Generative-AI-Powered-Tech-and-Expanded-Final-Mile-Offerings.html Uberfreight. (2020, January 24). *Introducing an improved web portal for carriers and dispatchers*. https://www.uberfreight.com/blog/how-to-use-the-uber-freight-web-portal
Convoy	Convoy (2025, October). SUPPLY CHAIN VISIBILITY AND THE DIGITAL FREIGHT NETWORK. Convoy. (2025, October 15). *ELEVATE YOUR BROKERAGE*. https://convoy.com/brokers/ Convoy. (2025, October 15). *Earn more with less hassle*. https://convoy.com/carriers Convoy. (2025, July 28). *DAT to acquire the Convoy Platform from Flexport*. https://www.dat.com/company/news-events/news-releases/dat-to-acquire-convoy-platform-from-flexport Convoy. *Convoy Platform*. https://convoy.com/
Flexport	Flexport, & Vivek Kishore. (2025, May 25). *Supply Ecosystem Integrations that are Powering Flexport Platform to Make Global Trade Easy*. https://flexport.engineering/supply-ecosystem-integrations-that-are-powering-flexport-platform-to-make-global-trade-easy-846a91fa94ef Flexport. (2025, October 15). https://www.flexport.com/company/about-us/ Flexport. (2025, October 15). https://moge.ai/de/product/flexport Flexport. (2025, September 28). *ShipperGuide TMS Software Review 2025: Features, Integrations, Pros & Cons*. https://www.capterra.com/p/207128/Loadsmart
Loadsmart	Loadsmart. (2025, October 15). *We are Loadsmart. We are the future of freight.* https://loadsmart.com/about Loadsmart. (2025, October 15). *Optimize shipping operations with our next generation Transportation Management System*. https://loadsmart.com/shipper/shipperguide

	Loadsmart. (2025, October 15). *Loadsmart's Next-Gen Transportation & Logistics Solutions*. https://lp.loadsmart.com/loadsmarts-next-gen-transportation-logistics-solutions?_gl=1*1xe7xiu*_gcl_au*MTcyMTczMzgxNC4xNzU4NjIwMTc2*_ga*OTUwNzU0OTY2LjE3NTg2MjAxNzY.*_ga_JFPJ1FMNWM*czE3NTg2MjAxNzYkbzEkZzEkdDE3NTg2MjA3NjYkajM2JGwwJGgw Loadsmart. (2025, October 15). *Everything you need to move more with less, in one place*. https://loadsmart.com/login/ Loadsmart. (2025, October 15). *240424 [ONE PAGER] Security, Compliance, and Trust at Loadsmart.pdf*. Loadsmart. (2021, July 16). *Loadsmart Launches Data Insights Product to Strengthen Shipper Operations*. https://loadsmart.com/about
Sennder	Sennder. (2025, October 15). *Verlader*. https://www.sennder.com/de/versender Sennder. (2025, October 15). *Terms & Conditions for orcas*. https://www.sennder.com/lv/terms-conditions-orcas Sennder. (2021, February 11). *sennder licenses SaaS platform to Zeitfracht, as part of a new strategic partnership*. https://www.sennder.com/press/sennder-licenses-saas-platform-to-zeitfracht-as-part-of-a-new-strategic-partnership Sennder. (15.102025). *Frachtführer*. https://www.sennder.com/de/frachtfuehrer Sennder. (15.102025). *EST-GESCHÄFT VON C.H. ROBINSON SCHLIEßT SICH SENNDER AN JETZT UNTER DEN TOP 5 DER KOMPLETTLADUNGSANBIETER IN EUROPA*. https://www.sennder.com/de
DSV A/S	DSV. (2025, October 15). *Warum DSV das Transport- und Logistikunternehmen der Wahl sein sollte*. https://www.dsv.com/de-de/warum-dsv DSV. (2025, October 15). *myDSV*. https://www.dsv.com/de-de/warum-dsv/connectivity/mydsv DSV. (2025, October 15). *Lösungen für Technologie- und Elektronik-Logistik*. https://www.dsv.com/de-de/unsere-loesungen/branchenloesungen/technologielogistik DSV. (2025, October 15). *HALF-YEAR 2022 RESULTS*. https://investor.dsv.com/static-files/b0548080-9163-4767-9ae9-6a334ab36f51 DSV. (2025, October 15). *DSV Self Services*. https://www.dsv.com/de-de/hilfe/self-services DSV. (2025, October 15). *Company structure*. https://www.dsv.com/en/about-dsv/company-structure
Amazon Fulfillment Network	Amazon. (2025). *Amazon FBA for beginners*. https://sell.amazon.com/blog/amazon-fba-for-beginners Warehousing1. (2025). *Was ist Fulfillment by Amazon? Definition FBA | Logistik-Lexikon*. https://warehousing1.com/blog/glossar/fulfillment-by-amazon-fba/ Amazon. (2025). *Selling Partner API Roles*. https://developer-docs.amazon.com/sp-api/lang-en_EN/docs/roles-in-the-selling-partner-api Neubecker, H. (2018). *FBA – Fulfillment by Amazon – Verkauf und Versand für Händler*. https://www.microtech.de/blog/fba-fulfillment-by-amazon/#elementor-toc__heading-anchor-3 Amazon. (2023). *Fulfillment by Amazon: How improving delivery fueled independent seller growth and success*. https://www.aboutamazon.com/news/small-business/fulfillment-by-amazon-how-improving-delivery-fueled-independent-seller-growth-and-success

Shopify Fulfillment Network	Shopify. (2025). *Shopify – Pläne und Preisgestaltung*. https://www.shopify.com/de/preise Shopify. (2025). *Registrieren – Shopify*. https://accounts.shopify.com/signup?rid=b4833b81-f1e5-4cf6-a7ae-193942cd2b45 Shopify. (2025). *Outsource fulfillment with Shopify Fulfillment Network*. https://www.shopify.com/fulfillment Shopify. (2025). *Fulfillment Network*. https://help.shopify.com/en/manual/fulfillment/shopify-fulfillment-network
TradeLens	Vaske, H., & Trueman, C. (2022). *Aus für TradeLens-Plattform: IBM und Maersk stellen Blockchain-Projekt ein*. https://www.computerwoche.de/article/2818818/ibm-und-maersk-stellen-blockchain-projekt-ein.html International Container Terminal Services, Inc. (2020). *ICTSI connecting its global network of terminals to TradeLens Blockchain network*. https://www.ictsi.com/press-releases/ictsi-connecting-its-global-network-terminals-tradelens-blockchain-network Krause, F. (2019). *TradeLens | Maersk und IBM Supply Chain*. https://blockchain-welt.de/tradelens-maersk-ibm-supply-chain/ MAERSK. (2020). *Amid surging use of digital solutions, TradeLens gets boost as major carriers finalize data integration*. https://www.maersk.com/news/articles/2020/10/15/tradelens-amid-surging-use-of-digital-solutions
Shippeo	Business Wire (2025): Real-Time Transportation Visibility Data-as-a-Service from Shippeo Now Available as SAP Endorsed App on SAP Store. Available online at https://www.finanznachrichten.de/nachrichten-2025-09/66330257-real-time-transportation-visibility-data-as-a-service-from-shippeo-now-available-as-sap-endorsed-app-on-sap-store-004.htm. Gartner, Inc. (2025). *Shippeo Platform Reviews, Ratings & Features 2025 | Gartner Peer Insights*. https://www.gartner.com/reviews/market/real-time-transportation-visibility-platforms/vendor/shippeo/product/shippeo-platform Shippeo. (2022). *Shippeo introduces Carbon Visibility, enhances Ocean and Road Visibili - Press releases*. https://www.shippeo.com/press-releases/shippeo-introduces-carbon-visibility-and-brings-powerful-new-features-to-ocean-and-road-visibility Shippeo. (2025). *Der weltweit meist empfohlene Anbieter für Transporttransparenz*. https://www.shippeo.com/de Shippeo. (2025). *Login | Shippeo*. https://auth.shippeo.com/auth/main/login/identifier?response_type=code&client_id=cbe7ef40-199b-49fc-a7ef-40199b49fc48&state=X3RDQ1FGUVNiMWRIZmR3aDJTQ1NnSTZ-fZVdzSEVMTnhmRV9qNGJ-MUpBRElNsemicolon%2Fredirect-home&redirect_uri=https%3A%2F%2Fweb.shippeo.com%2F&scope=openid+profile+offline_access+full_profile+termsOfUse%3A1.0&code_challenge=ISDumTGu-W8tT578yfp1oLiSY3-h8UcBJ1AFBgVTX8Q&code_challenge_method=S256&nonce=X3RDQ1FGUVNiMWRIZmR3aDJTQ1NnSTZfZVdzSEVMTnhmRV9qNGJ-MUpBRElN Shippeo. (2025). *Our Network | Shippeo*. https://www.shippeo.com/en/platform/our-network Shippeo. (2025). *Über uns | Shippeo*. https://www.shippeo.com/de/company/about-us

The project

ReMuNet identifies and signals disruptive events and assesses their impact on multimodal transport corridors. It reacts quickly and seamlessly upon disruptive events in real-time. It supports TMS providers to improve route planning resilience. ReMuNet communicates alternative, pre-defined, multimodal transport routes to logistics operators and subsequently to truck drivers, locomotive drivers and barge captains. Through this, it enables a faster and adaptive multimodal network response. ReMuNet orchestrates route utilization, suggests transshipment points and optimizes capacity allocation, minimizing damage and shortening the recovery time. What is ReMuNet's core objective? As trailblazer for the Physical Internet, ReMuNet pursues the vision to enable and incentivize synchro-modal relay transport on European rail, road, and inland waterways to increase the holistic network resilience. It significantly reduces emissions and boosts freight transport corridor efficiency in case of disruptive events. stakeholders to ensure Europe-wide practicability and acceptance.

Coordinator: FORSCHUNGSINSTITUT FUER RATIONALISIERUNG (FIR)

PARTNER		SHORT NAME
fir at RWTH Aachen University	FORSCHUNGSINSTITUT FUER RATIONALISIERUNG	FIR
HANKEN	SVENSKA HANDELSHOGSKOLAN	HANKEN
PTV GROUP	PTV PLANUNG TRANSPORT VERKEHR GmbH	PTV
4PL Intermodal	4PL INTERMODAL GMBH	INT
MANSIO truck meets truck	MANSIO GMBH	MAN
Fraunhofer AUSTRIA	FRAUNHOFER AUSTRIA RESEARCH GMBH	FHA
HAFEN WIEN ein unternehmen der wienholding	HAFEN WIEN GMBH	HWI
WHITE	WHITE RESEARCH SRL	WRE
UIRR UNION INTERNATIONALE POUR LE TRANSPORT COMBINE RAIL-ROUTE	UNION INTERNATIONALE DES SOCIETES DE TRANSPORT COMBINE RAIL-ROUTE SCRL	UIR
CONTARGO® trimodal network	CONTARGO GMBH & CO KG	CON
vedia	VEDIAFI OY	VED

RØDE KORS	DANSK RODE KORS (DANISH RED CROSS)	DRC
FMI	ILMATIETEEN LAITOS	FMI
alice Alliance for Logistics Innovation through Collaboration in Europe	ALLIANCE FOR LOGISTICS INNOVATION THROUGH COLLABORATION IN EUROPE	ETP-ALICE
SCHACHINGER LOGISTIK Branchenlogistik weitergedacht.	SCHACHINGER IMMOBILIEN UND DIENSTLEISTUNGS GMBH & CO OG	SCH