



Deliverable 3.3 (V1.0)

The concept of multimodal marketplace and innovation platform functionality

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¹ **DATA** = data sets, **DEC** = Websites, patent filings, videos, etc; **DEM** = Demonstrator, pilot, prototype, **ETHICS**; **OTHER**; **R** = Document, report.

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Abbreviations

Abbreviation	Definition
3PL	Third-Party Logistics
4PL	Fourth-Party Logistics
ABR	Application Boundary Resource (a type of TBR)
AI	Artificial Intelligence
API	Application Programming Interface
AS-IS	Current state (of business model)
B2B	Business-to-Business
BM	Business Model
BMC	Business Model Canvas
CO ₂	Carbon Dioxide (emissions context)
CSRD	Corporate Sustainability Reporting Directive
DBR	Developer Boundary Resource (a type of TBR)
DMA	Digital Markets Act (EU regulation)
EDI	Electronic Data Interchange
EC	European Commission
eCMR	Electronic Consignment Note (for road logistics)
EU	European Union
GLEC	Global Logistics Emissions Council (emissions framework)
ISO	International Organization for Standardization (standards)
IT	Information Technology
JSON	JavaScript Object Notation (data format)
ML	Machine Learning
MP	Marketplace Platform (context-specific)
R&D	Research and Development
REST	Representational State Transfer (API style)
RFQ	Request for Quotation
SDK	Software Development Kit
SBR	Social Boundary Resource (platform governance)
SMEs	Small and Medium-sized Enterprises
TBR	Technical Boundary Resource (platform governance)
TO-BE	Future state (of business model)
WPL	Work Package Leader
WP	Work Package

Executive Summary

Work Package (WP3) aims to enhance understanding of collaborative value creation, value delivery, value capturing, and value sharing within innovative transportation and logistics marketplace ecosystems. This deliverable focuses on Tasks 3.3, 3.4, and 3.5. These tasks examine the innovative business models for the ADMIRAL marketplace, the governance model designed to support marketplace ecosystem operation and document the overall concept for the ADMIRAL marketplace. The content provides a comprehensive overview of the approaches and frameworks underpinning the development and future sustainability of the ADMIRAL marketplace.

Task 3.3 “Exploring New Innovative Business Models” focuses on identifying and assessing potential new Business Models (BM) for managing a digital logistics multimodal marketplace ecosystem. This includes a BM for the platform owner, a BM for developing logistics services within the marketplace, and a BM for using the logistics marketplace ecosystem to buy and sell services. The task was led by the University of Ljubljana (UL), with support from the Transport Innovation Association (TIA), Steinbeis, and Technical Research Centre of Finland (VTT). The results and outputs of this task are presented in Chapter 1.

Chapter 1 defines and validates innovative BMs for the Advanced Multimodal Marketplace for Low-emission and Energy Transportation (ADMIRAL) digital logistics marketplace. The chapter analyses ‘AS-IS’ and ‘TO-BE’ models for key stakeholders, such as parcel providers, cargo owners, and transport companies, using cross-case comparisons to identify patterns and differences. It discusses how transitioning to a platform ecosystem can reshape TO-BE models and consolidates findings into cross-case conclusions. The qualitative research approach is outlined, including questionnaire design, sampling, and risk analysis related to joining ADMIRAL. Lastly, the validation process, including stakeholder workshops, is described, presenting finalised TO-BE canvases for three main stakeholder groups and highlighting changes, innovative aspects, and practical takeaways.

Three BMs were developed: platform owner, sellers and buyers, and complementors. These were further distilled into key takeaways for stakeholders. The complementor BM is particularly innovative, as it introduces logistics services that currently do not exist in the market. This model creates new roles, such as data and Application Programming Interface (API) products, certification-ready tools, and developer support, which facilitate an open ecosystem. The BM of the platform owner is also innovative, transforming the existing port-only marketplace into a comprehensive logistics ecosystem. It adds features such as partner enablement, governance, and monetisation opportunities beyond ports, formally integrating complementors into the value chain. For sellers and buyers, the changes are more evolutionary than revolutionary. These include enhancements focused on transparency—such as track-and-trace capabilities and emissions tracking—smoother onboarding processes, and options for low-emission alternatives. While we do not classify these as innovations, they are significant improvements aimed at better aligning with the ecosystem. Additionally, involving institutes, faculties, and logistics associations is beneficial. They can provide training, certification pathways, and advisory services that enhance the quality of the ecosystem, accelerate adoption, and reduce compliance risks for all participants. In summary, the new BMs for the platform owner and complementors are novel, while sellers and buyers experience pragmatic transformations.

Task 3.4 “Network development and governance practices”. Whereas Task 3.3 explores the potential business models for different stakeholder groups within the ADMIRAL marketplace, this task focuses specifically on examining the potential governance practices that could support the successful operation of the marketplace after the project. The aim is to identify governance mechanisms that ensure long-term sustainability, stakeholder engagement, and effective management beyond the project's lifecycle. This task was led by Technical Research Centre of Finland (VTT) with the other main contributions from the University of Ljubljana (UL), Awake.AI (AWA), and Universidad Politécnica de Madrid (UPM). The results and outputs of this task are presented in Chapter 2.

First, chapter 2 examines the concept of governance in the context of digital platforms and platform ecosystems (section 2.1). It then defines a governance framework (section 2.2), which will serve as the basis for developing the governance model for the ADMIRAL marketplace. The chapter also addresses several specific viewpoints (section 2.3), such as how to achieve a common understanding among marketplace participants, ensure the continuity of the marketplace, and what tools and levels can be applied to governance. By tackling these topics, the aim is to ensure that the management of the ADMIRAL ecosystem could be sustainable after the project itself has ended.

At the end of Section 2.4, a proposal for the governance model of the ADMIRAL marketplace is presented. This model is illustrated through two tables: one focusing on governance itself and the other on so-called boundary resources. The tables set out the choices and practices that have been jointly defined for the ADMIRAL marketplace, with input from both researchers and representatives from AWA. Many of the practices and tools highlighted have already been developed by AWA during the project, providing a strong foundation for further development of the marketplace after the project ends.

Task 3.5 “The concept of multimodal marketplace and innovation platform functionality” compiles the description of the ADMIRAL marketplace ecosystem. This task was led by Awake.AI (AWA) together with the Technical Research Centre of Finland (VTT) and supported by all ADMIRAL partners. This task combines results from different tasks and Work packages. Business models from task 3.3. Governance model from task 3.4 and description of marketplace functionality from WP4. Furthermore, the ADMIRAL marketplace overall vision represents a contribution of the whole ADMIRAL consortium. The results and outputs of this task are presented in Chapter 3.

The description of the concept consists of the following parts:

Overall vision: the vision describes the basic logic of the ADMIRAL marketplace ecosystem—what activities are possible and who the main actors are.

Defined actors: This section provides a more detailed description of the groups of actors participating in the operation of the marketplace and their respective roles. The actors are categorised into three groups: Core marketplace stakeholders, Complementor stakeholders, and In-direct stakeholders. Each group plays a distinct part within the ecosystem, contributing to the overall functionality and value creation of the ADMIRAL marketplace.

Business models: ADMIRAL project has defined proposed business models for different ADMIRAL marketplace user groups. These groups are buyers & sellers, complementors and the marketplace owner. Proposed business models are presented in detail in subsection 1.3.2 and Appendix A.

Governance model: The governance model provides a blueprint for how orchestration and decision-making are managed within the ADMIRAL marketplace ecosystem. The proposal for the governance model, together with both social and technical boundary resources, is set out in Section 2.4.

Functionality: This part presents the key functionalities of the ADMIRAL marketplace. The practical development work related to the marketplace has been carried out within Work Package 4.

Summary: platform canvas: This part provides a summary of the actors, activities, and definitions within the ADMIRAL marketplace ecosystem. The intention is that the reader can gain an overarching understanding of the operations and key elements at a high level, supported by the use of a canvas to illustrate these aspects.

In addition, this section presents lessons learned gained during the construction of the ADMIRAL marketplace and ecosystem. These reflections aim to provide valuable insights into what contributed positively to the project and highlight areas where further attention or improvement may be needed in future.

1. Exploration of new innovative business models

Companies explore and revise their BMs over time to develop a BM that is more attractive to their existing or targeted customers. BM exploration and renewal is a continuous process that helps companies stay relevant and competitive in a dynamic market environment. BMs have evolved in the digital age to take advantage of new technologies and changing consumer behaviours.

The aim of this task (Task 3.3) is to explore and assess potential new shared multimodal logistics BMs needed for the realisation of logistics services and a marketplace for low-emission freight. The existing BM have been examined and evaluated using BM Canvas (BMC) (to create a visual framework for representing key business components), cross-case analysis (to compare and contrast different cases to identify patterns, similarities and differences and understand how different companies operate and succeed under various conditions), etc. In addition, interviews have been important for capturing additional deep, qualitative insights.

The focus of this chapter is on BMC, which is a simple yet powerful tool for exploring and developing BMs. The chapter is divided into three sub-chapters: (1) a step-by-step guide on how to explore current BMs relevant to ADMIRAL marketplace with the BMC tool and which types of BMs exist, (2) a cross-case analysis of AS-IS and TO-BE BMs, focused on the potential modifications of BMs due to the use of a digital marketplace ecosystem and the overview of needs and challenges of the stakeholders that would enter the ADMIRAL marketplace, and (3) the identification of new and transformed BMs.

Figure 1 outlines the three-step approach adopted for BM analysis. Step 1 involved conducting a comprehensive review of BM transformations. Step 2 focuses on assessing both current and future BMs using the BMC. Drawing on the insights gained from these two steps, Step 3 proposes new BMs tailored to the different actors within the ADMIRAL marketplace ecosystem.




			
Phase objective	PHASE 1: Investigate business model transformation	PHASE 2: Audit curent (AS-IS) and future (TO-BE) business models	PHASE 3: Propose transformed business models for managing and utilizing ADMIRAL marketplace ecosystem
Key activities (What to do?)	Analysis of business model transformations	Map the current business models (AS IS business models) and future business models (TO BE business models) by explicating: <ul style="list-style-type: none"> - Value creation, Value delivery and Value capture. Analyze scope for business model transformation: <ul style="list-style-type: none"> - Number of business model blocks subject to change. - Magnitude of change within each block. Map shortcomings and opportunities	Design and develop a transformed business models based on the ADMIRAL marketplace requirements and partners aims: <ul style="list-style-type: none"> - Study on benchmark innovative business models from other firms and industries. - Achieve internal alignments (partners departments) and reach agreement on business models (revised value creation, value delivery, value capture + ensure that all business model blocks fit together)
Methodology	State-of-the art review	Canvas business model analysis, online questionnaires + interviews (potentially)	State-of-the-art review, Canvas business model
Phase outcome	Mapping and understanding types of transformations	The current business model made explicit, including shortcomings, opportunities and scope for transformation	Innovative business models per individual groups of ecosystem partners and managers/owners

Figure 1. A three-step approach to Task 3.3.

This deliverable contains extensive content. To support different audiences:

- **Service buyers and sellers** may focus on **Chapters 1.2.1-1.2.3, 1.2.7 and 1.3.2.1.**
- **Complementors** may focus on **Chapters 1.2.1, 1.2.2, 1.2.4, 1.2.7 and 1.3.2.3.**
- **The platform owner** may focus on **Chapters 1.2.1, 1.2.2, 1.2.7 and 1.3.2.2.**
- **Policy and sustainable experts** may focus on **Chapters 1.2.7.4 and 1.3.2.**
- **Academic researchers** may focus on **Chapter 1.3.2.4.**

1.1 Investigating BM transformation

1.1.1 What is a BM and BMC

A BM is a strategic framework that outlines how a company creates, delivers, and captures value. It describes the rationale of how an organisation operates, including its products or services, target customers, revenue streams, and cost structures. A well-defined BM helps businesses understand their position in the market and guides decision-making processes. Key components of a BM often include value proposition, customer segments, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure.

A standard tool used to represent BM visually is the BMC, which provides a clear and concise overview of the key elements and how they interact with each other. The BMC is a management tool, developed by Alex Osterwalder and Yves Pigneur, for describing an organisation's BM (Osterwalder and Pigneur, 2010). It is a one-page document, developed based on theory and science methods for BM development, and it helps organisations to understand their BM by visualising the elements of it and internal connections that have an impact on value creation (Joyce and Paquin, 2016). Sorri et al. (2019) state that BMC has become the de facto diagnostic tool for businesses to understand value creation potential. To achieve innovation in the company by using BMC, one must start by stating and visualising the current elements in the organisation or detailing an organisation's existing BM. Based on this, organisations can then assess their businesses and explore the potential changes (Joyce and Paquin, 2016).

BMC describes the logic of businesses through nine building blocks that cover four areas of business: customers, offer, infrastructure and financial viability. The nine building blocks that are included in the document are presented in Figure 2 (Osterwalder and Pigneur, 2010).

The right side of the Canvas is focused on the customer or the market, which are factors that the company can't control – external factors. The left side of Canvas is focused on internal factors that a company can control. In the middle is the value proposition, which shows what you give to your customers and what they give back to your business. Costs and revenue-related factors are positioned at the bottom of the Canvas BM. Canvas sections are presented in detail below.

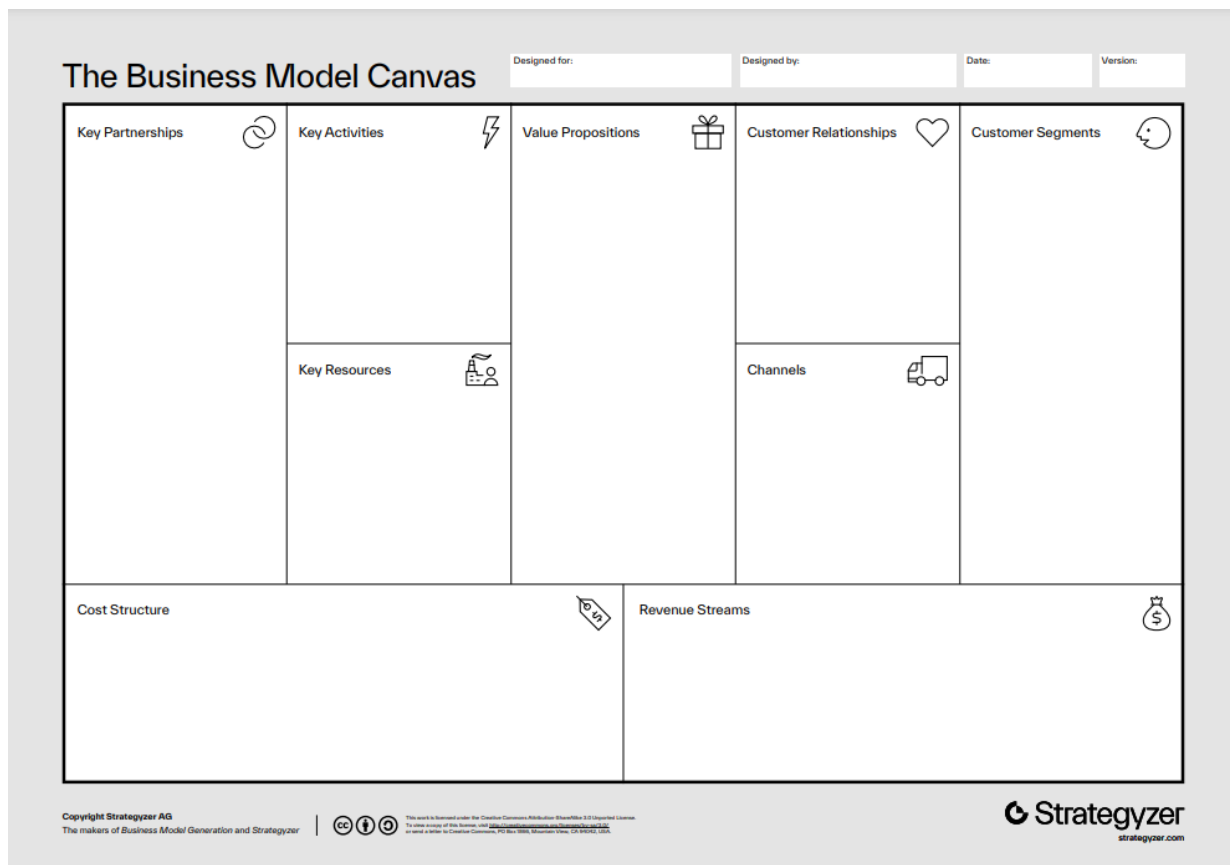


Figure 2. BMC (Source: <https://www.strategyzer.com/>).

Following is a detailed explanation of each Canvas section, including examples and questions a company need to ask when preparing a BMC:

Key partners/partnerships

Key partners are external companies that assist in a company’s main activities. These partnerships lower risks and get resources to the company (e.g. getting raw material for producing a product or semi-product, providing transport or any other service).

Types of partnerships that a company can form with its key partners include Typical relationships with buyers, suppliers, logistics providers; joint ventures or partnerships between competitors as well as those between non-competitors.

Key activities

The key activities of a company are those that create value and ensure a successful business. These activities are required to reach markets, maintain customer relationships, create and offer a value proposition and earn revenues. They depend on BM type, e.g. for a software maker, key activities include software development (Osterwalder and Pigneur, 2010).

Key resources

Key resources are all assets required to make the business operate successfully. They are necessary for companies to reach markets, create and offer a valuable proposition, maintain relationships with customers and earn revenues. Key resources can be in different forms, e.g. they can be physical,

financial, intellectual or human. They are owned or leased by the company or key partners (Osterwalder and Pigneur, 2010).

Value proposition

This is the central building block of the BMC, and it is considered the most crucial element of the model (as depicted in Figure 2). It represents the company's product or service, offered to customers. Some companies offer new things on the market while others offer an existing product or service with added features or attributes (Osterwalder and Pigneur, 2010).

Value propositions can be either quantitative (price, speed of service) or qualitative (customer experience or design).

Customer relationship

A customer relationship section outlines how a company engages with its customers and fosters and enhances customer relationships. To correctly identify the types of customer relationships, it is helpful for a company to recognise the various stages that its customers go through when interacting with the company. Customer relationships can be personal or automatic and are more often driven by the following motivators: customer acquisition, customer retention or boosting sales (Osterwalder and Pigneur, 2010).

There are several types of customer relationships that businesses can have, such as personal assistance, dedicated personal assistance, self-service, automated services, communities and co-creation.

Channels

This section outlines how a company communicates and engages with its customers. Channels represent the various points of contact through which customers can connect with a company.

Channels are vital in building awareness of company's product or service among customers, helping customers evaluate company's value proposition, allowing customers to purchase products and services, delivering a value proposition to customers and providing post-purchase customer support (Osterwalder and Pigneur, 2010).

There are two main types of channels: owned channels and partner channels.

Customer segment

The customer segment block of the BMC focuses on recognising the most significant customers to whom a company aims to provide value. These are the individuals or organisations that a company intends to target and sell its product or service to. To satisfy different customers, a company can divide them into groups based on their needs, behaviours and other attributes (Osterwalder and Pigneur, 2010).

A BM can target different customer segments such as (1) a general population with similar needs, and (2) a specific group of people with unique or slightly or very different needs.

Cost structure

In this section, a company needs to identify all the costs associated with running its BM. This includes evaluating the cost of creating and delivering its value propositions, creating revenue streams, and maintaining customer relationships. Once a company defines its key resources, activities, and partners, it is easier to evaluate these costs.

Costs can be classified into two main categories - fixed costs and variable costs.

Businesses can either be cost-driven, where the focus is on minimising costs whenever possible, or value-driven, where the focus is on providing maximum value to the customer.

Revenue streams

Revenue streams refer to the different sources through which a company generates income by selling its product or service to customers. In this section a company describes how it plans to earn revenue from its value propositions.

There are primarily two types of revenue models: transaction-based revenue and recurring revenue, which is generated from ongoing payments for continuing or post-sale services.

Prices can be fixed (list price, product feature-dependent, customer segment-dependent, or volume-dependent) or dynamic (negotiations or real-time market situation).

1.1.2 Type of BM transformations

A BM outlines how an organization creates, delivers, and captures value. It describes the key components, often referred to as “building blocks”, which include the product or service offering, target audience, revenue streams, and internal operations (activities and resources). Additionally, it explains how these elements work together to generate value for both the customer and the organization (Saebi et al., 2017; Demil and Lecocq, 2010).

Internal and external factors—such as the need to improve competitive positioning, respond to significant changes in the environment, or other considerations—often force companies to transform their BMs (George and Bock, 2011; Savič et al., 2016). BM transformation represents a change in the logic according to which value is created, delivered, and captured (Frishammar and Parida, 2019). A successful BM transformation can, and often does, involve change in several dimensions.

There are three primary options for BM transformation: (1) BM evolution, (2) BM adaptation and (3) BM innovation. The simplest alteration is the evolution of the BM, which mainly involves standardisation, replications, and primarily maintenance of the existing BM. BM adaptation involves changes that management makes to the existing BM in response to external factors such as shifts in the competitive environment, advancements in information and communication technologies, customer preferences, and supplier bargaining power (Saebi et al., 2017; Xie et al., 2022; Korneeva et al., 2023).

On the other hand, BM innovation requires management to actively conceptualise and implement new BMs that can respond to new conditions driven by either internal or external factors (Bucherer et al., 2012). This type of BM alteration necessitates changes in the overall configuration of the BM, (Codini et al., 2023; Bucherer et al., 2012).

Since the existing literature does not offer a widely accepted, operationalised method for assessing the innovativeness of business models, we adopted above mentioned theory-driven approach. We then applied these criteria to the BMs developed in this study and assessed, for each element, whether and how it exhibits the identified innovation characteristics.

Our evaluation of business model innovativeness is subject to several limitations. First, in the absence of a standardized and validated measurement instrument, our criteria for innovative or transformed BMs are derived from theoretical descriptions in the literature. Second, the classifications we propose are context-specific and may not be directly transferable to other industries or settings. Future research could build on our framework by developing more formal scales, testing them empirically, and examining inter-rater reliability across independent evaluators.

1.2 Understanding AS-IS and TO-BE BMs of stakeholders relevant to the ADMIRAL marketplace

To explore new innovative BMs introduced by joining a digital marketplace, it is crucial first to understand the current AS-IS BMs of potential marketplace users. The AS-IS BMs illustrate how a company (a potential marketplace user) is currently performing services without using a digital marketplace, but could potentially benefit from joining one. Based on these current BMs, TO-BE BMs will be designed to highlight the changes brought by selling and buying services on the digital marketplace. The TO-BE BM describes how an individual company will conduct business using the ADMIRAL marketplace.

This information is not only relevant for identifying new BMs but also provides the marketplace owner with insights into what customers will bring to the marketplace and what they need or require entering the marketplace.

Potential customers of the ADMIRAL marketplace include the following sellers:

- Sea port service providers.
- Land hubs/terminals service providers.
- Sea cargo transport providers.
- Digital services sellers.

Potential buyers of services on the ADMIRAL marketplace include:

- Cargo owners.
- Shipping lines and their representatives (shipping agents).
- Consumer and business-to-business (B2B) goods manufacturers.
- Governmental and nongovernmental organizations.

Methodological approach:

A three-step approach was used.

(1) Several stakeholders from the ADMIRAL consortium, together with some of their partners, were first introduced to the objectives of the task. The BMC, as well as the concepts of AS-IS and TO-BE business models, were explained in detail. Afterwards, they were asked to develop their AS-IS business models BMs.

(2) Following a review of the AS-IS models and feedback on specific elements, participants were asked to adapt and refine their AS-IS BMs to reflect how they intend to operate when using the ADMIRAL marketplace.

(3) Finally, a cross-case analysis was conducted within each stakeholder group (e.g. complementors, parcel providers). We examined similarities and differences across BMs in order to provide marketplace owners with richer input for defining and prioritising their requirements.

Among these mentioned sellers and buyers, the BMs of 13 different companies were analysed, covering seven different BM types (as shown in Figure 3). Two of these companies intend to buy services on the marketplace, while the others plan to sell either logistics or information technology (IT) services/tools (see Table 1). Among the twelve companies involved, excluding Awake.AI (AWA) as the marketplace owner, nine currently provide services to their customers, while the remaining three plan to introduce completely new service offerings.

Table 1. Sample of analysed BMs

Nr.	The name of a stakeholder	Admiral partner making a BM	Type of BM
<i>BMs of cargo owners</i>			
1.	Industrial company	VTT	Buyer
2.	Tehit	PS	Buyer
<i>BMs of freight forwarders/logistics operators offering transport services</i>			
3.	Intereuropa	PS	Seller
4.	Steveco	Steveco	Seller
5.	CargoGO	CargoGO	Seller
<i>BM of the multimodal marketplace operator</i>			
6.	Awake.AI (AWA)	Awake.AI	n/a
<i>BMs of the package providers</i>			
7.	Post of Slovenia	PS	Seller
8.	Croatian Post	Croatian Post	Seller
9.	Locodels	Locodels	Seller
<i>BM of port operator</i>			
10.	Steveco	Steveco	Seller
<i>BMs of IT developers</i>			
11.	Trevio	TRE	Seller (IT developer)
12.	CargoSign	CSign	Seller (a tool developer)
<i>BM of port authority</i>			
13.	Port of Sines	MARLO APS	Seller (data provider)

In total, we obtained 13 BMs (Figure 3): 3 BMs from Finnish, Slovenian, and Lithuanian logistics providers offering transport services, three BMs from parcel providers in Slovenia and Croatia, two BMs from cargo owners in Slovenia and Finland, one BM from a platform owner, and one BM from a port operator.

All these companies were able to create AS-IS and TO-BE BMs because they already provide services to their customers and plan to offer these services on the ADMIRAL marketplace. Additionally, two IT developers from Lithuania and one port authority from Portugal are currently not offering services that will be available on the ADMIRAL marketplace. As a result, they were not able to create AS-IS BMs.

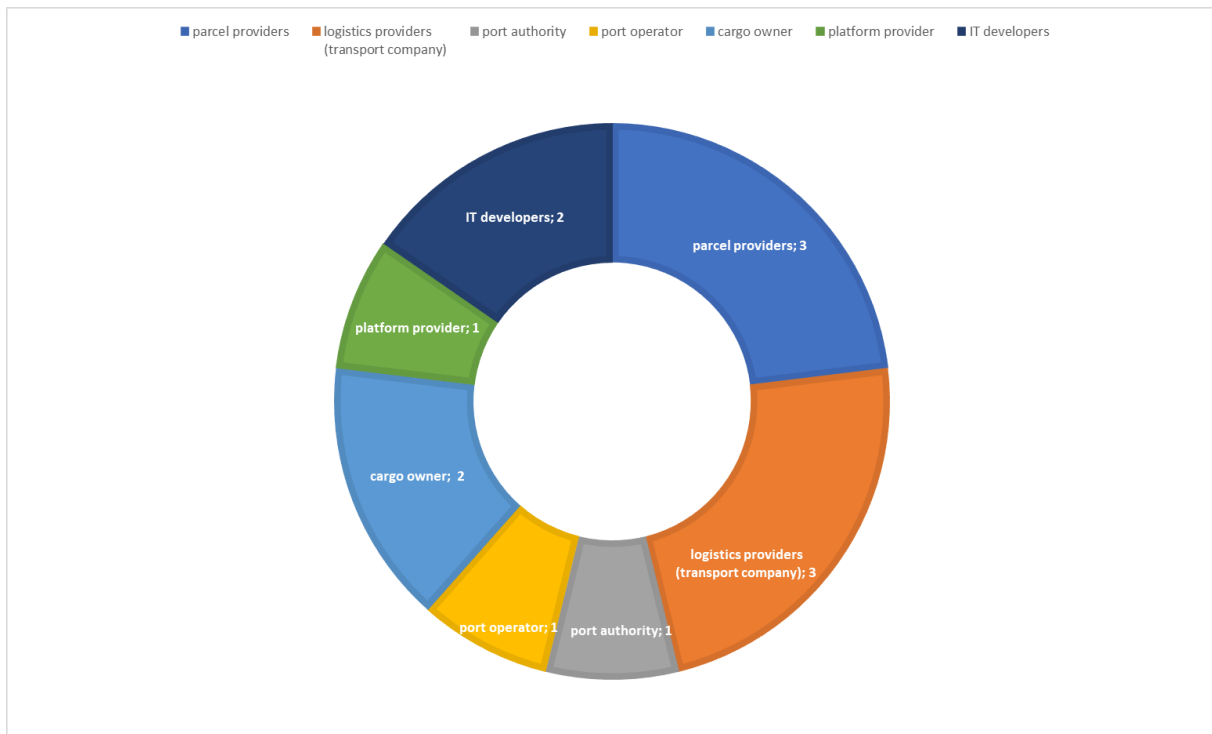


Figure 3. Types and number of investigated companies.

This study has several **limitations**. First, the number of BMs analysed is relatively low. In addition to the BMs of the project partners, we obtained BMs from only three additional companies that were willing to participate in the analysis. However, these companies did not agree to take part in interviews in the later phases of Task 3.3. Second, the results cannot be generalised to a broader population. To increase the robustness and generalisability of the findings, future research should analyse a larger and more diverse sample of BMs and, where possible, combine BM analysis with follow-up interviews.

1.2.1 Cross-case analysis of AS-IS BMs

Ten AS-IS BMs have been obtained: three from parcel providers, two from cargo owners, three from transport companies, one from a port operator and one from a platform provider (see Figure 3). All these stakeholder groups are potential partners or customers of the Admiral marketplace. Thus, it is essential to understand what each group can bring to the marketplace and their requirements for using it. This sub-section focuses on what companies from these different stakeholder groups are

contributing to the Admiral marketplace. Risks and requirements are beyond the scope of this subsection.

To gather the necessary data for the Admiral marketplace owners, we analysed the BMs of four distinct types of companies that complete AS-IS BMs: (1) parcel providers, (2) cargo owners, (3) transport companies, and (4) port operators. We conducted a cross-case analysis of the BMs for each of the above-mentioned types of companies (Figures A1-A11). For the platform provider or owner, a case analysis was provided instead of a cross-case analysis, as we only obtained the AS-IS BM from one platform owner.

Cross-case analysis of parcel providers BMs

Three BMs of parcel providers were obtained (Figure A1). All three intend to sell their services in the marketplace. All three cooperate with subcontracting transport companies, and two also work with technology providers. One company identified the following **partners** as relevant: state administration, a gas dealer, a packaging material supplier, security and authentication providers, consulting and advisory firms, foreign post operators, and warehouse providers.

All three parcel providers own a distribution network. One has its own transport fleet, while the other two use external providers. Two have their own warehouse facilities, while one relies on external infrastructure. Two offer postal facilities, but all have their own staff. Two also have digital **resources**.

Customers: All three companies sell services to retailers, e-commerce companies, and individuals. Two provide services to governmental bodies, and one serves producers and several medical institutions.

Their **key activities** include collection and delivery operations (all three companies), delivery network management (two companies), and quality management (one company).

Value propositions: All three parcel providers offer innovative solutions and technologies to differentiate themselves from competitors. Two provide customised solutions, such as changing delivery options. Two offer greater accessibility and availability. Convenient pricing, access to the flow of goods and services, reliable delivery, security, customer support, and last-mile delivery optimisation were each mentioned once.

The most frequently used **communication channels** are websites, digital platforms, and physical counters (each mentioned twice), followed by email, phone conversations, and customer contact centres.

Two parcel providers enhance **customer relationships** through regular personal communication, while one seeks feedback to improve service quality. One provider offers self-service options (parcel lockers) in addition to personal communication. Another uses key account managers for their crucial customers, while one uses external apps for customer communication.

Costs associated with running the business include customer service costs (employee, transportation, technology, infrastructure, and external delivery partner costs) mentioned by all three providers, followed by financial, marketing, and administrative costs (each mentioned once).

Two parcel providers earn **revenue** through parcel and letter collection and delivery, retail sales, and financial services. Revenue from premium service fees, added value services, and digital services was mentioned only once.

Cross-case analysis of cargo owners BMs

Two BMs representing cargo owners were analysed, one from a larger company and the other from a smaller company (Figure A2). The larger company also engages in production operations, while the smaller company focuses primarily on retail and distribution. Both companies sell products to **business customers**, with the smaller company additionally catering to educational institutions and government bodies. The larger company's business customers are environmentally conscious, making it essential for the company to meet sustainability requirements. Both companies identified suppliers and transport companies as important **partners**, along with freight forwarders and industry associations.

Key activities and key resources: Both companies have internal logistics operations, which include warehousing, packaging, delivery, and billing. The larger company also engages in production and sales activities, necessitating the supply of raw materials, conducting research and development (R&D) activities, and maintenance of production facilities. In contrast, the smaller company does not produce products but acts as a retailer, focusing on product procurement and maintaining an online e-commerce platform for order processing and fulfilment.

Value propositions: The larger company serves eco-conscious business customers, placing importance on sustainability-related values such as eco-friendliness, low-emission production, and transparency regarding emissions information. Both companies emphasize efficiency, with the smaller company additionally highlighting quality assurance and a wide product range. Reliability in the supply chain is also a significant selling point for both companies. The larger company bases its customer relationships on long-term partnerships, focusing on delivering quality products that meet customer business needs.

The smaller company cultivates **relationships** through personalised interaction, customer support, and engagement. Its marketing channels include a website, search engine optimisation (SEO), content marketing, and social media marketing, while the larger company primarily uses direct sales.

Both companies manage physical products, leading to **costs** associated with internal and external logistics, as well as marketing and sales activities. In the larger company, production activities also incur costs, including the procurement of raw materials and emissions calculations.

The smaller company generates **revenue** through product sales, earning profit margins on shipping costs. The larger company sells products that meet customer needs, including those that address sustainability requirements.

Cross-case analysis of transport companies BMs

Three companies were identified under transport company category, two freight forwarding companies and one trucking company, which also provides freight forwarding **services** (Figure A3). One forwarder primarily serves a specific customer segment, while the other has a broad set of customer segments. The trucking company focuses mainly on customers who require truck transportation.

The **key activities** of the companies differ as well; so that the forwarders focus on organising transport and arranging shipping documents between different transport modes, while the trucking company focuses on efficient fleet management. Sharing data with partners and customers is a common activity for all three. The key resources reflect these activities respectively.

With regards to the **value proposition**, the forwarders emphasise the global reach of their business networks and the truck company their efficiency through route optimisation. For global reach, the forwarders need a variety of partners globally (e.g. transport providers, port operators, customs), including other forwarders. The truck company emphasises freight exchanges and telematics equipment providers as key partners (telematics companies are also mentioned by one forwarder).

Customer relationship is typically based on longer term (annual) contracts. Two companies mention personal approach to decision-makers as one key aspect. Two companies mention websites as one of their customer channels, other mentioned channels were phone, email and EDI-messages for direct communication channels and industry events and campaigns as indirect channels.

The **cost** structure profile follows the key operations of the companies, typical items being equipment related costs (e.g. maintenance, fuel), personnel salaries and different service fees (e.g. technology services). Revenue streams consist of fees from provided services, e.g. transportation, cargo handling, warehousing, and route planning.

Case analysis of port operator BMs

Only one BM from a port operator was obtained (Figure A4). This BM shows that its **partners** are transport companies, customs, the port authority, service providers (IT, machinery, and utilities), and subcontractors.

The main **resource** the port operator utilizes is port infrastructure, followed by employees, digital resources, and warehouses. These resources enable the **key activities**: warehousing, information sharing, and loading and unloading of ships.

Customers: The port operator sells services to the Finnish forest industry, their subcontractors, and the shipping lines of their choice.

Value propositions: The port operator differentiates itself by ensuring improved information flow and accuracy, enhanced terminal planning, optimized port call and service planning, and an efficient specialized cargo processing hub.

The port operator enhances **customer relationships** through daily operational contact, ongoing communication between decision-makers, and yearly high-level agreements. Most frequently used **communication channels** are websites, direct EDI messages between cargo owners, emails, and phone conversations.

Costs associated with running the business include expenses for employees, machinery, rents, and taxes. On the other hand, the **revenue** is generated through cargo handling, warehousing, and forwarding.

Case analysis of the marketplace owner BM

Digital platforms offer indispensable support in terms of automating and simplifying many processes and are as such changing various industries. AWA company is the only multimodal marketplace operator within the ADMIRAL project, so it is not possible to do the cross-case analysis, instead only description of their BM is given (Figure A5).

AWA provides digital support to maritime logistics. Its **key partners** are these maritime ports and shipping agencies; however, they can't function without software developers (SW), developers and SW integrators, as well as third-party data providers and third-party service providers.

Key activities include customer research, SW development, marketing, and go-to market activities, as well as piloting assistance and onboarding assistance. At the same time, the main value propositions are to sell faster and smarter as well as to buy faster and with more transparency. The customers are able to sell faster and smarter as the marketplace allows fast sales via digital channels, streamlining sales with efficient tools, slashing customer acquisition costs and expansion of sales to new ports. Buying faster and with more transparency is done by giving the customers the possibility to stay in control (by tracking customers' service fulfilment and resolving issues faster with the efficient system), supercharge the purchases (rapid, intelligent buying allows handling more needs with fewer resources), buy faster port services, and review seller quality (buying with more confidence from highly reviewed sellers).

The multimodal marketplace operator has three key strategies in **customer relationships**. AWA participates in key association events to provide the latest development and business opportunity news, sends emails on new developments and mails physical brochures to potential customers. Its **customer segments** are port service sellers, port service buyers, port authorities and data providers, and AWA reaches these customers via several **channels**, namely maritime events, maritime port associations, maritime shipping agents association, maritime websites and publications and maritime port events and publications.

AWA has two revenue streams: monthly seller and buyer subscriptions and one-time fees. With these revenues, they must cover the costs of cloud infrastructure, third-party data and service providers, marketplace headless SW engine provider, security and availability monitoring services and development costs (maintaining SW).

1.2.2 Cross-case analysis of TO-BE BMs

We obtained the following TO-BE BMs: Cargo owners: 3 BMs, Port operator: 1 BM, - Platform provider: 1 BM, - Transport companies: 3 BMs, - Complementors: 3 BMs. Among the complementors, 2 are IT and tool developers, and 1 is a data provider and integrator.

To gain deeper insights, we conducted a cross-case analysis of the TO-BE BMs. This analysis was categorised by company type, including cargo owners, transport companies, port operators, parcel providers, data providers and integrators, and IT and other tools developers. We also analysed only the changes in BMs based on the role of platform partners (sellers, buyers and complementors) (see Figure 4).

The purpose of this analysis was to identify commonalities and differences across the various BMs. These insights are designed to assist the platform owner in creating a robust platform ecosystem that attracts a diverse range of partners and facilitates the generation of significant added value.

Cross-case analysis of cargo owner BMs

As cargo owners use the ADMIRAL marketplace for purchasing transport **services**, there is no change in their customer segments. However, ADMIRAL marketplace could enable them to provide their customers with more accurate emissions data, thus enhancing their value proposition, especially towards emissions-aware customers. Other added value propositions include the ability to decrease their own emissions and build brand image.

Key activities of both cargo owners remain the same as well, but ADMIRAL marketplace provides an additional resource to carry out relevant activities, e.g. related to emissions calculations and reporting, as well as transport service purchasing (Figure A6).

For **customer relationships**, ADMIRAL marketplace could add sustainability-related community building and loyalty programs as new features of the marketplace (e-shop) compared to current relationship activities. The ADMIRAL marketplace adds one more channel, as well as a partner to the existing logistics platforms the cargo owners already partner with.

For the **cost** structure of the cargo owners, the ADMIRAL marketplace only adds its service fees; otherwise, the cost items remain the same. On the **revenue** side, the marketplace may add revenue from profit margins of sustainable shipping, and it may also offer an opportunity to tap into extra revenue from the European Emissions Trading System, though it may also add something on the cost side.

Cross-case analysis of transport companies BMs

The transport companies' cross-case analysis covers three companies (Figure A7). It reveals that from an ADMIRAL concept point of view, there will be changes in the BM building blocks. From the **key partners'** point of view, one company estimates that AWA platform's sellers and buyers and ADMIRAL customers will be new key partner types for them. Another company states that ADMIRAL's new viewpoint may bring eco-friendly transportation providers as key partners into their business environment.

From a **key activity** viewpoint, the ADMIRAL approach could bring sustainability-related services and practices to transport companies' service palette (two companies). These are, for instance, CO₂ emission monitoring, developing low-emission services, and sustainability reporting in real-time. One company also stated that the ADMIRAL approach could bring information sharing about arrivals and departures available to transport companies. This is true since the data platform of AWA enables sharing this kind of information and even creates AI-based estimations for arrivals and departures. There will also be new **key resources** for companies' business environment, enabling the new services and capabilities. These new resources include carbon footprint calculators, sustainability certifications, ADMIRAL marketplace, etc.

Two companies identified new **value propositions**. One reduced carbon footprint and sustainable logistics solutions and the other offering information about emissions.

One company expects to get new **customer segments**, such as Customers/companies with sustainability goals, Brands with a green reputation, Renewable energy companies, and Early adopters. Furthermore, only one company identified changes to the **customer relationship** and stated that the ADMIRAL approach will enable Transparency and Data sharing, Multilingual capabilities and Omnichannel support. Two companies identified new **channels**. One of them identified that the ADMIRAL marketplace will be a new channel to reach the customer. The other mentioned outbound campaigns and content marketing.

Changes to the **cost structure** were identified in only one company, stating employee training on eco-driving as a new cost type. Related to the **revenue streams**, two companies identified consultancy services (like eco-driving improvement) as a possibility. One company stated that it could get premium

pricing for low-emission options in logistics. Also, the ADMIRAL marketplace was mentioned as a possible revenue stream by one company.

Cross-case analysis of parcel providers BMs

Cross-case analysis of the future BMs of parcel providers revealed expected changes in all BM blocks (Figure A8). Three parcel providers anticipate contracting additional transport providers, with one specifically planning to **partner** with new entities like rail operators, airline transport companies, and crowdsourcing providers.

Two logistics providers foresee offering auditing and reporting **services** along with route optimization. Other activities mentioned included digital services, market education and advocacy, and transport scheduling, though these were noted less frequently.

Value propositions: All three parcel providers believe that offering services on the ADMIRAL marketplace will reduce carbon footprints and speed up deliveries, likely due to a wider array of partners. Additionally, two providers assert that the marketplace will enable data-driven insights, regulatory compliance, and improved visibility and transparency.

Two parcel providers maintain that personal assistance will remain necessary for **customer engagement**. They also plan to engage with customers through reviews, feedback requests, and data sharing. Education was mentioned only once.

Offering services on a digital marketplace will require additional **resources**, including technology infrastructure, regulatory knowledge, and supply chain management expertise, as noted by two providers. Auditing and reporting systems, educational and advocacy resources, and green technologies were mentioned once each.

Marketing and marketplace costs were identified as new elements in the **cost structure** block. Changes in revenue streams are anticipated due to the ADMIRAL marketplace, including transaction-based revenue, usage fees, subscription fees, and new revenue from green delivery and pickup services.

Finally, two parcel providers expect to gain new customers, including large corporations. One provider anticipates collaborating with non-profit organizations, and another with retailers.

Cross-case analysis of IT and other tools developers BMs

Cross-case analysis of the future BMs of IT developers revealed expected changes in all blocks (Figure A9). Companies anticipate partnering with new entities, such as transport companies, freight forwarders, telematic providers, freight exchange companies, event managers, networking platforms, and production companies, so that they can offer paperless logistics, automated CO₂ reporting and a transport scheduling tool.

Key activities of these companies include shipping and delivery, sales, marketing, providing responsive customer service, innovation, product development and technology infrastructure.

Their main channels would include direct sales to business customers, networking platforms, freight exchange platforms, event managers, value-added resellers, online marketplaces and partnerships.

To nurture relationships with customers (retailers, manufacturers and logistics companies), IT developers intend to ensure good customer support, seek feedback to enhance service quality, offer product personalisation and implement self-service and chatbot solutions.

IT developers assume they will require additional resources e.g. employees, partnerships and alliances, technological resources, contracts between different players in the logistical chain and Admiral marketplace.

Cost structure would include IT system support, sales, research and development. On the other hand, revenue would be generated from more automated and paperless administration, automated CO₂ calculation and reporting. Furthermore, revenue would be received from the receiver of the goods.

Case-analysis of the marketplace owner BM

AWA will expand its business in line with stakeholder expectations and recognised market opportunities, meaning it will go from maritime logistics to comprehensive logistics (Figure A10). Therefore, eight out of nine blocks in its BMC will be changed and upgraded. Only the key resources will remain the same as in the AS-IS model. In the TO-BE model, AWA will have nine **key partners**; in addition to those in the AS-IS model (maritime ports, SW developers, SW integrators, third-party service providers and third-party data providers), it will partner with land hubs, freight forwarders, cargo owners and shippers, as well as nine **customer segments**. The new segments include land hub service sellers and land hub service buyers, cargo transport sellers and cargo transport buyers, and integration developers, which are added to the existing segment of port service sellers, port service buyers, port authorities and data providers.

Its **key activities** will be expanded into complex software development (currently only SW development), developer assistance and a developer portal, business partner material and business partner portal, as well as a discussion forum for developers and business partners. AWA plans to drop out of piloting assistance and go-to market activities.

AWA key **value proposition** remains the same: selling faster and smarter and buying faster and with more transparency. However, the elements on which they are based are more diverse. AWA aims to provide its customers with European Union (EU)-wide visibility, increased revenue with environmentally friendly equipment, the ability to transparently display reduced emissions (outperforming the competition), increase their revenue by opening up multi-country, multimodal cargo routes (increasing their reach and profits), increase their customers satisfaction by streamlining their purchases with efficient tools and transparent cargo insights, expand effortlessly by gaining the ability to open up new routes and services with reduced costs, and finally, obtain cloud-based logistics selling/purchasing and management tools (which is especially beneficial for SMEs). The second key value proposition, that is to buy faster and with more transparency means that customers will be able to stay green with informed choices, easily switch to lower-emission logistics options for a sustainable business, receive post-transport emissions calculations for comprehensive reporting, simplify logistics by sourcing all multimodal, multi-country transport needs in one convenient platform, and issue simple or advanced Request for Quotations (RFQs) to compare quote and their emissions impact.

AWA plans to remove physical brochures and emails related to new deployments from **customer relationships** and replace those with a newsletter. Following the idea that sellers & buyers must have a forum where they can provide feedback and ideas for improvement means setting up a business

partner forum and a discussion board. Also, the **channels** through which AWA reaches its customers will expand. AWA foresees land-side cargo transport events, maritime and land cargo associations, maritime and land cargo websites and publications and finally maritime/ land hub port events and publications.

Given that AWA plans considerable expansion of its services, it is expected that the cost structure and revenue streams in the TO-BE model differ from those in the AS-IS model. **Cost structure** will, besides cloud infrastructure cost, include costs for marketplace headless SW engine provider, security and availability monitoring services and development costs (maintaining SW), including also costs of developer and business partner community, discussion forum, routing engine(s) and for 3rd-party emissions calculator(s). On the other hand, there will also be more **revenue streams** than in the current model, namely revenues from premium functionality features, premium vetting of organisations, paid listings placement on catalogue and search results, APIs usage fees, per customer requirements marketplace development and some sellers possibly in percentage commission mode, not fixed fee subscription. Of course, monthly seller and buyer subscriptions, as well as integration one-time fees, will still form part of the company's revenues.

Case analysis of a data provider and integrator BMs

The port of Sines operates according to the "Landlord Port" model (Figure A11). In this model, the port authority owns the port infrastructure and leases it to private companies that handle the cargo. The Port of Sines is one of the major deep-sea ports in Portugal, known for its strategic location and its ability to handle various types of cargo.

The **key partners** of the Port of Sines are the rail operator, dry ports, other port authorities and the NEXUS project. The list of five **key activities**, namely integration with NEXUS Open Data Platform, provision of data publishing environment for service providers, coordination of processes through JUL, calculation of transport service emissions, and the publication of logistics services on developed AWA Marketplace and other marketplaces through a single integration. To succeed with these activities, the following **key resources** are to be used: technology infrastructure for integration and development, access to freight mobility data, and expertise in logistics, digital platforms, and the environment. And by providing the key activities, the customers will benefit from several **value propositions**, namely integration for enhanced efficiency and collaboration, track and trace visibility, access to low-emission transport services and environmental responsibility (by tracking and minimising the total carbon emissions in transport).

The **customer segments** for Sines Port Authority are expected to be logistics service providers, customers who need logistics services and other marketplaces seeking to expand service offerings. The **customer relationships** shall include support for integration and API implementation, and collaboration and engagement to enhance service offering, drive innovation, and ensure alignment. They plan to reach their customers through several **channels**, basically integration with NEXUS, service providers' platforms for service publishing and contracting (JUL) and direct engagement with logistics stakeholders.

The most relevant costs in the Sines Port Authority **cost structure** related to the ADMIRAL marketplace are technology infrastructure, development and maintenance, partnership fees with platform providers and research institutions, operational costs for customer support and monitoring and

marketing and promotion expenses. On the other hand, the expected **revenue streams** will include subscription fees from logistics service providers, transaction fees from contracted services and potential revenue-sharing agreements with Marketplace operators.

1.2.3 Potential changes in TO-BE BM due to the platform ecosystem: focus on buyers and sellers

Five consortium partners (potential buyers and sellers) changes were investigated. The three companies not part of the consortium were excluded from this analysis, as they declined to participate in the subsequent steps of this task.

Figure 4 illustrates the various anticipated changes identified by potential buyers and sellers when adopting the ADMIRAL marketplace ecosystem. The changes most frequently mentioned are highlighted in grey.

Business Model Canvas		Changes from marketplace ecosystem use	Case studies 2,3-2x,4, 5 and 6	Date: 23.05.2024	Version: final
Key Partners Platform sellers and buyers (3x) Marketplace ecosystem operator Eco-friendly transportation providers (2x) E-commerce companies Airline transport companies Railway operators Crowdsourcing providers Eco-friendly packaging suppliers	Key Activities CO ₂ emissions monitoring and reporting (5x) Development of low-emission services (2x) Route optimization (2x) Digital services on the marketplace Information sharing on arrivals and departures (2x)	Value Propositions Lower emissions (3x) More accurate emission information for customers (3x) Improved visibility and transparency (2x) Competitive pricing Regulatory compliance (2x) Leveraging data-driven insights and optimization (4x) Fast delivery Adjustable time slots	Customer Relationships Omnichannel support Feedback and reviews (2x) Community building (3x) Personalized assistance and recommendations (3x) Education Loyalty programs via e-shop Community building via e-shop	Customer Segments Companies with sustainability goals (5x) Renewable energy companies E-commerce companies Large corporations (2x) Commercial freight transporters (2x)	
Key Resources Marketplace infrastructure (3x) Telematics and route optimization software Carbon footprint calculator (2x) Sustainability certificates Freight forwarding software Comprehensive data (2x) Supply chain management expertise (2x) Regulatory knowledge (3x) Green delivery fleet Education and advocacy resources			Channels Marketplace ecosystem (5x) Industry events (2x) Public relations Paid advertising (2x) Social media marketing		
Cost Structure Employee training on eco-driving Marketplace costs (fixed monthly fee / per-user fee) (5x) Marketing costs Investments in technology (4x)			Revenue Streams Automated CO ₂ calculation and reporting Consultations on eco-driving improvements and maintaining a low-emission company (2x) European Emissions Trading System (ETS) revenues Premium pricing for low-emission options/Profit margins on sustainable shipping costs (3x) Revenue streams from green services (e.g., green delivery and pickup)		

Figure 4. Changes of BMs Canvas for sellers and buyers in a digital marketplace ecosystem.

A comparative analysis of the changes in the TO-BE BMs of six sellers and buyers revealed that companies anticipate modifications in all nine blocks of the BMC. No building block remains unchanged. All six potential buyers and sellers of services within the marketplace ecosystem expect adjustments in key activities. Five companies foresee changes in key resources, channels, and revenue streams. Four companies reported expected changes in key partners and value proposition. Fewer changes (noted by three case companies) were identified in the area of customer segments and customer relationships.

Most changes are related to the options offered by the marketplace ecosystem for calculating emissions. The Corporate Sustainability Reporting Directive (CSRD) encourages firms to report their emissions. This presents an opportunity for case companies to partner with eco-friendly organisations, such as transport providers and packaging suppliers (n = 4 case companies) and attract new customers who care about the environment (n = 5 case companies).

For many case companies, automatic emission calculations represent a new avenue for offering and purchasing solutions (n = 5 case companies). The same applies to real data sharing, which would improve visibility and transparency.

Companies, on the other hand, anticipate additional costs (fees) associated with using a marketplace (n = 5 case companies), as well as the need to train personnel, which would also cause additional costs. However, some believe that they will generate more revenue by offering and using more environmentally friendly solutions, such as better pricing for low-emission options and a new value stream from offering green services.

Companies recognize that calculating emissions accurately based on real data necessitates robust data management and regulatory understanding, as noted by four case companies. Furthermore, two companies highlighted the significance of supply chain management expertise, particularly since the ADMIRAL marketplace provides multimodal transport options.

1.2.4 Potential changes in TO-BE BM due to the platform ecosystem: focus on complementors

Three consortium partners (potential complementors) changes were investigated. One of the companies is developing an IT solution for the platform, the other a tool related to emissions calculations and the third will enable the integration and provide data from several supply and logistics chain partners. Figure 5 illustrates the various anticipated changes identified by potential complementors when offering their services on the ADMIRAL marketplace ecosystem.

Key similarities:

- Ecosystem orientation: All three parties—CargoSign, Trevio, and Marlo—focus on a strong orientation toward a platform-based or ecosystem model.
- Common vision: They share a vision of a more digital and integrated logistics value chain, which allows them to collaborate efficiently using common "languages" of automation, data integration, and cost-effectiveness.
- Diverse stakeholder collaboration: They collaborate with multiple stakeholder groups (transport companies, freight forwarders, port authorities, etc.) and share some types of partners—transport and other logistics companies, owners of freight that need logistics services telematics providers.
- Technology infrastructure and data sharing: All complementors emphasise the importance of robust technology infrastructures and data-sharing environments. They rely on APIs, open data, and related tools to improve efficiency and collaboration throughout the logistics chain.
- Recurring cost structures and revenue models: IT system development and maintenance, along with partnership fees (including those with research institutions), are present in every BM. Additionally, all parties reference or anticipate revenue-sharing agreements with a marketplace operator, underscoring the need for flexible financial and contractual frameworks that promote co-investment.

Key differences:

- Niche differentiation: While each party operates within the broader logistics sector, they focus more specifically on certain sub-segments, creating specialised offerings. These differences are often synergistic rather than competitive, resulting in a more comprehensive set of solutions when combined.

- **Go-to-market strategies:** Although they share the same ultimate goal of digitising logistics, some companies rely more on direct sales, while others prefer networking platforms.

CargoSign, Trevio, and Marlo each contribute unique perspectives to the platform, but there is still an opportunity to incorporate new players, such as AI providers and predictive analytics specialists, to address unmet needs. By broadening the ecosystem in this way, the platform can offer a more comprehensive range of capabilities and better respond to the evolving demands of customers. Additionally, maintaining a diverse network of partners, including telematics, sensor, and compliance providers, will further enhance the platform's strength and ensure its long-term viability.

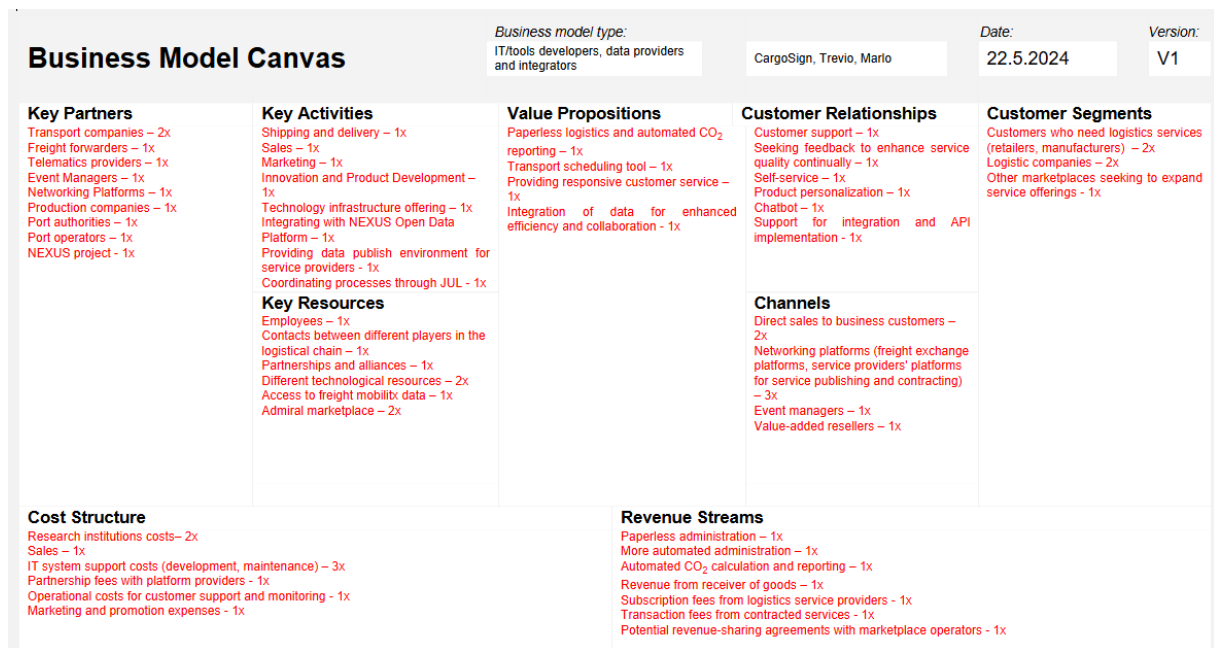


Figure 5. Changes in BMC for complementors.

1.2.5 Potential changes in the future BM from upgrading a digital platform to a digital platform ecosystem: focus on the platform owner

The comparison of AS-IS and TO-BE BMC of a platform owner indicates clear changes marked in red (Figure 6), which represent its evolution from a digital platform to a digital platform ecosystem capable of supporting multimodal transport emissions calculations.

Business Model Canvas		Transformations in marketplace ecosystem management	Platform provid	Date: 17.5.2024	Version: final	
Key Partners Maritime ports Land hubs Freight forwarders Shipping agents Cargo owners & shippers SW developers SW integrators 3 rd party service providers 3 rd party data providers	Key Activities Complex SW development Customer research Marketing Onboarding assistance Developer assistance, developer portal Business partner material and business partner portal Discussion forum for both developers and business partners Key Resources Sellers & buyers Port services to be traded Cargo transport services to be traded Web marketplace Cloud infrastructure Support personnel 3 rd party service providers 3 rd party data providers	Value Propositions Sell faster & smarter Slash customer acquisition costs Gain EU-wide visibility instantly Elevate revenue with eco-friendly equipment Showcase reduced emissions transparently Boost revenue with multi-country, multimodal cargo routes Streamline purchases with efficient tools and transparent cargo insights Unlock new routes and services with reduced costs Get cloud-based logistics selling/purchasing and management tools (especially for SMEs) Buy faster & with more transparency Stay green with informed choices Easily switch to lower-emission logistics options Receive post-transport emissions calculations for comprehensive reporting at your fingertips Source all your multimodal, multi-country transport needs in one convenient platform. Rapid, intelligent buying handles more needs with fewer resources Track your cargo seamlessly and resolve issues faster Advanced RFQs, easily compare quote and their emissions	Customer Relationships Sellers & buyers must have a forum where they can provide feedback and ideas for improvement (business partner forum and discussion board). Participation to key association events to provide latest development and business opportunity news Newsletter Channels Maritime events Land side cargo transport events Maritime and land cargo associations Maritime and land cargo web sites and publications Maritime / land hub port events and publications	Customer Segments Port service sellers Port service buyers Port authorities Land hub service sellers Land hub service buyers Cargo transport sellers Cargo transport buyers Data providers (sellers) Integration developers		
Cost Structure Cloud infrastructure Marketplace headless SW engine provider Security & availability monitoring services	Routing engine(s), 3 rd party emissions calculator(s) Development costs (maintaining SW) Developer & business partner community Discussion forum	Revenue Streams Monthly seller & buyer subscription Premium functionality features Premium vetting of organisations	Paid listings placement on catalogue and search results APIs usage fees Integration one-time fees Some sellers possibly in percentage commission mode			

Figure 6. Changes in BMC for the owner of a digital marketplace ecosystem.

The most substantial changes occur in the value proposition, key activities, customers and revenue streams blocks. These adjustments illustrate a strategic shift towards sustainability, multimodal logistics, technological advancement, and enhanced customer interactions.

The main reasons for transitioning to a platform ecosystem include the need for improved reporting on Scope 2 and Scope 3 emissions, the capability to support multimodal logistics chains, and the enhanced opportunities it offers to both developers and users of an online marketplace. Scalability is also a crucial factor. By adopting a platform approach, the platform provider expects to achieve significant revenue growth, a reduction in CO₂ emissions, access to new customer segments and a greater visibility and presence in international markets.

Creating value relies on developing new capabilities in collaboration with ecosystem partners. This involves building an emission calculator, offering premium features for larger enterprises, providing mechanisms to build trust, and utilising AI to improve various services (Figure 6). The platform provider recognises that human and financial resources are significant risks in achieving these goals.

The platform provider plans to **deliver value** in several ways (Figure 6):

- Cost savings: Increased competition among service providers in the marketplace will help reduce costs for end-users.
- Expanded transport options: This includes new possibilities such as rail transport, providing users with more sustainable choices.
- Improved efficiency: The platform will enable faster RFQs and reduce the time needed to find suitable logistics providers.
- Real-time visibility: Users will benefit from comprehensive tracking and situational awareness, which will assist in managing disruptions.
- Broad range of logistics services & tools: The provider will offer everything from specialized shipping options to advanced digital tools all in one place.
- Ease of use: The platform features a user-friendly interface and automated processes for a better user experience.

A representative of a platform provider stated, *“The platform ecosystem will enhance situational awareness and provide tools to handle disruptions and other issues during the cargo fulfilment phase, which will save costs and keep end-customers satisfied.”* He also emphasized the platform's potential to *“combine buying and selling into a single ‘silo,’ reducing many inputs and outputs, as well as the time spent managing multiple communication channels.”*

The provider anticipates collaborating with new types of customers and partners in EU countries. However, this transition to a platform ecosystem will require operational changes, such as automating billing cycles, updating terms of service, addressing privacy and legal aspects, and preparing for scenario detection. The provider believes that focusing on low-emission logistics, ensuring ease of use, and incorporating AI services will set them apart from competitors.

The provider plans to generate revenue primarily through a subscription model. As a representative of a platform provider explains, *“Our main revenue model is subscription-based, and we will introduce premium features about 6 to 12 months later. To attract a larger number of companies to the Marketplace, we will keep the subscription cost relatively low. Initially, we will likely offer three tiers: free, standard, and premium, which will be scaled based on the number of users and transactions allowed.”*

A platform provider acknowledges that maintaining and expanding the platform will incur additional costs, particularly for tools developed by external IT partners. However, they also anticipate benefiting from reduced marketing expenses and fixed costs once the marketplace gains traction.

1.2.6 Conclusions of cross-case analysis

Through a comparative cross-case analysis of the TO-BE Canvas BM *of five potential sellers and buyers in the ADMIRAL marketplace ecosystem*, we identified several key points:

1. **Key similarities:** All stakeholders intend to implement varying levels of digital transformation, expand partnerships, and focus on sustainability improvements. Joining ADMIRAL marketplace ecosystem signifies a shift from traditional, siloed operations to more integrated, data-driven approaches.
2. **Key differences:** The way each stakeholder leverages the marketplace depends on their role (seller vs. buyer), the resources they manage (in-house fleets vs. outsourced capacity), and the strategic importance placed on eco-friendly initiatives. Some stakeholders view these initiatives as a competitive differentiator, while others pursue them merely to comply with regulatory requirements.
3. **Frequency of changes in TO-BE BMC blocks:** Sellers and buyers have identified the most significant changes in their revenue models and key activities. These changes are followed by adjustments in key partners, value propositions, customer relationships, and cost structures. Furthermore, five businesses plan to revise their key resources, while four anticipate changes in their customer segments.

The analysis identifies which BMC blocks sellers and buyers are likely to modify. This information **helps the marketplace owner understand the types of support stakeholders may need.**

Since many stakeholders prioritise sustainability and are interested in investing in digital transformation, this **underscores the value that the platform aims to provide. This indicates that they are on the right track toward developing a sustainable platform ecosystem.**

Understanding the different roles of sellers and buyers, as well as the structures of their resources (whether in-house or outsourced), allows the marketplace owner to segment stakeholders effectively. This segmentation can lead **to customised onboarding pathways and solutions.**

Additionally, the analysis clarifies the types of new partnerships stakeholders expect to form, **enabling the marketplace owner to proactively establish relationships with suitable partners.**

Understanding value propositions and revenue models enables marketplace owners to identify the greatest demand, allowing them **to prioritise platform features that best align with emerging market needs.**

Through a comparative cross-case analysis of the TO-BE Canvas BM *of three potential complementors in the ADMIRAL marketplace ecosystem*, we identified several key points:

1. **Key similarities:** Although they operate in different niches, these organisations share a strong commitment to an ecosystem-based approach, a unified vision for a digitalised logistics value chain, extensive collaboration among stakeholders, and robust technology and data-sharing infrastructures. They also employ recurring cost and revenue models, which include revenue-sharing with marketplace operators.
2. **The key differences** between them lie in their niche specialisations and go-to-market strategies. Some focus on direct sales, while others prioritise partnerships and networking platforms.

Overall, each partner brings a unique perspective, and the entry of new players, such as AI providers, could further enhance the capabilities and resilience of the ecosystem.

1.2.7 Qualitative analysis insights into BMs changes and associated risks

Our analysis of the BMC for various types of logistics service providers and complementors has revealed both similarities and significant differences among them. While it is natural for companies to vary, these differences suggest the need for the modified approach we initially proposed in our application. This approach involves tailoring the BM for each type of partner, such as transport providers and manufacturers. Instead of this, we will evaluate the level of transformation required and recommend BM adjustments for four distinct stakeholder groups: (1) the platform owner, (2) sellers (providers of logistics services), (3) buyers (those who purchase logistics services, including manufacturers and retailers), and (4) IT/tool developers.

Additionally, while the BMC is useful for capturing key information, it does not provide the detailed insights necessary to fully understand the changes needed. To obtain more specific and in-depth information for Work Package 4 (WP4)—particularly for the ADMIRAL platform owner—we have decided to create four additional questionnaires for representatives of sellers/buyers, platform provider, IT and other tools developers, and service integrators (see Figure 7).

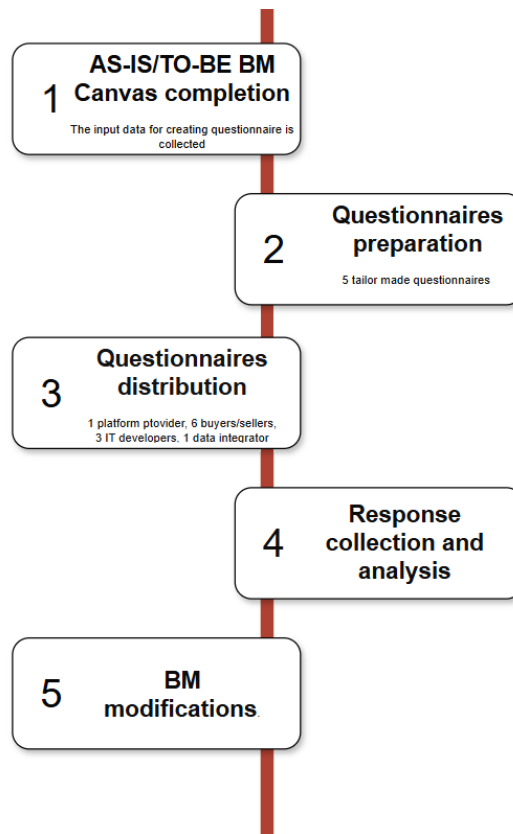


Figure 7. Workflow for questionnaire-based BM refinement.

Questionnaire development and distribution

To gather rich, context-specific data, we developed tailored questionnaires for each partner group involved in the ADMIRAL marketplace (Appendix B). The questionnaire was organised into four sections. The introduction was the same for all companies, while the other sections were customised for each specific partner group. The first section included six general questions aimed at assessing respondents' knowledge of or involvement in any marketplace, as well as their motivations and perceived risks associated with using, managing, or developing a marketplace solution. The second section encompassed three business-related questions, which were based on three dimensions and the nine building blocks of the BMC. The third section addressed concerns and risks and consisted of two questions, while the final section included three questions about the respondents' vision for the future.

All questions were open-ended to promote detailed, narrative responses. To ensure clarity, relevance, and logical flow, the draft questionnaires were reviewed by representatives from each stakeholder group. Revisions were made based on their feedback before finalizing the questionnaire. Enterprises were invited to complete the questionnaire between December 18, 2024, and February 15, 2025.

Given the logistical challenges of scheduling semi-structured interviews with representatives from various departments of selected case companies, we opted to distribute the questionnaires digitally. Participants were contacted via email, with a personalized invitation explaining the study's purpose, the importance of their participation, and assurances of confidentiality. Follow-up reminders were sent

to encourage responses. The respondents were mainly project managers and department managers (financial, sales, IT) (Table 2).

Sampling strategy

We used a purposive sampling strategy to select several representative companies from each of the four main partner groups active in the ADMIRAL project (sellers, buyers, complementors and platform provider) (Figure 8). This approach enhances the robustness, accuracy, and generalizability of our findings.

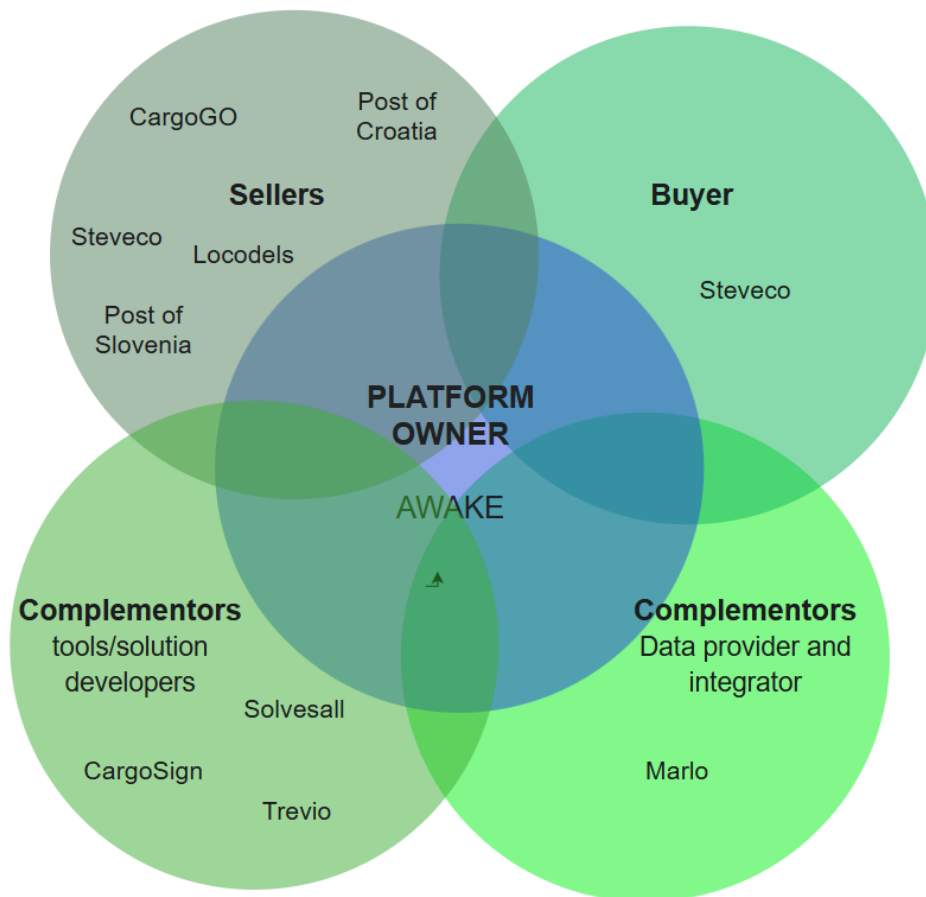


Figure 8. Partner groups of ADMIRAL platform ecosystems.

We selected ten, not 13, case companies as only 10 companies are consortium partners and were willing to answer the questionnaire. Blue-marked case company is a platform owner. Yellow-marked companies are potential sellers or buyers of logistics services. Three of them provide parcel services, focusing on parcel transport and warehousing. One company specialises in less-than-truckload and full-truckload solutions, while another operates as a RO-RO operator and freight forwarder. Green-marked companies are complementors (3 companies are IT or other solutions developers, and one company is a data provider and integrator). Table 2 and Table 3 provide further details on the case companies.

Table 2. Descriptive overview of case.

Case company	Platform role	Employees	Origin	Maturity	Position of the respondent/department
	PP, PS, PU, PP	< 100 100 - 500 500 – 1000 > 1000	Finland Slovenia Croatia Portugal Spain Lithuania	≤ 5 years 6 – 10 years ≥ 11 years	
Awake.AI (AWA)	PP	< 100	Finland	6-10	Vice president, Project manager
CargoGO	PS	100-500	Lithuania	> 11	Head of IT
Steveco	PS/PB	500-1000	Finland	> 11	Controller, Financial department
CargoSign	SD	< 100	Lithuania	≤ 5	Product Owner
Trevio	SD	< 100	Lithuania	≤ 5	Chief Executive Officer (CEO)
Solvesall	SD	< 100	Slovenia	6-10	Project manager
Marlo	SD	< 100	Portugal	> 11	Project manager, Product owner
Locodels	PS	0	Croatia	6-10	CEO, Logistics specialist
Post of Croatia	PS	> 1000	Croatia	> 11	Project managers
Post of Slovenia	PS	> 1000	Slovenia	> 11	Sales department, Parcel division, Innovations
Description: PP - Platform Provider, PS - Platform Seller, PB - Platform Buyer; SD – Solution Developer					

Table 3. Description of case companies.

Case company	Description
Awake.AI (AWA)	<p>Year established: 2008.</p> <p>Company headquarters: Turku, Finland.</p> <p>Core business: Port call planning and optimization tool, analytical AI / ML based services like maritime predictions.</p> <p>Local or international orientation: Internationally.</p> <p>Market share: 20 % in port call planning tools.</p> <p>Recent major changes/milestones:</p>
CargoGO	<p>Year established: 2009.</p> <p>Company headquarters: Vilnius, Lithuania.</p> <p>Core business: Transport services.</p>

Case company	Description
	Local or international orientation: Internationally. Market share: N/A.
Steveco	Year established: 1848. Company headquarters: Kotka, Finland. Core business: Stevedoring, cargo handling, freight forwarding, freight transporting. Local or international orientation: Both. Market share: We are the largest operator. Other relevant details: Owned by the largest forest industry companies in Finland. Recent major changes/milestones: Russian transit traffic was important before the 2022.
CargoSign	Year established: 2022. Company headquarters: Vilnius, Lithuania. Core business: eCMR with CO2 calculator for road logistics sector. Local or international orientation: International. Market share: N/A Recent major changes/milestones: eFTI ecosystem testing with Finnish Government.
Trevio	Year established: 2020. Company headquarters: Alytus, Lithuania. Core business: IT solutions for logistics. Local or international orientation: International. Market share: N/A. Recent major changes/milestones: Developed an AI-powered product that transforms paper-based data into digital format.
Solvesall	Year established: 2018. Company headquarters: Ljubljana, Slovenia. Core business: IT development. Local or international orientation: Primary regional, central Europe. Market share: N/A. Recent major changes/milestones: A company reached 20 employees in 2024.
Marlo	Year established: 2006. Company headquarters: Carnaxide, Portugal. Core business: Consulting and technology solutions for the transport and logistics sector. Local or international orientation: Both. Market share: N/A.
Locodels	Year established: 2016. Company headquarters: Velika Gorica, Croatia.

Case company	Description
	<p>Core business: Providing same-day delivery services through a crowd shipping platform.</p> <p>Local or international orientation: Local, Croatia.</p> <p>Recent major changes/milestones: The company continuously enhances its services to optimize last-mile delivery efficiency.</p>
Post of Croatia	<p>Year established: 1999.</p> <p>Company headquarters: Velika Gorica, Croatia.</p> <p>Core business: Postal services, parcel delivery, logistics services, financial services, digital and IT services.</p> <p>Local or international orientation: Both.</p> <p>Market share: 90 %.</p> <p>Recent major changes/milestones: The company strengthens its market position by expanding its logistics and parcel services, maintaining a strong customer focus. It is the leading logistics provider in the market and a pioneer in digital innovation.</p>
Post of Slovenia	<p>Year established: 1994.</p> <p>Company headquarters: Maribor, Slovenia.</p> <p>Core business: Post services, parcels delivery, logistics services, IT services.</p> <p>Local or international orientation: Both.</p> <p>Market share: National (40%), international – N/A.</p> <p>Other relevant details: The biggest logistics provider in Slovenia with more than 450 contact points across Slovenia. Universal Service Provider in Slovenia.</p>

None of the ten selected companies currently utilises or manages a similar digital platform ecosystem, although most intend to adopt one in the future. Complementors have the most limited understanding of existing logistics platforms. Only one out of four is currently using a platform, while the other three are familiar with but do not actively use them. Despite this, all developers claim to be creating solutions for these platforms.

On the other hand, a platform provider is knowledgeable about four different platform ecosystems. Among the sellers, only one is not familiar with any logistics platform. The others are aware of multiple platforms, but only one has utilised three of them. The most well-known logistics platforms are illustrated in Figure 9.

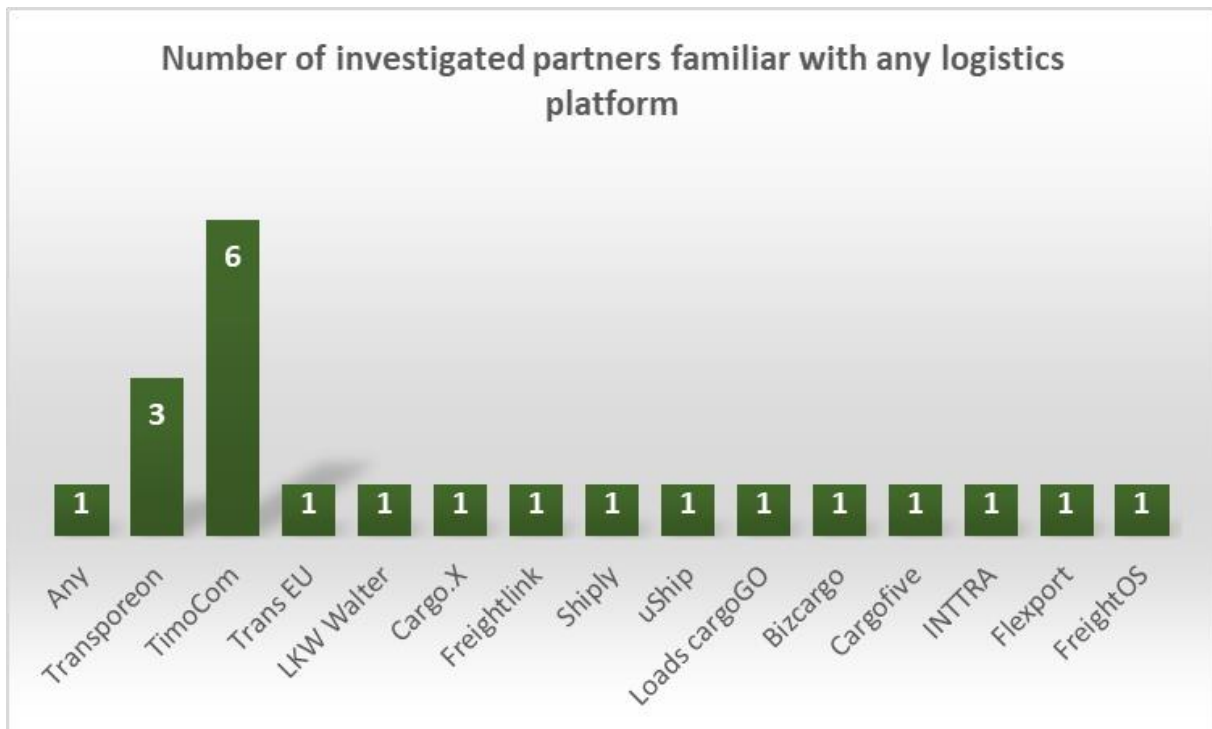


Figure 9. Familiarity with existing logistics platforms.

Only two sellers believe that using the marketplace could significantly support their business growth by enhancing sustainability and improving efficiency in logistics operations. They also see it as a way to strengthen their positions in both traditional and green logistics (Appendix C).

Nine out of eleven respondents are open to using the platform in the long term. However, two indicated that their decision would depend on the range and quality of services provided by the platform operator (Appendix C).

Three sellers expect to gain valuable experience and insights that will help them improve their processes within the first year of using the marketplace. Nearly half of the respondents believe the platform will help expand their customer base. At the same time, three have higher expectations, aiming to boost both efficiency and service quality (see Appendix C).

Data analysis of BMs changes

The responses from the questionnaires were analysed using a hybrid coding approach that combines deductive and inductive methods. Guided by the BMC, we applied predefined codes corresponding to each of the nine building blocks (see Appendix C). This ensured that our analysis remained anchored to established theoretical constructs. Following the initial coding, we conducted analysis by examining responses (1) within each of three BM groups, (2) within each actor group to uncover commonalities and intra-group differences and (2) cross-group patterns.

1.2.7.1 Changes analysed in the three BMC groups

Firstly, we checked the motives to use or manage a digital marketplace and realised that **only 2 of the 27 listed motivators are categorised as sustainable**; however, they account for 14% of all mentions,

with both ranking in the top four (Figure 10). This indicates that regulation and disclosure pressures, such as the CSRD rules, are already influencing adoption criteria, even in a list predominantly focused on economic benefits.

Respondents emphasise the customer experience over mere cost reduction or brand enhancement, suggesting that marketplace adoption is viewed primarily as a value-adding strategy rather than just a cost-cutting measure.

There are **four digital levers**—AI-driven insights, dynamic pricing, API enablement, real time tracking, and automated load matching—each receiving 1 to 3 mentions.

Interestingly, the marketplace's **multimodality motivates only one of eleven partners,** indicating that better promotion of this differentiator is necessary by the platform operator (Figure 10).

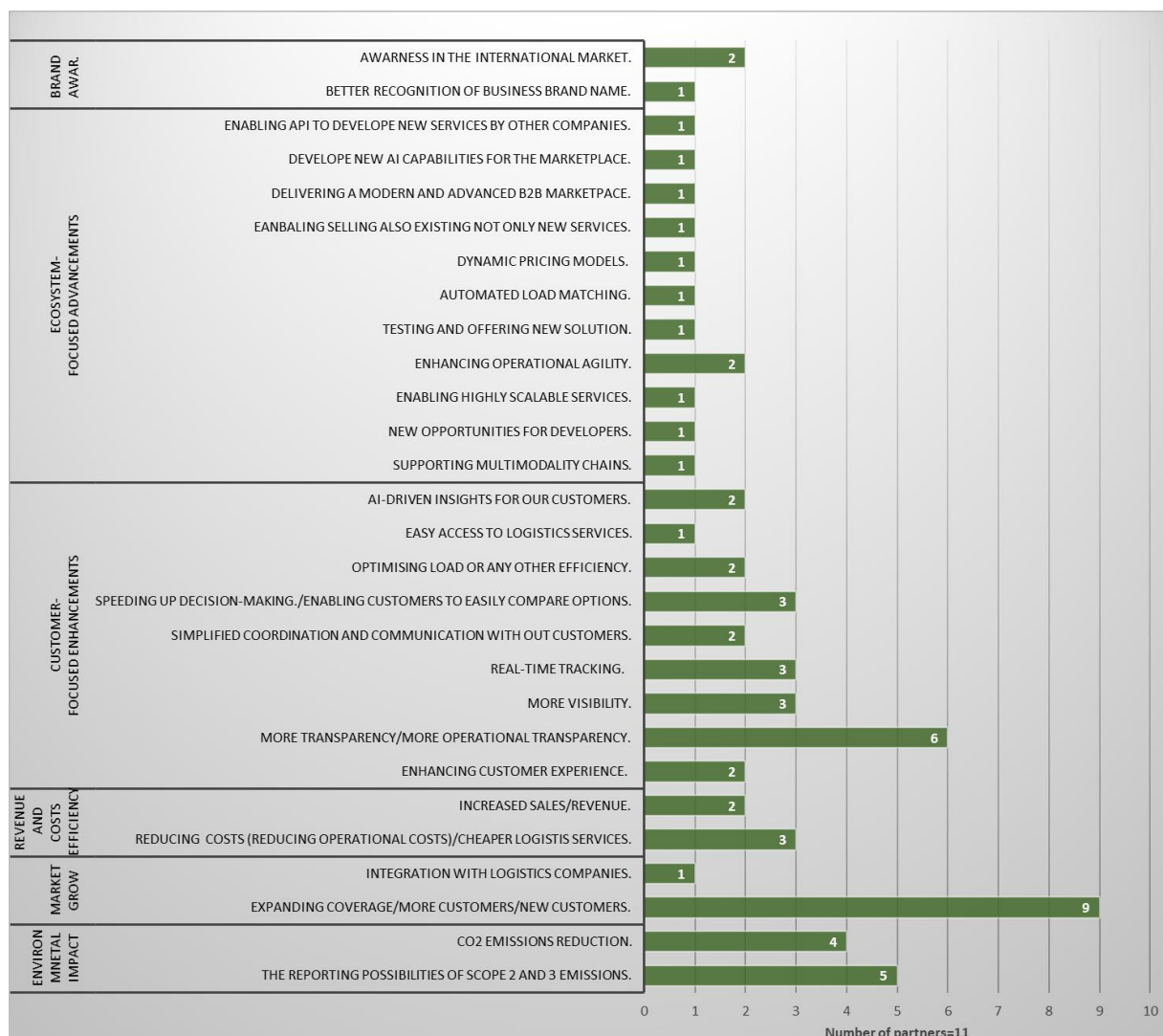


Figure 10. Motivations/expectations of managing/using a logistics platform ecosystem.

Then we investigated possible changes in BM groups of blocks (Table 4).

Table 4. BMC groups and blocks.

BM group	Definition	BMC blocks
1. Value Creation	The internal infrastructure that produces the value that a company promises to customers. It covers <i>who</i> a company relies on, <i>what</i> it needs, and <i>what</i> it does.	Key Partners – external organisations a company team up with; Key Activities – core processes that convert inputs into the offer; Key Resources – people, assets, data & IP that make it all possible (The Value Proposition sits at the interface between creation & delivery)
2. Value Delivery	Everything outward facing that delivers the created value to the right customer and shapes their experience.	Customer Segments – whom a company serves; Channels – how the offer reaches them; Customer Relationships – how a company acquires, retains and grows them
3. Value Capture	The financial engine that captures part of the value back for the firm and keeps the model sustainable.	Revenue Streams – how money comes in (pricing logic, payment models); Cost Structure – the major cost drivers that money flows out to

Possible changes to Value creation blocks

Partners: Three companies plan to **collaborate with** technology firms to enhance their digital capabilities. Another four plan to work specifically with digital solution providers for the same reason. Four companies aim to partner with international firms to expand their global reach, while two are seeking partnerships with green delivery providers and electric vehicle suppliers. Two IT developers reported they do not require new partners, while one noted that the marketplace offers opportunities to connect with a broader range of logistics providers (Figure 11).

Partners’ relationship: In terms of partner collaboration, many believe that the marketplace will lead to more frequent and intensive communication. However, most of them (n = 4) highlighted that increased transparency will help build trust and foster long-term partnerships. Three respondents indicated a need for human resources, such as IT experts or new employees. Another three mentioned the need for technological resources, like APIs and other integration tools. The remaining three emphasised the importance of establishing systems for data collection and analysis to support better decision-making and drive innovation within the digital marketplace (Figure 11).

Value proposition: Three companies see added value in helping their clients reduce costs, lower CO₂ emissions, and provide emissions data and more flexible delivery options. Two others mentioned benefits such as reducing manual work, improving operational efficiency, and introducing new modes of transport.

Additionally, four respondents believe that prioritising low-emission logistics will set them apart from competitors.

Some respondents also mentioned operational changes, including requirements for truck companies to report emissions, implementing new workflows, and updating privacy policies (Figure 11).

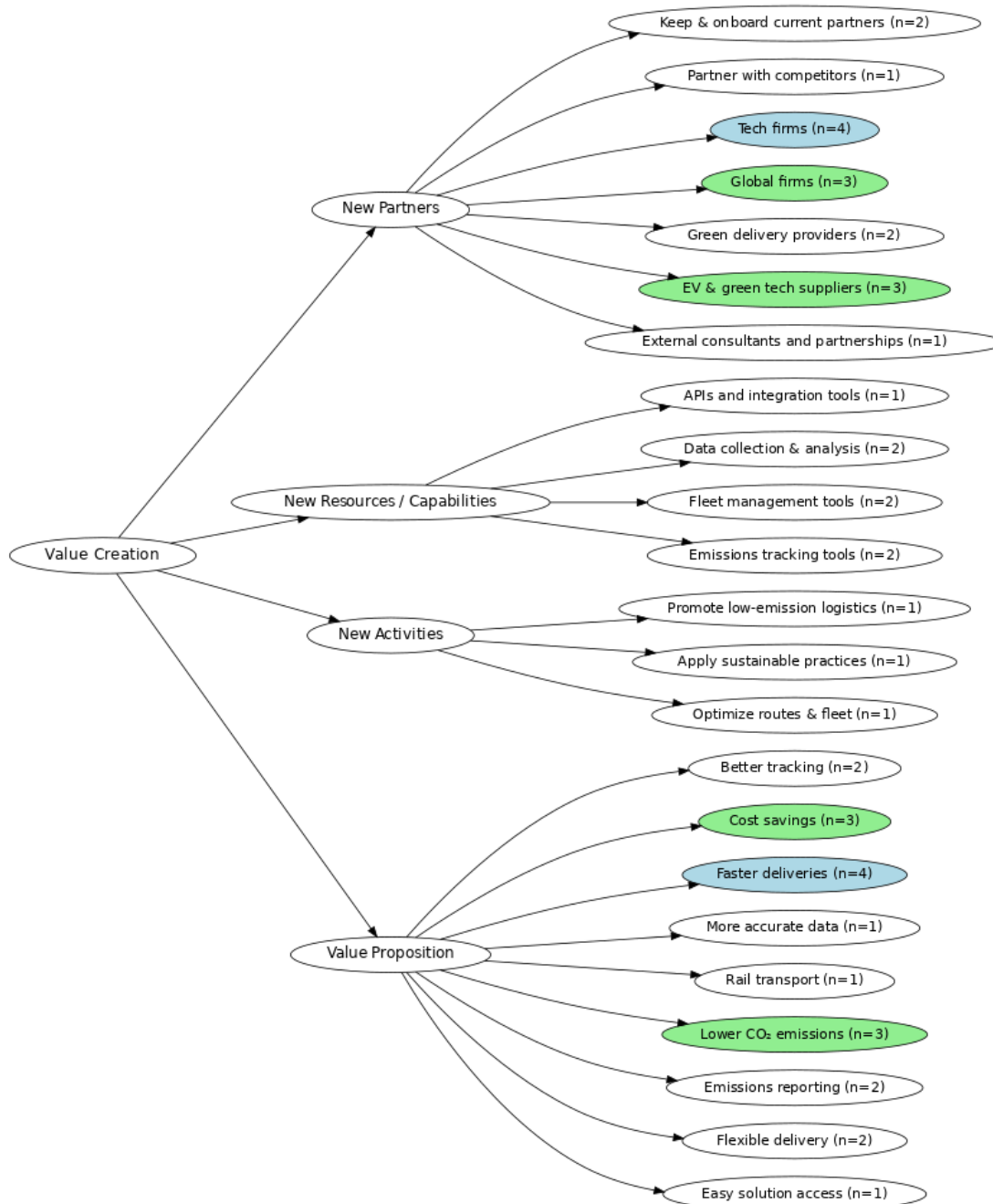


Figure 11. Possible changes to Value creation blocks.

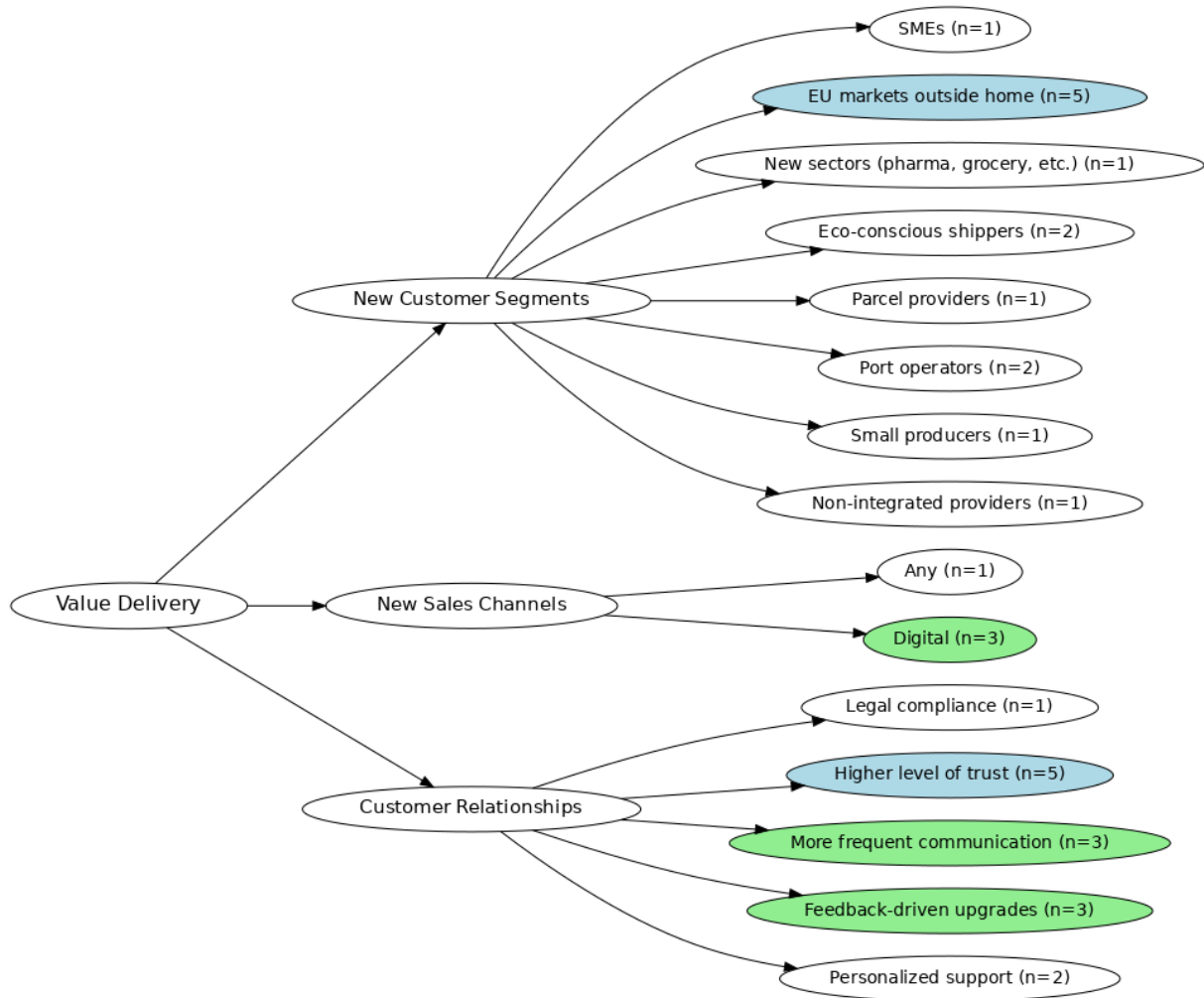


Figure 12. Possible changes to Value delivery blocks.

Possible changes to Value delivery blocks

Customers: The majority of respondents (n = 5) expect to gain new customers in other EU markets, while two believe they will attract more environmentally conscious customers (Figure 12).

Sales Channels: A few respondents mentioned that digital communication would be an important sales channel if they decided to use a marketplace. However, two respondents indicated that they don't anticipate any changes, suggesting they are not interested in using a marketplace (Figure 12).

Customer Relationships: Most respondents (n = 5) believe that using a marketplace will help build higher trust with customers, promote more frequent communication, and encourage feedback to improve solutions. One respondent also mentioned that their collaboration with existing partners could improve as a result (Figure 12).

Possible changes to Value capture blocks

Revenue: Complementors anticipate generating revenue through newly developed solutions, such as CO₂ prediction tools, tailored services, premium offerings, and the eCMR solution. However, most sellers do not expect significant changes to their revenue models. Two sellers specifically stated that their approach would remain largely the same, although both mentioned they are exploring more

flexible pricing strategies, such as pay-per-use models, for customers with occasional or infrequent needs (Figure 13).

Pricing: Several sellers highlighted the importance of offering more competitive pricing to attract and retain customers. They also noted the need to integrate new pricing strategies with their existing ones, including tiered pricing options for services like green delivery and flexible delivery windows (Figure 13).

Costs: While two complementors believe there will be no additional costs, the majority—four out of six sellers or buyers—expect increased expenses. These anticipated costs are primarily related to training programs aimed at upskilling employees in digital tools and marketplace operations, as well as investments in technology infrastructure and specialized tools such as fleet management systems, emissions tracking, and green vehicles. On a positive note, five respondents believe that the marketplace will help reduce marketing costs, and three foresee lower operational costs (Figure 13).

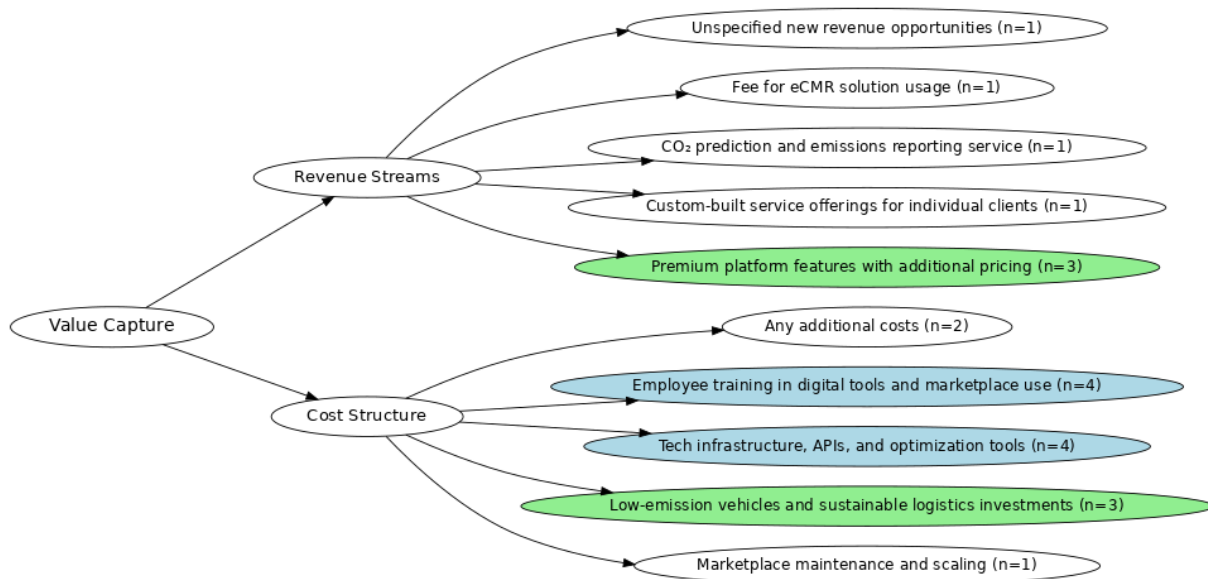


Figure 13. Possible changes to Value capture blocks.

1.2.7.2 Similarities across all groups of stakeholders

Table 5 presents similarities across all groups of stakeholders.

Table 5. Aligned interests across sellers, buyers, and IT complementors.

Topic	Observation
Motivations	All groups — sellers, buyers, and complementors — are motivated by expanding coverage and attracting more customers through the marketplace.
Expectations:	Transparency and visibility are consistently expected by all stakeholders to improve trust, decision-making, and collaboration.
Cost reduction	Many anticipate lower marketing and acquisition costs , especially through digital channels and competitive service comparison.
Risks	Data security is a shared concern, especially with the digitalization of sensitive logistics, pricing, and emissions data.
Strategy duration	The majority of respondents across all groups view marketplace adoption as part of a long-term strategy , although some express conditional commitment based on service quality.

1.2.7.3 Internal similarities within each stakeholder group

Table 6 presents aligned interests within the complementors group.

Table 6. Aligned interests within the complementors group.

Topic	Observation
Motivations	Most complementors — are motivated by expanding coverage and attracting more customers through the marketplace.
Expectations	Visibility is consistently expected by most complementors to improve trust, decision-making, and collaboration. Access to new customers is expected for most complementors.
Cost reduction	Many anticipate lower marketing costs , but two of them do not expect any additional costs .
Risks	Data security is a shared concern among complementors, especially with the digitalization of sensitive logistics, pricing, and emissions data.
Strategy duration	The majority of complementors view marketplace adoption as part of a long-term strategy .

Table 7 presents aligned interests within the sellers and buyers group.

Table 7. Aligned interests within the sellers and buyer group.

Topic	Observation
Motivations	Most sellers and a buyer — are motivated by expanding coverage , while buyers also aim to attract more customers through the marketplace.
Expectations	Greater transparency is a consistent expectation among most sellers and at least one buyer. Real-time tracking is expected by two sellers and a buyer.
Cost reduction	Many sellers and buyers anticipate lower operational and marketing costs through marketplace use.
Differentiation	Sellers expect to stand out by prioritizing low-emission logistics as a competitive advantage.
New customers	Sellers and one buyer believe they can gain new customers in other European Union countries via the platform.
Changes in relationship	More frequent and direct communication with customers is expected. Deeper collaboration is anticipated by integrating customer feedback into service improvements.
Revenue model changes	Sellers and one buyer plan to introduce flexible, pay-per-use pricing models .
Strategy duration	The majority of sellers and a buyer view marketplace adoption as a long-term strategy .
Achievements 1st year	Sellers and a buyer expect to improve both efficiency and service quality within the 1 st year of use.

1.2.7.4 Understanding stakeholders’ risks and challenges to enter the ADMIRAL marketplace

State-of-the-art insights on digital marketplace risks

Logistics marketplaces connect shippers with logistics providers, offering increased flexibility, cost savings, and access to a wider range of services. However, these benefits also come with various risks and challenges that companies must manage to ensure successful integration and operation within these platforms. Understanding these potential pitfalls is crucial for mitigating risks and fully leveraging the advantages of logistics marketplaces.

Below is a list of risks and challenges associated with using logistics marketplaces, along with detailed descriptions of each risk and challenge. These risks are organised into five broader categories (Figure 14).

1. Technological risks and challenges	Data security and privacy concerns.
	Integration with existing systems.
	Logistics platform stability and reliability.
	Resistance to technological change.
2. Operational risks and challenges	Dependence on third-party platform.
	Quality control and service reliability.
3. Financial risks and challenges	Hidden costs and financial risks.
4. Market and competitive risks and challenges	Intensified competition and market saturation.
5. Legal and regulatory risks	Regulatory compliance.
	Ethical and social responsibility issues.

Figure 14. Risks related to using logistics marketplace by several stakeholders.

Technological risks and challenges

Data security and privacy concerns: Interacting with logistics marketplaces involves sharing sensitive information, including customer data, shipment details, pricing strategies, and operational processes (Wang and Naim, 2007, Murtaza et al., 2004). This sharing raises the risk of data breaches and unauthorised access (Pressey and Ashton, 2009). Therefore, firms must verify that the marketplace has strong security measures in place to protect against cyber threats and comply with data protection regulations, such as the GDPR. Failure to safeguard this data can result in legal penalties, loss of customer trust, and competitive disadvantages.

Integration with existing systems: Integrating a logistics marketplace with a company's existing IT infrastructure can be complex and challenging (Murtaza et al., 2004). Differences in software systems, data formats, and technological standards may lead to compatibility issues. This integration process often requires significant time, financial resources, and technical expertise. Disruptions during integration can impact real-time data exchange, resulting in operational inefficiencies, delayed shipments, and decreased customer satisfaction.

Additionally, the rapid advancement of technologies such as AI, the Internet of Things (IoT), Blockchain, and Big Data analytics further complicates the integration process.

Logistics platform stability and reliability: The performance of a logistics marketplace platform significantly impacts the operations of businesses that depend on it. Technical issues, such as system downtimes, slow load times, software bugs, or insufficient customer support, can disrupt business activities. Because companies rely on the platform's stability, any technical problems can result in shipment delays, lost sales opportunities, and a decline in customer trust. Therefore, businesses must evaluate the platform's reliability and establish contingency plans to mitigate potential disruptions (Barykin et al., 2021a).

Resistance to technological change: Implementing a new logistics marketplace platform may encounter internal resistance from employees who are accustomed to existing processes and systems. This resistance can arise from fears of the unknown, concerns about job security, or discomfort with learning new technologies. Such pushback can slow down the implementation process, reduce efficiency, and lead to the underutilization of the platform's features. To overcome this challenge, it is often necessary to employ change management strategies, provide training programs, and communicate clearly about the benefits of the new system (Caliskan et al., 2024, Cichosz et al., 2020)

Operational risks and challenges

Dependence on third-party platforms: Relying on a logistics marketplace means entrusting a crucial part of the supply chain to an external provider. This dependency can expose companies to risks related to the marketplace's operational stability, policy changes, pricing structures, and technical issues. Sudden alterations in the platform's terms of service, fee structures, or algorithms that determine visibility can negatively impact a company's operations. Furthermore, any technical outages or shutdowns of the marketplace can disrupt the supply chain, resulting in financial losses (Asadullah et al., 2023).

Quality control and service reliability: Ensuring consistent quality and reliability among various service providers in a logistics marketplace is a significant challenge (Gadde and Hulthén, 2009, Yaragani, 2020). Differences in service standards, delivery times, handling procedures, and customer service can lead to an inconsistent customer experience (Wang et al., 2011). If any provider in a company's supply chain performs poorly, it can result in customer dissatisfaction, negative reviews, and a potential loss of future business.

Financial risks and challenges

Hidden costs and financial risks: Logistics marketplaces often promote cost savings, but there are frequently hidden expenses that can add up over time. These may include subscription fees, transaction charges, and fees for premium features or services. Additionally, there can be costs related to training staff to use the new system. Unexpected expenses might also occur due to currency fluctuations in international transactions or penalties for exceeding certain usage limits. These hidden costs can significantly affect the overall profitability of using the marketplace (Murtaza et al., 2004).

Market and competitive risks and challenges

Intensified competition and market saturation: Logistics marketplaces typically feature a wide array of service providers and suppliers competing for business. This increased transparency enables customers to easily compare prices and services, which heightens competition among providers. As a result, firms may feel pressured to either lower their prices or enhance their service offerings to stay competitive, which can lead to reduced profit margins. This environment hurts the industry because it makes successful companies fail and causes suppliers to lose potential profits (Nair, 2005). Because of this, emerging marketplaces are often seen as not trustworthy (Rios Lam, 2018).

Legal and regulatory risks

Regulatory compliance: Operating in logistics marketplaces, particularly on an international scale, involves following a complex set of regulations. Companies must comply with international trade laws,

customs regulations, transportation rules, environmental policies, and data protection laws that differ by country and region, as identified in the study carried out by a law firm as part of task 3.2 (D3.2). Navigating these regulations can be challenging and resource intensive. Failure to comply can lead to legal penalties, shipment delays, confiscation of goods, and harm to the company's reputation (Barykin et al., 2021b, Silva and Leite, 2019, Turienzo et al., 2024).

Many firms remain hesitant to engaging with emerging platforms, as some do not take responsibility beyond matching shipper demand with carrier capacity (Rios Lam, 2018).

Ethical and social responsibility issues: Companies are increasingly held accountable not only for their own practices but also for those of their partners and suppliers. When engaging with logistics providers through a marketplace, it is crucial to conduct due diligence to ensure these partners comply with ethical standards, such as fair labor practices, environmental sustainability, and adherence to laws and regulations. Associating with providers involved in unethical or illegal activities can result in reputational damage, customer boycotts, and legal consequences.

Insights on risks facing Admiral marketplace potential stakeholders

Data security and competition among platforms present common risks for all three stakeholder groups (see Table 8). Engaging in a logistics marketplace ecosystem necessitates the sharing of shipment data, rates, and sometimes customer information, which exposes all parties to potential breaches or unauthorised access.

Table 8. Potential risks of using a digital marketplace ecosystem.

Groups of risks	Risk	Stakeholder risk mentions by group		
		Sellers	Buyer	Complementors
Technological risks	Data Security	1	1	1
Operational risks	Platform dependability	1	1	0
	Losing brand control	1	1	0
Market and competitive risks	Competitors on the platform	1	1	1
Financial risks	Commission fees	1	1	0
	Subscription fees	1	0	0

Marketplace operators should implement some essential safeguards (Figure 15):

1. **Privacy-by-design (GDPR Art. 25):** Privacy must be integrated from the very first line of code, rather than added later. Collect only the data that is truly necessary; avoid hoarding data "just in case."
2. **Zero-trust security:** Follow the principle of "never trust, always verify." Every user, device, or microservice must prove its identity each time it requests access, even if it is within the company network. No automatic "staff-only" shortcuts should be allowed.

3. **Annual external check (e.g., International Organisation of Standardisation (ISO) 27001 audit):** Independent specialists should review policies and rigorously test the system, simulating a burglar's approach to ensure that digital locks, alarms, and emergency plans remain effective.
4. **Granular need-to-know data access:** Each role—such as shipper, carrier, and finance clerk—should only have access to the information necessary for their specific job. Nothing more.

Neglecting these fundamental practices undermines trust, hinders customer acquisition, and accelerates churn. The risk from competition only magnifies the consequences.

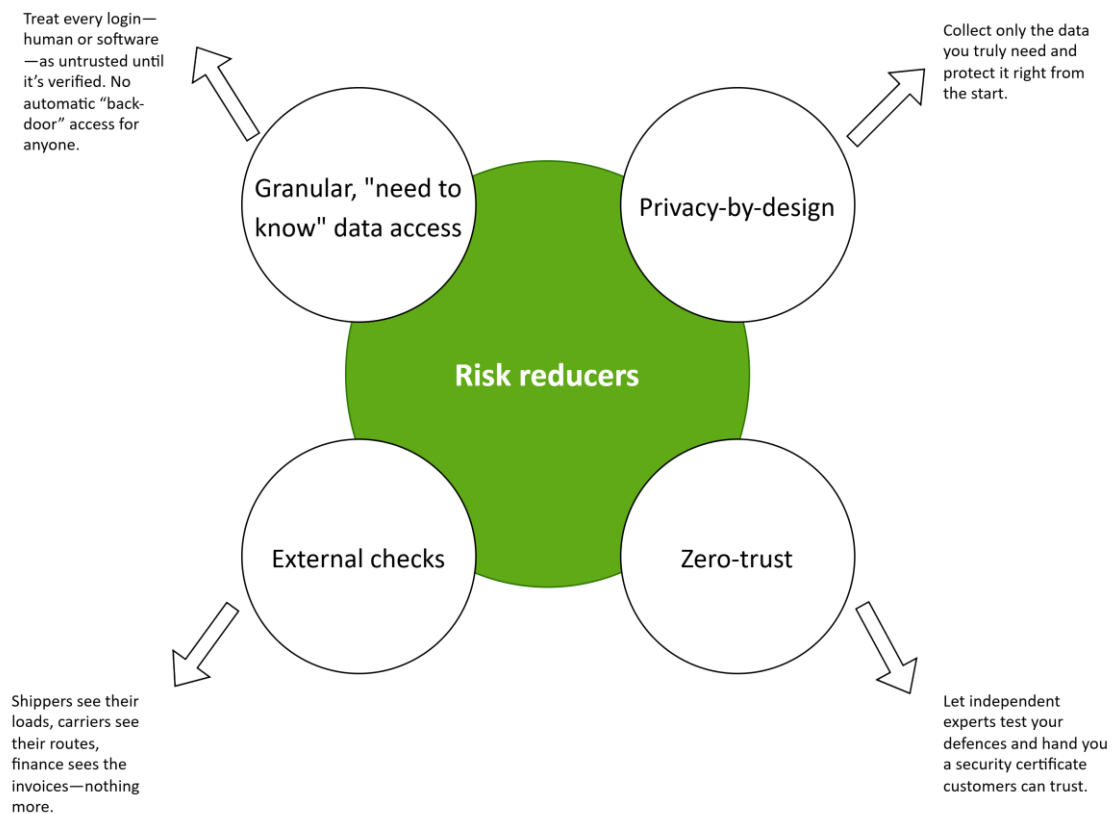


Figure 15. Potential risk reducers for data security-related risks.

In terms of data security-related risks, sellers, buyers, and complementors can take several measures to mitigate these risks:

- Encrypt data both at rest and in transit within their own systems.
- Request standardized security attestations from the platform.
- Use secure APIs instead of relying on manual uploads.

Many logistics marketplaces provide full transparency in pricing and service levels, allowing buyers to compare providers instantly. This transparency heightens price pressure, compelling carriers and forwarders to either reduce their rates or enhance their offerings to retain business, which often results in squeezed profit margins. Complementors (apps, add-on services) might worry the platform will copy their idea or bias search results toward an in-house clone.

Marketplace operators can take the following practical actions (see Figure 16):

- **Prove you play fair:** Publish your ranking rules—price, on-time rate, sustainability score, and so on—and apply them equally to every seller.
- **Offer more ways to stand out than price alone:** Add badges for carbon-neutral deliveries, certified cold-chain capability, 98 % on-time performance, or provide a “premium” lane where quality outweighs the lowest bid.
- **Lower entry barriers:** Supply open APIs, clear fee schedules, self-service onboarding, and built-in dispute-resolution and escrow.
- **Stay within competition law:** Carry out regular compliance checks against the EU Digital Markets Act (DMA).

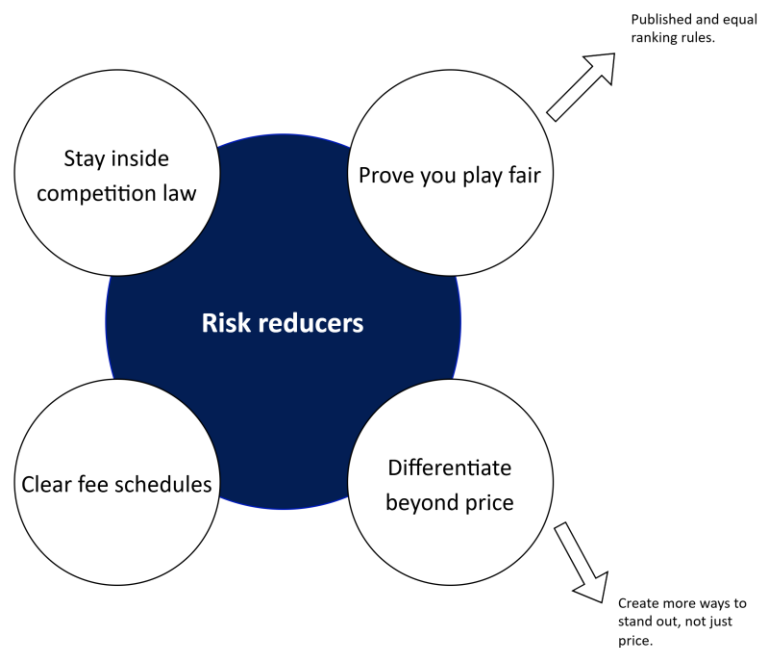


Figure 16. Potential risk reducers for competition-related risks.

Complementors, on the other hand, can add features that the core platform may never prioritize and can publish on multiple marketplaces to avoid being controlled by a single platform. Sellers, in contrast, have the option to differentiate themselves through service, rather than just pricing. They can also utilize platform analytics, if available, to identify underserved markets and adjust their pricing accordingly.

Marketplace providers encounter a closely interconnected set of risks. First, they must **prioritise and retain a sufficient number of high-quality sellers, buyers, and complementary service partners**. Once these participants are on board, they must **provide accurate data, images, and company details to ensure their profiles appear trustworthy**. Additionally, **the platform needs to promote itself effectively, address customer issues promptly, and maintain consistent service quality**; otherwise, user confidence may decline.

1.3 BMs of managing and utilising the ADMIRAL logistics marketplace ecosystem

1.3.1 Validation and refinement of TO-BE BMs

The TO-BE BMs designed in Section 1.2 by three different groups of stakeholders—buyers, sellers, the platform provider, and complementors—were validated one final time. This final validation occurred after all stakeholder representatives finalised and agreed on the necessary aspects for integrating their IT systems (for sellers and buyers) and developing solutions (for complementors) within the logistics marketplace ecosystem of AWA. **The purpose of this last validation phase** was twofold:

1. To achieve consensus on the BMC developed in Section 1.2.
2. To ensure that the TO-BE BMs of the platform provider, sellers, buyers, and complementors (IT solution developers and data integrators) accurately reflect real-world practices and do not overlook essential elements identified during the implementation phase of the logistics marketplace ecosystem.

The aim was not only to gather feedback but to conduct an in-depth analysis of the BMC by addressing the following questions:

- Does the BM accurately reflect how platform providers, sellers, buyers, and complementors operate within the platform ecosystem?
- Are there any critical elements missing (e.g., activities, revenue streams)?
- Do the companies agree with the BM, or do they identify any gaps or discrepancies in it?
- Do the companies concur with the type of BM presented, or would they classify themselves under a different, existing, or new BM type?

A two-step validation process for the BMs was implemented, as illustrated in Figure 17:

1. *Individual Validation*: Each company was invited to complete internal validations prior to the international meeting in Stuttgart on September 10, 2025.
2. *Workshop/Group Interviews*: In-person meetings held in Stuttgart on October 7th featuring separate discussions for each stakeholder group (sellers, buyers, complementors, and the platform owner).



Figure 17. BMs final validation approach.

Internal validation

Individual validation was conducted using the following process:

1. Invite representatives from each company that has tested the platform via email.
2. Send them the TO-BE BMCs, which include insights from all companies within a stakeholder group, not just one company (Figures A9, A10, A12, and A13).

3. Ask them to:

- Reflect on whether the proposed BM type is appropriate for their context. If it is not suitable, encourage them to suggest alternatives or adjustments. For example: "Do you consider this BM type suitable for your organisation? If not, what would you change or replace?"
- Evaluate each block of the Canvas by asking, "Does this reflect your reality?"
- Identify any missing or unclear aspects by asking, "What would you add or change?"
- Provide additional comments on feasibility, challenges, etc., if they wish.

4. Upgrade or modify the TO-BE BMC with the insights gathered.

Validation of the BMCs tailored to specific stakeholders through organised workshops

The updated versions of the TO-BE BMC were discussed during workshops held at the international meeting in Stuttgart on October 7, 2025. Three separate workshops were organised for each group of stakeholders. Each group was led by one person, with another individual supporting by taking notes. The workshops lasted between 60 and 75 minutes. A non-mandatory step-by-step script was provided to run the workshops (see Appendix C).

1.3.2 Finalised versions of the BMCs for the three main stakeholders and potential roles of faculties, institutions and logistics associations

Following a series of stakeholder workshops, we updated the BMSs for three groups of stakeholders to reflect real buyer–seller–complementor–platform interactions. Green items mark net-new or re-scoped elements (see sub-sections 1.3.2.1-1.3.2.3). Additionally, we explored the potential roles of faculties, institutes, and transport and logistics associations within the ADMIRAL consortium (see sub-section 1.3.2.4)

1.3.2.1 BMC changes (TO-BE BMCs) of potential buyers and sellers of the ADMIRAL digital logistics marketplace ecosystem

The BMC outlined below (Figure 18) only includes changes that occur when sellers and buyers intend to sell or purchase logistics services on the marketplace (referred to as the TO-BE BMC). The current BMC for Admiral buyers and sellers is depicted in Figure A12.

The green items indicate new or rescheduled elements, while the red elements highlight "old" elements identified by sellers and buyers in Section 1.2. The validated BMC eliminates vague or duplicate items and limits indirect partners. Stand-alone listings, such as separate airline, rail, and crowdsourcing partners, as well as duplicate entries for "arrivals and departures," have either been removed or consolidated. This is because access will primarily flow through eco-friendly carriers and a single track-and-trace capability that provides the strongest signal.

Partners are consolidated into a marketplace with an integrated IT ecosystem, where clear API/security responsibilities are defined. Optimization is presented as a pathway to achieving "cheaper and greener" solutions rather than as a separate activity. The concept of "community" is incorporated into onboarding, reviews, and personalized guidance, directly influencing user activation instead of existing in isolation.

Key resources are focused on building infrastructure, comprehensive data capture, carbon methodology, and regulatory knowledge to mitigate delivery and compliance risks.

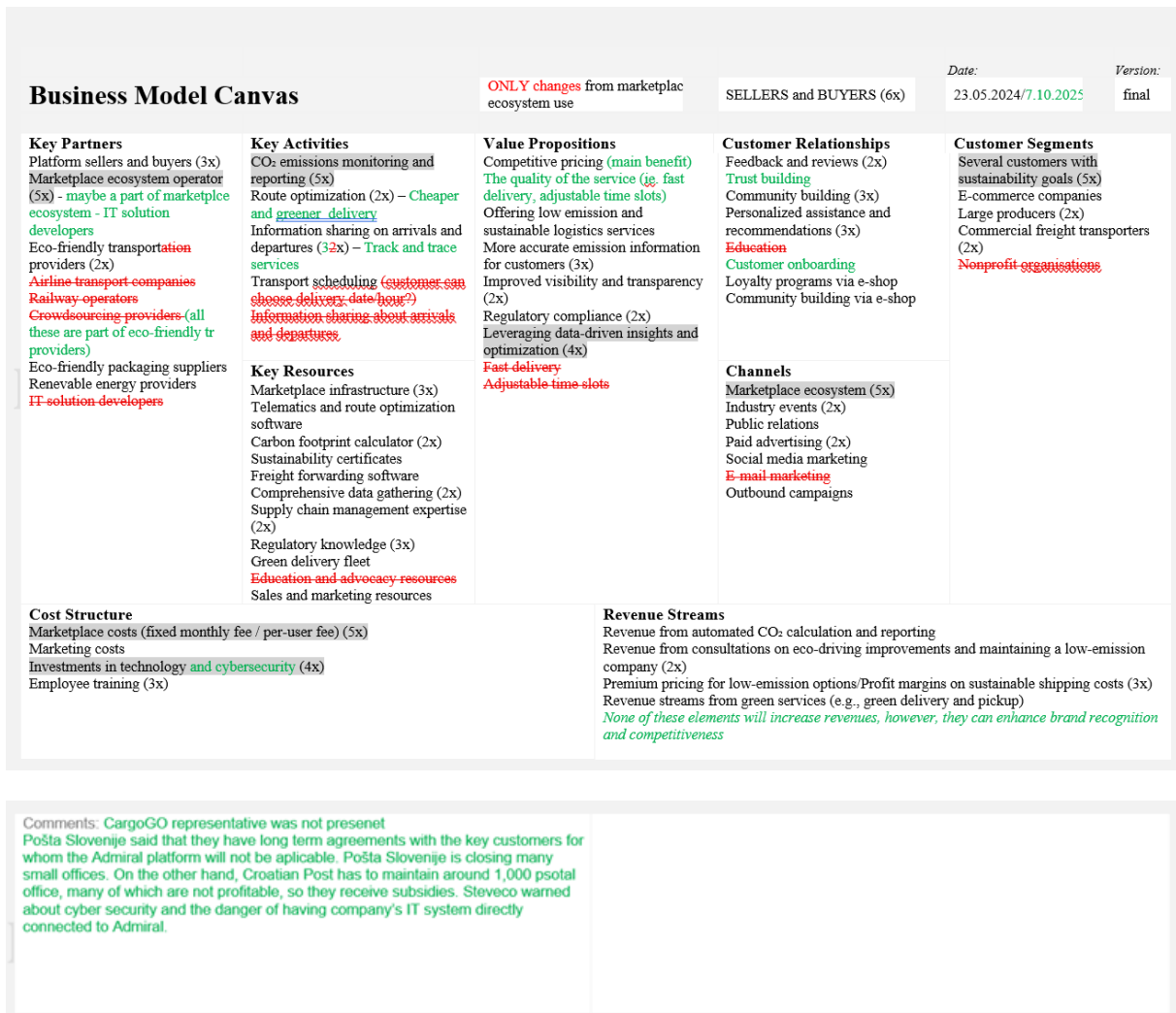


Figure 18. Changes of BM for sellers and buyers during validation phase.

The final version of the BM for sellers and buyers within a logistics marketplace ecosystem is illustrated in Figure 19.

Business Model Canvas		ONLY changes from marketplace ecosystem use	SELLERS and BUYERS (6x)	Date: 23.05.2024	Version: final
Key Partners Platform sellers and buyers (3x) Marketplace ecosystem operator (5x) Eco-friendly transport providers (2x) Eco-friendly packaging suppliers Renewable energy providers	Key Activities CO ₂ emissions monitoring and reporting (5x) Route optimization (2x) Information sharing on arrivals and departures (3x) Track and trace services Transport scheduling	Value Propositions Competitive pricing (main benefit) The quality of the service (i.e. fast delivery, adjustable time slots) Offering low emission and sustainable logistics services More accurate emission information for customers (3x) Improved visibility and transparency (2x) Regulatory compliance (2x) Leveraging data-driven insights and optimization (4x)	Customer Relationships Feedback and reviews (2x) Trust building Community building (3x) Personalized assistance and recommendations (3x) Customer onboarding Loyalty programs via e-shop Community building via e-shop	Customer Segments Several customers with sustainability goals (5x) E-commerce companies Large producers (2x) Commercial freight transporters (2x)	
Key Resources Marketplace infrastructure (3x) Telematics and route optimization software Carbon footprint calculator (2x) Sustainability certificates Freight forwarding software Comprehensive data gathering (2x) Supply chain management expertise (2x) Regulatory knowledge (3x) Green delivery fleet Sales and marketing resources			Channels Marketplace ecosystem (5x) Industry events (2x) Public relations Paid advertising (2x) Social media marketing Outbound campaigns		
Cost Structure Marketplace costs (fixed monthly fee / per-user fee) (5x) Marketing costs Investment in technology and cybersecurity (4x) Employee training (3x)			Revenue Streams Revenue from automated CO ₂ calculation and reporting Revenue from consultations on eco-driving improvements and maintaining a low-emission company (2x) Premium pricing for low-emission options/Profit margins on sustainable shipping costs (3x) Revenue streams from green services (e.g., green delivery and pickup) <i>None of these elements will increase revenues, however, they can enhance brand recognition and competitiveness</i>		

Figure 19. Finalised version of TO-BE BM for potential sellers and buyers.

Feedback from partners during these workshops has resulted in the following key takeaways:

1. **Strategy:** Embrace the marketplace ecosystem and its operators by conducting transactions where your partners are already established. Utilize eco-friendly carriers and packaging to differentiate your offerings based on sustainability, while remaining competitive on price.
2. **What to offer:** Focus on providing fast, reliable service with adjustable time slots and clear, comparable pricing. Combine this with low-emission options and accurate CO₂ information, allowing buyers to make informed choices based on speed, cost, and environmental impact. Treat visibility and regulatory compliance as essential parts of your offering rather than afterthoughts.
3. **How to operate:** Establish track-and-trace and information sharing regarding arrivals and departures as your baseline. Then, incorporate route optimization and formal CO₂ monitoring/reporting. This sequence aligns with customer preferences and minimizes integration risk.
4. **Relationships that convert:** Build trust through visible reviews, guided onboarding, and personalized recommendations. Keep the concept of "community" tied to activation and loyalty initiatives (such as e-shops or programs), rather than treating it as a standalone effort.
5. **Who to target first:** Initially, focus on e-commerce firms and customers with explicit sustainability goals. Once your playbooks are refined and repeatable, expand your outreach to larger producers and commercial freight transporters.
6. **Capabilities to secure:** Ensure integration with the marketplace, implement telematics and route optimization, develop a reliable carbon calculator, possess compliance expertise, and create a data foundation that supports transparent reporting and optimization. Certificates can help expedite buyer due diligence.
7. **Channels that matter:** Capture attention within the marketplace itself, then enhance your presence through industry events, public relations, paid advertising, social media, and targeted

outreach. Collaborating on marketing with the marketplace operator can help accelerate proof of your offerings and lower customer acquisition costs.

8. **Cost outlook:** Anticipate expenses for platform fees, marketing, technology, cybersecurity investment, and ongoing training. Prepare a budget for data collection and compliance efforts to ensure reporting is audit friendly.
9. **Monetization and value:** Revenue will be generated from premium low-emission options, automated CO₂ reporting, green services, and advisory offerings. Keep in mind that while some sustainability initiatives may enhance brand perception and win rates before generating immediate revenue, it's important to strategize pricing and ROI narratives accordingly.
10. **First Steps:** Begin by connecting to the marketplace, enabling track-and-trace and estimated time of arrival (ETA) sharing, publishing emissions information alongside pricing and time options, and encouraging reviews after delivery. Once stable, incorporate optimization and formalized reporting to enhance margins and build trust.

1.3.2.2 BMC changes for the owner of the ADMIRAL digital logistics marketplace ecosystem

The BMC outlined below (Figure 20) includes AS-IS and TO-BE BMC elements. The black text outlines the platform owner's current BM, which serves as the baseline. The red text indicates the necessary changes if a platform owner also operates a logistics platform ecosystem. These changes include broadening the partner network to include digital service providers and cloud/IT infrastructure. The core activities will expand to incorporate onboarding, a developer portal, partner portals, a community/forum, and structured user support. Channels will formalise outreach efforts through associations, events, and newsletters. Costs will increase to accommodate a headless marketplace engine, security and availability monitoring, routing and emissions components, as well as a designated ecosystem-coordination role. Revenue sources will extend beyond subscriptions to include paid listings, API usage fees, integration fees, and custom development. These additions and integrations aim to govern an ecosystem, reduce friction from third-party integration, and scale participation—exactly as indicated by the orange governance notes (e.g., "boundary resources," long-term continuity, decision-sharing).

The green text captures items added during validation, clarifying priorities without changing direction. These priorities include emphasising marketplace infrastructure, cybersecurity and reliability, as well as capability blocks such as emissions calculators and routing. Additionally, service-led revenue opportunities such as automated CO₂ reporting, low-emission upsells, and advisory services will be introduced, reflecting stakeholder demand for visibility, compliance, and sustainability.

The orange comments are directly related to these additions: warnings about cyber risk justify the emphasis on security and API posture; ecosystem governance notes explain the need for onboarding, developer tools, and a voice-of-community forum; and market context notes clarify why certain channels and segments are prioritized now while others are planned for the future.



Figure 20. Changes of BM for the owner of the ADMIRAL digital logistics marketplace ecosystem.

The final version of the BM for the ADMIRAL digital logistics marketplace ecosystem owner is illustrated in Figure 21. The red items indicate elements of TO-BE BM, while the red elements highlight AS-IS elements identified by the owner of the marketplace.

Business Model Canvas		Designed for:	Designed by:	Date:	Version:	
		AS IS and TO BE BM of platform owner	platform owner			
Key Partners Maritime ports Land hubs Freight forwarders Shipping agents Cargo owners & shippers 3 rd party logistics providers 3 rd party data providers 3 rd party (IT/SW) service providers (digital service providers) IT infra providers (e.g. cloud service providers as a foundation for marketplace (e.g. AWS platform provider))	Key Activities Customer research Marketing Onboarding assistance Developer assistance, developer portal Business partner material and business partner portal Discussion forum for both developers and business partners User support (e.g. creating IT support tickets/requests, real-time chat support, email-based support, ...) Key Resources Sellers & buyers Port services to be traded Cargo transport services to be traded Web marketplace Cloud infrastructure Support personnel (e.g. IT support) 3 rd party service providers 3 rd party data providers Ecosystem coordinator (runs daily activities related to the marketplace ecosystem: marketing, communication, engagement, contact point for marketplace, ...)	Value Propositions <u>Sell faster & smarter</u> Slash customer acquisition costs Gain EU-wide visibility instantly. Elevate revenue with eco-friendly equipment. Showcase reduced emissions transparently Boost revenue by tapping into multi-country, multimodal cargo routes Streamline purchases with efficient tools and transparent cargo insights Unlock new routes and services with reduced costs Get cloud-based logistics selling/purchasing and management tools (especially for SMEs) Increase digital service provider opportunity to market and sell digital services Content providers can share (digital) content effectively with stakeholders through a marketplace <u>Buy faster & with more transparency</u> Stay green with informed choices Easily switch to lower-emission logistics options for a sustainable business. Receive post-transport emissions calculations for comprehensive reporting at your fingertips. Source all your multimodal, multi-country transport needs in one convenient platform. Rapid, intelligent buying handles more needs with fewer resources. Track your cargo seamlessly and resolve issues faster with our efficient system Issue simple or advanced RFQs, easily compare quote and their emissions impact.	Customer Relationships Sellers & buyers must have a forum where they can provide feedback and ideas for improvement (e.g. business partner forum and discussion board). Participation to key association events to provide latest development and business opportunity news Newsletter Channels Maritime events Land side cargo transport events Maritime and land cargo associations Maritime and land cargo web sites and publications Maritime / land hub port events and publications SW events (e.g. conferences, hachathons) Invitation functionality (buyer / cargo owner can invite own logistics service suppliers to join the marketplace)	Customer Segments Port service sellers, buyers Port authorities Land hub service sellers, buyers Cargo transport sellers, buyers Data providers (sellers) Integration and SW developers NOTE: Future thoughts if content and other type of services will be included: - (Digital) content providers: e.g. training/course providers, training materials, (consultants and maybe academics). - Authorities: e.g. notifications and infos about regulations, training.		
Cost Structure Cloud infrastructure		Revenue Streams Monthly seller & buyer subscription				
Development costs (maintaining SW) Developer & business partner community Discussion forum Routing engine(s) 3 rd party emissions calculator(s) Cost of ecosystem coordination (ecosystem coordinator) IT support personnel Marketing costs		Paid listings placement on catalogue and search results (Paid listings includes advertisement service) APIs usage fees Integration one-time fees Per customer requirements marketplace development Some sellers possibly in percentage commission mode, not fixed fee subscription				

Figure 21. Finalised version of TO-BE BM for the marketplace ecosystem owner.

Key takeaways for would-be sellers and buyers on the marketplace ecosystem:

1. **Strategy:** Operate as an ecosystem orchestrator rather than just a marketplace site. Focus on maritime ports and land hubs, integrate third-party logistics (3PL) and fourth-party logistics (4PL), data providers, and digital service providers. Implement a cloud-first approach so that partners can scale effectively with you.
2. **Offering:** Facilitate seller growth and enhance buyer efficiency by providing EU-wide visibility, faster selling and buying processes, requests for quotes (RFQs) with comparable pricing and emissions data, and transparent post-transport CO₂ reporting. Ensure the experience is designed to be multimodal and applicable across multiple countries.
3. **Partners:** Establish two tiers of partners: logistics actors (such as ports, freight forwarders, and carriers) and enablers (including IT/cloud providers, third-party data sources, and digital services). Treat cloud and IT as foundational partners to ensure uptime, security, and quick integration.
4. **Activities:** Prioritise onboarding and integration as your core actions. Utilise customer research to inform your roadmap. Create a developer portal, partner portal, and discussion forum to minimise integration friction. Provide user support through tickets, chat, and email to ensure reliability.

5. **Resources:** Make early investments in the web marketplace, cloud infrastructure, support staff, third-party services and data. Appoint an ecosystem coordinator to manage daily engagement, marketing, and partner operations.
6. **Channels:** Reach buyers and sellers by attending maritime and land events, joining trade associations, engaging with industry media, participating in software conferences and hackathons. Additionally, use a newsletter and an in-product invitation flow that allows buyers to invite their suppliers.
7. **Cost Model:** Plan for expenses related to cloud services, a headless marketplace engine, security and availability monitoring, continuous development, routing and emissions components, community and forum operations, ecosystem coordination, IT support, and marketing.
8. **Monetization:** Combine subscription models for buyers and sellers with premium features and vetting. Introduce paid listings and ads in your catalogue and search, charge for API usage and one-time integration fees, offer custom development services, and consider a percentage commission for select sellers.

1.3.2.3 BMC changes for complementors of the ADMIRAL digital logistics marketplace ecosystem

The green items indicate new or rescheduled elements, while the red elements highlight “old” elements identified by the complementors in Section 1.2. (Figure 22). Several entries were merged to remove duplication, and a few were reallocated to their correct blocks. Notable updates include expanding Key Partners (e.g., Enterprise Resource Planning (ERP) providers), sharpening Key Activities around integration with open data platforms and customer support, clarifying Value Propositions (paperless logistics and automated CO₂ reporting), adding platform-to-platform Channels, and diversifying Revenue Streams (subscriptions, transactions, revenue sharing, onboarding, and consulting).



Figure 22. Changes of BM for the complementors during validation phase.

Concise “before → after” elements per block

Key Partners were expanded and clarified. ERP providers were added, port authorities/operators and standardisation bodies were emphasised as enablers of data and compliance. *The rationale is that complementors depend on data/ERP interoperability to deliver value* (Figure 22).

Key Activities focused on integration and support. Integration with open data platforms, publish environments, alerts/notifications, and ongoing product development/support to prevent tech bottlenecks were added. *Rationale: complementors must integrate into client systems and marketplaces seamlessly* (Figure 22).

Value Propositions are now made outcome-centric focusing on elevated paperless logistics, automated CO₂ reporting, and transport scheduling which clarified efficiency, visibility, and cost-saving outcomes. *The rationale is to provide measurable, compliance-relevant value for shippers and LSPs* (Figure 22).

Customer Relationships are now mixed mode, incorporating self-service options, a chatbot, and personal support for API/integration. This approach facilitates tailor-made personalisation where

needed. *The rationale behind this strategy is to combine scalable support with hands-on integration (Figure 22).*

Customer Segments have been refined to maintain a two-sided focus on freight owners and LSPs. Other marketplaces and customs authorities as secondary segments. *The rationale for this approach includes potential for other platform-to-platform expansion and regulatory touchpoints (Figure 22).*

Key Resources consist of standardised data and ecosystems. This includes highlighted standards (Global Logistics Emissions Council (GLEC), ISO), access to mobility data, alliances, and marketplace assets. *The rationale behind this is that data quality and standards are essential for supporting CO₂ and paperless initiatives (Figure 22).*

Channels refer to platform-to-platform routes. Added ERP systems and associations as acquisition and activation; leverage current users for advocacy. *The rationale is that complementors sell where workflows already exist (Figure 22).*

The Cost Structure was clarified for compliance and operations. Made IT support/maintenance, customer support ops, and certification costs explicit. *Rationale: these are recurring costs associated with integrations and standards (Figure 22).*

Revenue Streams should be diversified: subscriptions, transaction fees, revenue sharing with marketplace operators, onboarding setup fees, and consulting services to capture integration value. *The rationale aligns monetisation with usage, ecosystem interactions, and services (Figure 23).*

Explanation of deletions or merges

- *Merged duplicates:* We combined overlapping entries (for example, generic ‘sales/marketing’ activities) into more precise items categorised under other blocks or sections (Figure 22).
- *Reallocated to the right block:* Items that described channels or relationships were moved out of the Activities section to the proper blocks to ensure BMC logic distinguishes between how we reach and serve customers vs. what we do (Figure 22).
- *Deleted items:* We removed elements that did not create value for complementors or were already implied by other blocks, to keep the BMC concise and testable (Figure 22).

The innovative part of complementors BMC

The innovative aspects of this BMC (Figure 23) are:

1. **Standards-driven value at the core.** By building on GLEC/ISO standards and leveraging access to freight mobility data, complementors can automate CO₂ reporting and facilitate paperless workflows—providing a compliance-grade proposition that many companies find challenging to offer. (Innovation = transforming standards into productized services).
2. **Interoperability as a product.** Establishing explicit partnerships with ERP systems and integrating an open data platform turns integration from a project risk into a repeatable capability (using APIs, publish environments, alerts). (Innovation = treating integration and data management as core features rather than custom work).
3. **Platform-to-platform go-to-market.** Using freight exchanges, marketplaces, ERPs, and associations as distribution channels can shorten sales cycles and facilitate user engagement within existing workflows. (Innovation = using ecosystems for the distribution of service rather than relying on one-by-one enterprise sales).

- Outcome-linked monetisation.** Combining subscriptions, transactions, revenue-sharing with marketplace operators, onboarding fees, and consulting services aligns revenue with actual usage, integration effort, and ecosystem growth. (Innovation = monetising both software and the complementor’s role in enabling the marketplace).
- Scalable and high-touch relationships.** Blending self-service/chatbot features with personalised integration support helps balance unit economics with complexities of B2B onboarding. (Innovation = a hybrid relationship model tailored for integrations).

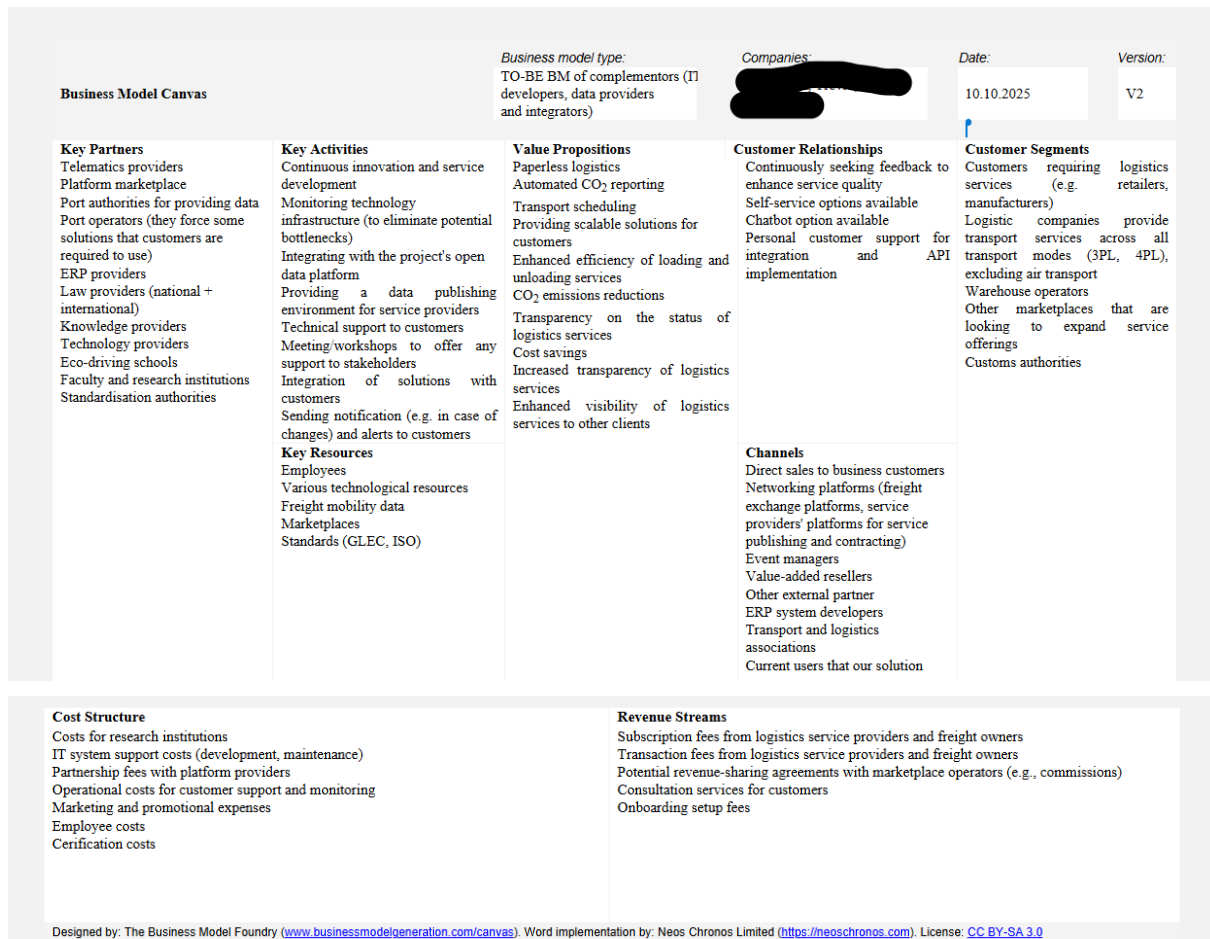


Figure 23. Finalised version of BM for the complementors.

Key takeaways for would-be complementors

To effectively join a logistics marketplace ecosystem, complementors (such as IT/tool developers, data providers, and integrators) should consider the following insights from the TO-BE BMC (Figure 23):

- Align your offerings with key areas/outcomes that marketplaces and their users value.
- Ensure your messaging emphasises efficiency, transparency, and cost savings; features should support the outcomes customers require.
- Arrive with a plan to integrate with the marketplace’s open-data platform and provide (or consume) a publishing environment for services. Have versioned APIs and a test sandbox.
- Line up ERP connectors and a lightweight notifications/alerts mechanism from day one—these are repeatedly needed across customers.

5. Build to relevant standards (for example, GLEC, ISO) so CO₂ and paperless artifacts are audit-friendly across customers and countries. Budget for certification.
6. Offer self-service and a chatbot for scale, but keep personal support for API/integration.
7. Expect freight owners (retailers/manufacturers), LSPs (3PLs and 4PLs across various modes), warehouse operators, as well as other marketplaces and customs authorities, as customers.
8. You can start with a small team (one person who owns the product and knows the standards for CO₂ and paperless flows – if offered, an API developer who can handle ERP and data integrations, someone for testing and automation, and a person who looks after customers and integrations during onboarding).
9. You'll spend on building and running the product: development, maintenance, cloud environments, and system monitoring. You'll also have marketplace costs, like partner fees, listing fees, and sometimes revenue sharing with the platform. Day to day, you'll pay for support and operations—people to help customers, tools for alerting. Set aside money for compliance and certification (for example, ISO or GLEC). If useful, plan a small budget for external research or pilots with universities or institutes.

1.3.2.4 Potential roles of faculties, institutions and logistics and transport associations on the ADMIRAL marketplace ecosystem

We also conducted a workshop with faculty, institutes, and transport and logistics associations to clarify their roles in the ADMIRAL multimodal logistics digital marketplace ecosystem. During the session, participants highlighted several key points:

1. **Opportunities for universities:** Participants noted that universities will have tangible offerings after the ADMIRAL project concludes. They expect to engage in contract research with companies and utilise the marketplace's matchmaking service to foster collaborations.
2. **Training initiatives by TIA:** TIA identified its primary avenue for exploitation as leading training courses. These could be either standardised courses based on ADMIRAL outcomes or specialised courses tailored to the specific needs and backgrounds of participants. TIA aims to provide the most up-to-date and relevant knowledge derived from the project.
3. **KLEZ's engagement with companies:** KLEZ's role will focus on engaging with companies and providing them with valuable information.
4. **Non-commercial exploitation by universities:** Universities primarily see non-commercial opportunities for exploiting ADMIRAL results. They plan to incorporate these results into their teaching and course offerings while recognising the challenge of keeping results relevant over time. Some courses may charge participation fees, but these are expected to constitute a minor part of their overall activities.
5. **Policy contributions:** In the realm of policy, universities can participate in public calls and tenders to develop proposals for new regulations. Additionally, staff may hold unpaid positions of trust that have significant societal impacts, and universities can contribute to policy briefs. They also plan to offer industry consultancy, such as advising on Scope 3 emissions and preparing companies for upcoming regulations.

6. **Engagement in standardisation:** University staff may serve on international committees, which would aid in sharing ADMIRAL-related data to support information exchange regarding standards. Involvement in ADMIRAL can also help align UN standardisation efforts with EU policies.

7. **Marketplace usage suggestions:** Participants proposed various potential uses for the marketplace, including a platform for selling data gathered within the ecosystem, facilitating matchmaking between industry and researchers (including young students), and promoting innovations. Overall, the workshop participants expressed optimism about the potential outcomes and opportunities arising from the ADMIRAL project.

2. Network development and governance practices

ADMIRAL project develops a multimodal low emission marketplace, called ADMIRAL marketplace, on top of an existing platform developed and maintained by AWA. Marketplace will have two main types of users: service providers like different types of logistics service providers, and buyers like cargo owners, consignees, and main contractors. Marketplace will help to operate e.g. in ports and other logistics hubs by simplifying cooperation between the actors. It will also include applications that are able to improve specific port operations. Additionally, ADMIRAL marketplace will also work as an innovation platform for new services, as it will be developed so that software and solution developers have clear guidelines to include the invented services to be available in the platform, which is typical features of innovation platforms.

Section 2 is structured as follows:

- Section 2.1 introduces the **terminology and elements related to platform governance**.
- Section 2.2 describes the **governance model framework**, which was utilised as a frame to define the governance model for ADMIRAL marketplace.
- Section 2.3 discusses certain **specific issues related to the governance of the ADMIRAL marketplace** that have been highlighted in the ADMIRAL project plan.
- **The proposed governance model for the ADMIRAL marketplace** is presented in section 2.4.

The proposal for the ADMIRAL marketplace governance model was developed as follows. A literature review was conducted on platform ecosystem governance models. This review provided insights into the elements that, according to the literature, constitute platform governance. Based on the literature review, a governance framework specific to the ADMIRAL marketplace was defined. This framework outlines which governance elements need to be specified for the ADMIRAL marketplace ecosystem. The proposal for the ADMIRAL marketplace governance model was created in collaboration with the research partner (VTT) and the marketplace owner (AWA). The results of the stakeholder interviews (drivers and barriers for digital logistics marketplace), as presented in publication Markuceviciute-Vincke et al. (2024), were taken into account in governance model definition. These definitions were discussed in the meetings of ADMIRAL Work Package 3 (WP3) and consortium meetings. The validation of the governance model was carried out as part of a business model validation workshop organised for the ADMIRAL marketplace owner (see section 1.3.1). In this workshop, the definitions were reviewed together with the research partner and AWA and finalised accordingly (see Appendix C for Stuttgart workshop practicalities).

2.1 Platform governance

Governance of digital platform ecosystems has been studied extensively, e.g. in Tiwana et al. (2010), Tiwana (2014), Mukhopadhyay & Bouwman (2019), Parker et al. (2016). There are multiple definitions for the platform governance typically derived from the definitions of the Tiwana et al. (2010) adding new components or motives to platform governance based on research objectives (Mukhopadhyay & Bouwman, 2019). In general, platform governance can be defined as the blueprint for (digital platform) ecosystem orchestration (Tiwana, 2014) as who makes what decisions about a (digital) platform (Tiwana et al., 2010).

Governance and platform ecosystems are often treated from a technical viewpoint addressing architecture issues and from software developers' point of view (Kapoor et al., 2021; Mukhopadhyay & Bouwman, 2019). However, the inherent social dimension cannot be overlooked (Kapoor et al., 2021). Since a platform ecosystem is constituted by a combination of the platform, its stakeholders, and the offerings developed on the platform, its operations require coordination, just as the internal operations of companies must be coordinated – changing internal operational control with orchestration of external sources of value (Kapoor et al., 2021).

Table 9 presents examples of how elements of governance have been classified in the literature.

Table 9. Elements of governance in literature

Reference	Views / elements of governance
Tiwana et al., 2010	Governance is divided into three distinctive perspectives: <ul style="list-style-type: none"> - Decision rights partitioning: refers to how decision-making authority is divided up between the platform owner and module developers - Control: refers to the formal and informal mechanisms implemented by a platform owner to encourage desirable behaviours by module developers, and vice versa - Proprietary versus shared ownership: whether a platform itself is proprietary to a single firm or is shared by multiple owners.
Tiwana, 2014	Platform governance encompasses three dimensions: <ul style="list-style-type: none"> - The division of authority and responsibilities between the platform owner and app developers (decision rights partitioning). - The collection of mechanisms through which the platform owner exercises control app developers (the control portfolio, which includes the authority to accept or reject apps). - Decisions about how proceeds will be divided up between a platform owner and app developers (pricing policies).
Parker et al., 2016	Basic platform governance elements are: <ul style="list-style-type: none"> - Laws: rules defined and enforced by the platform owner - Norms: practices that are based on vibrant communities. E.g. crowd curation and feedback. - Architecture: well-designed systems reward good behaviour and prevent and correct poor quality interaction. E.g. using algorithms to predict useful interactions (based on data) or automated systems to correct incorrect input. - Markets: monetary incentives, social currency
Schrieck et al., 2016	Eight key concepts focusing on the design and governance of platform ecosystems: <ul style="list-style-type: none"> - Roles: covers for example the number of sides it connects, the ownership regimes, the distribution of power which can be centralized or decentralized and the relationship to stakeholders of the platform ecosystem - Pricing and revenue sharing: refers to payment flows within the platform ecosystem and how they are distributed between the different stakeholders - Boundary resources: refers to tools, regulations or other resources that are used to govern co-creation of value in platform ecosystems - Openness: refers to “to the easing of restrictions on the use, development and commercialization of a technology”. Platform ecosystem can be opened

Reference	Views / elements of governance
	<p>by granting access to the platform or by partially giving up control over the platform.</p> <ul style="list-style-type: none"> - Control: refers to informal and formal control mechanisms - Technical design: comprises the modular architecture of the platform, the definition of its interfaces and the compatibility to relevant systems - Competitive strategy: describes whether competition, collaboration, or the mélange of both, co-opetition, is the most suitable strategy to establish a platform ecosystem among competing ones - Trust: is a counterpart of power and is a basic prerequisite for a platform ecosystem to succeed. It is relevant for the relationship between platform owner and complementors as well as for the relationship between customers and the platform ecosystem as a whole
Tura et al., 2018	<p>Governance is divided into three main elements that describe the common rules, laws, practices and managerial level of the platform:</p> <ul style="list-style-type: none"> - Leadership: Who manages the platform and how? - Ownership: Who owns the platform? - Platform rules: What types of rules are enforced? How are the services/content regulated? What consumers, producers, providers, and competitors are allowed to do?
Mukhopadhyay & Bouwman, 2019	<p>Proposal to define digital platform ecosystem governance in a more comprehensive manner by focusing on five key themes:</p> <ul style="list-style-type: none"> - Meta-organisation design: Single/multiple leaders, Membership openness, Tiering, Decision right sharing. - Coordination mechanisms: Values / shared world view, Rules. - Ecosystem value Co-creation mechanisms - Fair value appropriation mechanisms - Architectural principles: Degrees of modularity, Interface openness and richness.
Hein et al., 2020	<p>Three different building blocks to characterize digital platform ecosystems:</p> <ul style="list-style-type: none"> - Status of platform ownership: single, joint, community - Value-creating mechanisms in the ecosystem: transaction, innovation - Autonomy of complementors: loosely/tight coupled
Perscheid et al., 2020	<p>Five components to define platform governance:</p> <ul style="list-style-type: none"> - Decision rights: refer to the question, who has the authority and responsibility for making specific decisions - Transparency: encompasses documentation that allows users and employees to understand and to follow the platform's governance. Understand how a platform is governed, what decisions take place, and how decisions have been made - Accessibility: defines the degree of openness of a platform ecosystem in the sense of granting access to the platform - Trust is a crucial factor in defining a platform ecosystem's success. Trust defines the relationship between the governing entity, users, and complementors of the platform - Incentivization refers to the incentives a platform implements to reward internal or external developers
Halckenhäusser et al., 2020	<p>A core problem for platform firms is platform governance. The focal firm should focus less on designing, developing, and distributing products but</p>

Reference	Views / elements of governance
	<p>rather to focus on designing mechanisms that enhance the outcome of the ecosystem. Governance can be divided into:</p> <ul style="list-style-type: none"> - Cooperation: refers to mechanisms that seek to influence complementor behaviour by establishing interorganizational relationships either directly with the platform owner or among complementors - Resourcing: refers to the provision of resources to complementors: - Control: refers to the enforcement of rules, especially regarding the exclusion and screening of platform complementors. - Market: refers to mechanisms for regulating the supply and demand, often through pricing and competition.

Ownership is an important decision in the platform lifecycle (Hein et al., 2020), as it is closely linked to both the design of the platform and its governance (Tiwana et al., 2010). The platform owner is responsible for defining the governance mechanisms that regulate the platform ecosystem. Furthermore, platform owner defines a vision for the platform ecosystem and promote this among key actors (Gawer & Cusumano 2014). This is not easy because an ecosystem typically consists of different actor groups with different incentives and there needs to be balancing between these incentives. Therefore, for the platform sustainability it would be beneficial if the platform ownership could be decided early on (Valkokari et al., 2022).

Decision rights, or the granting of autonomy, refer to the level of independence that platform owners provide to complementors and service providers when they engage in activities, transactions, and interactions with customers (Chen et al., 2022; Staub et al., 2022). Tiwana (2014) examines platform governance through the lens of innovation platforms, emphasizing the importance of decision-making both at the platform level and at the application level. Decision rights, according to Tiwana, can be analysed from two perspectives: the strategic perspective, which addresses long-term direction; and the implementation perspective, which focuses on operational choices. This dual approach enables platform owners to balance overarching strategy with practical implementation. Naturally, the platform owner is ultimately responsible for making decisions regarding the platform itself, but takes into account the needs of the developer community.

When it comes to application-specific decisions, these are made by the respective application developers, as they possess the best understanding of their own customer base. However, the implementation of these decisions must respect the boundary resources and requirements set by the platform owner. From the perspective of buyers and sellers, the partitioning of decision rights is connected to their autonomy over commercial aspects. E.g. autonomy degree of the selection and configuration of service offerings, the setting of prices, and the determination of related terms and conditions, such as cancellation policies or other contractual issues that frame the exchange. Allowing buyers and sellers to exert meaningful control over these elements not only reinforces their operation within the platform but also supports the broader aims of trust and incentivization. There are several reasons to support decentralized decision rights. This approach enhances the fairness and credibility of the decision-making process, increases trust among partners, leverages knowledge effectively, allows complementors to better pursue their own interests, motivates more complementors to join the platform, and leads to a greater volume of innovations (Mukhopadhyay & Bouwman, 2019; Chen et al., 2022; Staub et al., 2022).

Platform ecosystem owners use **control mechanisms** to motivate participating organisations, reduce risks, uncertainties, and costs, and drive successful collaboration (Mukhopadhyay & Bouwman, 2019; Tiwana, 2014). Membership openness needs to consider “quality versus quantity” between unrestricted entry versus cherry picking among aspirants (Mukhopadhyay & Bouwman, 2019).

Tiwana (2014) divides control mechanisms into formal and informal. Formal mechanisms include input, output and process control, and informal ones include relational control. In input control, the platform owner uses predefined objective acceptance criteria for judging what content is allowed to be entered into a platform, thereby ensuring a high quality of contributions for platform users (Tiwana, 2014; Parker et al., 2016). Process control relates to decisions of how a platform owner rewards or penalizes users based on how they follow prescribed process, rules, and procedures that the owner believes will lead to desirable outcomes (Tiwana, 2014). These rules and procedures can be e.g. development tools and guidelines. Output control relates to the issue of how a platform owner rewards or penalizes contributors based on the degree to which the outcomes of their work achieve predefined target performance metrics (Tiwana, 2014). Here, platforms use tools to enable community feedback loops (Parker et al., 2016). Tools collect signals (e.g. end user ratings) about the quality of the content or the reputation of service providers and overwhelmingly negative feedback usually disappear from the platform. Relational control is an informal control mechanism where the platform owner relies on norms and values that are shared with platform members to influence their behaviour (Tiwana, 2014). The platform owner tries to provide a collective goal (shared identity) that defines the character of the platform ecosystem, enables continuous information exchange and supports working collaboratively to reduce cognitive distance and develop a shared worldview among participants (Mukhopadhyay & Bouwman, 2019).

Tiering is a strategy used for coordination and control, often implemented alongside rules and incentives. It creates structured differentiation within an otherwise open or diverse ecosystem. By introducing two or more tiers or levels of membership, tiering can serve several purposes: (1) control access and participation, (2) Manage quality, trust, or exclusivity and (3) incentivize desired behaviour (Mukhopadhyay & Bouwman 2019).

Boundary resources (BR) represent one of the critical elements in creating a successful digital platform by facilitating platform ecosystem participant engagement. Boundary resources are designed by platform owners as part of governance rules and they can be applied for innovation platforms and for transaction platforms (Wulfert et al., 2024). Boundary resources can be divided into (Bianco et al., 2014):

- Technical boundary resources (TBR): application boundary resources (ABR) (resources that enable the third-party applications to interact with the platform, e.g. APIs) and developer boundary resources (DBR) (resources that enable the third-party developers to develop easier the applications, e.g. SDKs)
- Social boundary resources (SBR): that are resources that are used to enable transfer knowledge between the participants. For instance, a social boundary resource could be a blog and a dedicated developer forum (Wulfert et al., 2024).

Incentives—whether monetary or non-monetary—are also an aspect of platform governance. This dimension is highlighted in many governance classification frameworks. Therefore, the platform owner needs to effectively facilitate value appropriation once the value is created. Without appropriate

monetary and non-monetary incentives, platform owners find it difficult to attract complementors and other participants (Mukhopadhyay, & Bouwman, 2019). This is an aspect that relates heavily to the BMs which are discussed in the previous part of this deliverable.

Governance cannot be seen as a static but rather a dynamic activity that must be adapted to the platform's context. Platforms and platform ecosystems - like many other artifacts - have a lifecycle (Isckia et al., 2020). They emerge, grow, expand and mature in the market (Kim & Yoo, 2019). While platform ecosystems make their way from design to the implementation and finally to operational phases, a suitable governance strategy needs to evolve over time to achieve the expected outcomes (Mukhopadhyay & Bouwman, 2019; Kim & Yoo, 2019; Parker et al., 2016; Wulfert et al., 2024).

2.2 Governance model framework

The following table presents a framework for defining the ADMIRAL governance model based on platform governance literature.

ADMIRAL marketplace is both a transaction and innovation platform. Furthermore, it is a multisided platform including Sellers, Buyers, SW developers, and Integrators. On the transaction platform point of view, key actors are logistics service sellers and buyers. On the innovation platform point of view, SW developers and integrators play central roles. Governance elements should consider the specific needs of each actor type, such as onboarding processes and relevant boundary resource types. Section 2.4 presents a proposal for the ADMIRAL marketplace governance model, structured according to the governance model elements presented in Table 10 **Error! Reference source not found.**

Table 10. Governance framework for ADMIRAL governance definition.

Marketplace stakeholder(s)	Governance element	Description & design options
All	Ownership <i>Hein et al. (2020); ADMIRAL D3.2 appendix: legal issues; Mukhopadhyay & Bouwman (2019); Valkokari et al. (2022)</i>	Platform ownership is an essential factor for the design and governance of digital platform ecosystems as well as long-term continuation of the platform ecosystem. Platform ownership is not just about the legal entity that owns the digital platform; it also relates to the distribution of power in the ecosystem, which can be centralized or decentralized. Owner also describes the relationships among partners in the ecosystem. Single, joint/community
All	Decision right sharing <i>Mukhopadhyay & Bouwman, 2019; Tiwana, 2014</i>	The degree to which all participants or selected participants are allowed to participate to the decision making related to the platform and platform services. Centralised, Distributed, Community-based
Buyer & seller	Control: membership openness (ADMIRAL adaptation: buyer & seller side) <i>Mukhopadhyay & Bouwman, (2019); Hein et al. (2020)</i>	How open is the marketplace ecosystem to new participants? Controlling who is allowed to join and operate within the marketplace. Are there specific criteria or requirements that restrict participation, and how does the platform owner ensure that only those meeting these criteria are admitted? Open, Controlled, Closed.
	Control: Input control (ADMIRAL adaptation: buyer & seller side) <i>Adapted based on Tiwana (2014) and Parker et al. (2016).</i>	Platform owner uses predefined objective acceptance criteria for judging what content are allowed into a platform. Content curation. Frictionless content entry must be balanced through effective curation. Users can find easily matches that produce significant value for them.
	Control: Process control (ADMIRAL adaptation: buyer & seller side)	How a platform owner controls users based on how they follow prescribed process, rules, and procedures that the owner believes will lead to desirable outcomes. From ADMIRAL point

Marketplace stakeholder(s)	Governance element	Description & design options
	<i>Adapted based on Tiwana (2014)</i>	of view consider especially guidance / support to good quality information.
	Control: Output control (ADMIRAL adaptation: buyer & seller side) <i>Adapted based on Tiwana (2014) and Parker et al. (2016)</i>	How platform owner controls buyers & sellers based on the degree to which the outcomes of their work achieve predefined target performance metrics. E.g. end-user ratings. Platforms use tools to enable community feedback loops. Tools are used to collect signals about the quality of the content or the reputation of service providers. Offerings that receive overwhelmingly negative feedback usually disappear from the platform.
	Control: Relational control (ADMIRAL adaptation: buyer & seller side) <i>Adapted based on Tiwana (2014), Mukhopadhyay & Bouwman (2019) and Gawer & Cusumano (2014).</i>	Refers to the degree to which the platform owner relies on norms and values that it shares with platform members to influence their behaviour. This control mechanism thus relies on the platform owner to provide an overarching collective goal for the platform ecosystem; a sort of shared identity that defines the character of the platform ecosystem. A shared vision, continuous information exchange and working collaboratively helps to reduce cognitive distance and develop a shared worldview among participants.
SW developers & integrators	Control: membership openness (ADMIRAL adaptation: SW company) <i>Mukhopadhyay & Bouwman (2019); Hein et al. (2020)</i>	How open is the marketplace ecosystem to new SW/integration providers? Controlling who is allowed to join and operate within the marketplace. Are there specific criteria or requirements that restrict participation, and how does the platform owner ensure that only those meeting these criteria are admitted? Open, Controlled, Closed.
	Control: Input control. (ADMIRAL adaptation: SW company) <i>Tiwana (2014)</i>	Platform owner uses predefined objective acceptance criteria for judging what apps are allowed into a platform's ecosystem. (Input control)
	Control: Process control (ADMIRAL adaptation: SW company) <i>Tiwana (2014)</i>	Refers to the degree to which a platform owner control app developers based on the degree to which they follow prescribed development methods, rules, and procedures that it believes will lead to outcomes desirable from a platform owner's perspective.
	SW: Output control (ADMIRAL adaptation: SW company) <i>Tiwana (2014)</i>	Platform owner control app developers based on the degree to which the outcomes of their work achieve predefined target performance metrics. E.g. market-oriented metrics such as sales, downloads, and end-user ratings. (Output control) Platforms use tools to enable community feedback loops. Tools are used to collect signals about the quality of the content or the reputation of service providers. Offerings that receive overwhelmingly negative feedback usually disappear from the platform.
	Control: Relational control (ADMIRAL adaptation: SW company) <i>Tiwana (2014); Mukhopadhyay & Bouwman (2019); Gawer & Cusumano (2014)</i>	Refers to the degree to which the platform owner relies on norms and values that it shares with platform members to influence their behavior. This control mechanism thus relies on the platform owner to provide an overarching collective goal for the platform ecosystem; a sort of shared identity that defines the character of the platform ecosystem. A shared vision, continuous information exchange and working collaboratively helps to reduce cognitive distance and develop a shared worldview among participants
All	Tiering <i>Mukhopadhyay & Bouwman (2019)</i>	Different levels of membership in an ecosystem reduce coordination complexity by assigning some of the coordination responsibilities of lower tiers to higher tiers. It also motivates complementors by offering the opportunity to move to a more central level and allowing the platform leader to award complementors who are dominant or make a higher contribution. Flat, Two-tiers, Multi-tiers.

Marketplace stakeholder(s)	Governance element	Description & design options
SW developers & integrators	Ecosystem value Co-creation mechanisms: technical boundary resources <i>Bianco et al. (2014); Mukhopadhyay & Bouwman (2019); Gawer & Cusumano (2014)</i>	APIs, Libraries, SDKs and other tools/environments that facilitate the development activities on the top of the platform.
All	Ecosystem value Co-creation mechanisms: social boundary resources <i>Bianco et al. (2014); Mukhopadhyay & Bouwman (2019)</i>	Guidelines, demonstrators, events (hackathons, WSS), trainings, partner programs, contracts, presentation material for engagement, etc. that facilitate platform partners to participate to the operation of the platform and transferring knowledge.
All	Fair value appropriation mechanisms <i>Mukhopadhyay & Bouwman (2019); Tiwana (2014)</i>	Platform owner need to effectively facilitate value appropriation once the value is created. Without appropriate monetary and non-monetary incentives, platform owners find it difficult to attract complementors and other participants.

2.3 Considering specific issues in ADMIRAL marketplace governance practices

The ADMIRAL project plan identified specific issues that require discussion within the context of the ADMIRAL marketplace ecosystem. These include: defining the purpose, common language, shared aims and ways of collaboration in ADMIRAL marketplace; considering the development path of the network; the long-term continuity, systemic goals and ecosystem perspective of the ADMIRAL marketplace; levels and tools for ADMIRAL marketplace ecosystem governance. In the following, these issues will be discussed.

2.3.1 Defining the purpose, common language, shared aims and ways of collaboration in ADMIRAL marketplace

In order for the ADMIRAL marketplace ecosystem actors to work together, they must have a common understanding of the purpose and aims of the marketplace and a common terminology for operating there. For the platform sustainability it would be beneficial if the platform ownership could be decided on in the early phase (Valkokari et al., 2022). This is because the platform owner is in the key role to develop a vision for the platform ecosystem and promote this among key actors (Gawer & Cusumano 2014). This is not easy because an ecosystem typically consists of different actor groups with different incentives. Therefore, the platform owner needs to balance between a shared vision of the platform ecosystem and the interests of the different partners on board in order to facilitate their operation and contributions (Isckia et al., 2020).

The ADMIRAL project has engaged project partners in developing a common understanding of the purpose, aims and terminology of the ADMIRAL marketplace ecosystem. The platform owner – AWA – has been in a key role in this process. Shared understanding was initially described in the form of the first ADMIRAL marketplace concept (ADMIRAL Milestone 4 document) and further documented as part of the ADMIRAL Marketplace Developer and Business portal (<https://developers.awake.ai/multimodal-emissions-aware-logistics-marketplace>). There are different actor groups in the logistics network. The portal explains the business opportunities of the marketplace for different actor groups (such as service providers, service buyers, integrators and developers) and the business terminology used which contributes towards a common understanding of the marketplace purpose and opportunities.

2.3.2 Considering the evolution path of the network

The logistics industry has traditionally operated through independent, fragmented networks, with each player managing their own supply chain and transportation operations in isolation. However, with growing environmental concerns and the increasing pressure to reduce carbon footprints, the sector is shifting towards more collaborative, sustainable models. The increasing complexity of global supply chains, technological advancements, and the growing demand for sustainability are all driving this shift. One promising approach to this evolution is the concept of collaborative logistics ecosystems, where multiple stakeholders—such as suppliers, carriers, and distributors—work together to optimize the flow of goods and services.

In this context, **the ADMIRAL marketplace offers a novel solution to foster collaboration across logistics networks**. By providing a platform for coordination, resource-sharing, and real-time data exchange, the ADMIRAL marketplace facilitates seamless interaction among logistics players, leading to enhanced efficiency, reduced costs, and improved sustainability.

The marketplace ecosystem offers value-creating opportunities for a rich set of actors. In addition to traditional logistics actors, the marketplace is intended to bring together suppliers of various value-added services. For example, actors offering emission calculation services can integrate their emission calculators into the marketplace, and software development companies can build integrations between the marketplace and cargo owners logistics information systems. Thus, the marketplace enables a wide range of business activities that go beyond the traditional logistics BM (see Section 1 “New innovative business models”). Furthermore, to strengthen emission awareness within the ADMIRAL marketplace ecosystem, it will be essential to involve third-party actors—such as authorities and experts in emission calculation frameworks. Their participation in webinars or other events (social boundary resources) ensures that knowledge related to emissions calculation is actively introduced and disseminated within the ecosystem.

2.3.3 Long-term continuity of the ADMIRAL marketplace ecosystem

The long-term continuation of the life of a platform ecosystem is naturally affected by having a clearly defined owner (Valkokari et al., 2022) who is responsible for maintaining the platform and ecosystem and develops it in a direction that serves the various stakeholders. The owner is responsible for the platform and its ecosystem, ensuring daily operations and keeping the platform ecosystem vibrant. There are several options for defining ownership (e.g. Hein et al., 2020), but the neutrality of the owner (not being a competitor to the platform ecosystem actors) is particularly important for the ecosystem (Pakkala et al., 2024; Markuceviciute-Vincke et al., 2024). For the ADMIRAL marketplace, post-project ownership arrangements are clearly defined: the owner of the post-project marketplace will be a neutral party—AWA.

During the ADMIRAL project, the marketplace platform and its associated tools are developed, its operational logic is defined, and initial governance practices and business models are outlined. After the project, AWA will open the marketplace for universal use. It is important for the marketplace platform owner to consider platform competition - how the platform launch will be executed and what is the growth strategy for the platform’s future.

Launching a marketplace presents a fundamental challenge: critical decisions must be made on how to overcome the notorious chicken-and-egg problem (Parker et al., 2016; Markuceviciute-Vincke et al.,

2024) and attract the very first users to the platform. It is evident from ADMIRAL marketplace launch perspective that both offerings (services) and buyers are required for the platform to function and create value. To address this, the ADMIRAL project is leveraged as a framework to assemble products and services from various project partners, ensuring that both supply and demand sides are represented for the initial testing phase during the ADMIRAL project. This approach enables the marketplace to be populated with relevant content from the outset, laying a foundation for future organic growth and engagement.

Digital platform ecosystems actively leverage social boundary resources (Bianco et al., 2014)—including industry events, trade fairs, hackathons, and similar gatherings—to communicate the importance of an emission-aware marketplace. Through these events, platforms foster understanding about why such a marketplace is necessary (changing the mind-set towards emission-awareness), outlining the advantages it brings not only in terms of improved transparency and sustainability, but also in creating new business opportunities (like applications developed on the top of the marketplace platform). These activities showcase the tangible benefits for various stakeholders, including software companies, who may act as marketplace complementors by building and integrating applications that extend the platform’s functionality and ecosystem value. This is why the use of social boundary resources is also important for the ADMIRAL marketplace throughout its lifecycle.

The ADMIRAL marketplace governance model also enables side switching (Parker et al., 2016), a desirable feature in platform ecosystems that increases users’ engagement with the platform. In practice, buyers can register as sellers and vice versa, ensuring that participants have flexibility to adjust their roles as needed. This dual registration fosters deeper commitment and network effects within the ecosystem.

Additionally, one effective mechanism for growing the marketplace ecosystem user base is to empower buyer parties to invite their own logistics service providers to join the platform, leveraging buying power (Markuceviciute-Vincke et al., 2024) as a driver for ecosystem expansion. By allowing cargo owners to bring their existing suppliers into the marketplace, relationships and transactions are transferred into the marketplace platform. The ADMIRAL marketplace owner actively supports the onboarding process for new participants (including invitation mechanism), ensuring a smooth transition and integration for all parties involved.

AWA also has a roadmap laying out the future direction of the marketplace. This roadmap foresees that marketplace ecosystem stakeholders are included into the development process by gathering development ideas, fostering open discussion, and enabling participation in the prioritization of new features or enhancements (via discussion forums or other collaborative tools). In addition, the impact of regulation and other external factors is taken into account by AWA by monitoring relevant developments and, when necessary, engaging third-party indirect stakeholders in the ecosystem's activities—for example, through dedicated training sessions or seminars. This approach ensures that the ADMIRAL marketplace remains responsive to changes in its operating environment and is able to adapt proactively to new requirements or expectations (e.g. possible changes to the emission standards and frameworks).

2.3.4 Levels and tools for ADMIRAL marketplace ecosystem governance

Operation of the innovation platform ecosystem can be structured into three levels (Valkokari et al., 2022; Hemilä et al., 2021; Kääriäinen et al., 2021); steering, coordination, operational. ADMIRAL marketplace ecosystem environment comprises different stakeholders such as sellers, buyers, SW developers, integrators. The organization of this ecosystem-based work can be described using this model (Figure 24).

The steering level includes overall steering and decision-making responsibilities and practices related to the ecosystem's operation. It focuses on aligning the ecosystem's and platform's goals with business needs. The coordination level contains practices and responsibilities for coordinating the ecosystem's "daily work" according to the boundaries set by the steering-level and the engagement of the network (e.g. to scout needed new partners/capabilities to the network and running the platform and operation on it). In TO-BE business model definition (Chapter 1) it was indicated that there is a need for an ecosystem coordinator to support the day-to-day operations of the marketplace ecosystem when it is in use after the ADMIRAL project. A digital platform aims to repeatedly attract participants (sellers, buyers, developers/integrators) to perform its defined interactions (Parker et al., 2016). The platform ecosystem coordinator and platform owner facilitate and support these interactions. Operational level supports practical innovative implementation work in ecosystem according to upper-level decisions - how practical innovative development work (platform development, integrations, new innovative applications, etc.) is guided and needed resources are provided for its implementation in order to ensure high-quality contributions to the platform ecosystem.

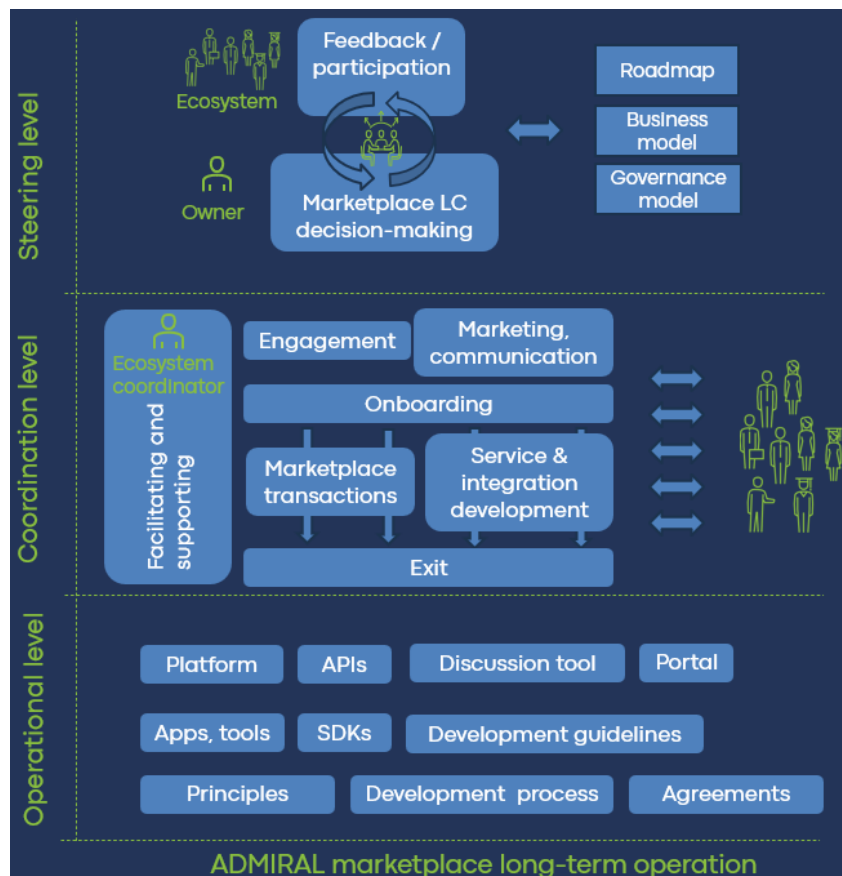


Figure 24. Levels of ADMIRAL platform ecosystem.

As illustrated in the previous figure, the platform owner can provide and utilize a variety of tools to support governance activities within the ecosystem. These tools help facilitate transparent operations, enable participation, and strengthen collaboration among stakeholders, making it possible to guide and develop the platform effectively. The following table outlines how some tools can support the governance of the platform ecosystem.

Table 11. Tools to support governance

Governance element	Tools to support governance
Decision sharing	<p>"The voice of the community" needs to be heard to understand the incentives of different actors to participate in the operation of the platform ecosystem. ADMIRAL online community forum (portal: business and developer portal; discussion tool: discussion groups, ...) is one example of this kind of tool that is a social boundary resource enabling ecosystem partners to interact with each other and with the platform owner.</p> <p>In the future, one possible way to involve ADMIRAL ecosystem members is to use a dedicated digital tool (web-tool/page) for collecting development ideas, thus providing a possibility for discussion, participation to the road mapping new features / enhancements (e.g. discussion groups, other tools). Based on this participative discussion AWA could identify valuable development items for marketplace development.</p>
Process control	<p>The platform owner must deeply understand the needs of the ecosystem actors and especially how they develop innovative applications/services that enrich the functionality of the platform (Tiwana, 2014) and support that process.</p> <p>AWA defines APIs and SDKs to connect the marketplace and develop applications. In the future maybe some sort of guided self-service will be created to help developers.</p>
Output control	<p>Tools for collecting feedback or other metrics that are signals about the quality of content or the reputation of ecosystem actors from the ecosystem (this covers sellers and buyers but also application developers (SW developers)). Examples of this kind of possible mechanisms can include end-user ratings (e.g. star-based ratings) of operators or metrics of the services provided (reporting actual versus planned).</p>
Input & output control	<p>One potential opportunity for the future is the utilization of artificial intelligence. AWA already employs an AI-based chat tool to guide users through various processes. In addition to this, artificial intelligence could be leveraged, for example, to detect partner review manipulation, etc. in marketplace.</p>

2.4 ADMIRAL governance model

In this section, we present a proposal for the ADMIRAL marketplace governance model, based on the governance framework outlined in the section 2.2. As the marketplace is still in its early stages, the definitions will continue to be refined until the end of the project. However, this framework provides a foundation for the marketplace owner to further specify practices throughout the lifecycle of the marketplace.

Table 12. ADMIRAL marketplace governance model.

Governance element	ADMIRAL
Ownership	<p>Single owner. AWA.</p> <p>AWA as neutral operator, not competing with Marketplace logistics traders or buyers.</p>
Decision right sharing: marketplace	<p>Partially distributed decision sharing.</p> <p>AWA makes the platform decisions. However, AWA wants to know how to best support the user's (buyers, sellers, SW houses) operation and needs in ADMIRAL marketplace.</p> <p>AWA will assist companies to onboard innovative new services into the Marketplace and develop needed "hooks" to enable a new type of services. Combine for example physical world activities with strong digital component.</p> <p>AWA participates ADMIRAL partners to the marketplace roadmap discussion with pilots. Marketplace roadmap: Roadmap Awake.AI Developers and Business Partners</p> <p>In future, one possible way to participate ADMIRAL ecosystem members is to use digital tool (web-tool/page) for collecting development ideas, providing possibility to discuss them, participation to the road mapping new features / enhancements (e.g. discussion groups, other tools). Based on this participative discussion AWA could identify valuable development items for marketplace development.</p>
Control: membership openness (ADMIRAL adaptation: buyer & seller side)	<p>Controlled membership openness.</p> <p>At first, there is a registration where AWA checks and approves members (Manual approval).</p> <p>In future: Onboarding process: Step-by-step process on how a buyer or seller can join the marketplace (possibly tailored processes for different roles). Possibility for the registrant to invite further stakeholders. Side switching is possible: buyers can register as sellers and vice versa.</p> <p>In future:</p> <ul style="list-style-type: none"> - there should be a more accurate "authentication service" that the company truly exists, etc. Membership level (e.g. providing badge for vetted partners) - possibly also checking company's social responsibility as part of the "authentication service". <p>Open issues to be considered later:</p> <ul style="list-style-type: none"> - Partner exit practices will be defined later.
Control: Input control (ADMIRAL adaptation: buyer & seller side)	<p>Input control.</p> <p><i>Emission calculations</i> need to be consistent with ISO14083:2023 and GLEC framework or any other calculation framework chosen. AWA (platform owner) selects emission calculators and services to be included in the marketplace.</p> <p>ADMIRAL marketplace is using marketplace UI to collect e.g. route input data and therefore it is easier to control the input data (what is entered and selected as input data).</p> <p>Future ideas:</p> <ul style="list-style-type: none"> - When the sellable item is entered to the platform AWA could approve new item and listings before publication. After that listings will be visible to buyers. Also changes to the sellable items will be checked before publication. - Ensuring pricing: how to identify outliers (outlier pricing) in order to identify unfair competition or exploitation of workers? - Content quality control for profile pictures. Profile picture library. Will be clarified if it is possible to monitor the quality of the pictures. - AWA is investigating whether random content quality tests should be conducted. <p>Open issues to be considered later:</p> <ul style="list-style-type: none"> - How are the services/content regulated or curated? Is it possible to build curation or validation mechanisms for the added/entered data?
Control: Process control (ADMIRAL adaptation: buyer & seller side)	<p>Process control.</p> <p>ADMIRAL marketplace uses predefined templates (with pre-defined lists) when seller enters items to the listings or buyer enters information to the RFQs.</p>

Governance element	ADMIRAL
	Marketplace is using transaction engine to guide marketplace activities through certain workflow (selling, buying, fulfilment, review, reporting). This aims to contribute to the good quality operation and content.
Control: Output control (ADMIRAL adaptation: buyer & seller side)	<p>Output control.</p> <p>Getting reviews/feedback after both Seller and Buyer have stated that fulfilment is complete (analytics (service quality data)), e.g.:</p> <ul style="list-style-type: none"> - textual feedback - star-based (1-5) rating <p>In future:</p> <ul style="list-style-type: none"> - planned and actual delivery times of certain logistics operator => quality indicator. - user analytics service will be deployed (collecting marketplace metrics): Matomo.org
Control: Relational control (ADMIRAL adaptation: buyer & seller side)	<p>Relational control.</p> <p>ADMIRAL marketplace ecosystem has built its vision towards low-emission logistics future where ADMIRAL marketplace ecosystem partners will share the common vision of low-emission transport. Initial ADMIRAL concept / vision has been communicated actively e.g. in logistics events, conferences and seminars. This forms good groundings for future ADMIRAL marketplace community vision. Marketplace ecosystem coordinator is in important role for communicating common vision and trust in marketplace.</p> <p>Business Opportunities Awake.AI Developers and Business Partners</p>
Control: membership openness (ADMIRAL adaptation: SW company)	<p>Controlled.</p> <p>Expression of interest for IT companies: Currently this is done using Awake.AI, Marketplace registration. No other entry procedure yet.</p> <p>Open issues to be considered later:</p> <ul style="list-style-type: none"> - Partner exit practices will be defined later.
Control: Input control. (ADMIRAL adaptation: SW company)	<p>Input control.</p> <p><i>(Technical) SW services to be integrated into the marketplace (e.g. emission calculators):</i> AWA makes the decision of services to be included into the marketplace. Main interests are in services which already exists and are NOT tailored at this time to AWA's Marketplace. Technically AWA seeks to find standard based REST + JSON or GraphQL powered secure APIs which are well documented and maintained.</p> <p>Developer "get started": Simple few steps to get started as a developer with the Marketplace APIs. Get Started Awake.AI Developers and Business Partners. Step-by-step procedure to start your operation in ADMIRAL Marketplace (e.g. integration).</p> <p>Application requirements:</p> <ul style="list-style-type: none"> - Emission calculators need to be consistent with ISO14083:2023 and GLEC framework (accredited). <p>Provide technical services for the Marketplace engine Awake.AI Developers and Business Partners</p> <p>In future, Marketplace will have advertising functionality where partners may advertise external solutions and thus get solutions sold.</p>
Control: Process control (ADMIRAL adaptation: SW company)	<p>Process control.</p> <p>Digital developer pathway: Digital developer path created in the developer portal (guides how developers can use the API to connect the marketplace and develop their applications)(e.g. QA principles). In the future maybe some sort of guided self-service will be created to help developers so that they do things correctly.</p> <p>Get Started Awake.AI Developers and Business Partners</p> <p>AWA will provide SDKs (libraries for the use of APIs) for developers.</p>
SW: Output control (ADMIRAL adaptation: SW company)	<p>Output control.</p> <p>Getting reviews/feedback about applications. E.g.:</p> <ul style="list-style-type: none"> - textual feedback - star-based (1-5) ratings <p>In future user analytics service will be deployed (collecting marketplace metrics): Matomo.org</p>

Governance element	ADMIRAL
Control: Relational control (ADMIRAL adaptation: SW company)	<p>Relational control.</p> <p>ADMIRAL marketplace ecosystem has built its vision towards low-emission logistics future where ADMIRAL marketplace ecosystem partners will share the common vision. Initial ADMIRAL concept / vision has been communicated actively e.g. in hackathon and logistics events. This forms good groundings for future ADMIRAL marketplace community vision. Marketplace ecosystem coordinator is in important role for communicating common vision and trust in marketplace.</p> <p>Business Opportunities Awake.AI Developers and Business Partners</p>
Tiering	<p>Multi-tiers.</p> <p>ADMIRAL marketplace has currently multi-tiers for the users: Free, Standard and Premium.</p> <p>Payment Tiers Awake.AI Developers and Business Partners</p>
Ecosystem value Co-creation mechanisms: boundary resources	<p>Technical and social boundary resources: see the next table “ADMIRAL marketplace boundary resources”.</p>
Fair value appropriation mechanisms	<p>ADMIRAL project has defined business models for different partner groups to understand the viable business potential and win-win for different partner groups. See section 1 for business models.</p>

Boundary resources are part of the platform governance model by facilitating platform ecosystem participant engagement. The boundary resource definition for ADMIRAL marketplace has been done by a research partner in cooperation with the marketplace owner. Boundary resources have been presented for ADMIRAL consortium in WP3 meetings and consortium meetings. The following table presents what type of boundary resources ADMIRAL marketplace uses (or plans to use) and practical examples of them in the context of ADMIRAL marketplace.

Table 13. ADMIRAL marketplace boundary resources (TBR = Technical Boundary Resource; ABR = Application Boundary Resource; DBR = Developer Boundary Resource; SBR = Social Boundary Resource)

Type	ADMIRAL BR	Purpose	ADMIRAL BR examples
TBR	ABR	APIs (Bianco et al., 2014)	Functionality: extending functionality, innovation, integration APIs Overview Awake.AI Developers and Business Partners Get Started Awake.AI Developers and Business Partners E.g. API: Emissions, API: Reviews
	DBR	SDKs (Bianco et al., 2014)	Reduction of development effort Libraries for the use of APIs will be developed.
	DBR	App Store (Petrik & Herzwurm, 2019)	Monetization, value capturing Functionality that enables advertising external developed services in marketplace will be developed.
SBR	Stakeholder forum (Bianco et al., 2014)	Fostering community building, communication	ADMIRAL stakeholder forum. Engaging partners for marketplace, WSs, webinars, etc. Communicating results.
	Registration (Bianco et al., 2014)	Knowledge transfer, establishing collaboration	Onboarding process for actor groups (upcoming) Awake.AI, Marketplace registration API get started: Get Started Awake.AI Developers and Business Partners
	Portal (Bianco et al., 2014)	Knowledge transfer (document based)	Multimodal Emissions Aware Logistics Marketplace Awake.AI Developers and Business Partners

Type	ADMIRAL BR	Purpose	ADMIRAL BR examples
			ADMIRAL Developer and Business portal
	Roadmap (Wulfert, 2023)	Knowledge transfer	Roadmap Awake.AI Developers and Business Partners Roadmap for Marketplace capabilities Development roadmap (Rome meeting)
	Discussion forum (Bianco et al., 2014)	Knowledge transfer, communication, fostering community building	Discussion Forum Awake.AI Developers and Business Partners ADMIRAL discussion forum for developers and business with categories.
	Webpages, blogs, ... (Petrik & Herzwurm, 2019)	Communication, knowledge transfer	ADMIRAL Web-pages
	Demonstrators (Petrik & Herzwurm, 2019)	Knowledge transfer, trust in the platform	Needed demonstrators, e.g.: - FIN marketplace UI demo in Lithuanian meeting - Product Demos Awake.AI (MP demo)
	Hackathons (Bianco et al., 2014)	Knowledge transfer, gap bridging	Lithuanian hackathon (June 2024)
	Workshops, seminars, conferences, trainings (Petrik & Herzwurm, 2019)	Knowledge transfer	Greenlogistics masterclass (LT) WSs with LOGY (Finnish logistics association) TRA24 HICL24 Greener Freight Made Easy webinar
	Design principles, quality standards (Engert et al., 2022)	Knowledge transfer, trust in the platform	Will be part of developer portal (guides, checklists)
	Code examples (Bianco et al., 2014)	Knowledge transfer	Will be part of developer portal (example code)
	Contracts, IPR rules (Bianco et al., 2014), terms of use, etc.	Knowledge transfer	IPR practices, marketplace privacy policy and terms of service will be defined in the beginning of 2026.

3. The concept of multimodal marketplace and innovation platform – the summary

The concepts of digital platforms and the starting point for ADMIRAL marketplace development have been documented in deliverables D3.1 and D3.2 as well as in the ADMIRAL conference papers by Mikkola et al. (2025) and Markuceviciute-Vincke et al. (2024). The initial concept of the ADMIRAL marketplace was documented in the ADMIRAL Milestone 4 document. Since that milestone, we have continued to work on various aspects of the project such as business models (T3.3), governance model (T3.4), and marketplace implementation (WP4) itself. In this section, we provide an overview of the concept of ADMIRAL multimodal marketplace (section 3.1) and share experiences (section 3.2) from the development of the marketplace during the ADMIRAL project.

3.1 ADMIRAL marketplace concept

ADMIRAL marketplace concept elements cover the description of the overall vision, defined actors (Marketplace ecosystem actors), the governance model with technical and cooperative boundary resources, business models and marketplace functionality and key components (Figure 25). Furthermore, we present a summary of the ADMIRAL marketplace concept description using the platform canvas.

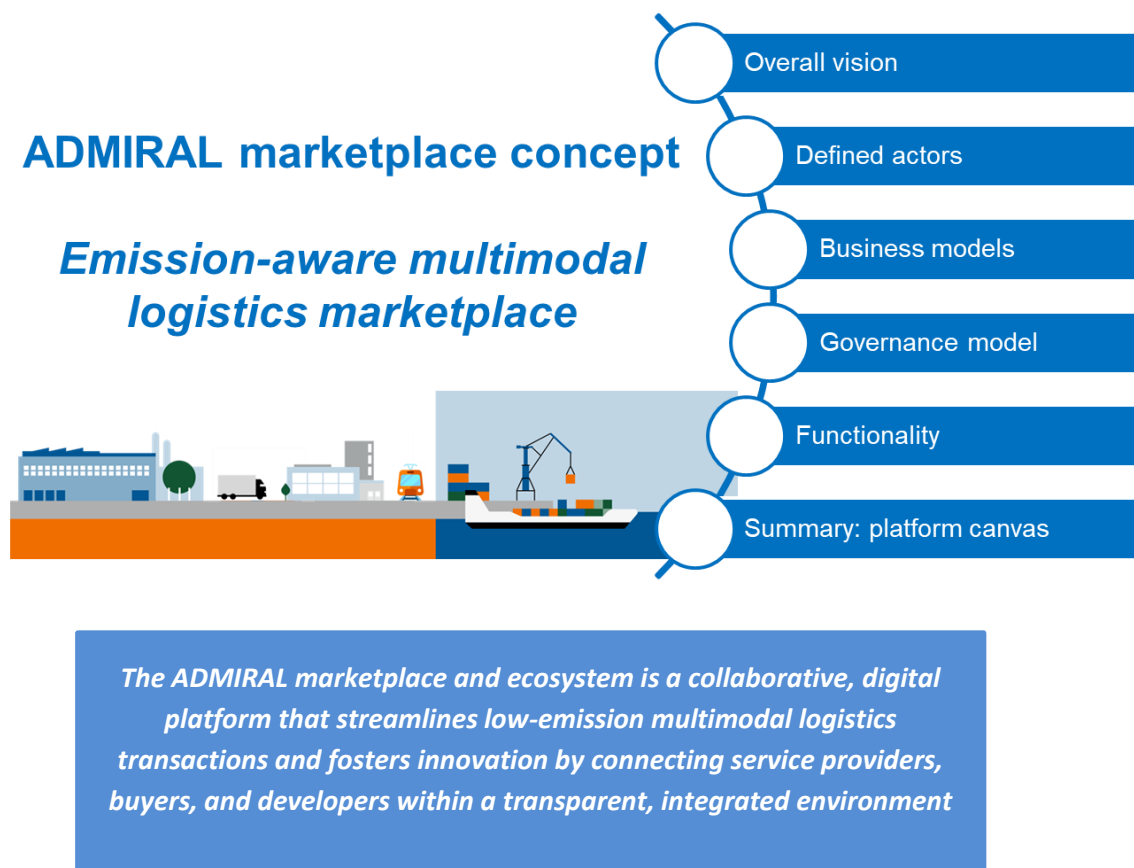


Figure 25. ADMIRAL marketplace concept elements.

3.1.1 Overall vision

The ADMIRAL marketplace is designed to simplify the sale, procurement, fulfilment, and reporting of low-emission, multimodal transport services (excluding air cargo), as well as associated hub services (Figure 26). It also ensures transparency of emissions data throughout multimodal logistics chains. By bringing together logistics service providers from various transportation modes, the marketplace enables more efficient and integrated use of resources in complex logistics operations.

As a collaborative platform, the marketplace empowers sellers (logistics service providers) for providing their logistics offerings, including different service alternatives (e.g. traditional and low-emission) and emission-aware cargo buyers to initiate tenders and select logistics chain providers that best meet their needs, manage logistics orders, and receive comprehensive reports on service fulfilment.

In addition to traditional transaction capabilities, the marketplace also serves as an innovation platform, allowing third-party developers and integrators to build and integrate applications on top of the platform using technical boundary resources (e.g. APIs).

Due to regulatory requirements and frameworks (such as CountEmissionsEU and GLEC), it is necessary to estimate, calculate, and report the emissions generated by multimodal logistics chains. The marketplace supports the entire logistics process—from purchasing through fulfilment to reporting—by enabling emission estimations during the RFQ phase, updating them as needed during fulfilment, and providing actual emission calculations upon completion of logistics services.

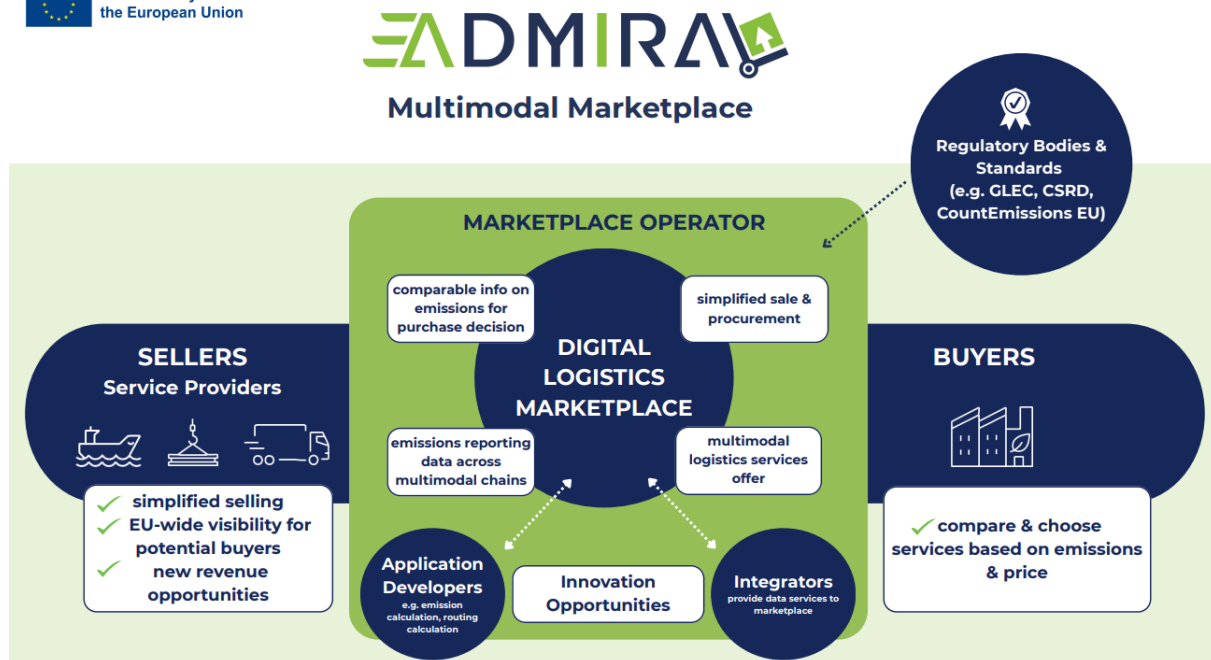


Figure 26. ADMIRAL marketplace ecosystem.

3.1.2 Marketplace ecosystem actors

The ADMIRAL marketplace involves a variety of actors (Figure 27). As the marketplace is not only a transactional platform but also an innovation platform, its actors can be categorised at different levels. Some actors are involved in the core functions of the marketplace—buying and selling logistics services—while others provide various complementary offerings to the marketplace.

In addition to these, it is possible to identify entities whose roles are more loosely connected to the marketplace. These can include, for instance, parties that introduce regulatory frameworks related to the ADMIRAL marketplace context, as well as those who communicate about the marketplace to their own members.

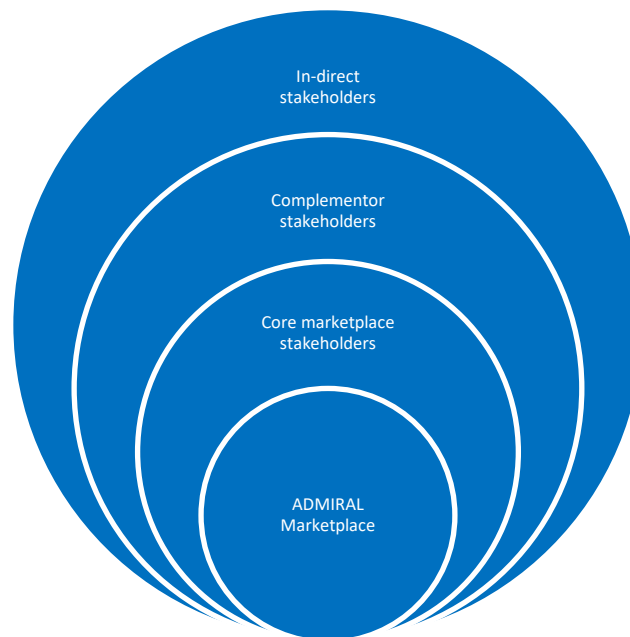


Figure 27. ADMIRAL marketplace ecosystem actors.

ADMIRAL ecosystem can be considered to consist of three types of actors (Figure 27):

1. Core marketplace stakeholders: core business partners: entities that use the platform to conduct their logistics business transactions, i.e., sellers (e.g. transport company) and buyers (e.g. cargo owners) of multimodal low-emission logistics services (physical or digital).
2. Complementor stakeholders (direct stakeholders):
 - a. Developers / Integrators: entities that support or facilitate the transactions of the direct business partners, e.g. emission calculation and routing calculation and optimization service providers and solution developers and integrators.
 - b. Content providers: entities that provide services or content other than direct business partners. These include, for example, organisations offering communication and training services and content such as educational institutions, research organisations and consulting companies.
3. In-direct stakeholders: entities in the ADMIRAL business environment that provide knowledge and support for 1) developing the marketplace to meet the broader needs of the market, and 2) reaching out to potential users to promote the uptake of the marketplace.

Operations concept of the marketplace regarding the first two groups, direct business partners and complementors, are described in further detail in the Milestone 4 document of the project and in the previous chapters 1 and 2 of this document.

For the third group, indirect stakeholders, the way of engagement is topic and region specific. For example, during the ADMIRAL project, collaboration has been made with national level organizations such as Finnish Association of Purchasing and Logistics LOGY to get insights of country specific situation on the logistics emissions data sharing issues. On regulatory side, collaboration has been made with Smart Freight Centre, which is one of the key organizations that promote the uptake of ISO14083:83 standard globally. To reach out to relevant market activities, projects like Virtual Watch Tower and Horizon Europe funded sister project TRACE have been collaborated with.

The stakeholder discussion forum established in Work Package 2 serves as a valuable collaboration channel for communicating about and disseminating the marketplace. Through this forum, the marketplace can be promoted and its visibility increased among relevant stakeholders.

3.1.3 Business models

ADMIRAL project has defined proposed business models for different ADMIRAL marketplace actors and user groups. **Actor specific business models:** AS-IS business models (*parcel providers, cargo owners, transport companies, port operator, platform owner*) and TO-BE business models (*parcel providers, cargo owners, transport companies, IT and other tools developers, marketplace owner, port authority*). User group specific business models for buyers & sellers, complementors and marketplace owner. Furthermore, potential roles of faculties, institutions and logistics and transport associations on the ADMIRAL marketplace ecosystem have been considered. **Proposed business models are presented in subsection 1.3.2. and actor specific business models in Appendix A.**

3.1.4 Governance model

Platform governance can be defined as the blueprint for (digital platform) ecosystem orchestration (Tiwana, 2014) as who makes what decisions about a (digital) platform (Tiwana et al., 2010). We have presented terminology, key elements, and a framework related to governance in Section 2. **In Subsection 2.4, we have described a proposed governance model for the ADMIRAL marketplace (see sub-section 2.4 Table 12).**

Boundary resources (BR) represent one of the critical elements in creating a successful digital platform by facilitating platform ecosystem participant engagement. The concept and structure of boundary resources, both technical and social, have been defined in Section 2. Furthermore, **a specification of these boundary resources for the ADMIRAL marketplace has also been developed and can be found in Subsection 2.4 (see sub-section 2.4 Table 13).**

3.1.5 Marketplace functionality

The following lists the core functionality of the marketplace:

- Wizard driven registration of new companies inc. Manual approval process to ensure organisations registering are of the nature they claim to be
- Organisation profile pages with description of the organisation, images, videos, PDF files and contact details. Organisations can be favoured for easier purchase targeting.

- Wizard driven addition for sellers of new listings to be then traded with buyers
- Ability to sell and purchase land side port hub and logistics hub services, transport service via trucks, trains and ocean-going vessels and digital logistics services and content.
- Digital services can be purchases as recurring subscriptions
- Advanced search for listings with filters
- Listing pages with descriptions, images and information form to request key parameters for the RFQ creation. Initial emissions estimation for transport via trucks, trains and ocean-going vessels. Routing and route visualisation for trucks and vessels.
- RFQ process with chat and multiple quotes triggering possibility
- Services fulfilment tools like maps, emissions, chat, cargo tracking, document sharing, eCMR for trucks and final review of each party once service has been rendered
- Ability to purchase and for sellers to participate in the multimodal complex routes via advanced multimodal routing and RFQ process.
- Track and trace for containers and ocean transport bills of lading
- AI-based estimated time of arrival (ETA) predictions for ocean-going vessels
- Short term detailed weather information (especially for port operations benefit)
- For business partners and SW developers a discussion forum and comprehensive developer portal is provided

3.1.6 Platform canvas: summary of ADMIRAL marketplace ecosystem

Platform canvas has been utilised in the definition and documentation of the ADMIRAL marketplace concept. This method provides a structured way to illustrate platform ecosystem actors, activities, and definitions. The first version of the ADMIRAL Marketplace platform canvas was created for the Milestone 4 document, and the updated version presented here incorporates additional definitions and refinements made since that milestone. In the next Figure 28 is a summary of the ADMIRAL marketplace and its ecosystem, presented using the platform canvas approach.

The platform canvas identifies the main user groups—buyers & sellers, complementors, and marketplace owner—alongside their respective roles and interactions within the ecosystem. Recent updates reflect enhancements in technical boundary resources, governance structures, business models and functionalities.

<p>Pull factors for sellers/producers</p> <ul style="list-style-type: none"> - Trial marketplace for free. There is an initial free testing period followed by a monthly fee. - How already on boarded users can invite others, market their presence on the Marketplace and otherwise pull others to join? <ul style="list-style-type: none"> - It is possible to invite new logistics service providers into the Marketplace and incentivize them to onboard their services. Marketplace owner will support in the onboarding 	<p>Entry smoothors</p> <p>Step-by-step marketplace joining process (sellers, buyers). For the dedicated onboarding of sellers and buyers we will have a 1st time experience where in a popup window some key concepts are shortly explained. These views will have graphical images of the UI parts and short textual description. This flow can be re-visited if user wishes to do so.</p> <p>Digital developer path: Digital developer path created in the developer portal (guides how SW developers can use the API to connect the marketplace and develop their applications). In the future maybe some sort of guided self-service will be created to help developers so that they do things correctly</p>	<p>Pull factors for consumers</p> <ul style="list-style-type: none"> - Trial marketplace for free. There is an initial free testing period followed by a monthly fee. - How already onboarded users can invite others, market their presence on the Marketplace and otherwise pull others to join? <ul style="list-style-type: none"> - Cargo owners (buyers) can invite their existing suppliers into the Marketplace and incentivize them to onboard their services. Awake AI will support in the onboarding.
<p>Sellers / Producers</p> <ul style="list-style-type: none"> - Sellers of cargo transport and logistics services: <ul style="list-style-type: none"> - Sea port service providers, - Land hubs / terminals service providers, - Sea/land cargo transport providers, - Digital services sellers, e.g. emission calculator and routing services providers - Application/integration providers: <ul style="list-style-type: none"> - SW developers, - IT system integrators 	<p>Interaction</p> <ul style="list-style-type: none"> - Sellers provide emission information about their logistics offering including alternatives. - Buyer makes RFQs, finds, compares, decides and buys easily emission-aware multimodal logistics. - Buyer gets estimated and realised emissions based on transport chain elements and hubs used. Possibly also including hub services emissions impact. - Utilising APIs for integrating marketplace or the data of the marketplace to 3rd party systems (using or producing data (import/export)). - Utilising APIs and developer portal building and offering 3rd party applications on top of the marketplace. - Buyer finds and buys easily sellable items (physical and digital services and physical goods) provided by producers through one channel 	<p>Buyers / Consumers</p> <p>Buyers of cargo transport and logistics services, e.g.</p> <ul style="list-style-type: none"> - Cargo owners, - Shipping lines and their representatives shipping agents, - Consumer & B2B goods manufacturers, - Governmental and NGO organizations
<p>Value proposition</p> <p>For sellers:</p> <ul style="list-style-type: none"> - Slash customer acquisition costs! - Gain EU-wide visibility instantly. - Elevate revenue with eco-friendly equipment. Showcase reduced emissions transparently, outshine the competition. - Boost revenue by tapping into multi-country, multimodal cargo routes. Expand your reach and profits - Skyrocket customer satisfaction! Streamline purchases with efficient tools and transparent cargo insights. - Expand effortlessly! Unlock new routes and services with reduced costs. - Get cloud-based logistics selling/purchasing and management tools (especially for SMEs) - Keep customers better aware what you sell, use customer specific prices when needed - Approve purchases with 1-click, have all details always available - Handle more buyers with less time <p>For Application / integration providers:</p> <ul style="list-style-type: none"> - innovate new marketplace trading items or new features for unique business competitive advantages and increased revenue (e.g. emissions calculators); - integrate marketplace functionality into existing IT solutions for consulting and SW development revenue; - provide (mostly API driven) technical services for marketplace engine and grow your revenue. 	<p>Facilitation</p> <ul style="list-style-type: none"> - Listings of offerings with standardized data collection template - ready-made templates for buyers for RFQ - Listings of optimal logistics service chains based on consumer's transportation needs. Route visualization. - Facilitates customer's emission-based decision-making. Emission calculators consistent with ISO14083:2023 and GLEC framework or any other explicit calculation framework chosen. - In future, sellers are checked by checking company's social responsibility (e.g. compliance with Ecovadis) - Facilitates logistics fulfillment monitoring - Facilitates (actual or post-calculated) emissions calculation - Very quick search with filters - Subscriptions, buy listing automatically with recurrence - Secondary currency, seller currency and your currency - Multiple UI languages - Online feedback and support tool - Works on PCs, tablet & smartphones (web browsers, no installs) - Work on multiple shopping carts at the same time - Document and video files in the organisation profile page - The marketplace owner is a neutral actor who, in accordance with platform economy principles, leverages the best available resources and competencies. - Marketplace owner will assist companies to onboard innovative new services into the Marketplace and develop needed "hooks" to enable a new type of services. - In future owner participates marketplace ecosystem stakeholders into development process by gathering development ideas, fostering open discussion, and enabling participation in the prioritization of new features or enhancements (via discussion forums or other collaborative tools). 	<p>Value proposition</p> <p>For buyers:</p> <ul style="list-style-type: none"> - Stay green with informed choices! Easily switch to lower-emission logistics options for a sustainable business. - Receive post-transport emissions calculations for comprehensive reporting at your fingertips. - Simplify logistics! Source all your multimodal, multi-country transport needs in one convenient platform. - Supercharge your purchases! Rapid, intelligent buying handles more needs with fewer resources. - Stay in control Track your cargo seamlessly and resolve issues faster with our efficient system. - Buy from multiple sellers multiple items with one shopping cart - Re-use shopping cart templates - Negotiate via chat, get price quotes & availability faster - Get rating information from sellers - Save costs by doing more of the buying yourself
<p>Substitutes</p> <p>Other logistics marketplaces, e.g.</p> <ul style="list-style-type: none"> - TIMOCOM (also used as a logistics auction platform => not desired functionality in ADMIRAL marketplace) - Transporeon 	<p>Substitutes</p> <p>Other logistics marketplaces, e.g.</p> <ul style="list-style-type: none"> - Transporeon - TIMOCOM (also used as a logistics auction platform => not desired functionality in ADMIRAL marketplace) <p>Producers own service listings in web-pages and marketplaces.</p>	<p>Substitutes</p> <p>Other logistics marketplaces, e.g.</p> <ul style="list-style-type: none"> - Transporeon - TIMOCOM (also used as a logistics auction platform => not desired functionality in ADMIRAL marketplace) <p>Producers own service listings in web-pages and marketplaces.</p>
<p>Friction to be removed from producer side</p> <ul style="list-style-type: none"> - Producers do not have a channel to offer emission-aware multimodal logistics services. - Producers have to offer their services and products through own channels or diverse 3rd party channels. - The marketplace owner is a neutral actor who, in accordance with platform economy principles, leverages the best available resources and competencies. 	<p>Friction to be removed from consumer side</p> <ul style="list-style-type: none"> - Consumers can not easily compare, decide and buy easily low emission optimal multimodal logistics (lacking especially multimodal viewpoint). - Consumers have to find and buy sellable items from different channels with different usage logic and user experience - The marketplace owner is a neutral actor who, in accordance with platform economy principles, leverages the best available resources and competencies. 	<p>Friction to be removed from consumer side</p> <ul style="list-style-type: none"> - Consumers can not easily compare, decide and buy easily low emission optimal multimodal logistics (lacking especially multimodal viewpoint). - Consumers have to find and buy sellable items from different channels with different usage logic and user experience - The marketplace owner is a neutral actor who, in accordance with platform economy principles, leverages the best available resources and competencies.
<p>Boundary resources / practices</p> <p>APIs, documentation, onboarding process guide (registration)</p> <p>Onboarding decisions:</p> <ul style="list-style-type: none"> - AWAKE approval or port approval (organization really exists, is providing services they claim, can be contacted on their given contact information and so on) - Some organizations that plan to provide services which require certificates and/or licenses must also be approved by the port authority. One relevant example of such an organization is bunkering service providers. <p>Developer portal (GitBook for portal and Discourse for discussion forum)</p> <p>QA for emission calculation and information (only external calculators compliant with ISO14083:2023 and GLEC framework will be added)</p> <p>Onboarding decision:</p> <ul style="list-style-type: none"> - AWAKE approval: More stringent approval process is in the plan and it would cover some tax, employee fees like insurance, social fees and so on. There will be a cost for this kind of approval and it gives a visual "badge" of a premium, better vetted, organization on the marketplace. - Other possible future entry criteria, such as external audits - see e.g. TFS (together for sustainability). - On later phase: there should be a more accurate "authentication service" that the company truly exists, etc. - On later phase: possibly also checking company's social responsibility. 	<p>3rd party platforms & services</p> <p>AWS GitBook Discourse</p>	<p>Metrics</p> <p>Marketplace platform:</p> <ul style="list-style-type: none"> - User analytics <p>Business process:</p> <p>Getting reviews/feedback after both Seller and Buyer have stated that fulfillment is complete:</p> <ul style="list-style-type: none"> - textual - star-based(1-5) <p>Planned and actual delivery times of certain logistics operator => quality indicator</p>
<p>Platform core</p> <p>Marketplace AWAKE Data Platform AWAKE sea emission calculator</p> <p>Cost model</p> <p>Platform and marketplace cloud infrastructure Marketplace headless SW engine provider Security & availability monitoring services Development costs (maintaining SW) Developer and business partner community (portal) Discussion forum Routing engines 3rd party emission calculators Other data source fees (e.g. Windy) Cost of ecosystem coordination (ecosystem coordinator) IT support personnel</p>	<p>Monetization</p> <p>Monthly seller & buyer subscription Premium functionality features Premium vetting of organisations Paid listings placement on catalogue and search results (Paid listings includes advertisement service) APIs usage fees Integration one-time fees Per customer requirements marketplace development Some sellers possibly in percentage commission mode, not fixed fee subscription</p>	<p>Other key resources</p> <p>New 3rd party data providers:</p> <ul style="list-style-type: none"> - Emissions calculator for trucks & trains cargo transport (Climatiq) - Integrations for reading land equipment positions - Windy API for accurate weather information inc. weather layers on top of a map - Possibly new Mapbox integration for truck routing (Here) <p>3rd party data providers:</p> <ul style="list-style-type: none"> - Vessel global positions -vessel technical particulars - Weather - vessel images <p>Other tools/services e.g.:</p> <ul style="list-style-type: none"> - Matomo (user analytics service) - GitLab (dev time security scanning)

Figure 28. ADMIRAL marketplace ecosystem described using platform canvas

3.2 History of ADMIRAL marketplace development

During the ADMIRAL EU project, history data was systematically collected to document the development process of the ADMIRAL marketplace. This information gathering took place using an Excel file, where monthly events, decisions, and implementation statuses were recorded. Data collection has been conducted up to November 2025, and the following section presents the first interpretations based on this data. It is also important to note that the outlook for 2026 remains a preliminary view at this stage. From this data, we have compiled a summary of the project's main phases, the challenges encountered, and the solutions to overcome these challenges (Figure 29).

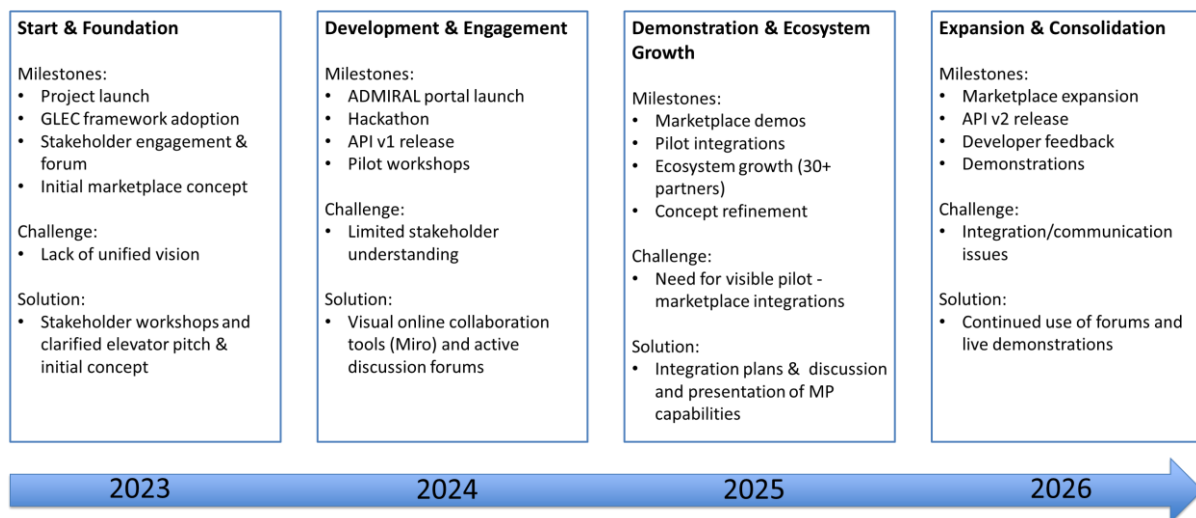


Figure 29. ADMIRAL development path.

The timeline in Figure 29 shows how ADMIRAL Marketplace has evolved from strategic planning to technical implementation and ecosystem expansion, solving key challenges through collaboration and innovative solutions.

The ADMIRAL Marketplace project progressed for three years through several key phases. In 2023, the project was launched, stakeholders were identified, the initial concept was defined, and the platform situation was analysed. A significant achievement was the early adoption of the GLEC framework, laying out the foundation for sustainable logistics development. Discussions with cargo owners and logistics partners began, and a discussion forum was launched in 2024 to highlight project challenges.

In 2024, the focus was on technical development, including selecting portal and discussion group technology and preparing documentation. A hackathon was organized to engage stakeholders and promote innovation. Piloting and API integrations progressed, and the perspective of cargo owners was actively included in the design.

In 2025, platform demonstrations were held for ADMIRAL partners, and the virtual logistics marketplace expanded. An internal marketplace release and a clickable demo video were added to the website. The ecosystem grew to over 30 registered partners that are interested in ADMIRAL marketplace. In 2026, the project will reach the consolidation phase, with the release of the final version of the marketplace API, business and developer portal, and finalization of the concept.

However, the development did not progress without challenges. The following challenges and solutions were confronted and mitigated during the project:

- **Lack of a Shared Vision**
 - In the early phase, there was no shared vision, making stakeholder engagement challenging. Workshops and an elevator pitch with a concept graphic clarified the objectives.
- **Marketplace Opportunities**
 - Pilots and software companies found it difficult to see the marketplace’s potential. This was solved with targeted discussions and use cases.
- **Fragmented Communication**
 - Email-based fragmented communication was replaced by a discussion forum, enabling open and centralized interaction.
- **Visibility of Integrations**
 - MP demonstrations and a clickable demo video illustrated how MP could work, MP-pilot integration diagrams improved stakeholder understanding.

During the ADMIRAL Marketplace project, several key challenges were encountered that affected both strategic planning and operational execution. The first major challenge was the lack of a shared vision, which made it difficult to engage stakeholders and ensure project clarity. This was addressed by organizing workshops and developing an elevator pitch to clarify the project’s goals.

Another challenge was that pilots and software companies struggled to see the marketplace’s potential. The solution was to hold targeted discussions and workshops, presenting concrete use cases and integration opportunities. Communication was initially fragmented, mainly via email and workshops, but this was solved by establishing a discussion forum for open and centralized interaction.

It was also observed that the perspective of cargo owners was underrepresented. This was addressed through active involvement and feedback rounds, ensuring their views were incorporated into concept development. Finally, the lack of visibility into integrations made it hard for stakeholders to understand the technical implementation. Demonstrations and a clickable demo video were used to illustrate how the marketplace works.

Solving these challenges demonstrates the project’s ability to adapt and evolve through collaboration, technology, and communication, which has been key to the success of the ADMIRAL Marketplace platform.

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Appendix A

AS-IS BM of parcel providers

Business Model Canvas		Business model type:	Date:	Version:
		PARCEL PROVIDER	22.5.2024	V1
Key Partners Transport companies – 3x Sub-contractors – 2x Technology providers – 2x State administration – 1x Gas and car dealer companies – 1x Packaging material suppliers – 1x Security and authentication providers – 1x Consulting and advisory firms – 1x Foreign post operators – 1x Warehouse providers – 1x	Key Activities Shipping & collection & delivery – 3x Delivery network management – 2x Technology integration – 1x Quality management – 1x Customs clearance services – 1x Key Resources Distribution Network – 2x Digital resources – 2x Warehouses facilities – 2x Employees – 3x Customs service representatives – 1x Transport fleet – 1x Post offices – 2x External providers' supra structure and infrastructure – 2x	Value Propositions Customized solutions & value-added services – 2x Possibility to change delivery option – 2x Innovative solutions and technologies & product development – 3x Providing responsive customer service – 3x Convenient price – 1x Digital services – 2x Access to the flow of goods & services – 1x Reliable delivery – 1x Accessibility and availability – 2x Security – 1x Information and support – 1x Monitoring & optimising last-mile delivery operations – 1x	Customer Relationships Personalized interaction – 1x Regular communication and updates – 1x Seeking feedback from customers to enhance service quality – 1x Self-service options (parcel lockers, online applications for pick up/delivery) – 1x Key account managers for key customers – 1x External business apps that allow communication between various customers – 1x Channels Website – 2x E-mail conversation – 1x Phone conversation – 1x Customer contact center – 1x Physical counters – 2x Digital platforms – 2x Cross-channel communication – 1x	Customer Segments Retailers – 3x E-commerce companies – 3x Producers – 1x Medical facilities, laboratories & clinics – 1x Individuals – 3x Governmental bodies – 2x
Cost Structure Financial services – 1x Marketing costs – 1x Customer service costs – 1x Employee costs – 1x Transportation costs – 1x Technology costs – 2x External delivery partners costs – 1x Infrastructure costs – 1x Material costs – 1x Administrative costs – 1x Integration costs – 1x		Revenue Streams Selling transportation services – 2x Premium service fees – 1x Adjustments in pricing based on demand and capacity – 1x Value-added services – 1x Retail sales – 2x Financial services – 2x Digital services – 1x		

Figure A1: A cross-case analysis of AS-IS BMC of parcel providers

AS-IS BM of cargo owners

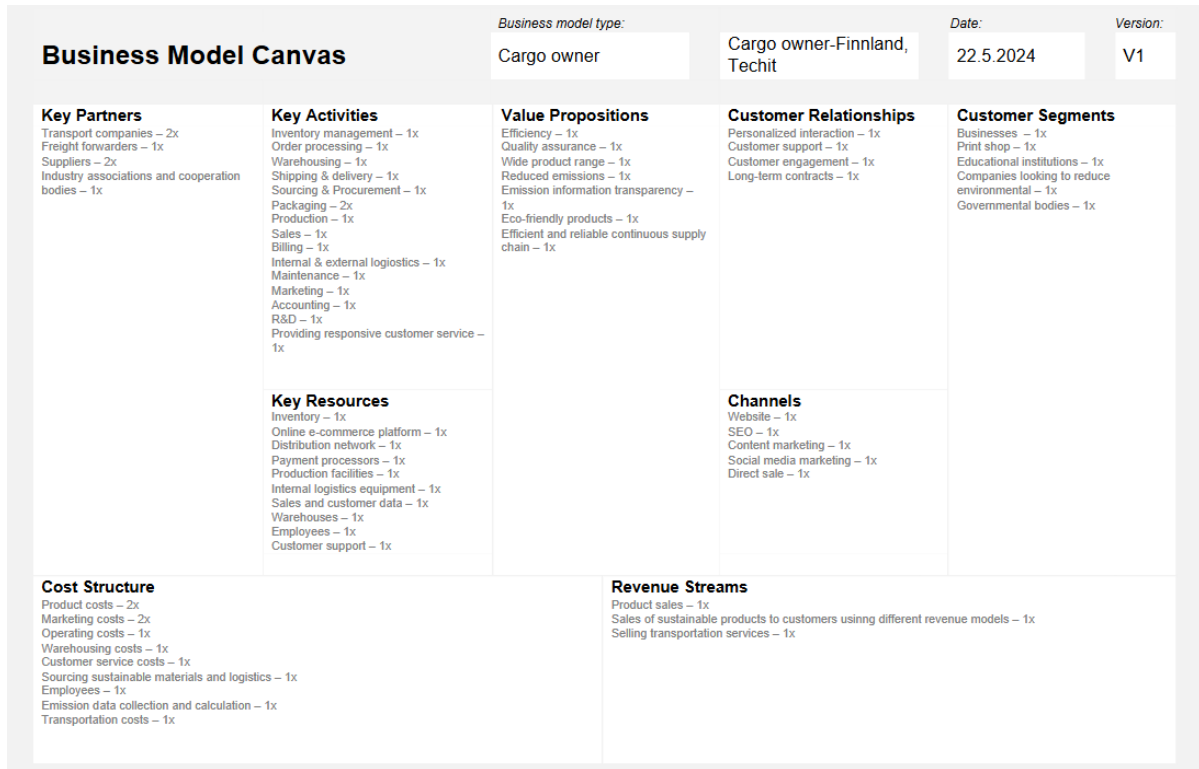


Figure A2: A cross-case analysis of AS IS BMC of cargo owners

AS-IS BM of transport companies



Figure A3: A cross-case analysis of AS-IS BMC of transport companies

AS-IS BM of port operator

Business Model Canvas		Type of business model:	Date:	Version:
		Port operator	22.5.2024	V1
Key Partners Port Authority; Service providers (IT, machinery, utilities, etc); Customs service;	Key Activities To load/unload ships; Warehousing services incl. lashing of cargo; Information sharing;	Value Propositions Specialized cargo processing hub; Improved port information flow and accuracy; Improved terminal planning; Improved port call and -service planning;	Customer Relationships Yearly high-level agreements ongoing contact between decision-makers; Daily contact in operations;	Customer Segments The most important customers by volume are the Finnish forest industry, their subcontractors, and the shipping lines of their choice.
External Partners Shipping companies; Railway operators; Trucking companies; Subcontractors;	Key Resources Skilled workforce; Up-to-date IT system-suitable machinery; Warehouses; Port infrastructure;		Channels Direct EDI messages between cargo owners and Stevedco; Email conversation; Phone conversation; Website;	
Cost Structure The cost of cargo processing includes: - Personnel. - Machinery. - Rents. - Utilities interest expenses taxes.		Revenue Streams Income from cargo handling. Income from warehousing. income from forwarding.		

Figure A4: A cross-case analysis of AS-IS BMC of a port operator

AS-IS BM of platform owner

Business Model Canvas - Current		Designed for:	Designed by:	Date:	Version:
		ADMIRAL project		17.5.2024	1
Key Partners Maritime ports Shipping agents SW developers SW integrators 3 rd party service providers 3 rd party data providers	Key Activities Customer research SW development Marketing Piloting assistance Onboarding assistance Go-to market activities	Value Propositions Sell faster & smarter Fast sales via digital channel Slash customer acquisition costs! Expand sales cheaper to new ports Streamline sales with efficient tools and execute fulfilment with modern tools like chat and location sharing on a map.	Customer Relationships Participation to key association events to provide latest development and business opportunity news Emails of new developments Physical brochure emailing to potential customers	Customer Segments Port service sellers Port service buyers Port authorities Data providers (sellers)	
	Key Resources Sellers & buyers Services to be traded Actual web marketplace Cloud infrastructure Support personnel 3 rd party payment provider 3 rd party currency data provider 3 rd party weather data provider	Buy faster & with more transparency Supercharge your purchases! Rapid, intelligent buying handles more needs with fewer resources. Stay in control! Track your service fulfilment and resolve issues faster with our efficient system Buy faster port services from one service and at the same time Review seller quality, buy with more confidence from highly reviewed sellers	Channels Maritime events Maritime port associations Maritime shipping agent associations Maritime web sites and publications Maritime port events and publications		
Cost Structure Cloud infrastructure 3 rd party service providers 3 rd party data providers Marketplace headless SW engine provider Security & availability monitoring services Development costs (maintaining SW)		Revenue Streams Monthly seller & buyer subscription Integration one-time fees			

Figure A5: A cross-case analysis of AS-IS BMC of a platform owner

TO-BE BM of cargo owners

Business Model Canvas		Business model type:	Date:	Version:
		Cargo owner	22.5.2024	V1
Key Partners Transport companies – 2x Freight forwarders – 1x Suppliers – 2x Industry associations and cooperation bodies – 1x ADMIRAL Marketplace operator – 1x Eco-friendly packaging suppliers – 1x	Key Activities Inventory management – 1x Order processing – 1x Warehousing – 1x Shipping & delivery – 1x Sourcing & Procurement – 1x Packaging – 2x Production – 1x Sales – 1x Billing – 1x Internal & external logistics – 1x Maintenance – 1x Marketing – 1x Accounting – 1x R&D – 1x Providing responsive customer service – 1x Key Resources Inventory – 1x Online e-commerce platform – 1x Distribution network – 1x Payment processors – 1x Production facilities – 1x Internal logistics equipment – 1x Sales and customer data – 1x Warehouses – 1x Employees – 1x Customer support – 1x Admiral marketplace – 1x Carbon footprint calculators – 1x	Value Propositions Efficiency – 1x Quality assurance – 1x Wide product range – 1x Reduced emissions – 1x Emission information transparency – 1x Eco-friendly products – 1x Efficient and reliable continuous supply chain – 1x Reduced carbon footprint – 2x Offering information about emissions – 1x Sustainable product selection choice and control – 1x Enhanced brand image – 1x	Customer Relationships Personalized interaction – 1x Customer support – 1x Customer engagement – 1x Long-term contracts – 1x Community building – 1x Loyalty programs via e-shop – 1x Sustainability commitment via e-shop – 1x Channels Website – 1x SEO – 1x Content marketing – 1x Social media marketing – 1x Direct sale – 1x ADMIRAL Marketplace – 1x	Customer Segments Businesses – 1x Print shop – 1x Educational institutions – 1x Companies looking to reduce environmental – 1x Governmental bodies – 1x Customers/companies with sustainability goals – 1x
Cost Structure Product costs – 2x Marketing costs – 2x Operating costs – 1x Warehousing costs – 1x Customer service costs – 1x Sourcing sustainable materials and logistics – 1x Employees – 1x Emission data collection and calculation – 1x Transportation costs – 1x (ADMIRAL) Marketplace costs – 2x		Revenue Streams Product sales – 1x Sales of sustainable products to customers using different revenue models – 1x Selling transportation services – 1x European Emissions Trading System revenues/costs – 1x Profit margins on sustainable shipping costs – 1x		
<p style="text-align: right; color: red;">Red text=BM modifications resulting from the use of a marketplace ecosystem</p>				

Figure A6: A cross-case analysis of TO-BE BMC of cargo owners

TO-BE BM of transport companies

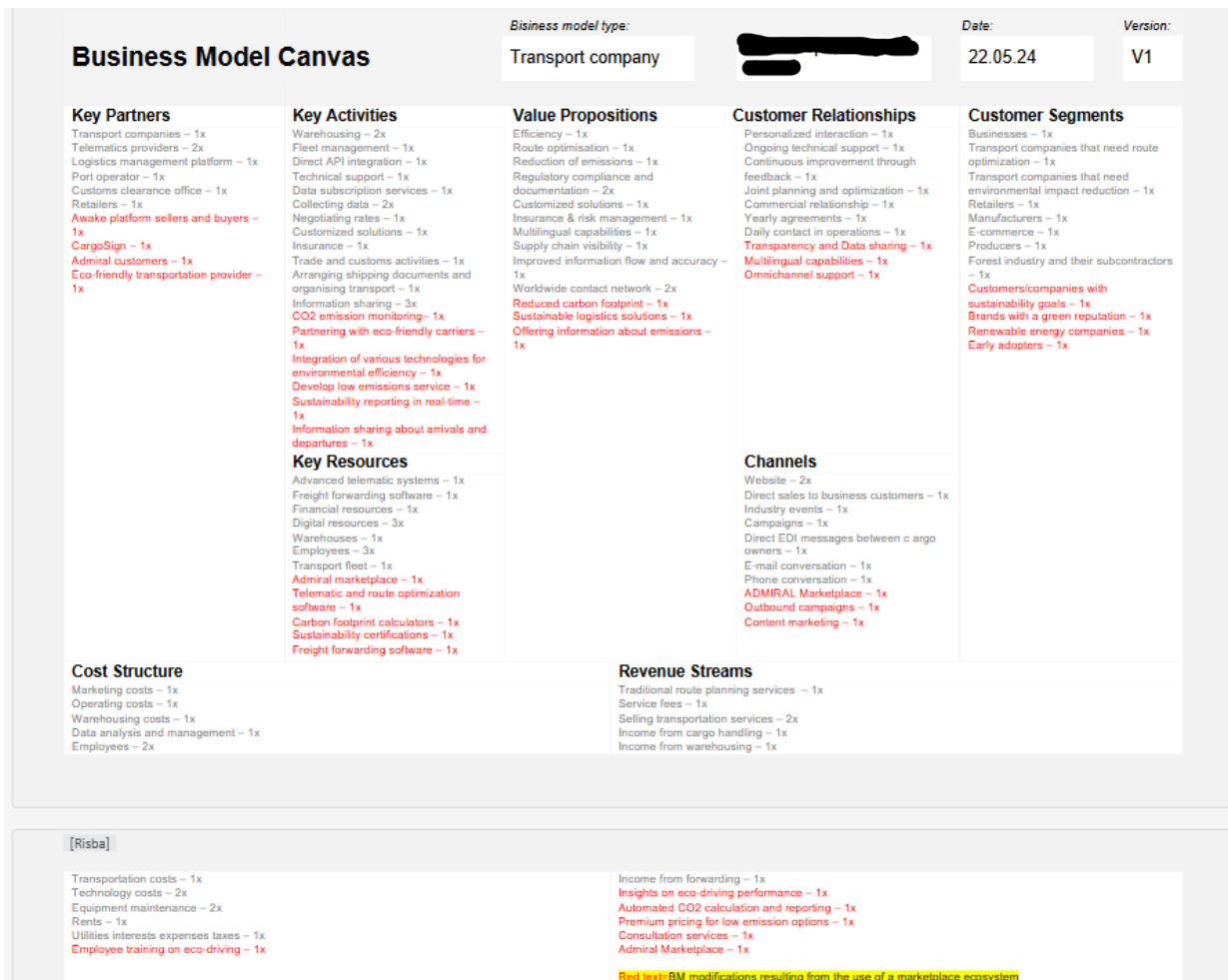


Figure A7: A cross-case analysis of TO-BE BMC of transport companies

TO-BE BM of parcel providers

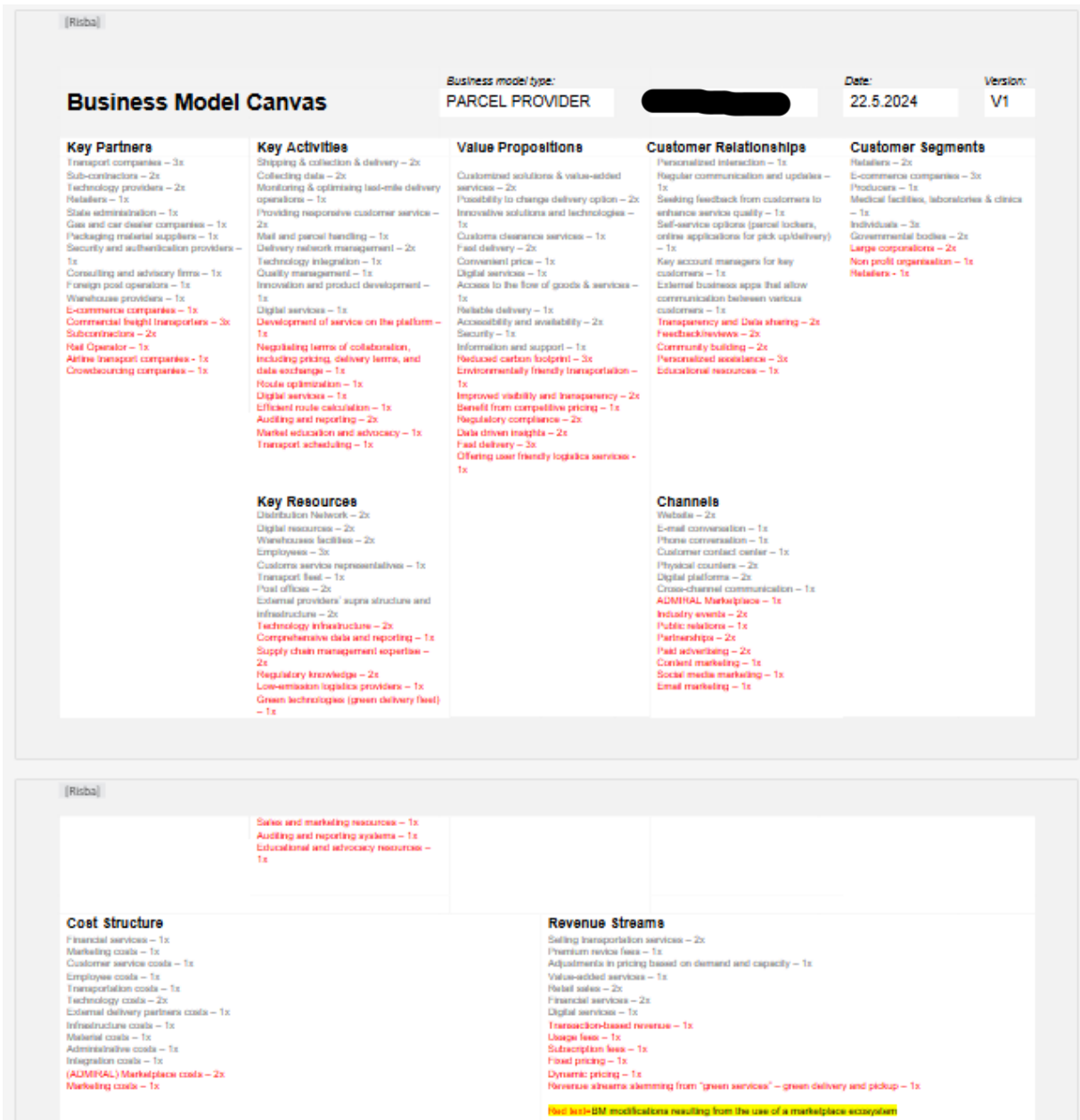


Figure A8: A cross-case analysis of TO-BE BMC of parcel providers

TO-BE BM of IT and other tools developers

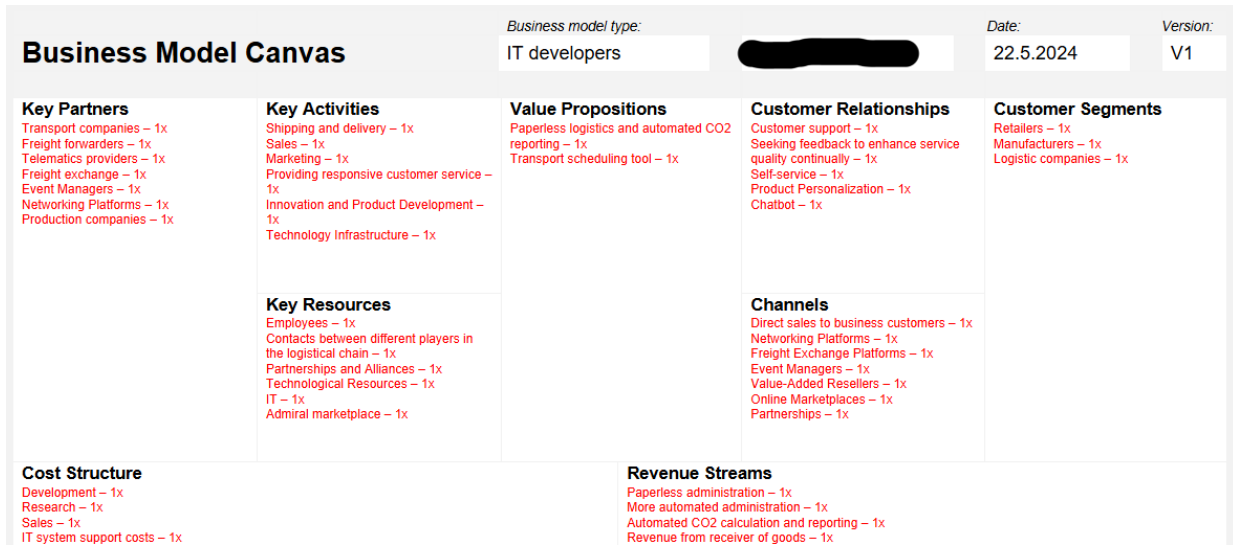


Figure A9: A cross-case analysis of TO-BE BM of IT and other tools developers

TO-BE BM of the marketplace owner

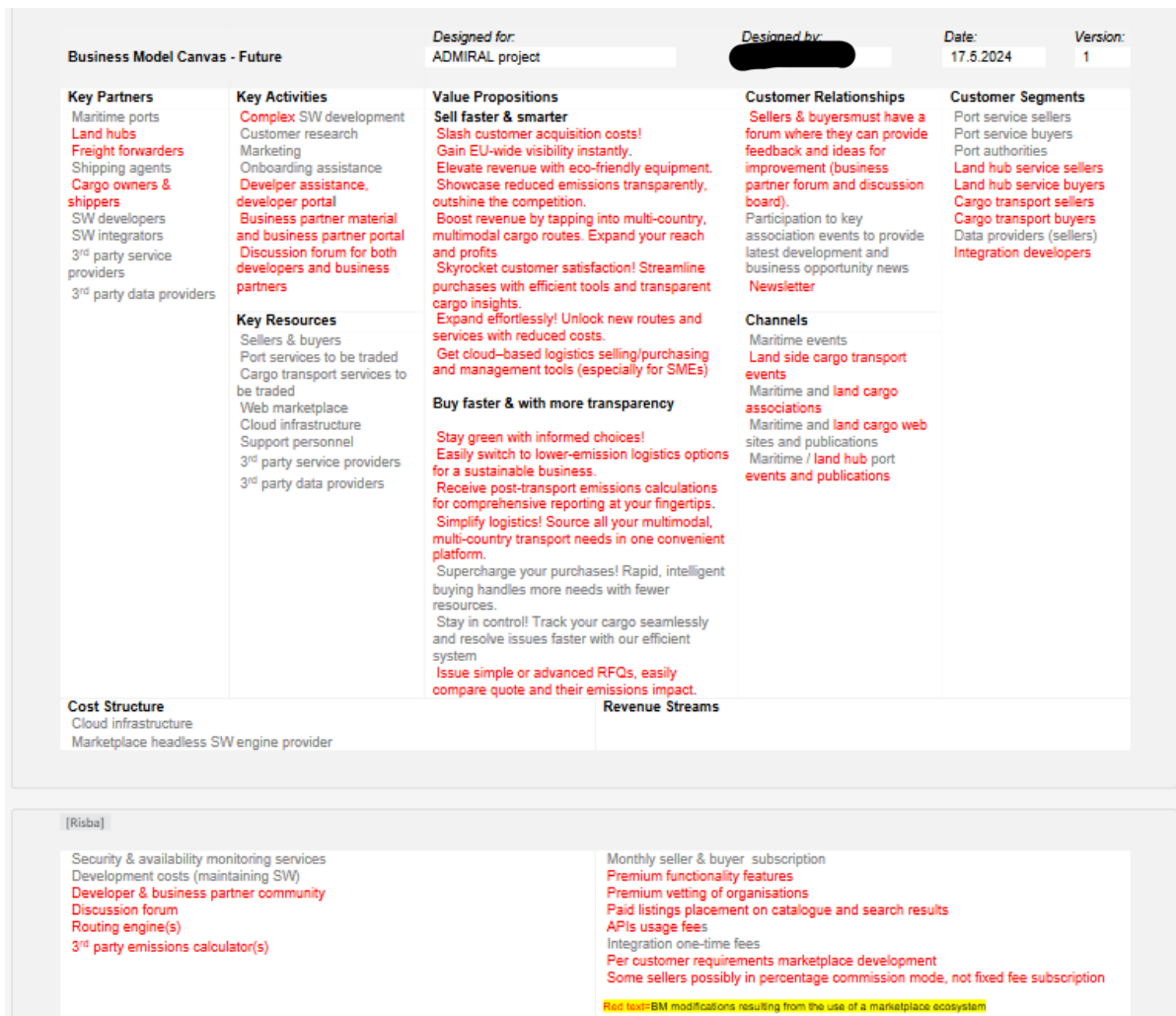


Figure A10: A cross-case analysis of TO-BE BMC of the marketplace owner

TO-BE BM of a port authority

Business Model Canvas		Designed for: Portugal-Spain Pilot Integrator – TO BE	Designed by: [REDACTED]	Date: 24/04/2024	Version: V2
Key Partners Rail Operator; Dry Ports; Port Authorities; NEXUS project;	Key Activities Integrating with NEXUS Open Data Platform; Providing data publish environment for service providers; Coordinate processes through JUL; Calculate transport service emissions; Enabling publication of logistics services on AWAKE.IA Marketplace and other marketplaces through one single integration; Key Resources Technology infrastructure for integration and development; Access to freight mobility data; Expertise in logistics, digital platforms, and environment;	Value Propositions Integration for enhanced efficiency and collaboration; Track and Trace visibility; Access to low-emission transport services; Environmental responsibility by tracking and minimizing the total carbon emissions in transport;	Customer Relationships Support for integration and API implementation; Collaboration and engagement to enhance service offering, drive innovation, and ensure alignment;	Customer Segments Logistics service providers; Customers who need logistics services; Other marketplaces seeking to expand service offerings;	
Cost Structure This is a business model more value-driven, where the most relevant costs are: <ul style="list-style-type: none"> - Technology infrastructure, development and maintenance; - Partnership fees with platform providers and research institutions; - Operational costs for customer support and monitoring; - Marketing and promotion expenses; 		Revenue Streams Subscription fees from logistics service providers; Transaction fees from contracted services; Potential revenue-sharing agreements with Marketplace operators;			

Figure A11: A cross-case analysis of TO-BE BMC of a port authority

Business Model Canvas		Business model type: AS-IS	Date: 22.5.2024	Version: V1
<p>Key Partners</p> <ul style="list-style-type: none"> Transport companies – 5x Sub-contractors – 2x Technology providers – 2x Retailers – 1x State administration – 1x Gas and car dealer companies – 1x Packaging material suppliers – 1x Security and authentication providers – 1x Consulting and advisory firms – 1x Foreign post operators – 1x Warehouse providers – 1x Telematics providers – 2x Logistics management platform – 1x Port operator – 1x Customs clearance office – 1x 	<p>Key Activities</p> <ul style="list-style-type: none"> Shipping & collection & delivery – 2x Collecting data – 2x Monitoring & optimising last-mile delivery operations – 1x Providing responsive customer service – 2x Mail and parcel handling – 1x Delivery network management – 2x Technology integration – 1x Quality management – 1x Innovation and product development – 1x Warehousing – 2x Fleet management – 1x Technical support – 1x Data subscription services – 1x Negotiations – 1x Customized solutions – 1x Insurance – 1x Trade activities Customs clearance activities – 1x Arranging shipping documents Organising transport service – 1x Information sharing – 3x <p>Key Resources</p> <ul style="list-style-type: none"> Distribution Network – 2x Digital resources – 2x Warehouses facilities – 2x Transport fleet – 1x Employees – 3x Customs service representatives – 1x Transport fleet – 1x Post offices – 2x External providers' supra structure and infrastructure – 2x 	<p>Value Propositions</p> <ul style="list-style-type: none"> Customized solutions & value-added services – 2x Possibility to change delivery option – 2x Innovative solutions and technologies – 1x Customs clearance services – 1x Fast delivery – 2x Convenient price – 1x Digital services – 1x Access to the flow of goods & services – 1x Reliable delivery – 1x Accessibility and availability – 2x Security – 1x Support – 1x Route optimisation – 1x Reduction of emissions – 1x Regulatory compliance and documentation – 2x Insurance & risk management – 1x Multilingual capabilities – 1x Supply chain visibility – 1x Improved information flow Accurate services – 1x Worldwide contact network – 2x 	<p>Customer Relationships</p> <ul style="list-style-type: none"> Personalized interaction – 1x Regular communication and updates – 1x Seeking feedback from customers to enhance service quality – 1x Self-service options (parcel lockers, online applications for pick up/delivery) – 1x Key account managers for key customers – 1x External business apps that allow communication between various customers – 1x Ongoing technical support – 1x Joint planning and optimization – 1x Yearly agreements – 1x Daily contact in operations – 1x <p>Channels</p> <ul style="list-style-type: none"> Website – 2x E-mail conversation – 1x Phone conversation – 1x Customer contact center – 1x Physical counters – 2x Digital platforms – 2x Cross-channel communication – 1x Direct sales to business customers – 1x Industry events – 1x 	<p>Customer Segments</p> <ul style="list-style-type: none"> Retailers – 2x E-commerce companies – 3x Producers – 1x Medical facilities, laboratories & clinics – 1x Individuals – 3x Governmental bodies – 2x Transport companies that need route optimization – 1x Manufacturers and their subcontractors – 1x
	<ul style="list-style-type: none"> Advanced telematic systems – 1x Freight forwarding software – 1x 		<ul style="list-style-type: none"> Campaigns – 1x Direct EDI messages between cargo owners – 1x 	
<p>Cost Structure</p> <ul style="list-style-type: none"> Financial services – 1x Marketing costs – 1x Customer service costs – 1x Employee costs – 1x Transportation costs – 1x Warehousing costs Technology costs – 2x External delivery partners costs – 1x Infrastructure costs – 1x Material costs – 1x Administrative costs – 1x Integration costs – 1x Data analysis and management – 1x Technology costs – 2x Equipment maintenance – 2x Renting costs – 1x Utilities interests expenses taxes – 1x 		<p>Revenue Streams</p> <ul style="list-style-type: none"> Selling transportation services – 2x Premium revicve fees – 1x Adjustments in pricing based on demand and capacity – 1x Value-added services – 1x Retail sales – 2x Financial services – 2x Digital services – 1x Traditional route planning services – 1x Service fees – 1x Income from cargo handling – 1x Income from warehousing – 1x Income from forwarding – 1x 		

Designed by: The Business Model Foundry (www.businessmodelgeneration.com/canvas). Word implementation by: Neos Chronos Limited (<https://neoschronos.com>). License: CC BY-SA 3.0

Figure A12: A cross-case analysis of AS-IS BMC of all buyers and sellers

Business Model Canvas		ONLY changes from marketplace ecosystem use	SELLERS and BUYERS (6x)	Date: 23.05.2024	Version: final
Key Partners Platform sellers and buyers (3x) Marketplace ecosystem operator (5x) Eco-friendly transportation providers (2x) Airline transport companies Railway operators Crowdsourcing providers Eco-friendly packaging suppliers Renewable energy providers IT solution developers	Key Activities CO ₂ emissions monitoring and reporting (5x) Route optimization (2x) Information sharing on arrivals and departures (2x) Transport scheduling Information sharing about arrivals and departures Key Resources Marketplace infrastructure (3x) Telematics and route optimization software Carbon footprint calculator (2x) Sustainability certificates Freight forwarding software Comprehensive data gathering (2x) Supply chain management expertise (2x) Regulatory knowledge (3x) Green delivery fleet Education and advocacy resources Sales and marketing resources	Value Propositions Offering low emission and sustainable logistics services More accurate emission information for customers (3x) Improved visibility and transparency (2x) Competitive pricing Regulatory compliance (2x) Leveraging data-driven insights and optimization (4x) Fast delivery Adjustable time slots	Customer Relationships Feedback and reviews (2x) Community building (3x) Personalized assistance and recommendations (3x) Education Loyalty programs via e-shop Community building via e-shop Channels Marketplace ecosystem (5x) Industry events (2x) Public relations Paid advertising (2x) Social media marketing E-mail marketing Outbound campaigns	Customer Segments Several customers with sustainability goals (5x) E-commerce companies Large producers (2x) Commercial freight transporters (2x) Nonprofit organisations	
Cost Structure Employee training (3x) Marketplace costs (fixed monthly fee / per-user fee) (5x) Marketing costs Investments in technology (4x)		Revenue Streams Revenue from automated CO ₂ calculation and reporting Revenue from consultations on eco-driving improvements and maintaining a low-emission company (2x) Premium pricing for low-emission options/Profit margins on sustainable shipping costs (3x) Revenue streams from green services (e.g., green delivery and pickup)			

Figure A13: A comparative analysis of changes in the BMs of sellers and buyers resulting from the use of the ADMIRAL logistics marketplace ecosystem.

Appendix B

Questionnaire for a marketplace owner

Dear *Marketplace owner*,

The purpose of this questionnaire is to gather additional information and detailed insights into how the ADMIRAL marketplace will impact your current business model (BM) **as a marketplace owner**. The questionnaire is specifically focused on three key elements of BMs:

1. **Value Offers:** How your value proposition, channels, customer segments, and customer relationships might evolve?
2. **Value Creation:** How might key partners, resources, and activities change?
3. **Value Capture:** How the cost structure and revenue streams may be affected?

The questions have been organized into 3 parts:

1. The first part includes four general open-ended questions.
2. The second part is divided into three sections corresponding to the three BM elements mentioned above (value offers, value creation and value capture). This is to streamline the process and facilitate clarity (see below). Section 1 includes questions and sub-questions related to changes in value offers by using the ADMIRAL marketplace. Section 2 contains value creation questions, and Section 3 contains value capture questions and sub-questions. Each section includes one main question (marked in black) and several sub-questions (marked with blue colour). Sub-questions should serve as assistance and guidance for you when answering. Please read all questions marked in blue and try to respond to each one, unless the question is irrelevant to you. In that case, please explain why the question is not relevant.
3. The final section addresses concerns as well as questions about their future expectations.

Thank you for your participation and valuable input.

1. GENERAL QUESTIONS:

- 1.1. Which digital marketplace in the logistics sector are you currently familiar with, and how do you differentiate your platform from them?
- 1.2. What motivated you to create a logistics digital marketplace?
- 1.3. What goals do you want to achieve through the ADMIRAL marketplace (e.g. market leadership, innovation, service expansion, etc.)?
- 1.4. What are main risks/concerns/challenges while managing the ADMIRAL marketplace (e.g. attracting users, platform security, relationship issues, regulations, etc.)?

2. BUSINESS MODEL RELATED QUESTIONS

2.1. VALUE OFFERS: How will offering logistics services and tools via the ADMIRAL marketplace affect the value proposition for your platform?

- *What value do you believe the marketplace brings to both buyers, sellers of logistics services, data providers, tools developers? How do you position this value compared to traditional logistics services?*
- *How will the services and tools offered on the marketplace improve logistics operations for users (e.g., efficiency, transparency, cost-effectiveness)?*
- *Do you anticipate offering innovative or AI-driven tools or any other service/solution that will attract new types of customers such as smaller logistics companies, tech-driven businesses, niche firms, etc.?*
- *How do you expect your customers to perceive the enhanced value you offer through the marketplace (e.g., smarter logistics, cost savings, improved service delivery, greater market share, promotion)?*

2.2. VALUE CREATION: How will running the marketplace influence the way you create value as a platform owner?

- *What key activities will you need to focus on to ensure the marketplace's success (e.g., platform development, user support, continuous innovation, etc.)?*
- *How will you foster relationships between logistics providers, buyers, and technology partners on the platform (e.g. entry conditions, contractual requirements, anti-competitive laws, etc.)? Will new partnerships be necessary to sustain growth?*
- *What resources (technological, human, financial) will be critical to operating and scaling the ADMIRAL marketplace?*
- *How will you adapt your current business processes to accommodate the integration of new logistics tools and services into the marketplace?*

2.3. VALUE CAPTURE: How will operating the marketplace affect your revenue model and cost structure?

- *What is your primary revenue model for the marketplace (e.g., transaction fees, subscription models, premium features)?*
- *Do you foresee opportunities to introduce new revenue streams (e.g., premium logistics tools, advanced analytics services)?*
- *How will the costs of maintaining and scaling the marketplace (e.g., technology upgrades, platform security) impact your cost structure?*
- *Do you anticipate any cost savings?*

3. CONCERNS & RISKS:

3.1. What concerns/hesitations/challenges do you foresee as the owner of the marketplace in managing needs of both buyers and sellers?

3.2. Are there any specific risks you foresee in terms of platform stability, security, marketplace growth?

4. VISION FOR THE FUTURE:

4.1. How do you envision the ADMIRAL marketplace evolving over the next 3–5 years in terms of services, customers, technology, etc.?

4.2. What role do you see the ADMIRAL digital marketplace playing in the broader logistics ecosystem in the future (e.g. becoming a leading marketplace, facilitating global trade, etc.)?

4.3. What milestones do you hope to achieve in the first year of operating the ADMIRAL marketplace?

5. COMMENTS:

5.1. Do you have any additional comments?

Questionnaire for a buyer of logistics services/tools

Dear *Pilot Representatives*, Dear *Pilot stakeholders*,

The purpose of this questionnaire is to gather additional information and detailed insights into how the ADMIRAL marketplace will impact the BM of your company **as a buyer** of logistics services/tools offered in the marketplace. The questionnaire is specifically focused on three key elements of BMs:

1. **Value Offers:** How might your value proposition, channels, customer segments, and customer relationships evolve?
2. **Value Creation:** How key partners, resources, and activities might change?
3. **Value Capture:** How the cost structure and revenue streams may be affected?

The questions have been organized into 3 parts:

1. The first part includes six general open-ended questions.
2. The second part is divided into three sections corresponding to the three BM elements mentioned above (value offers, value creation and value capture). This is to streamline the process and facilitate clarity (see below). Section 1 includes questions and sub-questions related to changes in value offers by using the ADMIRAL marketplace. Section 2 contains value creation questions, and Section 3 contains value capture questions and sub-questions. Each section includes one main question (marked in black colour) and several sub-questions (marked with blue colour). Sub-questions should serve as assistance and guidance for you when answering. Please read all questions marked in blue and try to respond to each one, unless the question is irrelevant to you. In that case, please explain why the question is not relevant.
3. The final section addresses concerns as well as questions about their future expectations.

Thank you for your participation and valuable input.

1. GENERAL QUESTIONS:

1.1. Which digital logistics marketplaces for buying services/products are you familiar with, even if you haven't used them?

1.2 Do you know any industry-specific or niche logistics digital marketplaces relevant to your business?

1.3. Has your company ever purchased services from a logistics digital marketplace?

If yes, which logistics digital marketplace did you use, and what was your experience?

1.4. What are the biggest motivators for you to use the logistics digital marketplace (e.g., expanding reach, cost efficiency, access to a wide range of providers, AI-driven insights)?

1.5 What do you expect a logistics digital marketplace can offer your business that traditional channels can't (e.g. more transparency, cost savings, better data insights)?

1.6 Are there any risks or concerns you have about buying/purchasing logistics services/tools via a logistics digital marketplace?

2. BUSINESS MODEL RELATED QUESTIONS

2.1. VALUE OFFERS:

How will purchasing logistics services or tools from the ADMIRAL marketplace change the value you offer to your customers?

- *Will new logistics services and smart tools offered on the marketplace **enhance the quantity, quality or efficiency** of the service/products you offer to your customers, and **how**? Will these new services or tools help you provide faster delivery times or more accurate services to your customers? How do you think your customers will perceive the new value (e.g., better tracking, improved customer service, cost savings)? Will this help you offer more personalized or customized services to your customers? How do you expect these tools will help differentiate your offering from competitors?*
- *Which **new customers** with whom you have not worked together before do you anticipate these services/tools will help you reach? Do you anticipate these services/tools helping you better serve your existing customers (e.g. faster delivery, better communication, more accurate data)? Do you expect the new tools to help you scale your business to serve a broader geographic market or a more specialized niche market?*
- *How will a platform **change or strengthen your relationship** with your customers (think about frequency and ways of communication; think about the level of trust; distrust regarding data sharing?; enhanced and/or intensified cooperation and/or better integration of customers?; think about the length of the cooperation; think about the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration); maybe increased transparency and why)?*
- *How will access to more streamlined or diversified logistics services through the marketplace enable you **to reach new sales markets or territories**? How might better logistics options influence your ability to sell through **different sales channels** (e.g., online stores, international markets, or niche markets)? Do you anticipate the marketplace improving your ability to fulfil orders from multiple sales channels more efficiently (e.g., e-commerce, B2B sales)? Do you see potential for partnerships with logistics providers through the marketplace to help optimize your sales and distribution channels?*

2.2. VALUE CREATION:

How will the ADMIRAL platform change the way you create value?

- *How will integrating logistics services or smart tools from the marketplace change the way you operate? Will **new processes or workflows** need to be created specifically for the marketplace? What critical activities (e.g. logistics management, data analytics, AI integration) will be impacted or improved by these new tools offered on the marketplace?*
- *Will you need to **establish new partnerships** to effectively leverage marketplace offerings (e.g. logistics providers, technology vendors)? Which **new partners** with whom you have not worked together before are you going to acquire)? Do you expect to get new partners within or/and beyond the ADMIRAL ecosystem?*
- *How will using a digital marketplace for buying logistics services **affect your relationship with your current partners**? Will there be any changes in the scope or terms of your agreements or frequency and ways of communication or level of trust/distrust regarding data sharing or the length of the cooperation or the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration)?*
- *What **new resources** that you have not used will be necessary to effectively use these services and smart tools? (e.g. technological resources, human resources, digital skills and capabilities, other skills and capabilities, etc.) How will your **existing resources need to adapt** to the marketplace environment?*

2.3. VALUE CREATION:

How will the ADMIRAL platform change revenue and cost models?

- *Do you anticipate **any changes in your pricing strategies** as a result of buying services on the marketplace (e.g. more competitive pricing, reduced operational costs, etc.)?*
- *Do you foresee **any new revenue streams** emerging as a result of using these logistics services or smart tools (e.g., enhanced customer offerings, premium services, etc.)?*
- *How do you expect **the costs of logistics services** and smart tools from a marketplace to affect your overall cost structure (e.g. investments in new technologies, staff, etc.)?*
- *Do you anticipate **cost savings** in buying logistics services by using a marketplace (e.g. operation costs reduction, logistics service costs, data management costs, etc.)?*

3. CONCERNS & RISKS:

3.1. What concerns or hesitations do you have about using the ADMIRAL digital marketplace for purchasing logistics services or tools (e.g., enhanced customer offerings, premium services)?

3.2. Are there any specific risks you foresee when buying these services or tools via the ADMIRAL marketplace (e.g., data security, integration issues).

4. VISION FOR THE FUTURE:

4.1. How do you envision your business to evolve over the next 3–5 years with the adoption of tools and logistics services from a digital marketplace?

4.2. Do you see using a digital marketplace for these services as a temporary strategy or a long-term component of your BM? If yes, why?

4.3. What do you hope to achieve in the first year of using logistics services/tools purchased from a digital marketplace?

5. COMMENTS:

5.1. Do you have any additional comments?

Questionnaire for developers of tools and IT solutions

Dear Developers of tools,

The purpose of this questionnaire is to gather additional information and detailed insights into how the ADMIRAL marketplace will impact the BM of your company **as a developer** of digital tools/solutions offered on the marketplace. The questionnaire is specifically focused on three key elements of business models:

1. **Value Offers:** How your value proposition, channels, customer segments, and customer relationships might evolve?
2. **Value Creation:** How key partners, resources, and activities might change?
3. **Value Capture:** How the cost structure and revenue streams may be affected?

The questions have been organized into 3 parts:

1. The first part includes four general open-ended questions.
2. The second part is divided into three sections corresponding to the three business model elements mentioned above. This is to streamline the process and facilitate clarity (see below). Section 1 includes questions and sub-questions related to changes in value offers by using the ADMIRAL marketplace. Section 2 contains value creation questions, and section 3 contains value capture questions and sub-questions. Each section includes one main question (marked black) and several sub-questions (marked with blue color). Sub-questions should serve as assistance and guidance for you when answering. Please read all questions marked in blue and try to respond to each one, unless the question is irrelevant to you. In that case, please explain why the question is not relevant.
3. The final section addresses concerns as well as questions about their future expectations.

Thank you for your participation and valuable input.

1. GENERAL QUESTIONS:

1.1. Has your company ever developed tools or services for logistics digital marketplaces or platforms in general?

If yes, which logistics marketplaces did you develop for, and what was your experience?

1.2. What are the biggest motivators for you to offer digital solutions through a logistics digital marketplace (e.g., expanding customer base, data insights, access to new markets, etc.)?

1.3. What benefits do you expect a digital marketplace can offer your business compared to the traditional sales and distribution channels (e.g. greater market reach, integration with logistics providers, access to whole new customers)?

1.4. What are the main risks or concerns about offering your digital solutions on a digital marketplace (e.g. competition, data privacy, platform control (e.g. entry, quality control) etc.)?

2. **BM RELATED QUESTIONS**

2.1. **VALUE OFFERS:**

How will offering digital solutions/tools on the ADMIRAL marketplace change the value you offer to your customers?

- *How do you believe the ADMIRAL marketplace **will enhance the value** or impact of the digital tool(s) you are developing for it (e.g., improved optimization, better integrations with logistics providers)?*
- *How do you believe will the marketplace **help you differentiate** your offering from competitors? Will it allow you to personalize or customize your digital solutions based on user needs or any other differentiation?*
- *Which **new customer segments**, such as smaller logistics providers or niche markets, do you anticipate to reach by offering your tools on the marketplace?*
- *How do you expect your tools could improve the efficiency, accuracy, or decision-making capabilities of logistics or other companies buying them?*

2.2. **VALUE CREATION:**

How will the ADMIRAL platform change the way you create value as a developer?

- *Will the marketplace **require you to change** your development process or introduce new features and integrations (e.g., API compatibility, AI-driven insights for logistics)?*
- *Do you foresee the **need for new partners** to fully leverage the marketplace or for the tool development (e.g., logistics providers, data platforms, other developers, etc.)? If so, what kinds of partners?*
- *What **new resources or capabilities** will be required to successfully offer your tools on the marketplace (e.g., more advanced analytics, user support, compliance with marketplace standards, new staff, etc.)?*
- *How will your relationship with **your existing and new customers** evolve as you offer your tools on the marketplace? Will you and the logistics providers jointly develop new features or solutions that better serve the needs of the logistics industry?*

2.3. **VALUE CAPTURE:**

How will the ADMIRAL platform change your revenue and cost models?

- *Do you anticipate any **changes to your pricing strategies** for your tools due to the marketplace (e.g., subscription models, freemium pricing)?*
- *Do you foresee **new revenue** streams emerging (e.g., offering premium features, tailored services, etc.)?*
- *How will the costs of adapting your tools for the marketplace (e.g., integration costs, ongoing support)*

impact your overall BM?

- Do you expect **cost reduction** by promoting a tool through the marketplace (e.g., reduced marketing expenses, streamlined distribution)?

3. CONCERNS & RISKS:

3.1. What concerns or hesitations do you have about offering your tools on the ADMIRAL digital marketplace (e.g., losing control over pricing, competition with solutions offered by other developers on the marketplace)?

3.2. Are there any specific risks you foresee when offering your tools on the ADMIRAL marketplace (e.g., issue with data security, integration issues)?

4. VISION FOR THE FUTURE:

4.1. How do you envision your business to evolve over the next 3–5 years with the adoption of a digital marketplace like ADMIRAL?

4.2. Do you see using a digital marketplace as a temporary strategy or a long-term component of your BM?

4.3. What do you hope to achieve in the first year of offering your tools on the ADMIRAL marketplace (e.g. new customers, improved market presence)?

5. COMMENTS:

5.1. Do you have any additional comments?

Questionnaire for data provider and integrator

Dear Pilot Representatives, Dear Pilot stakeholders,

The purpose of this questionnaire is to gather additional information and detailed insights into how the ADMIRAL marketplace will impact the BM of your company **as a service integrator and data provider** in the ADMIRAL marketplace. The questionnaire is specifically focused on three key elements of BMs:

1. **Value Offers:** How might your value proposition, channels, customer segments, and customer relationships evolve?
2. **Value Creation:** How key partners, resources, and activities might change?
3. **Value Capture:** How the cost structure and revenue streams may be affected?

The questions have been organized into 3 parts:

1. The first part includes five general open-ended questions.
2. The second part is divided into three sections corresponding to the three business model elements mentioned above. This is to streamline the process and facilitate clarity (see below). Section 1 includes questions and sub-questions related to changes in value offers by using the

ADMIRAL marketplace. Section 2 contains value creation questions, and section 3 contains value capture questions and sub-questions. Each section includes one main question and several sub-questions (marked with blue color). " Sub-questions should serve as assistance and guidance for you when answering. Please read all questions marked in blue and try to respond to each one, unless the question is irrelevant to you. In that case, please explain why the question is not relevant.

3. The final section addresses concerns as well as questions about their future expectations.

Thank you for your participation and valuable input.

1. GENERAL QUESTIONS:

- 1.1. Which logistics digital marketplaces are you familiar with, even if you haven't used them?
- 1.2 Do you know any industry-specific or niche logistics digital marketplaces relevant to your business?
- 1.3. Has your company ever used a logistics digital marketplace to provide data?
If yes, which digital marketplace have you used?
Can you briefly describe your experience using digital marketplaces?
- 1.4. What are the biggest motivators for you to use the logistics digital marketplace (e.g., expanding service usage, improving supply chain transparency, improving port operations, etc.)?
- 1.5 What do you expect a digital marketplace can offer your business that traditional channels can't?

2. BM RELATED QUESTIONS

2.1. VALUE OFFERS:

How will the ADMIRAL platform increase the value you offer to your current and new CUSTOMERS?

- *How will the platform **extend the value** you offer to your customers (logistics providers and other users)? How will the platform **improve the value** you offer (e.g. better integration with logistics providers, more timely and accurate information for supply chain partners, etc.)? How do you think the marketplace **will differentiate** your data offering from other data providers or any other source (e.g. enhanced visibility, custom data packages)?*
- *What **new customer** segment (e.g. smaller logistics providers, niche industries) do you expect to reach by sharing your data and offering new services?*
- *How do you expect the data you provide will improve decision-making capabilities or the operational efficiency of logistics companies using your data?*
- *How will a platform **change your relationship** with your customers? (think about frequency and ways of communication; think about the level of trust; distrust regarding data sharing?; enhanced and/or intensified cooperation and/or better integration of customers?; think about the length of the cooperation; think about the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration); maybe increased transparency and why?)*

2.2. VALUE CREATION:

How will the ADMIRAL platform change the way you create value?

- What will be **the most critical activities** when moving into a digital marketplace? How will **the collection, structure, or distribution of data change** (e.g. providing real-time updates, integration with different systems like APIs)?
- Do you foresee the need for **new partners** (e.g. logistics companies, technology providers) to fully leverage the marketplace for your port's data? If so, what kind of partners?
- How will a platform **change your relationship** with partners? (think about frequency and ways of communication; think about the level of trust; distrust regarding data sharing?; enhanced and/or intensified cooperation and/or better integration of partners?; think about the length of the cooperation; think about the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration); maybe increased transparency and why?)
- What **new resources** or **capabilities** will your port need to successfully share data on the marketplace (e.g. data management, compliance with marketplace standards)?

2.3. VALUE CAPTURE:

How will the ADMIRAL platform change revenue and cost models?

- Do you expect any changes in **pricing strategies** for accessing your data? If so, what kind of changes?
- Do you foresee **new revenue streams** emerging (e.g. offering premium or customized data services)? If so, what kind of revenue streams?
- How will the costs of adapting your data for the marketplace (e.g. integrating data streams, maintaining accuracy) affect your operations?
- Do you expect **cost reductions** by sharing your data through the marketplace (e.g. reduced manual distribution, streamlined information flow)? If so, what kind of costs reductions?

3. CONCERNS & RISKS:

3.1. What concerns or hesitations do you have about sharing your data on the ADMIRAL digital marketplace (e.g., data security, accuracy, etc.)?

3.2. Are there any specific risks you foresee in sharing your data through the marketplace (e.g., integration issues, etc.)?

4. VISION FOR THE FUTURE:

4.1. How do you envision your business to evolve over the next 3–5 years with the adoption of the digital marketplace like ADMIRAL?

4.2. Do you see using a digital marketplace as a temporary strategy or a long-term component of your BM?

4.3. What do you hope to achieve in the first year of sharing data on a digital marketplace (e.g. improved visibility, increased partnership, more efficient port operations, etc.)?

5. COMMENTS:

5.1. Do you have any further comments?

Questionnaire for sellers of services

Dear *Pilot Representatives*, Dear *Pilot stakeholders*,

The purpose of this questionnaire is to gather additional information and detailed insights into how the ADMIRAL marketplace will impact the BM of your company **as a seller** of logistics services. The questionnaire is specifically focused on three key elements of business models:

1. **Value Offers:** How might your value proposition, channels, customer segments, and customer relationships evolve?
2. **Value Creation:** How key partners, resources, and activities might change?
3. **Value Capture:** How the cost structure and revenue streams may be affected?

The questions have been organized into 3 parts:

1. The first part includes six general open-ended questions.
2. The second part is divided into three sections corresponding to the three BM elements mentioned above (value offers, value creation and value capture). This is to streamline the process and facilitate clarity (see below). Section 1 includes questions and sub-questions related to changes in value offers by using the ADMIRAL marketplace. Section 2 contains value creation questions, and Section 3 contains value capture questions and sub-questions. Each section includes one main question (marked black) and several sub-questions (marked blue). Sub-questions should serve as assistance and guidance for you when answering. Please read all questions marked in blue and try to respond to each one, unless the question is irrelevant to you. In that case, please explain why the question is not relevant.
3. The final section addresses concerns as well as questions about their future expectations.

Thank you for your participation and valuable input.

1. GENERAL QUESTIONS:

- 1.1. Which logistics digital marketplaces are you familiar with, even if you haven't used them?
- 1.2. Do you know any industry-specific or niche logistics digital marketplaces relevant to your business?
- 1.3. Has your company ever used a logistics digital marketplace to sell products or services?
If yes, which logistics digital marketplace have you used?
Can you briefly describe your experience using logistics digital marketplaces?
- 1.4. What are the biggest motivators for you to use the logistics digital marketplace (e.g., expanding reach, increasing sales, reducing costs, improving customer acquisition)?

1.5 What do you expect a logistics digital marketplace can offer your business that traditional channels can't?

1.6 Are there any specific risks you are worried about when considering a digital marketplace for your business?

2. BUSINESS MODEL RELATED QUESTIONS

2.1. VALUE OFFERS:

How will the ADMIRAL platform increase the value you offer to your current and new CUSTOMERS?

- How will the platform **extend the value** you offer to customers (e.g. how your service/product will be different or unique from the others)? How will the platform **improve the value** you offer (e.g. enhancing existing offerings of services/products with technology and online services)? Do you anticipate **offering different products or services** through the marketplace compared to your traditional channels?
- Which **new customers** with whom you have not worked together before are you going to acquire (e.g. industry or ownership-based differentiation; size-based differentiation)? Which **new customers within or/and beyond the ADMIRAL ecosystem** do you expect to get? What are the **potential challenges** of reaching your existing customers via a digital marketplace?
- How will a platform **change your relationship** with your customers? (think about frequency and ways of communication; think about the level of trust; distrust regarding data sharing?; enhanced and/or intensified cooperation and/or better integration of customers?; think about the length of the cooperation; think about the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration); maybe increased transparency and why?)
- How do you think a digital marketplace will **complement or disrupt your existing sales channels**? Which **new novel channels** of communication with your customers are you going to use (e.g. direct (digital), or indirect)? What **adjustments** do you foresee making to your sales and distribution strategies when using a marketplace?

2.2. VALUE CREATION:

How will the ADMIRAL platform change the way you create value?

- What will be **the most critical activities** when moving into a digital marketplace (e.g. logistics, marketing, customer service)? How will **the daily operations** of your business **change**? Will **new processes or workflows** need to be created specifically for the marketplace?
- Which **new partners** with whom you have not worked together before are you going to acquire (e.g. competitors, industry or ownership-based differentiation; size-based differentiation; geographic-based differentiation)? Do you expect to get new partners within or/and beyond the admiral ecosystem?

How will your **current partners be affected** by your entry into a digital marketplace?
- How will a platform **change your relationship** with partners? (think about frequency and ways of communication; think about the level of trust; distrust regarding data sharing?; enhanced and/or intensified cooperation and/or better integration of partners?; think about the length of the cooperation; think about the type of collaboration (e.g. horizontal/vertical) & barriers to horizontal collaboration); maybe increased transparency and why?)
- What **new resources** that you have not used will be necessary for integrating with a digital marketplace? (e.g. technological resources, human resources, digital skills and capabilities, other skills and capabilities)

*etc.) How will your **existing resources need to adapt** to the marketplace environment? Do you anticipate needing external support or partnership to succeed in a marketplace?*

2.3. VALUE CAPTURE:

How will the ADMIRAL platform change revenue and costs models?

- *How do you expect will the platform affect the **pricing strategies** you currently use (e.g. competition, price comparison)? (think about the type or pricing strategies Admiral is offering and consider how it/they can be integrated into your current BM?)*
- *How will your **revenue model change** with marketplace integration?*
- *How do you expect will the platform **change the cost structure**? (think about e.g. the changes you envisioned earlier with regards to your customer and/or partner relationships)*
- *Will you need to **invest** in new technologies, staff, or logistics to operate effectively in a marketplace?*
- *Do you anticipate **cost savings** in areas like marketing, sales, or distribution by using a marketplace?*

3. CONCERNS & RISKS:

3.1. What concerns or hesitations do you have about using the ADMIRAL digital marketplace for selling services (e.g., fees, competition, loss of control over branding)?

3.2. Are there any specific risks you are worried about when selling services via the ADMIRAL marketplace (data security, integration issues, etc.)?

4. VISION FOR THE FUTURE:

4.1. How do you envision your business evolving over the next 3–5 years with the selling of services on the digital marketplaces?

4.2. Do you see digital marketplaces as a temporary strategy or a long-term component of your business model? If yes, why?

4.3. What do you hope to achieve in the first year of selling services on a digital marketplace?

5. COMMENTS:

5.1. Do you have any further comments?

Appendix C

A step-by-step script for running the Stuttgart workshop and the potential follow-up online sessions

ADMIRAL Interview Workshop BM evaluation

Goal: Validate and refine the TO-BE BMs for the platform owner, buyers & sellers, and complementors so they reflect real practice and don't miss key elements. Platform owner group also validate proposed governance model table and boundary resources table.

Output: One reviewed BMC per stakeholder group, documented gaps/adjustments, and agreed on next steps for an online follow-up. Platform owner group also document changes to governance model table and boundary resources table.

Format: Facilitated workshop in three parallel groups, followed by an online session to complete remaining blocks.

Time: 60 minutes onsite.

Suggested Agenda

1. Use the table below to verify that the right representatives are present.

Table 1: Workshop participants and leaders

No.	Type of stakeholder	Nr. of persons	Leader(s)
1	Platform owner	1	Kääriäinen Jukka Mikkola Markku
2	Buyers and Sellers	5	Bajec Patricija Zanne Marina
3	Complementors	5	Fritz Jacqueline Findling Jacqueline
4	Institutes Universities Associations	13	Reimann Meike

2. **Welcome & objectives:** The text below explains the purpose and approach for the Workshops in Stuttgart and future online sessions.

We are now moving into the validation & refinement phase of BM design. Since companies are in the phase of integration and have tested the platform ecosystem, the right next step of Task 3.3 is to make sure that TO-BE BMs of platform provider, sellers, buyers and complementors (IT solution developers, data integrators) really capture practice and don't miss important elements.

1. *We don't just want feedback, but want to know:*
2. *Does the BM reflect how platform providers/sellers and buyer/complementors actually operate in the platform ecosystem?*
3. *Are any critical elements missing (e.g., activities, revenue streams...)?*
4. *Do companies agree with the BM, or do they see gaps/misfits?*
5. *Do companies agree with the BM type, or do they see themselves in any other existing or non-existing, new BM type?*

You have already received a request from UL, FPP (Patricija Bajec), to internally evaluate the BMC. Now it is time for us to discuss your comments and any proposals or suggestions.

3. **Ensure that each company representative has at least one printed copy of the BMC** for evaluation purposes. If we are in separate classes, it would be helpful to display the BMC on a computer; however, printed copies should suffice.
4. **Block by block will be evaluated** through a series of questions. Since not all blocks will be assessed, another workshop with the same participants will be organised online after the IM.

Begin by evaluating any block; the choice is yours. The evaluation questions listed below can be very helpful and are likely to provide valuable insights. Ensure that participants understand the requirements of each BM block (refer to the green text in the following sections for guidance).

Document answers and discussions for each block and submit to the UL/FPP representative after the workshop.

Evaluation questions

Use these prompts; adapt the wording to the stakeholder group. For each block, ask:

1. Value Proposition: **WHAT PROBLEM DO YOU SOLVE FOR YOUR CUSTOMERS (The job you help them do, and the main benefits.)**

- Does this value proposition reflect the **main benefits for your customers** you expect from using the platform/developing a solution for the platform?
- Is there something missing?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

2. Customer Segments: (WHO IS THIS SOLUTION YOU ARE OFFERING ON THE MARKETPLACE FOR? (List the main groups of organisations/customers you offer your solution.)

- Do these customers reflect the actual customer groups after using?
- Are there additional customer segments that haven't been considered?
- Should some groups be split or merged?
- Would you rephrase any of these values differently?

3. Channels: HOW DO CUSTOMERS FIND AND USE YOU? (How do you reach customers and deliver the service?)

- Are the described digital and physical channels realistic for connecting with partners through the platform?
- Do you already use some channels that are missing here?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

4. Customer Relationships: HOW DO YOU HELP AND RETAIN CUSTOMERS? (The kind of support/interaction you provide for customers for training, onboarding, and using services.)

- Does the model capture how you interact with service providers on the platform (self-service, automated matching, personal support)?
- Are there relationship aspects missing (e.g., trust building, reputation systems, after-sales support)?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

5. Key Activities: WHAT MUST HAPPEN EVERY DAY TO DELIVER SERVICE (OPERATE PLATFORM, MATCHING, SUPPORT)? (The critical day-to-day work.)

- Are the main activities on the platform well described?
- What activities do you see as critical but not listed?
- Would you rephrase any of these values differently?

- Should some groups be split or merged?

6. Key Resources: WHAT MUST YOU HAVE TO DELIVER SERVICE? (People, tech, data, brand, licenses.)

- Are the resources that you need (data, digital tools, financial means, staff) correctly represented?
- Are we missing anything?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

7. Key Partnerships: WHO HELPS YOU TO DELIVER SERVICES TO YOUR CUSTOMERS? (External organisations that reduce cost/risk or add value.)

- Does the BM capture the important partnerships you need (with sellers, platform operators, and IT providers)?
- Are there new types of partnerships emerging in the ecosystem that should be added?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

8. Revenue Streams: HOW DO YOU EARN MONEY? (What customers pay for and how.)

- Are the ways you create or save money on the platform clear?
- Do you agree with the described cost-benefit logic?
- Are there other revenue/cost-saving opportunities missing?
- Would you rephrase any of these values differently?
- Should some groups be split or merged?

9. Cost Structure: WHERE DO YOU SPEND MONEY TO OFFER A SOLUTION TO YOUR CUSTOMERS? (Main fixed and variable costs.)

- Are the main costs for buyers on the platform correctly identified (fees, IT integration, staff time)?

- Which costs are underestimated?
 - Are there hidden costs we should include?
 - Would you rephrase any of these values differently?
 - Should some groups be split or merged?
5. Five minutes before the end of the workshop, **please confirm the date for the online meeting** with the participants and inform them that their participation is mandatory.
6. Additionally, **thank everyone for their involvement** and let them know that the results will be included in a deliverable under WP3.

Materials & Setup (What else is required)

Bring/prepare:

- Printed **BMC** sets (min. 1 per participant).
- Printed Table 1 for each workshop leader.
- Sticky notes (optional) and pens for participants.
- Laptop + projector or large display (optional but helpful).
- Notetaker template (optional).