Flexible, multi-mOdal and Robust FREIGHt Transport

D4.3 Initial plan for maximisation of impact

Document Summary Information

Grant Agreement No	101069731	**Acronym**	FOR-FREIGHT
Full Title	Flexible, multi-mOdal and Robust FREIGHt Transport		
Start Date	01.09.2022	**Duration**	40 months
Project URL	https://www.for-freight.eu		
Deliverable	D4.3 Initial plan for maximisation of impact		
Work Package	WP4 - Commercialisation & Innovation		
Contractual due date	29.02.2024	**Actual submission date**	29.02.2024
Nature	R - Document, report	**Dissemination Level**	Public
Lead Beneficiary	ZSI		
Responsible Author	Dietmar Lampert (ZSI), Utku B. Demir (ZSI)		
Contributions from	Gorazd Weiss (ZSI), Johannes Waldmüller (ZSI), Giota Lilli (eBOS), Orestis Manos (WINGS), Stefan Stefanescu (BEIA), Alicia Enríquez Manilla (FVP), Jorge Feliu Escagüés (FVP), Georgia Ayfantopoulou (CERTH), Sofoklis Dais (CERTH), Katerina Batzou (CERTH), Maria Ramirez de las Navas (DHL)		

Funded by the European Union

Funded by the European Union under Grant Agreement no. 101069731. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Revision history (including peer reviewing & quality control)

Version	Issue Date	% Complete	Changes	Contributor(s)
V0.1	15.11.2023	5	Initial Deliverable structure - ToC	Utku B. Demir (ZSI)
V0.2	17.11.2023	10	ToC review & refinement	Dietmar Lampert (ZSI)
V0.3	28.11.2023	15	ToC update according to the Quality Assurance revision	Utku B. Demir, (ZSI), Dietmar Lampert (ZSI), Gorazd Weiss (ZSI)
V0.4	03.01.2024	35	Initial input	Utku B. Demir (ZSI)
V0.5	09.01.2024	50	Contributions to Chapter 4	Dietmar Lampert (ZSI), Utku B. Demir (ZSI)
V0.6	11.01.2024	55	Addressing comments after Quality Assurance review	Utku B. Demir (ZSI), Dietmar Lampert (ZSI), Giota Lilli (eBOS)
V0.7	18.01.2024	57	Contributions to Chapter 4 and Chapter 6	Orestis Manos (WINGS)
V0.8	31.01.2024	80	Contributions to Chapter 5	Orestis Manos (WINGS), Stefan Stefanescu (BEIA), Alicia Enríquez Manilla (FVP), Jorge Feliu Escagüés (FVP), Dietmar Lampert (ZSI), Utku B. Demir (ZSI)
V0.9	01.02.2024	85	Quality Assurance review	Giota Lilli (eBOS)
V1.0	13.02.2024	90	Consolidation of comments	Dietmar Lampert (ZSI), Utku B. Demir (ZSI)
V1.1	14.02.2024	92	Quality Assurance review	Giota Lilli (eBOS)
V1.2	19.02.2024	95	Peer Reviews	Georgia Ayfantopoulou (CERTH), Sofoklis Dais (CERTH), Katerina Batzou (CERTH), María Ramírez (DHL)
V1.3	23.02.2024	98	Final adjustments after Quality Assurance & Peer Review	Dietmar Lampert (ZSI), Utku B. Demir (ZSI)
V1.4	26.02.2024	100	Final Quality Assurance review	Giota Lilli (eBOS)

Disclaimer

Copyright message

[1] According to FOR-FREIGHT's Quality Assurance Process for reports:
4 months before Deliverable's Due Date: Table of Contents ready to be reviewed by WP leader/ Technical Manager/ Quality Manager
3 months before Deliverable's Due Date: 50% should be complete. Review by the Quality Manager (& Technical Manager for software).
2 months before Deliverable's Due Date: 80% should be complete. Review by the Quality Manager. (& Technical Manager for software).
1 month before Deliverable's Due Date:100% should be complete. Review by the Quality Manager and Peer Reviewers.
M: Sent to PC for Submission to the EC after addressing all comments by Quality Manager and Peer Reviewers

Table of Contents

List of Figures

List of Tables

Glossary of terms and abbreviations

Abbreviation / Term	Description
AAOPFR	Association of Shipowners and Port - River Operators from Romania
AI	Artificial Intelligence
ALICE	Alliance for Logistics Innovation through Collaboration in Europe
API	Application Programming Interface
BEIA	BEIA CONSULT INTERNATIONAL SRL
CERTH	CENTRE FOR RESEARCH & TECHNOLOGY HELLAS
CRM	Customer Relationship Management
D	Deliverable
D&C	Dissemination & Communication
DHL	DHL EXEL SUPPLY CHAIN SPAIN SL
DSS	Decision Support System
DTLF	Digital Transport and Logistics Forum
eBOS	EBOS TECHNOLOGIES LIMITED
EC	European Commission
EI	Expected Impact
eiKPI	Expected Impact Key Performance Indicator
EO	Expected Outcome
eoKPI	Expected Outcome Key Performance Indicator
ES_UC	Spanish Use Case
ETA	Estimated Time of Arrival
ETS	Emissions Trading System
EU	European Union
FVP	FUNDACIÓN DE LA COMUNIDAD VALENCIANA PARA LA INVESTIGACION, PROMOCIÓN Y ESTUDIOS COMERCIALES DE VALENCIAPORT
GA	Grant Agreement
GHG	Greenhouse Gas
GR_UC	Greek Use Case
ICT	Information and Communication Technology
IMEC	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM
IoT	Internet of Things
IT&C	Information Technology and Communications
KPI	Key Performance Indicator
LMS	Learning Management System
M	Month
MDM	METRO DE MADRID SA
ML	Machine Learning
NGO	Non-governmental Organisation
Q&A	Questions and Answers
RO_UC	Romanian Use Case
SotA	State of the Art

SWOT	Strengths, Weaknesses, Opportunities, Threats
T	Task
T&L	Transport and Logistics
TEN-T	Trans-European Transport Network
TRL	Technological Readiness Level
UC	Use Case
USP	Unique Selling Point
VTMIS	Vessel Traffic Monitoring and Information Systems
WINGS	WINGS ICT SOLUTIONS INFORMATION & COMMUNICATION TECHNOLOGIES IKE
WMS	Warehouse Management System
WP	Work Package
ZSI	Zentrum für Soziale Innovation / Centre for Social Innovation

1 Executive summary

This document constitutes Deliverable (D) 4.3 “Initial plan for maximisation of impact” which has been developed under Task (T) 4.3 “Socio-economic & environmental impact generation” (M07-M39) as a part of the Work Package (WP) 4 “Commercialisation & Innovation”. Subsequent activities related to T4.3 after D4.3's submission will contribute to the final WP4 deliverable, D4.5 "Business plan, impact generation, and innovation (Revised version)".

The initial plan for the maximisation of impact presents a strategic framework aimed at amplifying the socioeconomic and environmental impacts of the FOR-FREIGHT project. By integrating a detailed stakeholder mapping, alongside the identification and analysis of socio-economic and environmental impacts, the plan leverages project results, and innovations for a wider benefit, in terms of a comprehensive stakeholder engagement process.

The plan laid out in this document synthesises insights from various tasks and WPs, underlining the importance of a collaborative approach to achieving the intended impact. It outlines processes for assessing and enhancing the positive effects of the project and highlights the need for dynamic engagement and ongoing assessment to address the complexities of socio-economic and environmental sustainability. Moreover, by using external sources like scientific publications, or relevant Work Programmes, the plan also displays connections between the envisioned impacts of the project with the current discourse, and emphasises issues on the Transport and Logistics (T&L) landscape.

Conclusively, the plan articulates the FOR-FREIGHT project's commitment to meaningful change through strategic stakeholder engagement, impact assessment, and adaptive management. It showcases an optimistic vision for the project's potential to redefine standards in freight transportation, contributing to environmental stewardship and societal well-being through innovative solutions and focused impact maximisation efforts. Aligning with those ambitions, and with the consideration of the variety of solutions being developed in the project, as well as the diverse spectrum of multimodal transportation, D4.3 aims to present a tailored stakeholder engagement strategy adjusted to different stakeholder categories and their linkages to the identified potential impacts.

To capitalise on the FOR-FREIGHT consortium's expertise in deploying a tailored impact maximisation plan, T4.3 has embraced a collaborative methodology. This includes, beyond indirect contributions, internal workshops, and contributions to validation and writing from all consortium members in D4.3 development. This approach ensures that the specificities of FOR-FREIGHT solutions and the differences between the project’s use cases (UCs) are reflected in the initial impact maximisation plan. The plan is set to be further refined and adapted through collaborative efforts and feedback, securing the achievement of the project's impact objectives.

2 Introduction

This document is the result of the work done in T4.3, consolidating information about other tasks and WPs in the project, and constitutes the D4.3 “Initial Plan for Maximisation of Impact”. As the title implies, the purpose of this deliverable is to have a first version of the plan to help the project reach its fullest impact potential. It does so by bringing to the fore a mapping of the key stakeholder groups, the most relevant impacts and outcomes, and identifying the key activities that connect the two. Moreover, it provides a concrete plan tailored to each of the FOR-FREIGHT’s UCs. Lastly, it lays out a monitoring and evaluation strategy to ensure that the envisioned outcomes are being reached and that the impact maximisation plan is being updated when new results from the stakeholder engagement or technical development become available.

In aligning with FOR-FREIGHT's implementation goals, the deliverable significantly supports Objective 4, aiming to cultivate and validate innovative business models and cooperative T&L services, underpinned by a detailed socio-economic and environmental analysis. It establishes a robust framework for impact analysis, essential for enhancing the socio-economic and environmental effects of FOR-FREIGHT solutions across sectors. Furthermore, it lays foundational support for Objective 1, focusing on creating advanced T&L solutions to boost operational capacity, efficiency, and sustainability, by providing critical insights and a feedback mechanism for stakeholder-driven improvement.

2.1 Mapping FOR-FREIGHT Outputs

This section reports the commitments outlined in FOR-FREIGHT's Grant Agreement (GA), as detailed in the official deliverable and task descriptions. It focuses on the expected outputs and scope of work and aims to assist reviewers in locating sections of the document relevant to the tasks' requirements, ensuring that all necessary elements are comprehensively addressed. The following Table serves as a checklist for thorough coverage of all contractual obligations.

Table 2-1: Adherence to FOR-FREIGHT’s GA Deliverable & Tasks Descriptions

FOR-FREIGHT GA Component Title	FOR-FREIGHT GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D4.3 Initial plan for maximisation of impact	”Initial plan for maximization of socio-economic and environmental impact of the FOR-FREIGHT solutions. It is the output of Task 4.3”.	Methodology 3	Determines the methodology for the elicitation of evidence needed for the creation of the initial impact maximisation plan
		Project solutions and the Environment	Documents the results based on the employment of methods defined by the methodology, as well as results of relevant tasks contributing to D4.3; lays the foundation

			of the work done in Chapter 5
		Initial Plan for Impact Maximisation	Provides the initial impact maximisation plan per UC, based on a common framework
		Monitoring and Evaluation Strategy of Impact	Defines how the progress along the impact maximisation plan will be observed and reported
		Conclusions	Concludes the deliverable and provides an overview of how future updates of the initial impact maximisation plan are expected to be implemented
TASKS			
T4.3 Socio-economic & environmental impact generation	"This task aims at ensuring that positive economic, social, and environmental impacts of FOR-FREIGHT are increased and introduced to a broader stakeholder audience. Building on the results of the PESTLE and SWOT analysis in T4.1, the first step is the identification of potential economic, social, and environmental impacts of the FOR-FREIGHT Solutions for each of the involved sectors and categorised with regard to their temporal scope (short, medium, or long term). In a second step, the key stakeholders will be mapped, building on the market analysis previously done (T4.1). Each stakeholder group will be associated with different impact categories of FOR-FREIGHT Solutions. The initial plan for the impact maximisation (D4.2) is to be outlined, considering the stakeholder categorisation and the identified potential impacts. Pamphlets, social media presence, the website (to be developed in T5.1), and articles are formats that may be used to present the envisioned positive impacts. The next steps include a series of interactive events with different stakeholder groups to refine the strategy to maximise the impacts, where each group will be approached based	Project solutions and the Environment	Emphasises key results of the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis, related to the main strengths and weaknesses of the UCs; Identifies social, economic, and environmental impacts potentially relevant to the project; Maps stakeholders based on literature research, analysis done in WP1 and T4.1; Provides a first mapping of stakeholders and impacts, to identify those needed to achieve an impact and those affected by it; Outlines the project results most relevant for the impact maximisation;

	on the impact category that matches their profile best. Workshops, group interviews, stakeholder dialogues, and surveys are potential forms of for the engagement activities. It is foreseen feedback to be received from relevant external stakeholders (e.g., Alliance for Logistics Innovation through Collaboration in Europe – ALICE, Hellenic Institute of Logistics Management – ILME, Found.ation, INLECOM S.A., DIAKINISIS S.A., Port of Antwerp, Danube Digital Innovation Hub, Black Sea Economic Business Cooperation Council-BSEC BC, CEL (Centro Español de Logistica/ Spanish Logistics Centre), Logistop/Technological Platform in Logistics, Intermodality and Mobility, etc.) after the first implementation of the solutions, and based on early results. Key information about the solution design and performance will be shared with relevant mapped stakeholders, in order to receive their feedback on the perceived usability and effectiveness of the FOR-FREIGHT solutions. Their feedback can lead to the update of the solution design during the second phase of T1.4 (M20-M24), thus further strengthening the co-design aspects of the FOR-FREIGHT solutions and the influence of the wider multimodal T&L sector on the project outcomes. The results constitute building blocks for WP5 activities, and will also be shared with the involved stakeholders and presented to the general public (D4.3). Output: D4.3".	Initial Plan for Impact Maximisation	Creates a framework for the UCs to tailor their plan; Develops an initial plan for each UC, containing key activities targeting important internal as well as external stakeholder groups, to include players such as ALICE, ILME, Found.ation, or Danube Digital Innovation Hub; Establishes links to established plans and ongoing activities in WP5;
		Monitoring and Evaluation Strategy of Impact	Lays the foundation for gauging the implementation progress of the maximisation plan, offering Key Performance Indicators (KPIs) which are complementary to the overall project impact evaluation framework; defines data gathering needs and mechanisms

2.2 Linkage to other project outputs

This section gives details of the interdependencies of the respective deliverable with other WPs, project outputs, etc., as provided in the Table below.

Table 2-2: Links to other Project Outputs

WP Number	Task Number	Deliverable Number related	Content
WP1 SotA analysis, Use Case Definition		D1.1 D1.2	The State-of-the-Art (SotA) analysis conducted in T1.1 "Legacy system, state-of-the art and logistics standards analysis" has been a foundational

and Solution Design	T1.1 T1.2 T1.3 T1.4		element for the desk research undertaken in T4.3, offering a comprehensive understanding of the current landscape in T&L. Additionally, the detailed KPI definitions and stakeholder identification presented in D1.2 "FOR-FREIGHT multimodal transport Use Case definition" have been directly employed in T4.3 for further stakeholder mapping and impact identification. This integration of insights from T1.1 and D1.2 into T4.3 has been essential in evaluating the potential outcomes of FOR-FREIGHT's innovations and in identifying both internal and external stakeholders relevant to the project's innovations.
WP2 FOR-FREIGHT solution implementation, Integration & testing	T2.1 T2.2 T2.3 T2.4 T2.5	D2.1	WP2 is primarily focused on implementing the envisioned solutions for FOR-FREIGHT. The detailed descriptions of the UCs and the platform's structure, as outlined in WP2, are instrumental for customising the events and activities planned in T4.3. These details are essential for effectively engaging external stakeholders, as they provide a clear understanding of the operational aspects and potential impacts of the solutions. By aligning the stakeholder engagement efforts in T4.3 with the practical implementations in WP2, the project ensures a cohesive and targeted approach to maximising impact and fostering collaborative relationships with key external stakeholders.
WP4 Commercialisation & Innovation	T4.1 T4.2 T4.4	D4.2	The innovations and commercialisation efforts in WP4 play a central role in shaping T4.3. The development of D4.3 has significantly benefitted from the business plan construction undertaken in T4.1. A key component of T4.1, the SWOT analysis, which also forms part of D4.2, serves as a foundational element in D4.3. This analysis directly influences the strategies and approaches outlined in T4.3 for the impact maximisation plan. The intersection of these work packages underscores the integrated approach of the project, ensuring that commercialisation strategies are closely aligned with broader project goals and stakeholder interests.
WP5 Dissemination, Communication & capacity building	T5.1 T5.3	D5.3	The dissemination activities, along with training and clustering activities under WP5, significantly contribute to the impact maximisation efforts in T4.3. The design and execution of training activities in T5.3 will be informed and enhanced by the impact maximisation plan developed in T4.3. This plan

			provides a comprehensive understanding of the project's objectives, potential impacts, and stakeholder dynamics. Additionally, the categorisation and profiling of stakeholder groups, a key aspect of T4.3, will be instrumental in tailoring training activities to meet the specific needs and characteristics of different stakeholders. By integrating insights from T4.3, the training activities in T5.3 will be better positioned to address relevant challenges, disseminate key project findings, and foster effective stakeholder engagement, thereby maximising the overall impact of the FOR-FREIGHT project.

2.3 Deliverable Overview and Report Structure

This section provides an outline of the deliverable's structure, detailing the respective chapters and summarising their content. More specifically:

Chapter 3 details the methodological approach used throughout T4.3, including the impact identification process, stakeholder mapping, engagement strategies, and the development of the impact maximisation plan.

Chapter 4 delves into how the FOR-FREIGHT solutions align with broader socio-economic and environmental contexts. It analyses the potential implications of these solutions, their alignment with broader societal actors, and their potential for socio-economic and environmental development. The chapter is built on the findings from desk research, analysis of previous deliverables, impact and outcome identification/mapping, and internal and external stakeholder engagement activities.

Chapter 5 lays out the preliminary plan for maximising the impact of the project's solutions, tailored to the specific needs and stakeholders of each UC derived in Chapter 4. After setting the framework for the impact maximisation plan, the chapter also delves deeper into each of the UCs, as well as risk assessment and mitigation details.

Chapter 6 outlines the strategies for measuring the impacts of the FOR-FREIGHT solutions and the mechanisms for continuous improvement.

Chapter 7 Provides closing thoughts on the deliverable's findings, summarising the anticipated impacts and future directions of the project.

Chapter 8 gives the References.

3 Methodology

The implementation of T4.3 "Socio-economic & environmental impact generation" in the FOR-FREIGHT project began with a meticulous preparation effort, initiated at the beginning of the task in a collaborative effort with the consortium partners. This foundational stage was anchored in a detailed, step-by-step plan, with specific timeframes assigned to each phase, as outlined in the implementation plan (Figure 3-2). This chapter aims to systematically illustrate the methodology of the processes conceptualised and/or already implemented in T4.3. The main process until the submission of D4.3 was broken down into the following steps:

1. Desk research:
    - literature research;
    - bibliometric research; project deliverables; mapping of expected outcomes (derived from the (KPIs) defined in D2.1 "FOR-FREIGHT multimodal transport solutions - Early (testing) drop" and reported in Table 4-2; and impact categories (based on EC's Work Programmes, including *Horizon Europe,* see Table 4-3)
2. Stakeholder mapping & impact categorisation.
3. Engagement of internal stakeholders (series of workshops occurring with the FOR-FREIGHT consortium).
4. Development of the initial impact maximisation plan.
5. Suggested future updates of the initial plan:
    - engagement of external stakeholders;
    - incorporation of project results.

The desk research involved extensive literature research to explore the impact landscape in T&L. Through bibliometric analysis using citation databases such as Web of Science[1], Scopus[2], and Google Scholar[3], key publications addressing current multimodal transportation trends were identified. A deeper analysis provided insights pertinent to the FOR-FREIGHT project. These insights were further augmented by integrating findings from the SoTA analysis in D1.1 "Report on current multimodal T&L practices & recommendations for improvement", submitted in M6, as well as strategic insights from the business plan in D4.2 "FOR-FREIGHT Business plan", submitted in M12. Additionally, the analysis incorporated outcomes and stakeholder information from D1.2 "FOR-FREIGHT multimodal transport Use Case definition" submitted in M9, by analysing the defined KPIs (see Table 4-2) and associated stakeholders under each UC. The purpose of the desk research phase was to:

- understand the network and business landscape of the multimodal transport agents;
- to analyse the unique selling points (USPs) of the FOR-FREIGHT solutions in comparison with both, the contemporary advancements in T&L, as well as with the solutions developed in other T&L projects;
- to identify the potential socio-economic and environmental impacts of the FOR-FREIGHT solutions.

Simultaneously and after the desk research phase, the team engaged in a thorough stakeholder mapping and impact categorisation process. Building on the insights from D1.2, and later on, D2.1, the methodology included exploring the landscape of the multimodal transport agents relevant to the expected FOR-FREIGHT outcomes, both in and outside of the FOR-FREIGHT consortium. The identified stakeholders are categorised according, firstly, to the categorisation approach for the T&L agents defined in the selected publications (Kayikci, 2018; Wang, 2019), and secondly, to the relevance regarding the FOR-FREIGHT solutions tested at each of the trial sites in Spain, Greece, and Romania. The output from this phase was a comprehensive spreadsheet (see Annex I, and Annex II) that categorised stakeholders and impact categories, setting the stage for targeted stakeholders' engagement.

The identification and categorisation of the potential socio-economic, and environmental impacts of FOR-FREIGHT solutions followed a similar approach. The potential outcomes of the FOR-FREIGHT solutions defined in

[1] https://www.webofscience.com
[2] https://www.scopus.com
[3] https://scholar.google.com

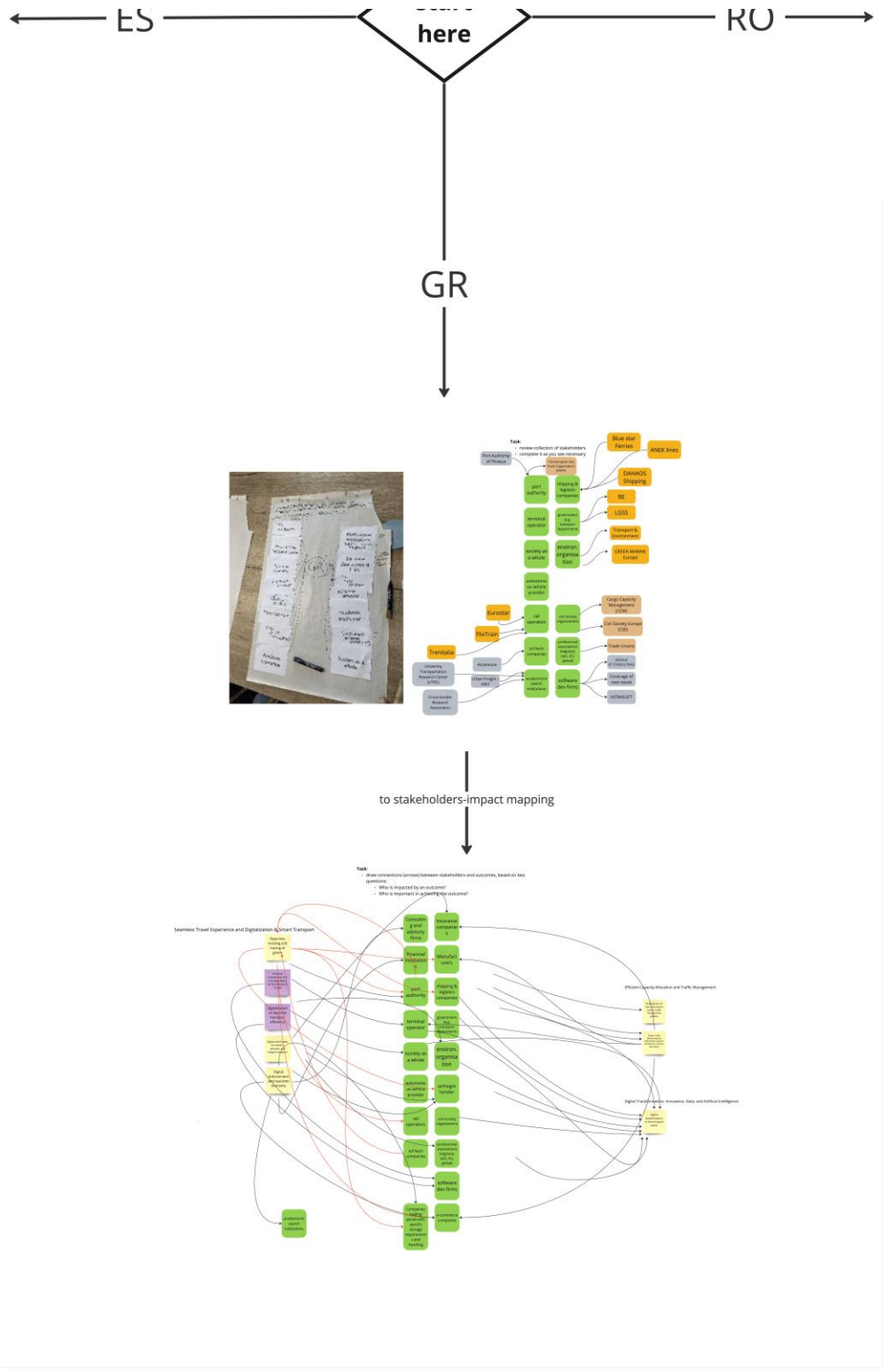
D1.2 constituted the basis for an overarching categorisation of the KPI categories under each UC. In the next step, Work Programmes of the European Commission (EC), including European Union (EU) Frame Work Programme Horizon Europe, have been analysed to identify some of the often-mentioned thematic clusters in the T&L-related calls, along with some of the completed projects (see Table 4-3 for more details about the analysis) which can be classified under socio-economic and environmental impact categories. The main goal of both categorisation processes was to associate specific outcomes in the project with overarching impact categories, and to identify which of the possible impacts of FOR-FREIGHT could be relevant/or appeal to the already mapped stakeholder categories. This integration was essential to gain a holistic understanding and to identify areas where FOR-FREIGHT innovations could generate significant impact, thereby differentiating the project's approach from existing practices in the field.

After the preliminary association between the project outcomes and the impact categories, as well as the stakeholder categorisation according to the research done in the previous steps in T4.3, the association process continued with a series of internal workshops with the WP4 consortium, designed to mobilise the knowledge curated in the desk research phase with the collaborative work of the consortium members. The task and the questions the internal workshops tried to tackle, as well as the individual methodologic process, were as follows:

1. **T4.3 Internal Workshop 1:**
    - **Main Task:** To validate, expand, and enrich the stakeholder categories:
        - **Subtask 1**: Which stakeholders do we impact directly on? *Reflect on the most relevant stakeholder groups*;
        - **Subtask 2**: Which stakeholders belong to wider groups? *Provide examples of stakeholders under the relevant categories.*
    - **Setting:** The workshop facilitated in-person collaboration, utilising pre-arranged flipcharts for process visualisation. Additionally, the results were dynamically illustrated and shared using the online whiteboard tool MiroBoard[4] interactively.
    - **Description**: The workshop was held at the General Assembly meeting in Antwerp, hosted by the project partner IMEC, at M13, and constituted a critical step in shaping the project's stakeholder engagement strategy. The activities focused on verifying and completing the identified impacts, mapping stakeholders to these impacts, and collating a comprehensive list of specific stakeholders. It commenced with an introduction to the workshop's goals, followed by a presentation summarising the work done in identifying potential impacts and relevant stakeholder groups, fostering a deeper understanding of the relationship between stakeholders and the project's impacts. The workshop culminated with a plenary session where groups presented their findings, providing a collective overview of the stakeholder-impact mappings, and setting the stage for future activities.
- **T4.3 Internal Workshop 2:**
    - **Main Task:** Connections between the FOR-FREIGHT Solutions and the most emphasised impact categories in EC's Work Programmes:
        - **Subtask 1**: Mark the most relevant socio-economic and environmental impact mentioned in the Work Programmes (see Table 4-3);
        - **Subtask 2**: Build connections between the respective impact categories and FOR-FREIGHT Solutions;
        - **Subtask 3 (Optional)**: Mark the impact categories irrelevant to the efforts in FOR-FREIGHT.
    - **Setting:** The workshop facilitated online collaboration using the online conference tool JitsiMeet[5]. The interactive online collaboration was done using the online tool MiroBoard[6].

[4] Miro | The Visual Workspace for Innovation
[5] JitsiMeet Conference Room: https://meet.jit.si
[6] The MiroBoard Canvas used for the internal workshops: https://miro.com/app/board/uXjVMuw4cEI=/

Figure 3-1: A visual capture of the GR_UC team's joint effort on the MiroBoard canvas during Workshop 2

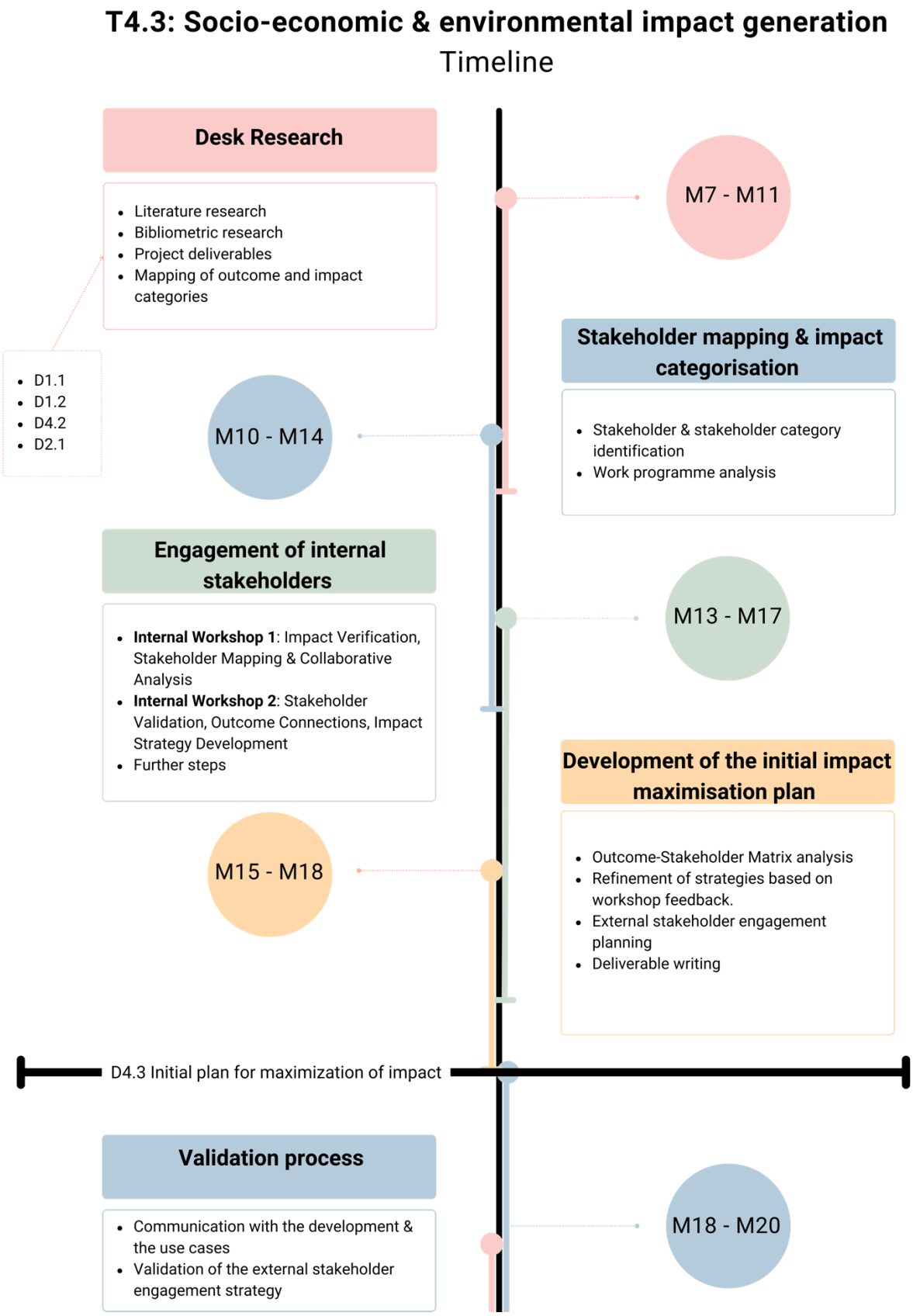


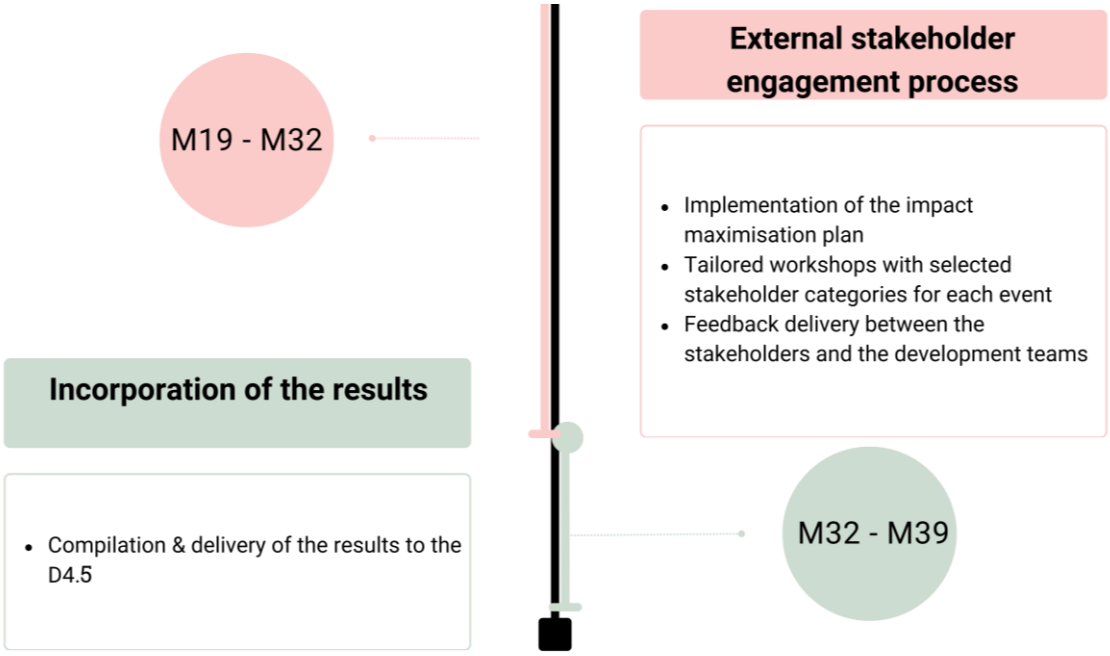
- **Description**: The workshop was conducted online in M15 and aimed to build upon the foundations laid in the first session. It started with a brief recap of the results from the first workshop, ensuring continuity in the engagement process. The workshop was divided into two main interactive sessions. In the first session, the participating project partners revisited the stakeholder groups identified previously, validating and adding new stakeholders. The second

session involved more intensive collaborative work using the online tool MiroBoard. Here, the focus was on drawing connections between the stakeholder groups and the highlighted strategic objectives in the previous session which were derived from EC's Work Programmes. Participants actively discussed and agreed on these mappings, leading to a preliminary version of the stakeholder outcome matrix. The workshop concluded with a plenary presentation of group results and a discussion on the next steps and writing assignments for the deliverable. This workshop was pivotal in advancing the project's understanding of the complex interplay between stakeholders and potential outcomes, leading to specific socioeconomic and environmental impacts, facilitating a more targeted and effective impact maximisation plan.

Upon concluding the two internal workshops aimed at validating and enriching the insights acquired during the desk research phase, the next phase outlined in the T4.3 implementation plan (see Figure 3-2 for a detailed illustration of the implementation plan) is to initiate the engagement process with external stakeholders. The formulation of this stakeholder engagement strategy (finalised in Section 5.5) is meticulously revised and refined based on the knowledge acquired from both, the desk research, and internal workshops. This includes the analysis of potential project outcomes, identified socio-economic and environmental impacts, categorised stakeholders, and the interconnections among these elements (see Chapter 4). Characterised by a series of planned workshops, the engagement phase aims to foreground pivotal activities surrounding impact identification and maximisation strategies. Chapter 5 in general displays an approach tailored to the nuances of different stakeholder categories and the distinct solutions within each UC. Feedback from the external stakeholder workshops will be systematically captured using a designated document template (see Section 6.3), and subsequently disseminated within the consortium for comprehensive analysis and action.

Figure 3-2: T4.3 Implementation Plan and Timeline




M19 - M32
External stakeholder engagement process
Implementation of the impact maximisation plan
Tailored workshops with selected stakeholder categories for each event
Feedback delivery between the stakeholders and the development teams
Incorporation of the results
Compilation & delivery of the results to the D4.5
M32 - M39

4 Project solutions and the Environment

The examination of the FOR-FREIGHT solutions, their ramifications in terms of socio-economic and environmental impacts as well as their relevance to diverse stakeholders, form the cornerstone of the activities in T4.3, encompassing both, analytical approaches, and collaborative efforts. This section delves into the collated results of T4.3, illustrating the fundamental information upon which the initial impact maximisation plan was constructed (see Chapter 5 for further details).

FOR-FREIGHT has started its journey with a comprehensive definition of the pathways to impact. A series of defined expected outcomes presents a structured overview of its aimed impact and meticulously defined KPIs. It not only enumerates the targeted improvements such as a significant reduction in transport times, external costs, and operational expenses, but also provides a rationale grounded in innovative logistics solutions. These solutions leverage advanced methodologies, such as direct metro station deliveries to circumvent city traffic and the utilization of blockchain for operational cost efficiencies, aiming for transformative changes in the multimodal T&L sector. Furthermore, this early classification elucidates the project's direction towards environmental sustainability and socio-economic benefits, underpinned by expert estimations and the application of EC guidelines on different aspects. Through this exploration, FOR-FREIGHT positions itself as a catalyst for sector-wide efficiency, resilience, and sustainability enhancements (see Table 4-1 for a detailed presentation of the medium-term and long-term expected outcomes[7]).

Table 4-1: Envisioned Medium-Term and Long-Term Impacts displayed in the Grant Agreement

Envisioned Expected Outcomes (EO), Envisioned Expected Impacts (EI)	Envisioned Expected Outcome KPIs (eoKPI), Envisioned Expected Impact KPIs (eiKPIs)	Baseline, benchmark, and target	Timeframe
EO1 More efficient, effective and sustainable management of goods and freight flows in (air)ports and inland terminals, taking into account all costs (economic, social and environmental) of the proposed solutions/innovations, including externalities and possible rebound effects**.**	1: Economic	• Improve existing capacity utilisation by 20%; • Increase by 20% the Truck load factor; • Increase by 20% the loading/unloading time in the terminals; • Improve by 10% the Train load factor; • Increase by 15% the efficiency of the storage area, and equivalently reduce the number of empty running wagons.	Medium-term
	2: Social	• Improved prediction of ETAs and delivery reliability (>15%);	

[7] The timeframes for anticipated outcomes and impacts are tentatively and broadly estimated, as outlined in the GA.

		• Reduction of errors, accidents and error-caused delays by 20-30%.	
	3: Energy consumption and Environmental	• Reduced Greenhouse Gas (GHG) emissions by15% due to more effective and sustainable management of goods and freight flows, and the use of public transport for last-mile delivery; • Improve energy consumption by 20% using flexible use of last-mile resources and routing optimisation; • Reduce by >20% the aggregate environmental footprint of the multimodal supply chain, via effective loading and reduced idle/waiting times.	
EO2 Expanded throughput of the nodes thanks to increased operational efficiency and optimised use of assets and infrastructures, without expanding the physical facilities.	4: Efficiency	• Improved coordination efficiency, measured through the reduction of the ITU Dwell time in port and airport terminals, by 25%; • Improve coordination efficiency, with an over 80% load factor for the shuttle services (# of loaded units per shuttle, max # of units per shuttle); • Improve collaboration efficiency, by raising the number of combined multi-modal transports by more than 10%; • Increased efficiency of the storage space by 15%; • Improved efficiency through increased accuracy of forecast planning by 15%; • Improved efficiency through the reduction of the customs clearance process time by 20%.	
EO3	5: Loading and storage Times	• 20% loading/unloading time reduction and 25% less transit storage time compared to the use of legacy systems/processes.	

Improved access to transhipment services at reduced costs.	6: Admin & OPEX Costs	• 20% increase of document digitalization; • 15% OPEX reduction due to the use of more efficient transport modes compared to the use of legacy systems/processes.	
EO4 More visible and standardised services provided within the multimodal freight transport nodes, seamlessly accessible by end users to maintain continuous door-to-door tracking of freight locations and boost shifting cargo to more efficient and sustainable transport modes.	7. Accessibility	• Single point of entry for T&L customers & end-users via the FOR-FREIGHT platform. Reduction of time to set up an end-to-end multimodal freight transport with multiple stakeholders by 25%; • Real-time, door-to-door cargo tracking & conditions monitoring 24/7.	
	8: Delivery Times	• Improve current on-time delivery ranges (from 30% - 70%) to top levels up to 85% and average by >20% compared to legacy systems and processes; • Reduction by 50% of the Trucks arriving at the terminal after cut-off time (10% of the Trucks) and reduction by 30% of Trucks' waiting time at the Terminals; • Reduction of delivery times in urban areas to 15%; • Reduction of the container idle time at the port and airport by >25%.	
EO5 Increased automation, digitalisation, standardisation and interoperability of processes, technologies and equipment, particularly intermodal transport units (ITUs) and cargo transport/transhipment procedures in multimodal freight transport nodes.	9: Throughput	• Increased end-to-end throughput due to optimization of combined resource utilization by 20%; • Increased throughput rates due to the reduction of ITU idle times by 25%; • Increased throughput due to reduction of the customs clearance time by 20%; • Increased throughput due to reduction of errors//mistakes by 20% thanks to increased digitalization and standardized, interoperable procedures.	

EO6 Better integration of the various freight transport nodes into overall logistic chains.	10: Technological Readiness Level (TRL)	• End-to-end integrated multimodal platform from TRL5 -> TRL7 by M28.	
EI1 Upgraded and resilient physical and digital infrastructure for clean, accessible, affordable, connected and automated multimodal mobility.	11: Clean mobility	• Reduction of GHG emissions by >25% due to more effective and sustainable management of goods and freight flows and/or thousands of containers per year taken off the road;	Long-term
	12: Connected and automated mobility	• >30% of T&L operational vehicles to be connected and automated in the EU; • 25% increase in offerings of integrated/combined T&L services by different stakeholders.	
EI2 Sustainable and smart long-haul, regional and urban freight transport and logistics, through increased efficiency, improved interconnectivity and smart enforcement. **EI3** Reduced external costs (e.g., congestion, traffic jams, emissions, air and noise pollution, road collisions) of urban, peri-urban (regional) and long-distance freight transport as well as optimised system-wide network efficiency and resilience.	13: Operational efficiency	• Improved operational efficiency by >30% through the optimized utilization of assets offered by the FOR-FREIGHT solution.	
	14: Supply chain optimisation	• Overall supply chain optimization by >50% based on the Decision Support System (DSS) and real-time information.	
EI4 Enhanced local and/or regional capacity for governance and innovation in urban mobility and logistics.	15: Connected logistics services	• >30% increase in connected logistics services by traditional and non-traditional logistics stakeholders (e.g., SMEs) with the use of heterogeneous multimodal data.	

The expected outcomes displayed in the GA of the project have been operationalised at the different stages of the project. The cycles of technical considerations, as well as the continuous reflection on the UC specific conditions, allowed the increasingly rigorous definition of the envisioned solutions, and the technical components to be implemented. These identified, and expanded envisioned outcomes at various stages of the project were again mapped to the initial outcome categories (see Table 4-1). In this sense, one of the important parts of the efforts made in T4.3 was the continuous analysis of the previous deliverables and ongoing efforts regarding the outcome definition, and categorisation under each UC.

The analysis of previous deliverables started with the aim to cultivate more information about the development regarding the envisioned impacts, and to categorise the expected outcomes under each of the UCs; i.e., Spanish (ES_UC), Greek (GR_UC), and Romanian (RO_UC). The analysis benefited from several efforts, either done or in development, by the delivery phase of the D4.3. Initially, D1.2, followed by D2.1, but also the still ongoing contributions to the KPIs under WP3, were essential components (see Table 4-2 for the analysis). Furthermore, another important source was the SWOT analysis done in T4.1 and captured in D4.2 (see Section 4.1). Finally, the course of the analysis was guided by specific questions previously identified in the implementation plan (see Figure 3-2).

Table 4-2: Categorisation of the FOR-FREIGHT Expected Outcomes

Outcome Category	Expected Outcomes (D1.2 KPIs)	Outcome Operationalisation (D2.1)	KPI_ID (T1.3)	Solution Components (D2.1)	Envisioned Medium-Term Expected Outcome (EO)	Envisioned Long-Term Expected Impact (EI)
Improved Efficiency/ Enhanced Decision-Making	Reduction of operational costs	Reduction by >12% on current operational cost	ES1/2_1	Digital Twin and DSS to forecast resource requirements.	EO3	EI1 EI2 EI3 EI4
				Digital Twin and DSS for the optimization/adjustment of resource allocation planning.		
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		

				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
		Reduction of operational costs by >12% on number of vehicles required for last-mile delivery	ES1/2_3	Predictive modelling/analytics to forecast parcel demand.	EO1 EO2 EO4	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
		Reduction by 10% on missed deliveries	ES1/2_2	Digitalisation and automation of processes.	EO1	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
	Improved forecast planning	(ES) Reduction by >15% on the current on-time delivery ranges	ES1/1_1	Digital Twin and DSS to forecast resources requirements.	EO1 EO4 EO5	
				Digital Twin and DSS for the optimization/adjustment of resource allocation planning.		
				Data analytics and predictive modelling/analyti		

				cs to forecast container arrivals and departures within port.		
		(ES) Reduction by >15% on errors and accidents	ES1/1_2	Digitalisation and automation of processes.	EO1	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
		(ES) Reduction by >15% on time to set-up an E2E multimodal freight transport with multiple stakeholders	ES1/1_3	Digital Twin DSS to forecast resources requirements.	EO2 EO4 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
		(ES) Reduction by >15% on the delivery lead time in inland transport	ES1/1_4	Digital Twin and DSS to forecast resources requirements.	EO4 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analyti		

				cs for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
		(GR) Platform which delivers end-to-end real-time view of the multimodal freight transport		Creation of an event-based storyline which monitors the containers movements within the T&L line.		
	Reduce container staying at the port	Reduction by >15% on trucks' waiting time at the terminals	ES1/1_5	Digital Twin and DSS to forecast resources requirements.	EO4	EI1 EI2 EI3 EI4
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within port.		
		Reduction by >15% on ITU/container dwell time in port	ES1/1_7	Digital Twin and DSS to forecast resources requirements.	EO2 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource		

				allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within port.		
		Reduction by >15% on loading time in the terminals	ES1/1_6	Digital Twin and DSS to forecast resources requirements.	EO1 EO3	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within port.		
	Document digitalisation	80% Document digitalisation	RO3_10	Digitalisation of information and procedures	EO3 EO5	
	Reduction of transport times from DHL warehouse to final destination	Increase average delivery loading per van by 10%	ES1/2_9	N/A	EO1 EO2	
		Reduction of average loading/unloading time per parcel by 10%	ES1/2_5	N/A	EO1 EO3	

		Reduction of missed deliveries by 10%	ES1/2_7	N/A	EO5	
		Reduction of average number of stops per route carried out by 1 vehicle (van) to deliver an average of 75 parcels by 10%	ES1/2_8	N/A	EO2	
		Reduction of transport times by >10% through average urban delivery times for the average number of units in one vehicle	ES1/2_6	Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.	EO4	
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
	Transport Orders digitalisation	Transport order digitalisation through Blockchain by 20%	ES1/1_9	Digitalisation and automation of processes.	EO3 EO5	
				Real cargo visibility and		

				monitoring along the T&L actors.		
				Collaboration and information sharing.		
Route Optimisation	Reduction of the customs clearance process time	Reduction by 20% of the customs clearance process time	GR2_4		EO2	
		Automated reservation of the air ticket		Utilisation of data analytics and predictive modelling to forecast container arrivals and departures within the T&L line.		
	Increased end-to-end capacity due to optimisation of resource utilisation, increased efficiency of the storage space	(RO) Increased end-to-end capacity by 20%	RO3_1	Digital Twin for T&L resources for ships, port and trains and environmental conditions among the T&L lines.	EO1 EO2 EO4	EI1 EI2 EI3 EI4
				Predictive modelling for container arrival time in port		
				Predictive modelling for container time in port		
				Predictive modelling for container arrival time from port to destination		
				Digitalisation of information and procedures		
				Suggestion for allocation of resources based on data analytics		

		(GR) Increased efficiency by 15% of storage space	GR2_6	Predictive analytics for the optimisation of resource allocation.	EO2	
				Advancing Warehouse Management System (WMS).		
		(GR) Increased by 20% of the End-to-end capacity due to optimisation of resource utilisation	GR2_5	Advanced WMS for the monitoring of cargo within the warehouse.	EO4	
				Predictive analytics for the optimisation of resource allocation.		
				Dynamic resource allocation.		
		DSS for resource utilisation optimisation		Predictive analytics for the optimisation of resource allocation.		
	Reduction of the container idle time at the port/airport	Reduction by 25% of container idle time at the port	GR2_1	Utilisation of data analytics and predictive modelling to forecast container arrivals, departures, and handling requirements.	EO2	
		Truck waiting time at the terminal	GR2_3	N/A	EO4	
		Reduction by 25% of container idle	GR2_2	Utilisation of data analytics and	EO2	

		time at the airport		predictive modelling to forecast container arrivals, departures, and handling requirements.		
				Predictive analytics for the optimisation of resource allocation.		
				Efficient slot booking.		
				Automated container handling.		
				Collaboration and information sharing.		
	Decrease loading/unloading time	Decrease loading/unloading time by 20%	RO3_2	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1 EO3	EI1 EI2 EI3 EI4
				Predictive modelling for container arrival time in port		
				Suggestion for allocation of resources based on data analytics		
	Reduction of (routing) errors	(RO) Reduction of routing errors by 20%	RO3_3	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1	
				Predictive modelling for		

				container arrival time in port		
				Predictive modelling for container time in port		
				Predictive modelling for container arrival time from port to destination		
				Digitalisation of information and procedures		
		(GR) Reduction of Errors by 20%	GR2_7, GR2_8	Process automation through the T&L line and unique bill of lading through the T&L line.	EO1 EO4 EO5	
				Automation of warehouse processes.		
	Reduction of accidents	Reduction of accidents by 30%	RO3_4	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1	EI1 EI2 EI3 EI4
				Suggestion for allocation of resources based on data analytics		
	Reduction of the container idle time	Reduction of container idle time by 20%	RO3_5 RO3_6	Digital Twin for T&L resources for ships, port and trains and environmental conditions among the T&L lines.	EO1 EO4 EO5 EO2 EO5	
				Predictive modelling for container time in port		
				Suggestion for allocation of		

				resources based on data analytics		
Greenhouse Gas **Emissions**	GHG emissions reduction	(ES) Reduction by >15% on GHG emissions	ES1/1_8	Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.	EO1	EI1 EI2 EI3 EI4
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
		(RO) Reduction of GHG emissions by 15%	RO3_7 RO3_8 RO3_9	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1	
				Suggestion for allocation of resources based on data analytics		
		(GR) DSS for the reduction of GHG emission		Predictive analytics for the reduction of GHG emission.		
Cost-related	Reduction of external costs, e.g.	Reduction of external costs by >80% in reducing GHG emissions	ES1/2_4	Digital Twin and DSS for the optimisation/adjustment of resource	EO1	EI1 EI2 EI3

	environmental & social cost			allocation planning.		EI4
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		

In the initial phase of the desk research process, bibliometric research was aimed at gathering insights into the socio-economic and environmental impacts highlighted in recent T&L literature, with a particular focus on multimodal transport. Bibliometric research illuminated current trends in multimodal transportation, underscoring the impact of FOR-FREIGHT solutions on efficiency and sustainability. These findings, together with analysis from previous deliverables, have shaped a stakeholder engagement strategy that is current and relevant.

The findings from the bibliometric analysis served several purposes. First, they provided an overview of current research trends in T&L, particularly those relevant to multimodal transport (see Sections 4.2 and 4.3 for relevant citations). This understanding was crucial for aligning the FOR-FREIGHT project with the latest academic literature about the multimodal transportation landscape (see Chapter 8). Second, the research helped identify potential impact categories (see Table 4-4 and Table 4-5 for more information), offering direction for further analysis of the potential ramifications of the solutions developed in the project. Finally, the collected data and insights were used to inform the stakeholder engagement process, ensuring that the collaboration is grounded in up-to-date and relevant content. Some of the directly relevant citations are also present in this deliverable to walk the reader through the socioeconomic and environmental impacts.

Another pillar of the preparation phase included the **impact identification** process, which constituted a crucial part of the preparation phase. The primary objective in defining the socioeconomic and environmental categories FOR-FREIGHT's envisioned outcomes might relate to, above all, examining the currently most emphasised topics related to T&L, especially the multimodal transportation landscape in the EU. Both current and past Work Programmes of the EC, alongside other analogous T&L projects, offered a valuable starting point in defining some thematic clusters and streamlining specific objectives the EC was envisioning from prospective projects to be funded. This analysis aimed to discern specific thematic clusters that prominently feature socio-economic and environmental impacts. To achieve this, a selection of Work Programmes (See Table 4-3) was meticulously analysed. These programs were selected based on their relevance to the project's goals, particularly in light of the specific emphasis each work program places on achieving socioeconomic and environmental impacts vital for a sustainable future within the EU. This relevance is further underscored by the parallel objectives and aspirations of the FOR-FREIGHT project, ensuring a synergistic approach towards shared goals.

Table 4-3: List of the analysed relevant EU Work Programmes

Work Programme	Reference Code
Sustainable and Smart Mobility Strategy: Putting European Transport on Track for the Future (2021)	**EU_Mobility2021**
Environmental Sustainability and Zero Pollution: Action plan zero pollution (2021)	**EU_HealthyPlanet2021**
Trans-European Transport Network (TEN-T): Creating a Green and Efficient Trans-European Transport Network (2021)	**EU_TENT2021**
Transition to Green Transport (2021)	**EU_GreenTrans2021**
Sustainable and Smart Mobility Strategy (2020)	**EU_MobilityStrategy2021**
DG MOVE Strategic Plan (2020-2024)	**EU_DGMOVE2024**
Horizon Europe Work Programme: WP 12 Missions (2023-2024)	**EU_Horizon2024**

The arguments sourced from the examined Work Programmes were reorganised into distinct socio-economic and environmental categories named thematic impact clusters (see Table 4-4 which displays the arguments as strategic objectives, and the overarching categories as the thematic impact clusters). This categorisation has aimed to establish a basis for building connections between the anticipated outcomes of the FOR-FREIGHT project and the often-emphasised impact areas in the mentioned Work Programmes above, which were meticulously addressed in the internal workshops. The following are the redefined impact categories, now aligned with socio-economic and environmental topics:

- **Seamless Travel Experience and Digitalisation & Smart Transport**: Focusing on enhancing the travel routes through technological innovations and smart transport solutions;
- **Efficient Capacity Allocation and Traffic Management**: Improving the efficiency of transport networks through better capacity allocation and traffic management;
- **Digital Transformation, Innovation, Data, and Artificial Intelligence (AI)**: Emphasising the role of digital transformation, Artificial Intelligence, and big data in advancing the T&L sector;
- **Sustainable Urban Mobility**: Prioritising the development of sustainable transport solutions in urban settings;
- **Safety and Resilience**: Ensuring the safety and resilience of transport systems;

- **Improving Our Health and Well-being, and of our planet**: Focused on the health implications of transport and its broader environmental impact;
- **Effective route planning**: Emphasising efficient routing to minimise environmental footprint;
- **Emissions Trading System (ETS) and Carbon print reduction**: Addressing the reduction of carbon emissions through ETS and other carbon footprint reduction strategies.

The information and responses garnered through this analytical process, as well as the desk analysis results also established the foundation for subsequent internal workshop sessions. These sessions, building upon the initial endeavors in stakeholder mapping and impact categorisation, harnessed the insights from the deliverable analysis. The aim was to guide the discussions in a more informed and focused manner, ensuring that every conversation was underpinned by data and comprehensive analysis. Sections 4.2 and 4.3 encapsulate the categorised outcomes, a direct result of this thorough analysis. It aligns the expected outcomes with the pertinent UCs. This alignment is not merely a listing, but a reflection of the meticulous work undertaken in understanding, categorising, and planning for the project's success.

4.1 Findings of the SWOT analysis

The SWOT analysis conducted for the FOR-FREIGHT UCs in D4.2 offers some preliminary insights into the project's alignment with its socio-economic and environmental impact objectives. While the efforts in T4.3 aim to identify the possible impacts of the project via the analysis of the previous deliverables and scientific literature, the SWOT analysis in D4.2 played an important role in the preparation for the collaborative efforts to validate the impact categories. The following information is specific to each UC and is based on the analysis in D4.2 (briefly presented in the following paragraphs).

In the case of ES_UC, integrated information and real-time data exchange significantly contribute to FOR-FREIGHT's digital transformation and smart transport goals. However, weaknesses such as reliance on multiple systems and implementation complexity underscore challenges in sustainable urban mobility. Opportunities in market demand for efficiency resonate with the project's efficient capacity allocation and traffic management objectives. Conversely, threats like competitor response and technological risks highlight the necessity for innovation and security, crucial for maintaining safety and resilience.

GR_UC's strengths in real-time tracking are in line with the project's focus on enhancing digitalisation and smart transport. Weaknesses in data security and privacy are pivotal for sustainable urban mobility. Opportunities for collaboration with stakeholders fortify FOR-FREIGHT's dedication to integrated, sustainable solutions. Threats from competitive landscapes and resistance to change underline the importance of adaptive strategies and stakeholder engagement.

Strengths of RO_UC in Internet of Things (IoT) solutions support especially the environmental goals of FOR-FREIGHT, particularly in reducing GHG emissions and optimising operations. Weaknesses such as adoption challenges and connectivity issues mirror the complexities in achieving sustainable port-rail mobility. Opportunities in smart mobility and EU standards alignment showcase the project's innovative approach to environmental sustainability. Threats related to technological risks and regulatory challenges stress the significance of compliance and collaboration.

Each UC's analysis intricately connects to the project's impact categories, underscoring the interplay between technological innovation, operational challenges, and the project's broader socio-economic and environmental goals.

The SWOT analysis across the ES_UC, GR_UC, and RO_UCs in logistics reveals a collective **strength** in integrating advanced technologies like AI, IoT, and blockchain for real-time tracking and efficient operations. However, they share **weaknesses** such as challenges in system integration, data security, and adoption by stakeholders. **Opportunities** are found in the rising demand for sustainable and efficient logistics solutions and the potential of technological advancements. The **threats** are similar across cases, including competitive market pressures,

technological risks, and the need to navigate evolving regulatory landscapes, emphasising the need for agile and adaptive strategies in the logistics sector.

Based on the SWOT analysis, each of the UCs focuses on the following aspects:

• The ES_UC focuses on the end-to-end supply chain process, using blockchain, AI/Machine Learning (ML), and Digital Twins to optimise resource utilisation, transport planning, and decision-making. The UC also utilises the existing subway network for last-mile delivery, reducing congestion, emissions, and costs. The main challenges are the integration of multiple management systems, implementation complexity, adoption challenges, and the potential risks related to data security, privacy, regulation, and technology.

• The GR_UC focuses on container tracking and monitoring, using sensor networks, ML algorithms, and automation to provide accurate information on cargo location, status, and conditions. The UC also streamlines the (un)loading, customs clearance, and transport processes, improving efficiency and coordination. The main challenges are legacy system compatibility, implementation complexity, data security, and privacy, and the potential risks related to competition, resistance to change, data governance, and technology.

• The RO_UC focuses on multimodal freight transport between Romania, involving road, rail, and port borders. The UC uses 5G and the Internet of Containers to enable real-time positioning, environmental monitoring, and optimisation of resources in the logistics chain. The UC also integrates disruptive technologies across various vertical domains, allowing for holistic and smart management of the port and efficient cross-domain connectivity. The main challenges are the adoption challenges, interference and connectivity issues, and the potential risks related to competition, technology, regulation, and stakeholder collaboration.

4.2 Socio-economic Impact Areas

The potential socio-economic impact of FOR-FREIGHT solutions is multifaceted and likely to address several important needs for a sustainable future for the multimodal T&L landscape. This section explores what the most emphasised socioeconomic impact categories are, how we approached the mapping of FOR-FREIGHT solutions to specific impact categories, and how the initiated collaborative work in the internal workshops benefited the impact identification, mapping, and the planning of impact maximisation in general.

The preliminary desk research in T4.3 yielded several important thematic areas in the T&L-related research areas. Digitalisation, before all, emerged as a transformative force within T&L, carrying extensive socio-economic implications. It facilitates a major shift towards improved efficiency and connectivity. The implementation of real-time tracking systems has transformed the supply chain by offering precise tracking of goods and substantially reducing risks associated with loss and delays. Digital certificates for drivers, vehicles, and cargo have streamlined regulatory compliance, cutting through bureaucratic red tape to expedite operations.

In parallel, the focus on digital enforcement within a real-time economy is enhancing the safety and regulation of transport operations. This, coupled with the commitment to research and innovation, is paving the way for cutting-edge technologies that promise to revolutionise transport management systems, optimise routes, and support environmental objectives. Interoperability across different transport modes is critical to this transformation, enabling a seamless intermodal network that bolsters supply chain flexibility and resilience. Furthermore, digitalisation in freight transport can have many different aspects. For example, introducing advanced technologies to aid workers and adopting automated systems for truck driving enhances freight transport safety but concurrently reduces opportunities for paid human employment (Levy, 2023). Crucially, the rapid pace of digitalisation demands a concurrent emphasis on the social dimension, ensuring that the transformation adequately addresses the needs of individuals and communities with a focus on intergenerational and class equity (Kayikci, 2018), otherwise, the transformation also carries the risk of creating a disadvantaged situation before all for workers as well as the society as a whole. Implemented considerately, the shift towards digital and alternative transport methods presents opportunities not only for reducing GHG

emissions, but also for creating safer working environments and minimising the risk of workplace accidents (Cowen, 2014).

Upon examining the latest research trends and the SotA analysis conducted in WP1, the focus of T4.3 shifted towards scrutinising the EC's recent Work Programmes. This examination aimed to consolidate the most frequently cited and significant arguments about the socio-economic impacts envisioned in recent years. This informed approach was instrumental in understanding the EC's strategic priorities and how they align with the FOR-FREIGHT project's objectives (see the introduction of Chapter 4 - the list of the analysed Work Programmes). Table 4-4 below displays the final results regarding the socioeconomic impact themes with the selected arguments from the given Work Programmes (some of the impact categories are also relevant to the environmental impact, and are mentioned in the following Section 4.3). Each theme is supported by carefully selected arguments extracted from the relevant Work Programmes of EC. These arguments reflect the consensus and recurring focal points that have shaped the EC's directives and initiatives, providing a coherent framework for the FOR-FREIGHT project to align its solutions with broader socio-economic objectives.

Table 4-4: Socioeconomic impact clusters from EC's recent Work Programmes & relevance association by the UCs[8]

Thematic Impact Cluster	Strategic Objective	Work Programme Reference[9]	Relevance UCs[10]	Associated EO	General EO	Associated EI
Seamless Travel Experience and Digitalisation & Smart Transport	Digitalisation to improve transport efficiency	EU_MobilityStrategy2021, EU_DGMOVE2024	ES, GR, RO	EO1 EO2 EO5	EO6	EI1 EI2 EI3 EI4
	Real-time tracking and tracing of goods	EU_Mobility2021	ES, GR, RO	EO1 EO2 EO5		
	Digital certificates for drivers, vehicles, and freight transport	EU_Mobility2021	GR	EO3 EO5		
	Enhance connectivity and interoperability across transport modes	EU_MobilityStrategy2021	ES, GR, RO	EO1 EO2 EO4 EO5		

[8] Strategic objectives and thematic impact clusters not designated as relevant in the analysis and collaborative workshops have been excluded from the table for clarity and focus.

[9] See Table 4-3 for reference.

[10] The relevance association is done at the internal workshop whereas three different groups formed according to their relevance to each UC (either partners involved in UCs, working close with the UC partners, or through regional association). Each team marked the impact categories most relevant to the FOR-FREIGHT solutions, in isolation from each other.

	Digital enforcement and real-time economy	EU_Mobility 2021, EU_Mobility Strategy2021	GR	EO5		
Efficient Capacity Allocation and Traffic Management	Development of train automation and air traffic management systems	EU_Mobility 2021	GR	EO1 EO2 EO5		
	Vessel Traffic Monitoring and Information Systems (VTMIS) for maritime operations	EU_Mobility 2021	GR	EO1 EO2 EO5		
Digital Transformation, Innovation, Data, and Artificial Intelligence	Digital transformation of the transport sector	EU_Mobility 2021	ES, GR, RO	EO5		
	Research and deployment of innovative and sustainable technologies in transport	EU_Mobility 2021	RO	EO1		
	Development and validation of new technologies and services	EU_Mobility 2021	RO	EO1 EO2 EO5		
	Implement intelligent systems and digital solutions for better connectivity	EU_Horizon 2024	RO	EO2 EO3 EO5		
	Emphasise the importance of research and innovation in driving Europe's competitiveness	EU_Horizon 2024	ES	EO1		

Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	EU_TENT2021, EU_Mobility 2021	ES	EO2 EO4 EO5		
	Shift towards shared and collaborative mobility services	EU_Mobility 2021		-		
	Focus on sustainable solutions to address societal challenges	EU_Horizon 2024	ES	EO1	EO6	
Safety and Resilience	Zero deaths across all modes of transport in the EU by 2050	EU_Horizon 2024, EU_Mobility 2021	-	-		
	Addressing cybersecurity threats	EU_Horizon 2024,	-	-		
Effective route planning	Increase use of rail, inland waterways, and short-sea shipping	EU_Mobility Strategy 2021, EU_Horizon 2024, EU_Mobility 2021	ES, RO	EO1 EO3 EO4	EO6	

After the identification of the thematic clusters of the prominent impact categories in the EC's recent Work Programmes, the next step in the analysis was to find connections between the envisioned outcomes of the FOR-FREIGHT solutions and the impact categories. After a preliminary mapping effort, the association effort has been initialised via the first part of the internal workshop within the consortium at the second General Assembly meeting of FOR-FREIGHT in Antwerp, Belgium. The workshop participants were grouped under the most relevant UC to them and were asked to work in isolation from each other (see Chapter 3 for workshop tasks).

In the initial internal workshop, participants engaged in a creative brainstorming session, followed by a validation phase, and culminated with presentations of their findings. As detailed in Table 4-4, the socio-economic impact category that garnered the most attention fell under "Seamless Travel Experience and Digitalisation & Smart

Transport". This thematic cluster, highlighted across various Work Programmes, aims to leverage digital technologies for socio-economic enhancement. Key areas such as "Enhancing transport efficiency through digitalisation", "Real-time tracking of goods", and "Enhancing connectivity and interoperability across transport modes" were underscored during the workshop discussions. The thematic cluster "Seamless Travel Experience and Digitalisation & Smart Transport" was also directly mapped to a couple of envisioned outcomes among the FOR-FREIGHT solutions in the collaborative workshop; especially the outcomes related to the "Reduction of the operational costs", and "Improved forecast planning", as well as, "Digitalisation of documents/transport orders" were seen as relevant to this specific thematic cluster, which is pertinent to the Spanish and Romanian UCs.

In a similar sense, the category "Digital Transformation, Innovation, Data, and Artificial Intelligence", which is more in line with in-depth data and ML-related solutions in the digital transformation of the T&L, was also emphasised often in its relevance with the FOR-FREIGHT solutions. Specifically, the subcategory "Digital transformation of the transport sector" was found to be highly relevant to the project's ambitions by all the participating groups. This association also includes the relevance to the expected outcomes like "Reduction of the customs clearance process time**, "**Increased end-to-end capacity due to optimisation of resource utilisation", "Increased efficiency of the storage space", and "Decreased loading/unloading times**"** implemented in Greek and Romanian UCs.

Furthermore, the thematic impact cluster "Efficient Capacity Allocation and Traffic Management" was another one highly relevant to the ambitious project outcomes. For instance, the outcome especially ambitioned in the Greek UC to "Reduce the container idle times at the port/airport" has been marked as highly relevant to the impact categories under this thematic cluster.

4.3 Environmental Impact Areas

The environmental dimension is increasingly critical in the multimodal T&L sector. FOR-FREIGHT's solutions are particularly significant in this context as they offer clear environmental benefits, aligning the project with broader ecological objectives and advancing the sector's commitment to environmental responsibility.

The emphasis on green and sustainable logistics is surging, reflecting a fifteenfold increase in related literature over a decade, signifying the sector's pivot towards environmental consciousness (Ren, 2019). The current discourse in environmental and transport sciences advocates for a collaborative, cross-disciplinary approach to tackle the multifaceted challenges of sustainability. This is evidenced by the growing body of research that not only scrutinises the environmental impacts of logistics but also explores synergistic relationships between economic activities and low-carbon initiatives by the mitigation options in freight transport to compensate the production loss through the increase of production activities in low carbon energy-intensive sectors (Boonpanya & Toshihiko, 2021). Carbon pricing emerges as a significant initiative aimed at reducing emissions conceptualised either as a tax or an emissions trading scheme. This mechanism has the potential to incentivise energy efficiency, particularly in shipping freight, aligning economic incentives with environmental goals. However, the journey towards decarbonising freight transport is fraught with complexity, owing to its systemic nature and the myriad of barriers that exist from testing to validation of new models. This complexity often impedes the acquisition of comprehensive data, which is essential for evaluating the entirety of environmental improvements (ibid).

Table 4-5: Environmental impact cluster from EC's recent Work Programmes

Thematic Impact Cluster	Strategic Objective	Work Programme Reference[11]	Relevance for UCs[12]	Associated EO	Associated EI
Improving Our Health and Well-being, and of our planet	Encourage the use of cleaner fuels and energy-efficient vehicles	EU_GreenTrans2021	RO	EO1	EO1 EO2 EO3
	Reduce air and noise emissions, greenhouse gas emissions from transport	EU_Horizon2024, EU_GreenTrans2021	RO	EO1	
	Promote sustainable transport solutions to address environmental challenges	EU_GreenTrans2021	ES, RO	EO1 EO2 EO4 EO5	

[11] See Table 4-3 for reference.

[12] The relevance association is done at the internal workshop whereas three different groups formed according to their relevance to each UC (either partners involved in UCs, working close to the UC partners, or through regional association). Each team marked the impact categories most relevant to the FOR-FREIGHT solutions in isolation from each other.

	Supporting zero pollution	EU_GreenTrans2021	RO	EO1	
	Strengthen Europe's commitment to sustainability and green solutions	EU_GreenTrans2021	ES	EO1	

The environmental dimension of FOR-FREIGHT not only prioritises the reduction of GHG emissions, pollution, and waste but also champions the principles of reuse and recycling. This holistic approach ensures that environmental considerations are woven into the fabric of every process, from route planning to operational execution (Kayikci, 2018). As the sector strides towards sustainability, the intersection of economic viability and environmental responsibility becomes increasingly critical, demanding innovative solutions and steadfast commitment to both present and future ecological imperatives. Table 4-5 details the environmental impact clusters as identified in the EC's recent Work Programmes, highlighting the strategic objectives relevant to FOR-FREIGHT. The thematic cluster of "Improving Our Health and Well-being, and of our planet" encapsulates several strategic objectives relevant to FOR-FREIGHT's environmental goals. Key objectives within this cluster include encouraging the use of cleaner fuels and energy-efficient vehicles, reducing air and noise emissions along with greenhouse gas emissions from transport, promoting sustainable transport solutions, supporting zero pollution efforts, and strengthening Europe's commitment to sustainability and green solutions.

As the workshop results, as well as the desk research both confirm, the strategic objectives, referenced from Work Programmes, closely align with the environmental goals of FOR-FREIGHT and represent the project's efforts towards enhancing the ecological sustainability of the T&L sector. In terms of relevance association, the RO_UC is closely associated with almost all strategic objectives within this cluster. This includes the encouragement of cleaner fuels and energy-efficient vehicles, reduction of emissions, and supporting zero pollution initiatives. These associations suggest that the RO_UC is heavily focused on integrating environmental sustainability into its operational framework. Similarly, the ES_UC shows a strong alignment with promoting sustainable transport solutions and strengthening Europe's commitment to sustainability and green solutions. In closing, the environmental aspect of FOR-FREIGHT solutions underscores the project's dedication to ecological sustainability. By aligning with EU directives and leveraging the latest advancements in environmental science, FOR-FREIGHT aims to foster a T&L sector that is not only efficient and robust but also harmonious with the environment, paving the way for a greener future.

4.4 Target Groups and Stakeholders

The identification and mapping of target groups and stakeholders are pivotal to the success of the FOR-FREIGHT project. However, this process did not start from scratch in T4.3, the stakeholder identification process has benefited from the deliverables under WP1, additionally from D4.2, and from the desk research done in T4.3, as well as, also from the first two internal workshops which have been instrumental in understanding the diverse needs and perspectives within the multimodal T&L sector. The mapping efforts have led to the identification of key stakeholders across various categories, including but not limited to T&L companies, regulatory bodies, technology providers, and end-users. This diverse stakeholder base reflects the multifaceted nature of the project, encompassing a wide range of interests and requirements (a detailed table including the stakeholders can be found under Annex I).

A crucial part of the stakeholder mapping process was the categorisation of the stakeholders. By comprehensively understanding the roles through their expectations and influence, the project aims to tailor its strategies and solutions to address specific needs effectively in the external stakeholder engagement process.

The identification of the categories to classify the identified stakeholders started with the help of the scientific literature, focusing on the different stakeholder types in T&L. More specifically, the publications focusing on stakeholder identification and mapping, that critically review stakeholder management literature applied to ports and port authorities (Dooms, 2019), as well as, the publications that re-explore the stakeholder landscape in the freight sector (Satta, Notteboom, Parola, & Lara, 2014) played a crucial role in this aspect. The list of categories curated from the scientific literature, as well as, from the previous deliverables validated and expanded throughout the internal workshops within the consortium. The main stakeholder categories after the identification and validation process are as follows:

- **Port Authority** – especially associated with objectives such as enhancing connectivity and interoperability across transport modes. This association is critical for achieving goals in digitalisation-related impact categories;
- **Terminal Operator** – relevant for each UC and key to realise multimodal transport and digital transformation;
- **Shipping & Logistics Companies** – highly relevant to all the ES, GR, and RO_UCs, they have a strong connection with the potential outcomes like real-time tracking and tracing of goods. This correlates with objectives like enhancing transport efficiency through digitalisation, particularly for the Spanish scenario;
- **Rail Operator** – extremely relevant to all the UCs, they are associated with strategic objectives in real-time tracking and enhancing connectivity, crucial for effective route planning and seamless multimodality;
- **Civil Society Organisations** – related to promoting sustainable transportation solutions and addressing societal challenges, contributing significantly to sustainable urban mobility;
- **Professional associations** (regional, national, EU, global) – play a role at least in the RO_UC in terms of outreach and the promotion of sustainable solutions;
- **Software Development Firm / IoT Tech Company** – particularly relevant to the digital transformation of the transport sector and connectivity enhancements, aligning with digital transformation and innovation objectives;
- **Academic/Research Institution** – plays a significant role in the objectives of the ES and RO_UCs, with a strong association with digital transformation and driving innovation. They align with strategic objectives such as the research and deployment of innovative technologies;
- **Government (Transport Department)** – associated with the development of seamless multimodal solutions and shared mobility services, in line with objectives in sustainable urban mobility and environmental sustainability;
- **Environmental Organisation** – especially emphasised in the RO_UC, environmental organisations are associated with advocating for sustainable transportation solutions and emission reductions, aligning with strategic objectives of promoting environmental sustainability and zero pollution initiatives;
- **Standardisation Bodies** – instrumental in enabling interoperability and realising the digital transformation.

The stakeholder mapping process not only facilitates better engagement and communication but also ensures that the project's outcomes are relevant and beneficial to all involved parties. In addition to the previously identified stakeholders (as a part of the preparatory phase), the additional stakeholders workshop participants added with the further categories introduced were also added to the identified stakeholders (see Annex II for a full list).

The initial phase of stakeholder mapping focused on categorisation. As a key objective of the impact maximisation process is to customise stakeholder engagement activities according to the relevance of each stakeholder group to FOR-FREIGHT's potential impacts, the subsequent phase involved collaboratively

establishing connections between identified impacts and stakeholder categories. To facilitate this, the second session of the internal workshop was dedicated to the following tasks:

- Review and expand the stakeholder categories;
- Draw connections between the strategic objectives (see Sections 4.2 and 4.3 for the strategic objectives derived from the EC's Work Programmes):
    - Who is impacted by each of the potential outcomes?
    - Who is important in achieving the potential outcomes?

The associations built through this collaborative effort, specifically the links between stakeholder categories, thematic impact clusters, strategic objectives extracted from the Work Programmes, and their relations to each of the UCs, are illustrated in Table 4-6.

Table 4-6: Stakeholder Category – Impact Association

Stakeholder Category	Thematic Cluster	Strategic Objective	Relevance for UCs
Port Authority	Seamless Travel Experience and Digitalisation & Smart Transport	Enhance connectivity and interoperability across transport modes	ES, RO
		Real-time tracking and tracing of goods	GR
		Digitalisation to improve transport efficiency	ES, RO
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
	Effective Route Planning	Increase the use of rail, inland waterways, and short-sea shipping	ES
	Improving Our Health and Well-being, and of our planet	Reduce air and noise emissions, greenhouse gas emissions from transport	RO
Shipping & Logistics Companies	Seamless Travel Experience and Digitalisation & Smart Transport	Enhance connectivity and interoperability across transport modes	ES
		Real-time tracking and tracing of goods	ES, GR, RO
		Digitalisation to improve transport efficiency	ES
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES

	Effective Route Planning	Increase the use of rail, inland waterways, and short-sea shipping	RO
	Digital Transformation, Innovation, Data, and Artificial Intelligence	Digital transformation of the transport sector	GR
Terminal Operator	Seamless Travel Experience and Digitalisation & Smart Transport	Enhance connectivity and interoperability across transport modes	ES, GR
		Real-time tracking and tracing of goods	ES, RO
		Digitalisation to improve transport efficiency	ES, GR
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
	Effective Route Planning	Increase the use of rail, inland waterways, and short-sea shipping	ES
	Efficient Capacity Allocation & Traffic Management	Vessel Traffic Monitoring and Information Systems (VTMIS) for maritime operations	GR
IoT Tech Company	Digital Transformation, Innovation, Data, and Artificial Intelligence	Digital transformation of the transport sector	ES
		Implement intelligent systems and digital solutions for better connectivity	RO
		Development and validation of new technologies and services	RO
	Seamless Travel Experience and Digitalisation & Smart Transport	Real-time tracking and tracing of goods	ES, GR, RO
		Digitalisation to improve transport efficiency	ES
Software Development Firms	Digital Transformation, Innovation, Data, and Artificial Intelligence	Digital transformation of the transport sector	ES, GR, RO
		Research and deployment of innovative and sustainable technologies in transport	RO

		Implement intelligent systems and digital solutions for better connectivity	RO
		Enhance connectivity and interoperability across transport modes	GR
	Seamless Travel Experience and Digitalisation & Smart Transport	Real-time tracking and tracing of goods	ES
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
Rail Operators	Seamless Travel Experience and Digitalisation & Smart Transport	Real-time tracking and tracing of goods	ES, GR, RO
		Enhance connectivity and interoperability across transport modes	ES
		Digitalisation to improve transport efficiency	ES
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
	Effective Route Planning	Increase the use of rail, inland waterways, and short-sea shipping	ES, RO
Civil society organisations & Society as a whole	Seamless Travel Experience and Digitalisation & Smart Transport	Enhance connectivity and interoperability across transport modes	ES
		Digitalisation to improve transport efficiency	GR
	Digital Transformation, Innovation, Data, and Artificial Intelligence	Emphasise the importance of research and innovation in driving Europe's competitiveness	ES

		Digital transformation of the transport sector	GR
	Sustainable Urban Mobility	Shift towards shared and collaborative mobility services	ES
		Focus on sustainable solutions to address societal challenges	ES
		Seamless multimodality enabled by digital solutions	ES
	Improving Our Health and Well-being, and of our planet	Promote sustainable transportation solutions to address environmental challenges	ES, RO
		Strengthen Europe's commitment to sustainability and green solutions	ES
		Encourage the use of cleaner fuels and energy-efficient vehicles	RO
		Supporting zero pollution	RO
Academic/ Research institutions	Digital Transformation, Innovation, Data, and Artificial Intelligence	Digital transformation of the transport sector	ES
		Emphasise the importance of research and innovation in driving Europe's competitiveness	ES
		Development and validation of new technologies and services	RO
		Research and deployment of innovative and sustainable technologies in transport	RO
	Sustainable Urban Mobility	Shift towards shared and collaborative mobility services	ES
		Focus on sustainable solutions to address societal challenges	ES

	Seamless Travel Experience and Digitalisation & Smart Transport	Digital enforcement and real-time economy	GR
Government (Transport Department)	Digital Transformation, Innovation, Data, and Artificial Intelligence	Emphasise the importance of research and innovation in driving Europe's competitiveness	ES
		Digital transformation of the transport sector	GR
	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
		Shift towards shared and collaborative mobility services	ES, RO
		Focus on sustainable solutions to address societal challenges	ES
	Improving Our Health and Well-being, and of our planet	Promote sustainable transportation solutions to address environmental challenges	ES, RO
		Strengthen Europe's commitment to sustainability and green solutions	ES
		Reduce air and noise emissions, greenhouse gas emissions from transport	RO
	Seamless Travel Experience and Digitalisation & Smart Transport	Enhance connectivity and interoperability across transport modes	RO
Environmental Organisation	Digital Transformation, Innovation, Data, and Artificial Intelligence	Emphasise the importance of research and innovation in driving Europe's competitiveness	ES
		Research and deployment of innovative and sustainable technologies in transport	RO

	Sustainable Urban Mobility	Seamless multimodality enabled by digital solutions	ES
		Focus on sustainable solutions to address societal challenges	ES
	Improving Our Health and Well-being, and of our planet	Promote sustainable transportation solutions to address environmental challenges	ES
		Strengthen Europe's commitment to sustainability and green solutions	ES
		Reduce air and noise emissions, greenhouse gas emissions from transport	RO
		Supporting zero pollution	
	Effective Route Planning	Increase the use of rail, inland waterways, and short-sea shipping	ES
Standardisation Bodies	Digital Transformation, Innovation, Data, and Artificial Intelligence	Emphasise the importance of research and innovation in driving Europe's competitiveness	ES
	Seamless Travel Experience and Digitalisation & Smart Transport	Real-time tracking and tracing of goods	ES
Professional Associations (regional, natl., EU, global)	Seamless Travel Experience and Digitalisation & Smart Transport	Digital certificates for drivers, vehicles, and freight transport	GR
		Real-time tracking and tracing of goods	RO
	Improving Our Health and Well-being, and of our planet	Promote sustainable transportation solutions to address environmental challenges	RO

The additional collaborative activities to the stakeholder mapping yielded insightful associations between stakeholder categories and possible impact categories. For instance, Port Authorities were predominantly associated with high relevance to enhancing connectivity and interoperability, as well as improving transport efficiency through digitalisation. This reflects their pivotal role in facilitating seamless transport experiences and smart transport solutions. Shipping & Logistics Companies, identified by workshop participants, are also

associated strongly with real-time tracking and tracing of goods, indicating their focus on operational efficiency and information transparency. Terminal Operators, similarly, were often linked to enhancing connectivity and interoperability, underlining their contribution to efficient and streamlined transport operations. Also, IoT Tech Companies were associated with the development and validation of new technologies, highlighting their influence in driving digital transformation within the sector. This connection points to their role in integrating innovative solutions across the T&L ecosystem. This collaborative effort during the second workshop revealed a deep understanding of how different stakeholders influence and are impacted by various aspects of the FOR-FREIGHT project. The exercise illuminated the importance of tailoring the project's solutions to meet the specific needs and contributions of each stakeholder category, ensuring that the project outcomes are relevant, effective, and widely adopted across the sector. While these main categories of the stakeholder groups and the associations built to the potentially relevant impact categories were substantial for further collaborative work, stakeholder categories and connections have been expanded under UC-specific collaborative efforts displayed in Sections 5.2, 5.3, 5.4.

4.5 Project results relevant for the impact maximisation

Leveraging the project results, FOR-FREIGHT aims to make a meaningful impact across various aspects of the T&L sector. The **introduction of DSS' is a key element**, promising **improved efficiency**, **resource optimisation**, and **automation**. This advancement is set to **enhance operations**, **ensuring quicker and more reliable transportation services** adhering to high safety protocols.

Warehouse companies stand to benefit by optimising resource allocation, leading to better inventory management and reduced operational costs. Route optimisation capabilities not only promise **reduced transit times** but also **significant cost savings**, making logistic operations more economically sustainable. Concurrently, **consulting and advisory groups** can elevate their services by providing **more informed recommendations**, **enhancing overall quality and service effectiveness** for their clients. The project's impact ambitions are aligned with the aforementioned stakeholder groups and include tailored benefits such as **resource optimisation**, **supply chain resilience**, and **strategic decision support** for consulting firms.

Financial institutions are expected to observe improved financial viability within their clientele in the logistics sector, while **insurance companies** can benefit from enhanced risk assessment practices. The overarching focus on **reducing GHG emissions** aligns with global environmental objectives, promoting a greener and more sustainable transportation ecosystem benefiting society as a whole. **Port authorities** can experience streamlined operations and improved resource utilisation, enhancing overall port efficiency. **Rail operators** stand to benefit from **optimised routes and resource allocation**, leading to increased **operational efficiency and cost savings**. **Logistics and transportation providers**, categorised as cargo/transport companies, **third-party logistics providers**, **shipping companies**, and **freight forwarders**, collectively, can anticipate **improved operational efficiency**, **reduced costs**, and thus, a **more sustainable business model**, aligning with impact ambitions for "Seamless Travel Experience" and "Digitalisation & Smart Transport".

Commercial entities, including e-commerce companies, retailers, companies trading goods with specific requirements of storage and handling, manufacturers, and other stakeholders, can expect **enhanced supply chain performance**, **reduced transit times**, and **improved cost-effectiveness**. Overall, these outcomes collectively contribute to the overarching impact ambitions of achieving "Seamless Travel Experience", and "Digitalisation & Smart Transport" across the entire supply chain ecosystem.

Companies such as IoT tech companies can leverage project outcomes to enhance their technologies by incorporating innovative solutions for **real-time monitoring**, **data analytics**, and communication within the transportation and logistics domain. The integration of these advancements can lead to the development of **more robust and efficient IoT solutions,** tailored to the specific needs of the industry. Software firms stand to benefit from the project's results by incorporating **advanced decision support systems** and **analytics tools** into their software solutions. This **integration can empower logistics software providers** to offer more

comprehensive and intelligent platforms, catering to the evolving requirements of transportation and logistics companies. The enhanced capabilities can contribute to the overall digital transformation of the industry.

Academic institutions can leverage the project results for educational and research purposes. The outcomes provide valuable insights into the practical application of IoT, decision support systems, and data analytics in real-world logistics scenarios. This can serve as a foundation for academic research, case studies, and the development of educational programs focused on the intersection of technology and logistics.

In addition, innovative cost-reduction strategies are poised to strengthen the financial viability of logistics operations, generating positive outcomes for service providers, end-users, and society at large. **Improvements in warehouse resource allocation** are expected to translate into **better inventory management**, **reduced lead times**, and an **overall enhancement in supply chain performance**.

By directly addressing critical challenges such as transportation costs and handling efficiency, FOR-FREIGHT's outcomes have the potential to reshape the industry landscape, fostering economic growth, sustainability, and operational efficiency in the T&L sector.

As a final note, as the implementation plan of the solvers and platform takes shape and becomes more concrete, tangible advancements will be observed in several envisioned impact areas. This ongoing commitment to impact-related considerations reflects the dedication to not only meeting but surpassing envisioned impacts. In this approach, the FOR-FREIGHT'S outcomes align seamlessly with broader objectives, promoting sustainability, efficiency, and innovation in the T&L domain.

5 Initial Plan for Impact Maximisation

This section presents a preliminary plan for maximising the impact of the FOR-FREIGHT project. It bases its approach on the developed solutions, the detailed mapping and categorisation of stakeholders, and the methodical mapping of impacts. Thus, the plan outlines the timing of various activities and describes the process for their subsequent refinement and adaptation to changing circumstances or findings.

5.1 Framework for Impact Maximisation

An overarching framework is proposed to guide the impact maximisation efforts. This framework, structured around the WHO (stakeholders), WHAT (project solutions and impacts), HOW (strategies and key activities), and WHEN (timeline) as outlined in the methodology chapter, will serve as a template for tailoring use-case-specific plans. Each plan will adapt this framework to suit individual needs, interests, objectives, and stakeholders, whereas the success of the impact maximisation is built upon the key stakeholder groups, tailored activities according to stakeholder characteristics, forming a flexible impact maximisation strategy in the end (see Figure 5-1).

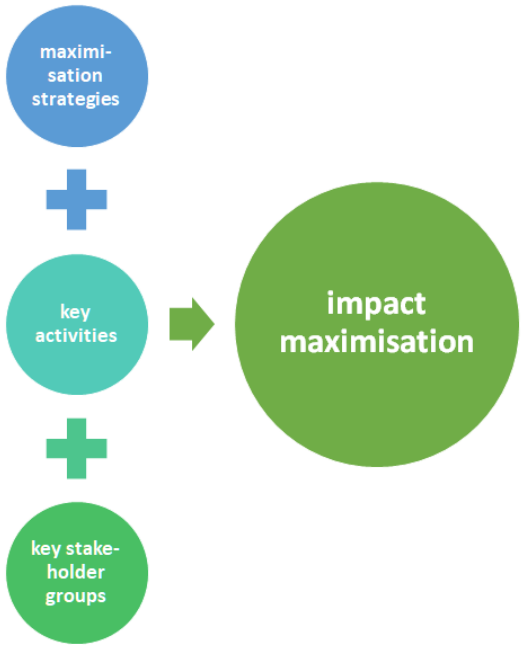


Figure 5-1: An overview of the essential components leading to impact maximisation

Furthermore, in the dynamic landscape of transportation and logistics, the FOR-FREIGHT project recognises the importance of adaptability and resilience in achieving impact maximisation. As such, our framework is designed not only to guide planned activities but also to anticipate and respond to unforeseen challenges and opportunities that may arise during the project's lifecycle. To ensure this flexibility, the framework incorporates a continuous feedback loop mechanism, allowing for the real-time integration of lessons learned, stakeholder insights, and emerging trends in the sector.

5.1.1 Stakeholders

The framework foresees the identification and involvement of a diverse range of stakeholders who are integral to the multimodal T&L landscape, as previously detailed in Section 4.4. By understanding the specific roles, expectations, and influence of each stakeholder group, from Port Authorities to IoT Tech Companies,

engagement, and other key activities can be precisely tailored to address and maximise the potential impacts of FOR-FREIGHT solutions.

The stakeholders who are integral to the FOR-FREIGHT project comprise a broad spectrum of the multimodal T&L landscape, each with distinct engagement roles and degrees of relevance to project outcomes. Table 4-6 briefly describes this relevance and helps guide each UC in defining its key stakeholders. These stakeholders have been identified through a comprehensive stakeholder mapping process, combining insights from multiple sources, as well as collaborative efforts in internal workshops. The methodology has integrated feedback from internal workshops, which played a significant role in the stakeholder categorisation process, ensuring that each group's relevance is determined about FOR-FREIGHT's potential impacts. The goal here is for each UC to review the results produced and complete their stakeholder mapping by adding details to existing entries, and new stakeholders, if necessary. For this purpose, a spreadsheet (see Annex II) has been created that provides further information needed in future engagements with those stakeholders. The idea is for each UC to work in that spreadsheet to:

- Map stakeholder categories to different impact groups by implicating which category is needed to achieve a specific impact, and which category is most likely to be affected by a specific impact;
- Choose or define a key activity to associate with stakeholder categories and specific impacts, as well as with individual tasks or WPs that should be carrying out the activity.

All of the presented categories and previously established connections between different categories have been made available for the UCs on the spreadsheets, while also allowing them to introduce their categories. UC leaders have been instructed to present their results, also under their sections in this deliverable (see Sections 5.2, 5.3, 5.4).

5.1.2 Project Solutions and Their Impacts

The KPIs identified for each UC in D1.2 and advanced in D2.1, as well as with the efforts under WP3, have been instrumental in defining the expected outcomes of the FOR-FREIGHT project. The task (T4.3) underlying this deliverable focused on categorising these KPIs based on their innovative aspects to facilitate the alignment with relevant socio-economic and environmental impact categories. This categorisation was informed by thematic impact clusters extracted from the EC's Work Programmes, which provided a framework to correlate the project's solutions with potential impacts.

Additionally, the internal workshops conducted in the context of T4.3 played a crucial role in examining the relationships between specific stakeholder categories and the identified socio-economic and environmental impacts. These workshops helped in determining which stakeholder groups are most likely to be influenced by or have an influence on these impact categories.

The outcomes of these internal workshops are now forming the foundation for the external stakeholder workshops. These external sessions are designed to engage with identified stakeholders, utilising the insights gathered in T4.3. The objective is to ensure that the project's initiatives are closely aligned with both the stakeholders' interests and the overarching socio-economic and environmental goals of the FOR-FREIGHT project.

Another important piece of information, next to the outcomes and impacts that are relevant for each UC, is the solution components connected to expected outcomes. Those are related to certain impacts and stakeholder groups, as Table 4-2 shows. Therefore, the components serve as further guidance to the UC partners when determining their activities with selected stakeholders in mind, and when determining **how** to bring out the desired outcomes – which is the most prominent factor in the next section of the framework.

5.1.3 Strategies and Key Activities

To maximise the project's impact, the following framework covers the key strategies presented in the Table below.

Table 5-1: Key strategies to maximise the project's impact

Category	Key strategy
Overall	Collaborative approach: Foster partnerships and collaborations across a range of stakeholders to leverage diverse expertise and resources.
Technology	Digitalisation and technology adoption: integrate the latest technologies and innovative practices to boost digitalisation.
	Data-driven decision-making: Utilise data analytics to inform decision-making processes, ensuring efficiency and effectiveness.
	Scalability and flexibility: design solutions that are scalable and flexible to allow tailoring and future expansion.
Policy	Policy alignment and advocacy: Align with current policies and advocate for policy changes that support the project's goals.
Stakeholders	Awareness and communication: maintain consistent and transparent communication to build awareness in the sector's ecosystem and shore up interest and support.
	Stakeholder engagement: actively involve all relevant stakeholders to ensure that real needs are met and that project solutions are accepted.
Monitoring	Continuous monitoring: regular progress monitoring to evaluate the impact, refine the approach, and demonstrate value.

To implement these strategies and work towards the maximisation of the project's impact, the following key activities are foreseen.

Key activities:

- Develop the FOR-FREIGHT platform and solutions:
  - user-friendly, efficient, interoperable, scalable, etc.;
  - involved project activities: WP2/WP3/WP1.
- Pilot-test and collect feedback:
  - conduct pilot tests via UCs and gather feedback for continuous improvement;
  - involved project activities: T3.5.
- Organise stakeholder workshops and interactions:
  - engage with stakeholders regularly to gather input and foster collaboration;
  - involved project activities: T4.3, T5.3, T5.1.
- Train and build capacity:
  - provide training to both internal teams and external potential users for effective adoption of the platform;

    - involved project activities: T5.3.
- Comply with standardisation efforts:
    - adhere to chosen standards and contribute towards the adoption of new standards;
    - involved project activities: T5.2, and cross-WP activities (led by TIC4.0).
- Create sustainability:
    - regularly gather data and evaluate outcomes;
    - involved project activities: T4.3 (ongoing).
- Outreach campaigns:
    - create awareness and interest in the project through targeted communication efforts;
    - involved project activities: T5.1.

These key activities connect the WHO and the WHAT, i.e., the stakeholders on the one hand, and the project solutions and envisioned impacts on the other. Each UC will elaborate in the sections below, starting with ES_UC in Section 5.2, on each of these key activities – for many of those, the UCs can relate to ongoing efforts and results of other WPs and tasks; the UCs are then asked to illustrate how a key activity can boost the effectiveness of ongoing efforts, to ensure that the right stakeholders are involved and that the envisioned outcomes can be reached.

5.1.4 Implementation Timeline

Finally, the timing of the key activities is crucial to ensure a sensible sequence of interactions with the stakeholders, both internal and external. The overall goal is to align with the technical development and the availability of project results. Interdependencies also exist with other plans, e.g., regarding training and clustering (T5.3), or the dissemination and communication (T5.1).

5.2 ES_UC: Solutions, Impact Strategies and Goals

The ES_UC exemplifies a strategic blend of innovative aspects with various socioeconomic and environmental impact implications by integrating advanced technologies like Digital Twins, AI/ML, and blockchain to elevate operational efficiency, cost-effectiveness, and environmental sustainability. This section illuminates the ES_UC's multifaceted approach, underpinned by robust stakeholder engagement across the spectrum from Port Authorities to IoT Tech Companies, aimed at aligning project solutions with both, stakeholder interests, and broad socio-economic and environmental objectives. Building on the previous results under T4.3 ES_UC is defining a tailored approach to building an initial impact maximisation plan.

5.2.1 Stakeholders involved in the impact maximisation effort

The stakeholders identified within the ES_UC play a key role in shaping and influencing the T&L sector from maritime to last-mile delivery. The diverse range of stakeholder categories reflects the complexity of the T&L landscape and underlines the importance of working with different entities to ensure the success of the FOR-FREIGHT project. These categories include academic/research institutions, serving as sources of expertise and knowledge dissemination; civil society organisations and society at large, representing the broader public interest and societal impacts; environmental organisations, highlighting the project's commitment to sustainability; government (Department of Transport), a key regulator shaping transport policy; IoT tech companies, providing cutting-edge technology solutions that the ES_UC requires; Port Authorities, crucial for maritime logistics; Professional associations at regional, national, EU, and global level, promoting cooperation and industry standards; Railway operators, contributing to the multimodal aspect; Shipping & Logistics companies, the backbone of freight movement; Software Development Companies, essential for the creation of technological solutions; Standardisation Bodies, ensuring compatibility and compliance with industry standards; and Terminal operators, vital components in the logistics chain. This comprehensive stakeholder engagement strategy ensures that the ES_UC addresses diverse interests, fosters collaboration, and maximises its socio-economic and environmental impact through a diverse group of stakeholders that responds to the needs of FOR-FREIGHT. The Table below captures the relevance of each of these stakeholder groups.

Table 5-2: Impacts and relevant stakeholder groups of the ES_UC

Stakeholder groups needed to achieve impacts	Impacts	Stakeholder groups affected by impacts
Academic/ Research institutions	**Digital transformation of the transport sector**	Academic/ Research institutions
Companies trading goods with specific storage requirements		Companies trading goods with specific storage requirements
IoT Tech Company		IoT Tech Company
		Port Authority
		Rail Operators
		Shipping & Logistics Companies
Software Development Firms		Software Development Firms
		Terminal Operator

Academic/ Research institutions	**Emphasise the importance of research and innovation in driving Europe's competitiveness**	
Civil society organisations & Society as a whole		Civil society organisations & Society as a whole
Environmental Organisation		Environmental Organisation
		Government (Transport Department)
		Standardisation Bodies
	Enhance connectivity and interoperability across transport modes	Civil society organisations & Society as a whole
Companies trading goods with specific storage requirements		Companies trading goods with specific storage requirements
Government (Transport Department)		
IoT Tech Company		
Port Authority		Port Authority
		Rail Operators
Shipping & Logistics Companies		Shipping & Logistics Companies
		Terminal Operator
Academic/ Research institutions	**Focus on sustainable solutions to address societal challenges**	
Civil society organisations & Society as a whole		Civil society organisations & Society as a whole

Environmental Organisation		Environmental Organisation
Government (Transport Department)		Government (Transport Department)
	Increase use of rail, inland waterways, and short-sea shipping	Civil society organisations & Society as a whole
		Environmental Organisation
Government (Transport Department)		
Port Authority		Port Authority
Rail Operators		Rail Operators
Shipping & Logistics Companies		
Terminal Operator		Terminal Operator
	Promote sustainable transport solutions to address environmental challenges	Civil society organisations & Society as a whole
Environmental Organisation		Environmental Organisation
Government (Transport Department)		Government (Transport Department)
Companies trading goods with specific storage requirements	**Real-time tracking and tracing of goods**	Companies trading goods with specific storage requirements
IoT Tech Company		
Rail Operators		Rail Operators
Shipping & Logistics Companies		Shipping & Logistics Companies
Software Development Firms		
Standardisation Bodies		

Terminal Operator		Terminal Operator
	Seamless multimodality enabled by digital solutions	Civil society organisations & Society as a whole
		Environmental Organisation
		Government (Transport Department)
		Port Authority
		Rail Operators
		Shipping & Logistics Companies
Software Development Firms		
		Terminal Operator
Academic/ Research institutions	**Shift towards shared and collaborative mobility services**	
		Civil society organisations & Society as a whole
Government (Transport Department)		Government (Transport Department)
Shipping & Logistics Companies		
	Strengthen Europe's commitment to sustainability and green solutions	Civil society organisations & Society as a whole
Environmental Organisation		Environmental Organisation
Government (Transport Department)		

5.2.2 Impacts and project solutions

The FOR-FREIGHT project's innovative solutions, strategically aligned with socio-economic and environmental goals, offer a range of impactful outcomes within the ES_UC. These solutions, based on the identified KPIs and their thematic impact clusters, are closely tied to the impact and influencing relationships analysed in internal workshops.

The integration with the FOR-FREIGHT platform ensures seamless connectivity between various stakeholders, fostering collaborative decision-making. The resource forecasting, planning optimisation, and parcel demand projection solutions at Metro de Madrid (MDM) lockers significantly contribute to cost reduction strategies. Predictive modelling and analytics solutions are leveraged by the ES_UC to enhance forecast planning, providing stakeholders with real-time insights into resource requirements, and also ensuring optimal operational efficiency. The use of solutions using advanced technologies, such as Digital Twins and AI/ ML, minimise routing errors, enhancing decision-making accuracy. Cargo visibility features contribute to a safer transport environment, reducing accidents. The connection to solvers, particularly those focusing on resource allocation planning, fortifies this improvement. Solutions intended to reduce the stay of the containers at the port and minimise the transport time from the different branches of the ES_UC, improve the operational and temporal processes of the port, and the delivery of goods from the DHL warehouse to the last mile. In addition, GHG emission reduction solutions foster sustainability and result in a noteworthy reduction in external costs, encompassing both environmental and social impacts, and strengthening Europe's commitment to sustainable transport solutions to address environmental challenges.

The FOR-FREIGHT platform, utilising blockchain technology, eradicates information silos, digitises workflows, and improves connectivity and interoperability across various transport modes. It supports seamless multimodality by digitising documentation and streamlining processes, creating a unified space that connects disparate partners for real-time data exchange and eliminates fragmented communication, thereby enhancing the efficiency and safety of freight transport. The connectivity between the ES_UC and the FOR-FREIGHT platform, alongside the strategic use of solvers, ensures a holistic and synergistic approach to achieving the defined impacts. This collaborative effort has the potential to revolutionise the T&L industry, fostering efficiency, sustainability, and innovation (for a detailed breakdown of the expected outcomes relevant to the ES_UC, see Table 5-3).

Table 5-3: Outcomes and solution components relevant to the ES_UC

Outcome Category	Expected Outcomes (D1.2 KPIs)	Outcome Operationalisation (D2.1)	KPI_ID (T1.3)	Solution Components (D2.1)	Envisioned Medium-Term Expected Outcome (EO)	Envisioned Long-Term Expected Impact (EI)
Improved Efficiency/ Enhanced Decision-Making	Reduction of operational costs	Reduction by >12% on current operational cost	ES1/2_1	Digital Twin and DSS to forecast resource requirements.	EO3	EI1 EI2 EI3 EI4
				Digital Twin and DSS for the optimization/adjustme		

				nt of resource allocation planning.		
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
		Reduction of operational costs by >12% on number of vehicles required for last-mile delivery	ES1/2_3	Predictive modelling/analytics to forecast parcel demand.	EO1 EO2 EO4	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
		Reduction by 10% on missed deliveries	ES1/2_2	Digitalisation and automation of processes.	EO1	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
	Improved forecast planning	(ES) Reduction by >15% on the current on-time delivery ranges	ES1/1_1	Digital Twin and DSS to forecast resource requirements.	EO1 EO4 EO5	
				Digital Twin and DSS for the optimization/adjustme		

				nt of resource allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within the port.		
		(ES) Reduction by >15% on errors and accidents	ES1/1_2	Digitalisation and automation of processes.	EO1	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
		(ES) Reduction by >15% on time to set up an E2E multimodal freight transport with multiple stakeholders	ES1/1_3	Digital Twin DSS to forecast resource requirements.	EO2 EO4 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
		(ES) Reduction by >15% on the delivery lead time in inland transport	ES1/1_4	Digital Twin and DSS to forecast resource requirements.	EO4 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		

				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
	Reduce container staying at the port	Reduction by >15% on trucks' waiting time at the terminals	ES1/1_5	Digital Twin and DSS to forecast resource requirements.	EO4	EI1 EI2 EI3 EI4
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within the port.		
		Reduction by >15% on ITU/container dwell time in port	ES1/1_7	Digital Twin and DSS to forecast resource requirements.	EO2 EO5	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		
				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within the port.		
		Reduction by >15% on loading time in the terminals	ES1/1_6	Digital Twin and DSS to forecast resource requirements.	EO1 EO3	
				Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.		

				Data analytics and predictive modelling/analytics to forecast container arrivals and departures within the port.		
	Reduction of transport times from DHL warehouse to final destination	Increase average delivery loading per van by 10%	ES1/2_9		EO1 EO2	
		Reduction of average loading/unloading time per parcel by 10%	ES1/2_5		EO1 EO3	
		Reduction of missed deliveries by 10%	ES1/2_7		EO5	
		Reduction of the average number of stops per route carried out by 1 vehicle (van) to deliver an average of 75 parcels by 10%	ES1/2_8		EO2	
		Reduction of transport times by >10% through average urban delivery times for the average number of units in one vehicle	ES1/2_6	Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.	EO4	
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		

				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
	Transport Orders digitalisation	Transport order digitalisation through Blockchain by 20%	ES1/1_9	Digitalisation and automation of processes.	EO3 EO5	
				Real cargo visibility and monitoring along the T&L actors.		
				Collaboration and information sharing.		
				Collaboration and information sharing.		
GHG Emissions	GHG emissions reduction	(ES) Reduction by >15% on GHG emissions	ES1/1_8	Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.	EO1	EI1 EI2 EI3 EI4
				Predictive modelling/analytics for the reduction of costs (from A to B).		
				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		
Cost-related	Reduction of external costs, e.g., environmental & social cost	Reduction of external costs by >80% in reducing GHG emissions	ES1/2_4	Digital Twin and DSS for the optimisation/adjustment of resource allocation planning.	EO1	EI1 EI2 EI3 EI4
				Predictive modelling/analytics for the reduction of costs (from A to B).		

				Predictive modelling/analytics for the reduction of time (from A to B).		
				Predictive modelling/analytics for the reduction of GHG emissions (from A to B).		

5.2.3 Activities contributing to impact maximisation

Recognising the diverse interests and roles of stakeholders is integral to tailoring impactful strategies for the ES_UC within the complex realm of transportation and logistics. FOR-FREIGHT adopts an inclusive approach, designing strategies and activities attuned to the unique needs of each stakeholder category. Stakeholder groups in the ES_UC, such as academic/research institutions, civil society organisations, government (Transport Department), IoT Tech Companies, Port Authorities, Rail Operators, Shipping & Logistics Companies, Software Development Firms, and Standardisation Bodies constitute distinct clusters with specific characteristics and expectations. The strategic design involves organising targeted stakeholder workshops, tailored to the relevance and interconnectedness of these groups. Some of the actions would be the realisation of webinars to address their logistic challenges and needs and expose the target audience to the value-added of the project and its outcomes, present lessons learned, highlight best practices, and identify the potential for improvement, and co-design future application trajectories extracted from the ES_UC. These workshops and webinars that aim to present the FOR-FREIGHT platform to the participants are demonstrating tangible impacts on their domains. To enhance outreach, engagement, and awareness, prelude activities include strategic social media campaigns, active participation in relevant exhibitions, and impactful news releases to promote the project's innovations.

Compliance with standardisation efforts, particularly adhering to the TIC4.0 standard for information representation in the ES_UC will be crucial. This ensures interoperability and contributes to the adoption of new standards. Regular data gathering and outcome evaluation will facilitate continuous monitoring, enabling the project to refine its approach and demonstrate the value of applying common standards to the different stakeholders of the ES_UC. These activities collectively contribute to a comprehensive strategy ensuring that the ES_UC maximises its impact by aligning with stakeholder needs, policy frameworks, and technological advancements.

Table 5-4 captures a first attempt at outlining activities that connect stakeholders to impacts relevant to this UC, and the project overall. The goal is to expand on these activities, step by step in future updates, to ensure that all relevant stakeholders are involved either in contributing to achieving an envisioned impact or because they might be affected by or be interested in benefitting from the project's activities and impacts.

Table 5-4: Mapping of stakeholder categories to envisioned activities and their potential impacts in ES_UC

Stakeholder	Activity	Impact
Software Development Firms	Organise a joint event to demonstrate the capability of the FOR-FREIGHT platform	Digital transformation of the transport sector
		Real-time tracking and tracing of goods
Shipping & Logistics Companies		
Software Development Firms		

Shipping & Logistics Companies		Seamless multimodality enabled by digital solutions
		Enhance connectivity and interoperability across transport modes
		Digitalisation to improve transport efficiency
		Shift towards shared and collaborative mobility services
		Increase use of rail, inland waterways, and short-sea shipping
Terminal Operator	The webinar will address logistic challenges and how new technologies/solutions have been used to improve processes, operations, and efficiency in the ES_UC (topics: a short introduction of FOR-FREIGHT and added value of the project, ES_UC Business impact, FOR-FREIGHT solutions).	Enhance connectivity and interoperability across transport modes
Port Authority		
Rail Operators		
Terminal Operator		Real-time tracking and tracing of goods
Rail Operators		
Standardisation Bodies		
Terminal Operator		Digitalisation to improve transport efficiency
Port Authority		
Rail Operators		
Terminal Operator		Seamless multimodality enabled by digital solutions
Port Authority		
Rail Operators		
Terminal Operator		Increase use of rail, inland waterways, and short-sea shipping
Rail Operators		
Port Authority		
Academic/ Research institutions		Digital transformation of the transport sector
Academic/ Research institutions		Emphasise the importance of research and innovation in driving Europe's competitiveness
Standardisation Bodies		
Academic/ Research institutions		Shift towards shared and collaborative mobility services
Academic/ Research institutions		Focus on sustainable solutions to address societal challenges
Companies trading goods with specific storage requirements	Refining the FOR-FREIGHT platform based on feedback and needs of stakeholders and end-users	Enhance connectivity and interoperability across transport modes
Port Authority		
Rail Operators		
Shipping & Logistics Companies		
Terminal Operator		
Companies trading goods with specific storage requirements		Real-time tracking and tracing of goods
Rail Operators		

Shipping & Logistics Companies		
Standardisation Bodies		
Terminal Operator		
Companies trading goods with specific storage requirements		Digitalisation to improve transport efficiency
Shipping & Logistics Companies		
Port Authority		
Rail Operators		
Terminal Operator		
Port Authority		Seamless multimodality enabled by digital solutions
Rail Operators		
Shipping & Logistics Companies		
Terminal Operator		
Port Authority		Increase use of rail, inland waterways, and short-sea shipping
Terminal Operator		
Rail Operators		
Shipping & Logistics Companies		
Shipping & Logistics Companies		Shift towards shared and collaborative mobility services
Standardisation Bodies		Emphasise the importance of research and innovation in driving Europe's competitiveness
Companies trading goods with specific storage requirements	Prepare material to document and educate stakeholders on the use of the platform/solutions	Enhance connectivity and interoperability across transport modes
Port Authority		
Rail Operators		
Shipping & Logistics Companies		
Terminal Operator		
Companies trading goods with specific storage requirements		Real-time tracking and tracing of goods
Rail Operators		
Shipping & Logistics Companies		
Terminal Operator		
Companies trading goods with specific storage requirements		Digitalisation to improve transport efficiency
Rail Operators		
Shipping & Logistics Companies		
Port Authority		
Terminal Operator		
Academic/ Research institutions		
Port Authority		Seamless multimodality enabled by digital solutions
Rail Operators		

Terminal Operator		
Shipping & Logistics Companies		
Port Authority		Increase use of rail, inland waterways, and short-sea shipping
Rail Operators		
Shipping & Logistics Companies		
Terminal Operator		
Shipping & Logistics Companies		Shift towards shared and collaborative mobility services
Academic/ Research institutions		Emphasise the importance of research and innovation in driving Europe's competitiveness
		Focus on sustainable solutions to address societal challenges

5.2.4 Implementation Timeline

To ensure a phased and impactful implementation of the ES_UC, key milestones are strategically mapped out in a timeline, aligning them with the different solution drops presented by the project. ByM21, the blockchain-based platform will be prepared to facilitate information sharing among stakeholders. The next drop of solutions, which includes solvers that improve predictive capabilities, demand forecasting for MDM packages, and optimisation of cargo stay at the port, among other functionalities supported by the FOR-FREIGHT platform, is scheduled for release in M21. To effectively engage stakeholders, a webinar dedicated to the ES_UC is planned for M36, where value-added premises of the UC and its outcomes will be presented, as well as the lessons learned, highlighting best practices, identifying potential for improvement, and co-design future application trajectories extracted from the ES_UC. The timeline aims to implement initiatives gradually and comprehensively, allowing stakeholders to participate and benefit from each stage of the project.

5.3 GR_UC: Solutions, Impact Strategies and Goals

The GR_UC showcases a comprehensive strategy that includes innovative solutions with impactful socio-economic and environmental goals, leveraging SotA technologies. This section highlights the GR_UC's holistic contribution to the stakeholder engagement plan with the inclusion of a broad stakeholder spectrum including examples like shipping companies, e-commerce platforms, and governmental bodies. The efforts are directed to synchronise project outcomes relevant to the GR_UC with the wide-ranging interests and objectives of these stakeholders. Building upon the foundational work conducted in T4.3, the GR_UC is sculpting an impact maximisation plan, designed to cater to the unique challenges and opportunities within UC's setting.

5.3.1 Stakeholders involved in the impact maximisation effort

The stakeholders identified within the GR_UC represent a diverse spectrum of entities crucial to the T&L sector. These key categories encompass a wide range of participants, including cargo and transport companies responsible for the efficient movement of goods, third-party logistics providers offering outsourced services, e-commerce businesses reliant on streamlined logistics, and shipping companies facilitating international trade. Retailers, companies dealing in goods with specific handling requirements, warehouse facilities, consulting groups, insurance providers, financial institutions, freight forwarders, manufacturers, government bodies, NGOs, and environmental organisations constitute vital contributors to this interconnected ecosystem. Table 5-5 captures the relevance of each of these stakeholder groups.

Table 5-5: Impacts and relevant stakeholder groups of the GR_UC

<table>
<tr><th>Stakeholder groups needed to achieve impacts</th><th>Impacts</th><th>Stakeholder groups affected by impacts</th></tr>
<tr><td rowspan="3"></td><td>Credit risk assessment</td><td>Financial institutions</td></tr>
<tr><td>Digital certificates for drivers, vehicles, and freight transport</td><td>Professional Associations (regional, natl., EU, global)</td></tr>
<tr><td>Digital enforcement and real-time economy</td><td>Academic/ Research institutions</td></tr>
<tr><td>Shipping & Logistics Companies</td><td rowspan="5">Digital transformation of the transport sector</td><td rowspan="2"></td></tr>
<tr><td>Terminal Operator</td></tr>
<tr><td></td><td>Software Development Firms</td></tr>
<tr><td>Government (Transport Department)</td><td rowspan="2"></td></tr>
<tr><td>Environmental Organisation</td></tr>
</table>

	Digitalisation to improve transport efficiency	Civil society organisations & Society as a whole
		Environmental Organisation
	Enhance connectivity and interoperability across transport modes	Terminal Operator
		Software Development Firms
	Provision of strategic decisions to the clients	Consulting and advisory firms
	Provision of tailored insurance policies	Insurance companies
Port Authority	**Real-time tracking and tracing of goods**	Port Authority
		Shipping & Logistics Companies
IoT Tech Company		
		Rail Operators
	Vessel Traffic Monitoring and Information Systems (VTMIS) for maritime operations	Terminal Operator

5.3.2 Impacts and project solutions

The solutions put forth by FOR-FREIGHT offer substantial benefits to the aforementioned stakeholders. These encompass the reduction of idle times and streamlining customs clearance processes, minimising errors while simultaneously optimising storage space, and enhancing overall capacity. The implementation of DSS ensures optimal resource utilisation, while efficient slot booking and automated container handling contribute to seamless operations. Further advantages include process automation throughout the T&L line and the introduction of a unique bill of lading system. Predictive analytics are leveraged for resource allocation optimisation, and warehouse processes are automated to boost efficiency. The platform also focuses on reducing GHG emissions through DSS, automating air ticket reservations, and providing an end-to-end real-time view of

multimodal freight transport. These solutions collectively address diverse needs across the T&L spectrum, fostering efficiency, sustainability, and innovation within the industry.

Table 5-6: Outcomes and solution components relevant to the GR_UC

Outcome Category	Expected Outcomes (D1.2 KPIs)	Outcome Operationalisation (D2.1)	KPI_ID (T1.3)	Solution Components (D2.1)	Envisioned Medium-Term Expected Outcome (EO)	Envisioned Long-Term Expected Impact (EI)
Improved Efficiency/ Enhanced Decision-Making	Improved forecast planning	(GR) Platform which delivers end-to-end real-time view of the multimodal freight transport		Creation of an event-based storyline that monitors the containers movements within the T&L line.	N/A	N/A
Route Optimisation	Reduction of the customs clearance process time	Reduction by 20% of the customs clearance process time	GR2_4		EO2	
		Automated reservation of the air ticket		Utilisation of data analytics and predictive modelling to forecast container arrivals and departures within the T&L line.		
	Increased end-to-end capacity due to optimisation of resource utilisation, increased efficiency of the storage space	(GR) Increased efficiency by 15% of storage space	GR2_6	Predictive analytics for the optimisation of resource allocation.	EO2	
				Advancing WMS.		
		(GR) Increased by 20% of the End-to-end	GR2_5	Advanced WMS for the monitoring of	EO4	

		capacity due to optimisation of resource utilisation		cargo within the warehouse.		
				Predictive analytics for the optimisation of resource allocation.		
				Dynamic resource allocation.		
		DSS for resource utilisation optimisation		Predictive analytics for the optimisation of resource allocation.		
	Reduction of the container idle time at the port/airport	Reduction by 25% of container idle time at the port	GR2_1	Utilisation of data analytics and predictive modelling to forecast container arrivals, departures, and handling requirements.	EO2	
		Truck waiting time at the terminal	GR2_3		EO4	
		Reduction by 25% of container idle time at the airport	GR2_2	Utilisation of data analytics and predictive modelling to forecast container arrivals, departures, and handling requirements.	EO2	
				Predictive analytics for the optimisation of		

				resource allocation.		
				Efficient slot booking.		
				Automated container handling.		
				Collaboration and information sharing.		
	Reduction of (routing) errors	(GR) Reduction of Errors by 20%	GR2_7, GR2_8	Process automation through the T&L line and unique bill of lading through the T&L line.	EO1 EO4 EO5	
				Automation of warehouse processes.		
GHG Emissions	GHG emissions reduction	(GR) DSS for the reduction of GHG emission		Predictive analytics for the reduction of GHG emission.		

5.3.3 Activities contributing to impact maximisation

Recognising the distinctive roles and interests of each stakeholder category is paramount in formulating comprehensive strategies to effectively tackle the nuanced challenges within the T&L sector. FOR-FREIGHT adopts an inclusive approach to amplify the impact of its solutions, focusing on tailored strategies and activities that align with the diverse needs of stakeholders. For instance, stakeholders such as cargo/transport companies, third-party logistics providers, shipping companies, and freight forwarders, collectively identified as **logistics and transportation providers**, share common backgrounds and anticipate similar impacts on their businesses. A parallel categorisation approach extends to other stakeholder groups, encompassing **commercial entities** like e-commerce companies, retailers, companies trading goods with specific storage and handling requirements, manufacturers, and **service providers and advisors** such as warehouse companies, consulting, and advisory groups, insurance companies, financial institutions, etc. Another cluster involves **regulatory bodies and environmental organisations**, including government agencies, NGOs, and sustainability organisations. This categorisation allows the design of four distinct workshops based on relevance and interconnectedness among these groups. These workshops are thoughtfully crafted to provide participants with immersive training on the FOR-FREIGHT platform, demonstrating tangible impacts on their business operations. To expand outreach and engagement, a prelude to the workshops involves strategic campaigns across social media platforms, active participation in exhibitions relevant to stakeholders, and the dissemination of impactful news releases. This

proactive approach ensures widespread awareness, participation, and understanding of the platform's benefits within the stakeholder community.

The Table 5-7 captures a first attempt at outlining activities that connect stakeholders to impacts relevant to this UC and the project overall. The goal is to expand on these activities, step by step in future updates, to ensure that all relevant stakeholders are involved either in contributing to achieving an envisioned impact, or because they might be affected by or be interested in benefitting from the project's activities and impacts.

Table 5-7: Mapping of stakeholder categories to envisioned activities and their potential impacts in GR_UC

Stakeholder	Activity	Impact
Shipping & Logistics Companies	Organise a joint event to demonstrate the capability of the FOR-FREIGHT platform	Real-time tracking and tracing of goods
IoT Tech Company		
Shipping & Logistics Companies		Digital transformation of the transport sector
Software Development Firms		
Government (Transport Department)		
Environmental Organisation		
Software Development Firms		Enhance connectivity and interoperability across transport modes
Financial institutions		Credit risk assessment
Insurance companies		Provision of tailored insurance policies
Consulting and advisory firms		Provision of strategic decisions to the clients
Civil society organisations & Society as a whole		Digitalisation to improve transport efficiency
Environmental Organisation		
Shipping & Logistics Companies	Introduction of the platform to the selected participants and monitoring of the performance during the pilot site	Real-time tracking and tracing of goods
		Digital transformation of the transport sector
Shipping & Logistics Companies	Refining the FOR-FREIGHT platform based on the specific needs and feedback from stakeholders associated with infrastructure operators	Real-time tracking and tracing of goods
		Digital transformation of the transport sector
Shipping & Logistics Companies	Development of stakeholder-centric training material to engage them in the FOR-FREIGHT platform	Real-time tracking and tracing of goods
IoT Tech Company		
Shipping & Logistics Companies		Digital transformation of the transport sector
Software Development Firms		
Government (Transport Department)		
Environmental Organisation		
Software Development Firms		Enhance connectivity and interoperability across transport modes

Financial institutions		Credit risk assessment
Insurance companies		Provision of tailored insurance policies
Consulting and advisory firms		Provision of strategic decisions to the clients
Civil society organisations & Society as a whole		Digitalisation to improve transport efficiency
Environmental Organisation		
Shipping & Logistics Companies	Development of effective campaigns tailored to the needs of specific stakeholder groups	Real-time tracking and tracing of goods
IoT Tech Company		
Shipping & Logistics Companies		Digital transformation of the transport sector
Government (Transport Department)		
Environmental Organisation		
Software Development Firms		
Software Development Firms		Enhance connectivity and interoperability across transport modes
Financial institutions		Credit risk assessment
Insurance companies		Provision of tailored insurance policies
Consulting and advisory firms		Provision of strategic decisions to the clients
Civil society organisations & Society as a whole		Digitalisation to improve transport efficiency
Environmental Organisation		
Freight Forwarders	Organise a joint event to demonstrate the capability of the FOR-FREIGHT platform	
Cargo/Transport companies		
Third-party logistics providers		
Airfreight handlers		
Companies trading goods with specific storage requirements and handling		
e-Commerce Companies		
Manufacturers		
Warehouse companies		
NGOs		
Freight Forwarders	Introduction of the platform to the selected participants and monitoring of the performance during the pilot site	
Cargo/Transport companies		
Third-party logistics providers		
Freight Forwarders	Refining the FOR-FREIGHT platform based on the specific needs and feedback from stakeholders associated with infrastructure operators	
Cargo/Transport companies		
Third-party logistics providers		
Airfreight handlers		

Freight Forwarders	Development of stakeholder-centric training material to engage them in the FOR-FREIGHT platform	
Cargo/Transport companies		
Third-party logistics providers		
Airfreight handlers		
Companies trading goods with specific storage requirements and handling		
e-Commerce Companies		
Manufacturers		
Warehouse companies		
NGOs		
Cargo/Transport companies	Development of effective campaigns tailored to the needs of specific stakeholder groups	
Third-party logistics providers		
Airfreight handlers		
Companies trading goods with specific storage requirements and handling		
e-Commerce Companies		
Manufacturers		
Warehouse companies		
NGOs		

5.3.4 Implementation Timeline

Considering the evolution of the solutions over time, the projected timeline outlines the initiation of the Strategic campaign in M21. Subsequently, the plan envisions the organisation of the four workshops, scheduled consecutively, with one workshop conducted per week, starting at the beginning of M25 until the end of the same month. This timeline is strategically designed to ensure a comprehensive and well-paced implementation of key initiatives, allowing stakeholders to engage progressively and derive maximum benefit from each phase of the project.

5.4 RO_UC: Solutions, Impact Strategies, and Goals

The RO_UC exemplifies a targeted approach towards enhancing the T&L sector by implementing FOR-FREIGHT solutions from the Danube River ports to the railways. This section is dedicated to the potential impacts RO_UC's strategic deployment of advanced technologies aims to create. For instance, RO_UC's contributions to the collaborative stakeholder engagement include the presentation of the impacts like reducing emissions and optimising the T&L chain efficiency. Stakeholders, including state institutions, academic entities, civil society, and technology companies, play critical roles in achieving the project's socio-economic and environmental objectives related to RO_UC. The section details the identification of stakeholders, the impact of project solutions on operational efficiency, and activities designed for impact maximisation. Through the foundational work in T4.3, the RO_UC is supporting an impact maximisation plan to address specific challenges and leverage opportunities, underscoring the project's commitment to innovation, efficiency, and sustainability.

5.4.1 Stakeholders involved in the impact maximisation effort

The stakeholders identified within the RO_UC play a defining role in the formation and transformation of the T&L sector, from the river ports of the Danube, via the railway infrastructure, to the end user. The number and profile of stakeholders reflect the complexity of the T&L chain and underline the importance of cooperation between different entities to ensure the success of the FOR-FREIGHT project. These categories include state institutions, such as the Ministry of Transport and the Ministry of the Environment (Romania), the first representing a regulatory shaping transport policy, and the second representing a supervisory entity. Next are academic/research institutions, which serve as sources of expertise and knowledge dissemination represented by Danubius University, CERONAV, and ANCONAV. Civil society organisations and the broader community, represented by the Tehnopol Association and House of Danube, underscore the public and societal interest, supporting the project's goals for societal impact. Environmental groups, such as the Green Solutions Cluster, back the project's dedication to sustainability. Furthermore, the involvement of IoT technology firms like BEIA Consulting, alongside the IT&C Cluster for software development, highlights the demand for modern technological solutions by the RO_UC, illustrating a collaborative push across diverse sectors. The port authorities, crucial for maritime logistics, are regulated by the Administration of Danube Maritime Ports. Railway operators, GFR, CFR Freight, and DB Cargo, contribute to the multimodal function of Regional and national professional associations that promote cooperation and industrial standards, such as the Romanian River Transport Cluster. River transport companies and associations that ensure the movement of goods: Inland Shipping, Association of Shipowners and Port - River Operators from Romania (AAOPFR), Custom Broker. Also, Terminal Operators including Metaltrade SRL. The involvement of all stakeholders in the FOR-FREIGHT project creates a collaborative environment for the RO_UC, ensuring a positive socio-economic and environmental impact. The Table below captures the relevance of each of these stakeholder groups.

Table 5-8: Impacts and relevant stakeholder groups of the RO_UC

<table>
<tr><th>Stakeholder groups needed to achieve impacts</th><th>Impacts</th><th>Stakeholder groups affected by impacts</th></tr>
<tr><td>IoT Tech Company</td><td rowspan="2">Development and validation of new technologies and services</td><td rowspan="2"></td></tr>
<tr><td>Academic/Research institutions</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Digital transformation of the transport sector</td><td>Software Development Firms</td></tr>
<tr><td>Port Authority</td><td>Port Authority</td></tr>
</table>

Civil society organisations & Society as a whole	**Encourage the use of cleaner fuels and energy-efficient vehicles**	
Port Authority	**Enhance connectivity and interoperability across transport modes**	Port Authority
Government (Transport Department)		
IoT Tech Company	**Implement intelligent systems and digital solutions for better connectivity**	
		Software Development Firms
Shipping & Logistics Companies	**Increase use of rail, inland waterways, and short-sea shipping**	
Rail Operators		
Civil society organisations & Society as a whole	**Promote sustainable transport solutions to address environmental challenges**	
Government (Transport Department)		
Professional Associations (regional, natl., EU, global)		Professional Associations (regional, natl., EU, global)
Shipping & Logistics Companies	**Real-time tracking and tracing of goods**	
Terminal Operator		
IoT Tech Company		
Rail Operators		
Professional Associations (regional, natl., EU, global)		Professional Associations (regional, natl., EU, global)

	Reduce air and noise emissions, greenhouse gas emissions from transport	Port Authority
Government (Transport Department)		
Environmental Organisation		Environmental Organisation
	Research and deployment of innovative and sustainable technologies in transport	Software Development Firms
Academic/ Research institutions		
Environmental Organisation		Environmental Organisation
Government (Transport Department)	**Shift towards shared and collaborative mobility services**	
Civil society organisations & Society as a whole	**Supporting zero pollution**	

5.4.2 Impacts and project solutions

The FOR-FREIGHT project aims at modernising T&L operations in the Danube port of Galati, to optimise and streamline the transport of goods, increasing transport capacities, and reducing waiting times, as well as CO2 emissions. Table 5-9 displays a detailed mapping of the potential outcomes relevant to the RO_UC.

Table 5-9: Outcomes and solution components relevant to the RO_UC

Outcome Category	Expected Outcomes (D1.2 KPIs)	Outcome Operationalisation (D2.1)	KPI_ID (T1.3)	Solution Components (D2.1)	Envisioned Medium-Term Expected Outcome (EO)	Envisioned Long-Term Expected Impact (EI)
Improved Efficiency/ Enhanced Decision-Making	Document digitalisation	80% Document digitalisation	RO3_10	Digitalisation of information and procedures	EO3 EO5	

Route Optimisation	Increased end-to-end capacity due to optimisation of resource utilisation, increased efficiency of the storage space	(RO) Increased end-to-end capacity by 20%	RO3_1	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1 EO2 EO4	EI1 EI2 EI3 EI4
				Predictive modeling for container arrival time in port		
				Predictive modelling for container time in port		
				Predictive modelling for container arrival time from port to destination		
				Digitalisation of information and procedures		
				Suggestion for allocation of resources based on data analytics		
	Decrease loading/unloading time	Decrease loading/unloading time by 20%	RO3_2	Digital Twin for T&L resources for ships, ports, and trains and environmental conditions among the T&L lines.	EO1 EO3	EI1 EI2 EI3 EI4
				Predictive modelling for container arrival time in port		
				Suggestion for allocation of resources based on data analytics		
Route Optimisation	Reduction of (routing) errors	(RO) Reduction of routing errors by 20%	RO3_3	Digital Twin for T&L resources for ships, ports and trains and	EO1	

				environmental conditions among the T&L lines.		
				Predictive modelling for container arrival time in port		
				Predictive modelling for container time in port		
				Predictive modelling for container arrival time from port to destination		
				Digitalisation of information and procedures		
				Automation of warehouse processes.		
	Reduction of accidents	Reduction of accidents by 30%	RO3_4	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1	EI1 EI2 EI3 EI4
				Suggestion for allocation of resources based on data analytics		
	Reduction of the container idle time	Reduction of container idle time by 20%	RO3_5 RO3_6	Digital Twin for T&L resources for ships, ports and trains and environmental conditions among the T&L lines.	EO1 EO4 EO5 EO2 EO5	
				Predictive modelling for container time in port		
				Suggestion for allocation of		

				resources based on data analytics		
GHG Emissions	GHG emissions reduction	(RO) Reduction of GHG emissions by 15%	RO3_7 RO3_8 RO3_9	Digital Twin for T&L resources for ships, ports, and trains and environmental conditions among the T&L lines.	EO1	EI1 EI2 EI3 EI4
				Suggestion for allocation of resources based on data analytics		

5.4.3 Activities contributing to impact maximisation

The innovative solutions of the FOR-FREIGHT platform ensure 4G-5G connectivity between stakeholders, enabling collaborative decision-making. They allow forecasting of resources, optimisation of planning, and reduction of waiting times, having the effect of reducing costs and emissions with the greenhouse effect. Predictive modelling and analytics solutions using advanced technologies such as IoT, Digital Twins, and AI/ML model interactions between stakeholders, enabling T&L flow tracking throughout the cargo, and door-to-door journey, facilitating comprehensive visibility and operational efficiency in logistics and supply chain management. For the RO_UC, three types of solvers are provided. Prediction, recommendation, and optimisation solutions. Along with this, we also use real-time tracking devices for containers, so-called tracking devices. The predictions of the solvers refer to the estimation of the Estimated Time of Arrival (ETA) for the river vessels and the train sets, as well as the time of the cargo's stay in the port. Recommendations will be made regarding the resource requirements for transshipment of containers and the need for railway resources, number of railway sets, number of wagons, machinery, and personnel. The third type of solution will ensure the optimisation of transport costs, the reduction of the carbon footprint and emissions, and the time required for the goods to arrive from the port to the recipient. The visibility characteristics of the goods contribute to a safer transport environment, reducing the possibility of incidents and accidents, and offering a sustainable transport solution. The FOR-FREIGHT platform, by using blockchain-based solutions, digitises workflows and improves connectivity and interoperability between different modes of transport. It enables the digitisation of documentation and simplified processes such as transport orders and also provides traceability of goods that becomes accessible to all partners, favouring real-time information exchange and eliminating fragmented communication challenges. The RO_UC, in collaboration with the ES_UC and the GR_UC, will be integrated into the FOR-FREIGHT platform, aiming to harmonise both their similarities and differences for the collective benefit.

Table 5-10 presents an initial effort to outline activities that link stakeholders with impacts relevant to the RO_UC and the overall project. The goal is to expand on these activities, step by step in future updates, to ensure that all relevant stakeholders are involved either in contributing to achieving an envisioned impact, or because they might be affected by or be interested in benefitting from the project's activities and impacts.

Table 5-10: Mapping of stakeholder categories to envisioned activities and their potential impacts in RO_UC

Stakeholder	Activity	Impact

Professional Associations (regional, natl., EU, global)	Introduction of the platform to the selected participants and monitoring of the performance during the pilot site	Real-time tracking and tracing of goods
Shipping & Logistics Companies		Promote sustainable transport solutions to address environmental challenges
Software Development Firms		
Port Authority	Organise a joint event to demonstrate the capability of the FOR-FREIGHT platform	Enhance connectivity and interoperability across transport modes
Government (Transport Department)		
Terminal Operator		Real-time tracking and tracing of goods
Port Authority		Digitalisation to improve transport efficiency
Port Authority		Reduce air and noise emissions, greenhouse gas emissions from transport
Environmental Organisation		
Government (Transport Department)		
Academic/ Research institutions		Development and validation of new technologies and services
Academic/ Research institutions		Research and deployment of innovative and sustainable technologies in transport
Environmental Organisation		
Civil society organisations & Society as a whole		Promote sustainable transport solutions to address environmental challenges
Government (Transport Department)		
Civil society organisations & Society as a whole		Encourage the use of cleaner fuels and energy-efficient vehicles
		Supporting zero pollution
Government (Transport Department)		Shift towards shared and collaborative mobility services
IoT Tech Company	Development of effective campaigns tailored to the needs of the specific stakeholder groups	Implement intelligent systems and digital solutions for better connectivity

		Development and validation of new technologies and services
		Real-time tracking and tracing of goods
Rail Operators	Introduction of the platform to the selected participants and monitoring of the performance during the pilot site	Real-time tracking and tracing of goods
Shipping & Logistics Companies		
Rail Operators		Increase use of rail, inland waterways, and short-sea shipping
Shipping & Logistics Companies		
Software Development Firms		Digital transformation of the transport sector
		Research and deployment of innovative and sustainable technologies in transport
		Implement intelligent systems and digital solutions for better connectivity

5.4.4 Implementation Timeline

For the RO_UC (RO_UC) within the FOR-FREIGHT project, the implementation strategy is devised to address socio-economic and environmental objectives. As the development of the UC progresses, specific dates for milestones and activities remain flexible, ensuring adaptability to evolving project needs and stakeholder feedback. The activities and events outlined in Table 5-10 are to be carried out in alignment with the current level of the development of each UC, prioritising a phased and responsive approach. This strategy facilitates the gradual integration of advanced technologies and collaborative initiatives, allowing for the iterative refinement of solutions and stakeholder engagement mechanisms. By maintaining this flexible timeline, the RO_UC is poised to effectively adapt to new insights and challenges, ensuring the impactful and sustainable transformation of Romania's transportation and logistics sector.

5.5 Stakeholder Engagement and Communication

Effective stakeholder engagement and communication are pivotal elements in the FOR-FREIGHT project's pathway to success. Recognising the importance of these aspects from the outset, the project initiated with a foundational dissemination and communication (D&C) strategy, as displayed in the Table 5-11. As the project has progressed, this initial strategy has been further refined and expanded with detailed phases and enriched content. This section outlines detailed strategies for engaging with diverse stakeholders identified in the mapping process, as well as, communicating effectively with them, tailored to the context of the impact maximisation plan.

Table 5-11: FOR-FREIGHT Dissemination & Communication (D&C) Phases

Type of information	Target audience	Channels	Goals
D&C Phase 1 – M1-M12			
Presentation of the project including its objectives. Expected project results. Solutions roadmap workshop	Industry, technological, research, and academic communities. Potential end-users International. Stakeholders Group identified.	Conferences, workshops, Brochures, and posters. Website, Social media channels (LinkedIn, Facebook, YouTube, etc.).	General visibility. Attracting potential collaborators. Attracting potential customers. Attracting investors.
D&C Phase 2 – M12-M24			
Presenting elaborated use cases of FOR-FREIGHT. Demonstration and prototype.	Potential end-users Specific technological, research and academic communities.	Conferences, workshops. Publications in journals. Special session in congress/conference. Web site, social media channels.	General visibility. Attracting potential collaborators. Attracting potential customers. Attracting investors.
D&C Phase 3 – M25-M33			
Running results of the project. Demonstration and field trials.	Potential end-users. Specific technological, research and academic communities (Open source, social media, event processing).	Conferences, workshops. Publications in journals. Special sessions in congress. Website, Social media channels.	Attracting potential investors. Attracting potential customers.
D&C Phase 4 M34-M40 and >M40			
Final results of the project. User-oriented demonstration.	Specific technological, research, and academic communities. End-users and institutional organizations.	Website, demos, Publications in journal or press, Industry Focused events, Client demonstrations.	Attracting potential customers, and investors. Informing the EC. Demonstrating results to existing customers.

Engagement strategies have been initially implemented within the D&C scope which reflects the work done in T5.1 "Dissemination & communication activities", under WP5 "Dissemination, Communication & capacity building", by M18. In more detail, in D5.2 "Dissemination, Communication, training, and clustering activities (Initial version)", submitted in M06, the project partners identified successful methodologies in approaching the target audiences of FOR-FREIGHT, and engaging with them. As to what concerns the successful adoption planning activities for further engaging with the project's stakeholders and end-users, understanding for example the value of the project outcomes, as well as acknowledging potential adopters are considered essential factors. Raising awareness about the project's solutions by reaching out to T&L stakeholders, policymakers, and authorities, enhancing the acceptance of FOR-FREIGHT's innovation, as well as providing an ongoing information flow on key outcomes are additional criteria for effective engagement. In addition, other engaging parameters are to maintain continuous interaction with specific potential adopters and actively involve communities to gather feedback on outcomes, strategically liaise with existing EU projects and international networks, etc. As stated in the various chapters and sections of this deliverable, providing workshops, training activities, or even webinars, while actively involving the project's stakeholders and other interested bodies and individuals in getting informed or updated about the FOR-FREIGHT progress and results, is a need-to-do process for collecting feedback and improving the FOR-FREIGHT solutions based on end-users' needs. As to what concerns standardisation in FOR-FREIGHT, the project will collaborate with T&L European and international standardisation and other reference groups to contribute to their gaps and needs and provide guidelines for a more innovative framework.

Impact in FOR-FREIGHT is also ensured through the various D&C activities, those already implemented, as well as those planned until the end of the project. Such activities follow and reflect the project's progress and updates, and a regular flow of information exchange is safeguarded through a collaborative effort amongst all project partners in the FOR-FREIGHT consortium. Having said that, engaging the project's stakeholders and end-users in the project via various channels requires an ongoing D&C effort, and specifically through the following activities:

- **Present demos of UCs and key project results in key T&L conferences:** Stakeholders become updated about the project and provide their feedback for technical improvements that affect the socioeconomic and environmental impact in FOR-FREIGHT;
- **Development of standardisation roadmaps and contributions to new standardisation activities:** Gaps, needs, improvements, and expected outcomes will be discussed amongst FOR-FREIGHT and European and international standardisation bodies;
- **Involvement of policymakers for information exchange and knowledge sharing:** This will help the project consortium to improve the project's UCs and redefine the FOR-FREIGHT solution;
- **Promotion of dissemination material:** Disseminate the project's impact, relevant progress, and advancements by promoting technical, but also non-technical information (through the development of project brochures, flyers, roll-up banners, newsletters, etc.);
- **Participation in scientific conferences and publications in scientific journals:** A great form of dissemination and engagement, as these kinds of events gather a pool of stakeholders, specifically interested in the T&L sector;
- **Push project results to clusters, relevant associations, and communities:** Partners acting as liaisons to target communities in which they are active members, such as the Digital Transport and Logistics Forum (DTLF), Centro Español de Logistica, etc.;
- Engagement is reflected via the project's **online media channels and website content**, as well as via the dissemination of **press releases**, communicated via the press, or TV/radio interviews, where the project partners will brief the project audience and interested bodies about the project developments, connectivity, solvers, etc., emphasising the desired and achieved impact in the project;
- At least three **video clips** will be produced: FOR-FREIGHT platform demonstration, promoting technical and non-technical information (also for the non-technical-oriented audience), innovation, and impact.

The project partners are currently developing D5.3 "Dissemination, Communication, training and clustering activities (Interim version)" (updated version of D5.2), which is to be submitted at M20. Deliverable D5.2

provided the D&C methodology and action points, whilst D5.3 provides an updated plan of the methodology and achieved actions. Therefore, by reading D5.3, the FOR-FREIGHT readers will be able to learn, among other aspects, about the progress made in T5.3, emphasising the clustering activities. Clustering activities are reflected through partners' collaborations with other Horizon Europe projects, initiatives, groups, and associations. Besides the exchange of knowledge and information, important is to also highlight the involvement of the Alliance for Logistics Innovation through Collaboration in Europe (ALICE), which is active in FOR-FREIGHT. ALICE collaborates with the FOR-FREIGHT partners for the organisation and implementation of various activities and events, which amongst other aspects, focus the attention on the identification of gaps and needs in the T&L sector, aiming to promote different ideas and approaches for the greatest impact generation, and innovation. Part of their role is to provide feedback on the project's produced materials (i.e., deliverables, etc.), and share their technical and business expertise. Other activities, such as events organisation or participation, are also reported in depth in D5.3 and are considered key activities for the enhancement of engagement and impact in the project.

Furthermore, the insights gathered in the UC-specific sections in Chapter 5 lay out a list of activities to be carried out on the pathway to envisioned impacts (these are already detailed and specific to each of the UCs in

Table 5-4, Table 5-7, Table 5-10). Each of the key activities is associated with key WPs and Tasks to carry out the specific activity, relevant stakeholder categories, and relevant strategic objectives. Table 5-12 displays these UC-specific key activities in aggregated format and also associates them with three distinct phases based on the approximation according to the UC-specific information. These phases are:

- Phase 1: M18 – M25
- Phase 2: M26 – M32
- Phase 3: M33 – M40

Table 5-12: Key Activities to be carried out for Impact Maximisation

Activity to be carried out	Responsible task(s), WPs	Relevant UC	Relevant stakeholder categories	Relevant strategic objective	Estimated Phase
Organise a joint event to demonstrate the capability of the FOR-FREIGHT platform	T4.3, T5.3, T5.1	ES_UC	Shipping & Logistics Companies. Software Development Firms.	Digital transformation of the transport sector. Real-time tracking and tracing of goods. Seamless multimodality enabled by digital solutions. Enhance connectivity and interoperability across transport modes. Digitalisation to improve transport efficiency. Shift towards shared and collaborative mobility services. Increase use of rail, inland waterways, and short-sea shipping.	Phase 1

		GR_UC	Shipping & Logistics Companies. IoT Tech Company. Software Development Firms. Government (Transport Department). Environmental Organisation. Financial institutions. Insurance companies. Consulting and advisory firms. Civil society organisations & Society as a whole. Environmental Organisation. Freight Forwarders, Cargo/Transport companies. Third-party logistics providers. Airfreight handlers. Companies trading goods with specific storage requirements and handling. e-Commerce Companies. Manufacturers. Warehouse companies. NGOs.	Real-time tracking and tracing of goods. Digital transformation of the transport sector. Enhance connectivity and interoperability across transport modes. Credit risk assessment. Provision of tailored insurance policies. Provision of strategic decisions to the clients. Digitalisation to improve transport efficiency.	Phase 1

		RO_UC	Port Authority. Government (Transport Department). Terminal Operator. Environmental Organisation. Academic/ Research institutions. Civil society organisations & Society as a whole.	Enhance connectivity and interoperability across transport modes. Real-time tracking and tracing of goods. Digitalisation to improve transport efficiency. Reduce air and noise emissions, and greenhouse gas emissions from transport. Development and validation of new technologies and services. Research and deployment of innovative and sustainable technologies in transport. Promote sustainable transport solutions to address environmental challenges. Encourage the use of cleaner fuels and energy-efficient vehicles. Supporting zero pollution. Shift towards shared and collaborative mobility services.	Phase 1
A webinar to address logistic challenges and how new technologies /solutions have been used to improve processes, operations and efficiency in the ES_UC	T4.3, T5.3, T5.1	ES_UC	Terminal Operator. Port Authority. Rail Operators. Standardisation Bodies. Academic/ Research institutions.	Enhance connectivity and interoperability across transport modes. Real-time tracking and tracing of goods. Digitalisation to improve transport efficiency. Seamless multimodality enabled by digital solutions. Increase use of rail, inland waterways, and short-sea shipping, Digital transformation of the transport sector.	Phase 3

(topics: short introduction of FOR-FREIGHT and added value of the project, ES_UC Business impact, FOR-FREIGHT solutions).				Emphasise the importance of research and innovation in driving Europe's competitiveness. Shift towards shared and collaborative mobility services. Focus on sustainable solutions to address societal challenges.	
Refining the FOR-FREIGHT platform based on feedback and needs of stakeholders and end-users associated with infrastructure operators	WP2, WP3, WP1	ES_UC	Companies trading goods with specific storage requirements. Port Authority. Rail Operators. Shipping & Logistics Companies. Terminal Operator. Standardisation Bodies.	Enhance connectivity and interoperability across transport modes. Real-time tracking and tracing of goods. Digitalisation to improve transport efficiency. Seamless multimodality enabled by digital solutions. Increase use of rail, inland waterways, and short-sea shipping. Shift towards shared and collaborative mobility services. Emphasise the importance of research and innovation in driving Europe's competitiveness.	Phase 2
		GR_UC	Shipping & Logistics Companies. Freight Forwarders. Cargo/Transport companies. Third-party logistics providers. Airfreight handlers.	Real-time tracking and tracing of goods. Digital transformation of the transport sector.	Phase 2

Prepare material to document and educate stakeholders on the use of the platform/ solutions	T5.3	ES_UC	Academic/ Research institutions. Companies trading goods with specific storage requirements. Port Authority. Rail Operators. Shipping & Logistics Companies. Terminal Operator.	Digitalisation to improve transport efficiency. Emphasise the importance of research and innovation in driving Europe's competitiveness. Enhance connectivity and interoperability across transport modes. Focus on sustainable solutions to address societal challenges. Increase use of rail, inland waterways, and short-sea shipping. Real-time tracking and tracing of goods. Seamless multimodality enabled by digital solutions. Shift towards shared and collaborative mobility services.	Phase 2
Introduction of the platform to the selected participants and monitoring of the performance during the pilot site	T3.5	GR_UC	Shipping & Logistics Companies. Freight Forwarders. Cargo/Transport companies. Third-party logistics providers.	Real-time tracking and tracing of goods. Digital transformation of the transport sector.	Phase 2
		RO_UC	Professional Associations (regional, natl., EU, global). Rail Operators. Shipping & Logistics Companies. Software Development Firms.	Real-time tracking and tracing of goods. Increase use of rail, inland waterways, and short-sea shipping. Digital transformation of the transport sector, Research and deployment of innovative and sustainable technologies in transport.	Phase 2

				Implement intelligent systems and digital solutions for better connectivity.	
Development of stakeholder-centric training material to engage them in the FOR-FREIGHT platform	T5.3	GR_UC	Shipping & Logistics Companies. IoT Tech Company. Software Development Firms. Government (Transport Department). Environmental Organisation. Financial institutions. Insurance companies. Consulting and advisory firms. Civil society organisations & Society as a whole. Freight Forwarders. Cargo/Transport companies. Third-party logistics providers. Airfreight handlers. Companies trading goods with specific storage requirements and handling. e-Commerce Companies. Manufacturers. Warehouse companies.	Real-time tracking and tracing of goods. Digital transformation of the transport sector. Enhance connectivity and interoperability across transport modes. Credit risk assessment. Provision of tailored insurance policies. Provision of strategic decisions to the clients. Digitalisation to improve transport efficiency.	

			NGOs.		
Development of effective campaigns tailored to the needs of specific stakeholder groups	T5.1	GR_UC	Environmental Organisation. Shipping & Logistics Companies. IoT Tech Company. Government (Transport Department). Software Development Firms. Financial institutions. Insurance companies. Consulting and advisory firms. Civil society organisations & Society as a whole. Cargo/Transport companies. Third-party logistics providers. Airfreight handlers. Companies trading goods with specific storage requirements and handling. e-Commerce Companies. Manufacturers. Warehouse companies. NGOs.	Real-time tracking and tracing of goods. Digital transformation of the transport sector. Enhance connectivity and interoperability across transport modes. Credit risk assessment. Provision of tailored insurance policies. Provision of strategic decisions to the clients. Digitalisation to improve transport efficiency.	

		RO_UC	IoT Tech Company.	Implement intelligent systems and digital solutions for better connectivity. Development and validation of new technologies and services. Real-time tracking and tracing of goods.	

5.6 Risk Assessment and Mitigation

Several risks could hinder the successful implementation of the above-stated activities, in terms of their contribution to the maximisation of the project's impact. This section defines those risks and suggests mitigation measures, so that the project remains on track.

Table 5-13: Risk and Mitigation Measures associated with each Key Activity

Key Activity	Risk	Mitigation measure
Developing the FOR-FREIGHT platform and underlying solutions	Technology complexity leads to user-unfriendly systems, lack of interoperability with existing systems, and scalability issues.	Ensure that the agile development approach allows an iterative design and incorporates user feedback early. Ensure that the platform is built on open standards to promote interoperability. Ensure that the plan for scalability from the outset is being followed, to accommodate future growth.
Pilot-testing and collecting feedback	Inadequate representation in pilot tests leads to feedback that doesn't encompass all user types or use cases, and subsequent limited applicability of the solutions.	Treat each UC with the same level of attention. Use structured feedback mechanisms to ensure all relevant aspects are covered and to guide continuous improvement.
Organising stakeholder workshops and interactions	Insufficient stakeholder engagement could lead to a lack of buy-in or missed opportunities for collaboration	Develop a comprehensive stakeholder engagement plan, ensure regular and meaningful interactions, and tailor the approach to different stakeholder groups.
Training and building capacity	Training might not reach all potential users or may not be adequately comprehensive, leading to the underutilisation of the platform.	Develop a robust training programme that is easily accessible online and covers different roles and skills. Provide ongoing support and resources.
Complying with standardisation efforts	Rapidly evolving standards or conflicting standards between regions could complicate compliance.	Actively promote open standards, monitor developments in standards, and ensure the platform's design is flexible enough to adapt to new standards;

Creating sustainability	Without a clear plan for long-term sustainability, the platform may become obsolete or fail to maintain its user base.	Develop a clear business model for sustaining the platform beyond the funding period. Regularly update the platform based on user feedback and technological developments.
Outreach campaigns	Ineffective communication strategies may fail to reach or resonate with the targeted stakeholders, leading to poor participation in project activities and use of the platform.	Develop a strategic plan that uses a mix of communication channels tailored to the targeted stakeholders. Use KPIs to gauge the effectiveness of campaigns and adjust strategies accordingly (see Section 6.1).

On the project level, risks are being assessed regularly, to track the need for mitigation actions and ensure that the project's objectives are being reached.

6 Monitoring and Evaluation Strategy of Impact

This chapter sets forth a robust framework for impact evaluation, integrating a multi-step approach for assessing UC outcomes and their alignment with KPIs. It also refines monitoring methods to capture the progress of key initiatives and employs feedback mechanisms for the continuous refinement of the project. Furthermore, the chapter advocates for a systematic reporting protocol to document the impacts effectively, facilitating strategic adjustments and enhancements in line with the project's overarching goals.

6.1 Impact Measurement

To ensure that the maximisation plan succeeds, this section defines how the plan implementation should be measured and how this can be operationalised in the form of KPIs. It includes the methods and timing of the measurement, and incorporates the information gathered under each UC-specific section in Chapter 5.

6.1.1 FOR-FREIGHT Evaluation Framework

Regarding the technical evaluation and monitoring of the proposed impacts of the UCs, the FOR-FREIGHT project has created a holistic evaluation framework (T1.2, T1.3, T3.5) to define and validate the results of the solutions. More specifically, using FENIX's Common Evaluation Framework[13] which is based on a six-step approach, the project aims to measure and evaluate the FOR-FREIGHT solutions' impact on T&L operations:

- Set impacts per UC;
- Identify KPIs & measures;
- Measure Baseline scenario;
- Measure the TO-BE scenario;
- Determine evaluation outcomes;
- Report overall impact.

The project has already set specific goals and targets regarding its impact in D1.2 and D1.3 by refining the mid and long-term impacts, and targeting specific KPIs. For each one of the three UCs, the KPIs have been described, and the threshold limits and their target objectives, along with the logistic processes for their measurement were defined. In addition, a connection between medium-term expected outcomes and long-term expected impacts was conducted under Task 1.2. For the technological validation, the baseline values of the KPIs, the data collection methods of the ex-ante scenario and the means of verification were reported under Task 1.3.

The ex-post scenario and more specifically, the KPIs' values and the data collection methods, will be defined at the end of the project when the trials and the validations in each UC will be completed. Then, an ex-ante/ex-post analysis, as well as the impact analysis will be performed by CERTH. This information will be covered by Task 3.5 in D3.3, where the holistic evaluation analysis (operational and technical) will be completed and best practices will be presented (M38).

6.1.2 Monitoring dimensions complementary to the existing evaluation framework

The key activities outlined in Section 5.1.3 and further broken down in the subsequent UC sections are expected to contribute to the maximisation of the project impacts. They largely correspond with the FENIX Common Evaluation Framework's objectives (see previous section), especially in areas of user engagement, stakeholder impact, interoperability, and sustainability. Consequently, the following KPIs can be regarded as complementary to already ongoing efforts.

[13] For more information, see https://www.researchgate.net/publication/363687464_Assessing_the_impact_of_platform_federation_in_European_transport_and_logistics_operations_FENIX's_Common_Evaluation_Framework

Each of the following KPIs corresponds to a particular key activity and may be used to gauge the progress of their implementation:

- Key activity: Develop an Integrated Online Platform:
  - KPI: Number of active users on the platform;
  - KPI: System uptime and reliability;
  - KPI: Time taken from user registration to active use;
  - KPI: Number of interoperable systems connected.
- Key activity: Pilot-test and Collect Feedback:
  - KPI: Number and diversity of pilot tests conducted;
  - KPI: Volume of feedback collected from users;
  - KPI: Percentage of feedback items addressed;
  - KPI: User satisfaction rates post-pilot.
- Key activity: Organise Stakeholder Workshops:
  - KPI: Number of workshops held and stakeholders participated;
  - KPI: Quantity and quality of stakeholder input received;
  - KPI: Changes made to the project based on stakeholder input;
  - KPI: Satisfaction of workshop participants.
- Key activity: Train and Build Capacity:
  - KPI: Number of training sessions conducted and attendees;
  - KPI: Pre- and post-training competency levels;
  - KPI: Number of trained users;
  - KPI: Satisfaction of trained users.
- Key activity: Create sustainability:
  - KPI: User retention rates;
  - KPI: Number of self-funded platform customers.
- Key activity: Comply with Standardisation Efforts:
  - KPI: Number of new stakeholders committed to the adoption of relevant standards;
  - KPI: Number of new stakeholders compliant with relevant standards.
- Key activity: Outreach Campaigns:
  - KPI: Number of outreach events hosted;
  - KPI: Attendees at conferences and webinars;
  - KPI: Engagement during events (questions, interactions);
  - KPI: Leads generated from booths and demonstrations;
  - KPI: Conversion rates from physical outreach to platform sign-ups;
  - KPI: User feedback on demonstrations and interactions;
  - KPI: Engagement rates (click-throughs, sign-ups, inquiries);
  - KPI: Conversion rates from outreach to active users.

6.2 Feedback Mechanisms and Continuous Improvement

In alignment with the previous section, this one determines which feedback mechanisms need to be set up, and who implements them, how, and when. Moreover, it defines a mechanism to ensure that the gathered feedback leads to a continuous improvement of the plan implementation and, perhaps, the development of project solutions.

Continuously refining and optimising the FOR-FREIGHT platform to align with the dynamic needs and expectations of our stakeholders is paramount to our commitment to excellence. To achieve this, we employ a set of specific tools and strategies. User Feedback Surveys form a key component of our approach, involving periodic surveys directly with platform users, covering aspects such as user experience, feature satisfaction, and the overall effectiveness of the platform. By actively seeking user input, we ensure that the platform remains user-centric and responsive to stakeholder requirements. Leveraging advanced analytics tools, we systematically track user behaviour, feature utilisation, and overall platform performance. The insights derived from analytics serve as valuable indicators, guiding our decision-making process for continuous improvements and updates to the platform. Maintaining open and accessible communication channels is integral to our feedback loop. We provide stakeholders with dedicated helpdesk services, forums, and communication platforms. This transparent and interactive approach fosters real-time feedback, enabling stakeholders to voice their suggestions and concerns. By combining these tools within our feedback mechanisms, we actively engage with stakeholders, gather insights, and implement iterative improvements. This iterative approach ensures that the FOR-FREIGHT platform remains at the forefront of industry standards and consistently exceeds stakeholder expectations.

In addition to these platform-related gathering methods, several mechanisms could be put in place to cover the gathering of data on the KPIs related to the key activities, as presented in the previous section. Table 6-1 shows potential gathering mechanisms for each of these KPIs. This initial set may be subject to future change, depending on the validation of the usefulness of these KPIs and gathering mechanisms, as well as the emergence of new needs.

Table 6-1: Potential KPIs and data gathering mechanism to gauge the implementation of key activities

Key Activity	Suggested KPI	Potential data gathering mechanism
Develop the FOR-FREIGHT platform	Number of active users on the platform	Automated user tracking within the platform's backend
	System uptime and reliability	Automated monitoring tools
	Time taken from user registration to active use	System database timestamps
	Number of interoperable systems connected	Automated Application Programming Interface (API) or service use logs (e.g., message tracing or interaction logs)
Pilot-test and collect feedback	Number and diversity of pilot tests conducted	Online survey tools, pilot session recordings
	The volume of feedback collected from users	Feedback forms within the platform, pilot apps
	Percentage of feedback items addressed	Project management tools tracking feedback

	User satisfaction rates post-pilot (no. of satisfied responses vs. no. of total responses)	Automated satisfaction surveys
Organise stakeholder workshops	Number of workshops held and stakeholders participated	Online event management systems
	Quantity and quality of stakeholder input received	Digital feedback forms, interactive polls
	Changes made to the project based on stakeholder input	Project management software tracking changes
	Satisfaction of workshop participants	Digital feedback forms, interactive polls
Train and build capacity	Number of training sessions conducted and attendees	Learning Management System (LMS) tracking
	Pre- and post-training competency levels	Online assessments and surveys
	Number of trained users	Certification tracking through LMS or platform
	Satisfaction of trained users	Digital feedback forms, interactive polls
Comply with standardisation efforts	Compliance rate with relevant standards	Automated compliance checking tools
Create sustainability	User retention rates	Platform analytics tools tracking user activity
	Number of self-funded platform customers	Licensing or use of the FOR-FREIGHT platform
Outreach campaigns	Number of outreach events hosted	Event scheduling and management platforms
	Attendees at conferences and webinars	Registration and sign-in sheets (physical and digital)
	Engagement during events (questions, interactions)	Live polling/survey tools, Q&A session recordings
	Leads generated from booths and demonstrations	Lead capture forms, business card collection
	Conversion rates from physical outreach to platform sign-ups	Follow-up communications tracking sign-ups post-event
	User feedback on demonstrations and interactions	Feedback forms, post-event surveys
	Engagement rates (click-throughs, sign-ups, inquiries)	Web analytics tools
	Conversion rates from outreach to active users	Customer Relationship Management (CRM) systems

		tracking conversions; report from FOR-FREIGHT platform use

6.3 Reporting and Documentation of Impact

The purpose of this section of to set up a template to efficiently report on the plan implementation and document the achieved impacts, putting as little burden as possible – but as much as necessary – on the implementers of the plan.

The reporting format to be employed for this purpose depends on the final set of planned activities and the measurement of related KPIs. As neither is in place yet, here is an outline of essential parts of a report that may be updated continuously:

- Implementation progress by key activity, for each key activity, the report would include:
  - activity name;
  - objective – brief description of the activity's purpose and its importance to the project;
  - KPIs and targets – list of defined KPIs for this activity and targets set for each KPI within the reporting period;
  - data gathering mechanisms and formats – summary of how data was collected for each KPI; description of the data format used for analysis and reporting.
- Progress analysis:
  - analysis of the data collected for each KPI;
  - comparison of actual performance against targets;
  - graphs, charts, or tables to adequately summarise the data;
- Challenges and Mitigation Strategies:
  - description of challenges encountered during the implementation of activities;
  - actions taken or planned to address these challenges;
- Next steps: short-term plans for each key activity, including any adjustments to the strategy based on data analysis;
- Overall implementation progress:
  - project's current status about the planned timeline and milestones;
  - areas where the project is ahead/behind schedule;
- Conclusions and recommendations:
  - recommendations for the future implementation of activities;
- Appendices:
  - summary of stakeholder participation and feedback, including key insights and how they have influenced the project;
  - detailed data tables, additional graphs, and charts;
  - copies of surveys or feedback forms used;
  - any other relevant documentation supporting the analysis.

7 Conclusions

This document proposes an initial strategy for enhancing the impact of the FOR-FREIGHT project. It builds upon the foundational work from related WPs, notably WPs 1 and 2, along with T4.1 from WP4, to craft a preliminary plan. This plan assesses the strengths and weaknesses of the FOR-FREIGHT UCs, identifies relevant outcomes and broader impacts, highlights critical stakeholders for engagement, and determines which project results are essential for the strategy's success.

Leveraging the foundational work, the deliverable displays a nuanced framework aimed at amplifying impact, tailored specifically to meet the diverse needs and specifications of the three UCs. This framework facilitates the creation of a bespoke action plan for each UC, encompassing both universal themes and unique aspects pertinent to their specific context. It meticulously refines the engagement with stakeholder groups, highlights key factors with the greatest potential impact on these stakeholders, and outlines strategic activities poised to significantly elevate the intended outcomes. This approach ensures a cohesive yet flexible strategy for impact maximisation across the project's spectrum.

Additional to the analysis of the envisioned socioeconomic and environmental impacts in FOR-FREIGHT, the initial maximisation plan outlines strategic pathways for enhancing envisioned impacts, involving specific stakeholder groups, establishing timeframes, and linking actions with corresponding partners and tasks. This reflects the culmination of efforts initiated at the beginning of Task 4.3, now matured into actionable steps aimed at realising the projected impacts.

However, it's important to note that these plans are initial. They are based on the information available at the time of writing and require further elaboration, especially concerning the detailed activities that engage both internal and external stakeholders. Continued dialogue with Use Case (UC) leaders and project partners remains pivotal for refining the transition from activities to outcomes and impacts. This includes expanding consultations to encompass external stakeholders, not only to validate the progress achieved but also to incorporate their insights and needs into the development of the platform and broader project activities. As the project evolves, these tailored plans will undergo ongoing refinement, adapting to new developments and milestones. The insights gained following the submission of D4.3 will significantly enrich the final WP4 deliverable, D4.5 "Business Plan, Impact Generation, and Innovation (Revised Version)", with advanced insights and progress from T4.3.

8 References

[1] Kayikci, Y. (2018). Sustainability Impact of Digitization in Logistics. *Procedia Manufacturing 21*, 782–789.

[2] Levy, K. (2023). Data Driven: Truckers, Technology, and the New Workplace Surveillance. *Princeton: Princeton University Press*.

[3] Cowen, D. (2014). The Deadly Life of Logistics: Mapping Violence in Global Trade. *University of Minnesota Press*.

[4] Ren, R. E. (2019). A Systematic Literature Review of Green and Sustainable Logistics: Bibliometric Analysis. *International Journal of Environmental Research and Public Health*, 17(1): 261.

[5] Boonpanya, T., & Toshihiko, M. (2021). Assessing the Economic and Environmental Impact of Freight Transport Sectors in Thailand Using Computable General Equilibrium Model'. *Journal of Cleaner Production*, 280: 124271.

[6] Dooms, M. (2019). Stakeholder Management for Port Sustainability. *Elsevier*, 63–84.

[7] Satta, G., Notteboom, T., Parola, F., & Lara, P. (2014). Disclosure as a tool in stakeholder relations management: a longitudinal study on the port of Rotterdam. *Proceedings of the IAME Annual Conference, International Association of Maritime Economists*.

[8] Sustainable and Smart Mobility Strategy: Putting European Transport on Track for the Future. (2021).

[9] Environmental Sustainability and Zero Pollution: Action plan zero pollution. (2021).

[10] Trans-European Transport Network (TEN-T): Creating a Green and Efficient Trans-European Transport Network. (2021).

[11] Transition to Green Transport. (2021).

[12] Sustainable and Smart Mobility Strategy. (2020).

[13] DG MOVE Strategic Plan. (2020-2024).

[14] Horizon Europe Work Programme: WP 12 Missions. (2023-2024).

[15] Wang, R. Z. (2019). Resource-Expandable Railway Freight Transportation Routing Optimization. *IEEE Access 7: 161607–20*.

Annex I: Stakeholder Categorisation Spreadsheet

Figure 0-1: Stakeholder categorisation spreadsheet – excerpt

	META-DATA					
Stakeholder	Association leve	Category	Category (based on Dooms, Mich	Relevance for ES	Relevance for GR	Relevance for RO
ALICE	Primary	Professional associati	Regional organisation/ interest groups			
ILME	Primary	Professional associati	Regional organisation/ interest groups			
DIAKINISIS S.A.	Primary	Terminal Operator	Port users (tenants)			
Port of Antwerp-Bruges	Primary	Port Authority	Port authority/ - service provider			
Digital Innovation Hub	Primary	Professional associati	Regional organisation/ interest groups			
BSECBC	Primary	Professional associati	Regional organisation/ interest groups			
CEL (Centro Español de Logística)	Primary	Professional associati	Regional organisation/ interest groups			
LOGISTOP	Primary	Professional associati	Regional organisation/ interest groups			
CLECAT (European Association for Forwarding, Transport, Logistics and Customs Services)	Primary	Professional associati	Regional organisation/ interest groups			
ELA (European Logistics Association)	Primary	Professional associati	Regional organisation/ interest groups			
FIATA (International Federation of Freight Forwarders Associations)	Primary	Professional associati	Regional organisation/ interest groups			
IATA (International Air Transport Association)	Primary	Professional associati	Regional organisation/ interest groups			
IRU (International Road Transport Union)	Primary	Professional associati	Regional organisation/ interest groups			
UIC (International Union of Railways)	Primary	Professional associati	Regional organisation/ interest groups			
ERA (European Union Agency for Railways)	Primary	Professional associati	Governmental agencies/ Regulators			
ESPO (European Sea Ports Organisation)	Primary	Professional associati	Regional organisation/ interest groups			
...						

Annex II: Impact Categorisation Spreadsheet ES_UC

Figure 0-2: Impact categorisation spreadsheet ES_UC – excerpt

			stakeholder group ...	
stakeholder category	impact	impact category	impacted?	needed to achieve impact?
Port Authority	Enhance connectivity and interoperability across transport modes	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes
Port Authority	Digitalisation to improve transport efficiency	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Port Authority	Seamless multimodality enabled by digital solutions	Sustainable Urban Mobility	yes	no
Port Authority	Increase use of rail, inland waterways, and short-sea shipping	Effective route planning	yes	yes
Shipping & Logistics Companies	Enhance connectivity and interoperability across transport modes	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes
Shipping & Logistics Companies	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes
Shipping & Logistics Companies	Digitalisation to improve transport efficiency	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Shipping & Logistics Companies	Shift towards shared and collaborative mobility services	Sustainable Urban Mobility	no	yes
Shipping & Logistics Companies	Increase use of rail, inland waterways, and short-sea shipping	Effective route planning	no	yes
Shipping & Logistics Companies	Seamless multimodality enabled by digital solutions	Sustainable Urban Mobility	yes	no
Terminal Operator	Enhance connectivity and interoperability across transport modes	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Terminal Operator	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes

Annex II: Impact Categorisation Spreadsheet GR_UC

Figure 0-3: Impact categorisation spreadsheet GR_UC – excerpt

			stakeholder group ...	
stakeholder category	impact	impact category	impacted?	needed to achieve impact?
Port Authority	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes
Shipping & Logistics Companies	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Shipping & Logistics Companies	Digital transformation of the transport sector	Digital Transformation, Innovation, Data, and Artificial Intelligence	no	yes
Terminal Operator	Enhance connectivity and interoperability across transport modes	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Terminal Operator	Vessel Traffic Monitoring and Information Systems (VTMIS) for maritime operations	Efficient Capacity Allocation and Traffic Management	yes	no
Terminal Operator	Digital transformation of the transport sector	Digital Transformation, Innovation, Data, and Artificial Intelligence	no	yes
IoT Tech Company	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	no	yes
Software Development Firms	Digital transformation of the transport sector	Digital Transformation, Innovation, Data, and Artificial Intelligence	yes	no
Software Development Firms	Enhance connectivity and interoperability across transport modes	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Rail Operators	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no
Civil society organisations & Society	Digitalisation to improve transport efficiency	Seamless Travel Experience and Digitalisation & Smart Transport	yes	no

Annex II: Impact Categorisation Spreadsheet RO_UC

Figure 0-4: Impact categorisation spreadsheet RO_UC – excerpt

			stakeholder group ...	
stakeholder category	impact	impact category	impacted?	needed to achieve impact
Port Authority	Digitalisation to improve transport efficiency	Seamless Travel Experience and Digitalisation & Smart Transport	yes	yes
Port Authority	Reduce air and noise emissions, greenhouse gas emissions from transport	Improving Our Health and Well-being, and of our planet	yes	no
Shipping & Logistics Companies	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	no	yes
Shipping & Logistics Companies	Increase use of rail, inland waterways, and short-sea shipping	Effective route planning	no	yes
Terminal Operator	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	no	yes
IoT Tech Company	Implement intelligent systems and digital solutions for better connectivity	Digital Transformation, Innovation, Data, and Artificial Intelligence	no	yes
IoT Tech Company	Development and validation of new technologies and services	Digital Transformation, Innovation, Data, and Artificial Intelligence	no	yes
IoT Tech Company	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	no	yes
Software Development Firms	Digital transformation of the transport sector	Digital Transformation, Innovation, Data, and Artificial Intelligence	yes	no
Software Development Firms	Research and deployment of innovative and sustainable technologies in transport	Digital Transformation, Innovation, Data, and Artificial Intelligence	yes	no
Software Development Firms	Implement intelligent systems and digital solutions for better connectivity	Digital Transformation, Innovation, Data, and Artificial Intelligence	yes	no
Rail Operators	Real-time tracking and tracing of goods	Seamless Travel Experience and Digitalisation & Smart Transport	no	yes