Progress towards Federated Logistics through the Integration of TEN-T into A Global Trade Network

D4.3 Electronic Visualisation Library of outputs from WP1-WP2 and WP3

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1 According to PLANET's Quality Assurance Process

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Glossary of terms and abbreviations used.

Abbreviation / Term	Description
EGTN	EU-Global T&L Networks
EVL	Electronic Visualisation Library
T&L	Transport & Logistics
LLx	Living Lab number
UCx	Use Case number
WPx	Work Package number

1 Executive Summary

The purpose of this deliverable is to report on the work undertaken in T4.3 of the PLANET project. More specifically, it presents the methodology and the path taken towards the development of the Electronic Visualisation Library.

The work included a classification of the potential users of all project outputs (developed in WP1, WP2, WP3), an assessment of the potential of these outputs in collaboration with each Work Package leader and respective task leaders, and an online survey that validated the outputs and specified the learning material requirements per classified user group.

Based on the learning material requirements four learning courses were identified for development: (i) EGTN concept and specifications, (ii) Corridor Connectivity Index, (iii) Business Analytics toward PI, and (iv) Innovation Technologies: Impact and Roadmapping. The courses were designed using outputs and material from the PLANET project and piloted with project stakeholders in four separate workshops.

As a final step, an open-source solution was selected as the platform for the Electronic Visualisation Library (EVL). The developed courses were uploaded on the EVL, thereby creating four online courses in an online environment.

The purpose of the EVL is to encourage and promote knowledge sharing to any interested party outside the realm of the PLANET project by developing courses that disseminate PLANET outputs. In addition to this, the EVL aspires to stimulate communication and interactivity among course participants by taking advantage of the possibilities for interaction that such an online collaborative environment offers. Taking all the above into consideration, the ultimate goal is to create a community of interested stakeholders that exchange knowledge and best practices in T&L in a trusted environment that the EVL offers.

2 Introduction

2.1 Mapping PLANET Outputs

Purpose of this section is to map PLANET's Grant Agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

Table 1: Adherence to PLANET's GA Deliverable & Tasks Descriptions

PLANET GA Component Title	PLANET GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D4.3: Electronic Visualisation Library of outputs from WP1-WP2 and WP3	Library of project outputs, and open source components structured in line with EGTN users classification including innovative learning and teaching materials to support public and business stakeholders use the Library resources.	Sections 5.2, 5.1, 3.1, 4.1	Section 5.2 presents in detail the Electronic Visualisation Library, while section 5.1 presents the PLANET GitLab repository where the open source components of the project can be found. The EGTN users classification is presented in section 3.1, while the learning materials are presented in section 4.1.
TASKS			
T4.3 will provide a modular library of open source EGTN support components for easy transferability of Framework improving accessibility to EU Global EGTN network enhancing performances, productivity, and capacity. It provides learning material specifically for public authorities in maximizing with lower use of resources the "Time" & "Space" dimensions towards a low emission/green/environment friendly EGTN network.		Section 5.1, Chapter 4	The library of open source EGTN components is presented in section 5.1. The learning material is developed in ST4.3.3 and presented in chapter 4.

ST4.3.1 Learning material requirements will provide a classification of the potential users of the project outputs and will assess the use potential of all outputs including the ICT infrastructure components. Based on that, it will specify the learning material needed for each stakeholder group.		Chapter 3	Section 3.1 presents the classification of potential users of the project outputs. Section 3.2 presents all PLANET outputs and their potential. Section 3.4 describes the learning material specifications per stakeholder group as validated through an online survey.
ST4.3.2 Electronic Visualisation Library will provide an Electronic Visualization Library of outputs from WP1, WP2 and WP3, structured in line with users' classification from subtask 4.3.1.		Chapter 5	Section 5.2 presents in detail the Electronic Visualisation Library, which was developed using the courses in ST4.3.3 in accordance with the users classification developed in ST4.3.1.
ST4.3.3 Learning courses will design and deliver innovative learning and teaching courses to support public and business stakeholders in using the Electronic Visualisation Library. The developed courses will be piloted with stakeholders participating in the project, who will provide feedback on the content and the delivery methodology. Feedback will drive revisions/additions to the respective material.		Sections 4.1, 4.2	Section 4.1 presents the developed courses, that are uploaded to the Electronic Visualisation Library. Section 4.2 focuses on the pilot workshops and the revised courses based on the feedback received during the workshops.

2.2 Deliverable Overview and Report Structure

The deliverable is organised in separate chapters as follows:

- Chapter 3 is dedicated to the learning material requirements. It lays out the methodology undertaken to identify the different user groups of project outputs and the classification of the project outputs into different categories. An online survey was designed and launched among project partners to validate the outcomes of the previous two classification tasks.
- Chapter 4 presents the methodology behind the courses that were developed in accordance with the outputs of the survey presented in chapter 3. It continues by presenting the pilot workshops and feedback received during these.
- Chapter 5 focuses on the Electronic Visualisation Library that was developed to provide the platform for the delivery of the learning courses presented in chapter 4. In addition to this, it presents the library of open source components of the project.
- Finally, a conclusion summarising the task outcomes is provided.

3 Learning Material Requirements

This chapter describes the methodology followed to identify the learning materials needed per user group, as a key step to develop the capacity building program in PLANET.

3.1 Classification of Potential Users

The main aim behind the PLANET Capacity Building effort is to accelerate the realisation of the EGTN targeting a variety of stakeholders, including public authorities.

Organisations differ from one another depending on their relationship with PLANET solutions, hence the following three categories can be identified [1]:

- **consumers** of PLANET outputs and solutions
- **providers** who own and operate the solutions and
- **enablers,** i.e., organisations that sell products and services that facilitate the delivery, adoption and use of the EGTN Platform. More information, regarding the EGTN Platform can be found in *D2.2 Open EGTN Platform Architecture final version*.

Further distinctions between the Target Audiences can take place with respect to their role in the organisation. Indeed, Authorities, Top Level Management, operational stakeholder and IT departments tend to have very different interests in PLANET.

Based on the classification undertaken in the SELIS[2] project (SELIS Deliverable 1.3 [2]), this distinction leads to the definition of the following Target Audiences for the PLANET outputs:

A. **PLANET end-users - Top Level Management** (Large, or Small-Medium Enterprise CEO, CIO, CTO, IT management of Enterprises): they are the decision-makers on the adoption of PLANET; they are all interested in the business value of PLANET and the advantages of the technological offering but the relevant importance of these two aspects might vary according to their specific function;
B. **PLANET end-users - Middle Level Management** Business Staff of Enterprises: they are the users of the PLANET solution, interested in the business value and the use of the solution and the pathway towards the implementation; if they are convinced of the advantages of the PLANET offering, they can make the relay towards the Top Management and facilitate the adoption.
C. **PLANET end-users - IT and Analytics Departments**: these are the members of Analytics Team, IT departments, IT Managers, Data Scientists, Business Analysts of Enterprise; they are interested in the PLANET technical offering.
D. **PLANET Solutions Providers**, Integrators and Technology Consultants: these are organizations providing Business-Technology solutions based on PLANET and finding the best ways to integrate the PLANET solutions to result collaborating supply chains; they are interested in the technological attributes and advantages of PLANET.
E. **Business Consultants**: these are organizations using and expanding the PLANET business models, business analysts, making cost-benefit analysis and gap analysis for the implementation of PLANET applications; it should be noted that they can be a part of the same organization as the PLANET Solutions Providers and Integrators since large organizations of this type often propose end-to-end services
F. **Ports, Administrations and Authorities (including Customs)**: they are using PLANET to extend their reach and acceptance of their facilities in Port Community Systems and Single Windows; they can enforce the use of PLANET on a large number of organizations and as such are important enablers; the main target audience within these organizations is the top level management; in case that Ports and Authorities are

[2] https://selisproject.eu/, Towards a Shared European Logistics Intelligent Information Space

considered as end-users of the PLANET solutions, all considerations for that specific Target Audience are still relevant, including the separations with regards to the roles within the organization.

G. **Academia**: Universities, research institutes will leverage project results in further R&D&I efforts, publications and conferences and development of teaching materials. They will be enablers though outreaching activities creating awareness.
H. **Policy makers**: DGMOVE, Strategic international cooperation agenda, Digital Transport&Logistics Forum, and Policy Makers from **Disadvantaged** Regions specially interested in the briefing reports for public authorities and guide on the inclusion of disadvantaged regions into the international trading system.

SMEs such as technology start-ups, or at the operational levels (LSPs) were also considered. They are represented in groups A-E and were nott included in a separate classification.

3.2 Potential of PLANET Outputs

Building upon Clusters 2.0[3] *D1.5 Final Exploitation plans*, project outputs have been split into the following categories according their potential:

1. Research
2. Education
3. Consultancy
4. Hardware
5. Software
6. Analytics
7. Recommendations (this category includes both, direct recommendations to policy makers and recommendations that could be also of interest of policy makers stemming from some of the solutions developed in WP2)

All project outputs were then identified and their potentials assessed according the seven categories above in an exercise performed by each Work Package and the respective task leaders using an Excel spreadsheet. The outcomes of each Work Package are presented in Figure 3-1, Figure 3-2, Figure 3-3 and Figure 3-4.

Following that, the categories were clustered into three separate groups based on the relevance for the potential users identified previously in section 3.1: i) Research, Education and Consultancy; ii) Hardware, Software and Analytics, and iii) Recommendations.

[3] http://www.clusters20.eu/, Clusters 2.0

				Potential of the output							Potential (clustered)		
WP	PLANET output	Description	Leader/owner	Research	Consultancy	Education	Recommendations	Hardware	Software	Analytics	Research Consultancy Educati	Hardware/Software/Analytics	Recommendations
WP1	EGTN Foundational Position papers	(1) Geo-economics impact of new trade routes for Europe; (2) New trade routes' impact on TEN-T Corridors and nodes; (3) Interconnection issues of railway transport-corridors to/from Europe; (4) Transition towards the Physical Internet paradigm.	ITAINNOVA	x		x	x				x		x
WP1	EGTN Modelling and simulation capability	EGTN modelling and simulation capability for a comprehensive analysis of the impact of emerging trade routes, national strategies and technological concepts on trans-continental freight flows and modal split to/from Europe and on the required interfaces to the TEN-T	ITAINNOVA	x		x					x		
WP1	Simulation based impact of new trade routes on the TENT-T and disadvantaged regions	Predicted flow changes for all TEN-T corridors with focus on 2030 horizon, and a range of Principal Entry Nodes. Also projected flows in an EGTN network optimised for use of new technologies	PAN	x	x		x			x	x	x	x
WP1	Simulation-based analysis of T&L and ICT innovation technologies	Quantitative models that for performing simulation-based analysis of T&L and ICT innovation technologies	EUR	x	x		x			x	x	x	x
WP1	EGTN reference specifications	in EGTN simulation scenarios	CERTH	x	x		x				x		

Figure 3-1. PLANET outputs in WP1 and their potential

				Potential of the output							Potential (clustered)		
WP	PLANET output	Description	Leader/owner	Research	Consultancy	Education	Recommendations	Hardware	Software	Analytics	Research Consultancy Educa	Hardware/Software/Analy	Recommendations
WP2	Cloud-based ICT Infrastructure Architecture	Prototype of an open Cloud-based platform	INL					1) EGTN Planet platform/infrastructure	2) Services' integration and interconnection to dashboard			x	
WP2	IoT Infrastructure	IoT infrastructure for increased automation in T&L operational management with automated localised data capture, processing and event-based transmission including registration of events through EPCIS (GS1 standard); hardware and software for the High-level gateway	NGS						3) Events Generation, 4) Consolidation & Deconsolidation	1) Track&Trace&Monitoring 2) Metadata & Statistic		x	
WP2	Connectivity Infrastructure	Connectivity Infrastructure Components linked to a commercial suite of semantic technologies enabling better content management, knowledge discovery and semantic search in supply chain /corridor communities	SIR							1) KG query: weather 2) KG query: IoT readings 3)KG query: IoT events 4) KG query: Route data 5) KG query: CLN		x	
WP2	Predictive and optimisation analytics components to support Physical Internet models.	Development of the analytics and cloud deployment	IBM							1) Routing optimisaiton 2) Deman forecast for Warehouse Analytics 3)Transport models		x	
WP2	Multi-user and multi-criteria decision support models	Models to allow stakeholders to analyse and assess the effect of new T&L developments (e.g. new trans-continental freight routes) that cross or neighbour their regions	VLTN	Operational utilisation of MAMCA for identification of viable collaborative opportunities			Transport infratructure development considering various stakeholders				x	x	x
WP2	Services for Intelligent PI Nodes and Network	intelligent forecasting and planning, intelligent and automated operations, and real time reporting of operations and the status of the nodes and the network	VLTN	Journal paper(s): One on last mile delvery and one on port clustering impact and influennce on infrastructure development			Reflections on TEN-T network development		1) Last mile collaboartive parcel delivery, 2) PI port/ hub choice	Reduction of unsuccessfull deliveries due to delays		x	x
WP2	Interoperability layer supporting federation of Blockchain		KNT						2) Provision of blockchain events from heterogeneou			x	
WP2	Prototypes of Blockchain-enabled smart contracts	PI driven models for EU-Global transportation networks operating on smart contracts hosted on interconnecting blockchains.	KNT				1) Streamline of warehouse management		1) Streamline of warehouse management			x	
WP2	HMI (Human Machine Interface)	HMI is to deliver a unified interface to communicate with all of PLANET's Cloud-based Open EGTN Infrastructure components (T2.1) via suitable interfaces, including mobile devices and HMI touch panels	EBOS						Planet dashboard			x	

Figure 3-2. PLANET outputs in WP2 and their potential

				Potential of the output							Potential (clustered)		
WP	PLANET output	Description	Leader/owner	Reasearch	Consultancy	Education	Recommendations	Hardware	Software	Analytics	Research Consultancy Education	Hardware/Software/Analytics	Recommendations
WP3	LL1 PI and Blockchain for optimized door-to-door Asia-Europe corridors Mediterranean Corridor Case Studies	achievements, obstacles and issues. Potentially split into 2: ports/inteligent WHs and LMD	COSSP	publications, new R&D projects		training materials					x		
WP3	LL2 China-Rotterdam/USA through rail	achievements, obstacles and issues	PAN	publications, new R&D projects		training materials					x		
WP3	LL3 - IoT for Silk Road Route	achievements, obstacles and issues	ILiM	publications, new R&D projects		training materials					x		
WP3	EGTN Generic Use Case		ZLC	publications, new R&D projects			recommendations to the EC, disadv. Regions and public authorities				x		
WP3	EGTN impact assessment		CERTH	publications, new R&D projects		training materials on the EGTN					x		
WP3	IoT Proof of concept	IoT PoCs based on DASH7, RFID, LPWSN and sensor systems to support the Polish and EU logistics industry	ILiM	publications, new R&D projects		training materials		x	x			x	
WP3	Blockchain Platform	Synchromodality based on a Blockchain enabled platform - combination of intelligent routing driven by advanced IoT and analytics and encapsulated in Blockchain platform. This PoR platform will further enable the Port to become an intelligent hub for all of their customers in a future PI world.	Blocklab	publications, new R&D projects		training materials		x	x			x	

Figure 3-3. PLANET outputs in WP3 and their potential

				Potential of the output							Potential (clustered)		
WP	PLANET output	Description	Leader/owner	Reasearch	Consultancy	Education	Recommendations	Hardware	Software	Analytics	Research Consultancy Education	Hardware/Software/Analytics	Recommendations
WP4	Briefing EGTN reports including disadvantaged regions		WI				for developers of Horizon Europe and CEF calls						x
WP4	Recommendations for TEN-T Interfacing to Global trade routes		PAN			briefing sheets, case studies/tea	policy guides						x
WP4	PI-facilitating technology Roadmaps	understanding of the impact of emerging disruptive technologies on the PI	ZLC	roadmap		roadmap	roadmap						x
WP4	Recommendations for PLANET standardisation		ILiM				recommendations for standardization						x

Figure 3-4. PLANET outputs in WP4 and their potential

3.3 Learning Material Specifications

The methodology undertaken in order to specify the learning material requirements included the design and delivery of an online survey aimed at the project partners and the Advisory Board members. More specifically, the survey aspired to validate the relevance of the project outputs to the stakeholder groups and to assess their learning needs and potential interest on relevant e-learning courses.

The respondents were asked to provide the following information:

- name, e-mail, position in their organisation
- user group to which they belong to according to the classification of 3.1 and
- group of outputs of their interest: i) Research, Consultancy and Education, and/or ii) Hardware, Software and Analytics, and/or iii) Recommendations.

The following information was requested per project output:

PLANET Output XYZ

- Short description and link to the project repository, if available.
- Relevance of the output: Is this output relevant to you? (Likert scale 1-5)
- For the higher levels of the scale: I am interested in the value that brings to my business/technical capabilities.
- What is your current level of knowledge regarding this topic (Likert scale 1-5)?
- Please elaborate what would be your learning needs around this topic (open question).
- Would a e-learning course on this output be of interest to you? (Y/N)

A indicative version of the survey can be found in Annex I that includes the questions for two PLANET Outputs.

Figure 3-5 shows the profile of the survey respondents. The most represented stakeholders groups include Academia, Middle level management (end users), and solutions providers.

Figure 3-5 Learning materials needs per stakeholder group respondents' profile

No representatives from end user-top level management and policy makers took the survey. For the latter group, the project team assumed that they would be mainly interested in the project outputs under the "Recommendations" category.

Table 2 presents the aggregated interests per category of users in the groups of project outputs.

Table 2. Thematic groups of outputs

Users	Thematic groups of outputs		
	Research/Consultancy/ Education	Software/Hardware/ Analytics	Recommendations
End user- middle level management	x		x
End user- IT and Analytics Departments		x	
Solutions provider	x	x	

Business Consultant	x		
Ports, Administrations and Authorities (including Customs)	x		
Universities, Research Institutes	x	x	x
Policy Makers			x

The following table (Table 3) shows the outputs of the project that received more interest on an e-learning course (considering all stakeholder groups). The outputs highlighted in green colour, are the ones with the highest number of positive votes.

Table 3. Users interest in an e-learning course per PLANET output

	#	Output	Votes in favour of an e-learning course
Group 1 Research/Consultancy /Education thematic group of outputs	1	EGTN Foundational Position papers	0
	2	EGTN Modelling and simulation capability	9
	3	Simulation based impact of new trade routes on the TENT-T and disadvantaged regions	6
	4	Simulation-based analysis of T&L and ICT innovation technologies	7
	5	EGTN reference specifications	8
	6	MAMCA support models	7
	7	LLs Case Studies achievements, obstacles and issues.	5
Group 2 Software/Hardware/Analytics thematic group of outputs	8	Cloud-based ICT Infrastructure Architecture	2
	9	IoT infrastructure	4
	10	IoT proof of concept	5
	11	Connectivity Infrastructure	5
	12	Predictive and optimisation analytics	8
	13	Services for intelligent PI nodes and network	6
	14	Interoperability BC	4
	15	BC platform	4
	16	PLANET dashboard	0
Group 3 Recommendations group of outputs	17	Recommendations for TEN-T Interfacing to Global trade routes	3
	18	Services for Intelligent PI Nodes and Network	4

	19	Multi-user and multi-criteria decision support models	6
	20	EGTN briefing sheets	
	21	PI-facilitating roadmaps	4
	22	Recommendations for PLANET standardisation	3
	23	Foundational position papers	

Based on these results, the following Learning Courses were proposed for development:

1. EGTN concept and specifications
2. Corridor Connectivity Index
3. Business Analytics toward PI
4. Innovation Technologies: Impact and Roadmapping

The courses were designed and developed in the context of ST4.3.3 and are presented in Chapter 4.

4 Learning Courses

This chapter is dedicated to the four learning courses that have been developed in the PLANET project based on the project process and outcomes. The learning courses can be used to interact with a variety of audiences, including public and business stakeholders but also students that represent a new generation of decision makers.

Based on the learning requirements surveyed in Task 4.3.1, four learning courses have been identified. The criteria for the focus and setup of the learning courses were the following:

(1) the courses connect with interests of the target audiences.

(2) the content is readily available from the project outputs, although it may need to be converted into learning materials, and

(3) the open library should be able to support the courses by providing public materials.

Following on the survey results from Task 4.3.1 (presented in chapter 3), it became apparent that the following central topics of the PLANET project connected well with stakeholder interests: Integrated Green EU-Global T&L Network (EGTN), Network Connectivity, Multi-Actor Multi-Criteria Analysis (MAMCA), Data Analytics, and Physical Internet. As MAMCA is a concept well described in the current body of knowledge[4], it was not incorporated in the new learning courses. Based on the correspondence with the most preferred output goals (Table 4), the following learning course topics were selected:

1. Integrated Green EU-Global T&L Network (EGTN)
2. Corridor Connectivity Index (CCI)
3. Business Analytics Towards Physical Internet (BA towards PI)
4. Innovative Technologies: Roadmap towards Physical Internet (Roadmap towards PI).

Table 4. Correspondence learning courses with output goals PLANET project

#	Name	Output goals
1	EGTN	• EGTN Modelling and simulation capability. • Simulation based impact of new trade routes on the TENT-T and disadvantaged regions. • EGTN reference specifications.
2	CCI	• Connectivity Infrastructure.
3	BA towards PI	• Predictive and optimisation analytics. • Services for intelligent PI nodes and network.

[4] See for example Cathy Macharis, Laurence Turcksin, Kenneth Lebeau (2012). Multi actor multi criteria analysis (MAMCA) as a tool to support sustainable decisions: State of use. Decision Support Systems 54(1): 610 – 620. https://doi.org/10.1016/j.dss.2012.08.008

4	Roadmap towards PI	• Simulation-based analysis of T&L and ICT innovation technologies. • IoT infrastructure and proof of concept. • PI-facilitating roadmaps.

For each of the learning courses, a course manual was developed and provided to the course attendees that caters a variety of setups. A two-hour workshop setup is provided including learning materials that have been piloted in the project with consortium members. The course manuals also offer more extensive learning course setups. An overview of the course manuals can be found in section 4.1.

In addition, for each of the learning courses, a reflection on the pilot workshops is provided in section 4.2.

The course manuals and learning materials were uploaded and are currently available in the Electronic Visualisation Library, which is presented in chapter 5.

4.1 Courses Structure and Content - Overview of the course manuals

The following subsections present in detail the four developed learning courses.

4.1.1 EU-Global Transportation & Logistics Network (EGTN)

The vision of PLANET is to advance the European Commission's strategy for Smart, Green and Integrated Transport and Logistics by efficiently interconnecting infrastructure (TEN-T, Rail-Freight Corridors) with geopolitical developments, as well as to optimise the use of current & emerging transport modes and technological solutions, while ensuring equitable inclusivity of all participants, increasing the prosperity of nations, preserving the environment, and enhancing Citizens quality of life. The realisation of this vision is what PLANET calls the Integrated Green EU-Global T&L Network (EGTN). One major objective that PLANET approaches is to assess the impact of emerging trade corridors on the TEN-T network and ensure effective connectivity and sustainability of the European Global Network. Hence, being aware of geo-economic developments that drive these emerging trade flows is of crucial importance.

The objectives of this learning course are fourfold:

Objective 1: Understand the concept of EGTN.

Objective 2: Identify and assess different trends for influencing the development of EGTN.

Objective 3: Understand the concept of a diagnostic model and scenario planning.

Objective 4: Apply scenario planning to the EGTN in the context of the emerging routes.

The learning course consists of (a) presentation of background information and theoretical concepts through a guided discussion, (b) based on pre-reading materials handed to the participants ahead of time, and (c)

workshops that teach participants the proposed methodology. It is structured into three modules: each meeting specific course objectives. These are the following:

Module 1: Introducing the EGTN concept (Objective 1)

Module 2: Introducing current trends affecting the TEN-T network (Objective 2)

Module 3: Working with a diagnostic model and scenario planning (Objectives 3&4)

As the main aim of the course is to communicate to the participants how to work with the diagnostic model and scenario planning methodology, most of the course consists of interactive exercises related to these concepts. The **delivery formats** include offline or online tutorials as well as interactive sessions.

Depending on the audience, the necessary background information should be first presented and discussed, for which pre-reading materials and slide decks are provided. The **course materials** include:

Material 1: PLANET position paper on impact of the new trade routes to the TEN-T network (PP2).

Material 2: PLANET methodology description on model & scenario building.

Material 3: Documentation on Open EGTN Platform architecture.

Material 4: Slides deck for the introductory modules.

Material 5: 4 short case studies about 3 emerging routes (Arctic, BRI, North-South) and one focusing on the disadvantaged regions.

Depending on the audience's familiarity with the topic, the introductory modules of the workshop and the time given to work on the tasks can be either reduced or increased. The agenda below (Table 5) is ideal for participants who are familiar with the field (experienced professionals or Master students in a supply chain and logistics program), but not with the presented topics specifically. A one-day workshop (5 hours + breaks) is therefore suitable for them to get familiar with these concepts but can easily be extended to two days if the expected output from the tasks is more complex. For participants who are not that familiar with general logistics and supply chain topics either, some extra content to be covered is included in the slide decks.

The trial workshop is intended for participants already familiar with the PLANET project and therefore do not require theoretical introduction and training for the methodology.

Table 5. Recommended timetables for learning course EGTN

Section	Abridged workshop	Full workshop
Introducing the EGTN concept	-	45 min

Current trends affecting the TEN-T network	-	45 min
Diagnostic model and scenario planning	2 hours	4.5 hours
Introduction to the methodology of building a diagnostic model and scenario planning	10 min	30 min
Task 1: Building a diagnostic model for an emerging route	40 min	90 min
Presentations & discussion of Task 1	20 min	45 min
Task 2: Scenario planning for an emerging route	30 min	60 min
Presentations & discussion of Task 2	20 min	45 min
Total	**2 hours**	**6 hours**

4.1.2 Corridor Connectivity Index (CCI)

The TEN-T policy of the European Commission focuses on the implementation and development of a European network of roads, railways, inland waterways, sea routes, ports, and airports (European Commission, 2020a). The PLANET Corridor Connectivity Index (CCI) aims at capturing a transport node's level of integration in the TEN-T network as well as in the global maritime transport network, since accessibility and connectivity are indicators for the effectiveness of the transport network as an enabler for trade. This methodology envisages a connectivity index which indicates the best nodes in the transport network, reflected by seven components. The hypothesis is that the strongest nodes – with the highest corridor connectivity index score- are a predictor for the most favourable routes as reflected by actual shipped volumes. Ideally, a map with the corridor connectivity index of multiple seaports and inland ports will highlight the best route through the network by using the scores of each node in the network.

The CCI learning course has four objectives:

Objective 1: Understand the concept of hinterland connectivity as described in the literature.

Objective 2: Understand the various components of the CCI and the reasoning behind developing them.

Objective 3: Be able to use the different components of the CCI to determine connectivity in a certain corridor along the TEN-T Network.

Objective 4: Apply the results of the CCI on different topics (such as disadvantaged regions).

This learning course can be developed in multiple directions. A teaching note, student note, reading materials, exercises and slide deck are available. But this course can be extended very easily as well into a longer period. The course consists of 3 different learning modules:

Module 1: Introducing the CCI concept (Objective 1)

Module 2: Discussing the CCI components (Objective 2)

Module 3: Working with case study explanation tasks (Objectives 3&4)

The **delivery formats** of the above modules can be offline or online tutorials as well as interactive sessions. The **course materials** that support the workshop include:

Material 1: PLANET position paper, specifically the corridor connectivity methodology

Material 2: Working Paper Corridor Connectivity Index by Maurice Jansen & Hannah Mosmans;

Material 3: PPT Corridor Connectivity Index

Material 4: Slides deck for the introductory module

Material 5: Case studies and datasets to compute CCI *(Note: The case study has two versions, one for handing out to students and the other with a teaching note for instructors' use.)*

Depending on the audience's familiarity with the topic and the time available to the instructor, this learning course can be devised either as a half-day abridged workshop or as a one-day full workshop. The abridged workshop is based on the case study teaching note but includes simpler questions (Table 6). The full workshop follows the structure of and questions in the teaching note. This division of time in Table 7 offers an example. Depending on the audience, the different tasks could be narrowed down or further elaborated upon. Furthermore, the reading materials could be provided before the workshop, during the workshop or after the workshop.

Table 6. Recommended timetable for an abridged workshop (learning course CCL)

Section	Abridged Workshop
Introducing the CCI concept	40 min
Discussing the CCI components	
Explanation tasks	5 min
Task 1: Consider the maps on your given corridor • *Which inland ports are performing <u>best</u> and why?* • *How can these inland ports improve even more?*	40 min

• *Explain which CCI components will be affected by a disruptive event, such as long period of drought in summer. Which ports and terminals will be affected most?*	
Mentimeter[5] evaluating task 1.	25 min

Task 2: Consider the maps of your given corridor
• *Which inland ports are performing worst and why?*
• *Explain why inland ports have limitations enhancing their performance to the same level as the best performing inland ports.*
  ○ *Baltic-Adriatic: consider inland ports in Poland.*
  ○ *Rhine-Alpine: consider Italian ports.*
  ○ *Rhine-Danube: consider ports on the Danube vs ports on the Rhine.*
• *What is the way forward for these inland ports and how can they improve?*
	40 min

Mentimeter evaluating task 2.	25 min
Conclusion + thanking for participation	5 min
Total	**180 min**

Table 7. Recommended timetable for a full workshop (learning course CCL)

Section	Full workshop
Introducing the CCI concept	30 min
Discussing the CCI components	30 min
Explanation tasks	10 min
Task 1: Case study question 1 (in groups)	25 min
Discuss task 1 in class	10 min
Coffee break	30 min
Task 2: Case study question 2 and 3 (in groups)	40 min
Short presentation task 2	15 min

[5] https://www.mentimeter.com/

Task 3: Case study question 4 (in groups)	60 min
Lunch break	45 min
Task 4: Case study question 5 and 6 (in groups)	60 min
Final presentation task 3 and 4	45 min
Conclusion + thanking for participation	20 min
Total	**7 hours**

4.1.3 Business Analytics towards the Physical Internet (BA towards PI)

The TEN-T policy addresses a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes and railroad terminals. The ultimate policy objective is to close gaps, remove bottleneck and technical barriers in the EU. Traditionally, the development of the TEN-T network predominantly focuses on physical infrastructures and services developed on them. In the PLANET project, we propose to develop an Integrated EU Global Transport & Logistics Network (EGTN) that incorporates innovative technologies and is geoeconomics aware. We emphasize the need to develop digital infrastructures next to physical infrastructures with the accompanying services. In this learning course, we focus on business analytics tools enabled by digital infrastructures that help accommodate the optimal utilization of the physical infrastructures.

This PI learning course has four objectives:

Objective 1: Understand the main principles of the (roadmap towards the) Physical Internet (PI).

Objective 2: Apply the main principles of the PI in a specific logistics environment.

Objective 3: Understand basic principles of predictive and prescriptive business analytics.

Objective 4: Analyze the relevance and application of business analytics in the context of services for intelligent PI networks, based on a specific logistics situation.

The learning course contains the following 3 modules:

Module 1: Introduction to Physical Internet (PI)

Module 2: Introduction to Business Analytics techniques (BA)

Module 3: Working with case study to apply BA

The **delivery formats** of the above modules can be offline or online interactive sessions, or online collaborative workshop sessions. The **course materials** that support the workshop include:

Material 1: PLANET position paper on PI

Material 2: PLANET case study on PI in the last mile delivery in Madrid

Material 3: PLANET EGTN Support Services based on Big Data Analytics Models Slides deck for theory and introduction.

Material 4: PLANET EGTN Solution Description and Test Results

Material 5: Slides deck for theory and introduction

Material 6: Other readings, e.g., selected ALICE documents on PI

Depending on the audience's familiarity with the topic and the time available to the instructor, this learning course can be devised either as an abridged workshop or as a full workshop (see **Table 5**). The instructor can also decide to narrow down or further elaborated upon the given tasks based on the audience knowledge of the topics.

Section	Abridged Workshop	Full Workshop
Warming up	5 min	5 min
Explanation of tasks	5 min	5 min
Introduction of PI and main types of BA	15 min	45 min
Task 1: Discussion about specific PLANET Use Cases from the Living Labs	5 min	30 min
Reflect on the application of BA in the use cases (in groups)	30 min	40 min
Presentation of main results and discussion with the whole class	15 min	30 min
Task 2: The Big Picture: How can different BA components contribute to PI (in groups)	30 min	40 min
Presentation of main results and discussion with the whole class	10 min	30 min
Task 3: Teaching case: Last Mile Delivery in Madrid	0 min	2 hours
Conclusion	5 min	15 min
Total	**2 hours**	**6 hours**

Table 5: Recommended timetables for learning course BA towards PI

5.1.4. Innovation Technologies: Impact and Roadmap

The TEN-T policy addresses a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes and railroad terminals. The ultimate policy objective is to close gaps, remove bottleneck and technical barriers in the EU. Traditionally, the development of the TEN-T network predominantly focuses on physical infrastructures and services developed on them. In the PLANET project, we propose to develop an integrated transport and logistics (T&L) network that incorporates innovative technologies and is geoeconomics aware. We emphasize the need to develop digital infrastructures next to physical infrastructures with the accompanying services. In this learning course, the focus is on how technology innovations, next to regulatory developments and logistics innovations pave the way towards Physical Internet (PI) along a roadmap.

This PI learning course has four objectives:

Objective 1: Understand how technology innovations, regulations, T&L innovations, and research can contribute to the roadmap towards PI.

Objective 2: Analyze how different stakeholders contribute to the roadmap towards PI.

Objective 3: Develop and discuss roadmap steps by stakeholders towards PI based on feasibility and prioritisation.
Objective 4: Discuss roadmaps for specific logistics environments towards PI based as well as different scenarios of PI adoption and the role of different stakeholders for each of them.

The learning course contains the following 4 modules as outlined below:

Module 1: Introduction to Physical Internet (PI)

Module 2: Introduction to Innovation Technologies (e.g., blockchain, machine learning, LoT, 5G)

Module 3: Development of a roadmap towards PI and roadmaps for specific logistics environments (e.g., ports, city logistics, hinterland transport)

The **delivery formats** of the above modules can be offline or online interactive sessions, or online collaborative workshop sessions. The **course materials** that support the workshop include:

Material 1: PLANET position paper on PI

Material 2: PLANET EGTN Foundational Position Papers and Simulation Scenarios

Material 3: PLANET case study “Smart Contract enabled Synchromodal Transport”.

Material 4: PLANET policy guide, briefing sheets, and case study on freight transport for policymakers in emerging economies

Material 5: Slides deck for theory and introduction

Material 6: Other readings, e.g., selected ALICE documents on PI

Depending on the audience's familiarity with the topic and the time available to the instructor, this learning course can be devised either as an abridged workshop or as a full workshop (Table 8). The instructor can also decide to narrow down or further elaborated upon the given tasks based on the audience knowledge of the topics.

Table 8. Recommended timetables for learning course Roadmap towards PI

Section	Abridged Workshop	Full Workshop
Warming up	5 min	5 min
Explanation of tasks	5 min	5 min
Introduction of PI and main types of Technology Innovations	10 min	45 min
Task 1: Development of a roadmap for a specific logistics environment (in groups)	30 min	30 min
Reflect on the role and interdependencies among different stakeholders and technologies in the selected case (in groups)	15 min	40 min
Presentation of main results and discussion with the whole class	10 min	30 min
Task 2: The Big Picture: Work with different scenarios of PI adoption (in groups)	30 min	40 min
Presentation of main results and discussion with the whole class	10 min	30 min
Task 3: Teaching case: Smart Contracts Enable Synchromodal Transport	0 min	2 hours
Conclusion	5 min	15 min
Total	**2 hours**	**6 hours**

4.2 Pilots: Description and analysis of outcomes

The following four subsections present the four pilots including their outcomes.

4.2.1 EU-Global Transportation & Logistics Network (EGTN)

Workshop Date Tuesday, April 4, 2023, 9:00 – 11:00 (CET)

Before the workshop

A few days before the workshop, reading materials were sent to the participants for them to read before the workshop. The first document, *Suggested EGTN platform architecture*, elaborates on the definition and design of an EGTN platform. The second document, *Impact of the new trade routes to the TEN-T Network*, serves as an

introduction to the different transport networks that are developing and their impact on the TEN-T network. Finally, the third document, *the Diagnostic Model and Scenario Planning Methodology*, elaborates on scenario planning, the tool participants will use during the workshop. Apart from the reading materials, another document with case studies was sent to the participants, containing three relevant case studies focusing on different transport networks: the Belt and Road Initiative, the Arctic route, and the north-south corridor. The case studies document served as an introduction for the participants to the different networks, with a description of the network and relevant statistics for the last few years.

During the workshop

The workshop was initially planned as displayed in Table 9.

Table 9. EGTN Workshop agenda

Section	Time allocated
Introduction to the methodology of building a diagnostic model	10 min
Task 1: Building a diagnostic model for an emerging route	30 min
Introduction to the methodology of scenario planning	10 min
Task 2: Scenario planning for an emerging route	40 min
Presentations & discussion of Task 2	30 min
Total	**2 hours**

In **Task 1** the goal was to divide the group into three sub-groups, so we could use break-out rooms to discuss the three emerging trade routes. Given the small number of participants, it was decided to adjust the task and discuss the Belt and Road Initiative with the entire group, using Mentimeter. The main takeaways are:

Barriers

- The different levels of perception of technology in different regions.
- The different gauges when you compare East and West EU.
- There are different cultures in the different countries that the goods go through.
- Principal entry nodes might favour terminals such as Duisburg.

Opportunities

- Sharing information is a key component here.
- The land bridge of China is a big opportunity as a facilitator to develop the disadvantaged regions.
- The value added to the EGTN is the technology and accessibility.

In **Task 2** the Arctic Route was selected for discussion. We divided the group into two smaller ones and gave them 30 minutes to execute the task. The participants came up with interesting uncertainties, such as urbanization, level of activities within the Arctic area, temperature dynamics, geopolitical stability, and interconnection with global platforms. More time would have been needed to develop the different scenarios further.

Feedback from participants

Useful general feedback from the participants regarding the workshop is the following:

- **Awareness of participants**: adjust the introductory slides towards the relevant participant group, e.g., the Planet consortium is already familiar with the different routes, but another group might be less familiar and needs more explanation.
- The learning material is **comprehensive** enough. You have taken us this morning through a very well-structured and organised session, considering that you do not have much time. You do not have to go into too much detail because you must also stimulate the student to have questions.
- There are two different options for the **audiences**:
  - Senior people and professionals: short lecture also with integration of reading materials.
  - Students: interactive classroom. The reading may be provided after the exercise and not before.

4.2.2 Corridor Connectivity Index (CCI)

Dates Tuesday, April 6, 2023, 9:00 – 11:00 (CET) / Pilot 7 – 25 February 2022 with group of students

This course was developed to be piloted in a workshop (April 6th) but was also taught in a student class at Erasmus university. Given the lack of participants in the workshop (April 6th), the feedback presented here stems from teaching this course to students at Erasmus University. The course and the manuals have been revised based on that feedback.

More specifically, this course was validated twice with Erasmus student groups: in total 51 students in the context of a course on Port Operations and Data Analytics. This course was set up in 3 modules, spread out over 3 weeks. The second week was dedicated to Corridor Connectivity, while the third week focused on operationalising the CCI. Participants had to compute a corridor connectivity index using a pre-set Excel template with data on container terminals on a European TEN-T corridor.

Before the workshop

One week before the workshop, reading materials were sent for the participants to read ahead of time. The first document was the lecture handout which elaborates on the definition of connectivity concept. The second document was the scientific article that provides a more conceptual understanding on the importance of connectivity from an inland node perspective. The case studies document served as an introduction for the

participants to the different networks, with a description of the network and relevant statistics for the last few years.

During the workshop

In the week thereafter, participants were given the third document which is the case study handout. After a lecture on data analytics, participants were given time to work in a workshop on the CCI. The participants were given a few days of time to complete the CCI calculations – using an Excel template – and use the output in a presentation, which was then used to assess whether students had managed to comprehend and apply the learnings. The session ended with a debriefing.

Feedback after the workshop

The Monday after the week with the tutorial and presentation session, the EUR faculty reviewed the course with the faculty of the incoming group of participants. The Case Study was received well. Especially the type of case study and how it brings better understanding to the course contents was appreciated. The 'sandwich' approach was specifically mentioned: first build knowledge and understanding via lectures, then the case driven approach via the tutorial/workshop which is then concluded with student presentations and reflections. An opportunity for improvement is to tailor the workshop and CCI calculations to the audience, e.g., if there is an Italian group of participants, use the corridors that are most applicable to this context. Another element is to also elaborate how a better CCI can be achieved by practical solutions in the transport network. Who needs to do what in which part, transport node or connection and where will that result in a higher performance?

4.2.3 Business Analytics towards the Physical Internet (BA towards PI)

Date Wednesday, April 12, 2023, 11:00 – 13:00 (CET)

Before the workshop

The participants received some days prior to the workshop an e-mail with a short description of it (learning objectives, structure, and agenda), as well as some suggested pre-reading materials.

The links to Zoom[6] and Miro[7] online environments were also sent; Zoom for the introduction and discussions and the Miro board for the interactive sessions.

During the workshop (including participant feedback)

The workshop started with a short introductory presentation, during which the main principles and key concepts of Physical Internet and the main techniques of Business Analytics were discussed. The presentation sparked a discussion among participants about lessons learned from the maritime/container industry that can be

[6] https://zoom.us
[7] https://miro.com

transferred to other logistics environments. It was highlighted that to achieve standardisation one has to go through modularisation. A participant claimed that, in addition to the use of technology, co-loading (better utilization of resources) is the way to reduce costs. The importance of visibility in the system was also highlighted. Furthermore, the pivotal role that carriers play in a door-to-door chain was discussed, and the struggle of power that this might entail was underlined. It is worth mentioning that the participants think that port operators are interested in the last mile to make money by creating value there but also this gives them the opportunity to take decisions about ports etc., so maybe we notice two competing rationales in that case.

Following this discussion, the participants were invited to connect to the Miro online board and select a PLANET use case to focus and analyse how BA techniques were used. A short description was offered to them to refresh their memory and pick between two use cases of the PLANET Living Lab 1: The first one was the Madrid Last Mile Distribution case, so the focus was on city logistics, and the other one the China – Europe: Iberian PI Network Connection, hence the focus was on global corridors. The participants voted using sticky notes on Miro and the results showed that they preferred to analyse the global corridors case. In this use case, prescriptive analytics were used.

Following that, the participants were asked to reflect on the application of BA in this use case, using a 4 Ls retrospective table (Liked, Learned, Lacked, Longed for), having in mind the following questions:

- Has the method been used to its full potential?
- What other BA methods could have been useful for this case?
- What are the prospects of using alternative methods?
- What are the lessons learned that can be applied to other cases?

The results of this process are presented in Figure 4-1.

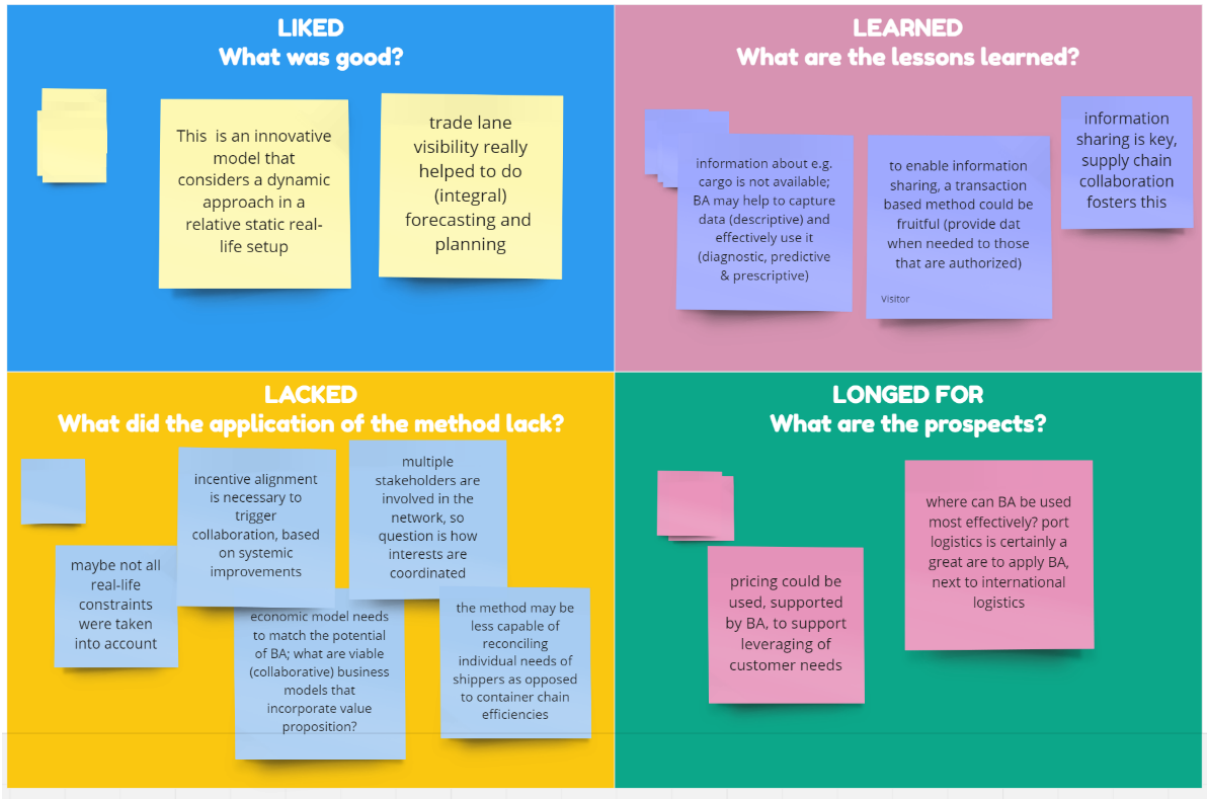

Figure 4-1. Results of the 4 Ls retrospective process

The participants added that in relation to what can be learned from the application of BA in this particular case, that sometimes it is taken for granted that the information regarding the content of a container is there. But this is not necessarily true, as most of the times the information is not there, and what is inside the container is not known.

It was also highlighted that to make any application applicable in the marketplace, an economic interest needs to be created. To move IT from theory to practice, the economic basis for the market to use this application needs to be created, possibly through increased competitiveness and reduction of cost. An economic driver was found to be important as an incentive to make partners cooperate. This economic driver could be reduction of cost, increase of efficiency, easiness of customs declaration, safety of the cargo etc.

In addition to that, a participant mentioned that it is important to identify as well the places where the BA forecasting can be used, that is why he thinks that the use of teaching cases is crucial in the learning course, in order to move from the abstract discussion to reality; he thinks that you have to specify the places where these operations are going to take place.

Next, the participants were asked to move from specific to general and think of the big picture, with the first question to be discussed being how different BA components can contribute to PI. The results of the thought process in Miro are presented in the following figure (Figure 4-2).

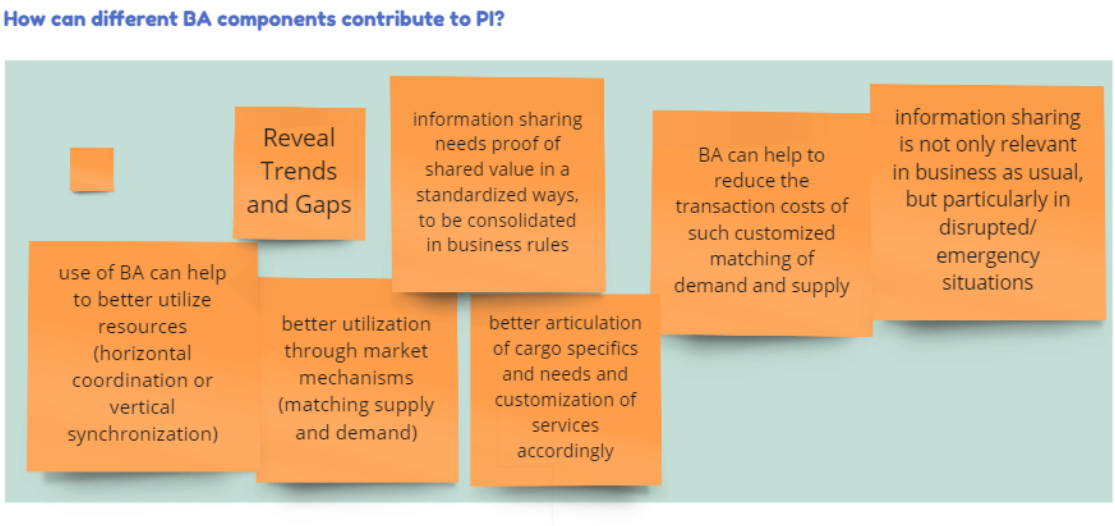

Figure 4-2. Answers to the question how different BA components can contribute to PI

A participant added that BA can contribute in terms of better utilization of available resources and then it was discussed that market mechanisms can be used to match supply and demand and go for customization of services according to these needs, and that BA can help to reduce transaction costs of this mismatching of demand and supply. The transparency of the information was also found to be important, to find a standardised way so people know that there is added value from their information sharing. Bilateral agreements were suggested to build the trust and it was emphasized that more standardized ways are needed to match provisional data with the added value. It was also mentioned that the transportation network should be resilient, and the emergency response can contribute to that.

To conclude the workshop, the participants were asked to complete an impact/effort matrix for BA techniques towards PI. The results of this process can be found below (Figure 4-3).

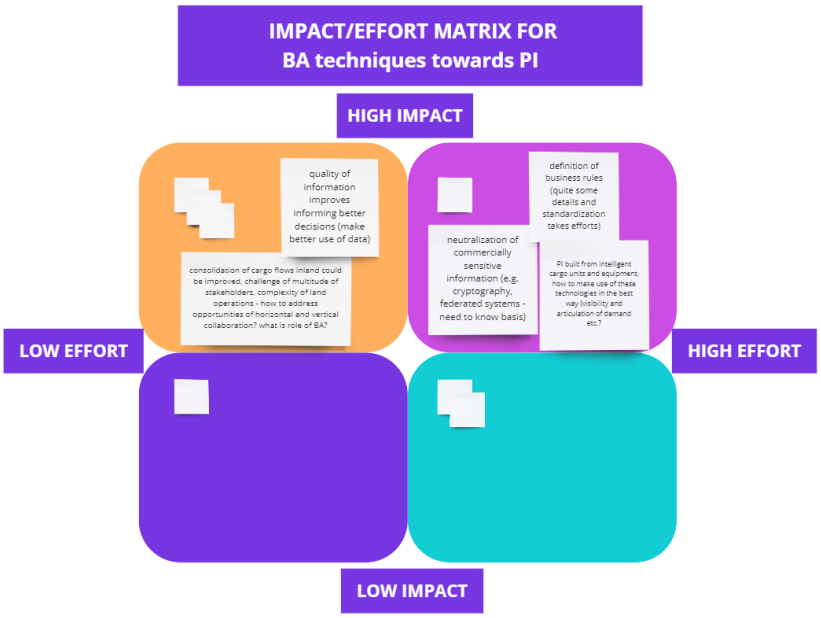

Figure 4-3. Impact/Effort Matrix for BA techniques towards PI

It was underlined that a low effort, but significant in terms of results, idea would be to use better the information we now have, while a high effort/high impact action would be the neutralization of the commercial sensitive information because it can be a pre-requisite for sharing, possibly using cryptography. Using BA techniques often requires support from IT infrastructure, which has an entry cost, and this is something to be kept into consideration according to some workshop participants. Finally, they referred to the fact that one of the challenges for co-loading is that people could feel indeed that they share sensitive information with their competitors and that BA can play a role in addressing this issue.

Additional remarks

It should be noted, since the number of participants was lower than expected, the moderators decided on the spot to skip the warming up activity and the Miro voting sessions that were planned in the agenda, as the latter makes more sense when there are many participants. Moreover, some participants expressed the view that you have to be familiar with the Miro board (or new technologies) in general in order to be able to fully participate in the interactive sessions, that is why, in order to be more inclusive it was decided to replace some of the Miro activities with discussion on Zoom (while the moderators were adding some post-it on Miro based on this discussion). This is something to be considered though when the learning course is addressed to post-experience participants, that may be less familiar with this type of online interactive activities.

For an overview of the Miro board with the full questions and answers set, please use the following link: https://miro.com/app/board/uXjVMTnVCEI=/?share_link_id=132106736808

4.2.4 Innovation Technologies: Impact and Roadmap

Date Friday, April 14, 2023, 11:00 – 13:00 (CET)

Before the workshop

The participants had received some days prior to the workshop an e-mail with a short description of it (learning objectives, structure, and agenda), as well as some suggested pre-reading materials.

The links to Zoom and Miro online environments were also sent; Zoom for the introduction and discussions and the Miro board for the interactive sessions.

During the workshop (including participant feedback)

The workshop started with a short introductory presentation, during which the main principles and key concepts of Physical Internet and Innovation Technologies were discussed. During the presentation, a discussion took place among the participants regarding cross-learning and more specifically about what lessons learned from the maritime container industry can be transferred to other logistics environments. A participant claimed that, in addition to the IT application, maybe the most important lesson learned is about standardization, as we see more and more the importance of standardised units to facilitate loading and unloading of packages. In the continental business there are different shapes and sizes, and while more and more the clients would like to go towards the standardized container transportation, but we are not there yet.

It was also mentioned that an interesting aspect to look at can be the size of larger containers – in addition to the pi containers – as right now the ideal size of container seems to depend on the continent on which you are on (reference to the difference standard container sizes in Europe and the USA).

A participant who is looking at things from the decision-makers and urban planning perspective highlighted that the last mile connectivity of the supply chain is what interests them more. He added that since we are moving to a cleaner and more electrified fleet for deliveries, these standardized containers are also going to dictate what kind of space is required.

The participants were invited to connect to the Miro online board, select a logistics environment (last mile or gateway to hinterland) and study its roadmap towards PI. Please note that for this pilot workshop we built upon the outputs of the PLANET online workshop that took place on 29 June 2022 and used the opportunity of this workshop to validate those findings (roadmaps). The participants chose to focus on the roadmap of the last mile logistics environment. They were then asked to spend some time to review the roadmap and see if they have any comments/remarks/additions to it.

One of the participants commented that he thinks that for intermodal transport blockchain technology is often seen as a must, but this is usually not the case in practice. Therefore, according to him there is a question about blockchain technology; we do not really see the benefits yet, so why we should go in this direction necessarily if we do not see the benefits?

It was then underlined that it is critical to be able to explain why we need blockchain. They will be some need for sharing data in a very controlled way among stakeholders, and blockchain is an interesting choice for that, but there are also other choices, so we must carefully explain why we need it to stakeholders.

Another comment was that the European institutions will have an important role to play in the field of establishing standards for containers. For the transport and logistic companies, it was said that in around 10 years they will probably be operating in a more automated way, but right now we are not there yet mainly because of the cost (e.g., blockchain, autonomous vehicles inside the warehouses etc.) Moreover, it was emphasized that there is a lack of professionals in this field, and that this is something that operators notice and hope to change in the next years with the help of knowledge institutions and authorities.

The Port of Rotterdam was brought up as an example, as there is dedicated infrastructure to use automated vehicles, but this would require a high level of safety in the operation and this indicates a bit the barriers of introducing AVs, as the lack of professional talent is considered fact. This was highlighted as a great contribution to the discussion, and it was said that it should be emphasized as an important factor to withhold form this discussion.

Another participant added that creating the necessary conditions and ensuring that privacy guidelines will be kept is also of crucial importance. Following that it was mentioned that standards and best practices can be a bit conflicting – there is always an interesting trade-off to be made. Things must be done in a specific way to fit the needs of the city and on the other hand, cross-learning is also important. Furthermore, a participant said that as the project focuses also on disadvantaged regions, we should keep in mind that standardization can help these regions leapfrog in a different state; this can also be the role of European projects, to disseminate the role of such platforms etc.

The role of the government and authorities was found to be also important because they can accommodate innovations through spatial planning activities for which they are responsible (e.g., city hubs), in addition to introducing standards etc.

After the discussion regarding the roadmap, the participants moved to the next task which was to identify how innovation technologies can be enablers to address challenges in the selected logistics environment (last mile). The following figure presents the results of the brainstorming that took place using Miro (Figure 4-4).

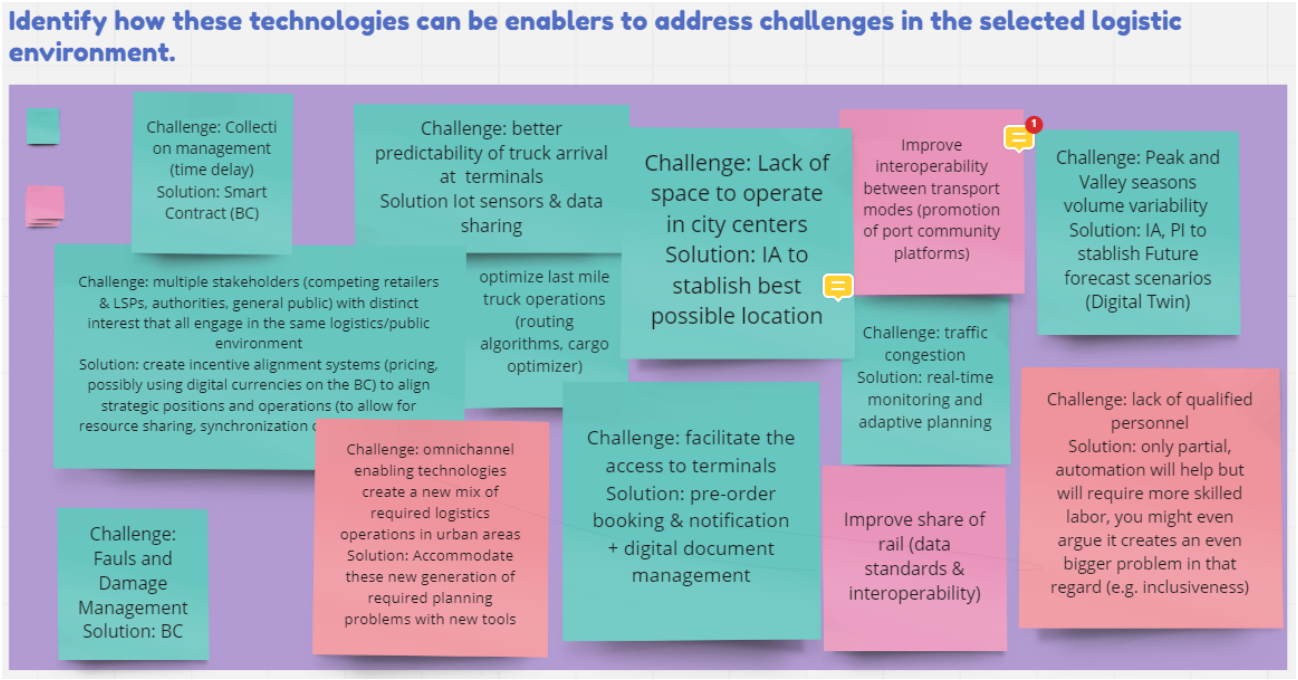

Figure 4-4. Ways in which innovation technologies can be used as enables to address challenges in last mile logistics.

There was a comment about seasonality – how you can make sure that different activities are well aligned (e.g., early delivery of goods during congestion times)? It was mentioned that to deal with the needs of freight mobility and the congestion situation in urban areas we can use predictive models to make sure stakeholders are aware of the situation but also incorporate it in the planning process using all kinds of optimization intelligence. It was found to be important to focus not only on the strategic planning of the logistics system but also the spatial and urban planning.

Another idea that was discussed was providing a mix of delivery options, all kind of combinations (omnichannel) – but this would require a whole new way of operations. we need much more interoperability; local authorities use more and more port community platforms to get the information. It was suggested that possibly there could be urban community platforms like we have port community platforms, accommodated, or managed by the municipality, although it is easier to develop such a platform in the port level.

The participants were then asked to identify potential obstacles and impeding factors that could pose a risk on the necessary activities to be performed for the roadmap to work; what are the implementation risks of the roadmap in terms of the independent activities but also from the perspective of the roadmap as a whole. The answers can be found in the following figure (Figure 4-5).

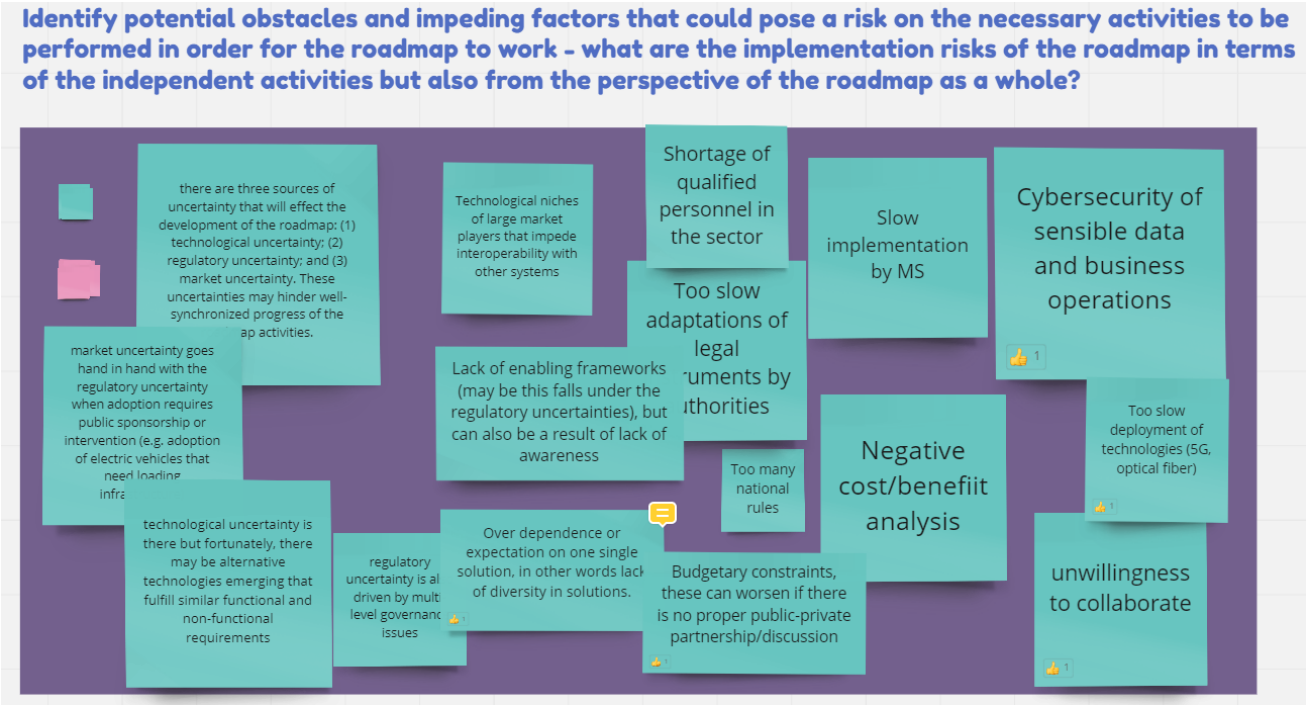

Figure 4-5. Potential obstacles and impeding factors for the implementation of the roadmap

Finally, the participants were asked to comment on the interdependencies among stakeholders and different technologies (Figure 4-6).

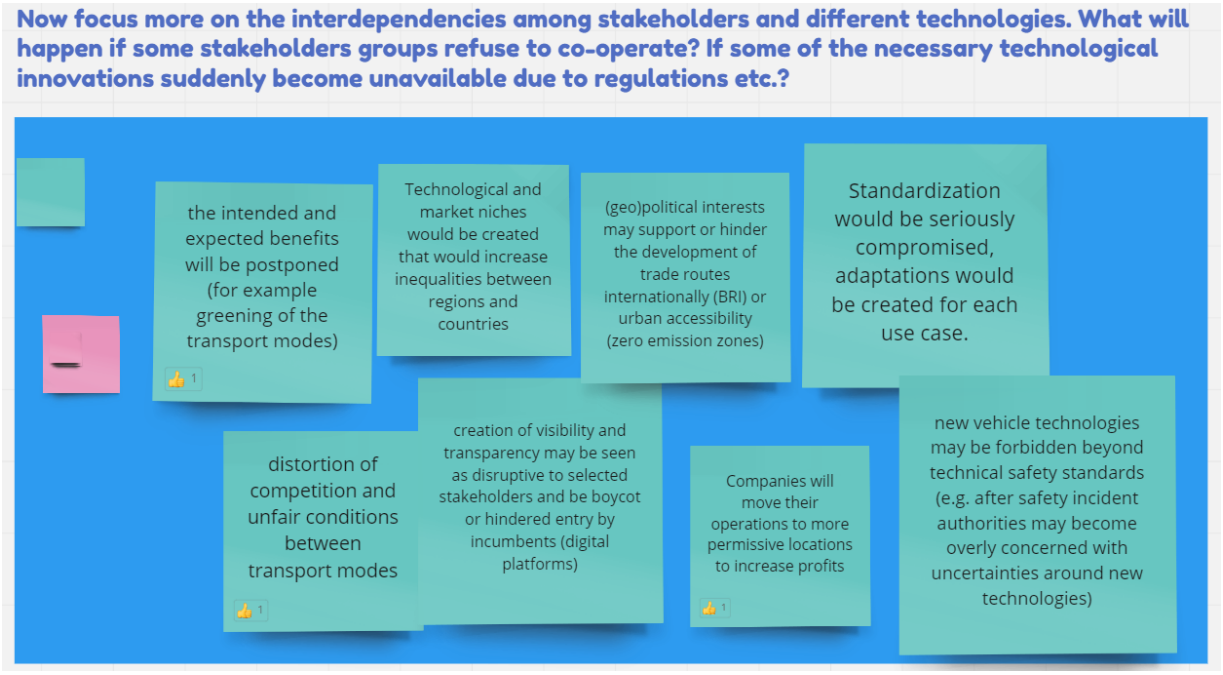

Figure 4-6. Discussion on the interdependencies and what would happen if different challenges occurred.

Additional remarks

It should be noted, that since the number of participants was lower than expected, the moderators decided on the spot to skip the warming up activity and the Miro voting sessions that were planned in the agenda, as the latter makes more sense when there is a large number of participants. Moreover, it was decided to replace some of the Miro activities with discussion via Zoom.

For an overview of the Miro board with the full questions and answers set, please use the following link:

https://miro.com/app/board/uXjVMVgwV-g=/?share_link_id=362141126136

5 Electronic Visualisation Library

This chapter reports on the work undertaken under ST4.3.2, and more specifically it presents the Electronic Visualisation Library of the outputs delivered in WP1, WP2 and WP3. The outputs are delivered in the form of learning courses, which are the focus of ST4.3.3 and are presented in chapter 4. These were developed in accordance with the user classification undertaken in ST4.3.1 and reported in chapter 3. In addition to the previously mentioned the open-source components developed during the project's lifetime were brought together in the form of an open-source library.

5.1 Open-Source PLANET GitLab

The PLANET codebase has been brought together under one single umbrella: the PLANET GitLab repository (https://gitlab.com/planet-h2020). The various software components developed by the project partners have been integrated within the repository in the form of subgroups and subprojects as depicted in Figure 5-1.

GitLab was chosen as the ideal candidate for the open-source library, as it offers a number of significant features:

- It fosters collaboration. It allows developers and modellers to review, comment and improve each other's code.
- It encourages reusability and extendibility of a project. By uploading the codebase to an open library, any party interested in reusing or even extending any of the project's open-source components is empowered to do so.
- It allows track & trace. It has a powerful auditing feature for all collaborators within the project.

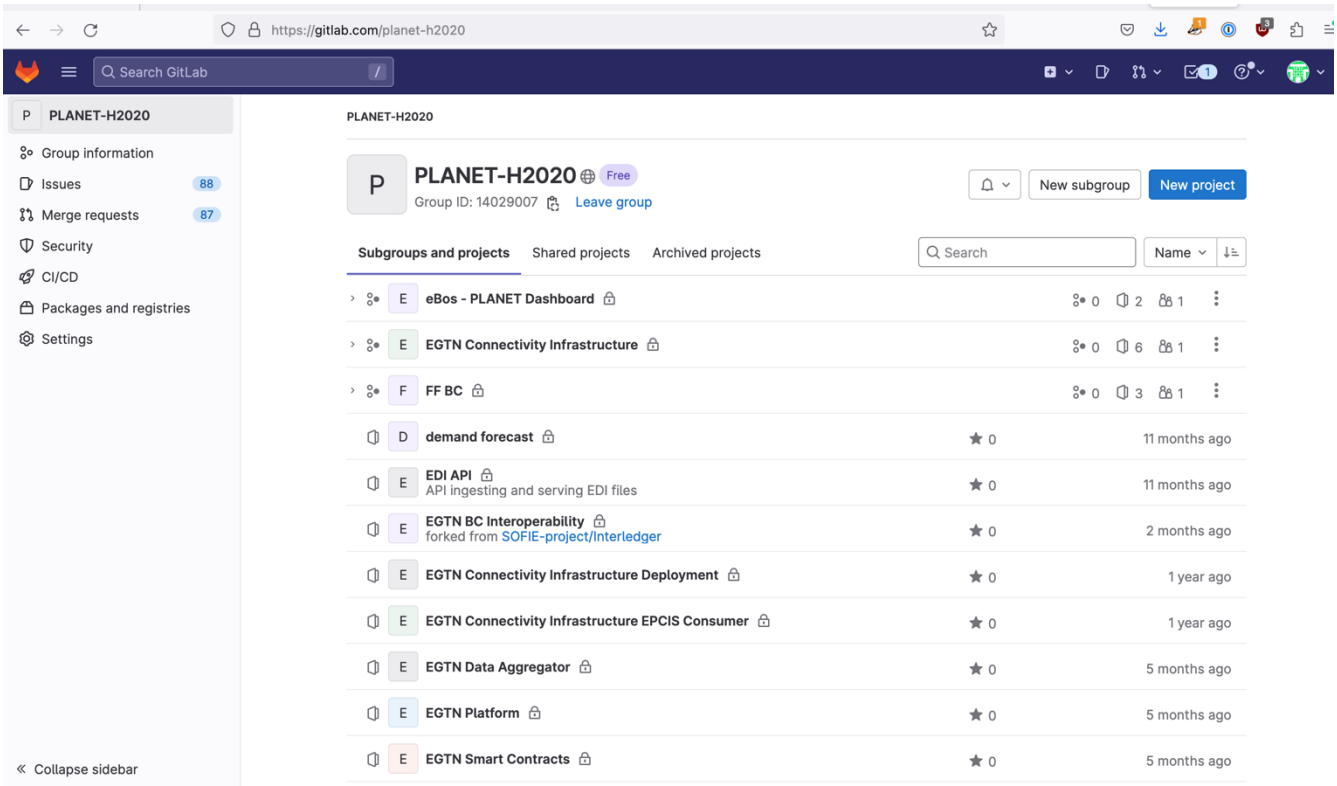

Figure 5-1. PLANET GitLab Repository.

Several components have been made available as open-source, as indicated in Figure 5-2. PLANET Open-Source Components.

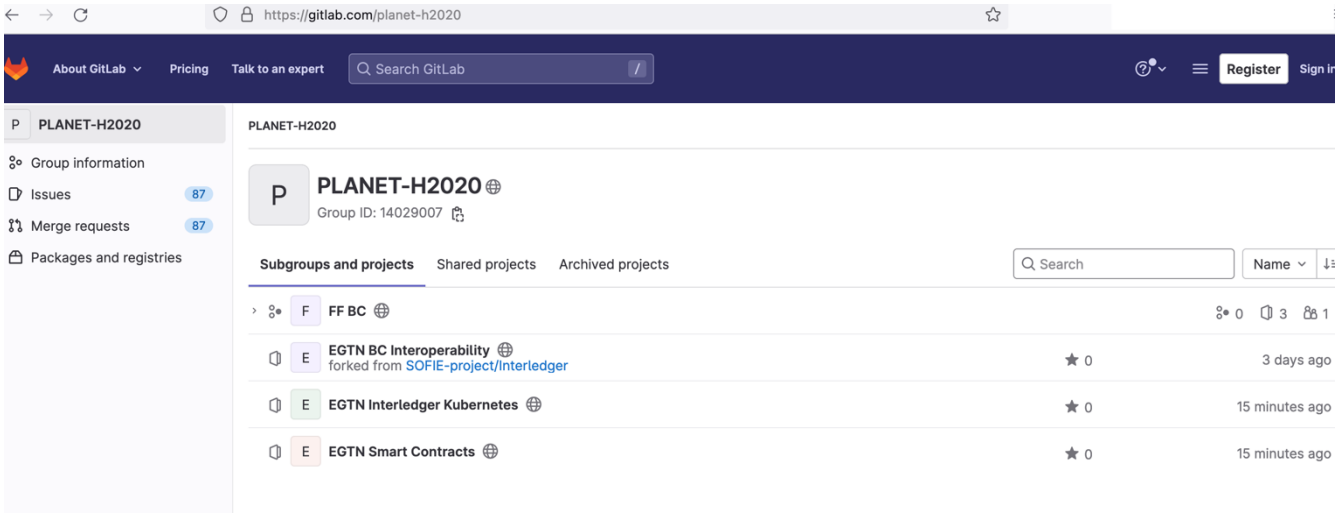

Figure 5-2. PLANET Open-Source Components

However, in some cases restrictions do apply and this is mainly due to:

- Pending patents.
- Internal organisation policies that do not allow code sharing outside their entities.

Restricted components are available to GitLab users that have been authorised by the PLANET GitLab administrator.

Overall, the idea behind releasing the project's technical components as open source is to enable reusability and extendability by any interested party. In this manner, anyone is encouraged to adapt and build on top of the technical solutions developed in PLANET.

5.2 Library for the Learning Courses

The Electronic Visualisation Library, i.e., the home for the courses developed in the context of this task (T4.3) and presented in section 4.1, can be found in https://openedx.inlecomsystems.com. We have selected a self-managed distribution of Open edX, as it is a free-of-charge and open-source solution that can be hosted on the PLANET servers. In addition to this, it is a scalable learning software platform that provides all the necessary functionalities for the design and delivery of online courses including interaction among course attendees.

Table 10. Learning courses

Course Code	Course Title
PLANET1	EGTN
PLANET2	Corridor Connectivity Index
PLANET3	Business Analytics towards PI
PLANET4	Innovative Technologies towards PI

The Electronic Visualisation Library offers all four courses developed in ST4.3.3, as presented in Table 10. A user who has enrolled in all the courses, may view them once logged in as shown in Figure 5-3.

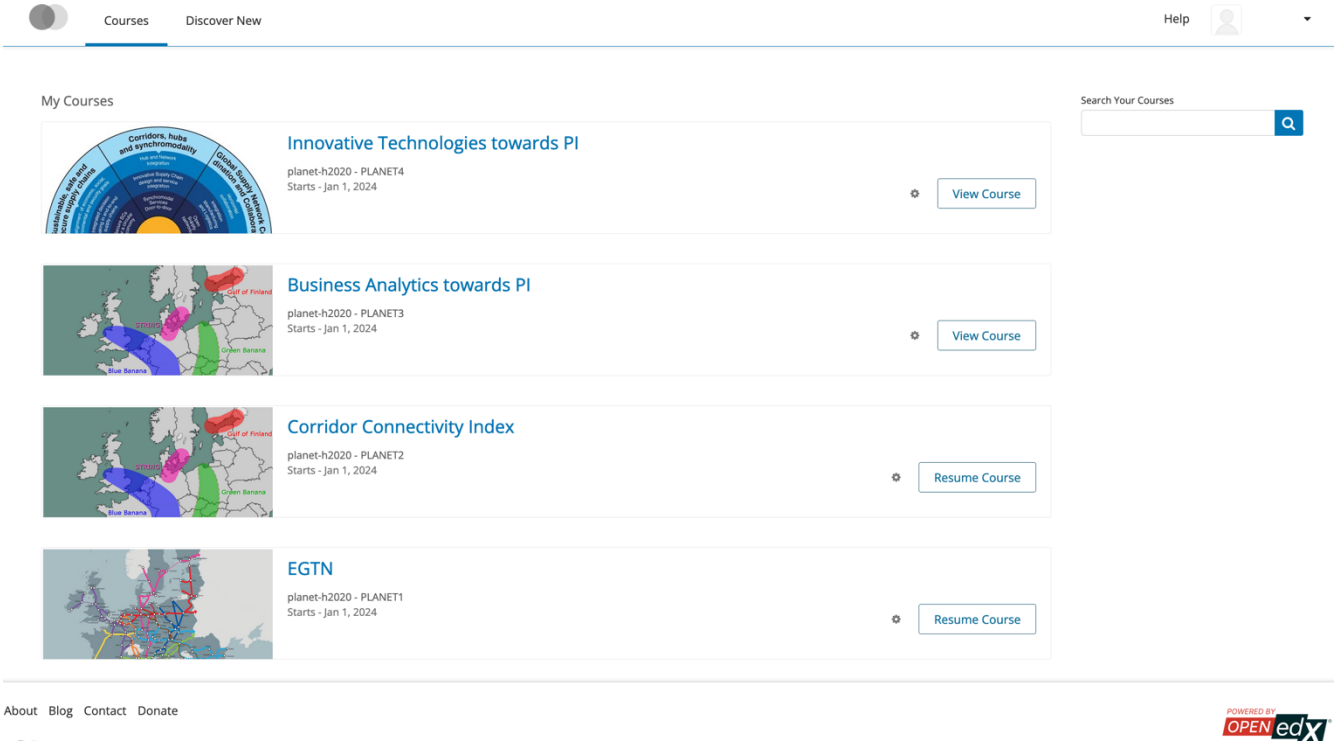

Figure 5-3.Dashboard of a user enrolled in all PLANET courses.

5.2.1 Courses Structure

The following paragraphs present the different components of the Electronic Visualisation Library as developed on Open edX.

5.2.1.1 Summary Page

All courses have an introductory page that sets the scene for each course; what the course is about, what are the learning objectives and what is the reading material necessary for the course completion. The presented material is taken from the courses manuals developed in ST4.3.3 and presented in chapter 4. Figure 5-4 illustrates the EGTN Summary page as such an example. Links to all summary pages are provided in Table 11.

Table 11. Course Summary Pages

Course Code	Course Title	Course Summary Page
PLANET1	EGTN	EGTN Summary
PLANET2	Corridor Connectivity Index	CCI Summary
PLANET3	Business Analytics towards PI	BA Summary
PLANET4	Innovative Technologies towards PI	IT Summary

Figure 5-4. EGTN Course Summary page

5.2.1.2 Reading Material

The final section of the Summary Page lists the reading material that is expected from the course students to read ahead of the course attendance (Figure 5-5).

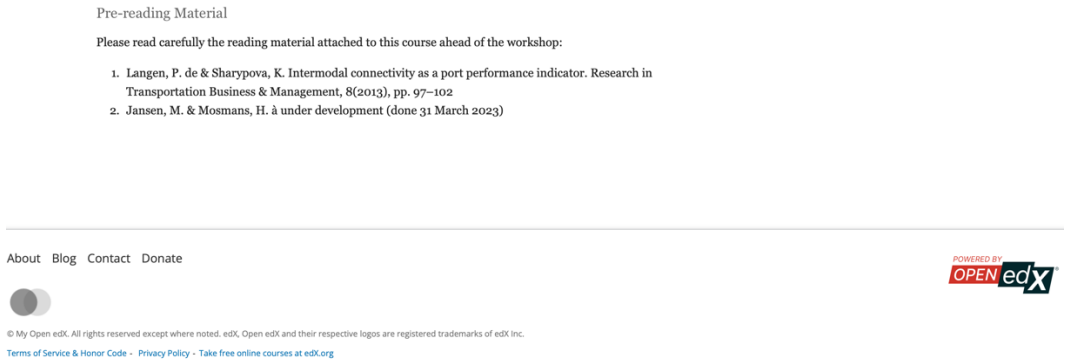

Figure 5-5. Reading Material for Corridor Connectivity Index course

The actual files containing the reading material are a part of the course experience and are presented in the relevant paragraph of the following section (section 5.2.1.3).

5.2.1.3 Courses

Each course has its own page. Figure 5-6 illustrates the EGTN course as it is viewed by any enrolled student. The main page shows the *course outline*, i.e., the container for the entire course content, which may contain one or more sections. By clicking on the button on the right ("Resume course") the student is redirected to the *course section* that they are following now, as presented in Figure 5-7. In the case of Figure 5-6, the student shall be redirected to the third *section* "Scenario planning methodology" that is displayed in different colour than the other *sections*; indicating the progress the student has made so far.

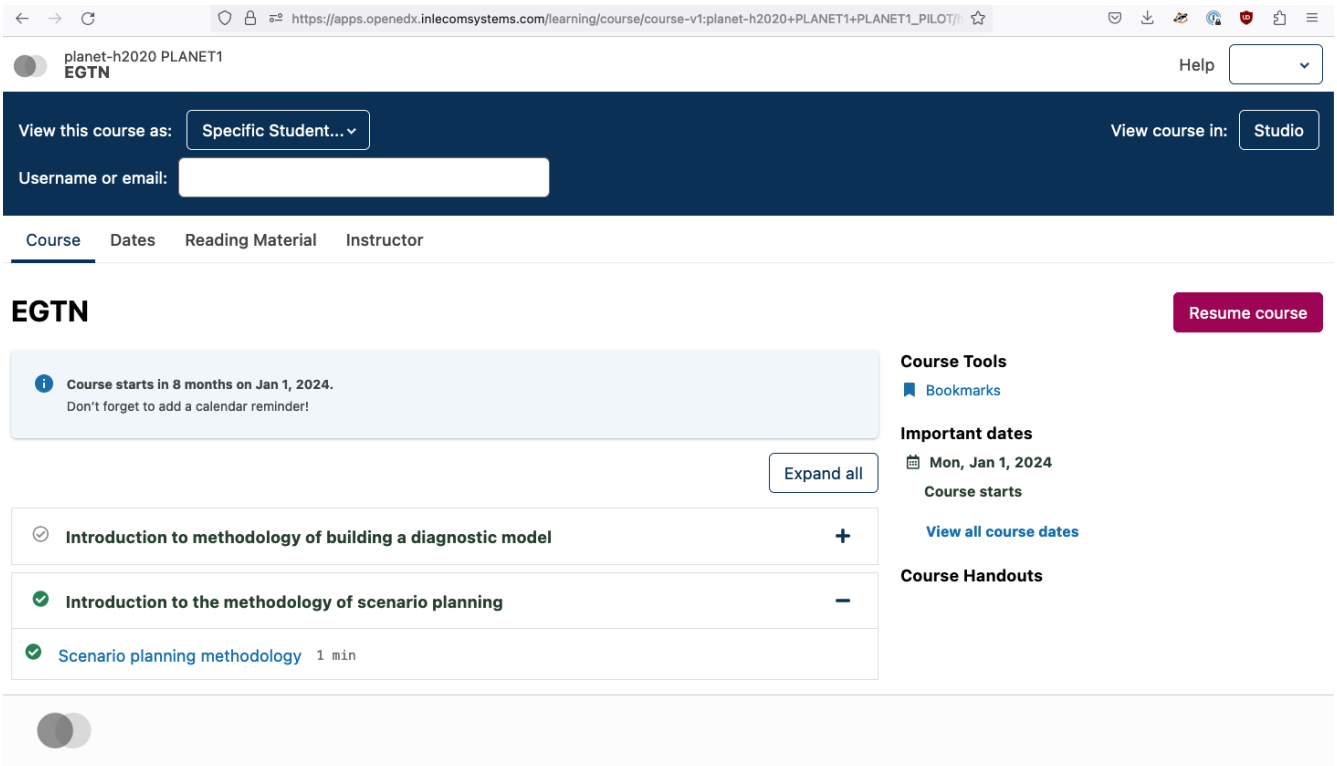

Figure 5-6. Course Page

Course sections may include several types of content, such as presentations, text, diagrams, figures or even video content. In Figure 5-7 the student is presented with a PowerPoint presentation. The courses also aspire to foster interaction among the students and of course with the instructor, therefore providing a *Discussion* section (Figure 5-9).

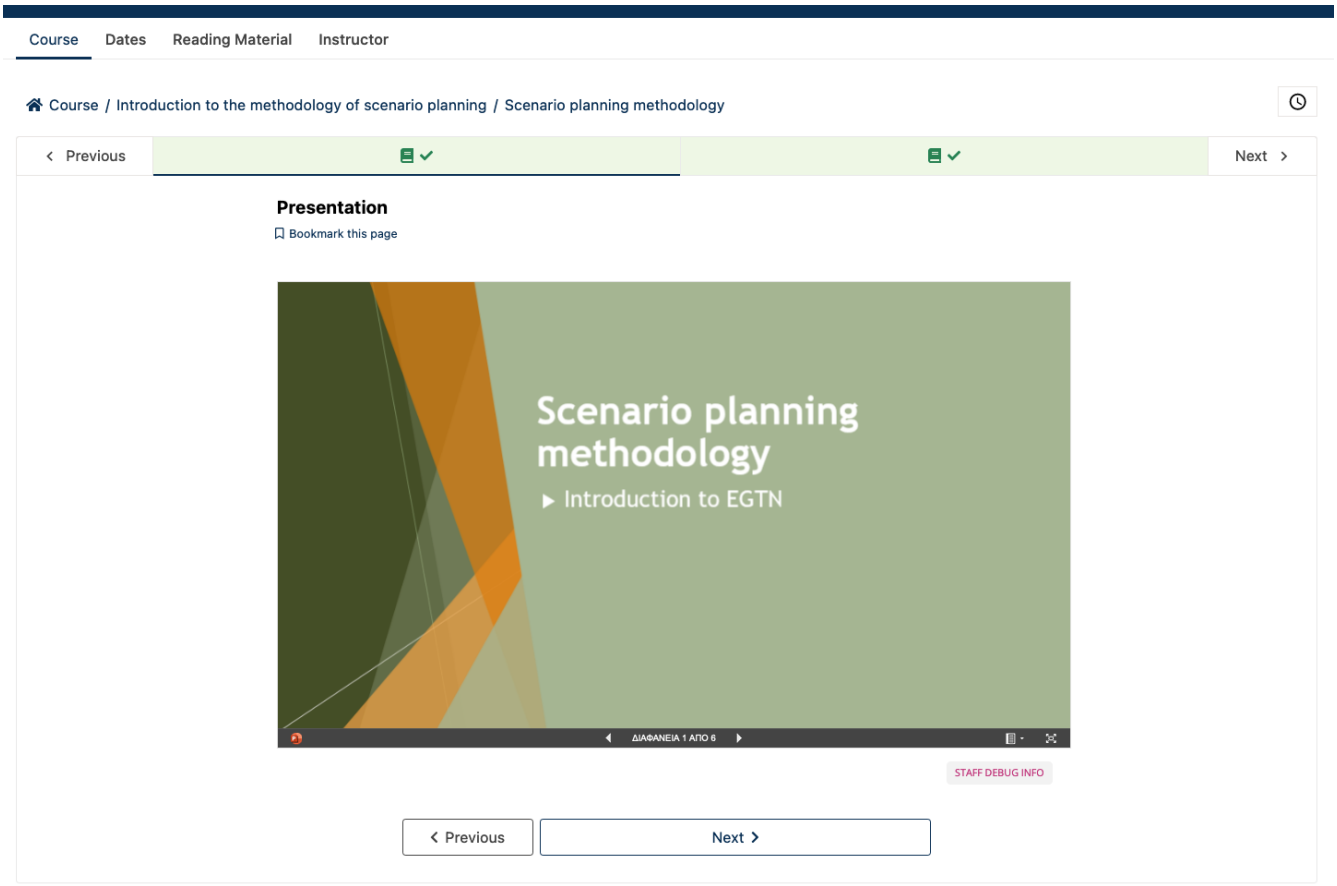

Figure 5-7. Example course section

All courses are set to start on Jan 1, 2024, as depicted in the second tab of the course page (Figure 5-8).

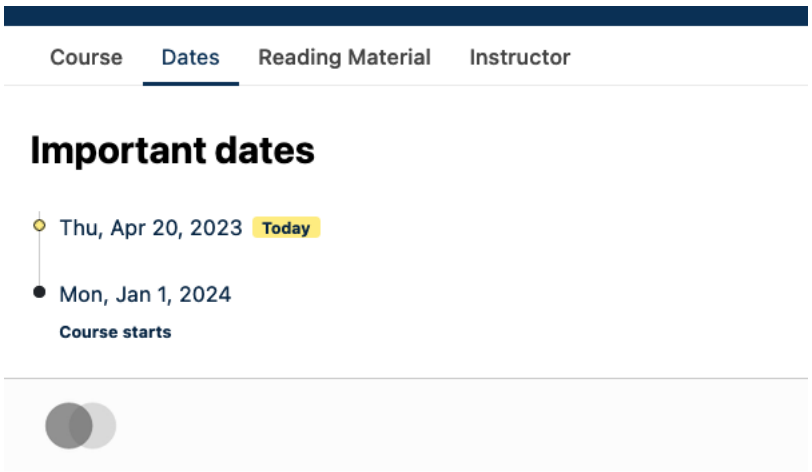

Figure 5-8. Course Dates

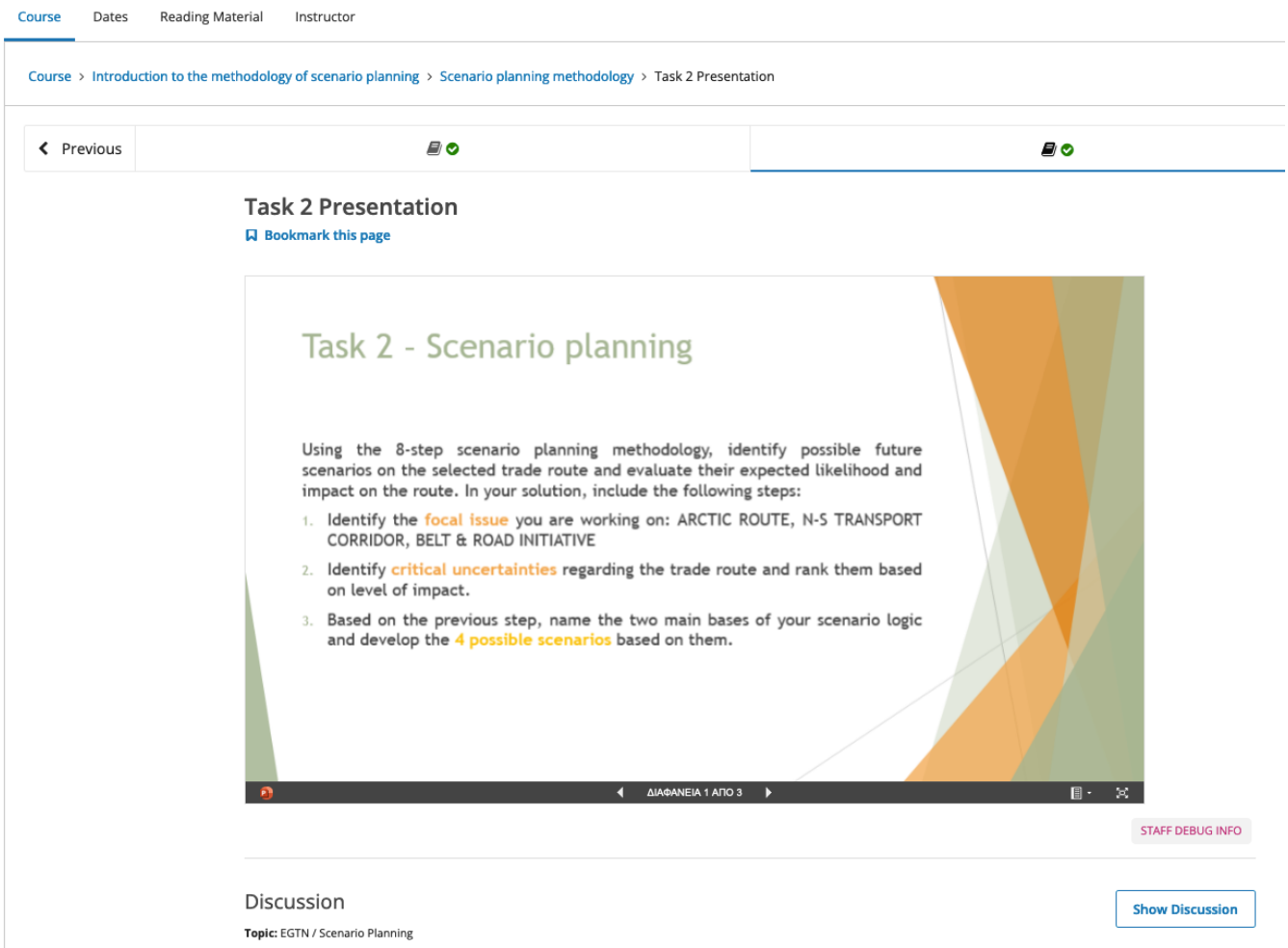

Figure 5-9. Discussion following presentation.

The expected reading material can be accessed on a separate tab that allows the students to read all the related files directly on the browser, but also download them in their local machine (Figure 5-10).

Figure 5-10. Example Reading Material for the EGTN course.

Finally, there is one last tab that is only visible to the course *instructor* (i.e., the individual assigned to teach the specific course). That is the *Instructor Dashboard* (displayed in Figure 5-11) and it contains several basic information regarding the course, such as learner enrollment, course staffing, grade reports and adjustments, and bulk email messaging[8] but it is also the key course management tool used by the instructor.

[8]https://edx.readthedocs.io/projects/open-edx-building-and-running-a-course/en/latest/CA_instructor_dash_help.html#instructor-dashboard

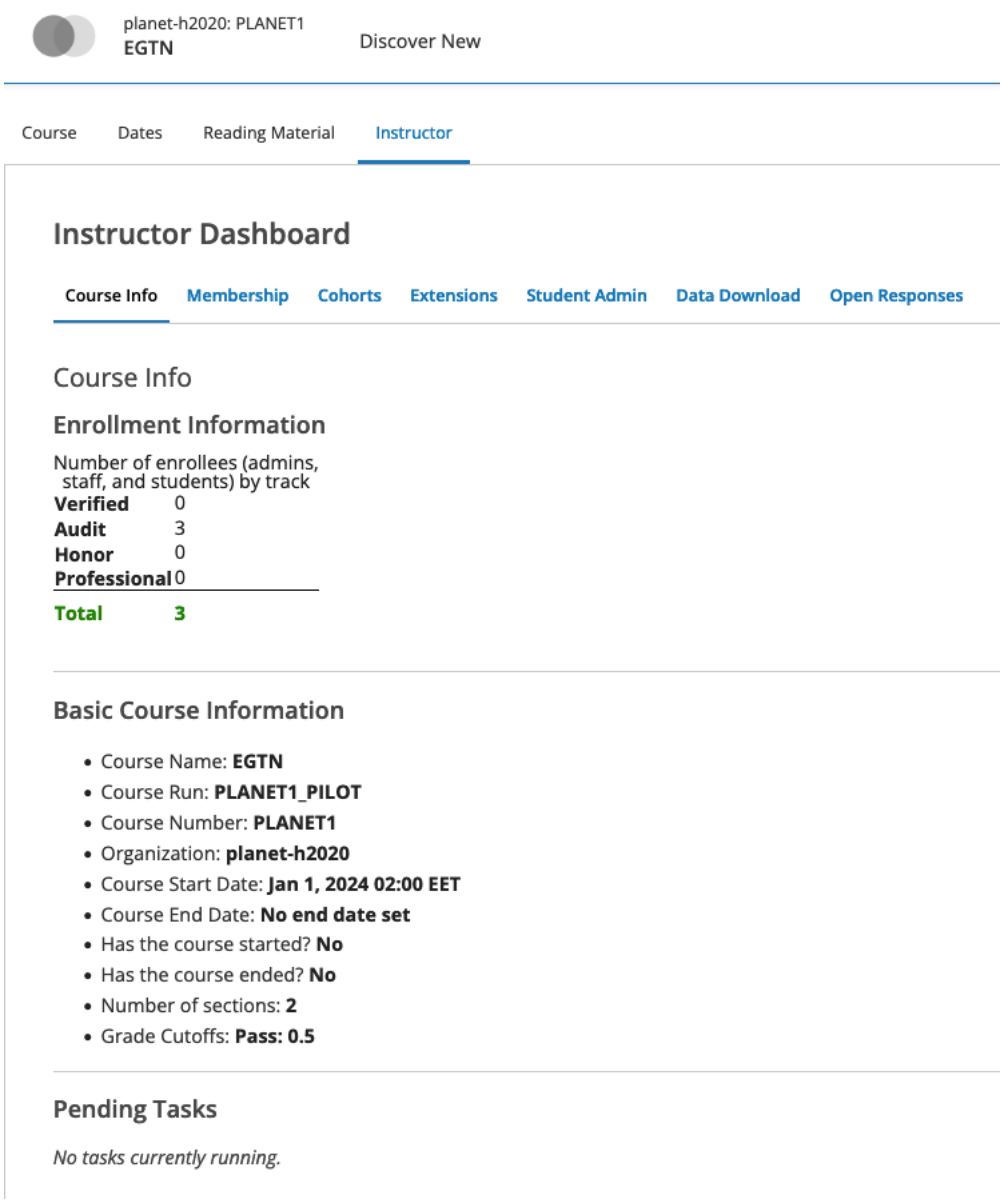

Figure 5-11. Instructor Dashboard

5.2.2 Account Management

Open edX users can log in by accessing the https://openedx.inlecomsystems.com website. Once logged in, they can manage their account settings through the dedicated *Account* Page (Figure 5-12). A separate *Profile* Page allows users to manage their online profile, add a bio or even link their social media accounts (Figure 5-13).

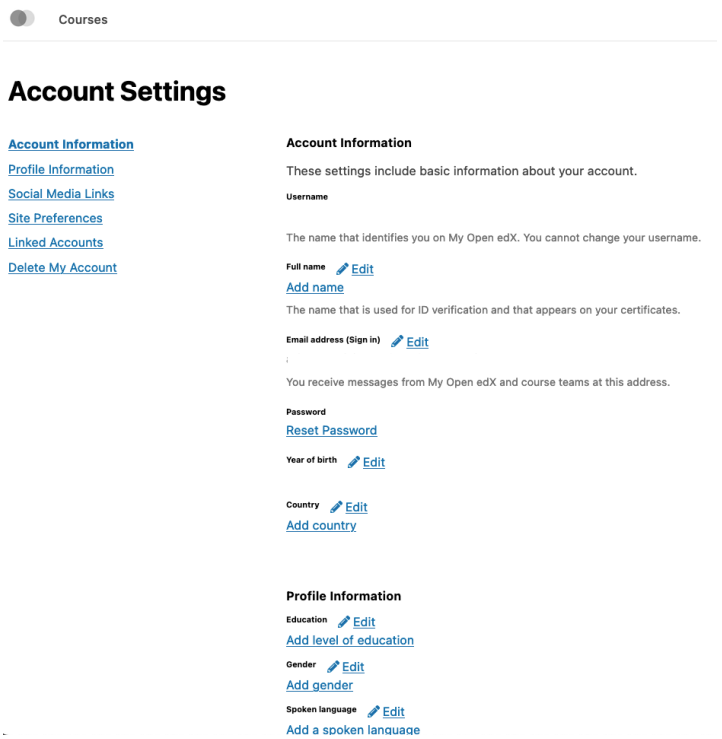

Figure 5-12. Account Settings

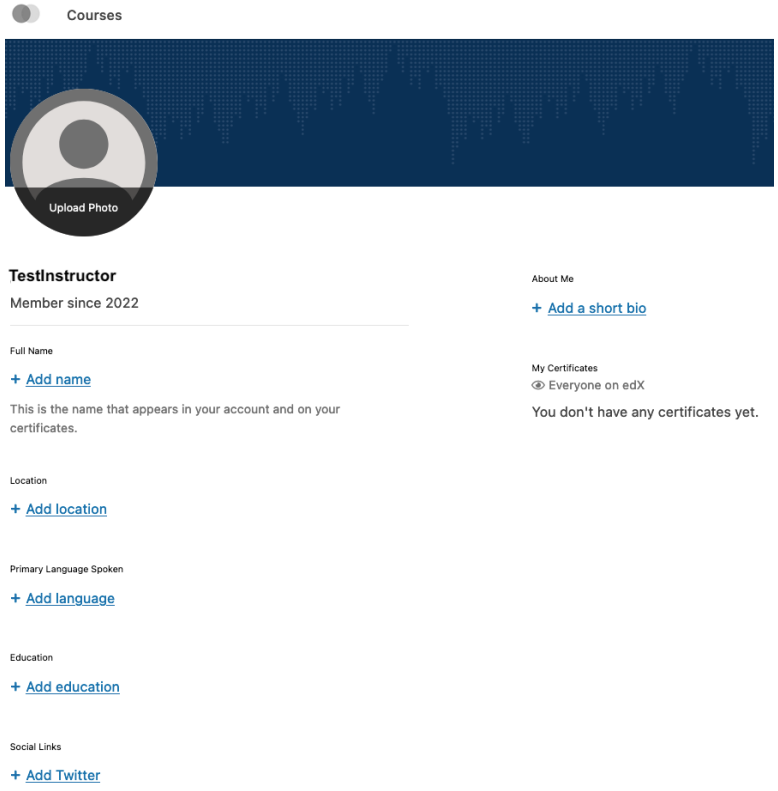

Figure 5-13. Profile Settings

6 Conclusions

This report presented the Electronic Visualisation Library (EVL) and the methodology undertaken towards its development. The EVL aims at promoting knowledge sharing to any interested stakeholder outside the PLANET project by offering courses that disseminate PLANET outputs. However, it takes dissemination one step further by encouraging interaction between course participants through the use of the interactive and collaborative environment the EVL offers. With that in mind, the EVL of project outputs from WP1, WP2 and WP3 hopes to create a community of interested stakeholders that exchange knowledge and best practices in a trusted environment.

Towards that end, three key contributions were made in the context of Task 4.3. The first contribution was the specification of the learning requirements that designated which courses were to be developed for the different project outputs and user groups.

The second contribution included the design of the courses and the piloting sessions undertaken with PLANET stakeholders to assess the courses. Four courses were selected for development: (i) EGTN concept and specifications, (ii) Corridor Connectivity Index, (iii) Business Analytics toward PI, and (iv) Innovation Technologies: Impact and Roadmapping.

An open-source platform became the host for the Electronic Visualisation Library and the four developed courses, allowing in this manner any interested party to attend the courses and interact with other attendees. In addition to this, all project source code (open source and closed source) was uploaded to GitLab to enable reusability and extension of the PLANET technical components.

To sum up, the Electronic Visualisation Library including the developed courses, but also the released open source software components aspire to bring value to the T&L community long after the PLANET project has finished by fostering knowledge exchange and collaboration, but also reusability and extendibility of the project outputs.

7 Bibliography

[1] S. L. Z. B. S. Z. J. &. G. A. Marston, "Cloud computing—The business perspective," *Decision support systems,* vol. 51, no. 1, pp. 176-189, 2011.

[2] M. Janjevic, "D1.3 Capacity Building requirements," SELIS, 2017.

Annex I: Survey

PLANET Learning Materials T4.3 Open Source Libraries and Transferability Framework (ST4.3.1)

Grant agreement ID: 860274

* Obligatoria

1. Name *

2. E-mail *

3. Organization and position *

4. Please indicate the user group you belong to *

- ◯ End user-top level management
- ◯ End user- middle level management
- ◯ End user- IT and Analytics Dpts
- ◯ Solutions provider
- ◯ Business Consultant
- ◯ Ports, Administrations and Authorities (including Customs)
- ◯ Universities, Research Institutes
- ◯ Policy Makers
- ◯ Policy Makers-Disadventaged Regions

5. Is the Research/Consultancy/Education thematic group of outputs of your interest?

- ◯ Yes
- ◯ No

EGTN Foundational Position papers (Research, Consultancy, Education)

Compendium of research and study results (position papers).
Main objective is to analyse, understand and assimilate the global, geopolitical, commercial, and economic imperatives of the main European trade routes.
Topics:
(1) Geo-economics impact of new trade routes for Europe;
(2) New trade routes' impact on TEN-T Corridors and nodes;
(3) Interconnection issues of railway transport-corridors to/from Europe;
(4) Transition towards the Physical Internet paradigm.

This resource is available at https://tinyurl.com/yckj3d25

6. Is Position Paper 1 (Geo-economics impact of new trade routes for Europe) relevant to you?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is relevant to me	◯	◯	◯	◯	◯

7. Is Position Paper 2 (New trade routes' impact on TEN-T Corridors and nodes) relevant to you?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is relevant to me	◯	◯	◯	◯	◯

8. Is Position Paper 3 (Interconnection issues of railway transport-corridors to/from Europe) relevant to you?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is relevant to me	◯	◯	◯	◯	◯

9. Is Position Paper 4 (Transition towards the Physical Internet paradigm) relevant to you?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is relevant to me	◯	◯	◯	◯	◯

10. To what degree are you already familiar with this

- ◯ Extremely familiar
- ◯ Very familiar
- ◯ Somewhat familiar
- ◯ Not so familiar
- ◯ Not familiar at all

11. Please elaborate if you think you have learning needs around this topic

EGTN Modelling and simulation capability (Research, Consultancy and Education)

EGTN modelling and simulation capability for a comprehensive analysis of the impact of emerging trade
routes, national strategies and technological concepts on trans-continental freight flows and modal split to/from Europe and on the required interfaces to the TEN-T

12. Is this output relevant to you?

- ◯ It is relevant
- ◯ Somewhat relevant
- ◯ Not relevant

13. To what degree are you already familiar with this

- ◯ Extremely familiar
- ◯ Very familiar
- ◯ Somewhat familiar
- ◯ Not so familiar
- ◯ Not familiar at all

14. Please elaborate what would be your learning needs around this topic

15. Would an e-learning course on this output be of interest to you?

- ◯ Yes
- ◯ No

