WP3: KPI, PILOT INNOVATIONS AND TEST SCENARIOS

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1- WP3 STATUS OVERVIEW

WP3 goals:

- Defining KPIs
- Setting improvements and innovations to be tested in pilot cases
- Defining test scenarios for the virtual pilot cases

WP	Title	Start	End	YEAR 1											
				M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
WP3	**Data & Indicators definitions (research act.)**	**1**	**12**												
Task 3.1	Definition of KPI and KRI	1	3			D3.1									
Task 3.2	Setting of pilot cases	1	12						D3.2						D3.3

1- WP3 STATUS OVERVIEW

- WP3 has been carried out according to the DoA
- 3 deliverables submitted:
  - D3.1 Study of the state of the art and description of KPI of terminals, hinterland mobility and rail network (M3)
  - D3.2 Pilot innovations and improvements (M6)
  - D3.3 Input data analysis and scenarios (M12)
- 1 conference paper sent
  - 3rd Interdisciplinary Conference on Production, Logistics and Traffic, Darmstadt, Germany (ICPTL) (25th – 26th September 2017)

  'Assessment of intermodal freight terminals with Key Performance Indicators integrated in the BIM process'
- Melzo and La Spezia terminals visited in October 2016 for KPI definition
- Internal meetings

Done Active Upcoming

- Tasks:
  - Definition of KPIs (Task 3.1)
  - Setting of pilot cases(Task 3.2)
    - Pilot innovations and improvements (3.2.1)
    - Test scenarios (3.2.2)

2- OBJECTIVES AND DELIVERABLES

Done Active Upcoming

Deliverable	Month	Important
D3.1 Study of the state of the art	M1-M3	KPIs definition.
D3.2 Pilot innovations and improvements	M1-M6	Setting of pilot cases.
D3.3 Input data analysis and scenarios	M7-M12	Setting of pilot cases.

Milestone	Month	Related deliverables
MS4 Definition of KPIs	M3	D3.1
MS5 Characterization of pilot cases	M12	D3.2, D3.3

3- WORK DONE

Task 3.1	Task 3.2
Period: M1 to M3 **Participants**: FGC, CENIT, IDP, CSI, DHL, MAC, VIAS, APSP **Objective**: Establish a set of Key Performance Indicators for the assessment of intermodal freight terminals through an ICT environment	**Period**: M1 to M12 **Participants**: FGC, CSI, IDP, CENIT, DHL, VIAS, APSP, BED, KIR, BASF **Objective**: Set improvements and innovations to be tested in pilot cases and define test scenarios for the virtual pilot cases **Subtasks**: -3.2.1 Pilot innovations and improvements -3.2.2 Test scenarios
Activities carried out: -Review of the state of the art -Collection of the most relevant indicators by each of the participants & Workshop in Melzo and La Spezia. -Template design for KPI and PI definition	**Activities carried out relative to subtask 3.2.1**: -Review of the improvements proposed by WiderMOS and OPTIRAIL projects -Questionnaire to partners and other stakeholders about innovations they plan to apply in their facilities and in daily operations. -List of innovations and improvements to be implemented in each case study - Scenarios for logistic market evolution - Melzo and La Spezia future demand analysis - Input data required for BIM definition of pilot cases
D3.1 State of the art and description of KPIs (M3)– SUBMITTED AND APPROVED	D3.2 Pilot innovations and improvements (M6) - SUBMITTED AND APPROVED D3.3 Input data analysis and scenarios (M12) - SUBMITTED. PENDING APPROVAL

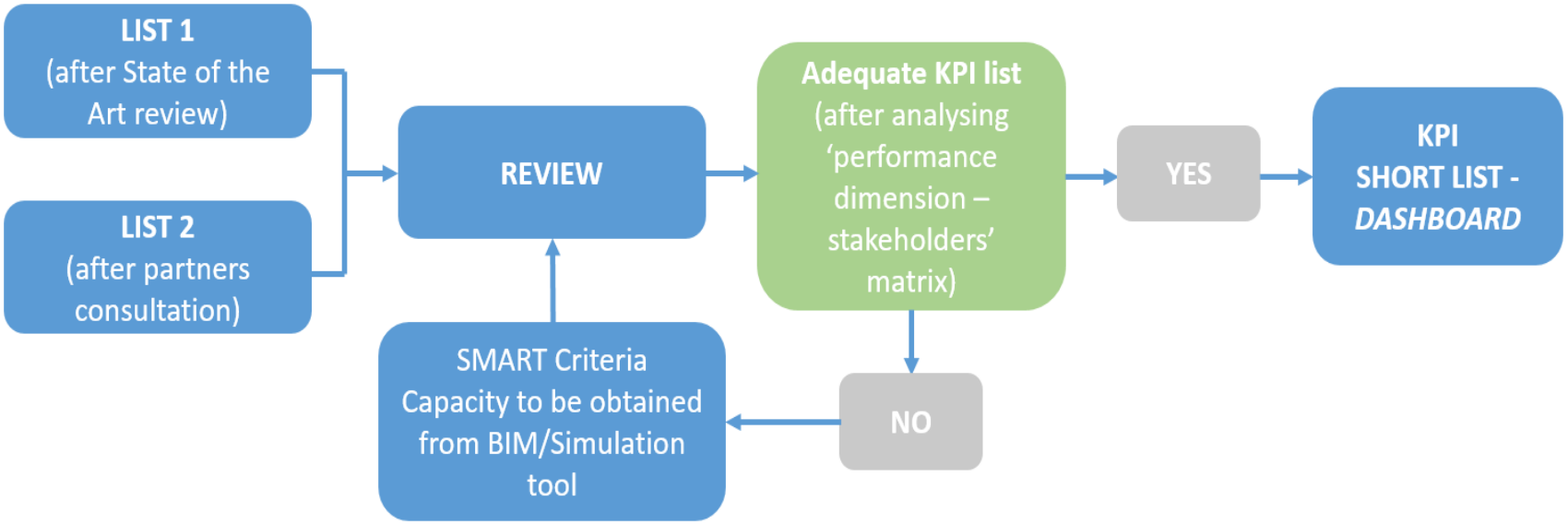
D3.1 – Study of the state of the art and description of KPI

- Categories proposed for the KPI definition

		Stakeholders		
		Investor	Operator	Public authority
Performance dimension	Operation	Productivity	Efficiency Productivity Volume Congestion	
	Finance	ROI Costs Revenues	Unit cost Maintenance costs Revenues	Employment Maintenance costs Investment on modal shift
	Quality		Service quality – time Damages	Congestion (road and rail)
	Environment		Energy efficiency Alternative fuels	Carbon footprint
	Safety			Accidents costs

D3.1 – Study of the state of the art and description of KPI

- KPI and PI list methodology



D3.1 – Study of the state of the art and description of KPI

- Classification of performance indicators

Key Performance Indicators (KPIs)	Performance Indicators (PIs)
Operational	
1-Intermodal terminal throughput (volume) 2-Equipment utilization 3-Gate utilization 4-Labour utilization rate 5-Storage area utilization 6-Rail track utilization 7-Berth utilization 8-Turnaround time 9-Waiting time	28-Maneuvering time 29-Service time 30-Berthing time 31-Idle time (equipment)
Financial	
10-Return On Investment (ROI) 11-Terminal's profitability 12-Operating efficiency (operating margin) 13-Operating revenues per unit 14-Operating benefits per unit 15-Direct jobs sustained by terminal activities 16-Indirect jobs sustained by terminal activities 17-Road and rail track maintenance cost	32-Capital Expenditure (CAPEX) 33-Operational Expenditure (OPEX) 34-Corrective maintenance cost - equipment 35-Preventive maintenance cost - equipment 36-Corrective concrete structures maintenance cost 37-Preventive concrete structures maintenance cost
Quality, environmental and safety	
18-Easiness of entry and exit from highways 19-Easiness of entry and exit from rail network 20-Energy consumption per handled unit 21-Carbon footprint per unit 22-Delays produced (reliability) – road 23-Delays produced (reliability) – railway 24-CO, NOX, SOC, PM emissions 25-Population exposed to high levels of traffic noise 26-Number of road accidents 27-Number of railway accidents	38-Waiting time / turnaround time 39-Use of alternative fuels from total consumption 40-Accidents related to hazard cargo

D3.2 – Pilot innovations and improvements

- General overview of tendencies in logistics

- Stricter rules regarding the environment impact and local emissions. Regulation regarding emissions for COx, NOx, but also for sound and light will become.
- Characteristics of the trains and train services will change in the near future:
  - Longer trains will be used. Currently the maximum length in most countries is 750 meters. However, the actual length in reality is (much) shorter.
  - The average weight of cargo (bulk and containers) will increase. This requires the use of stronger and heavier locomotives and terminal equipment.
  - New ways of scheduling and operating train services will be introduced, such as dedicated shuttle services and hub-and-spoke networks.
  - Train services will cover longer distances. An example of this is the new rail service between the Port of Rotterdam and several ports in China.
- Deep-sea vessels are becoming larger and larger to maximize benefits of scale economies. The same applies for barges in a smaller degree.
- Terminals are operating in global (or European) terminals networks. The activities of terminals that operate together in a network have to be optimized and aligned.
- Land and space are becoming scarce resources for terminals.
- More terminals are being bought by big terminal operators or investment companies.

D3.2 – Pilot innovations and improvements

- Logistics trends and innovations

- ALTERNATIVE CONTAINER DESIGN FOR BULK CARGO
- MODULAR CONTAINER CONSTRUCTION
- ALTERNATIVE PROPULSION TECHNOLOGIES
- AUTONOMOUS DRIVING AND ASSISTANCE SYSTEMS IN RAIL TRANSPORTATION
- INTERNET OF THINGS and IT SOLUTIONS *(WIDERMOS)*
- INTELLIGENT FREIGHT CARS, NEW HANDLING MACHINERY AND PROCESSES
- NEW MATERIALS
- NEW TRACK MAINTENANCE PROCESSES *(OPTIRAIL)*
- INTEGRATING MODES OF TRANSPORT AND CONSOLIDATING TRANSPORT VOLUMES

D3.2 – Pilot innovations and improvements

- Future projects in real terminals

➢ Port of La Spezia

- New railway terminal design with new 9 tracks, at least 570 m long
- Extension and improvement of the Corridor Management Platform
- Integrate BIM and 'Cross Border logistic fast corridor information pipeline'

➢ Melzo inland terminal

- Conversion a warehouse into temperature controlled warehouse in order to be able to cross-dock temperature controlled goods from maritime containers to intermodal swap bodies or regular trailers;
- Implementation of a third gantry crane in order to have
- Building 4 new shunting rail tracks in order to have a better buffer capacity in the shunting area;
- Building a second gate in/out in order to better serve the gantry crane area of the terminal avoiding trucks to run around the terminal to/from the gate to/from the gantry crane area.

D3.2 – Pilot innovations and improvements

- Methodology for improvements and innovations

Questionnaire survey was undertaken with relevant actors related to intermodal terminal and key experts within the Consortium

INNOVATIVE SOLUTION	Northern ports		Northern intermodal terminals		Logistics operators		Southern ports		Southern terminals		Cargo handling equipment companies		Logistics consultants		Cartagena	
1. Digitization																
Internet of things	x	5	x	5	x	3	x	4	x	5	x	5	x	5	x	3
Intelligent traffic guidance systems	x	4			x	5		3	x	3	x	5	x	4	x	5
Intelligent freight cars	x	4	x	3	x	2		4	x	3	x	5		2	x	4
2. Integrating modes of transport and consolidating transport volumes	x	5	x	5	x	5	x	5					x	5	x	4
3. Technology																
Modular container construction		1			x	2	x	5	x	3	NA			4		1
Alternative container design (bulk, cold chain)		1			x	2	x	5	x	3	NA			4		1
Automatic coupling	x	3			x	3		4	x	4	NA			3	x	2
Waste heat utilization	x	2			x	3		3			x	3		3	x	1
Autonomous assistance systems	x	4	x	3	x	5		3			x	5		3	x	2
Autonomous driving in rail transportation		5			x	3		3	x	5	NA			3	x	3
Alternative propulsion technologies	x	3	x	3	x	4	x	5	x	5	NA		x	4		1
Electromobility																
Compressed Natural Gas (CNG)																
Liquified Natural Gas (LNG)																
Hybrid technology																
Hydrogen																
4. Others			x	3												

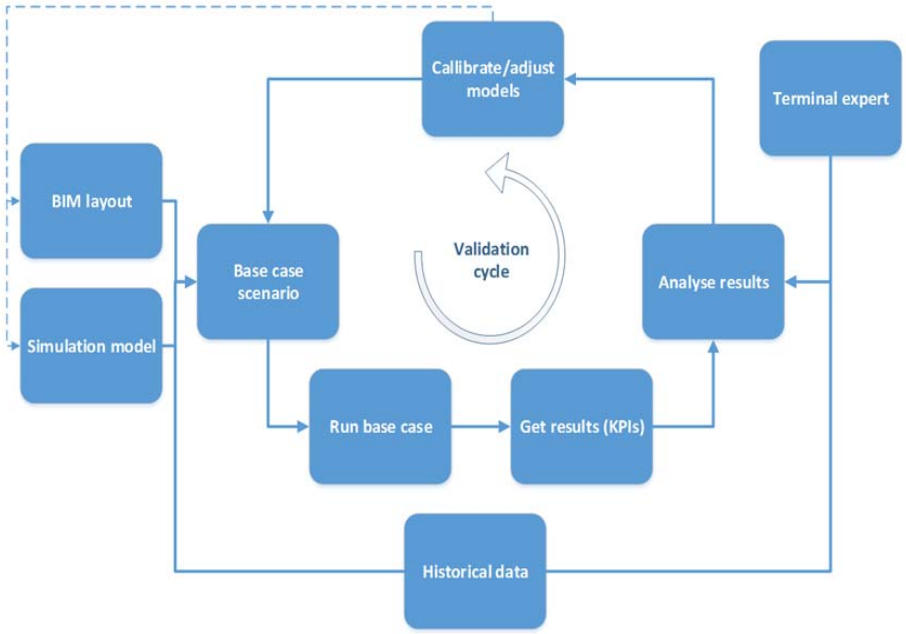
D3.2 – Pilot innovations and improvements

- Selected technological and operative innovations to be implemented into the four pilot terminals

Real pilot cases	Virtual pilot cases
La Spezia seaport terminal - New railway terminal design; - Extension and improvement of the CMP; - Improved maintenance scheduling (railway interconnection).	*Virtual pilot case 1* - Internet of things; - Alternative container design for bulk cargo/reefer container – multi-purpose terminal; - LNG; - LCA – new materials.
Melzo inland terminal - Conversion of F3 warehouse into temperature controlled warehouse; - Implementation of a third gantry crane; - Four new shunting rail tracks; - Second gate in/out; - Improved maintenance scheduling (railway interconnection).	*Virtual pilot case 2* - Internet of things; - Automated and robotized equipment (automated cranes and AGV); - LNG; - LCA - New materials.

D3.3 – Input data analysis and scenarios

- Test scenarios for real pilot cases



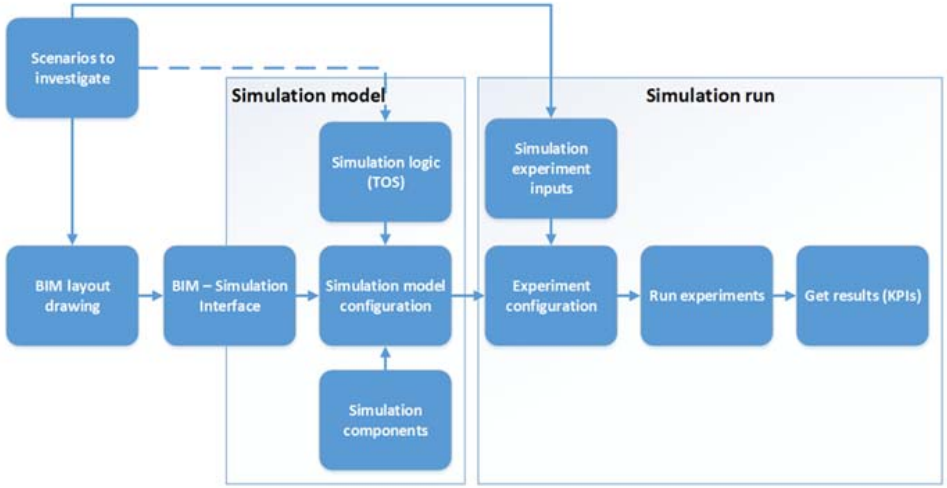
Real pilot case: La Spezia	
Future demand	3 different scenarios: According to prognosis of the terminal itself Optimistic and future-oriented view Pessimistic and future-oriented view
Current situation Improvements and innovations	No modifications in the layout are considered Future projects planned (D3.2)
Process times	List of process times to obtain KPIs (D3.1) taking into account previous improvements and innovations
Climate conditions	Already established (fixed location)
Costs	Based on standard unit costs and country
Data input	Modal split Fixed data according to current layout and future projects
Restrictions	Opening hours and closing days fixed

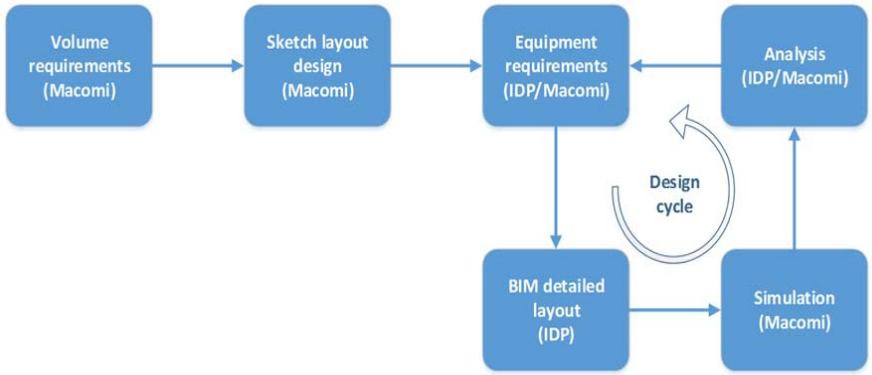
Railway connection according to European standards

Real pilot case: Melzo	
Future demand	3 different scenarios: According to prognosis of the terminal itself Optimistic and future-oriented view Pessimistic and future-oriented view
Current situation Improvements and innovations	No modifications in the layout are considered Future projects planned (D3.2)
Process times	List of process times to obtain KPIs (D3.1) taking into account previous improvements and innovations
Climate conditions	Already established (fixed location)
Costs	Based on standard unit costs and country
Data input	Modal split Fixed data according to current layout and future projects
Restrictions	Opening hours and closing days fixed

D3.3 – Input data analysis and scenarios

- Test scenarios for virtual pilot cases





Virtual pilot case: Seaport bulk-container terminal	
Future demand	3 different scenarios: Demand according to similar size terminals from benchmarking Optimistic and future-oriented view Pessimistic and future-oriented view
Improvements and innovations	Chosen innovations (D3.2)
Process times	List of process times to obtain KPIs (D3.1) taking into account previous improvements and innovations
Climate conditions	Seaport (southern and northern Europe)
Costs	Based on standard unit costs and country
Data input	Modal split / Deep sea quay / Rail / Rail yard / Yard / Road Refrigerated storage facilities / Container park with plugs Dry bulk terminal
Restrictions	Opening hours and closing days proposal

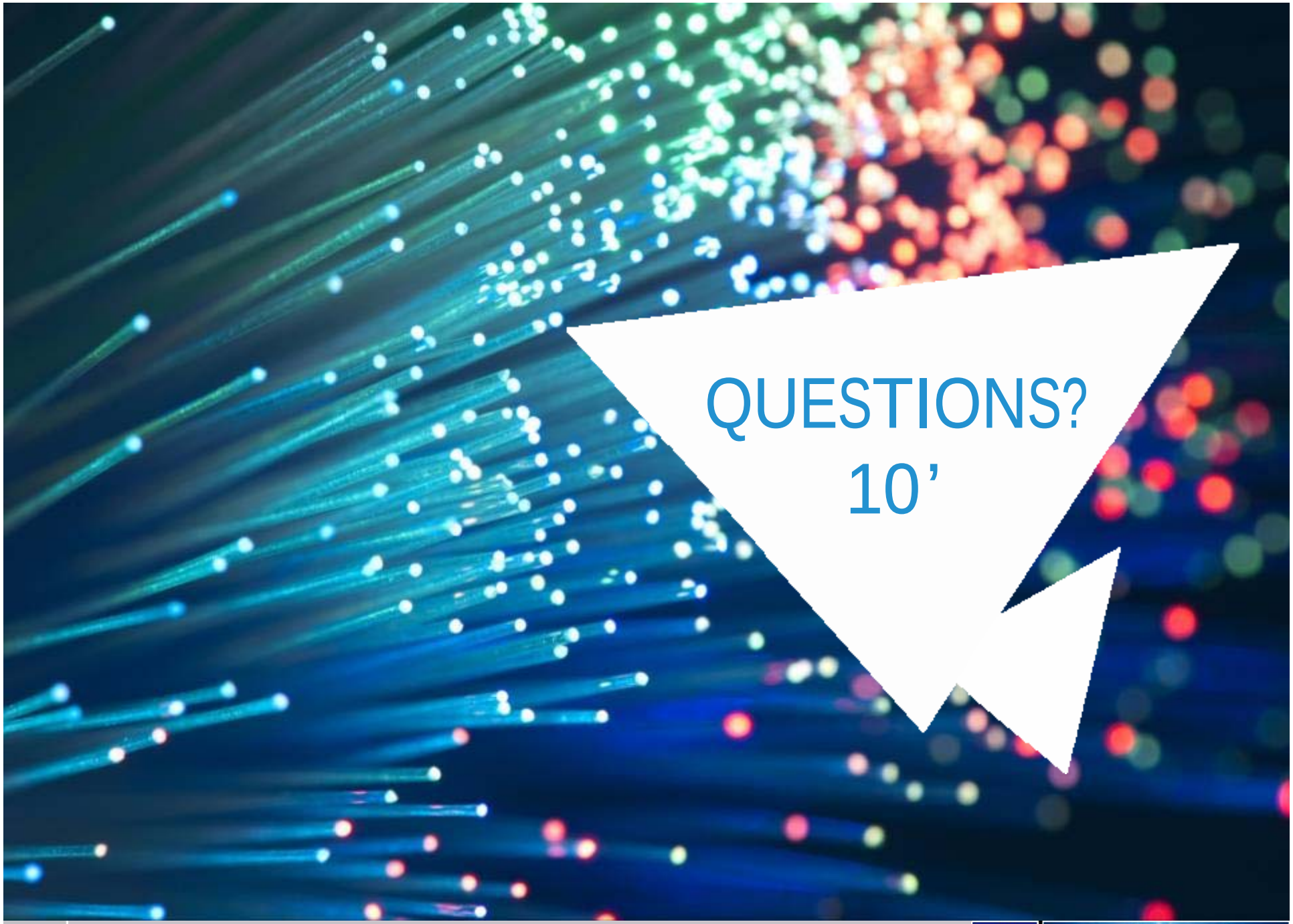
Railway connection according to European standards

Virtual pilot case: Inland bulk-container terminal	
Future demand	3 different scenarios: Demand according to similar size terminals from benchmarking Optimistic and future-oriented view Pessimistic and future-oriented view
Improvements and innovations	Chosen innovations (D3.2)
Process times	List of process times to obtain KPIs (D3.1) taking into account previous improvements and innovations
Climate conditions	Inland (northern and southern Europe)
Costs	Based on standard unit costs and country
Data input	Modal split / / Rail / Rail yard / Yard / Road Refrigerated storage facilities / Container park with plugs Dry bulk terminal
Restrictions	Opening hours and closing days proposal

D3.3 – Input data analysis and scenarios

- Pilot cases and scenarios summary

	Real pilot case 1 La Spezia seaport	Real pilot case 2 Melzo dry port	Virtual pilot case 1 Seaport terminal	Virtual pilot case 2 Inland terminal
Type of product				
Container	X	X	X	X
Solid bulk			X	X
Cold chain			X	X
Mode of transport				
Road	X	X	X	X
Rail	X	X	X	X
Ship	X		X	
Demand				
Current	X	X		
Future (optimistic-pessimistic)	X	X	X	X
Design				
Current	X	X		
Representative capacity			X	X
With improvements and innovations	X	X	X	X
Process times				
Current situation	X	X		
Taking into account improvements	X	X	X	X
Climate conditions				
Fixed location	X	X		
Northern Europe			X	X
Southern Europe			X	X
Costs				
Standard unit costs and country	X	X	X	X
Data input				
Modal split	X	X	X	X
Deep sea quay	X		X	
Rail	X	X	X	X
Rail yard	X	X	X	X
Yard	X	X	X	X
Road	X	X	X	X
Refrigerated storage facilities	X	X	X	X
Container park with plugs	X	X	X	X
Dry bulk terminal	X	X	X	X
Restrictions				
Opening hours and closing days	X	X	X	X
Railway connection				
Seaport - inland connection		X		X



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