



# IM-SAFE<sup>.EU</sup>

Pan European CoP forum

**Change Management, guidelines to  
implement the proposed new standards**

Agnieszka Bigaj-van Vliet, Diego Allaix, Jos Wessels, Paola Daró

IM-SAFE (ref. 958171)

[www.IM-safe-project.eu](http://www.IM-safe-project.eu)

<https://www.linkedin.com/company/im-safe-project/>

<https://cordis.europa.eu/project/id/958171>

H2020 Project IM-SAFE - 958171



# Agenda

14:00	Welcome ( <b>Diego Allaix, TNO</b> )
14:05	IM-SAFE proposal for new standardization on monitoring, data-informed safety assessment and maintenance of the transport infrastructure ( <b>Diego Allaix, TNO</b> )
14:15	Session 1: Guidelines for the adoption plan of the new standards ( <b>Jos Wessels, CROW</b> )
14:40	Session 2: Recommendations about the set-up of pilot projects ( <b>Paola Daró, Sacertis</b> )
15:00	Q&A
15:30	Closure





## Speakers



### Dr. Diego Allaix

- **IM-SAFE WP Leader (Standardization)**
- TNO Department of Structural Reliability
- Senior Scientist Structural Reliability
- Visiting Professor University of Gent
- Member of CEN/TC 250 WG3 “Safety formats for non-linear problems”
- Member of *fib* TG3.1 “Reliability and safety evaluation”



### Jos Wessels MSc, MBA

- **IM-SAFE WP Leader (Stakeholder Engagement)**
- CROW
- Senior project manager
- Coordinator platform Inner City Quay Walls
- Coordinator platform Geotechnics
- Project manager CROW Program Advisory Board Hydraulics and Geotechnics
- Involved in establishing NL platform Bridges & NL platform Inspections





## Speakers



### **Dr.ir. Paola Darò**

- **IM-SAFE WP Leader (Data informed safety evaluation and maintenance management)**
- SACERTIS Ingegneria S.r.l
- Technical Director Engineering Department
- SHM, structural diagnostics, data analytics field expert
- Former Research Fellow DISEG - Politecnico di Torino
- MIT Technology Review Italy - Award as Young Innovator TR35 2019





# IM-SAFE proposal for new standardization on monitoring, data-informed safety assessment and maintenance of the transport infrastructure

Diego Allaix (TNO)



# Scope of amending and extension of standardisation

- **New standard on structural monitoring**
  - decision-making regarding the design of the monitoring strategy
  - effective use of monitoring data to produce useful and meaningful information relevant for diagnostics of structures, safety assessment and maintenance approaches
- **Further amendment to the existing Eurocodes** on safety assessment taking into account inspections, monitoring and testing
  - full utilisation of structure-specific data in the safety assessment of existing structures
  - assessment of actual safety through consideration of deterioration and damage by models
  - better prediction of end-of-service life by appropriate choice of the safety framework
- **New standard for risk-based maintenance management and preventive condition-based maintenance of transport infrastructures**
  - improvement of the decision-making process regarding maintenance at network and object level
- **Digitalization as enabling technology**





## New standard on structural monitoring

### Objectives:

- to formulate the **principles of setting the objectives of structural monitoring**
- to formulate essential principles of setting the design of the monitoring system incl. requirements related to the reliability of sensor systems
- to provide essential requirements related to the **methodologies used for translating data into useful and meaningful information** relevant for diagnostics of structures, safety assessment and maintenance approaches
- to maintain the **openness to innovations** (i.e. in sensing technology and data analysis methods)

### Needs for standardization :

- framework for **decision making** regarding the monitoring strategy:
  - definition of the objectives of the monitoring activities
  - choice of the monitoring type (e.g. periodic / continuous)
  - choice of the measured quantities
  - definition of the required measurement accuracy
  - selection of the monitoring technologies
  - design of the monitoring system, including amount and placement of the monitoring devices
  - evaluation of alternative monitoring strategies
- the principles and requirements for **installation and operation of the monitoring system** aiming to guarantee reliable data
  - requirements for data acquisition (calibration, post-installation verification, management and maintenance of the acquisition system)
  - requirements for data pre-processing (identification of outliers, removal of the environmental effects from the raw data, data validation, etc.)
- the principles and requirements for **analysis of the monitoring data for extracting useful information** for the safety assessment and risk management of structures (updating of structural models, identification of damage and deterioration processes)
- the principles and requirements for **data management for future use**
  - requirements for data storage and management (in relation to through-life information management systems)
  - requirements for data security and ownership





## Further amendment to the existing Eurocodes on safety assessment taking into account inspections, monitoring and testing

### Objectives:

- to enable the use of structure-specific data in the safety assessment of existing structures
- to formulate the **framework for including information from diagnostics** of structures based on data from inspection, monitoring and testing
- to provide background material to CEN for translating the framework into practical clauses for the assessment at the semi-probabilistic level

### Needs for standardization :

- use of structure-specific indirect information in the safety assessment
  - updating the failure probability and the basic variables of the limit state functions based on direct and indirect information
  - use of the outcomes of proof-load testing in the safety assessment at the semi-probabilistic level
  - to determination of the design value of the loads
- consideration of deterioration and damage in the safety assessment incl. implementation of state-of-the-art models for damage and deterioration in the safety verification
- use of monitoring of the structural response in combination with threshold values for assessing safety during operation incl. the definition of alarm thresholds
- minimum reliability requirements (and corresponding reference period) considering differentiation of reliability requirements between the assessment of the fitness-for-use of an existing structure during operation and the design of structural interventions
- via amendments to the current Eurocodes :
  - EN 1990 “Eurocode - Basis of structural design”
  - EN 1991-2 “Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges”
  - EN 1992 “Eurocode 2: Design of concrete structures”





## New standard for condition-based and risk-based maintenance of transport infrastructure

### Objectives:

- to promote transition from corrective maintenance strategies towards the **preventive maintenance strategies**
- to promote risk-based maintenance management
- to provide principles and requirements for **data-informed (inspection, monitoring and testing) decision-making in maintenance management**

### Needs for standardization:

- classification of hazards and vulnerable elements of bridges and tunnels
- framework for data-informed decision-making for risk management
- **risk-based** decision-making process regarding **maintenance management**:
  - the principles of performance assessment of the transport infrastructure network (key performance requirements and indicators for network management)
  - the principles of risk-based prioritization of structures
  - the principles of updating risks based on inspection, testing and monitoring
- decision-making process regarding the **maintenance strategies**:
  - the principles of selection of the maintenance strategies
  - the principles of predictive **condition-based** maintenance based on key performance indicators
- through-life information management





# **Guidelines for adoption plan of the new standards**

Jos Wessels (CROW)



# Implementation

## 1. GOALS

- to raise the **awareness** about the necessity to develop and adopt the new standards;
- to identify and **remove** the PEST **barriers** related to different stakeholders;
- to **motivate** decision-makers in the public and commercial organisations to improve the knowledge and skills of their employees about the new standards.

## 2. RESULTS

- Awareness campaign (on going business)
- **Practical guidelines (focus on EU)**
- Generic setup for future pilot projects
- Evaluation method (included)



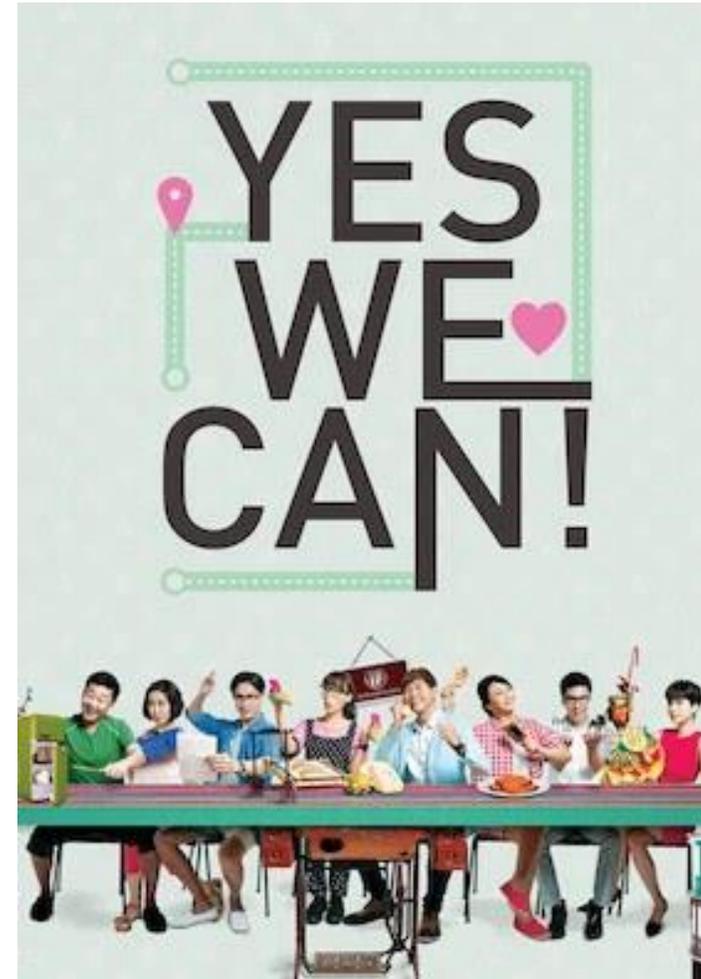
## How?

### Guidelines: focus on support by EU

- Financial support
- Program
- Timeline (roadmap)

### Approach

- Inventory:
  - Elements to be addressed:
    - EU examples
    - Change management
    - SWOT
  - Stakeholders
  - EU tools
- Analysis => guidelines

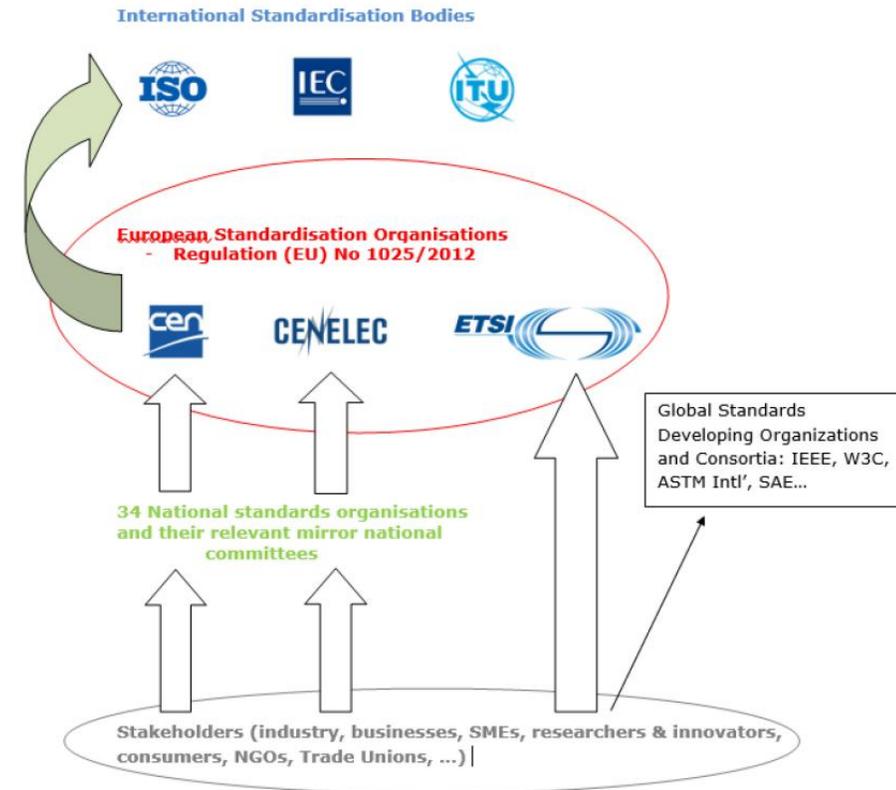


# EU Examples

## CEN-CENELEC

*An EN shall be implemented*

- *by giving it the status of a national standard, either by publication of an identical text (see 11.2.4.3) or by endorsement (see 11.2.4.4), and*
- *by withdrawing any conflicting national standards.*



## EU Examples

### Concluding elements

- Translate standard in national language
- Setting of National Determined parameters (NDP's),
- Publishing National Standard and National Annex (NA),
- Adoption of national provisions,
- Training.



From: J. Engelen et al. / The role of technical standards for AT and DfA equipment and services

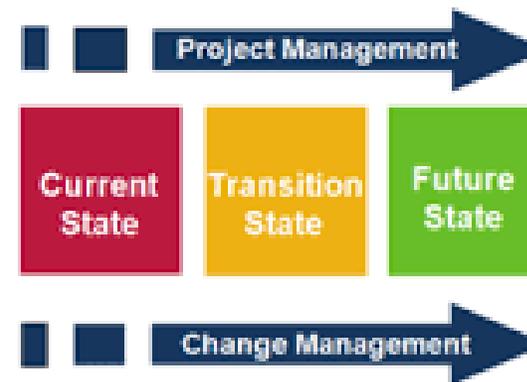


# Change management

1. Creation of urgency, awareness
2. Creation of group(s) of frontrunners with authority
3. Showing wins, good examples
4. Money and time to invest in new way of working
5. Interaction between stakeholders
6. Knowledge building
7. Measurement of progress
8. Sharing of lessons learned

## What is Change Management?

Technical side of moving from current state to future state



People side of moving from current state to future state

[https://cio-wiki.org/wiki/Change\\_Management](https://cio-wiki.org/wiki/Change_Management)



# SWOT

- Creating awareness;
- Creating knowledge;
- Adjusting and adapting of contracts;
- Translating the standards;
- Gathering and analyzing predictive maintenance data;
- Arranging finance/funding;
- Including the proper stakeholders, like local authorities;
- Knowledge dissemination

Generic features of the sector (General perspective)

KANBAN – SWOT (Strengths, Weaknesses, Opportunities and Threats)  IM - SAFE	<b>Strengths</b>	<b>Weaknesses</b>
	<ul style="list-style-type: none"> <li>✓ Contribute to the enforcement of laws and regulations for the sector.</li> <li>✓ Enables reduction of infrastructure lifecycle costs.</li> <li>✓ Enables the prevention of catastrophic failures.</li> <li>✓ Standardized maintenance and monitoring will help establish/improve lesson learned.</li> </ul>	<ul style="list-style-type: none"> <li>× Countries have their own standards, experiences, culture, way of working.</li> <li>× Change resistance of traditional players.</li> <li>× Maintenance is normally contracted in long term contracts</li> <li>× Each stakeholder has a unique economic and timeframe schedule.</li> <li>× Prediction is hard.</li> </ul>
	<b>Opportunities</b>	<b>Threats</b>
	<ul style="list-style-type: none"> <li>✓ Contribution to employment stabilization</li> <li>✓ Promotes new ways for data processing and monitoring.</li> <li>✓ Allows the introduction of new digital tools</li> <li>✓ Allows the incorporation of sensor systems more cost-effective and quicker</li> <li>✓ Enables reduction of infrastructure lifecycle costs</li> <li>✓ Enables the prevention of catastrophic failures</li> </ul>	<ul style="list-style-type: none"> <li>× Ignorance of responsibility to advise in critical situations</li> <li>× Reduction of maintenance budget due to the effectiveness of harmonization</li> <li>× Each country has a standard as a reference and creates its own ad-hoc standard</li> <li>× Uncertainty associated with deterioration of materials</li> <li>× Obsolescence of current quality standards.</li> </ul>





# Conclusion: elements to be addressed

1. Urgency, awareness
2. Acceptance
3. Knowledge
  - a) Creation
  - b) Dissemination
4. National adoption
  - a) Translation
  - b) NDP's
  - c) NA
  - d) Adoption national provisions
5. Finance / funding
6. Monitoring implementation

Element => impact	Examples	Through	Funding EU
1. Creation of urgency, awareness => willingness to change	awareness campaign	CoP	COST / Horizon
	communication strategy	CoP	COST / Horizon
	showing wins, good examples	CoP	COST / Horizon
2. Creation of acceptance => standard is supported	Creation of group(s) of frontrunners with authority,	SAG	
	interaction between stakeholders	CoP	COST / Horizon
	Exemplar contracts	Pilots	Horizon Europe / Interreg / Digital Europe
	Infrastructure specific translation of standards	TC	CEN
	Provide/develop required software	Pilots	Digital Europe
3. Knowledge => standard and practical use is understood	Make data available from own assets	CoP / digital platform	Digital Europe
	Pilot projects and evaluation	Pilots	Horizon Europe / Interreg / Digital Europe
a. Creation	Education and training	Training	Erasmus+
	Development of courses,	Training	Erasmus+
	Pilot projects and evaluation	Pilots	
b. Dissemination	Adjustment and adoption of contracts	Pilots	
	Sharing knowledge	CoP / training	Erasmus+
	Education and training	Training	Erasmus+
	(IM-Safe) website and Wiki	CoP	COST / Horizon
	CoP's	CoP	COST / Horizon
4. National adoption => local accessibility of standards, connection to national legislation and circumstances, formal approval	Practical handbooks (day to day use)	Pilots	Horizon Europe / Interreg / Digital Europe
	CEN-CENELEC process (development of standards in TC's)	TC	?
a. Translating the standards;	Translate to local language by National TC	TC	?
b. Setting of National Determined parameters (NDP's),	By National TC	National TC	?
c. Publishing National Standard and National Annex (NA),	By National TC	National TC	?
d. Adoption of national provisions,	By EU	EU	DG
5. Arranging finance/funding => governmental / public support of change	EU tools for financial support	EU	DG
6. Monitoring implementation => show results, create pressure (awareness and urgency)	Measurement of progress	EU	Direct assignment
	Best practices, pilot projects	Pilots	Horizon Europe / Interreg / Digital Europe
	(Re)distribution of effort, money and capacity	EU	DG





## Stakeholders (supply chain)

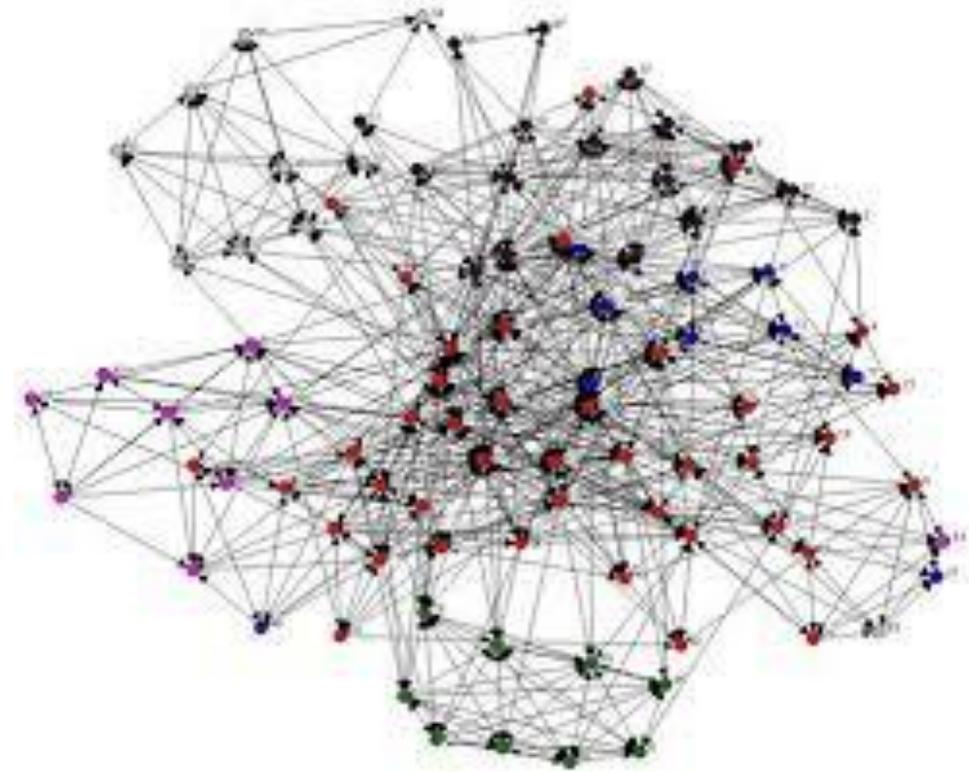
- Asset owners, governmental bodies and suppliers of financial services (investments and insurance, strategic)
- Asset managers (tactic)
- Engineering companies (operational, limited liability, great responsibility)
- Building companies (operational, great liability and responsibility)
- Suppliers of services (eg, inspection services, research, laboratories)
- Suppliers of material (concrete, steel, girders, etc.)





## Stakeholders (others)

- CEN-CENELEC
- Network organisations
  - ECTP
  - CEDR
  - FEHRL
  - FIB
  - EUROSTRUCT
  - EIC
- Knowledge institutes (national)



<https://rossdawson.com/>





## EU tools

- Direct assignments
- Erasmus+
- Horizon Europe
- COST action
- ~~Connecting Europe Facility (CEF) transport (investment in TEN-T network)~~
- Digital Europe
- ~~Important Projects of Common European Interest (IPCEI)~~
- Interreg





# Process

## EU

1. Prepare CEN-CENELEC standard development activity  
Prepare preconditions: subject addressed in EU tools  
Connect with CEDR in order to prepare an Infravation-like call
2. Incorporate the elements of the program in the calls for proposals (EU tools)
3. Assign projects to consortia in order to execute the program
4. Assign monitoring project(s) to dedicated organisations / consortia

## CEN-CENELEC

In parallel: start and carry out standardisation and adoption / implementation process





# Actions and funding

Element => impact	Examples	Through	Funding EU
<b>1. Creation of urgency, awareness =&gt; willingness to change</b>	awareness campaign	CoP	COST / Horizon Europe
	communication strategy	CoP	COST / Horizon Europe
	showing wins, good examples	CoP	COST / Horizon Europe / Interreg
<b>2. Creation of acceptance =&gt; standard is supported</b>	Creation of group(s) of frontrunners with authority	SAG	COST
	interaction between stakeholders	CoP	COST / Horizon
	Exemplar contracts	Pilots	Horizon Europe / Interreg / Digital Europe
	Infrastructure specific translation of standards	TC	?
	Provide/develop required software	Pilots	Digital Europe
	Make data available from own assets	CoP / digital platform	Digital Europe
	Pilot projects and evaluation	Pilots	Horizon Europe / Interreg / Digital Europe





# Actions and funding

Element => impact	Examples	Through	Funding EU
<b>3. Knowledge =&gt; standard and practical use is understood</b>	Education and training	Training	Erasmus+
	Development of courses,	Training	Erasmus+
<b>a. Creation</b>	Pilot projects and evaluation	Pilots	Horizon Europe / Interreg / Digital Europe
	Adjustment and adoption of contracts	Pilots	Horizon Europe / Interreg / Digital Europe
	Sharing knowledge	CoP / training	Erasmus+
<b>b. Dissemination</b>	Education and training	Training	Erasmus+
	(IM-Safe) website and Wiki	CoP	COST / Horizon Europe
	CoP's	CoP	COST / Horizon Europe
	Practical handbooks (day to day use)	Pilots	Horizon Europe / Interreg / Digital Europe





# Actions and funding

Element => impact	Examples	Through	Funding EU
<b>4. National adoption =&gt; local accessibility of standards, connection to national legislation and circumstances, formal approval</b>	CEN-CENELEC process (development of standards in TC's)	TC	?
<b>a. Translating the standards;</b>	Translate to local language by National TC	TC	?
<b>b. Setting of National Determined parameters (NDP's),</b>	By National TC	National TC	?
<b>c. Publishing National Standard and National Annex (NA),</b>	By National TC	National TC	?
<b>d. Adoption of national provisions,</b>	By EU	EU	EU





# Actions and funding

Element => impact	Examples	Through	Funding EU
5. Arranging finance/funding => governmental / public support of change	EU tools for financial support	EU	EU
	Measurement of progress	EU	Direct assignment
6. Monitoring implementation => show results, create pressure (awareness and urgency)	Best practices, pilot projects	Pilots	Horizon Europe / Interreg / Digital Europe
	(Re)distribution of effort, money and capacity	EU	EU





# Stakeholder involvement

	Supply chain					Norm.	Network organisations						Other		
	asset owner/manager	engineering comp	building comp	suppliers of services	suppliers of material	CEN-CENELEC	Nat. norm. bodies	ECTP	CEDR	FEHRL	FIB	EUROSTRUCT	EIC	Nat. know. institutes	DG
CoP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
SAG						x		x	x	x	x	x	x	x	
Pilots	x	x	x	x	x				x	x	x	x	x	x	
Digital platform	x	x	x	x	x				x	x				x	
Training	x	x	x	x	x	x	x		x	x				x	
(Nat.) TC	x	x	x	x	x	x	x							x	x
EU															





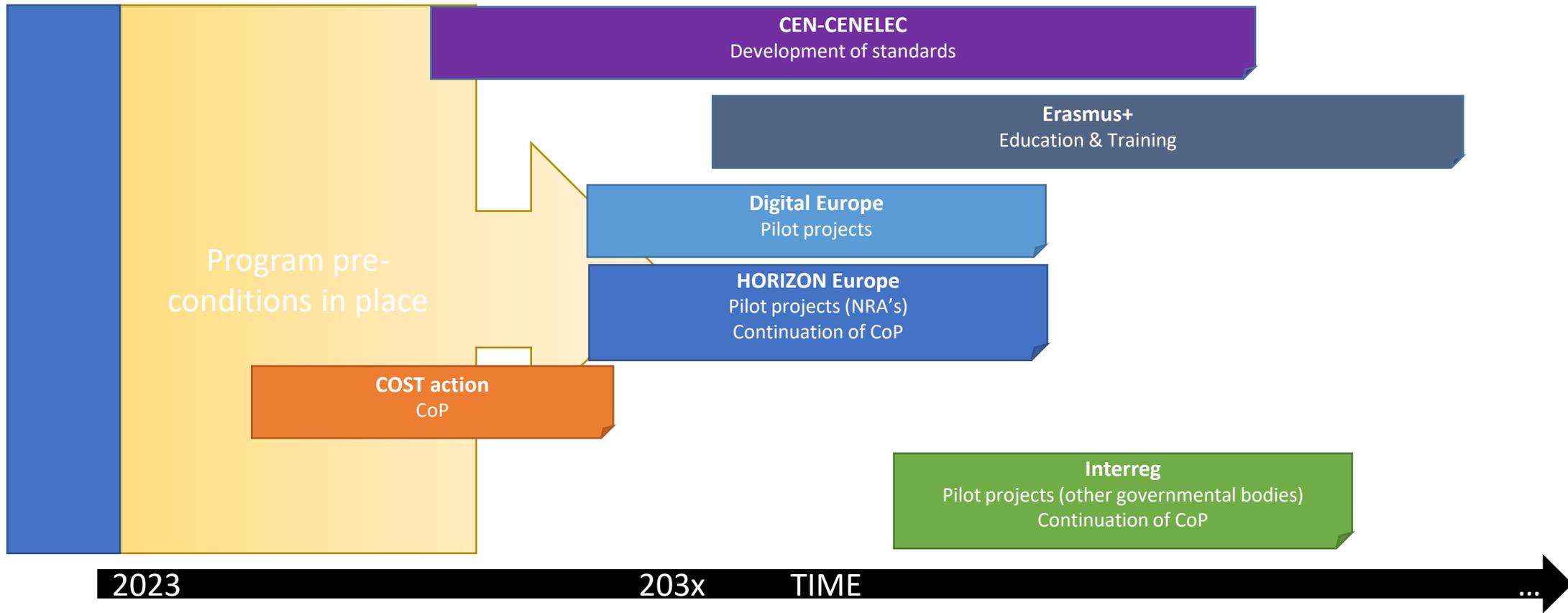
## Stakeholders: “specials”

- CEDR => infravation, NRA's
- FEHRL => opportunities for innovation (members)
- FIB, EUROSTRUCT, EIC, etc. => dissemination, SAG, CoP
- CEN-CENELEC / national standardisation bodies => TC's, Training



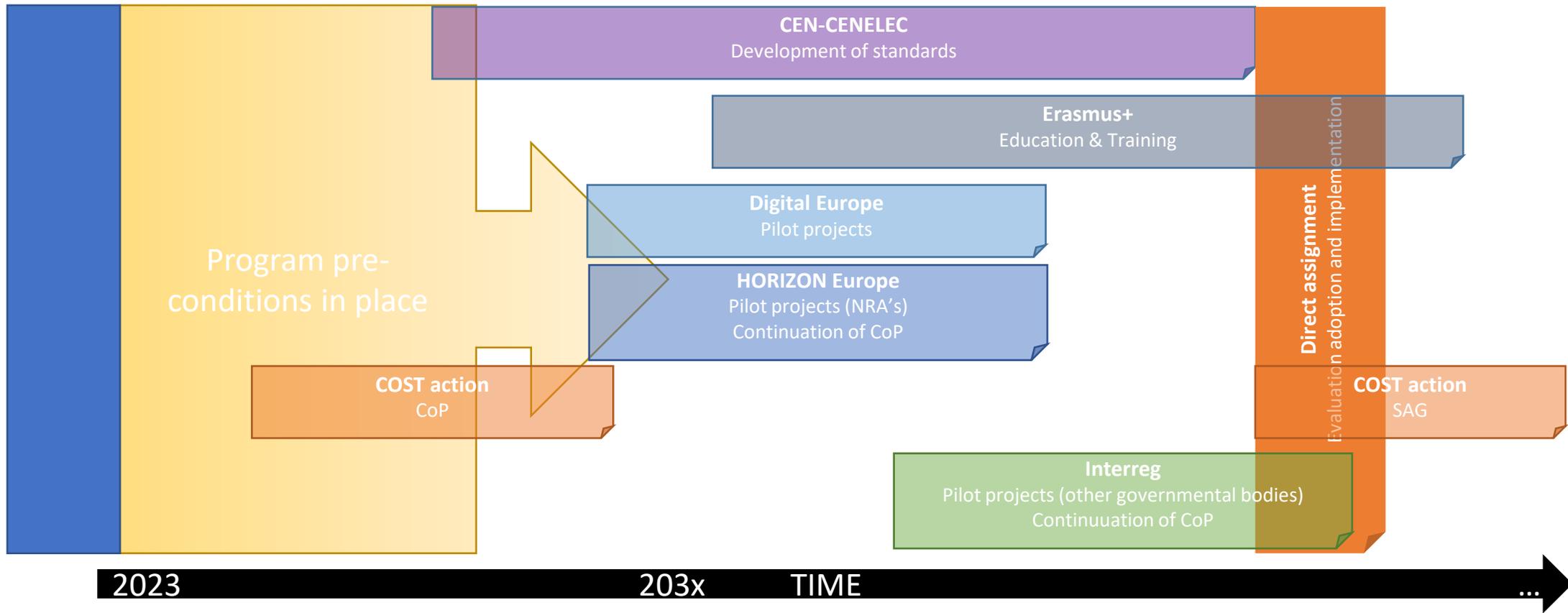


# Program / Roadmap





# Program / Roadmap





# 14:40 - 15:00 Session 2: Recommendations about the set-up of pilot projects

Darò Paola (SACERTIS Ingegneria S.r.l.)





## Purpose of Task 5.2

### Change management, adoption plan and pilot setup

#### 1. GOALS

- to raise the **awareness** about the necessity to develop and adopt the new standards;
- to identify and remove the **PEST barriers** related to different stakeholders;
- to motivate decision-makers in the public and commercial organisations to **improve the knowledge and skills of their employees about the new standards.**

#### 2. RESULTS

- Awareness campaign (video)
- Practical guidelines ('self-instruction')
- **Generic setup for future pilot projects**
- Evaluation method ('self assessment')



*This session provides **guidance on the setup of pilot projects and recommendations** for the follow-up upscaling to support the **practical application of the 3 new standards** on:*

- *structural monitoring*
- *data-informed safety assessment*
- *preventive maintenance in real-world cases.*





## Main objectives

### Project context

A **PILOT** is a way of testing a **theoretical model, new technology, process, system, product, partnership, or related project on a small-scale level**, in order to:

- evaluate its full **impact, benefits and weaknesses**
- discover **potential problems** that may arise on a full-scale deployment.

#### OBJECTIVE:



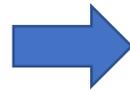
Development of a **generic setup for future pilot projects**, and an **evaluation method** to **assist the stakeholders** to carefully plan the initial settings of the pilot projects depending on the **needs** of their organisations, and the selected **scope** in terms of:

- ✓ ORGANISATIONAL
- ✓ TECHNICAL
- ✓ FINANCIAL
- ✓ HUMAN RESOURCE CAPACITIES
- ✓ REPLICATION POSSIBILITIES

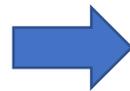


## Main objectives

### Project context



- Combination of **practical applications**, their step-by-step development and the gradual integration into the implementation of the new standards;
- **Organisational development** and **change process to increase acceptance**;
- Further development of the **software tools**;
- **Education and training** of employees to become experts.

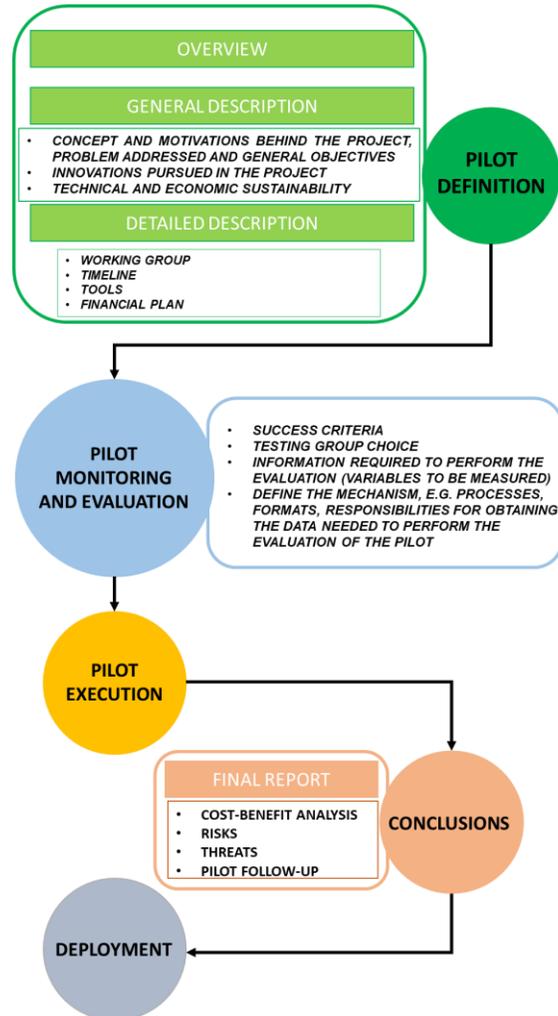


An evaluation method will also be developed to assess:

- The **user need for upscaling**;
- The **adaptability** of the new standards implementation approach;
- **Organisational capacity** for a **smooth transition** to the new standards
- **Feedback and learning loops** internally within an organisation and externally between the value-chain stakeholders in the field of SHM, safety and asset management.



# Pilot Project steps



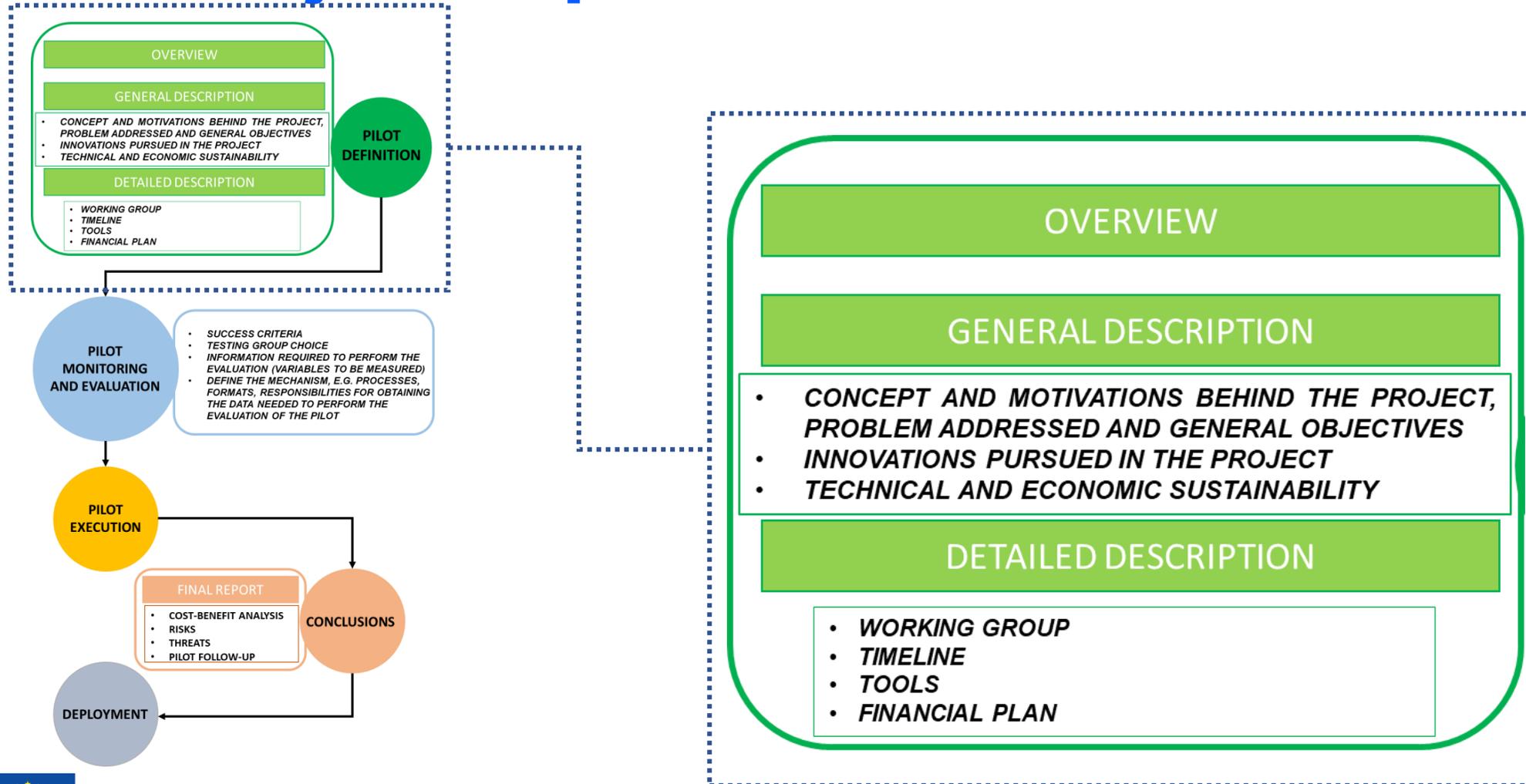
There are **5 KEY STEPS** to conduct a pilot project:

- PILOT DEFINITION
- PILOT MONITORING AND EVALUATION
- PILOT EXECUTION
- CONCLUSIONS
- DEPLOYMENT



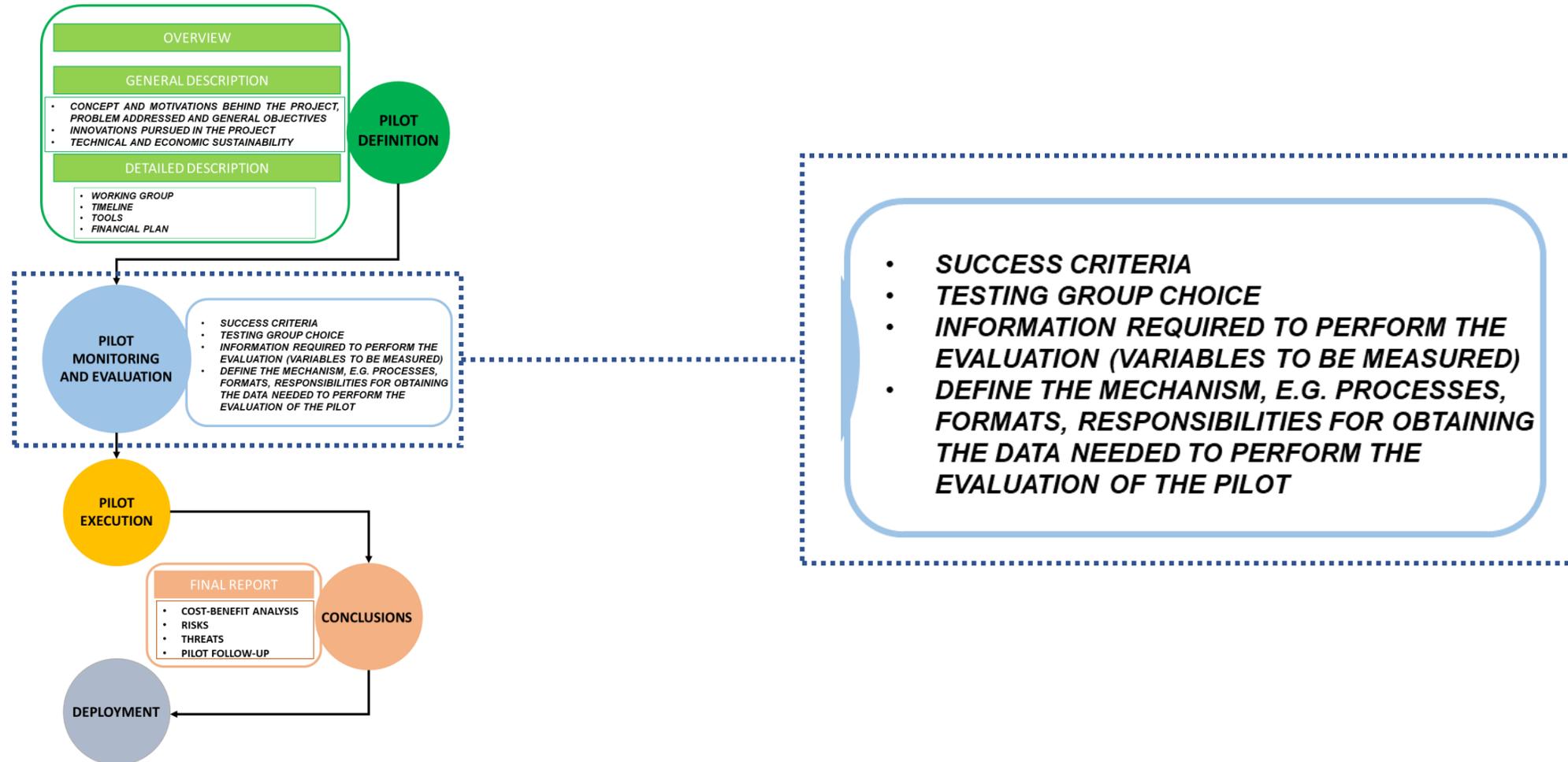


## Pilot Project steps



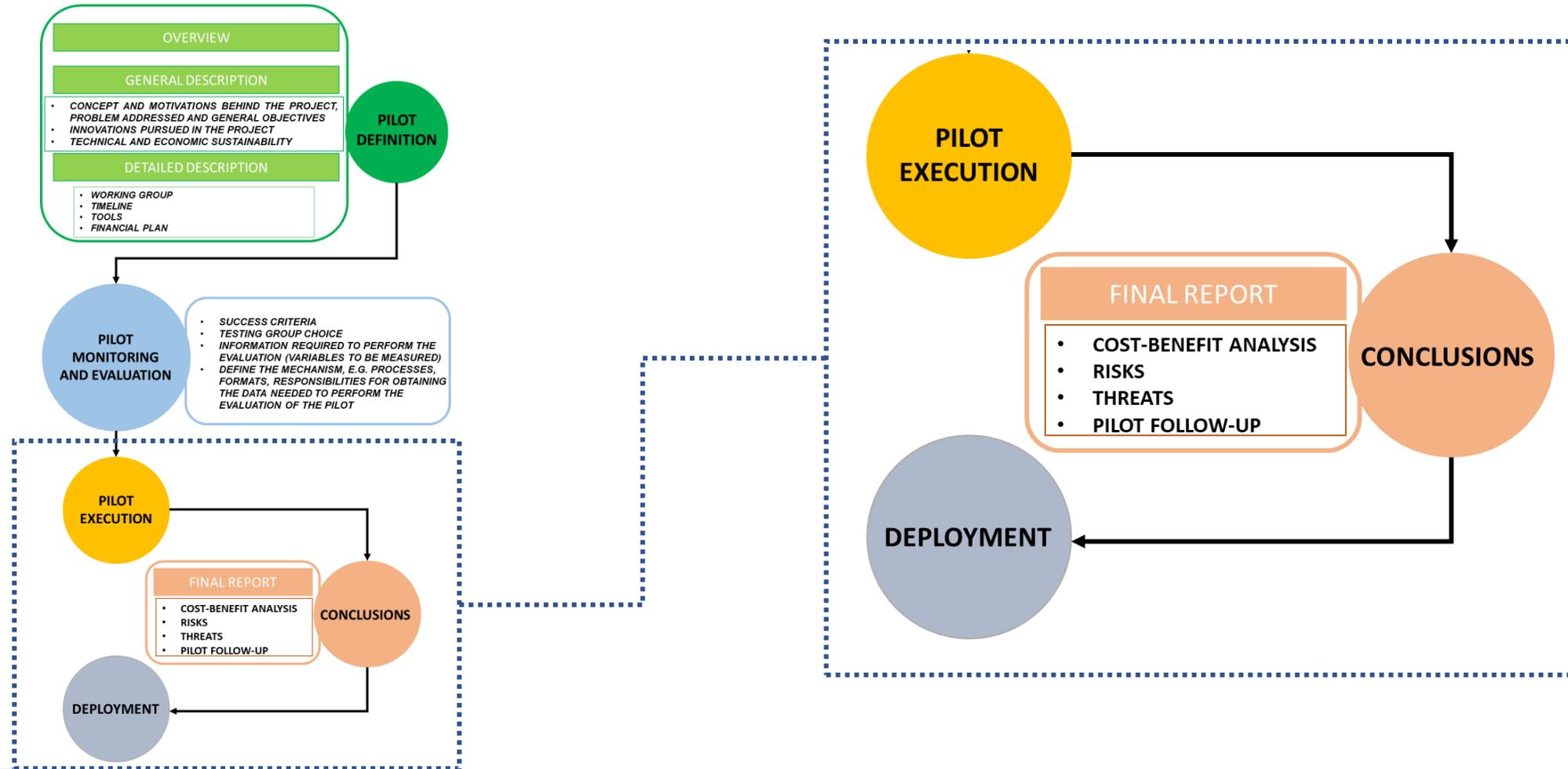


## Pilot Project steps





## Pilot Project steps





## Pilot Project IM-SAFE Template

[PILOT PROJECT TITLE]	
<b>PILOT OVERVIEW</b>	
Project name	
Project acronym	
Project coordinator	
Participants	
Funding required	
Expected duration	
<b>PILOT GENERAL DESCRIPTION</b>	
Concept, motivation & objectives	<p>Introduction of the general context and overall scenario (e.g. sectoral, technological, territorial and corporate) in which the proposal is set, the need and motivations that led to the realisation of the project and the type of problem to which it is proposed to provide a solution. Highlight the relevance of the project to the proposed objectives. Also provide, if available, information on the economical context in which the project is set.</p> <p>Example questions to consider/answer:</p> <ul style="list-style-type: none"> <li>Which new standard(s) are implemented?</li> <li>Which type of structure(s) are considered?</li> <li>What should the pilot project accomplish?</li> <li>What are the technical objectives?</li> <li>What are the additional objectives related to the implementation of the new standards?</li> </ul>
Innovations pursued in the project	<p>Highlight and describe the innovative value and elements of originality of the project, as well as any improvements/adaptations to existing solutions. Explain why the intended results are competitive. Explain the main technical/scientific obstacles to be overcome and the prospective validity of the project.</p> <p>Example questions to consider/answer:</p> <ul style="list-style-type: none"> <li>How will this pilot generate innovation for your organisation?</li> <li>What innovative solution/innovative methodology are you considering?</li> <li>What innovative product/service/materials/components are you developing/using for the project?</li> <li>Is it an application of existing solutions to a new application context?</li> </ul>
Technical and economic sustainability	<p>Outline the level of maturity of the technical solutions envisaged and the feasibility of the project, in terms of time and costs, highlighting the ability to deal with possible risks (negative results) during the activity.</p> <p>Example questions to consider/answer:</p> <ul style="list-style-type: none"> <li>Do you envision an afterlife for the pilot activities?</li> <li>Do you have thoughts on how your pilot activity could be made sustainable?</li> <li>Could the pilot scale up?</li> </ul>

PILOT DETAILED DESCRIPTION	
Working group	<p>The definition of the working group includes the list of participants, the characterisation of those involved in terms of competencies and description of the contributions of each to the project. The dimension and the level of knowledge of the working group depends on the size of the pilot.</p> <ul style="list-style-type: none"> <li>A small size pilot implies limited knowledge/expertise and single representatives for each stakeholder, whose aim is to acquire basic skills.</li> <li>A medium size pilot implies basic knowledge/expertise and multiple representatives for each stakeholder, whose aim is to deepen the knowledge through practical applications.</li> <li>A large size pilot implies good knowledge/expertise and an extended group of experts, whose aim is to prove the state of art of proven technologies/methodologies.</li> </ul>
Timeline	<p>The timeframe needed for the pilot depends on its size: as the size of the pilot increases, the time required for project development increases. For each phase a list of activities should be defined, as well as the established deadlines and the contribution of each participant to the actions above. It should be noted that the period of time to be considered depends on the pilot objectives.</p> <p>The timeline analysis should encompass:</p> <ul style="list-style-type: none"> <li>duration of the project</li> <li>time schedule</li> <li>final objective and intermediate goals</li> </ul>
Tools	<p>Description of the tools to be used within the pilot project, for instance:</p> <ul style="list-style-type: none"> <li>Training tools</li> <li>Project management tools</li> <li>Dedicated software.</li> </ul>
Financial plan	<p>Personnel costs, cost of tools, equipment, cost of consultancy services, additional overheads, other operating costs are some of the costs to be considered in the financial planning. The financial plan has to be evaluated based on the objectives set for the pilot, for which the funds needed may differ significantly. Generally, the funds needed are directly proportional to the size of the project.</p>

PILOT MONITORING & EVALUATION	
Success criteria	<p>Individual success criteria should be specified across the following categories:</p> <ul style="list-style-type: none"> <li>Scope- the project fulfils all the objectives given in the definition phase.</li> <li>Schedule- the project is completed in the set time limit set.</li> <li>Budget- The project has to be completed within the budget allocated.</li> <li>User satisfaction- The project meets consumer demand.</li> <li>Quality- The project delivers the top quality of any product or service.</li> <li>Team goals- The team gains experience and is satisfied with the project results</li> <li>Deliverables- The project has a high quality deliverable.</li> <li>Resource capacity- The project has a proper resource allocation and understanding of the resource capacity.</li> <li>Risk management- The project successfully identifies every tangible or intangible risks.</li> <li>Documentation- The documentation of the entire project gives a clear picture of every step of the project.</li> </ul>
Testing group choice	<p>To ensure that pilot performs effectively, a study group to test it out should be gathered. For instance, in case of a pilot project that aims to release a new product, it is recommended to provide a prototype or less established version of the item for your group to try.</p>
Information required to perform the evaluation (variables to be measured)	<p>The results of the pilot are evaluated based on indicators, which are the variables to be measured and analysed. Indicators might be quantitative and/or qualitative. Quantitative indicators have numeric values (quantitative) and are easier to measure, while qualitative indicators are much harder to measure.</p> <p>Indicators can be measured daily (e.g. daily usage of computer devices), weekly, or per case results (i.e. total % of equipment that failed).</p>
Define the mechanism for doing the evaluation of the pilot	<p>Define the mechanism, e.g. processes, formats, responsibilities for obtaining the data needed to perform the evaluation, such as:</p> <ul style="list-style-type: none"> <li>Stakeholders whose inputs are important to evaluate the pilot</li> <li>Information required to perform the evaluation</li> <li>Processes, formats, responsibilities for obtaining the data needed to perform the evaluation</li> <li>Automatic tools:</li> <li>External, such as observers;</li> <li>Subjective: participants can document their impressions, experiences and ideas through tools like journals or diaries, questionnaires, tables or forms.</li> <li>Environmental: data gathered from sector workers</li> </ul>





# Pilot Project Alternatives

## SMALL SIZE PILOT

- ✓ **short-term** involvement
- ✓ more **limited budget**
- ✓ **simpler objectives, quicker results obtained**



## MEDIUM SIZE PILOT

- ✓ **medium-sized working group** and **medium-term involvement**
- ✓ aim to further the objectives of the project with a **greater financial investment**



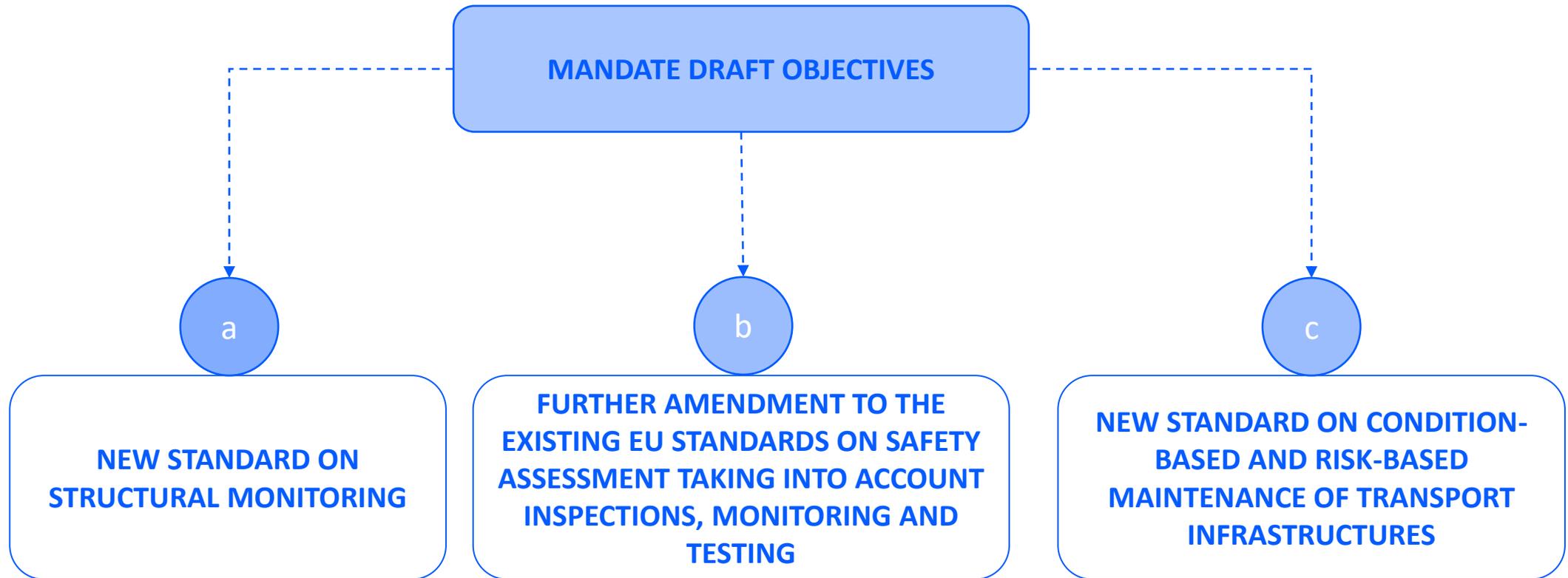
## LARGE SIZE PILOT

- ✓ **long-term investment** in terms of **resources** and **economic investment** to respond to **complex objectives**





# Mandate draft objectives

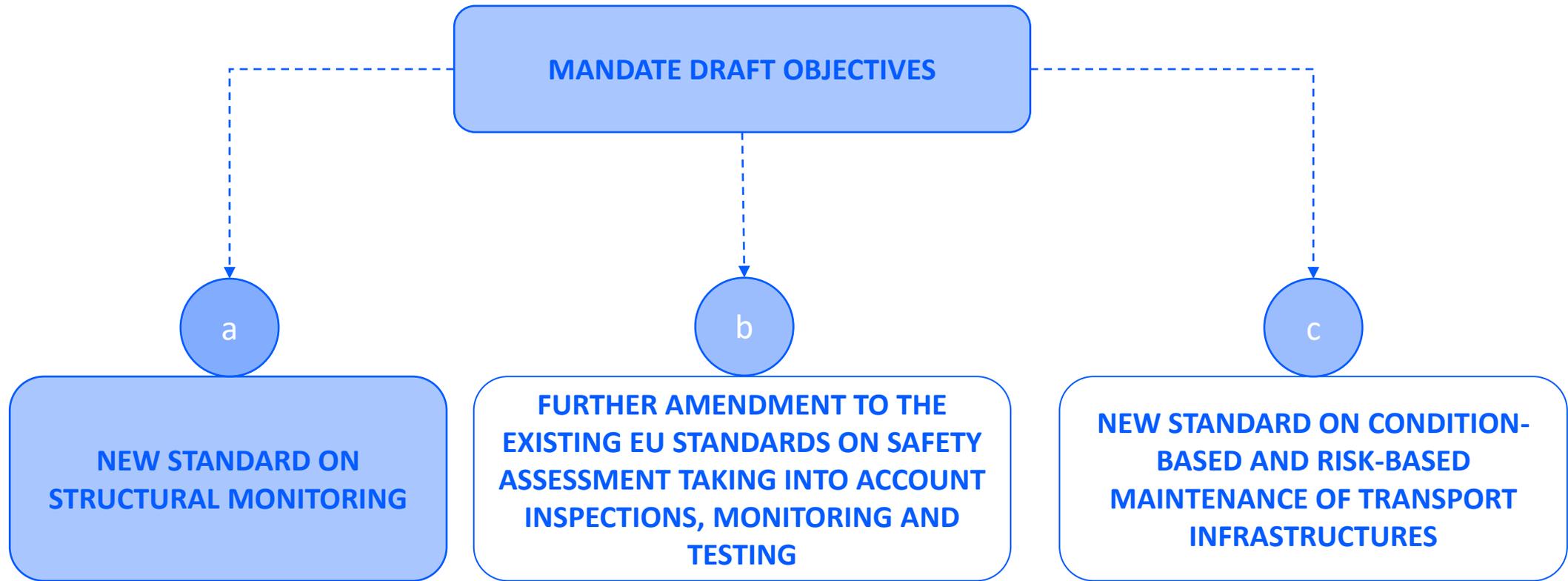


➔ **n.3 WORKED EXAMPLES PILOTS**



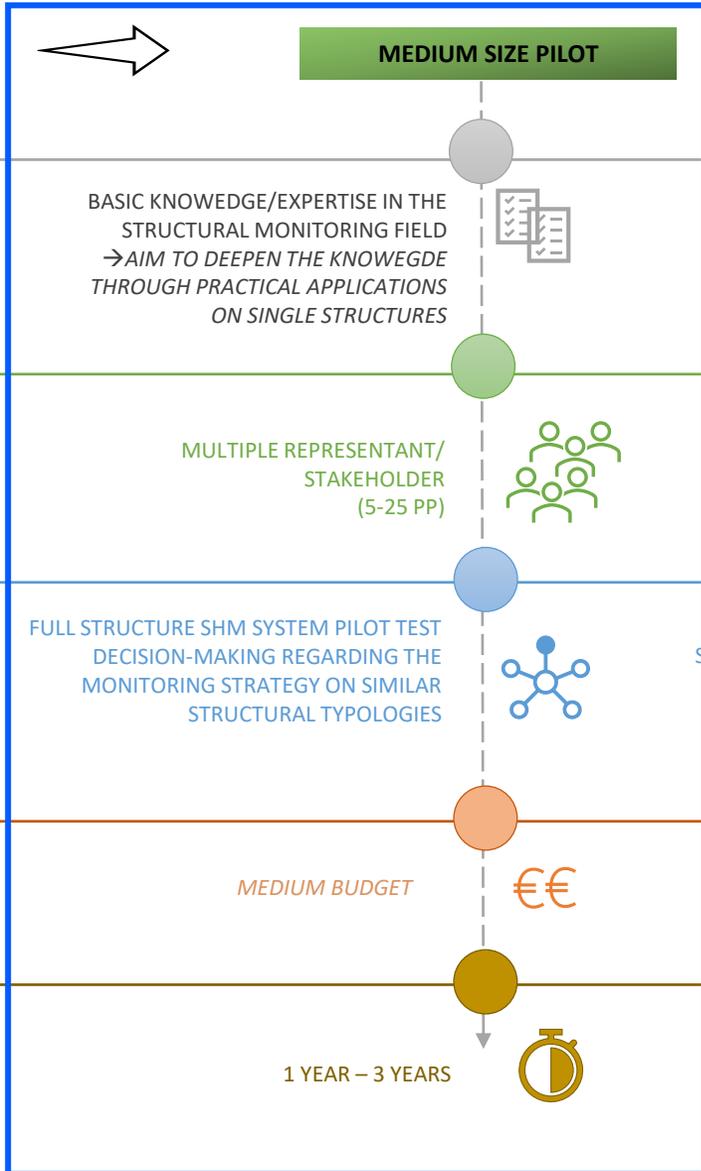
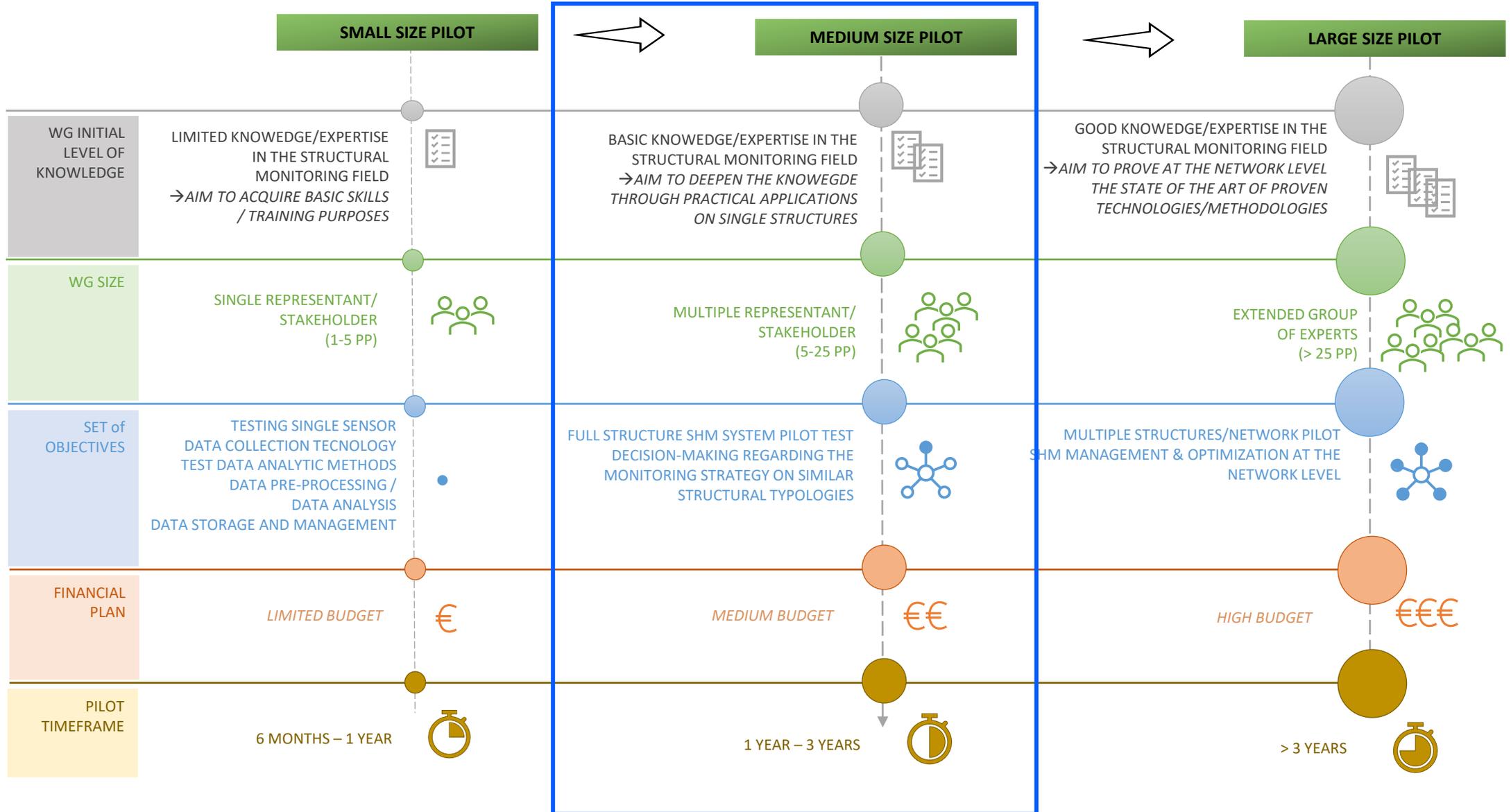


# Mandate draft objectives



➡ **n.3 WORKED EXAMPLES PILOTS**





Worked Example

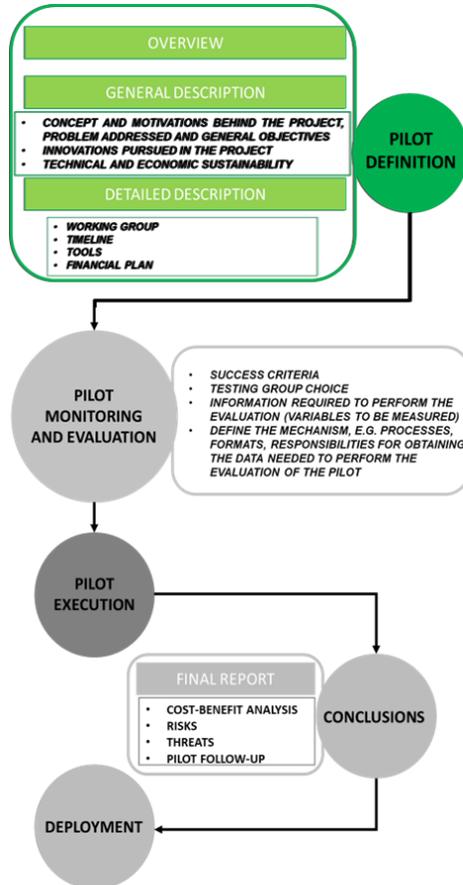


# Pilot Projects

## Worked example n.1

NEW STANDARD ON  
STRUCTURAL MONITORING

a



Select the **STANDARD TOPIC** (1 or multiple) object of the pilot project:

- DECISION-MAKING REGARDING THE MONITORING STRATEGY
- DATA COLLECTION
- DATA PRE-PROCESSING
- DATA ANALYSIS
- DATA STORAGE AND MANAGEMENT



Set the **WORKING GROUP** –representatives of the stakeholders (1 or multiple) :

- ASSET OWNERS AND SUPPLIERS OF FINANCIAL SERVICES
- ASSET MANAGERS
- ENGINEERING COMPANIES
- SUPPLIERS OF MATERIAL



Set **FINANCIAL PLAN, TOOLS, TIMELINE** as a function of the **OBJECTIVES**



# Pilot Projects

## Worked example n.1

NEW STANDARD ON  
STRUCTURAL MONITORING

a

Stakeholders

objectives from SWOT analysis

		OPPORTUNITIES												
		IMPROVED HIGH-LEVEL DECISION MAKING (DUE TO DATA-DRIVEN DECISION MAKING)	IMPROVEMENT OF RISK EVALUATION AND RISK MANAGEMENT	REDUCED MAINTENANCE AND INFRASTRUCTURE COSTS	MODERN DIGITAL SYSTEM FOR ASSET MANAGEMENT	OPTIMIZED MONITORING SYSTEMS THAT COMBINE ECONOMICAL LIMITS, TIMING EFFECTIVENESS AND VALUABLE OUTCOMES	IMPROVED CAPACITY FOR FORECASTING NECESSARY WORKLOADS AND IMPROVED ESTIMATION OF COSTS AND BENEFITS	INCREASED LEVEL OF KNOWLEDGE ON THE STRUCTURAL PERFORMANCE, STRUCTURAL DIAGNOSTICS AND SAFETY ASSESSMENT	GOOD ASSET MANAGEMENT SYSTEM FOR THE EASIER IDENTIFICATION OF WHICH OBJECTS SHOULD BE PRIORITIZED FOR MAINTENANCE	REDUCTION IN THE AMOUNT OF SYSTEMS/SIMPLICITY FOR MONITORING	CREATION OF A STANDARD OF TECHNOLOGICAL STANDARDS	IMPROVEMENT OF DATA COLLECTION OF MATERIAL BEHAVIOUR	AUTOMATION WITH TECHNOLOGY OF THE MOST REPETITIVE MAINTENANCE TASKS (I.E. MONTHLY DRONE SWARM).	IMPROVEMENT OF TRANSPARENCY IN OPERATIONS
TOPIC	DECISION-MAKING REGARDING THE MONITORING STRATEGY	●	●	●	●	●	●	●			●		●	
	DATA COLLECTION									●	●	●	●	
	DATA PRE-PROCESSING									●	●			
	DATA ANALYSIS	●			●		●	●						
	DATA STORAGE AND MANAGEMENT	●			●		●	●	●	●	●	●	●	

STANDARDS Topics  
= Pilot tasks



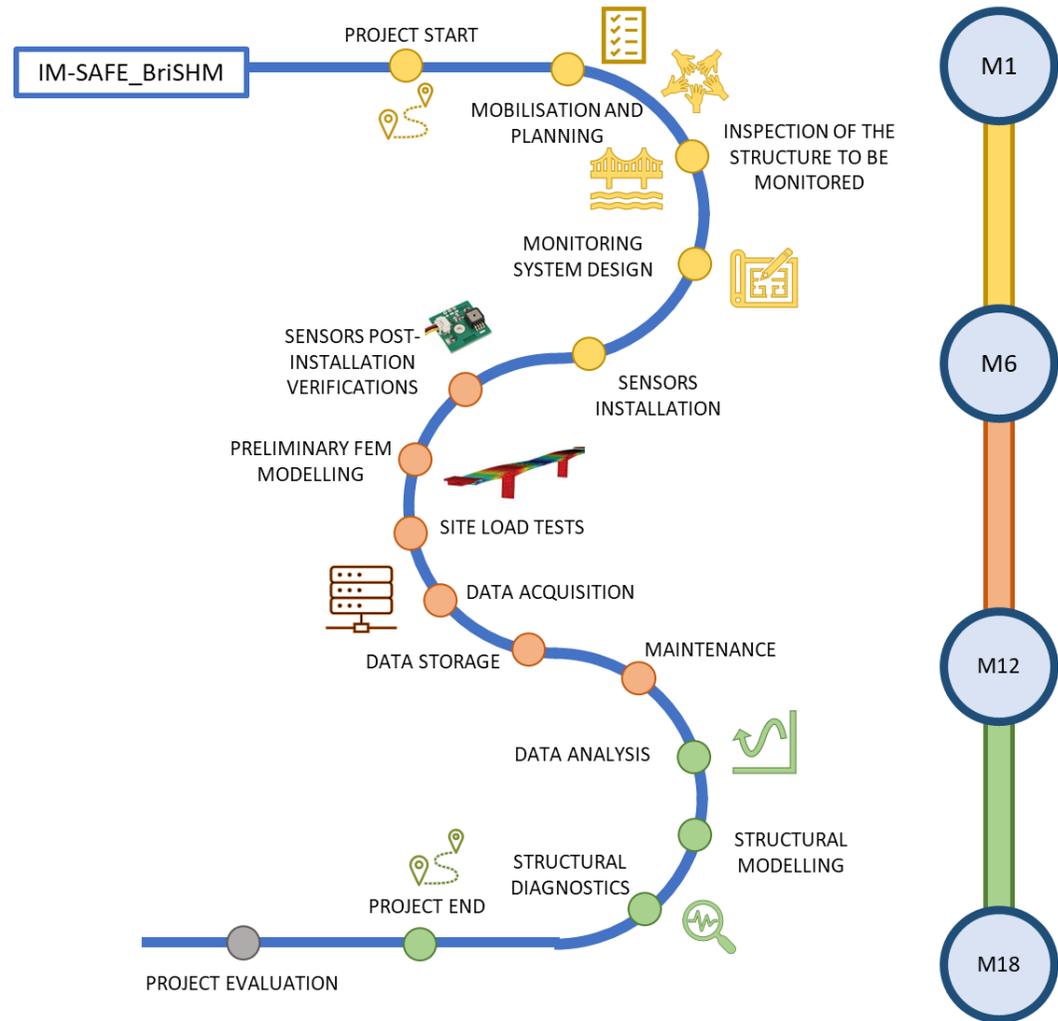
# Pilot Projects

## Worked example n.1

**NEW STANDARD ON  
STRUCTURAL MONITORING**

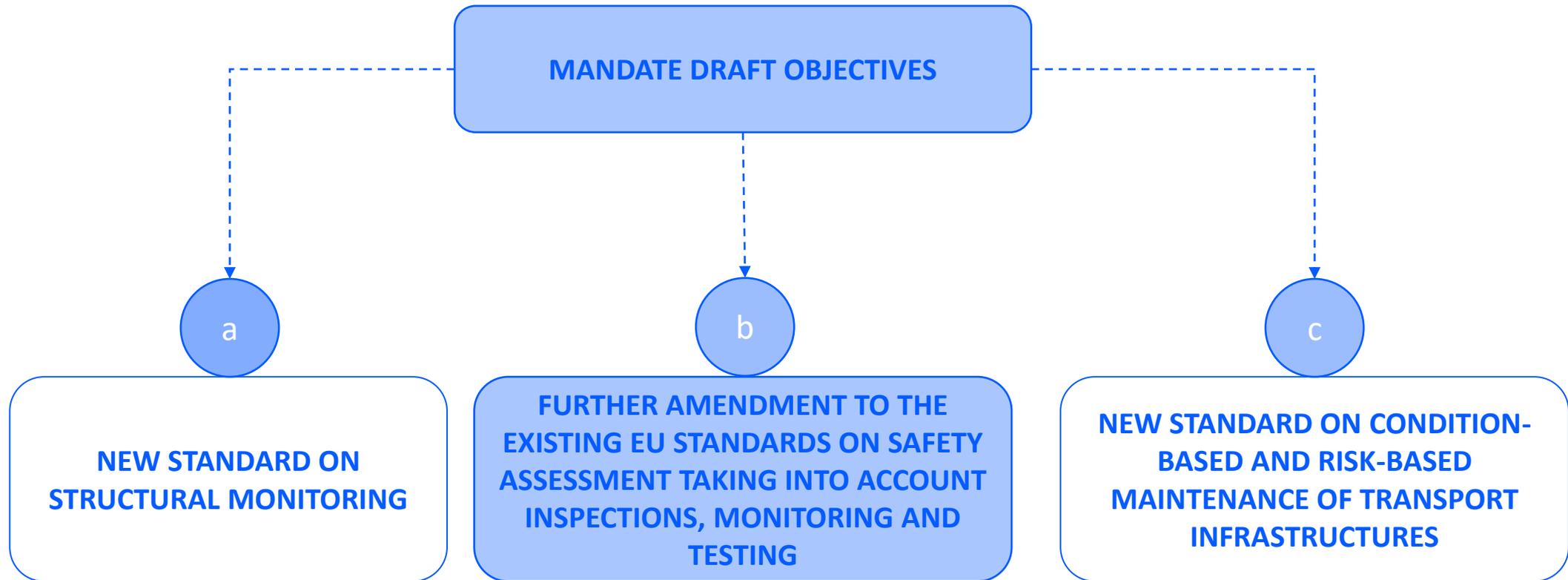
a

IM-SAFE\_BriSHM Pilot  
*Prestressed concrete  
bridge SHM Pilot Project*



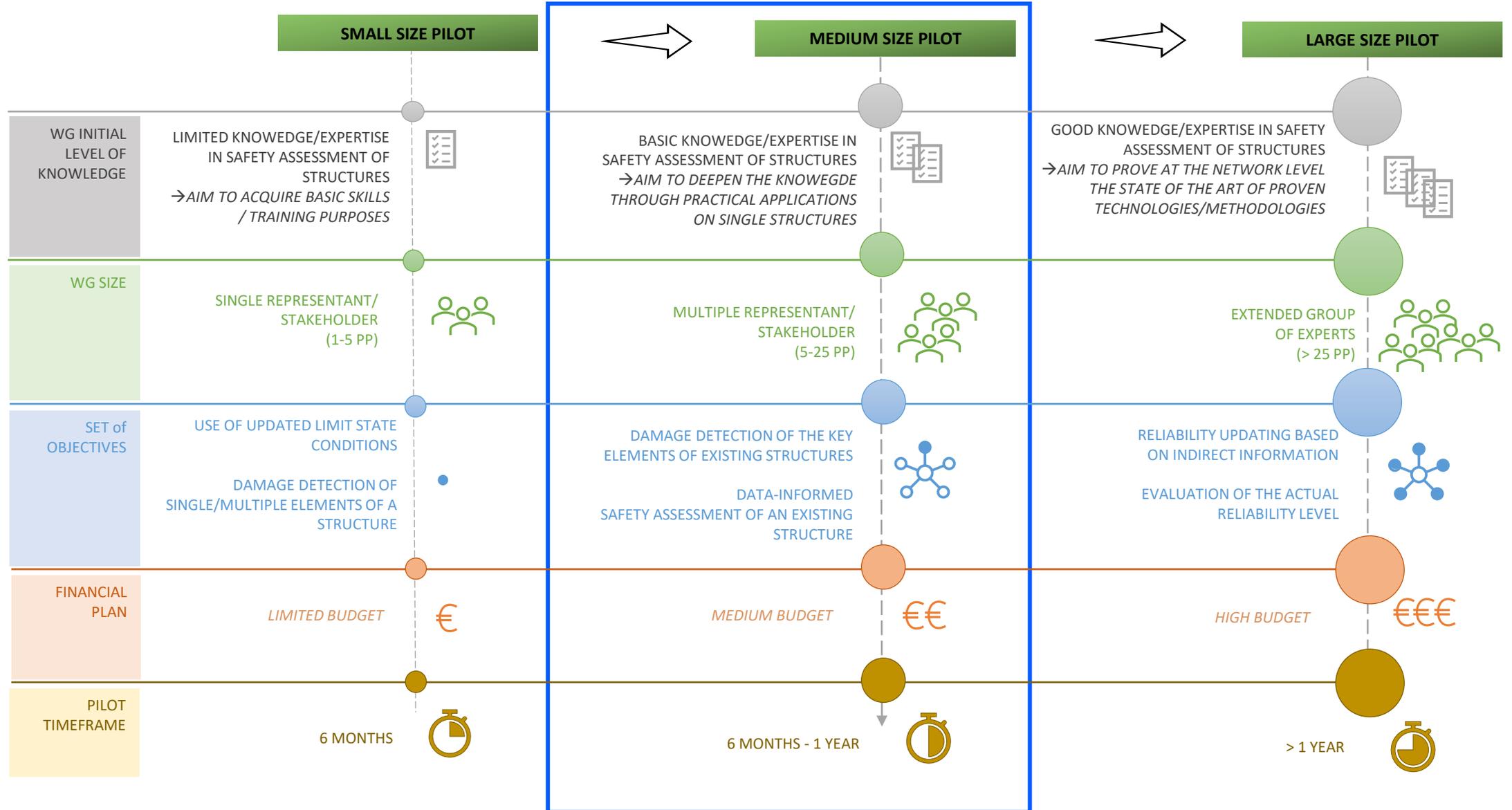


# Mandate draft objectives



➡ **n.3 WORKED EXAMPLES PILOTS**





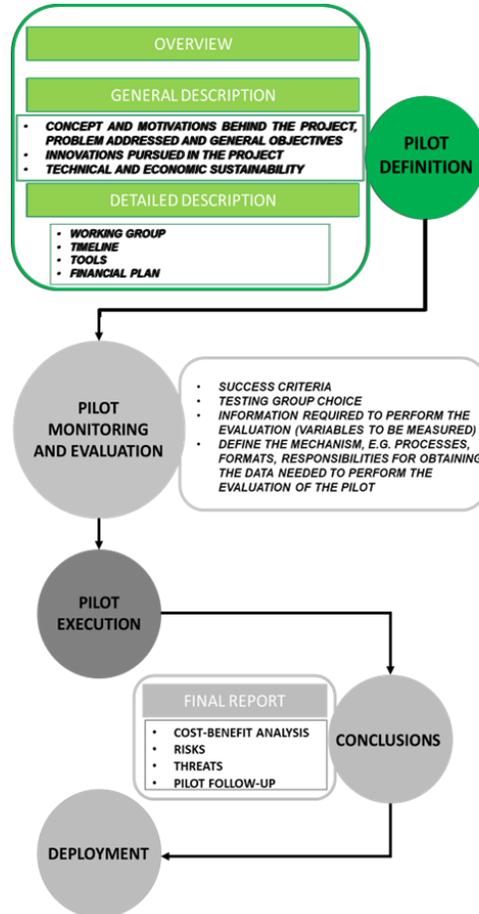
Worked Example



## Pilot Projects Worked example n.2

FURTHER AMENDMENT TO THE EXISTING EU STANDARDS ON SAFETY ASSESSMENT TAKING INTO ACCOUNT INSPECTIONS, MONITORING AND TESTING

b



Select the **STANDARD TOPIC (1 or multiple)** object of the pilot project:

- MINIMUM RELIABILITY REQUIREMENTS AND REFERENCE PERIOD
- LIMIT STATE CONDITIONS
- DETERIORATION AND DAMAGE
- USE OF STRUCTURE-SPECIFIC INFORMATION FOR SAFETY ASSESSMENT



Set the **WORKING GROUP –representatives of the stakeholders (1 or multiple)** :

- ASSET OWNERS AND SUPPLIERS OF FINANCIAL SERVICES
- ASSET MANAGERS
- ENGINEERING COMPANIES
- SUPPLIERS OF SERVICES/TECHNOLOGIES



Set **FINANCIAL PLAN, TOOLS, TIMELINE** as a function of the **OBJECTIVES**





## Pilot Projects Worked example n.2

FURTHER AMENDMENT TO THE EXISTING EU STANDARDS ON SAFETY ASSESSMENT TAKING INTO ACCOUNT INSPECTIONS, MONITORING AND TESTING

b

### Stakeholders

- ASSET OWNERS AND SUPPLIERS OF FINANCIAL SERVICES ●
- ASSET MANAGERS ●
- ENGINEERING COMPANIES ●
- SUPPLIERS OF TECHNOLOGIES ●
- SUPPLIERS OF SERVICES ●

### objectives from SWOT analysis

		OPPORTUNITIES														
		HARMONIZATION FOR THE IMPROVEMENT OF THE PERCEPTION OF THE STATE OF THE ENTIRE INFRASTRUCTURE	AVOID RECENT CATASTROPHES DUE TO LACK OF MAINTENANCE	POTENTIAL REDUCTION IN THE FAILURE RATE OF INFRASTRUCTURE	IMPROVING HIGH-LEVEL DECISION MAKING	IMPROVED CAPACITY FOR FORECASTING NECESSARY WORKLOADS AND IMPROVED ESTIMATION OF COSTS AND BENEFITS	USE OF THE STANDARDS AS TOOLS TO ARGUE FOR BETTER MONITORING, SUFFICIENT BUDGETS AND BETTER SOLUTIONS	INCREASED LEVEL OF KNOWLEDGE ON THE STRUCTURAL PERFORMANCE, STRUCTURAL DIAGNOSTICS AND SAFETY ASSESSMENT	IMPROVING TRANSPARENCY IN OPERATIONS	ENHANCED TOOLS AND GUIDANCE AVAILABLE TO SUPPORT DATA ANALYTICS, STRUCTURAL PERFORMANCE ASSESSMENT AND DIAGNOSTICS	CREATION OF A STANDARD OF TECHNOLOGICAL STANDARDS	IMPROVEMENT OF DATA COLLECTION OF MATERIAL BEHAVIOUR	IMPROVEMENT OF RISK EVALUATION AND RISK MANAGEMENT	POTENTIAL REDUCTION IN THE FAILURE RATE OF INFRASTRUCTURE	MODERN DIGITAL SYSTEM FOR ASSET MANAGEMENT	REDUCED MAINTENANCE AND INFRASTRUCTURE COSTS
TOPIC	MINIMUM RELIABILITY REQUIREMENTS AND REFERENCE PERIOD	●	●	●	●	●										
	LIMIT STATE CONDITIONS						●	●								
	DETERIORATION AND DAMAGE				●	●		●	●	●	●	●				
	USE OF STRUCTURE-SPECIFIC INFORMATION FOR SAFETY ASSESSMENT				● ●	●		●	●	●		●	●	●	●	●

STANDARDS Topics = Pilot tasks



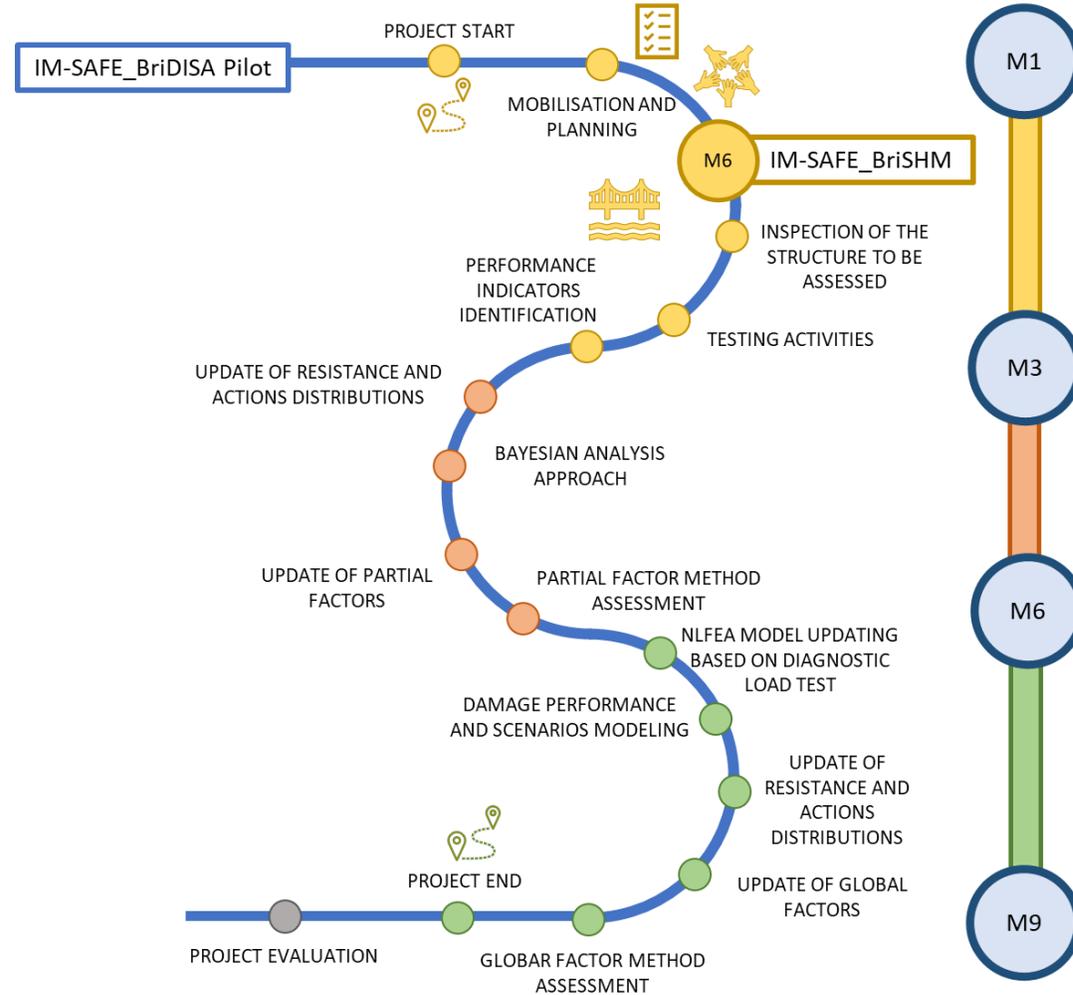
# Pilot Projects

## Worked example n.2

**FURTHER AMENDMENT TO THE EXISTING EU STANDARDS ON SAFETY ASSESSMENT TAKING INTO ACCOUNT INSPECTIONS, MONITORING AND TESTING**

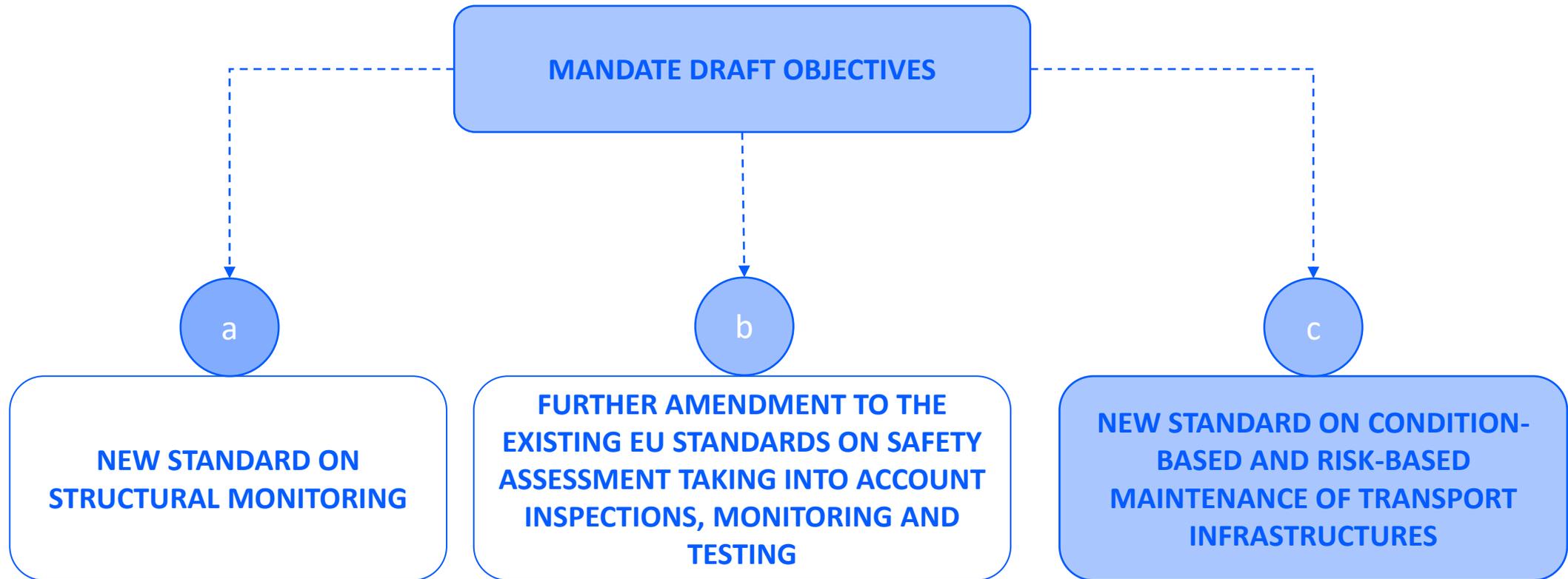
b

IM-SAFE\_BriDISA Pilot  
*Data-informed safety assessment of a prestressed concrete bridge*



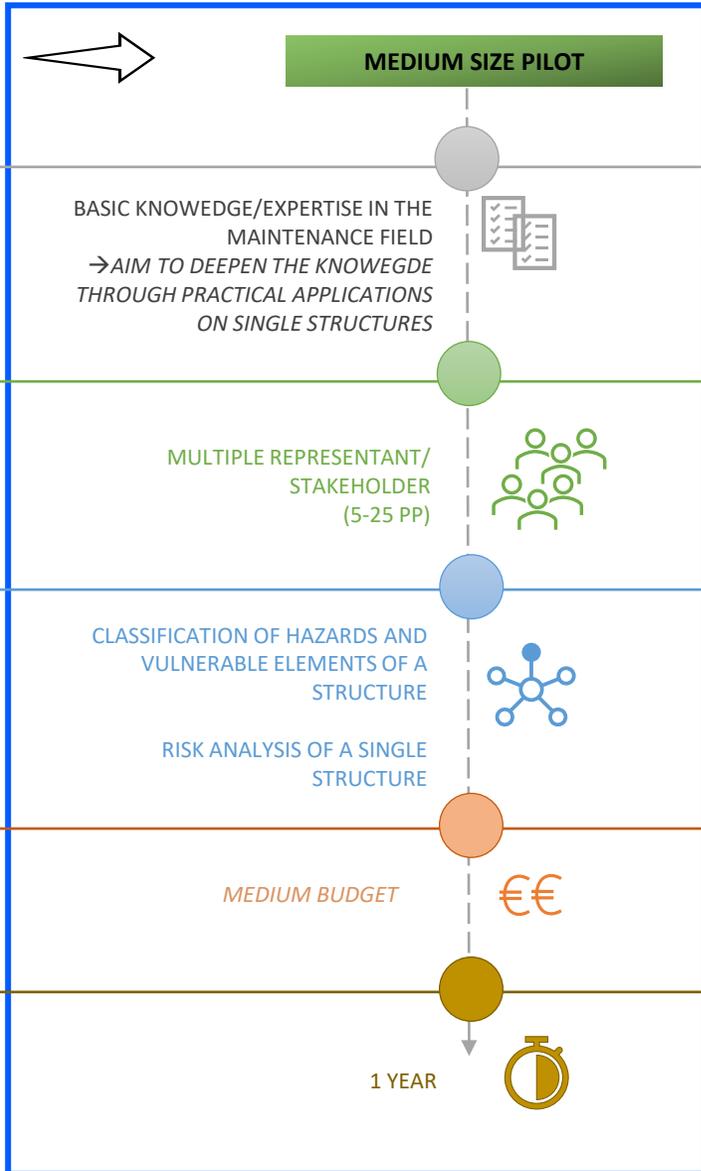
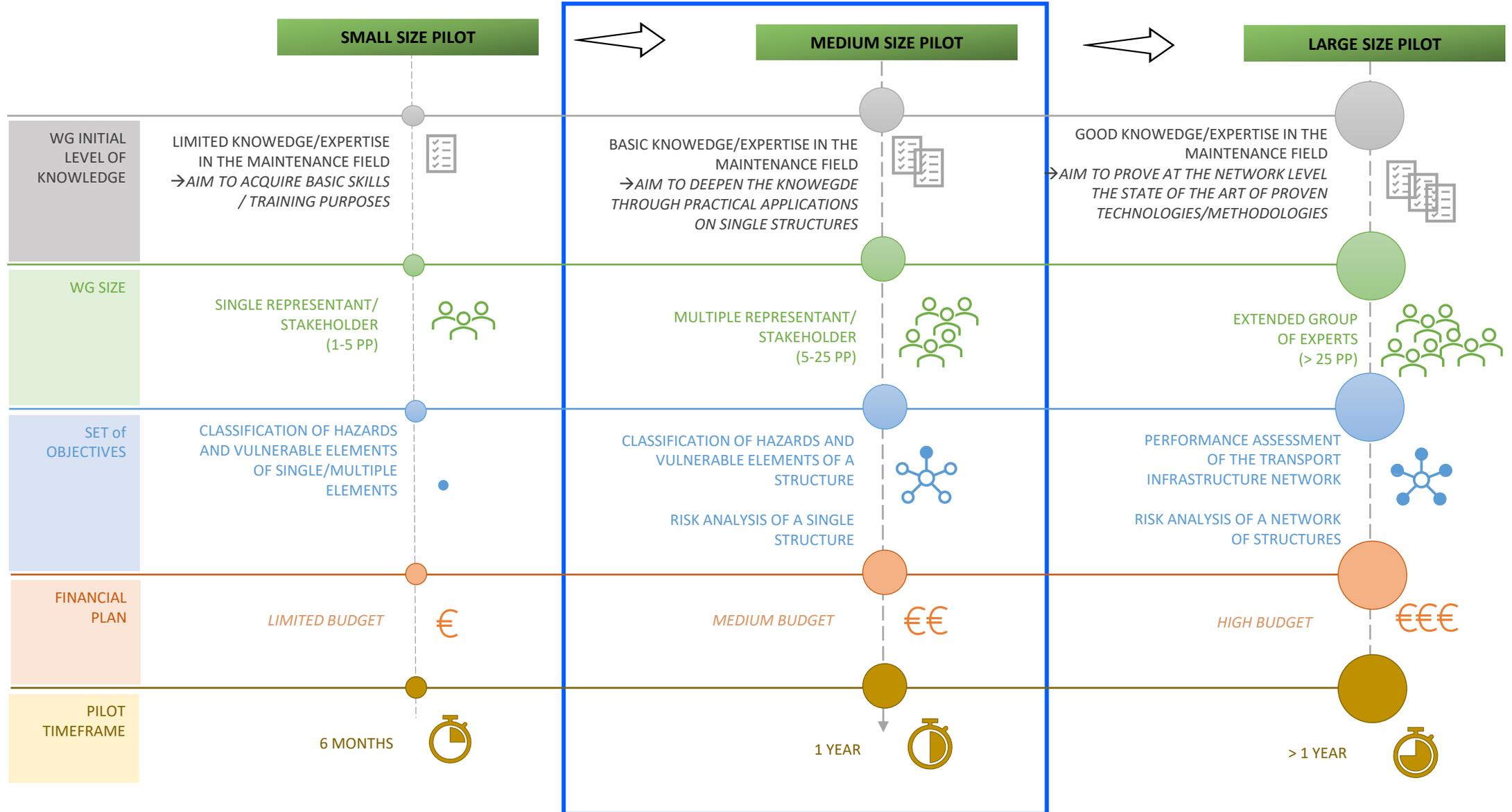


# Mandate draft objectives



➡ **n.3 WORKED EXAMPLES PILOTS**





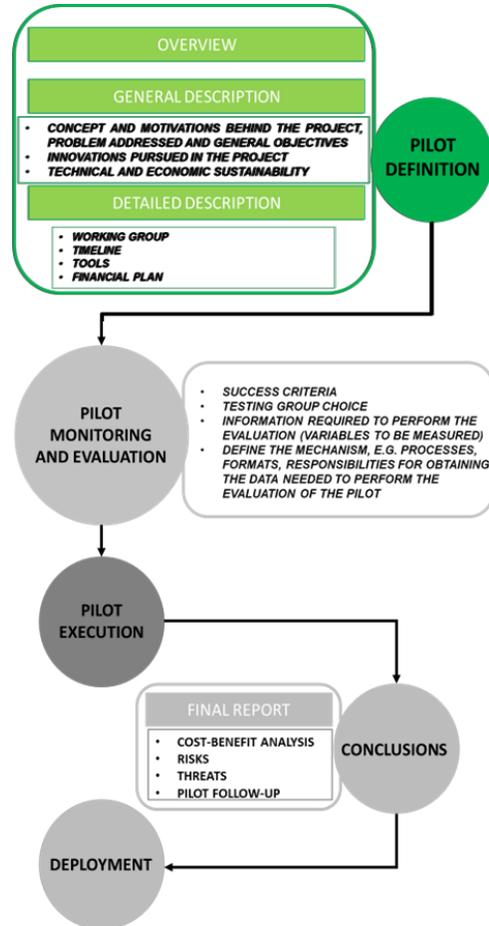
Worked Example





## Pilot Projects Worked example n.3

NEW STANDARD ON CONDITION-BASED AND RISK-BASED MAINTENANCE OF TRANSPORT INFRASTRUCTURES



Select the **STANDARD TOPIC (1 or multiple)** object of the pilot project:

- CLASSIFICATION OF HAZARDS AND VULNERABLE ELEMENTS OF BRIDGES AND TUNNELS
- CONDITION-BASED DECISION PROCESS REGARDING INSPECTION AND MAINTENANCE
- RISK-BASED DECISION PROCESS REGARDING INSPECTION AND MAINTENANCE
- PERFORMANCE ASSESSMENT OF THE TRANSPORT INFRASTRUCTURE NETWORK
- THROUGH-LIFE MANAGEMENT DOCUMENTATION



Set the **WORKING GROUP –representatives of the stakeholders (1 or multiple)** :

- ASSET OWNERS AND SUPPLIERS OF FINANCIAL SERVICES
- ASSET MANAGERS
- ENGINEERING COMPANIES
- BUILDING COMPANIES
- SUPPLIERS OF SERVICES
- SUPPLIERS OF MATERIALS



Set **FINANCIAL PLAN, TOOLS, TIMELINE** as a function of the **OBJECTIVES**



# Pilot Projects

## Worked example n.2

NEW STANDARD ON CONDITION-BASED AND RISK-BASED MAINTENANCE OF TRANSPORT INFRASTRUCTURES



### Stakeholders

- ASSET OWNERS AND SUPPLIERS OF FINANCIAL SERVICES ●
- ASSET MANAGERS ●
- ENGINEERING COMPANIES ●
- SUPPLIERS OF TECHNOLOGIES ●
- SUPPLIERS OF MATERIALS ●
- SUPPLIERS OF SERVICES ●
- BUILDING COMPANIES ●

### objectives from SWOT analysis

		OPPORTUNITIES														
		IMPROVED HIGH-LEVEL DECISION MAKING	IMPROVEMENT OF RISK EVALUATION AND RISK MANAGEMENT	COST REDUCTION IN MAINTENANCE AND INFRASTRUCTURE	AVOID RECENT CATASTROPHES DUE TO LACK OF MAINTENANCE	REDUCED MAINTENANCE AND INFRASTRUCTURE COSTS	POTENTIAL REDUCTION IN THE FAILURE RATE OF INFRASTRUCTURE	INCREASED LEVEL OF KNOWLEDGE ON THE STRUCTURAL PERFORMANCE, STRUCTURAL DIAGNOSTICS AND SAFETY ASSESSMENT	GOOD ASSET MANAGEMENT SYSTEM FOR THE EASIER IDENTIFICATION OF WHICH OBJECTS SHOULD BE PRIORITIZED FOR MAINTENANCE	PRIORITIZE MAINTENANCE BUDGETS	OPPORTUNITY TO SIMULATE THE INTRODUCTION OF TECHNOLOGICAL IMPROVEMENTS FOR MAINTENANCE OPERATIONS	AUTOMATION WITH TECHNOLOGY OF MAINTENANCE TASKS	AUTOMATION WITH TECHNOLOGY OF THE MOST REPETITIVE MAINTENANCE TASKS (I.E. MONTHLY DRONE SWARM).	ENHANCED TOOLS AND GUIDANCE AVAILABLE TO SUPPORT MAINTENANCE ACTIVITIES OPTIMIZATION	REDUCTION OF COSTS AND INCREASE OF MARGINS	
<b>TOPIC</b>	CLASSIFICATION OF HAZARDS AND VULNERABLE ELEMENTS OF BRIDGES AND TUNNELS	<span style="color: orange;">●</span> <span style="color: blue;">●</span> <span style="color: green;">●</span>		<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span> <span style="color: orange;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>		<span style="color: green;">●</span> <span style="color: grey;">●</span>		
	CONDITION-BASED DECISION PROCESS REGARDING INSPECTION AND MAINTENANCE	<span style="color: orange;">●</span> <span style="color: blue;">●</span> <span style="color: green;">●</span>		<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span> <span style="color: orange;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>		<span style="color: green;">●</span>		
	RISK-BASED DECISION PROCESS REGARDING INSPECTION AND MAINTENANCE	<span style="color: orange;">●</span> <span style="color: blue;">●</span> <span style="color: green;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: blue;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span> <span style="color: orange;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>	<span style="color: green;">●</span>		<span style="color: green;">●</span>		
	PERFORMANCE ASSESSMENT OF THE TRANSPORT INFRASTRUCTURE NETWORK							<span style="color: green;">●</span>								
	THROUGH-LIFE MANAGEMENT DOCUMENTATION		<span style="color: blue;">●</span>					<span style="color: green;">●</span>				<span style="color: yellow;">●</span> <span style="color: grey;">●</span> <span style="color: red;">●</span>	<span style="color: yellow;">●</span> <span style="color: grey;">●</span>	<span style="color: yellow;">●</span> <span style="color: grey;">●</span>	<span style="color: yellow;">●</span> <span style="color: grey;">●</span> <span style="color: red;">●</span>	<span style="color: purple;">●</span>

STANDARDS Topics = Pilot tasks



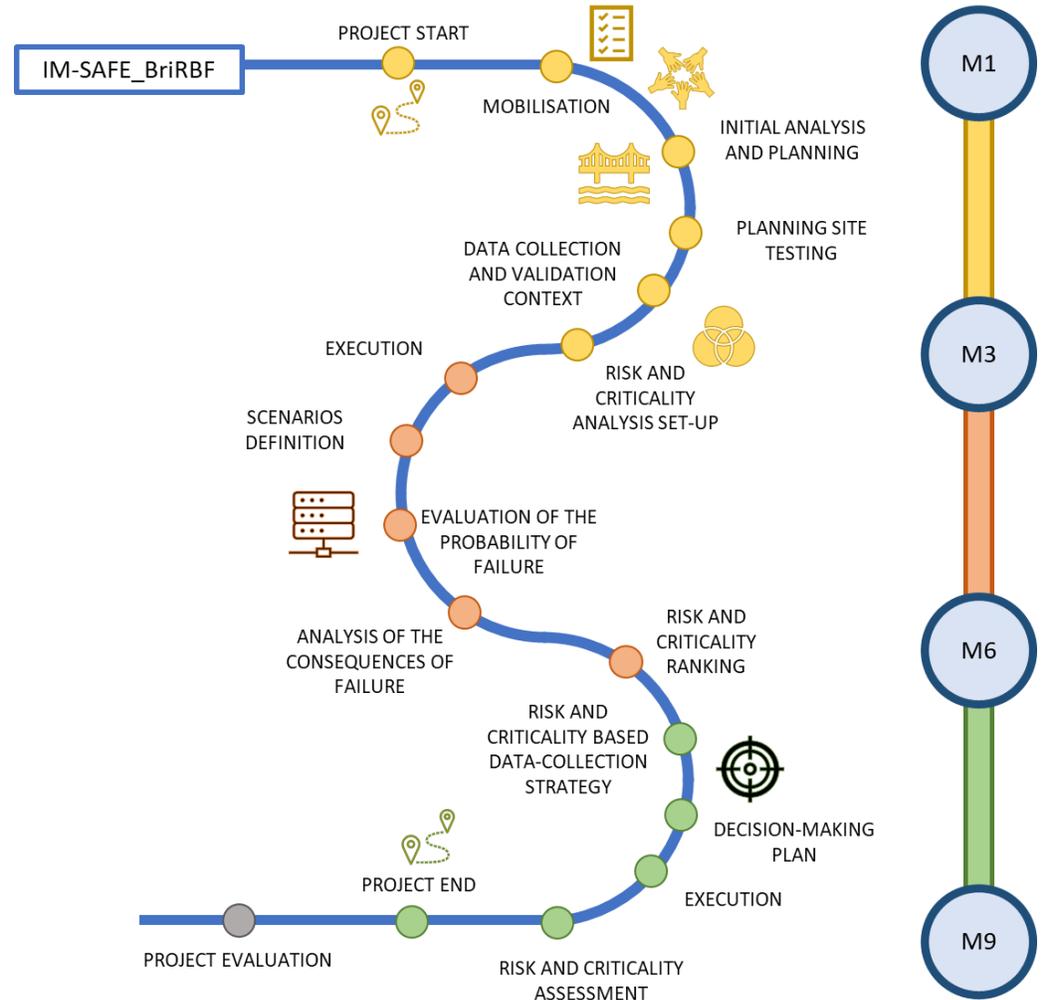


## Pilot Projects Worked example n.3

### NEW STANDARD ON CONDITION-BASED AND RISK-BASED MAINTENANCE OF TRANSPORT INFRASTRUCTURES



IM-SAFE\_BriRBF Pilot  
*Risk-based framework for  
the maintenance of a  
prestressed concrete  
bridge*



# Conclusions:

- The **IM-SAFE Project** provides **guidance on the setup of pilot projects and recommendations** for the follow-up upscaling to **support the practical application of the 3 new standards** on:
  - structural monitoring
  - data-informed safety assessment
  - preventive maintenance in real-world cases.
- A **Pilot Project template** has been developed and will be made available to support implementation
- **N.3 Pilot Projects as worked examples** have been detailed





# Q&A



› **Thank you for your attention**

[www.IM-SAFE.eu](http://www.IM-SAFE.eu)

[www.platformbruggen.nl](http://www.platformbruggen.nl)