DigiPLACE
TOWARDS A EUROPEAN DIGITAL PLATFORM FOR CONSTRUCTION

D6.3 – Strategy Roadmap and Implementation Action Plan

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D6.3 – Strategy Roadmap and Implementation Action Plan

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EXECUTIVE SUMMARY

DigiPLACE project aims at creating **a Reference Architecture Framework (RAF) and a roadmap for a coherent implementation of Digital Platforms for Construction in Europe**. It will introduce a common "ecosystem" of innovation, standardisation and marketplace, with the goal to increase the productivity of the sector and the quality of its end products: buildings and infrastructures. It has defined the RAF for future digital construction platform(s) based on an EU-wide consensus involving a large community of stakeholders, and a Strategic Roadmap for a successful implementation of this RAF. As a follow up after the end of the project, starting from suitable reference architectures, platform interfaces are proposed to be defined, tested through piloting, supported via ecosystem set up to prepare their roll-out and contribute towards standards.

The overarching purpose of work package 6 (WP6) is to define a **Strategy Roadmap to support the stakeholders for the future gradual implementation and deployment in Europe of the RAF and its applications** as defined in WP5. This will complement the work done in the previous packages, in particular the creation of DigiPLACE stakeholders community (WP2), the identification of good practices and existing initiatives or technological solutions already used, as well as attention points including success factors (WP3), the identification of barriers and factors for digitalisation enhancement (WP4) and, most of all, the **reference architecture framework** (WP5) which **provides a comprehensive set of common guidelines for building and deploying interoperable digital platforms for the construction sector** across Europe. This includes **several open options to consider** regarding European/national platforms, large scale data space, digitalised public services among others.

An "Implementation action Plan" is a comprehensive, structured and prioritised set of actions aiming at the further development of what has been described in Deliverable 6.2 by defining a **Strategy Roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications** as defined in WP5.

Therefore**,** this deliverable is seen as a **continuation of the work done in deliverable D6.2** in which one of the main results has been to define **four main topics seen as "corner-stones" of the roadmap**:

1. **Promote and network**, with the intention of creating a long-lasting stakeholders ecosystem to promote, support and refine DigiPLACE RAF;
2. **Develop and deploy,** featuring a set of actions towards integrating, stimulating, experimenting (large-scale pilots), assessing the use and monitoring the impact of platforms and associated services leveraging on DigiPLACE RAF;
3. **Foster and Secure**, contributing notably to RAF-based digitalisation of European and national regulations;
4. **Capitalise and train**, contributing to training/digital skills development in construction while developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services etc.

The **methodology of this report is twofold**:

- the identification of adequate financial resources to sustain the implementation of the proposed RAF;
- The development of a seven-year Strategy Roadmap that includes key strategic priorities, leading to an Implementation Action Plan.

In the following chapters, after having presented the consolidated scenarios and, in particular, those scenarios considered as priority ones by the contributions to online consultation, the economic analysis is presented with the aim of identifying adequate financial resources to sustain their implementation.

In addition, a strategy roadmap has been developed based on the results of the previous project tasks, with the aim of supporting stakeholders for the progressive implementation of the Reference Architecture Framework and applications defined in WP5.

In fact, the timeline and relevance of each action has been analysed and detailed, with the aim of creating an implementation plan for the RAF in order to be the basis for the future activities in each EU member country.

The results of this is summarized in the following Gantt charts representing the DigiPLACE roadmap:

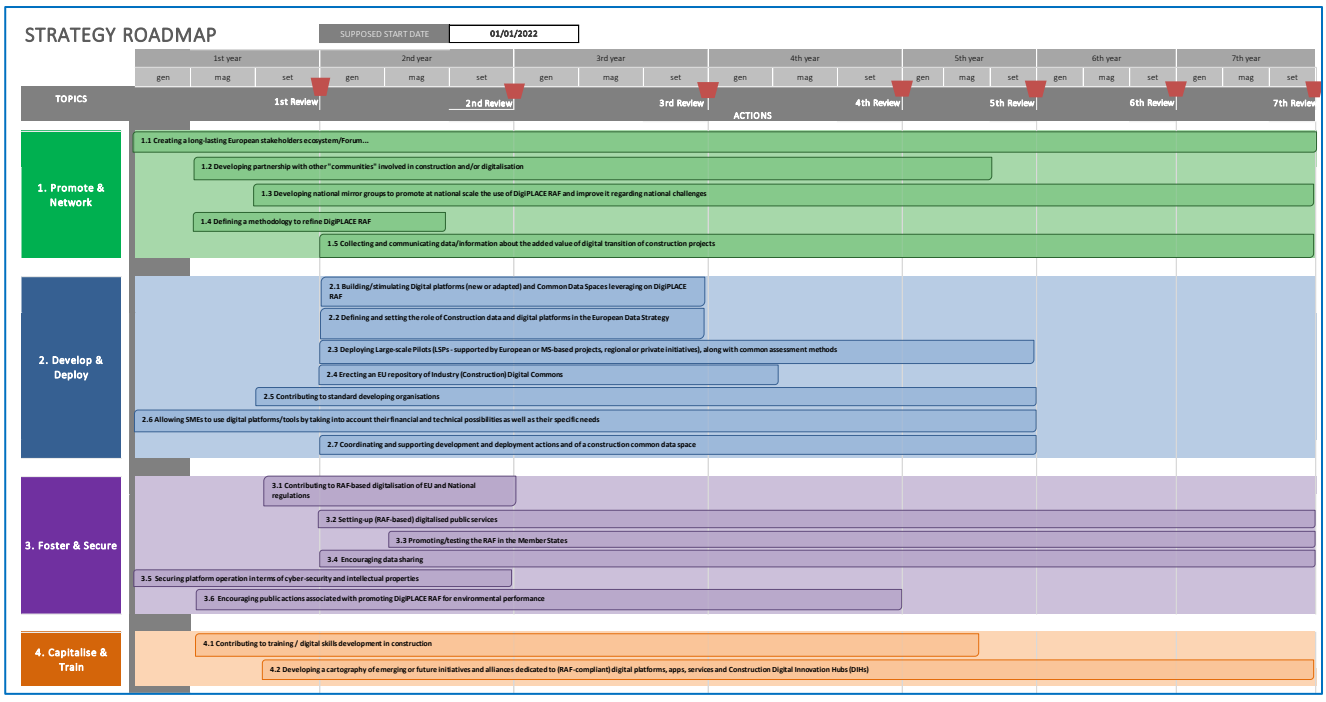

Figure 1 – General Strategy Roadmap: Topics and Actions

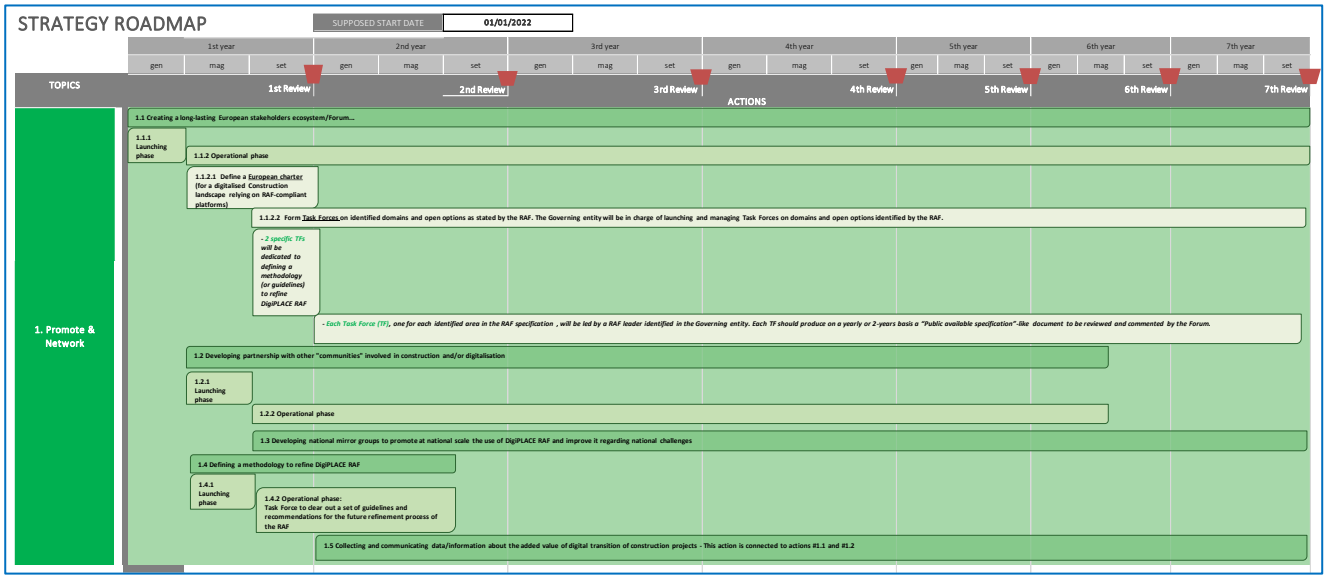

Figure 2 – Strategy Roadmap: Promote and Network: Actions and Sub-Actions

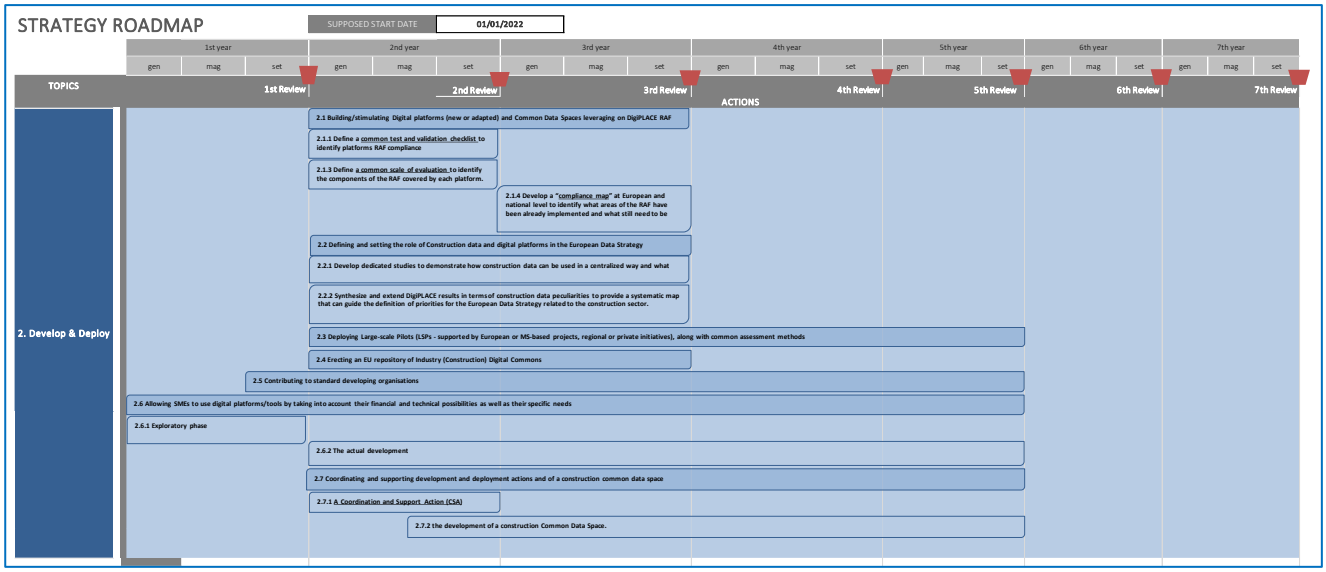

Figure 3 - Strategy Roadmap: Develop and Deploy: Actions and Sub-Actions

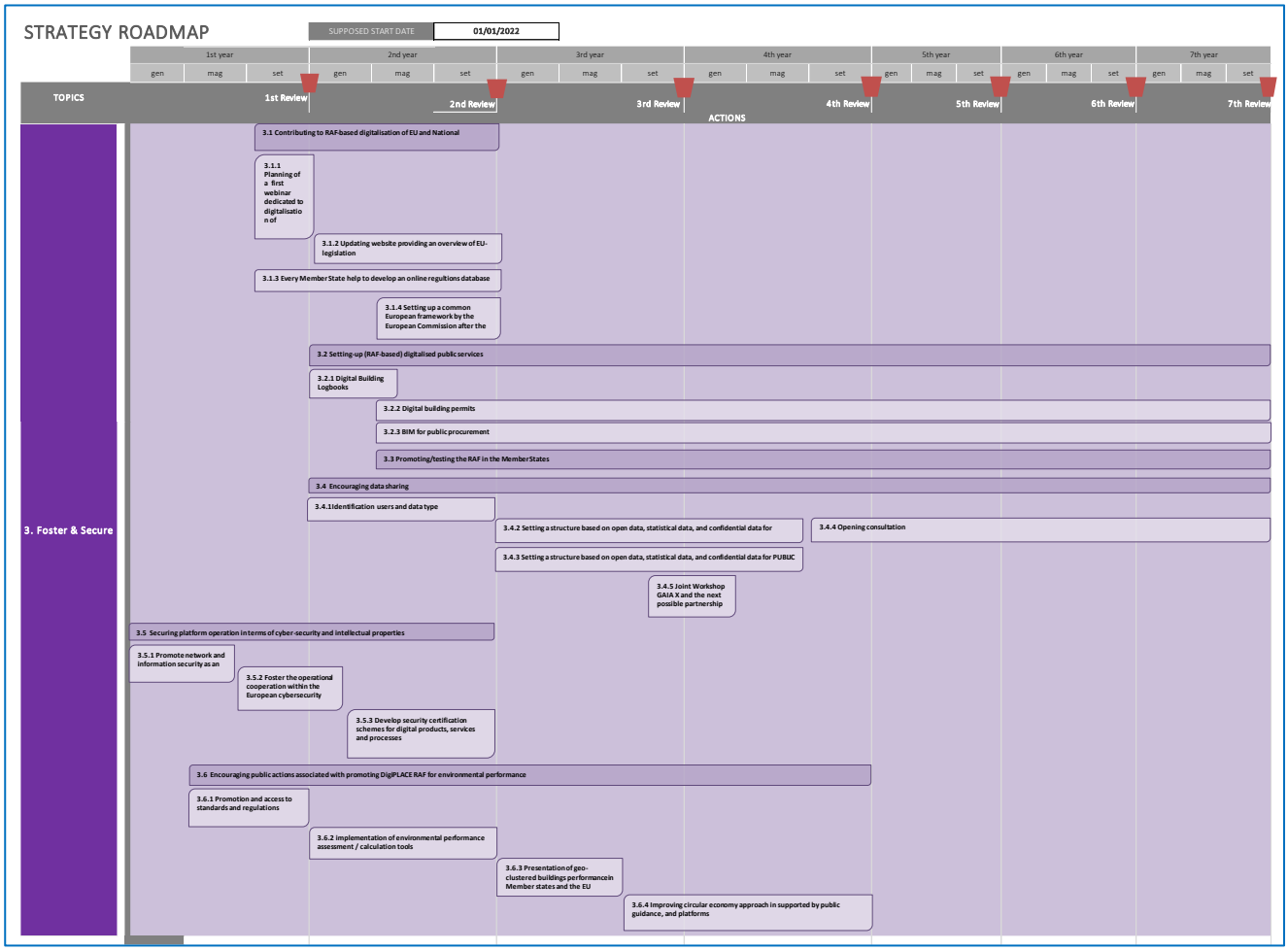

Figure 4 - Strategy Roadmap: Foster and Secure: Actions and Sub-Actions

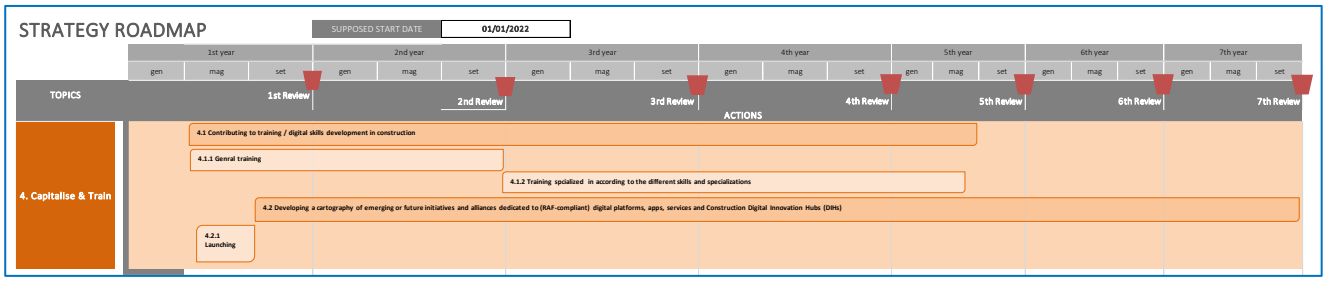

Figure 5 - Strategy Roadmap: Capitalise and Train: Actions and Sub-Actions

PUBLISHING SUMMARY

The overarching purpose of WP6 is to define a Strategy Roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications as defined in WP5.

This complements the work done in the previous packages, in particular the creation of DigiPLACE stakeholders community (WP2), the identification of good practices and existing initiatives or technological solutions already used, as well as attention points including success factors (WP3), the identification of barriers and factors for digitalization enhancement (WP4) and the reference architecture framework (WP5) which provides a comprehensive set of common guidelines for building and deploying interoperable digital platforms for the construction sector across Europe and several open options to consider regarding European/national platforms, large scale data space, digitalized public services among others.

The strategy has been defined in coherence with the four main topics seen as “corner-stones” for the roadmap.

The first step consisted in studying priorities in terms of urgency and relevance for every action in order to organize actions effectively and efficiently as part of the RAF implementation plan in EU member countries.

As a result, a seven-year roadmap was implemented in order to be the basis for the development of future action plans at different levels.

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1 Introduction

1.1 DigiPLACE Project

DigiPLACE project aims at creating a Reference Architecture Framework (RAF) and roadmap for a coherent generalisation of Digital Platforms for Construction in Europe. It has initiated a common "ecosystem" of innovation, standardisation and market, with the goal to increase the productivity of the sector and the quality of its end products: buildings and infrastructures. The definition and development of the RAF for future digital construction platform(s) has been based on an EU-wide consensus involving a large community of stakeholders, resulting in a Strategic Roadmap for a successful implementation of this RAF. As a perspective after the end of the project, starting from suitable reference architectures, platform interfaces will be defined, tested through piloting, supported via ecosystem set up to prepare their roll-out and evolution into standards.

DigiPLACE digital industrial platforms approach intends to set the scene of a Digital Transition, i.e. a digital ecosystem at European level dedicated to the Construction sector by bringing together all relevant stakeholders – including software vendors and 3rd-party services vendors. The target is to respond to the wider group of construction stakeholders' needs concerning improved digital skills, access to data and available appropriate interoperable software and services. SMEs and micro-businesses are especially targeted, to avoid a digital gap with other larger players (among the 3.3 million enterprises of the construction sector in Europe 95% are SMEs with fewer than 20 and 93% with fewer than 10 operatives).

The overarching purpose of work package 6 (WP6) is to define a Strategy Roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications as defined in WP5. This complements the work done in the previous packages, in particular the creation of DigiPLACE stakeholder community (WP2), the identification of good practices and existing initiatives or technological solutions already used, as well as attention points including success factors (WP3), the identification of barriers and factors for digitalisation enhancement (WP4) and the reference architecture framework (WP5) which provides a comprehensive set of common guidelines for building and deploying interoperable digital platforms for the construction sector across Europe and several open options to consider regarding European/national platforms, large scale data space, digitalised public services among others.

With particular attention paid to the SME's, WP6 has to develop further implementing scenarios used as a tool to engage discussion and actions with the broader community of stakeholders through on online consultation (set up between 8-10/03/2021). By taking an active part in the development of the implementing scenarios, the stakeholders share **a common understanding of possible futures, which will stimulate coherent innovation strategies and approaches**. As for all other work packages, issues connected to environmental performance of building and circular economy are treated in a horizontal manner.

Based on the consolidated implementing scenarios, a **seven-year Strategic Roadmap** (deliverable D6.3 of task T6.2) is to define the key strategic priorities and propose an **Implementation Action Plan**, with major working areas, milestones and Key Performance Indicators. This includes a specific focus on the development of skills, as educating and training are instrumental in breaking down technical and social barriers. Another vital part of this work package is the identification of adequate financial resources to guarantee the implementation of the proposed RAF.

The task T6.1, on the results of which this report is based, aims at the development of both actions supporting the technical guidelines and consolidated implementing scenario based on the open options of the Reference Architecture Framework.

Figure 6 - DigiPLACE aims at paving the way for the future digital construction platform. Find out more on the official project Web site: https://www.digiplaceproject.eu

1.2 Purpose of this report

Starting from the results presented in D6.1 and D6.2 this last deliverable proposes the strategy roadmap and the implementation action plan for a coherent generalisation of Digital Platforms for Construction in Europe.

The purpose of the third Deliverable of the WP6 (D6.3 - “Strategy Roadmap and Implementation Action Plan”) is to provide with a development plan for what has been described in Deliverable 6.2 by defining a Strategy Roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications as defined in WP5.

Therefore, this deliverable is a continuation of the work done in deliverable D6.2.

The general purpose of this third deliverable of the WP6 (D6.3) aims to:

- the identification of adequate financial resources to sustain the implementation of the proposed RAF;
- the development of a seven-year Strategy Roadmap that includes key strategic priorities, an Implementation Action Plan to support the stakeholders for the future progressive implementation of the RAF and its applications.

1.3 Relation to other activities in the project

The purpose of the second deliverable of the WP6 (D6.2) was more particularly to support the RAF

implementation through the drafting of consolidated implementing scenarios. This deliverable was then seen as a continuation of the work done in deliverable D6.1 in which one of the main results was to define four main topics seen as “corner-stones” of the future roadmap:

1. **Promote and network**, following the idea of creating a long-lasting stakeholders ecosystem to promote, support and refine DigiPLACE RAF;
2. **Develop and deploy** with the overall idea of integrating, stimulating, experimenting (large-scale pilots), assessing the use and monitoring the impact of platforms and associated services leveraging on DigiPLACE RAF;
3. **Foster and Secure**, contributing notably to RAF-based digitalisation of European and national regulations;
4. **Capitalise and train**, contributing to training/digital skills development in construction while developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services etc.

1.4 Methodology for T6.2 – D6.3

The methodology used to achieve the expected targets in the last deliverable of WP6 was the following :

- economic and financial analysis of the consolidated scenarios;
- identification of adequate financial resources to sustain the implementation of the proposed RAF;
- development of a seven-year strategy roadmap providing the stakeholders with a set of structured and prioritised well identified actions to be carried out for the future progressive implementation of the RAF and its applications through the application of the following steps:
  - revaluation of actions and sub-actions;
  - study and implementation of priorities in terms of time and relevance;
  - first structure of the roadmap;
  - verification of the coordination and coherency between the different actions priorities;
  - verification of periods;
  - verification of the feasibility of the plan (i.e. in terms of technical, financial and regulatory feasibility);
  - evaluation of the feasibility at national and local level.

So, the first step in building the roadmap was to start from the four topics of D6.2 and the related actions, which are listed below:

Table 1 – Promote and Network actions

Promote and Network	
Creating a long-lasting stakeholder ecosystem to promote, support and refine DigiPLACE RAF	
Action #1.1	Creating a long-lasting European stakeholders ecosystem/Forum to promote, support and continuously refine DigiPLACE RAF
Action #1.2	Developing partnership with other "communities" (public bodies, outside EU, outside construction sector, etc.) involved in construction

	and/or digitalisation
Action #1.3	Developing national mirror groups to promote at national scale the use of DigiPLACE RAF and improve it regarding national challenges
Action #1.4	Defining a methodology to refine DigiPLACE RAF
Action #1.5	Collecting and communicating data/information about the added value of digital transition of construction projects

Table 2 – Develop and Deploy actions

Develop and Deploy	
Integrating, stimulating, experimenting (large-scale pilots), assessing the use and monitoring the impact of platforms and associated services leveraging on DigiPLACE RAF	
Action #2.1	Building/stimulating Digital platforms (new or adapted) and Common Data Spaces leveraging on DigiPLACE RAF
Action #2.2	Defining and setting the role of Construction data and digital platforms in the European Data Strategy
Action #2.3	Deploying Large-scale Pilots (LSPs - supported by European or MS-based projects, regional or private initiatives), along with common assessment methods
Action #2.4	Erecting an EU repository of Industry (Construction) Digital Commons (e.g. common data ontologies, reference data library, data sharing protocols…)
Action #2.5	Contributing to standard developing organisations
Action #2.6	Allowing SMEs to use digital platforms/tools by taking into account their financial and technical possibilities as well as their specific needs
Action #2.7	Coordinating and supporting development and deployment actions and of a construction common data space

Table 3 – Foster and Secure actions

Foster and Secure	
Contributing to RAF-based digitalisation of European and national regulations	
Action #3.1	Contributing to RAF-based digitalisation of EU and National regulations
Action #3.2	Setting-up (RAF-based) digitalised public services
Action #3.3	Promoting/testing the RAF in the Member States
Action #3.4	Encouraging data sharing
Action #3.5	Securing platform operation in terms of cyber-security and intellectual properties

Action #3.6	Encouraging public actions associated with promoting DigiPLACE RAF for environmental performance

Table 4 – Capitalise and Train actions

Capitalise and Train	
Developing expertise and contributing to training/digital skills development in construction while developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services etc.	
Action #4.1	Contributing to training / digital skills development in construction
Action #4.2	Developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services and Construction Digital Innovation Hubs (DIHs)

The second step was to assign **priorities** to the various actions, both in terms of importance of temporal urgency, through the identification of some indicators, as well as the implementations of a matrix of priorities.

The considered indicators are the following:

- sequentiality between actions;
- ending times;
- feasibility;
- known critical issues;
- economic impact;
- required training;

In addition to these, the DESI index (The Digital Economy and Society Index)[1] was examined.

Desi index is a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU Member States, across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services.

This index is useful for contextualizing the general roadmap, built at European level, in the individual member states in order to build national digital platforms.

This matrix of priorities has been the starting point for subsequently making a qualitative assessment, fundamental to create a Strategy Roadmap. The qualitative evaluation was conducted starting from the conclusions of D6.2 and is detailed in this report.

Based on the indicators identified and listed above, on the analyses carried out for each action and sub-action during the development of D6.1 and D6.2 and through a qualitative approach based on the experience of the partners in the sector, a first version of the roadmap was built.

This roadmap was re-analysed by all the partners who participated in WP6.

[1] https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi

Several observations were therefore provided, which were acknowledged and resulted in the development of the second version of the roadmap.

The contribution of the various partners was fundamental, not only for the knowledge and experience gained in the development period of DigiPLACE project, but also because each partner represents a different European country which is characterized by peculiarities, development, regulatory framework, different experiences.

In this way, the roadmap is the result of the different characteristics of the countries that worked on the project, making it more applicable and achievable.

2 Preliminary analysis of financial aspect preparatory for Strategy Roadmap development in DigiPLACE project

2.1 DigiPLACE multi-fold Strategy Roadmap

In addition to providing technical guidelines, the DigiPLACE RAF highlights several open options to be discussed before being considered in the Strategic Roadmap. These open options concern several imperative issues such as “large scale data sharing in the construction sector”; “public and private data sources”; “publicly driven open platforms for BIM and other digital services”; “European platforms and/or national platforms” and “digitalised building permit and regulation checking tools”.

One of the tasks of the previous WP6 deliverable (see D6.2) has been to suggest one or two specific implementing scenarios for each of these open options. Scenarios are defined by the Organisation for Economic Co-operation and Development (OECD) as: “***carefully constructed snapshots of the future and the possible ways a sector might develop***. […] *A well-constructed scenario must contain enough detail to be useful for strategic planning, but not so much as to become overly specific and irrelevant to the issues of interest*. *Scenarios can range from rather simple to quite complex pictures of the future, but they must always be plausible and challenging*”[2].

Based on this definition, thirteen scenarios have been developed according to the four issues raised by the RAF in order to compare them and prioritise some over others:

- Scenario #1.1 – Self-supporting platforms for digital services
- Scenario #1.2 – Gateway platforms for digital services
- Scenario #2.1 – Top-down approach in the development of national platforms
- Scenario #2.2 – Bottom-up approach in the development of national platforms
- Scenario #2.3 – Development of European platforms
- Scenario #3.1 – Development under the authority of government policy
- Scenario #3.2 – Development by software editors
- Scenario #3.3 – Free development by softwares with no public recommendations
- Scenario #3.4 – Free development by softwares under public recommendations
- Scenario #4a.1 – Integration by design
- Scenario #4a.2 – Integration at need
- Scenario #4b.1 – Connection provided from platform to source
- Scenario #4b.2 – Connection provided from source to platform

These implementing scenarios have been also subject to an online consultation open to the Community of Stakeholders from 8 to 19 March 2021. The target of this consultation was both to collect their opinions and inputs in order to consolidate these scenarios and to prioritise them on the basis of the needs expressed by the sector.

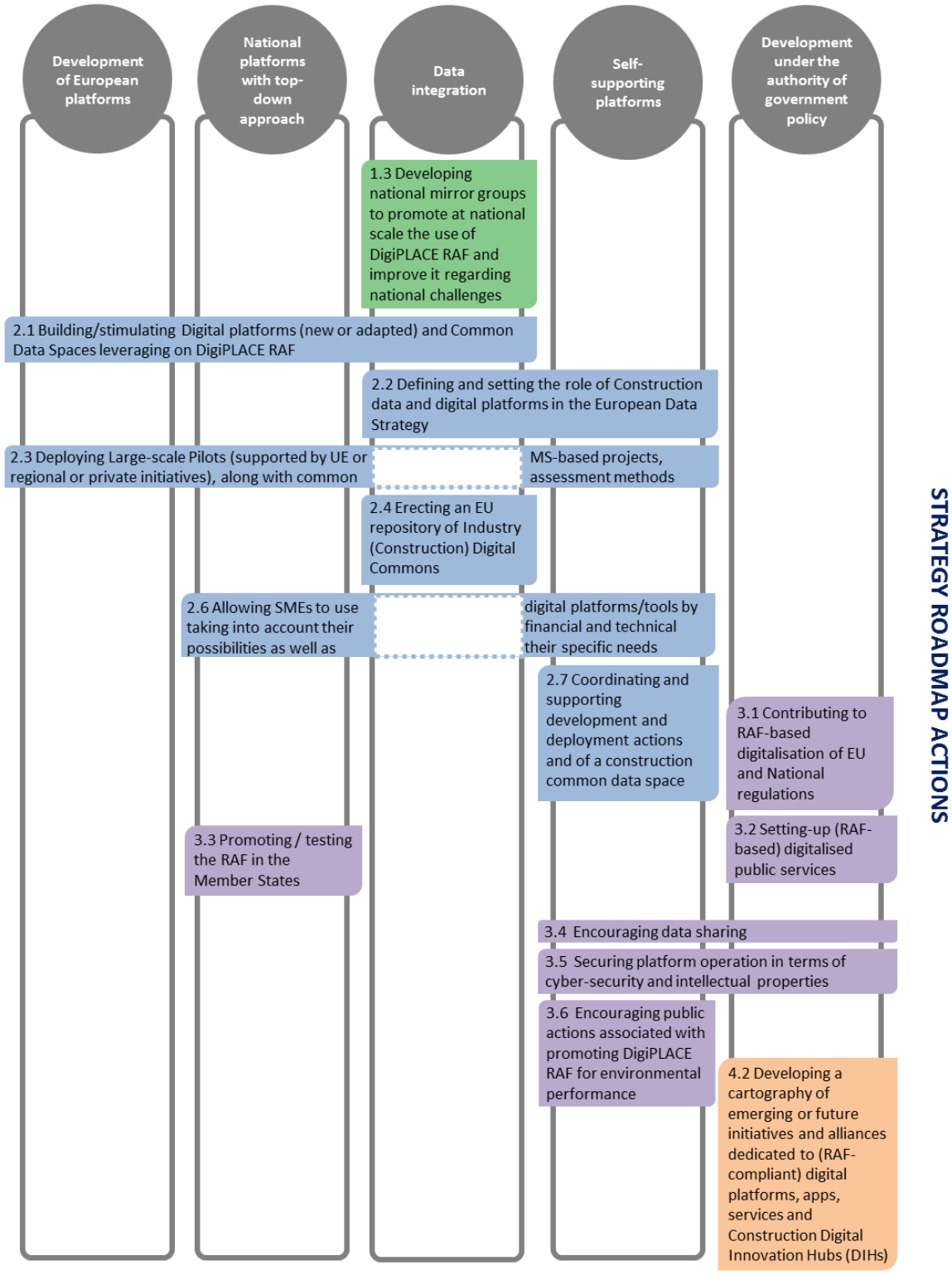
As a result, the scenarios (described below) that the respondents put forward are the following eight best rated in terms of priority, relevance and necessity:

[2] https://www.oecd.org/site/schoolingfortomorrowknowledgebase/futuresthinking/scenarios/whyusescenarios.htm

- Scenario #1.1 – Self-supporting platforms
- Scenario #2.1 – National platforms with top-down approach
- Scenario #2.3 – Development of European platforms
- Scenario #3.1 – Development under the authority of government policy
- Scenario #4a.1 – Integration by design
- Scenario #4a.2 – Integration at need
- Scenario #4b.1 – Connection provided from platform to source
- Scenario #4b.2 – Connection provided from source to platform

These selected **implementing scenarios could then be seen as a possible achievement of the roadmap.** As indicated in the previous deliverable (see D6.2), they would require however the prior implementation of several actions described in the Strategy roadmap as shown in figure 8 below.

SELECTED IMPLEMENTING SCENARIOS



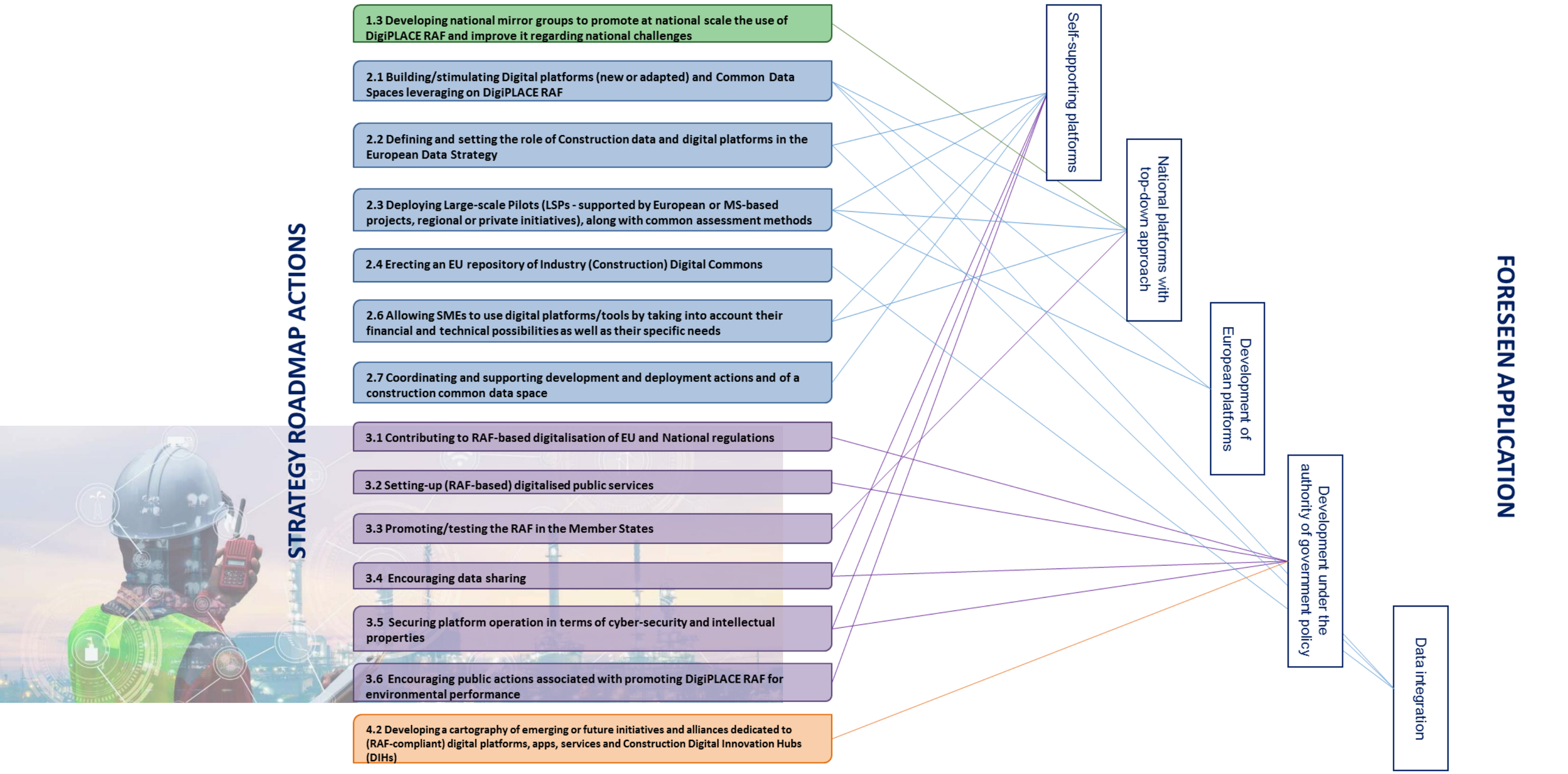


Figure 7 - Strategy roadmap actions to be developed to support the implementation of the selected scenarios

In order to go further in the analysis of these eight implementing scenarios, this chapter aims to provide an overview of operational (involved actors), economic and financial aspects associated with them, with the view to develop business models. This part is structured as follows:

- For each implementing scenario, the value network of selected key actors involved is visually represented in the form of a stakeholder map centred on the main actor of the scenario (focal point). Then, the potential economic and contractual flows are represented on the stakeholder map. Finally, capital expenditures (CAPEX) and operating costs (OPEX) are qualitatively assessed for each scenario.

- A preliminary analysis of potential sources of funding to support the implementation of digital platforms for construction is provided. It includes financing options at European level to cover the initial investment to set up the platform (CAPEX) and a review of possible business model options to cover its operating costs (OPEX).

2.2 Economic analysis of selected Implementing Scenarios

2.2.1 Implementing Scenario #1.1 "Self-supporting platforms for digital services"

In this scenario Public Authorities (PA) develop and manage public platforms to give everyone access to tools and services. All services are directly accessible from platforms. This scenario mainly concerns huge, full and computing heavy platforms, which group all services and tools.

The public platforms presented by this Scenario are intended to be "self-supporting platforms", different from the "gateway platforms" of Scenario #1.2, which obtained a lower rating from the WP6 Online Consultation with Stakeholders.

Figure 8 shows the Stakeholder Map of Scenario 1.1 for a single PA administrating the platform (incorporating the collaborative space and tools), which is the focal point of the map. The main actors interacting directly or indirectly (in terms of exchanges of data/information) within the collaborative space of the platform have been represented. They can be clustered in four main groups:

- Public / Private entities providing/exchanging data with the platform (in yellow boxes);
- Software developers, editors of the collaborative main platform (dark grey box);
- Third-parties digital solutions providers (light blue boxes);
- All other users of the platform (light grey boxes).

For the purpose of this Stakeholder Map, Project Managers, Contractors and Various suppliers linked to the practical implementation of the project and the management of the building site have been grouped together as they share the same value captured and delivered vis-à-vis the platform.

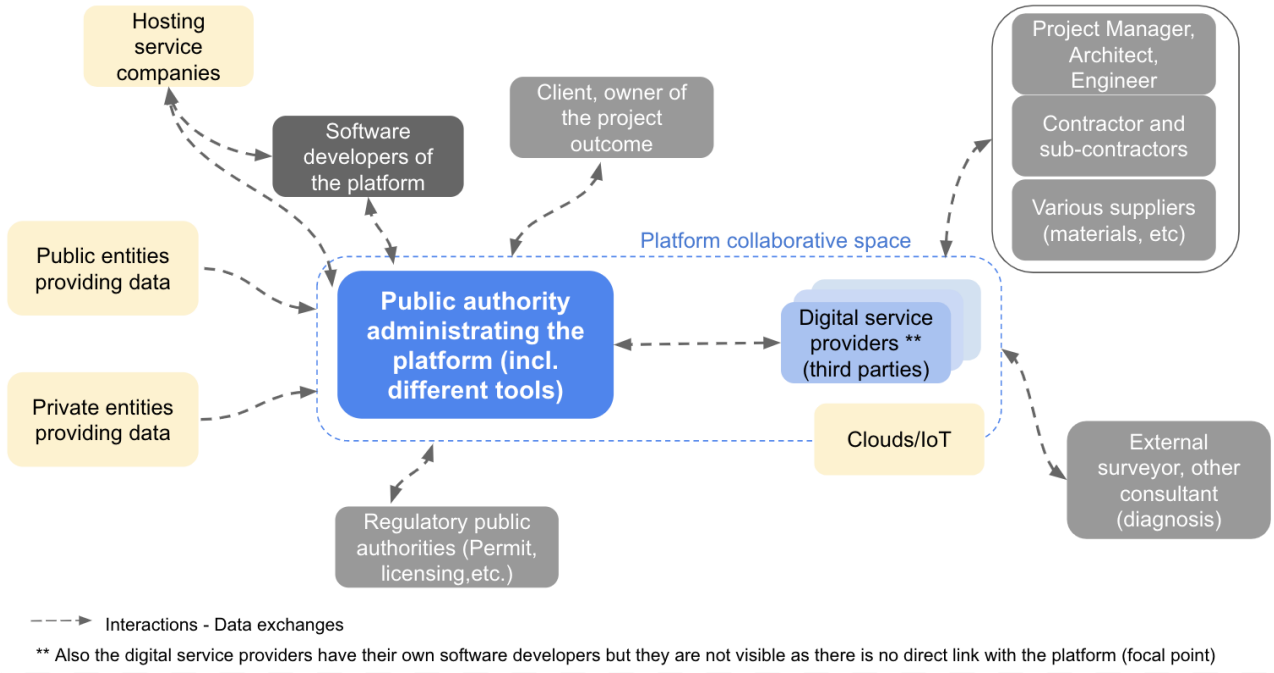


Figure 8 - Scenario 1.1 - Stakeholders map of the public self-supporting collaborative platform

Value proposition of the public self-supporting collaborative platform

Based on the following main aims of DigiPLACE project:

- To deploy interoperable digital platforms for the construction sector across Europe and several open options regarding European/national platforms, large scale data space, digitalised public services among others;
- To target a coherent generalization of digital platforms for Construction in Europe;
- To initiate a common "ecosystem" of innovation, standardisation and market, with the goal to increase the productivity of the sector and the quality of its end products: buildings and infrastructures;
- To respond to the wider group of construction stakeholders' needs concerning improved digital skills, access to data and available appropriate interoperable software and services. SMEs and micro-businesses are especially targeted, to avoid a digital gap with other larger players.

The value proposition of the public collaborative platform is as follows[3]:

The public self-supporting collaborative platform **helps** all actors involved in the value chain of a construction project **who want to** collaborate simultaneously, share public/private interoperable information, have access to standards/regulations **by facilitating** the use of BIM and/or other innovative digital services for a higher quality of end products **by reducing** data loss, process inefficiencies and time

[3] Based on the Ad-Lib Value Proposition template by Strategyzer.
https://assets.strategyzer.com/assets/resources/ad-lib-value-proposition-template.pdf

spent on the project.

Unlike existing collaborative frameworks, the public self-supporting collaborative platform is an open tool (embedding all necessary digital services for construction projects) targeting a coherent generalization of digital platforms at EU level and guaranteeing the open access to all actors without digital gaps in the construction market (i.e.: SMEs vs larger players).

Overview of the main value streams in the business model of the public collaborative platform

Table 5 - Value streams between main stakeholders

Organisation type	Value captured	Value delivered
PA administrating the platform Role: To manage the public collaborative space and its tools	- To contribute to the overall targets of the Construction industry in terms of digitalisation, jobs creation; - Increased compliance to regulation; - Induced digitalisation process of the PA itself.	- Boosting of the use of BIM and/or other digital services; - Access to everyone to digital tools and services with the same level of services; - Easier access to standards and regulations; -Increased market uptake of software for the Construction industry. -Uptake of a common use framework.
Software developers, editors Role: To develop the platform and its functionalities, to support data management and interoperability, to maintain and update the platform	- Revenues from the software development service; - Revenues from the data management (integration of APIs and new data, data security services, etc.); - Revenues from platform maintenance and software update (for new functionalities). -Marketing benefit in publicly advertising themselves as EU platform developers.	- Multi-collaborative functionalities for the platform; - Interoperability of different types of data; - Data management in general (redundancy, security, storage, GDPR, etc.);
Digital services and technological solutions providers (third parties) Role: To sale their digital solutions via the collaborative platform	-Revenues coming from the sale of the digital solution chosen on the platform by the users; -Visibility/Exposure to many players along the Construction value chain; - Increased collaborative opportunities with PA;	-Innovative solutions for the Construction industry; -Exponential availability of data useful for project delivering.

	-Improved provided tools according to the stakeholders' real needs (e.g. expressed via questions on the forum).	
Client Role: Owner of the project and financing entity	-High quality outcome; -Process efficiency; -Continuous access to updated information; - Centralization and transparency of information; -Access to market innovative solutions applied to the project; -Time saving in project schedule.	- Financing of the project.
Project Manager, Architect, Engineer **Contractor, sub-contractor** **Various suppliers (materials, etc.)** Role: They have the responsibility of the carrying out and final delivering of the project to the client.	-Centralized information and data; -Easier project management: no issue of file transfer, interoperability, data loss; -Access to innovative solutions to increase productivity and process efficiency; -Easier and comprehensive access to standards and regulations; - Storage is organised at EU level: no need for big data server; -BIM-based Model Checking; -Increased availability of construction data set.	- Increased control on project planning and scheduling; -Increased productivity in delivering the service; -Higher quality of the end product; -Transparency of processes; -Guaranteed compliance with regulations.
Regulatory public authority Role: To ensure the compliance to existing regulations and standards	-Digitalisation of process; -Easier access to project documents and data; - Automatic compliance-checking; -Increased availability of construction data set; -No or minor need to advertise new or existing regulations/standards.	-Increased rapidness of regulatory process; -Increased transparency; -Guaranteed compliance with regulations; -Prevention of illegal use of data (i.e. re-sale of data outside the platform).
External auditors, consultants Role: To carry out the requested diagnosis on the project	-Centralised data and information; -Easier access to the full set of project documentation; -Easier technical check due to	-Increased rapidness of regulatory process; -Increased transparency; -Guaranteed compliance with regulations.

	the extended availability of data; -BIM-based Model Checking.	

Analysis of potential economic / contractual flows

Taking as a focal point the Public Authority managing the collaborative platform, the potential main contractual relationships between the identified stakeholders are visualised in Figure 9, in which the green and red arrows represent the economic/contractual streams.

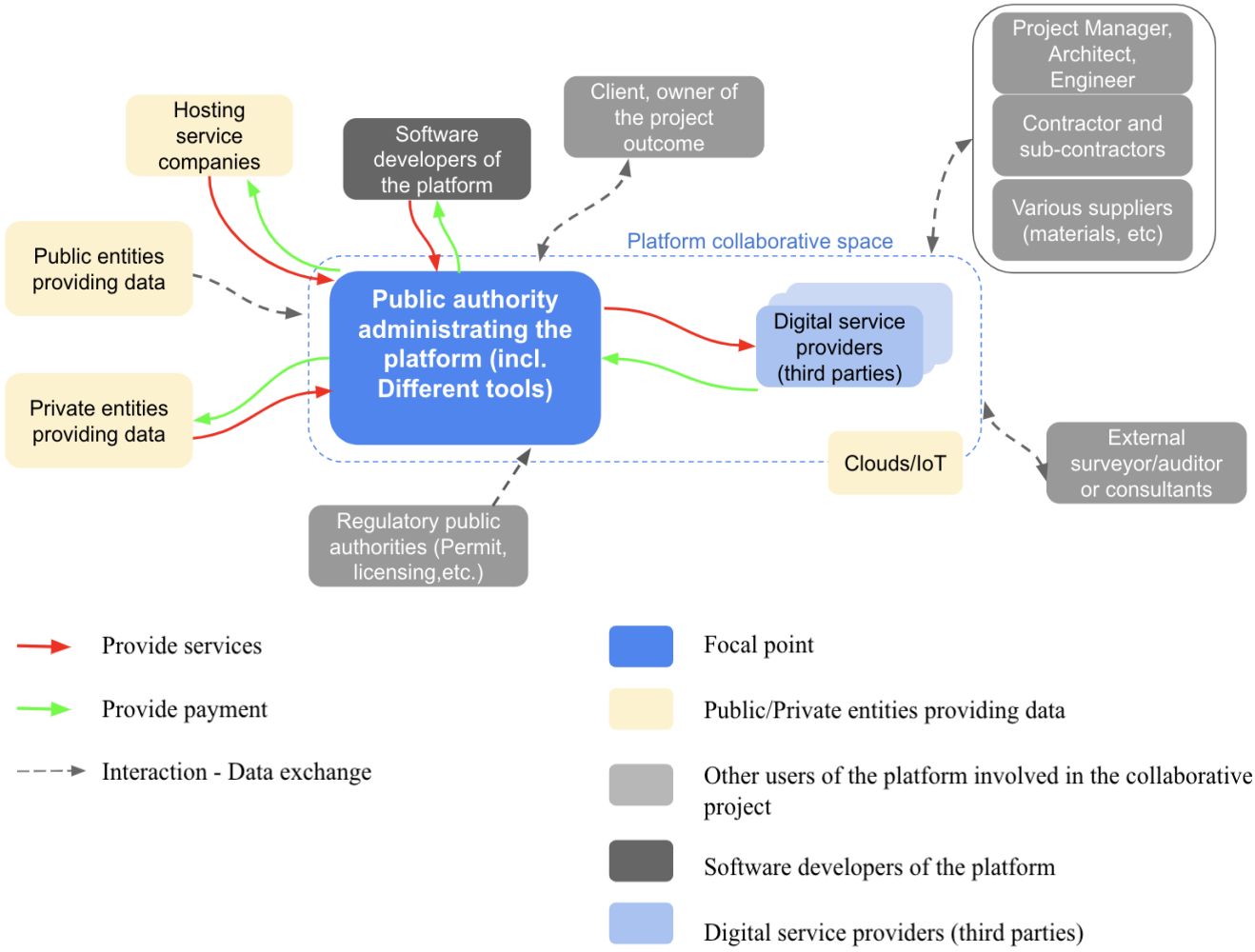


Figure 9 - Potential economic / contractual flows of the focal point

CAPEX linked to the design and set up of the platform

The Capital Expenditure (CAPEX) linked to the development and implementation of the collaborative platform could be clustered in the following categories depending on their nature:

Table 6 - Main Capital Expenditure of the collaborative platform

CAPEX categories	Description
C1	**R&D costs** linked to platform design intended as feasibility study, planning and definition of the platform requirements, etc.
C2	**Software development**: programming of the platform code or integration of existing code in order to generate the platform infrastructure and operations.
C3	**Any acquisition of servers for data storage** (if the storage is not cloud-based).
C4	**Platform domain name to be registered.**
C5	**Any trademarks, copyright or other IP protection linked to the platform/data.**

The above-mentioned categories of CAPEX (from 1 to 5) are the core costs of the platform development: they don't change in nature depending on the Scenarios. However, the entity bearing the related cash out and registering these CAPEX in their accounts can change depending on the Scenarios. The financial amounts can be quite different as well, because the development time and complexity can be increasing.

Operating costs associated with the operation of the platform

Table 7 - Main Operating Costs of the collaborative platform

OPEX categories Costs borne by the owner of the platform	Description
O1	**Maintenance** (non-core functionalities updates[4], anti-hacker service) **and management of new integrations** (APIs management, interoperability of other tools and platforms).
O2	**Personnel costs of internal resources** managing the platform operational life, some examples of tasks: - interlocutory contacts for all users as **helpdesk;** - **relationship with digital services providers** (third parties); - **billing/admin services** (linked to potential fee-based services); - **marketing**/promotion of the tool; - **training** opportunity about the use of the platform; - **market watch** on disruptive technologies on the market; - **regulatory compliance** surveillance; - **basic IT** management (which is not outsourced).
O3	**IoT/Clouds services** for data storage, back-up, recovery and real-time data management.
O4	**Data Protection services and ad-hoc assistance** (outsourced or covered by an internal skilled team): legal assistance for GDPR and other data protection

[4] In case of structural core updates, this should be considered as Development costs in the Intangible Assets, Category C1 of the previous table.

	topics (e.g. data ownership).
O5	**Acquisition** of specific data from **databases** (e.g. acquisition of standards ISO, CEN/CENELEC).
O6	**Renewal of web hosting.**

Figure 10 visually reports the CAPEX and OPEX in the economic/contractual map of the collaborative platform (it also includes additional OPEX and CAPEX identified for each Scenarios):

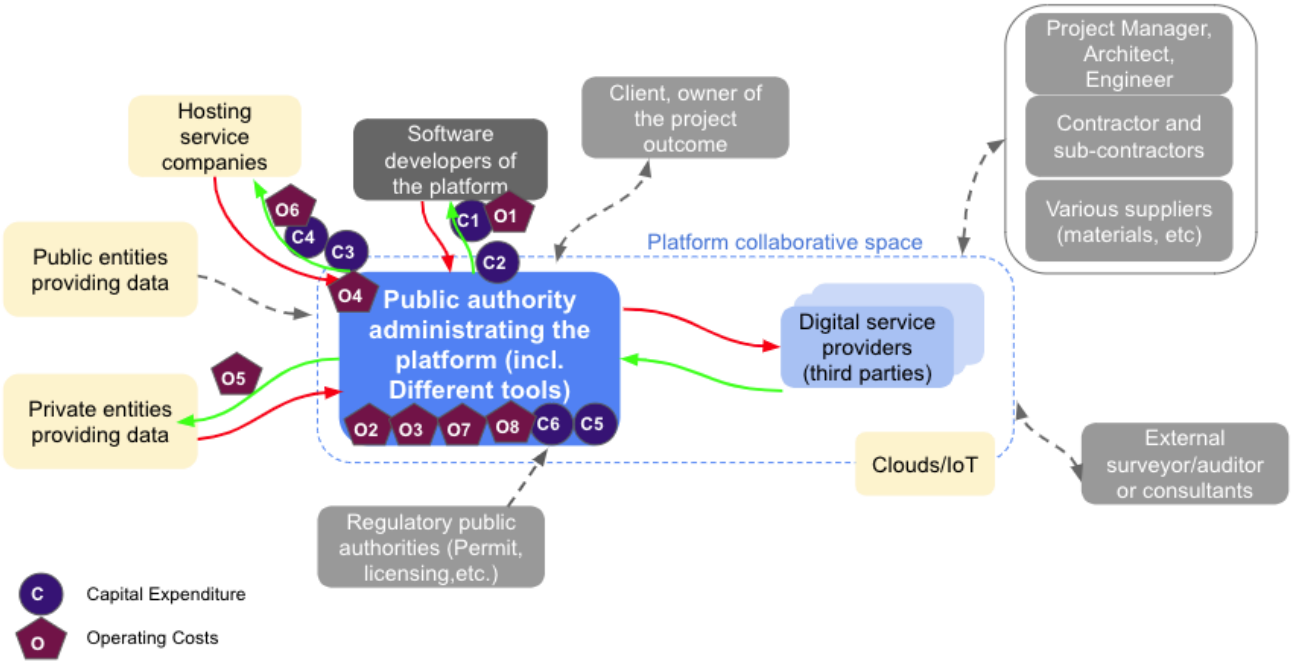


Figure 10 - Visualization of OPEX and CAPEX

2.2.2 Implementing Scenario #2 "European platforms and/or national platforms"

Scenarios #2.1 and #2.3: Top-down approach and EU coordination

The scenario 2.1 focuses on the development of platforms at local, national, and European scale with coordination rules based on a top-down approach[5]. This structure will allow for a local and/or national management of the specific rules and local conditions (geological, climatic, etc.) and also the national language used, under a European coordination. The fundamental services are defined at European level and then developed and integrated at the local one.

[5] Scenario #2.1 has been developed in comparison with the bottom-up approach (Scenario #2.2) which obtained a lower rating in the WP6 Online Consultation with Stakeholders. For this reason, it has not been included in the economic analysis.

The top-down approach requires a strong coordination and harmonization activity at European level to facilitate the development of national and local platforms that can always guarantee the same level of quality, rules, services, etc.

The Scenario 2.3 is a complement of Scenario 2.1 as it allows to further detail the above-mentioned European level. There is a European centralized development of the platforms, tools and services in order to guarantee that all countries have access to the same level of digital services. Nevertheless, the results of DigiPLACE WP5 highlight the need to approach this development with multiple platforms that can work according to the different perceptions of a platform, e.g. data sharing, marketplace, etc.; then, the platform at European level should be intended as a public service in support to all the construction stakeholders and may work as coordination pivot point for national developments of interoperable local platforms (please refer to Figure 11 - Scenario #2.1 and #2.3: Top-down approach and EU coordination).

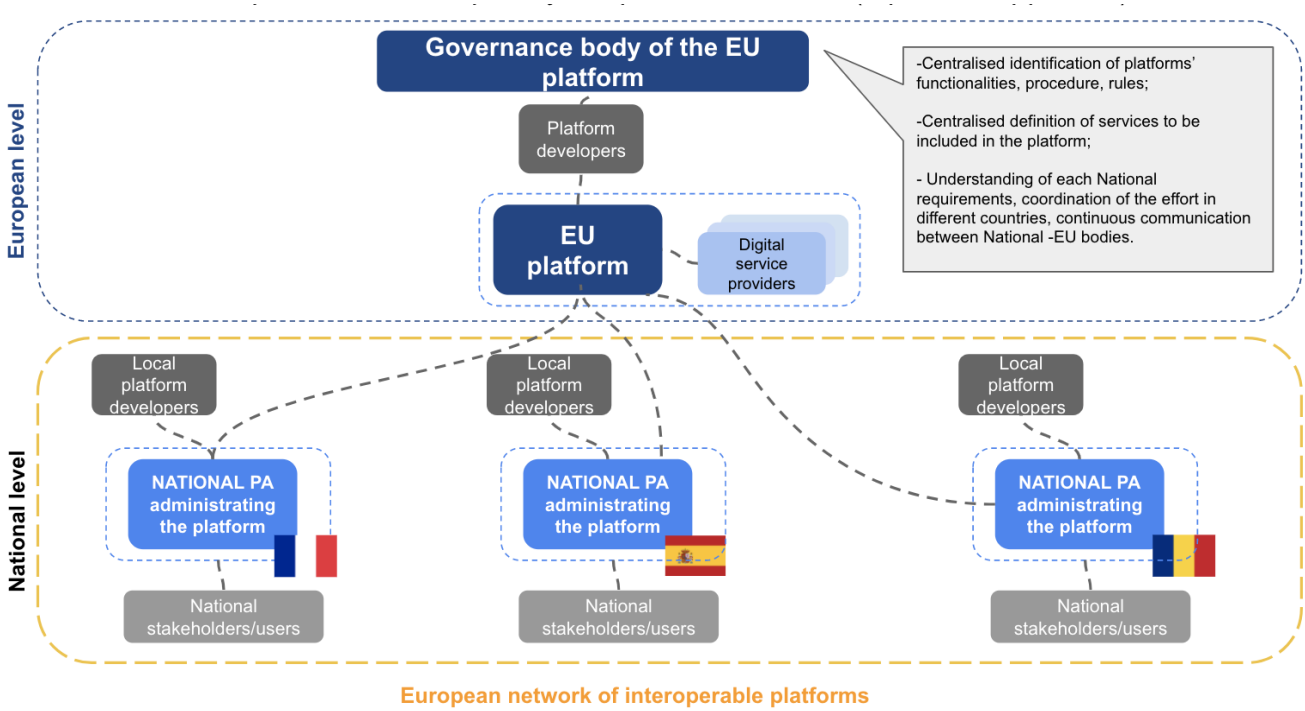


Figure 11 - Scenario #2.1 and #2.3: Top-down approach and EU coordination

CAPEX related to Scenario 2.1 / 2.3

In this combined Scenario there are two levels of governance: the Governance body of the EU platform and the National public authorities that would be responsible for the management of the platform at local/National level.

In this combined Scenarios, the repartition of CAPEX categories (previously described in Tables 6, 7) could be as follows:

Table 8 - CAPEX allocation to governance levels

At EU level	**C1 - Platform R&D costs** **C2 - Software development** **C3 - Data storage (hardware costs if any)** **C4 - Platform domain registration**

	C5 - IP protection
At National public authority level	**C2 - Software development** **C3 - Data storage (hardware costs if any)** **C4 - Platform domain registration** **C5 - IP protection**

C1 is only at EU level as the identification of functionalities and services is centralised and developed by the governing body of the EU platform. The other CAPEX (from C2 to C5) could exist at both levels as they are strictly related to the programming of the multiple platforms and their needs in storage and domain registration. Certainly, the CAPEX at EU level would be higher as it is correlated to higher complexity of the platform and tools and will facilitate the local development at national level by providing centralised procedures and functionalities.

Operating costs related to Scenario 2.1 / 2.3

In this configuration, the categories of OPEX would be allocated as follows:

Table 9 - Operating Costs allocation at governance levels

At EU level	**O1 - Maintenance and APIs integration costs** **O2 - Personnel costs** **O3 - IoT/Clouds services** **O4 - Data Protection assistance** **O5 - Acquisition of not-for-free available data** **O6 - Web hosting service** and additionally: **Governance/strategy costs** linked to the role of the governance body of the EU platform (additional OPEX category **O7**); **Resources for coordination and communication** effort towards national public authorities (additional OPEX category **O8**)
At National public authority level.	**O1 - Maintenance and APIs integration costs** **O3 - IoT/Clouds services** **O4 - Data Protection assistance** **O5 - Acquisition of not-for-free available data** **O6 - Web hosting service** and partially **O2 - Personnel costs** as all costs linked to the digital service providers (third parties) are only borne at EU level.

2.2.3 Implementing Scenario #3 "Digital tools/services provided by public authorities"

Scenario #3.1: Development under the authority of government policy

In this Scenario, the platform and the tools provided in the platform are developed by public authorities, internally or via calls for expression of interest for developing specific tools, based or not on existing tools. Public authorities become owners of tools by financing their development and making them free of charge for users[6].

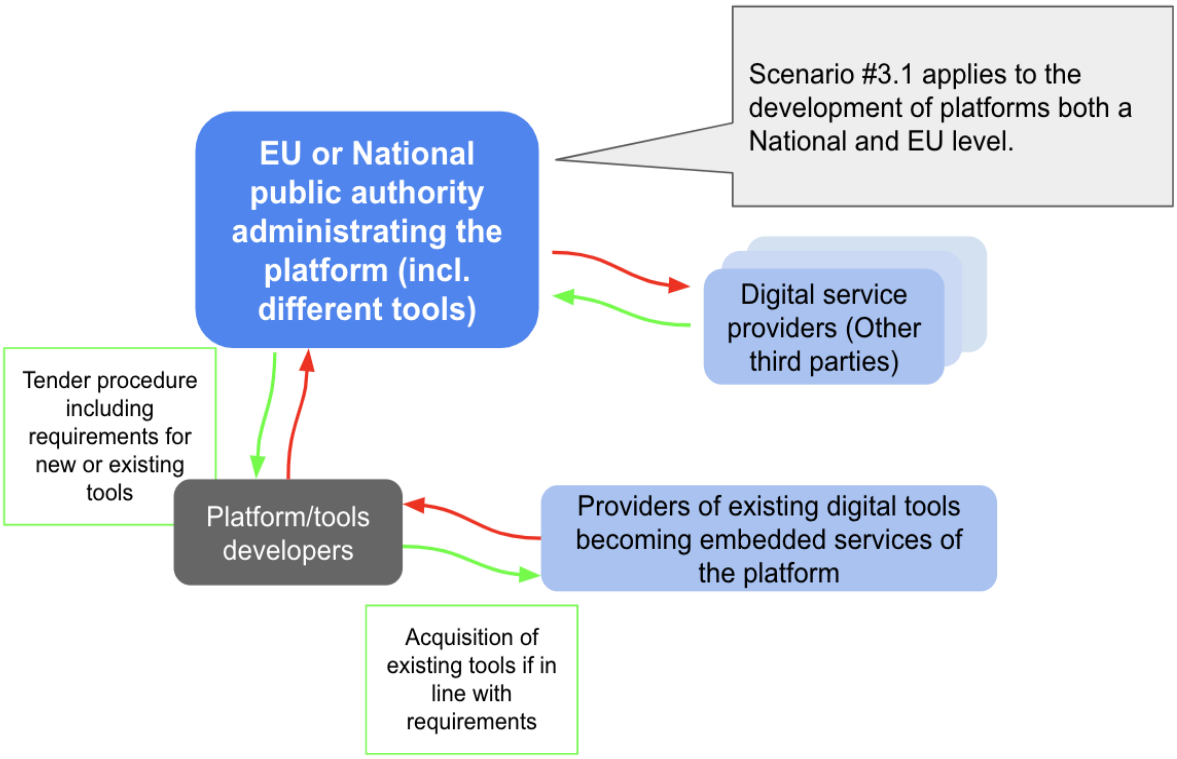


Figure 12 - Scenario 3.1 - Development under the authority of government policy

CAPEX related to Scenario 3.1

This Scenario does not bring new kinds of CAPEX. In particular, the cost for tendering is reflected by **C1 - Platform design** and would be borne at EU or National public authority levels. The same for the platform development costs represented by **C2 - Software development**. The other existing capex are still to be included: **C3 - Data storage** (hardware costs if any), **C4 - Platform domain registration**, **C5 - IP protection**.

Operating costs related to Scenario 3.1

[6] Scenario #3.1 has been developed in comparison with Scenario #3.2 consisting in the development by software editors. Scenario #3.2 obtained a lower rating in the WP6 Online Consultation with Stakeholders, then it has not been included in the economic analysis.

No additional OPEX needs to be highlighted specifically for this Scenario. All related operating costs are reflected by **O1-O5**.

2.2.4 Implementing Scenario #4 "Data integration"

DigiPLACE Implementing Scenarios on Topic 4 concern **data integration.** They include the following 4 cases presenting different ways to integrate publicly owned data and privately owned data in the platform:

Table 10 - Data integration options under Scenario 4

Focus on **data owned by public entities**	Focus on **data owned by private companies**
Scenario 4.a.1: Integration by design Data owned by public entities are developed according to a coordinated architecture that can guarantee their integration with no further adaptations.	**Scenario 4.b.1: Connection provided from platform to source** The platform administrator develops the connection to integrate the data related to the technological solution based on the open-API of the technological solution.
Scenario 4.a.2: Integration at need this scenario aims at centralising the service to provide the required instruments for the integration of some (only when needed) of existing data from existing public data sources (Eg. open-API).	**Scenario 4.b.2: Connection provided from source to platform** The provider of the technological solution develops the connection to enter in the platform using the open-API of the platform.

Scenario #4 focuses on the way to connect data from sources (which are owners that could be public or private entities) to the platforms. The fact that data can be in open access or restricted/private access (subject to sale or not) does not affect the analysis of Scenario #4.

Topic 4a. Integration of data owned by public entities

In order to understand the changes in data flows brought by the Implementing Scenarios, it is useful to start from a potential current situation of a theoretical collaborative platform. The scheme below (Figure 13) focuses on the integration of publicly available data, then only the Stakeholders strictly connected to this focus have been represented.

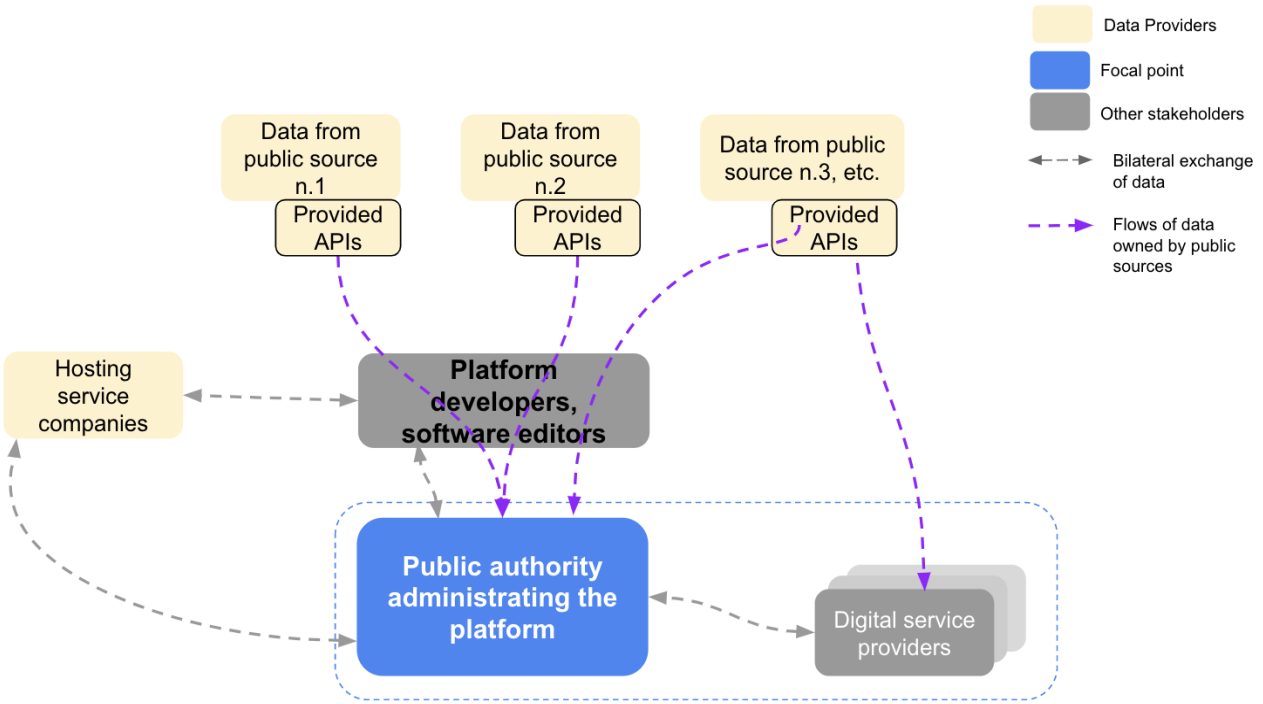


Figure 13 - Potential representation of the current situation of a collaborative platform

The platform integrates data owned by public entities, which are of different types and from different sources. It means that different APIs are usually needed and are mainly provided by the sources. They are all different and the intervention of the software editors is required to integrate/read the various APIs into the platform, allowing the reception of data.

Scenario 4a1: Integration by design

The new data developed and owned by public entities is provided already in line with the data requirements set by the platform according to a coordinated architecture that can guarantee their integration with no further adaptations (no APIs needed). For some of the existing data owned by public entities, there could be a re-development in line with the mentioned platform requirements, contributing to create a "**Data Space**" readable by the platform, which includes new and some existing data, which has been re-developed/adapted (being characterised by a higher up-front cost).

An extended quantity of data from public sources has been set up to ensure the maximum interoperability with the platform.

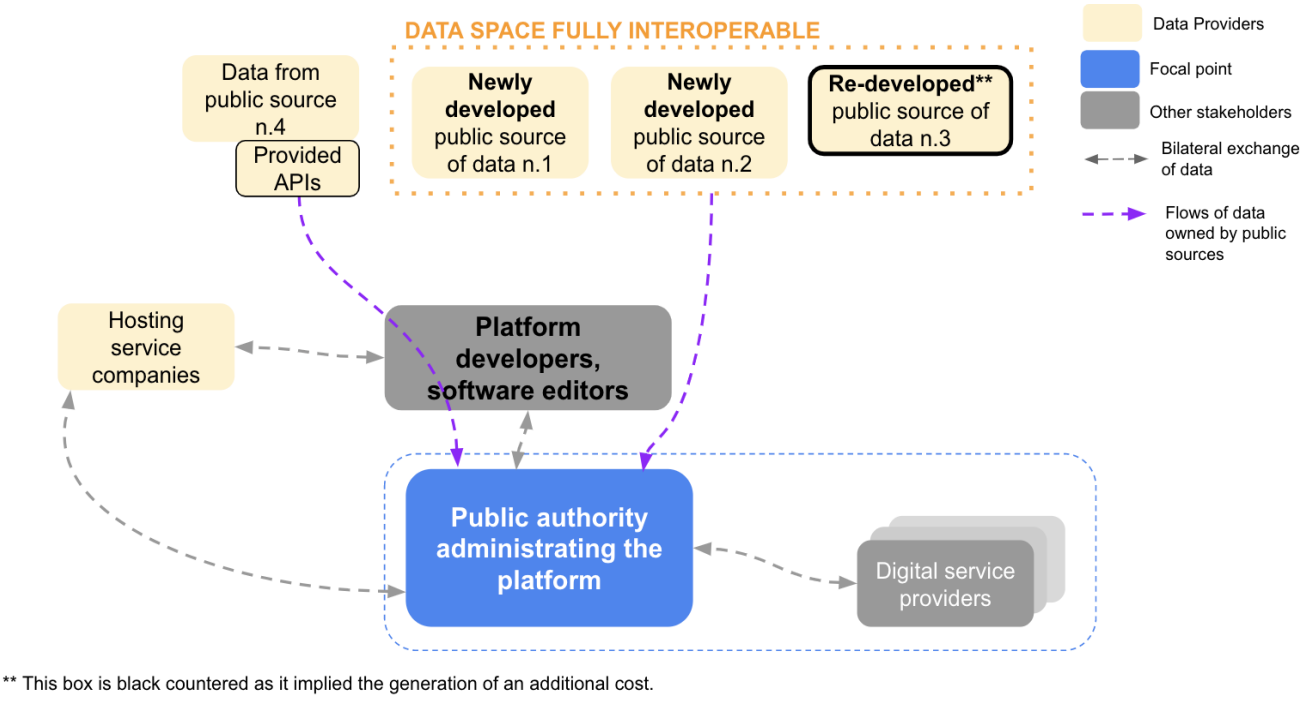


Figure 14 - Scenario 4.a.1 Integration by design

CAPEX related to Scenario #4.a.1

This Scenario can be combined with different options, e.g. Scenario #2.1 or #2.3 that respectively have their own CAPEX (see Table 8). From the point of view of the public authority managing the platform, both at National and EU level, there is no additional categories of capex to highlight as the up-front costs linked to the newly developed data or re-developed data (to be directly interoperable with the platform) are borne by the public sources (not by our focal point).

Operating costs related to Scenario #4.a.1

The categories of operating costs linked to the operations of the platform would not change vs. Scenario #1.1, but Scenario #4.a.1 could probably bring a reduction of costs for APIs integration (**O1**): the data are built in a way to be easily integrated in the platform, bringing to time-cost savings from the point of view of the public authority managing the platform.

Scenario #4a2: Integration at need

While the previous scenario aims at creating an interoperable data space for the platform, this scenario aims at centralising the service to **provide the required instruments** for the integration of some (only when needed) of existing data from existing public sources (e.g. open-API). These required integration instruments could be developed by the governing body of the EU platform only when needed.

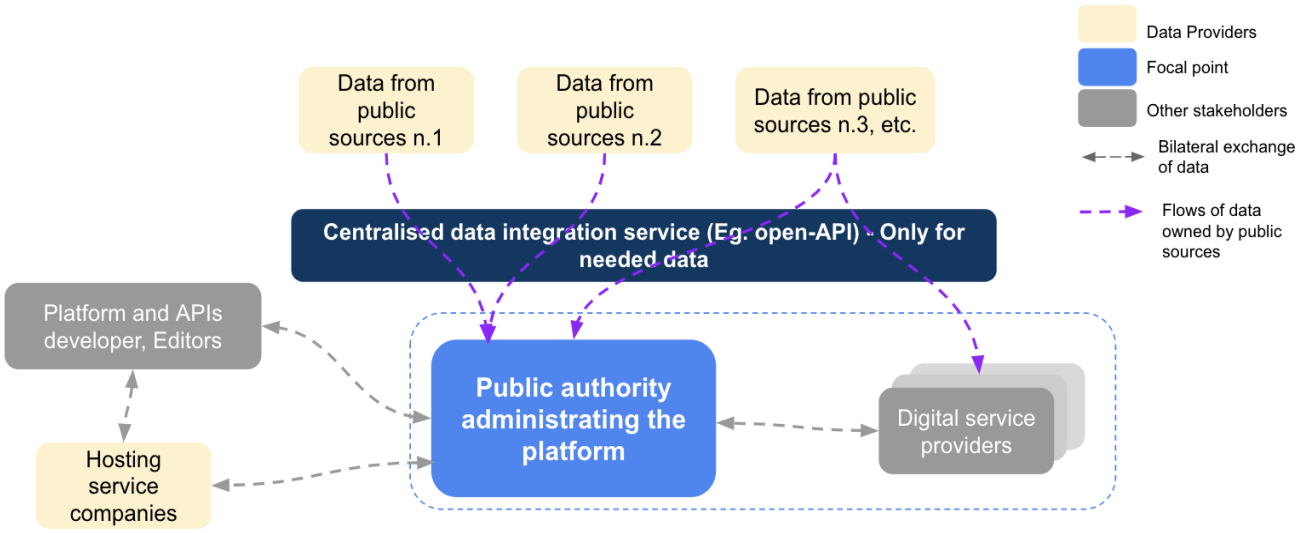


Figure 15 - Scenario #4.a.2 Integration at need

CAPEX related to Scenario #4.a.2

As per Scenario #4.a.1, there could be different combinations with other options, e.g. Scenario #2.1 or #2.3 that respectively have their own CAPEX (see Table 8).

An additional CAPEX category to be considered for Scenario #4.a.2 is the development cost for the centralised data integration service (**C6**) that could be allocated at EU level (i.e. Governing body of the EU Platform).

Operating costs related to Scenario #4.a.2

The categories of operating costs linked to the operations of the platform would not change vs. Scenario #1.1, but Scenario #4.a.2 could bring a decrease in software developers work to integrate/read the APIs at National level, but an increase of the same category of cost at EU level due to the centralised effort in data integration service (i.e. Open APIs development). This means a decrease of **O1 - Maintenance and APIs integration** at National level vs. an increase of **O1 - Maintenance and APIs integration** at EU level.

For both scenarios #4.a.1 and #4.a.2 there is likely no change in data storage cost for the administrator of the platform, as the scenarios only differ for their ways to connect data from sources to platform.

Topic #4.b. Integration of data owned by private companies

The integration of data from private sources requires the identification of dedicated rules that should be defined for each private source type. In fact, this kind of data refers to technological solutions developed by private companies that consequently have a private and dedicated architecture. In this context, the relation between private technological solutions (i.e. data owned by private companies) and centralized platforms may be developed according to two opposite flows.

Starting from platform to technological solutions or vice versa starting from the technological solution towards the platform.

Scenario #4.b.1: Connection provided from platform to source

The digital service providers provide the open-APIs to make their data readable by the platform. The software editors of the platform (if the administrator of the platform has no internal capability for this) will integrate/read the APIs of the digital service providers and allow interoperability. This integration (the cost of which is borne by the administrator of the platform) needs to be developed for each digital service provider.

Under this scenario, the platform gives the possibility to all digital service providers on the market to join the platform ("no one is left behind"), but the cost of **O1 - Maintenance and APIs integration** will be higher than in the following Scenario #4.b.2.

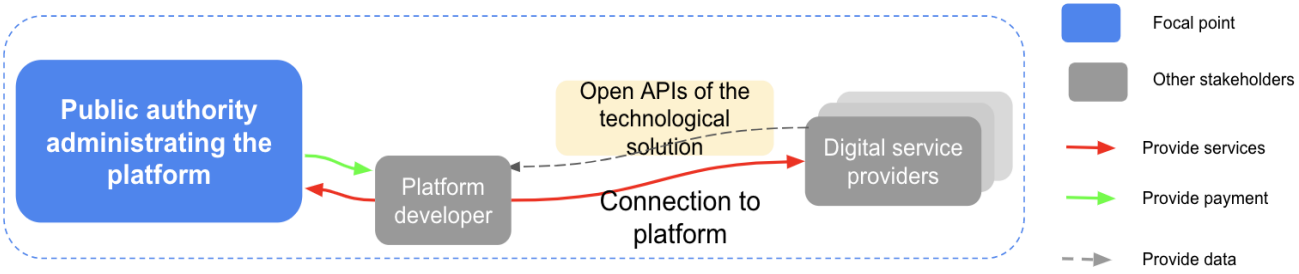


Figure 16 - Scenario #4.b.1 Connection provided from platform to source

Scenario #4.b.2: Connection provided from source to platform

In this Scenario, the software editors of the platform (if the administrator of the platform has no internal capability for this) provide the open APIs of the platform. Each digital service provider develops a plug-in able to use the open APIs of the platform.

The decision to enter the EU collaborative platform is made by the digital service provider that needs to bear the cost of integration.

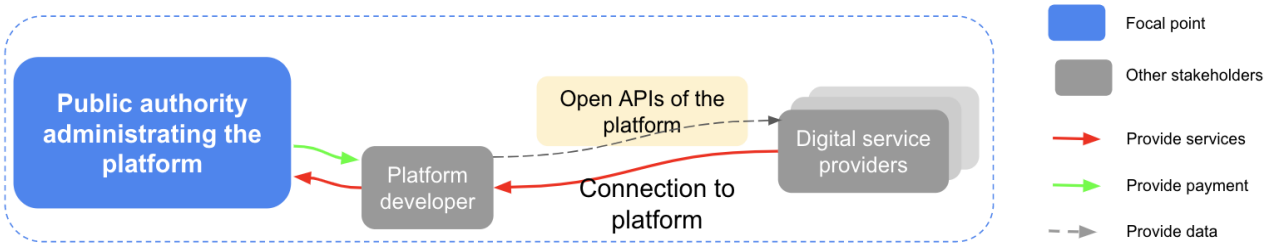


Figure 17 - Scenario #4.b.2 Connection provided from source to platform

There is no additional CAPEX or OPEX categories to be highlighted for these Scenarios.

2.3 Financing options and business models

In the previous sections, a preliminary analysis of the CAPEX and OPEX related to the development and operation of the collaborative platform has been introduced and the allocation of the different costs slightly changes depending on the Scenarios.

In general terms, the CAPEX and a portion of the OPEX before the achievement of any breakeven point (approx. 2 years) must be covered by the appropriate financing sources, which cover the **initial investment**. Once the breakeven point has been reached, the **income generated by the service** on the market must cover the ongoing operating costs.

2.3.1 Financing options to cover the initial investment (CAPEX)

Taking into consideration all Scenarios, the needs to be covered by funding sources have been identified as follows:

C1 - Platform R&D costs
C2 - Software development
C3 - Data storage (hardware costs if any)
C4 - Platform domain registration
C5 - IP protection
C6 - Development of the centralised data integration service (only for Scenario 4.a.2)

A preliminary list of sources of financing are presented in the table below. Each of the financing sources could bring to different ownerships of the output.

Table 11 - Preliminary analysis of potential funding sources

	Instrument	Output	Examples/References
1	EC call for tenders divided into different lots (C1→ C6)	Multiple Framework Agreement between public/ private entities and the appropriate agency in the EC. Ownership of the output: EC.	• Smart Cities Marketplace • ETIP SNET knowledge sharing platform
2	Follow-up CSA from cluster 4 of Horizon Europe	Public/Private Partnership beneficiary of EU funds. Ownership of the output: Joint amongst Partners.	• DigiPLACE • IoF2020 -Internet of Food & Farm 2020
3	CEF Telecom	Public/Private Partnership beneficiary of EU funds. Ownership of the output: Joint amongst Partners.	• Europeana
4	Funding from interested EU Industry Associations, Federations (via call for	Contracts with the sub-contracting entities (public or privates). Ownership of the output: Funding	• DATABio Platform funded by Big Data Value Association

	tender)	organisation.	
5	Mixed financing from EIB and private Private EU banks	Bank loan backed by the Investment Plan for Europe and in line with the Digital Agenda for Europe Ownership of the output: Legal entity subscribing the loan.	● EIB and ICO financing to Dominion to develop its RDI strategy in 3 EU countries[7]
6	EIB backed loan	EU loan provided under the European Fund for Strategic Investments (EFSI). Ownership of the output: Legal entity subscribing to the loan.	● EIB loan to artificial intelligence software innovator Cortical.io[8]
7	Search for private investors via the European Investment Project Portal	Equity funds gathered via the EU matching platform. Ownership of the output: Legal entity promoting the project.	Many success stories here: https://ec.europa.eu/eipp/desktop/en/find-out-more.html

The search of EU funding for the development of the collaborative platform at EU level represents the most intuitive way to reach the goal as EU funds are meant to fund projects / investments which have added-value at EU level (in this case having an impact on the European Construction Sector) or which cannot be funded efficiently at national level because there is a need for coordination[9]. Then, items from 1 to 3 in Table 11 present some examples of funding mechanisms.

However, this could not be enough if the TRL of the outcome of the EU funded project is not mature enough to uptake the market and also survive in the first years before breakeven. This probably means that other resources coming from private investors could be necessary.

Given the importance and urgency of the digital transformation of the construction industry and the parallel transition to the age of collaborative working, professional orders and industry associations could also be asked to contribute to this shared goal if they are in a position to fund this project opportunities or part of it (item 4 of Table 11).

Furthermore, consequently to a necessary deeper analysis of the bankability of the EU Platform initiative and to the decision about the form of governance of the platform, investigations on alternative sources of funding (different from EU grants) could be carried out. Items 5 and 6 in Table 7 bring some examples of public loan backed by EIB, mixed with private bank financing. The EIB is backing investment in digitalisation of specific sectors and networks, then a further analysis of the

[7] https://www.eib.org/en/press/all/2020-203-digital-innovation-eib-and-ico-provide-eur50-million-to-dominion-to-develop-its-rdi-strategy

[8] https://www.eib.org/en/press/all/2021-077-eib-provides-eur7-5-million-to-austrian-artificial-intelligence-software-innovator-cortical-io

[9] https://cor.europa.eu/en/engage/studies/Documents/eu-added-value-test-to-justify-eu-spending.pdf

annexed potentiality is recommended[10]. In particular, it could be beneficial to further explore the requirements under the European Fund for Strategic Investments to check eligibility criteria[11] for organisations different from SMEs and belonging to specific sectors.

Item 7 of Table 11 presents the opportunity to explore whether the EU Platform project could be registered on the European Investment Project Portal[12] (EIPP), which is a central EU project matching platform which aims to create a bridge between EU project promoters and investors. The Portal seeks to boost the visibility of existing EU investment opportunities.

2.3.2 Possible business model options to cover the operating costs (OPEX)

Targets to be considered

There is a list of fundamental considerations that need to be taken into account in this preliminary analysis of potential business models, which are based on the outcomes from the detailed analysis carried out by DigiPLACE project in WP3, WP4, WP5 and from the WP6 online consultation amongst stakeholders. The main targets are as follows:

T1) **The platform(s) needs to be an open tool as much as possible** to reach a coherent generalization of digital platforms at EU level and to avoid digital gaps in the construction market from a geographical and company size perspective.

T2) Besides the openness, **the tools and services used via the platform must address all stages of the life cycle of construction projects** allowing the users to have a single digital interface for all project phases.

T3) Based on similar collaborative platforms/tools existing in other sectors and also based on the outcome of the online stakeholders' consultation, **the platform could preferably be managed by a Public Private Partnership (PPP)**.

T4) In the long term, the platform should represent only the collaborative place where users chose the appropriate **digital services for their needs which are only provided by third parties.** The platform, which would be managed also by public authorities (at EU and national levels) will not have embedded services for users as they should be provided by private actors.

Business Model items responding to the targets

T1 and T2 could be better ensured by a **strong public involvement** in the development and management of the collaborative platform. From the other side, some existing successful examples of comparable platforms (e.g. IoF 2020, DataBIO platform) and the opinions collected amongst DigiPLACE stakeholders (WP6 Online Consultation), indicate that a Public Private Partnership could

[10] More examples of EIB financing here: https://www.eib.org/attachments/thematic/innovation_overview_2020_en.pdf

[11] https://www.eib.org/en/efsi/how-does-a-project-get-efsi-financing/index.htm

[12] https://ec.europa.eu/eipp/desktop/en/index.html

be successful as the combined participation of the private sector could be important to keep a market-oriented solution able to easily react to market innovations. A deeper investigation on **the opportunity to prefer a PPP as governing body of the EU platform** would be beneficial.

Guaranteeing the open access of the tool to all the actors of the construction value chain, in line with T1, means that the collaborative platform becomes the business-as-usual tool for all construction projects in the EU. In order to reach such an ambitious audience, the openness could be provided by different business models or combinations of them:

- ***Freemium business model***: A good amount of functionalities are provided for free, then a range of upgrades is proposed. *Example: Spotify.*
- ***Commission-based business model***: A commission is charged from each transaction. *Example: AirBnB.*
- ***Subscription-based business model***: Customers are charged with a recurring fee — typically monthly or yearly — to access a service. *Example: Netflix.*
- ***Pay per use business model***: The use of a product or service is metered, and customers are charged each time they use the service. *Example: Amazon Web Services.*
- ***Pay per user business model***: Users pay different amounts depending on the number of people using the service. *Example: Matlab.*

However, **a common starting point is the definition and development of a core-platform that could guarantee the basic services able to allow the full deployment of a project for free in all its life cycle (in line with T2).**

Some market uptake options could include:

Case A: The openness could be guaranteed to all users for a fixed period of time to allow the spread of the tool (in its core version) in the Construction industry. After this first period of free use, the platform runs according to the chosen business model in the long run.

Case B: The core version of the platform remains for free use and a series of premium options and services are offered to the users in exchange of fees since the beginning.

In line with T1, T2 and T4, it could be envisaged to follow the example of the existing French KROQI platform (managed by CSTB) which is based on **the business model of Platform as a Service (PaaS)**.

Under this configuration, the Paas provider can choose to have in its business model also hosting capability to host data or to have a “smarter” approach by avoiding the data hosting. Without the hosting capability, they provide an API connection to existing hosting platforms such as Dropbox.

Categories of potential revenues streams

The categories of potential revenues streams could be clustered based on the following domains:

Table 12 - Preliminary analysis of revenues categories of the platform

Users incl. clients, project managers, architects,	Users pay for premium options/services which are additional to the basic free package (core-functionalities): - additional data hosting; - additional number of users to invite;

surveyors, etc.	- additional embedded digital services; - additional real-time data recording (e.g. energy performance data, weather data, etc.) - additional support (dedicated helpdesk); - additional periodical training on new tools and functionalities; - additional access to specific data or statistics provided by the platform; - additional security options for project data/documents.
Data	-Private entities (products or know-how resellers) pay to have the opportunity to share their data on the platform for commercial reasons: - different products' catalogues; - sector analysis reports which are not public. The aim could be to sell final products or data / statistics / knowledge to the final users. In case of effective sale of the product, a fee could be recognised to the platform. -Data from public sources (territorial data, territorial digital twins, underground networks information) could be partially bought (certainly under the respect of safety restrictions) by users [13] correlated with a partial fee for the platform.
Marketing/Sponsorship	- Digital service providers (third parties) pays a fee to have visibility on the platform and be able to offer their tool to users as premium service; - Once the service from the digital service provider is selected by the user, a fee is paid to the platform; - Other kind of sponsorship could be possible via the platform (eg. training opportunity or others).
Training	- Training service provided by the administrator of the platform based on best practices on the use of the platform itself (including free and paid sessions); - Training service provided by digital services providers or other users in exchange for a fee for the platform (which is actually providing a larger audience).

In similar collaborative platforms or tools existing on the market, the users have free and open access to core-functionalities offering a limited hosting capacity, limited multi-users access and a few services. Usually, under the payment of a monthly fee they can choose for additional options, which are a combination of the "users options" presented in the above table.

Different monthly fees of the premium services could be proposed also depending on the typology of user: e.g. single user package, SMEs package, Large Industry package to customize the services in correlation with the kind of use and financial availability of the users.

[13] Based on D5.2 Section 8.4.1 considerations about the progressive opening of public authorities data.

The above-mentioned options fit in the PaaS business model. Other kinds of business models could be envisaged based on the sale of full-options subscription for those users who want to have access to all available services and functionalities and their periodical updates without being obliged to make a screening of different premium options.

A deeper investigation on the categories of revenues that could be generated in the framework of the collaborative platform will be needed. It could start from a deeper analysis of the value streams for each actor involved. **Additional revenues could be generated in correlation with the additional value provided to each of the stakeholders.**

3 The Strategy Roadmap – What is it?

The main goal of task T6.2 – deliverable D6.3 is to provide a seven-year Strategy Roadmap.

The first step is to define, in a correct way, our goals and how to achieve them.

Therefore, it is fundamental to start from a definition. The question is: What is a Strategy Roadmap?

A strategy roadmap is a bridge (or link) between strategy and execution[14]. It visualizes the key outcomes that must be delivered over a particular time horizon in order to achieve DigiPLACE's goals.

The outcomes from the strategy roadmap are substantiated by a clear understanding of which priorities must be addressed. From a practice point of view, a roadmap is a strategic plan that identifies a goal or desired outcome and includes the major steps or milestones needed to reach it.

It also serves as a communication tool, a high-level document that helps articulate strategic thinking—the why—behind both the goal and the plan for getting there[15].

The premises described above serve to frame the goal of this work.

The Strategy Roadmap is the last deliverable out of the DigiPLACE project because it's important to find a common way for all the European countries in the digitalization process in construction market.

Starting from the main goal, which means to support the implementation of the Reference Architecture Framework and applications, the roadmap has been defined considering the action plan elaborated to incentivize, motivate and support the Member State as well as private stakeholders in order to make it real in the future the main outcomes potentially initiated by the DigiPLACE project.

It is fundamental to clarify that a strategy roadmap is a continuous process that evolves "continuously" along some iterative process, as a function of time, and as a function of the results obtained during and at the conclusion of each sub-action. This must be taken into account when the roadmap, from its implementation plan, becomes an ongoing action plan.

A well-designed strategy roadmap visualizes the future of the project into a picture that shows both current and future state[16]. Therefore, it is necessary that at the time the roadmap becomes operational, a monitoring plan is also implemented. so as to verify the effectiveness and accuracy of the implementation of the roadmap and the achievement of the targets at periodic intervals established in the plan itself.

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[14] https://www.jibility.com/what-is-a-strategy-roadmap/#:~:text=A%20strategy%20roadmap%20is%20a,achieve%20the%20organization's%20strategic%20vision

[15] https://www.productplan.com/learn/roadmap-basics/#:~:text=A%20roadmap%20is%20a%20strategic,the%20plan%20for%20getting%20there

[16] Digital Strategy roadmap: A step-by-step approach to success – An Enginess business guide

3.1 The general methodology

In D6.1 four main topics has been defined, as “corner-stones” of the future roadmap:

1. **Promote and network**, following the idea of creating a long-lasting stakeholders ecosystem to promote, support and refine DigiPLACE RAF;
2. **Develop and deploy** with the overall idea of integrating, stimulating, experimenting (large-scale pilots), assessing the use and monitoring the impact of platforms and associated services leveraging on DigiPLACE RAF;
3. **Foster and Secure**, contributing notably to RAF-based digitalisation of European and national regulations;
4. **Capitalise and train**, contributing to training/digital skills development in construction while developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services etc.

A list of of actions supporting the **RAF technical guidelines** has been erected to form the key point of the implementation plan.

In order to implement the roadmap, the key point was the necessity to apply two kind of approach.

First of all, a quantitative approach: the goal is to analyse D6.1/2 topics and actions to build a list or a group of priorities based on relevance and time urgency.

A qualitative approach: starting from the results of D6.1 and D6.2, every actions and sub-actions have been re-analysed in order to evaluate their priority according to the goal of determining the way forward to make DigiPLACE real in Europe and in every single country to increase the digitalization process in the construction sector. In this approach, the consolidated scenarios and economic analysis have been taken into account.

3.2 Urgency and Relevance Priority Index

Assigning priority to actions can reveal a complicated task. There are many prioritization methods in bibliography.

The chosen method is the basic priority numbering system: 1, 2, 3.

In order to evaluate the priority among the actions identified in the four main topics, it has been decided to identify time urgency and relevance as fundamental index.

A priority matrix has been built and a number between 1 and 5 has been assigned for every sub-action in the different topic.

The considered indicators are the following:

- sequentiality between actions;
- ending times;
- Feasibility;
- known critical issues;
- economic impact;
- required training.

This approach allowed structuring a first priority list among the sub-actions, which have been

identified in the various actions of the topics.

There are often dependencies within complex projects. Hence, compulsory actions that must be concluded before proceeding with the next steps have been identified providing additional inputs for the prioritization of the actions.

With these basic principles, it has been possible to create a time frame for each action and sub action.

In order to structure the roadmap it has been necessary to consider that the European Union is made up of countries with very heterogeneous characteristics in terms of digitalization, training, regulatory framework and more. To evaluate the efficiency of an action plan, it is also necessary to consider the social context.

Therefore, to implement a general European roadmap, it has been assumed an average starting point regarding digital innovation, so that the implementation plan could be effectively applicable in each country.

To make this assessment, it was necessary to re-analyse the actions and scenarios addressed in D6.1 and D6.2, declining them in terms of real applicability.

Therefore, in the following paragraphs, the individual actions have been analysed, taking into account those characteristics that highlight and permit to achieve the goals.

3.3 Revaluation of WP6 topics

3.3.1 Promote and Network.

The following five actions proposed in this topic are intended to support the RAF as a whole and not only certain guidelines. The goals are to make the RAF known, to evolve over time and to be used by as many actors in the construction sector as possible.

For these reasons, these actions can be considered the basis from which to start the subsequent actions and can be considered actions transversal to all the topics.

Table 13 – Promote and Network actions

Promote and Network	
Creating a long-lasting stakeholders ecosystem to promote, support and refine DigiPLACE RAF	
Action #1.1	Creating a long-lasting European stakeholders ecosystem/Forum to promote, support and continuously refine DigiPLACE RAF
Action #1.2	Developing partnership with other "communities" (public bodies, outside EU, outside construction sector, etc.) involved in construction and/or digitalisation
Action #1.3	Developing national mirror groups to promote at national scale the use of DigiPLACE RAF and improve it regarding national challenges
Action #1.4	Defining a methodology to refine DigiPLACE RAF
Action #1.5	Collecting and communicating data/information about the added value of digital transition of construction projects

In the following paragraphs, the actions analysed in D6.2 have been taken up and for each of them the individual sub-actions have been identified, as much as possible. Based on the priority of each sub-action, understood as the sum of the "Relevance" of an action for the achievement of the final goal and the temporal "Urgency" of an action compared to the others, and the necessary time frame for the action to develop over time, the specific roadmap for this topic has been obtained.

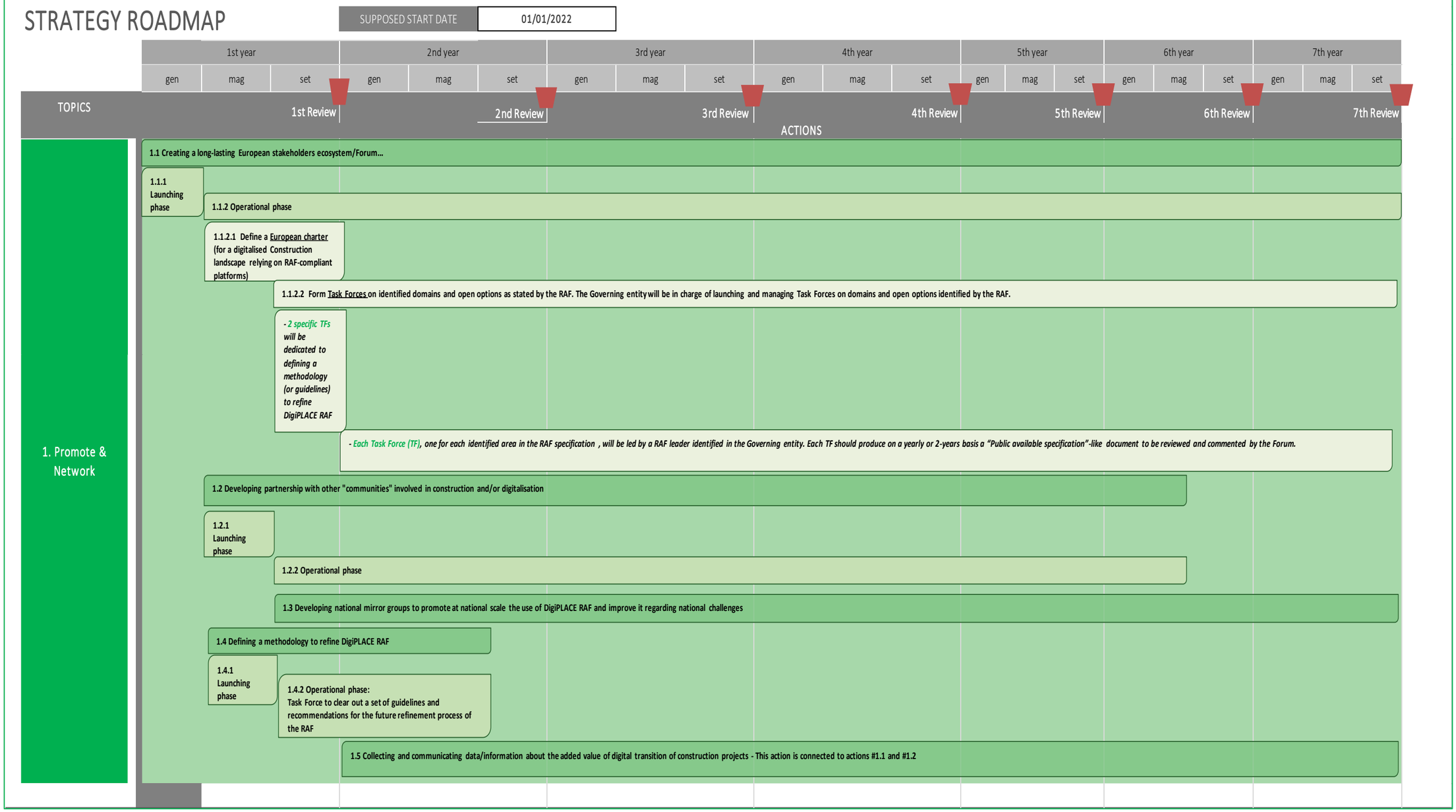

Figure 18 – Promote and Network Roadmap

Action #1.1	Creating a long-lasting European stakeholders ecosystem/Forum to promote, support and continuously refine DigiPLACE RAF

The main targets of this action are to:

1. develop and nurture the DigiPLACE community, increasing the number of stakeholders involved and consolidating those already included in the network;
2. promote their involvement in order to increase the sharing of knowledge and the creation of common consensus, as well as in order to encourage the activation of horizontal experiments among construction stakeholders and platform development actions in progress in favor of SMEs.

To achieve these goals, we can identify: a Launching phase, lasting up to 4 months, and an operational phase, which lasts until the end of the 7-year roadmap. The latter can in turn be broken down into 2 sub-actions:

1.1.1 Define a **European charter** (for a digitalized Construction landscape relying on RAF-compliant platforms)

1.1.2 Form **Task Forces** on identified domains and open options as stated by the RAF. The Governing entity will be in charge of launching and managing Task Forces on domains and open options identified by the RAF.

1.1.1 European charter (for a digitalised Construction landscape relying on RAF-compliant platforms):

The Charter establishes **non-regulatory principles and guidelines** to be used, on a voluntary basis, as a reference for the drafting of rules and conditions useful for the creation of digital platforms.
The Charter should establish some Key Perfonmance Indicators that indicate the level of expectations towards any stakeholder who subscribes to it.

This Charter, that each stakeholder should be ready to sign, should promote a complete transparency for the adoption and harmonisation of policies and procedures to develop (ensuring interoperability), deploy (with the final purpose of enabling Users to access the best digital platforms and data spaces infrastructure(s) to perform their work, wherever it might be located).

This Charter may be updated with agreed regularity - also in relation to the periodic updating of the RAF and must reflect the state of the art of thought and practice of professionals regarding access to digital platforms. and data spaces infrastructures in Europe.

1.1.2 Task Forces on identified domains and open options as stated by the RAF (see deliverable D5.2)

Each Task Force (TF) will be led by a RAF leader identified in the Governing entity.

As a preliminary step, lasting up to four months, 2 specific TFs will be dedicated to defining a methodology (or guidelines) to update and refine DigiPLACE RAF and to monitor and collect all available data on the impact of digitalisation on construction projects in all its relevant dimensions, so as to prepare the ground for future work by the TFs. This is presented in the Action #1.5 "*Defining a*

methodology to refine DigiPLACE RAF" and Action #1.6 "*Providing the answers to the main question about the impacts of the digital transition on construction projects*".

At the end of the work of these 2 TS, the other task forces will enter the field, whose action will last for all the remaining years.

The other TFs are composed of working groups dedicated to specific elements of the RAF topics (and further implementation) requiring additional collective work beyond the end of DigiPLACE project – also organising sets of online and physical workshops as milestones for the TF activities, providing opportunities to increase the Forum size and attractiveness with new projects, innovations and stakeholders. Each TF should produce on a yearly or 2-years basis a "Public available specification"-like document to be reviewed and commented by the Forum, including in case recommendations for policy initiatives, that will further feed the evolution of the RAF (and potentially impact on a longer-term the Charter). This should be based on lessons learnt, case studies and large-scale experimentations of RAF-compliant digital platforms and Data spaces (see §Topic "Develop and Deploy"), to review and detail specific parts of DigiPLACE RAF set of guidelines.

It is expected to set-up a TF for each identified area in the RAF specification – namely:

- Regulation and public services;
- Business, market and collaboration;
- Environmental performance;
- Large scale data and knowledge sharing;
- Common language, interoperability;
- Control over the use of data.

Action #1.2	Developing partnership with other "communities" (public bodies, outside EU, outside construction sector, etc.) involved in construction and/or digitalisation

This action intends to create and nurture links with different organizations and communities that have an interest in the future growth and generalisation of Digital platforms and connected IT tools for Construction.

This action is to be assimilated to a trans-national and European (and even beyond) coordination to support innovation activities (and also potentially policies) in the fields of Digital platforms for Construction, via instruments for networking and exchanges, sharing of knowledge, trans-national access to (digital) infrastructures (like EDIHs or public digital platforms).

This is an action to be launched once action #1.1 is operational (set-up of the Governing Body and of the Task Forces), and it may be constituted by:

1.2.1 Launching phase (lasting a maximum of 4 months): create a 1st inventory of the public bodies, associations, communities and other entities being subject to partnering;

1.2.2 Operational phase (lasting a maximum of 5 years), which may include a variety of activities, the organization and frequency of which should be detailed at the beginning of this action. The list below, already described in D6.2, is not exhaustive:

- *"Enable a **holistic approach** by identifying and bringing together all related stakeholders within technology platforms, associations and international fora, and implementation ecosystems - including public authorities and policy makers;*
- *Increase **synergies and potential collaborations** between those various stakeholders and partners in the fields of building construction and digitalisation – e.g. relying on the establishment of inter- relationships between selected Horizon Europe Partnerships, inviting a comprehensive set of expertise in the elaboration of the various Task Forces, etc.;*
- *Provide with **incentives to favour information sharing and collaborative developments** at a trans- national level (as a means to support collaborative refinement and evolution of the RAF and associated implementations, but taking into account specificities of countries and providing opportunities of sharing of experiences and good practices), as well as international cooperation;*
- ***Accompany the European Construction industry in the innovation process** (after the research and development phase), by providing a coherent European framework for developing common approaches (including a preparatory work and proposals for future refined or new common European standards), and the localisation and adaptation of common solutions which have to be compatible with varying environmental contexts, the capacities of the different enterprises including SMEs in terms of digital understanding, social (user) preferences and regulatory aspects at national or regional level across Europe;*
- *Define a **common methodology to measure achievements**, based on experiences sharing that can speed up pre-normative research towards standardisation. Activities may be developed on a coordinated basis within national and international certification bodies;*
- ***Promote replicable real scale pilot projects** so that greater impact can be achieved at middle and long term - used as demonstrators and empowered disseminations means too (link with action #2.3 Deploying Large-scale Pilots (LSPs - supported by European or MS-based projects, regional or private initiatives), along with common assessment methods);*
- *Establish common framework and methodologies for Digital platforms implementations and assessment within pilot projects (link with action #3.3 "Promoting/testing the RAF in the Member States")."*

Action #1.3	Developing national mirror groups to promote at national scale the use of DigiPLACE RAF and improve it regarding national challenges

This action intends to make known the results of the DigiPLACE project, and in particular of the RAF, to professionals in the construction sector at national level so that they can familiarize themselves with it, providing suggestions or adaptations in the light of national challenges, and more generally, they can meet to *"stimulate the use of digital solutions / tools, to solve common problems, inform, network and create new opportunities"* (see WP4 deliverable D4.2-3).

These groups, composed of the representatives of the different construction (private and public) stakeholders operating in the country, could meet to discuss the problems/solutions/advantages encountered by using the RAF (see action #3.3). Members of DigiPLACE ecosystem as presented in action #1.1 could be invited to present the RAF at national level. Members of these national groups could also be invited to participate in action #1.1 TFs on the basis of their expertise or nationally developed projects.

This action could be launched once action #1.1 is operational (once sub-action 1.1.2.2 has started) and could last until the end of the 7 years of the roadmap.

Action #1.4	Defining a methodology to refine DigiPLACE RAF

This action is to be considered as linked to the action #1.1 "*Creating a long-lasting European stakeholders ecosystem/Forum to promote, support and continuously refine DigiPLACE RAF*", as it indeed consists of creating a dedicated **Task Force** to clear out a set of guidelines and recommendations for the future refinement process of the RAF.

This is an action, lasting 2 years, to be launched almost simultaneously with action # 1.1, and it may be constituted by:

1.4.1 Launching phase (lasting a maximum of 4 months), useful to further support the start of the operational phases of the Task Forces in action # 1.1: create a 1st inventory of the public bodies, associations, communities and other entities being subject to partnering;

1.4.2 Operational phase (lasting 1 year and a half): create the task force mentioned above.

The approach that will be developed may consist of the following steps (to be completed and fine-tuned at operation time of this specific TF - see deliverable D6.2):

a) Identify key players (profiles & types) who could be impacted by the future evolution of the RAF and who are to be involved in the steps to manage the change induced by innovative digital platforms and tools in the market as well as in working practices;

b) Express/review with them how innovative digital platforms and tools could impact these actors and their processes and describe the expected benefits for each of these actors;

c) Refine use-cases scenarios and potentially define new ones;

d) Identify possible obstacles to achieve transformation of processes in particular for SMEs (through described use-cases scenarios) and strategy to overcome these obstacles;

e) Review technologies, data models and standards underpinning the future development or adaptation of innovative digital platforms and tools;

f) Review/refine and extend the RAF and its set of guidelines;

g) Describe predictions of future range of outcomes and expected impacts, which can be used in priority setting for development and (pilot-based) experimentations of the RAF-compliant platforms, including priorities for contributions expected from the actors to achieve these outcomes and impacts.

Action #1.5	Collecting and communicating data/information about the added value of digital transition of construction projects

This action is strictly connected to action #1.1"Creating a long-lasting European stakeholders ecosystem/Forum to promote, support and continuously refine DigiPLACE RAF" as it consists in creating a dedicated **Task Force** to continuously monitor and collect all available data on the impact of digitalisation on construction projects in all its relevant dimensions (cost, time savings, construction quality, safety, reliability, liability reductions, efficiency,…), and make it available and usable by stakeholders.

This Task Force should be put in place at a European level, formed by a selected set of high-level experts but also including, where possible, national sub groups (e.g. already structured mirror groups – see action #1.3) in order to collect information about the country specific differences due to legislative, regulatory, competitive and industry structure, traditions/culture and other issues.

This action could be launched once action #1.1 is operational and could last until the end of the 7 years of the roadmap.

3.3.2 Develop and Deploy

The “Develop and Deploy” topic is particularly linked to several RAF guidelines developed in D5.2. The actions included in this topic are the following:

Table 14 – Develop and Deploy Actions

Develop and Deploy	
Integrating, stimulating, experimenting (large-scale pilots), assessing the use and monitoring the impact of platforms and associated services leveraging on DigiPLACE RAF	
Action #2.1	Building/stimulating Digital platforms (new or adapted) and Common Data Spaces leveraging on DigiPLACE RAF
Action #2.2	Defining and setting the role of Construction data and digital platforms in the European Data Strategy
Action #2.3	Deploying Large-scale Pilots (LSPs - supported by European or MS-based projects, regional or private initiatives), along with common assessment methods
Action #2.4	Erecting an EU repository of Industry (Construction) Digital Commons (e.g. common data ontologies, reference data library, data sharing protocols…)
Action #2.5	Contributing to standard developing organisations
Action #2.6	Allowing SMEs to use digital platforms/tools by taking into account their financial and technical possibilities as well as their specific needs
Action #2.7	Coordinating and supporting development and deployment actions and of a construction common data space

The following image represents the specific roadmap of this topic and the sub-actions necessary to achieve the goal of this topic are explained in the following paragraphs.

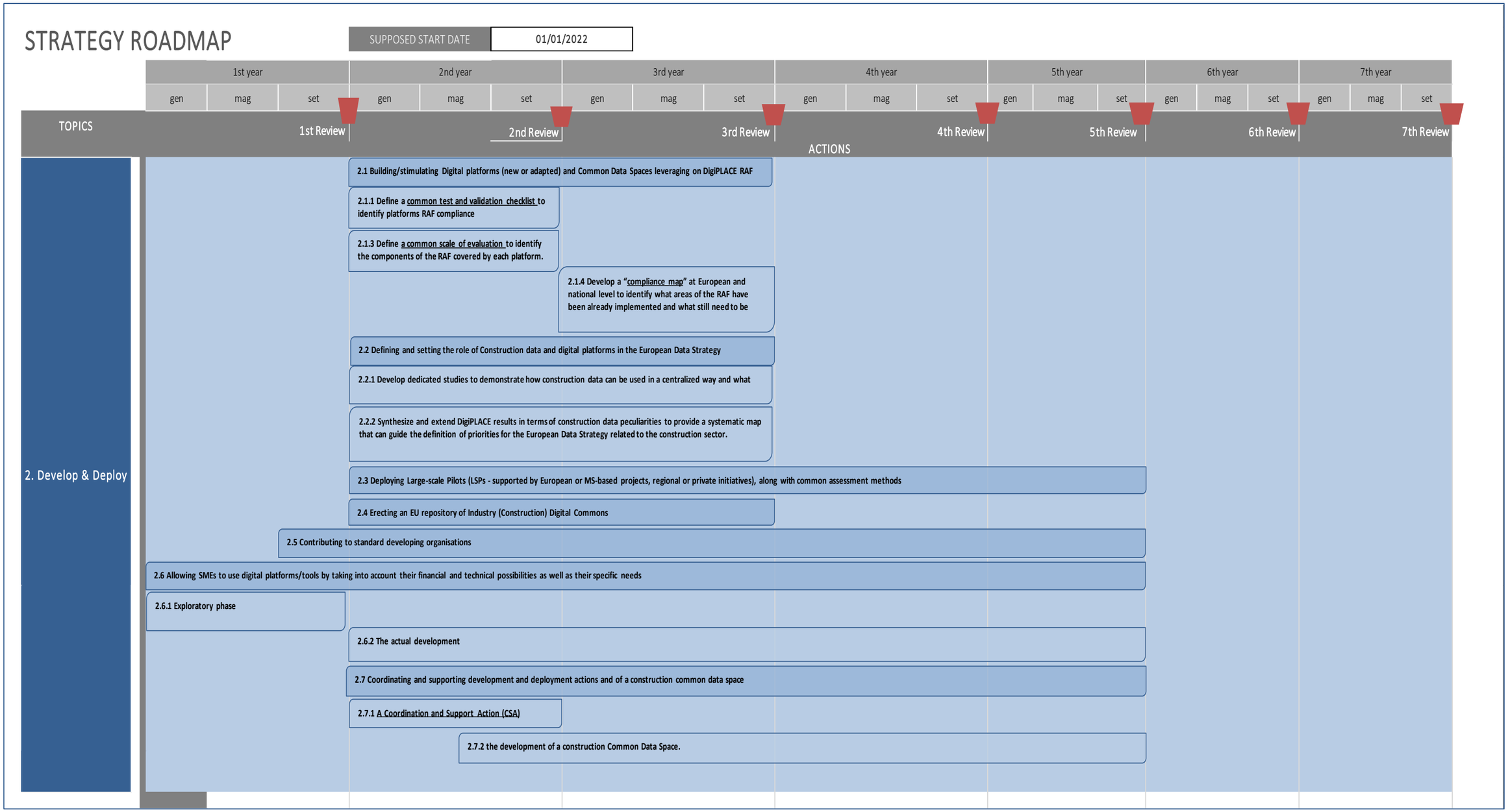

Figure 19 - Develop and Deploy Roadmap

Action #2.1	Building/stimulating Digital platforms (new or adapted) and Common Data Spaces leveraging on DigiPLACE RAF

This action focuses on the identification of shared lines for design, test, validate and measure the impact of new and/or adapted platforms to provide a common ground of work.

This action should be intended as the promoter for the development of platforms, services and large scale pilots up to the development of a construction common data space.

This action should be launched once the constitution of the Task Force groups envisaged in the "*Promote and Network*" theme has been consolidated, which will be able to provide active and useful support for its development. Therefore, this action is expected to start in the second year of the roadmap and can last around 2 years.

The following sub-actions should be considered:

2.1.1 Definition of a **common test and validation checklist** to identify platforms RAF compliance (lasting one year);

2.1.2 Definition of a **common scale of evaluation** to identify the components of the RAF covered by each platform (lasting one year and simultaneous with the previous action);

2.1.3 Developing a "**compliance map**" at European and national level to identify what areas of the RAF have been already implemented and what still need to be developed (lasting one year and consequential to the previous actions).

Action #2.2	Defining and setting the role of Construction data and digital platforms in the European Data Strategy

This action should be developed by the expert Task Forces created under the "*Promote and Network*" theme according to their different levels of interest.

Therefore, this action should be launched once the constitution of the Task Force groups envisaged in the "*Promote and Network*" theme has been consolidated, which will be able to provide active and useful support for its development. Then, this action is expected to start in the 2nd year of the roadmap and can last around 2 years.

this action will consist of the following simultaneous sub-actions:

2.2.1 Developing **dedicated studies** to demonstrate how construction data can be used in a centralized way and what type of impacts can produce;

2.2.2 Synthesize and extend DigiPLACE results in terms of construction data peculiarities to **provide a systematic map** that can guide the definition of priorities for the European Data Strategy related to the construction sector.

Action #2.3	Deploying Large-scale Pilots (LSPs - supported by European or MS-based projects, regional or private initiatives), along with common assessment methods

The target of this topic is to create a **sample European set of experimental projects and facilities implementing and assessing the RAF set of specifications and development/deployment guidance**, relying on a representative set of business scenarios, data spaces, and applications/services. According to the RAF guidelines three main areas can already be

identified, namely **market place**, **procurement place**, and **digital site and smart working environment**. These areas, should be based on both the lines of action #2.1 and #2.6 to promote the development of services that can be used by SMEs.

The implementation of large-scale data pilot projects should start together with the construction / stimulation of digital platforms (action # 2.1), then from the second year, and last about 4 years.

As explained in D6.2, each large scale pilot should consider all the following components as well as integrating the rules defined in action #2.1 to guarantee DigiPLACE RAF compliance:

- ***Analysis and definition of the Data Platform Architecture:*** *Analysis and definition of the Data Management System, i.e. the Machine framework platform component. The different database technologies (e.g. relational, object, graph, etc.) should be analysed to identify the best solutions according to the needs of construction sector.*
- ***Data Mining Architecture:*** *Analysis and definition of the Data Analysis System, i.e. the Knowledge management platform component. The application of Big data technologies, Artificial Intelligence, etc. should be considered to define the database analysis system. It should focus on the critical services highlighted in DigiPLACE project RAF.*
- ***Data Network Architecture:*** *Analysis and development of the Data Share System, i.e. the interface with other Databases and platforms. The interaction between existing public and private databases as well as the interaction with future ones should be considered defining a database network system.*
- ***Apps and services:*** *Analysis and development of dedicated apps and services to support the operating works and products according to the stakeholders' needs and the use cases scenarios defined. It should consider the output of DigiPLACE project RAF.*
- ***Common language:*** *Semantic web and linked data technologies should be considered as means to promote the interoperability between tools, subjects and environments. The definition of construction domains, ontologies, classes, lexicon, taxonomy, topology, etc. should be considered according to the specific areas of development.*
- ***Digital Construction Standards and Regulations:*** *The identification of a common structure for technical standards and Law standards (mandatory rules) should be considered to promote the creation of technical rules, regulations and laws that are machine-readable.*

Action #2.4	Erecting an EU repository of Industry (Construction) Digital Commons (e.g. common data ontologies, reference data library, data sharing protocols…)

As identified in the RAF, the development of interoperable and open digital platforms for the construction sector relies on the elaboration, diffusion and wide adoption of different types of shared agreements and methods.

Therefore, this action is of fundamental importance in order to achieve the final target of the DigiPLACE project.

The process of developing and sharing these *"digital commons"* requires adequate governance and is one of the most important use cases for a future European public platform.

This sharing of digital commons is a basic condition for the development of collaborations based on openBIM processes, but it will be useful at the same time for the development of interoperability and the opening of proprietary software.

There are different types of agreements to be shared, such as: standards, dictionaries and data ontologies, and finally shared models and methods for digital-based collaboration.

Such a repository of digital commons would be an important factor for the dissemination of new collaborative processes envisaged to support the underlying targets of the RAF (e.g. Simple and easy to use BIM based collaboration, digital supply chain, digital twins, LCA based on BIM, buildings as material banks ...).

This action should start together with the construction/stimulation of digital platforms (action # 2.1), then from the second year, and last about 2 years.

Action #2.5	Contributing to standard developing organisations

This action should be understood as the way to promote the strengthening of existing standards and the development of new ones.

Standards development should be developed through:

- continuous action by DigiPLACE partners involved in international, European and national standardization bodies to promote the principles resulting from the DigiPLACE project;
- the creation of a dedicated group based on the actions defined in the first area.
- national mirror groups (see action # 1.3) to capture the national dimension and promote better integration considering all the different levels.

Therefore, the launch of this action is foreseen at the same time as action #1.3 (*"Developing national mirror groups"*), to then continue in parallel with action #2.3 ("*Deploying Large-scale Pilots*"), as the identification of the support action as a possible development of platforms dedicated to the integration of standards should follow the timing identified for the development of pilots' actions and consider the integration with the possible developments identified there to support their development and guarantee a continuous integration with the standard that exist and/or that will be developed.

Action #2.6	Allowing SMEs to use digital platforms/tools by taking into account their financial and technical possibilities as well as their specific needs

In order to bridge the gap between large and small businesses, digital platforms should specifically focus on use cases and tools suitable for SMEs.

This action is closely linked to actions # 2.1 and # 2.3 and should be understood as an integration of services dedicated to SMEs that can allow the use of platforms, and in general of digital systems, by SMEs by removing the barriers to entry due to a knowledge gap, application difficulties, etc.

To achieve this, it is necessary:

- on the one hand, **private financing**, which will support the development of private services integrated into the platforms;
- on the other hand, **public services**, which should be financed through both European and Member State support depending on the level at which the service is located, i.e. whether it is of national / local interest or is of European interest.

In parallel, the development of transversal activities such as virtual Hackathon[17] focused on SMEs issues, needs, peculiarities, etc. can be supported by associations and universities (see deliverable D6.2).

The overall duration of this action has been defined as 5 years, and can be divided into the following sub-actions:

2.6.1: an exploratory phase, lasting 1 year, in which there will be the discussion among the stakeholder communities, the organization of hackathons and in general the exploration of possible solutions and support services, which can begin immediately after the completion of DigiPLACE, and therefore parallel to action 1.1;

2.6.2: an effective development phase, lasting 4 years, which should follow the development of the platforms, and then continue after the completion of the platform in order to continuously update and provide new services based on the emerging and changing needs of the sector.

Action #2.7	Coordinating and supporting development and deployment actions and of a construction common data space

Among the main areas identified in DigiPLACE RAF is the perspective on large-scale data sharing, a European Big Data platform for the construction sector.

To achieve this goal, the activities that can be integrated in this action are different and can be summarized in the need to promote data sharing by overcoming existing barriers by pushing for the creation of a common language, process, interoperability, standards and tools.

This action should be intended as divided in two consequent sub-actions:

2.7.1 a **Coordination and Support Action (CSA)** that can be used for the development and implementation of actions for creating RAF compliant construction platforms;

2.7.2 the development of a **construction Common Data Space**.

2.7.1 The first sub-action can be intended as a Coordination and Support action that can be used to link and related the different actions ongoing on this area. This CSA should consider the following actions (as detailed in the deliverable D6.2):

a. ***Ecosystem building****: development and nurturing of DigiPLACE community, increasing the number of stakeholders involved and consolidating those already included in the network.*

[17] Such as the AEC (Architecture, Engineering, Construction) Hackathon created in 2013. The last online even took place during the month of October 2020 https://hackaec.com/. The focus is not on SMEs but the model itself could be replicated in this sense.

Promote their involvement to increase knowledge sharing and consensus creation as well as to activate horizontal experimentations between construction stakeholders and ongoing platforms development actions favouring SMEs (see actions #1.1, #1.2, and #1.3 of Promote and Network topic).

b. ***Support pilot activities and knowledge transfer across different platforms and application domains**: Coordination of the ongoing construction platforms development actions considering other similar activities activated at European level and the standardisation initiatives in the specific focus area. Identification of shared lines for design, testing, validation and impact measurement (see action #2.1).*

c. ***Legal, regulatory and security support**: Contributions and support to the standardisation bodies and/or pre-normative/pre-standardisation activities should be considered in the development of coordination and support activities. Security and private mechanisms for digital platforms, regulatory and legal aspects in relation to data ownership and protection, security, liability, across sector legislations represent key areas (see action #2.6).*

d. ***Preparation of a construction data space**: Considering the update of DigiPLACE RAF according to the evolution of the construction digital platform developments actions the analysis and development of a new reference architecture framework for the future Construction Data Space should be considered. The definition of one or more roadmaps for the implementation of the construction data space should be included in this activity (paving the way for the second step of this action).*

2.7.2 The second sub-action, understood as a research and innovation action, should consist in the effective development of a construction data space by considering the output of the aforementioned CSA and condensing the results obtained from large-scale data pilots.

This first action, lasting 1 year, should start in parallel with action #2.1*("Building/stimulating Digital platforms (new or adapted) and Common Data Spaces leveraging on DigiPLACE RAF"*), and the second action should start after the deployment of the large-scale pilot projects (action # 2.3), in the second half of year 2, to last another 3 years working on the development of a common construction data space.

3.3.3 Foster and Secure

The “Foster and Secure” topic is linked to the RAF guidelines developed in chapter 5 on Environmental performance and in chapter 8 on public services of deliverable D5.2. The goal is to propos actions to create a level playing field for the digitalisation of the construction sector.

In the D6.2 we proposed six actions:

Table 15 – Foster and Secure Actions

Foster and Secure	
Contributing to RAF-based digitalisation of European and national regulations	
Action #3.1	Contributing to RAF-based digitalisation of EU and National regulations
Action #3.2	Setting-up (RAF-based) digitalised public services
Action #3.3	Promoting/testing the RAF in the Member States
Action #3.4	Encouraging data sharing
Action #3.5	Securing platform operation in terms of cyber-security and intellectual properties
Action #3.6	Encouraging public actions associated with promoting DigiPLACE RAF for environmental performance

Each action has a specific period of implementation; to translate this period of implementation in a roadmap readable for everyone we consider also, the specific sub-actions contained in every actions.

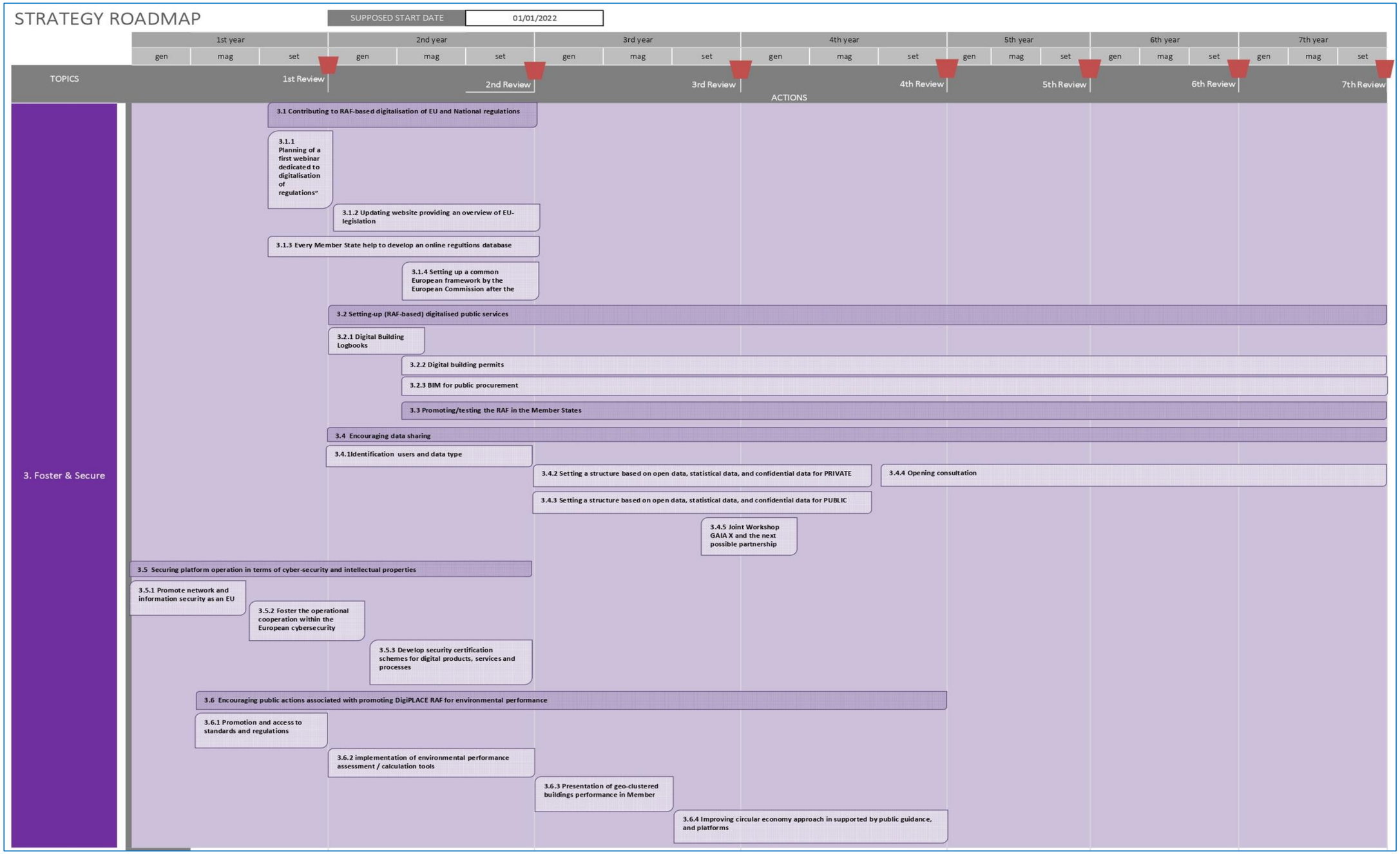

Figure 20 - Foster and Secure Roadmap

Action #3.1	Contributing to RAF-based digitalisation of EU and National regulations

Public authorities have an important role to play in fostering the digitalisation of the construction sector by providing policy orientations or through regulations or incentives. However, while many public initiatives exist in European Member States to support the digitalisation of the construction sector, a European approach appears also necessary to allow better interoperability between these national services and initiatives, greater coherence of national policies and better exchange of data and information while avoiding fragmentation of efforts and the implementation of sub-optimal solutions at national level. To implement services like **Access to regulations, Digitalisation of rules, Automatic checking of project compliance** (RAF "Digitalised public services and regulations") several sub-actions could be envisaged.

The kick off could be a first **webinar dedicated to "digitalisation of regulations"** to present and list in more detail the existing initiatives supporting the digitalisation of rules, after that the Member State should help to develop a network of online regulations databases with multi-lingual user interfaces and in parallel keep updating the website providing an overview of EU-legislation in according with the roadmap of the EU BIM task group. At the end, the setting up of automatic **checking of project compliance** depending on the degree of digitalisation of procedures in Member States and linked to local or national regulations.

Action #3.2	Setting-up (RAF-based) digitalised public services

The main goal of this action is to deliver key digitalised public services to construction stakeholders and more broadly to citizens, working on three areas of interest:

1. Digital Building Logbooks;
2. Digital building permits;
3. The spread of BIM used in public procurement.

We start from the **Digital Building Logbooks** because it requires several issues around data ownership, access, storage, privacy and security notably to be settled. An European approach could be a solution to have a common practice across Member States but it would need to be adapted to these diverse local contexts, with different need, culture, processes as well as capacity and market readiness. In a second moment we can start with **Digital building permits** and **the spread of use of BIM for public procurement**, the duration of which is assumed until the end of the roadmap.

Action #3.3	Promoting/testing the RAF in the Member States

This action is linked to action #1.3"Developing national mirror groups to promote at national scale the use of DigiPLACE RAF and improve it regarding national challenges" and action #3.2 "Setting-up digitalised public services", as it consists of presenting, promoting and implementing the RAF guidelines by the public stakeholders of the construction sector so that it could be adopted by the greatest number. This process is double:

- at the level of each Member State with the help of the mirror groups defined in action #1.3;
- at the European level, through the EU BIM Task group which includes in particular an action of its roadmap related to “supporting the creation of a common digital platform for the built environment”.

Action #3.4	Encouraging data sharing

This action aims to guarantee security and encourage construction stakeholders to share their data in a safe and fair environment. The preliminary operation it will be the identification of the users and the type to encourage the data sharing. Only after closed this phase we will be able to set a structure based on open data, statistical data and confidential data for Private and Public. The last step of this actions it will be an opening consultation to allow users and stakeholders to have access to structured data.

Expected impacts:
For the Public Sector the expected impacts could be:
- Growth of services enabled by the platform environment
- Increasing the digital culture of construction stakeholders
- European, national and/or regional regulations that can promote the opening of public data toward the platform
- Creation of Ad hoc services that can be based on statistical and open data
- One entry point to manage data from multiple sources

For the Private Sector the expected impacts could be:
- Ad hoc services that can be based on confidential, statistical and open data
- One entry point to manage data from multiple sources
- Growth of services enabled by the platform environment
- Increase the digital culture of construction stakeholders

Action #3.5	Securing platform operation in terms of cyber-security and intellectual property

”Data storage, security and sovereignty”, moving towards higher levels of integration between sectors, there is a need to address inherent vulnerabilities and take appropriate and proportionate measures to protect:
- built assets and environments;
- personnel and other occupants or users of built assets, including the built environment’s citizens, encompassing residents, business, visitors and commuters;
- data and information, including that which is commercially sensitive or constitutes intellectual property; and
- societal, environmental and/or commercial services.

To achieve this action, it seems necessary to work on two fronts, passive security, designed to block or at least slow down attacks by offering technical and practical barriers to programs or users who represent a threat, and active security, capable of securing data and information by providing

mechanisms more or less sophisticated authentication. A European coordination on the application of the regulatory framework and security protocols is therefore needed. In light of these cybersecurity challenges, the European authorities have been working on various fronts to:

- enhance cyber resilience
- fight cybercrime
- boost cyber diplomacy
- reinforce cyber defence
- boost research and innovation
- protect critical infrastructure

This action can be subdivided in 3 phases:

1. Promote network and information security
2. Foster and operational cooperation within the European cybersecurity
3. Develop security certification schemes for digital products, services and processes.

It's important to underline that the cyber security regulation framework (III phase) has to be applied as soon as possible, both at European and national level.

Action #3.6	Encouraging public actions associated with promoting DigiPLACE RAF for environmental performance

Digitalization and digital platforms play a crucial role in relation to the environmental performance of buildings. This action serves the need for higher environmental performance in accordance with EU policies.

The action will follow those steps:

1. The promotion and access to standards and regulations, lasting approximately 8 months;
2. Implementation of environmental performance assessment / calculation tools, lasting one year;
3. presentation of geo-clustered buildings performance in Member states and the EU, lasting approximately 8 months;
4. Improving circular economy approach in construction should also be supported by public guidance, and platforms that implement it, which will start approximately after sub-action 3 and will end at the end of action 3.6.

3.3.4 Capitalise and Train

The “Capitalise and Train” topic is particularly linked to the RAF guidelines developed in chapter 7 Business, market and collaboration (and in chapter 8 on public services of deliverable D5.2.

These guidelines could be could then be supported through the following two actions:

Table 16 – Capitalise and Train Actions

Capitalise and Train	
Developing expertise and contributing to training/digital skills development in construction while developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services etc.	
Action #4.1	Contributing to training / digital skills development in construction
Action #4.2	Developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services and Construction Digital Innovation Hubs (DIHs)

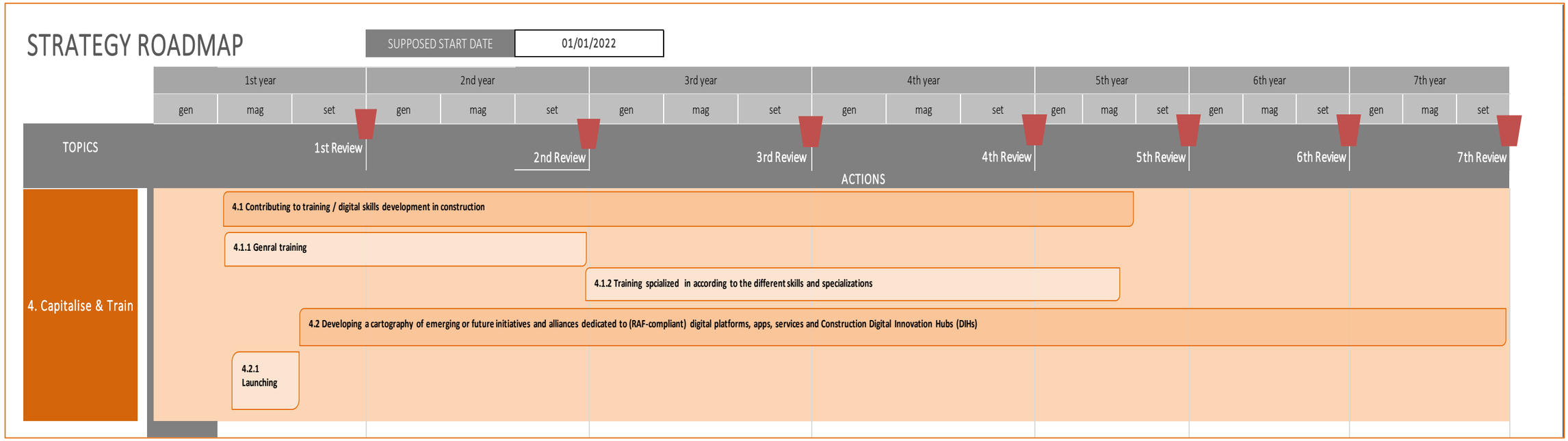

Figure 21 – Develop and deploy Roadmap

Action #4.1	Contributing to training / digital skills development in construction

This action has two strategic priorities, on the one hand, fostering the development of a high-performing digital education ecosystem and on the other, enhancing digital skills and competences for the digital transformation. This plan can allow to play at European level a more active role in:

- identifying, sharing and scaling up good practices;
- supporting Member States and the education and training sector with tools, frameworks, guidance, technical expertise and research;
- fostering cooperation between all stakeholders.

In addition, a new European Digital Education Hub would:

- link national and regional digital education initiatives and actors; and
- support cross-sector collaboration and new models for exchange of digital learning content, addressing issues such as common standards, interoperability, accessibility and quality-assurance.

This actions has got two main phases, the first one more general focused to develop digital skills and a second one dedicated to train technicians with different skills and specializations.

Action #4.2	Developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services and Construction Digital Innovation Hubs (DIHs)

The overall concept is to create a web portal to centralise information both from potential (European collaborative) project development and findings, specific public initiatives and programme development, as well as private development in terms of platforms and services – as a global service for the Construction stakeholders community in Europe.

Before to start this overall action will be important to set a preparatory phase to identify the types and sources of information, the process of collecting information, the format to make it public and the way to finance it sustainably.

3.3.5 The General Strategy Roadmap

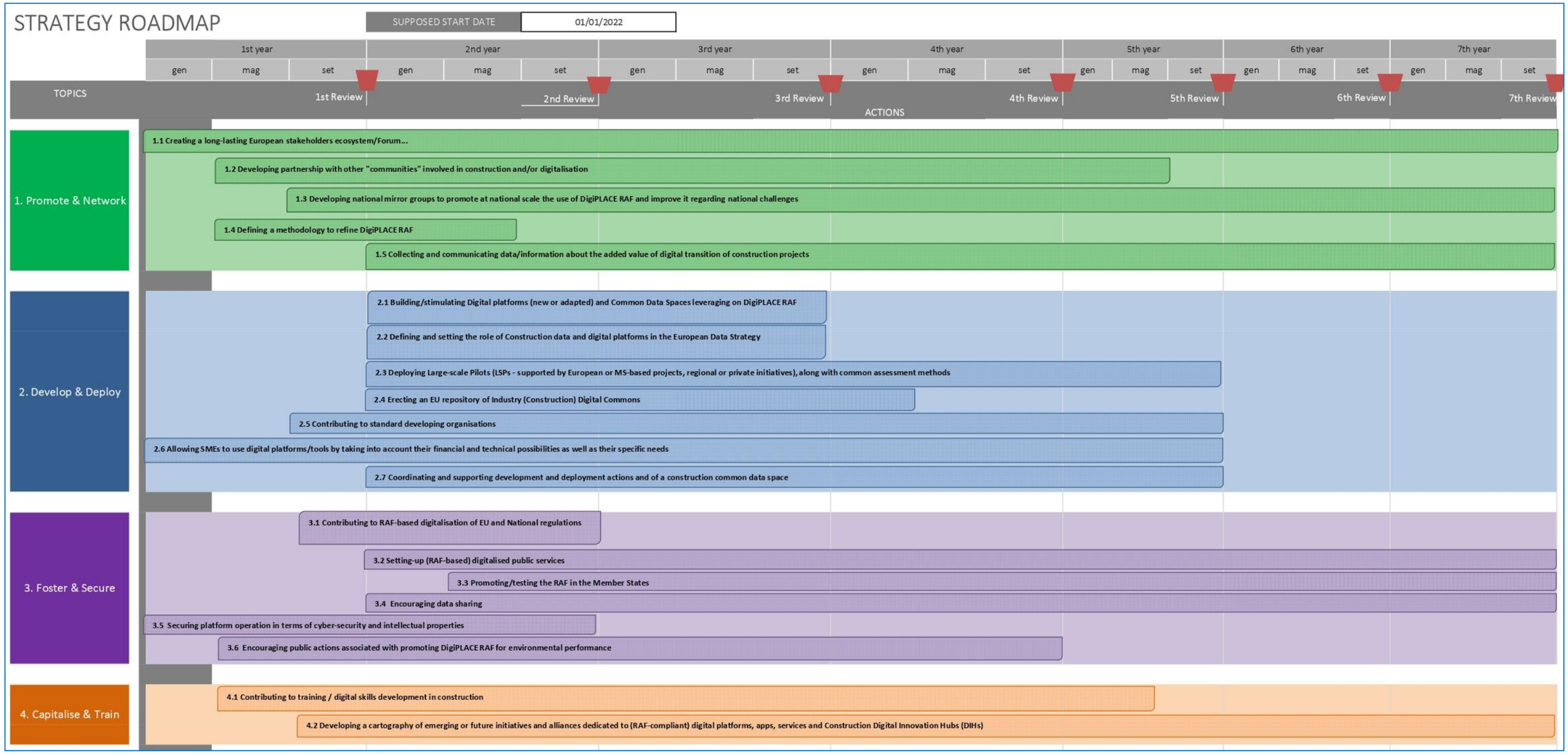

Figure 22 – the General strategy roadmap

4 Conclusions

In recent years, in Europe, a real case of transition from traditional analogue processes to digital ones is in progress in the world of construction. Different delivery methods for technology have been tried to date, yet a lag in the adoption of information technology in the construction industry can be observed.

In this context, the DigiPLACE Project has set a cutting-edge goal: creating a Reference Architecture Framework (RAF) and a roadmap for a coherent development of future digital platforms as common ecosystems of digital services.

The roadmap defines the vision to support the stakeholders for the future gradual implementation of the RAF and its applications.

The present document summarizes the work carried out within T.6.2 – D6.3: Development of the Strategy Roadmap and Implementation Action Plan, which is the last deliverable of WP6.

The tasks of WP6 complete the work done in previous work packages, in particular the creation of the DigiPLACE stakeholder community (WP2), the identification of good practices and existing initiatives or technological solutions already used, as well as attention points including success factors (WP3), the identification of barriers and factors for digitalisation enhancement (WP4) and the reference architecture framework (WP5).

The purpose of the third Deliverable of the WP6 (D6.3 - “Strategy Roadmap and Implementation Action Plan”) is to develop what has been described in Deliverable 6.2 by defining a Strategy Roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications as defined in WP5.

Moreover, a preliminary analysis of financial aspect preparatory for strategy roadmap development activity in DigiPLACE project has been developed, in order to pave the way for the development of the DigiPLACE roadmap for a coherent generalisation of Digital Platforms for Construction in Europe.

The economic analysis focused on eight selected implementing scenarios resulted best rated in terms of priority, relevance and necessity in the online consultation open to the Community of Stakeholders from 8 to 19 March 2021.

The methodology used to achieve the targets in the last deliverable of WP6 was the following :

- Re-evaluation of the consolidated scenarios in order to proceed with their economic and financial analysis
- The identification of adequate business model to guarantee the implementation of the selected implementing scenarios;
- The development of a seven-year strategy roadmap to support the stakeholders for the future progressive implementation of the RAF and its applications through the application of the following steps:
    - revaluation of actions and sub-actions;
    - study and implementation of priorities in terms of time and relevance;
    - first structure of the roadmap;
    - verification of the coordination between the different actions priorities;
    - verification of periods;
    - verification of the feasibility of the plan;

- evaluation of the feasibility at national and local level.

So, the first step taken for the construction of the roadmap was starting from the four topics of D6.2 and the related actions.

The second step has been to assign **priorities** to the various actions, both of importance and of temporal urgency, through the identification of some indicators, through the implementation of a matrix of priorities.

The indicators considered was the following:

- sequentiality between actions;
- ending times;
- feasibility;
- known critical issues;
- economic impact;
- required training.

Starting from priorities matrix, built by the application of time urgency and relevance index and considering the results of the qualitative assessments, the roadmap was built.

In conclusion, all the process and the roadmap described in the page above is about a standard approach of implementation of digitalization to the construction sector in Europe.

It is lapalissian that each single Member State has got a different level of digitalization right now. There are countries with a high level of connectivity but a lower level of human capital in terms of internet use, basic and advanced digital skills or State member with a strong legislation about Government and eProcurement and other with a lower level.

The gaps among Member States will be a big challenge for the European Union, for this reason we recommend looking at the roadmap like a dynamic element that should be customized for each Member State according to its own level of digitisation, digitalization and digital transformation.

Therefore, it will be necessary to implement a monitoring plan to verify the progress of the actions, the outcomes, the difficulties encountered and to identify preventive or corrective measures.

In conclusion, it should be noted that the proposed roadmap represents a dynamic process that will have to be adapted to the specific needs of European countries. Not only that, on the basis of the results and experiences gathered during the implementation of actions, the roadmap will have to be re-evaluated and updated as in an iterative process.

It is worth mentioning that during the last Advisory Board meeting, held the 28th of May 2021, the AB memebers expressed their interest in find effective ways to make both the RAF and the Strategy Roadmap operational for the construction sector. One of the first step that has been activated thanks to the AB memebrs is the evaluation of some of the existing national paltforms according to the RAF to start a draft version of a European RAF compliance check. Moreover, thanks to a consulation launched during the last weeks of the project, we collected the interst of 10 public bodies in the Strategy Roadmap and its follow-up.

STRATEGY ROADMAP

SUPPOSED START DATE 01/01/2022

1st year | 2nd year | 3rd year | 4th year | 5th year | 6th year | 7th year

gen | mag | set

TOPICS

1st Review | 2nd Review | 3rd Review | 4th Review | 5th Review | 6th Review | 7th Review

ACTIONS

1. Promote & Network

1.1 Creating a long-lasting European stakeholders ecosystem/Forum...

1.1.1 Launching phase

1.1.2 Operational phase

1.1.2.1 Define a European charter (for a digitalised Construction landscape relying on RAF-compliant platforms)

1.1.2.2 Form Task Forces on identified domains and open options as stated by the RAF. The Governing entity will be in charge of launching and managing Task Forces on domains and open options identified by the RAF.

- *2 specific TFs will be dedicated to defining a methodology (or guidelines) to refine DigiPLACE RAF*

- *Each Task Force (TF), one for each identified area in the RAF specification , will be led by a RAF leader identified in the Governing entity. Each TF should produce on a yearly or 2-years basis a "Public available specification"-like document to be reviewed and commented by the Forum.*

1.2 Developing partnership with other "communities" involved in construction and/or digitalisation

1.2.1 Launching phase

1.2.2 Operational phase

1.3 Developing national mirror groups to promote at national scale the use of DigiPLACE RAF and improve it regarding national challenges

1.4 Defining a methodology to refine DigiPLACE RAF

1.4.1 Launching phase

1.4.2 Operational phase: Task Force to clear out a set of guidelines and recommendations for the future refinement process of the RAF

1.5 Collecting and communicating data/information about the added value of digital transition of construction projects - This action is connected to actions #1.1 and #1.2

2. Develop & Deploy

2.1 Building/stimulating Digital platforms (new or adapted) and Common Data Spaces leveraging on DigiPLACE RAF

2.1.1 Define a common test and validation checklist to

2.1.3 Define a common scale of evaluation to identify the components of the RAF covered by each platform.

2.1.4 Develop a "compliance map" at European and national level to identify what areas of the RAF have been already implemented and what still need to be

2.2 Defining and setting the role of Construction data and digital platforms in the European Data Strategy

2.2.1 Develop dedicated studies to demonstrate how construction data can be used in a centralized way and what type

2.2.2 Synthesize and extend DigiPLACE results in terms of construction data peculiarities to provide a systematic map that can guide the definition of priorities for the European Data Strategy related to the construction sector.

2.3 Deploying Large-scale Pilots (LSPs - supported by European or MS-based projects, regional or private initiatives), along with common assessment methods

2.4 Erecting an EU repository of Industry (Construction) Digital Commons

2.5 Contributing to standard developing organisations

2.6 Allowing SMEs to use digital platforms/tools by taking into account their financial and technical possibilities as well as their specific needs

2.6.1 Exploratory phase

2.6.2 The actual development

2.7 Coordinating and supporting development and deployment actions and of a construction common data space

2.7.1 A Coordination and Support Action (CSA)

2.7.2 the development of a construction Common Data Space.

3. Foster & Secure

3.1 Contributing to RAF-based digitalisation of EU and National regulations

3.1.1 Planning of a first webinar dedicated to digitalisation of regulations"

3.1.2 Updating website providing an overview of EU-legislation

3.1.3 Every Member State help to develop an online regultions database

3.1.4 Setting up a common European framework by the European Commission after the

3.2 Setting-up (RAF-based) digitalised public services

3.2.1 Digital Building Logbooks

3.2.2 Digital building permits

3.2.3 BIM for public procurement

3.3 Promoting/testing the RAF in the Member States

3.4 Encouraging data sharing

3.4.1Identification users and data type

3.4.2 Setting a structure based on open data, statistical data, and confidential data for PRIVATE

3.4.4 Opening consultation

3.4.3 Setting a structure based on open data, statistical data, and confidential data for PUBLIC

3.4.5 Joint Workshop GAIA X and the next possible partnership

3.5 Securing platform operation in terms of cyber-security and intellectual properties

3.5.1 Promote network and information security as an EU

3.5.2 Foster the operational cooperation within the European cybersecurity

3.5.3 Develop security certification schemes for digital products, services and processes

3.6 Encouraging public actions associated with promoting DigiPLACE RAF for environmental performance

3.6.1 Promotion and access to standards and regulations

3.6.2 implementation of environmental performance assessment / calculation tools

3.6.3 Presentation of geo-clustered buildings performance in Member

3.6.4 Improving circular economy approach in supported by public guidance, and platforms

4. Capitalise & Train

4.1 Contributing to training / digital skills development in construction

4.1.1 Genral training

4.1.2 Training spcialized in according to the different skills and specializations

4.2 Developing a cartography of emerging or future initiatives and alliances dedicated to (RAF-compliant) digital platforms, apps, services and Construction Digital Innovation Hubs (DIHs)

4.2.1 Launching

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