



**Politecnico
di Torino**

MSCs in Engineering and Management

MSCs Thesis

“An analysis of the Italian PNRR project financing scheme from the perspective of project management: critical points and areas for improvement.”

Thesis realised within Business Integration Partners,
Via Sicilia, 43 00187 Roma

Relatore

Prof. Alberto De Marco

Co-relatore

Prof. Filippo Maria Ottaviani

Candidato

Alessandro Di Turi

Academic year 2022/2023

1.	Introduction	5
1.1	What is PM.....	5
1.1.1	Principal success criteria for a project.....	6
1.1.2	PM processes and process groups	7
1.1.3	Projects, programs and portfolios.....	8
1.1.4	Project Governance.....	9
1.1.5	Risk management	10
1.1.6	Change management (FIGURE).....	12
1.1.7	Monitoring and control (FIGURE EVM – MILESTONES AND TARGETS).....	15
1.2	What is National recovery and resilience plan (PNRR)	16
1.2.1	Next Generation EU (NGEU).....	16
1.2.2	Recovery and Resilience Facility (RRF)	17
1.2.3	RRF Pillars and PNRR Missions.....	18
1.2.4	Country access to Funds and allocation.....	19
1.2.5	Recovery and Resilience Facility performance-based nature.....	20
1.2.6	Governance structure and Governance principles	21
1.2.7	PNRR Transversal principles	23
2.	PM and PNRR main commonalties and criticalities	27
2.1	Commonalties.....	27
2.1.1	PNRR and portfolio, program and project management	27
2.1.2	PM and PNRR transversal nature	28
2.1.3	ReGiS System vs Earned value management.....	29
2.2	Criticalities	32
2.2.1	Spending capacity.....	32
2.2.2	Managing risk and managing change	33
3.	Case study – BIP supporting the largest Italian DSO to get funds from PNRR.....	35
3.1	Initiating	35
3.1.1	Context and objectives.....	35
3.1.2	Standard types of interventions	36
3.2	Planning.....	37
3.2.1	Criteria definition, strategy and perimeter.....	37
3.2.2	Definition of a list of candidable intervention.....	38
3.2.3	Planning and drafting documentation.....	39
3.2.4	Packaging and application submission	40
3.3	Executing.....	40
3.4	Monitoring and controlling.....	41
3.5	Closing.....	41
4.	CSFs, improving margins and next challenges.....	42

4.1	CSFs	42
4.1.1	Outcome of the application.....	42
4.1.2	KPI definition	42
4.2	Next challenges	45
4.2.1	Implementation.....	46
4.2.2	Critical issues.....	47
4.2.3	Reporting and disbursement of the grant.....	47
5.	Conclusions	49

1. Introduction

The Italian government is currently grappling with the complex task of administering a significant amount of funds granted through the European Recovery and Resilience Facility (RRF). While Italy has demonstrated commendable aptitude in devising a plan to invest these funds, it now faces the daunting challenge of managing large-scale projects within a tight timeframe.

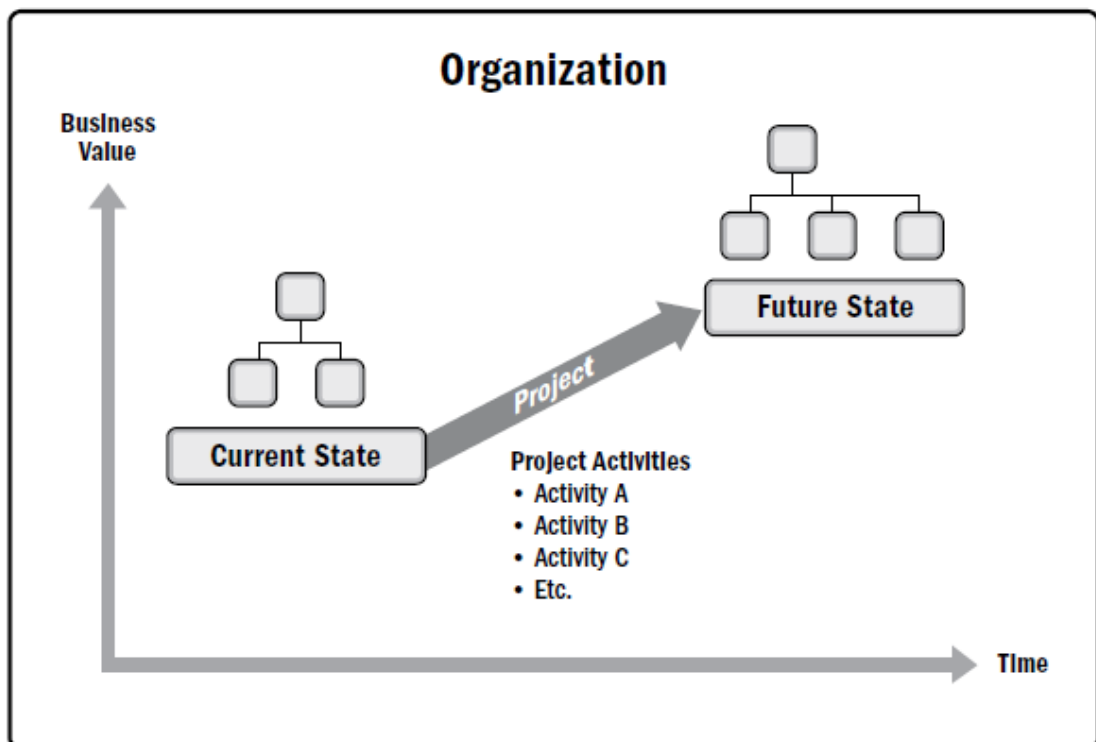
This paper seeks to examine the RRF investment plan from the standpoint of project management, with the aim of presenting a case study that demonstrates how a robust understanding of project management principles and practices can enhance the efficiency of coordination and processes.

To illustrate the impact of project management principles, a case study will be presented, which showcases how the know-how of project management can help in the successful implementation of complex projects. The case study will examine the challenges faced by a DSO in implementing PNRR-funded projects and highlight how the adoption of project management methodologies can help overcome the main challenges.

The ultimate goal of this analysis is to demonstrate how the application of project management principles and practices can enhance the effectiveness of coordination and processes in the context of RRF-funded projects. By providing practical insights into the application of project management methodologies, this paper seeks to offer useful guidance to government bodies responsible for administering large-scale projects, helping them to improve their efficiency and increase their chances of success.

1.1 What is PM

A project is a temporary endeavor undertaken to create a unique product, service, or result. (Project Management Institute) Projects drive change in organizations, they are aimed at taking them from a current state to a future state in order to achieve specific goals. This is well explained by Figure



1. Figure 1

Project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements. PM enables organizations to execute projects effectively and efficiently.

1.1.1 Principal success criteria for a project

Project management is a discipline that has evolved over the years, with various methodologies and techniques being developed to ensure the success of projects. One of the critical aspects of project management is identifying and defining the success criteria for a project. The success criteria are the standards against which the project's success will be measured, and they define what the project must achieve to be considered successful.

The principal success criteria of project management are the fundamental principles that guide the planning, execution, and control of projects. These criteria reflect the expectations of stakeholders and help project managers measure the success of their projects objectively. The identification and definition of these success criteria are critical to ensure that the project meets its objectives and delivers the desired outcomes.

Let's see the principal success criteria for a project:

- **Compliance with the targets:** This criterion refers to the project's ability to achieve the objectives set out in the project plan. It is essential to define these targets at the beginning of the project, and they should be specific, measurable, achievable, relevant, and time-bound (SMART). Compliance with targets ensures that the project is progressing as planned, and it helps project managers identify areas that need improvement.
- **Budget compliance:** Staying within the project budget is essential for its success. The budget is a critical aspect of project planning, and it sets the financial parameters for the project. Project managers must monitor the budget continuously and make adjustments to keep the project within budget. Failure to comply with the budget can lead to project delays, scope creep, and ultimately project failure.
- **Timeliness:** Projects must be completed on time to be considered successful. Timeliness is a critical success factor for projects, and project managers must ensure that the project is progressing according to the project schedule. Delayed projects can lead to increased costs, missed opportunities, and lost revenue.
- **Compliance with quality requirements:** Quality is a critical aspect of project management, and it refers to the degree to which the project meets the specified requirements. Compliance with quality requirements ensures that the project is meeting stakeholder expectations and is delivering the desired outcomes. Project managers must continuously monitor and measure quality throughout the project life cycle to ensure compliance with quality requirements.
- **Stakeholders satisfaction:** Stakeholder satisfaction is critical to the success of a project. Stakeholders are individuals or groups who have an interest in the project, and their satisfaction is essential to ensure the project's success. Project managers must engage with stakeholders and manage their expectations throughout the project life cycle to ensure their satisfaction.

In short, compliance with the targets, budget compliance, timeliness, compliance with quality requirements, and stakeholders satisfaction are critical success criteria for any project. Project

managers must define and manage these criteria throughout the project life cycle to ensure project success. By meeting these success criteria, project managers can increase the likelihood of project success and deliver projects that meet stakeholder expectations.

1.1.2 PM processes and process groups

The project life cycle is managed by executing a series of project management activities known as project management processes. Every project management process produces one or more outputs from one or more inputs by using appropriate project management tools and techniques. The output can be a deliverable or an outcome. Outcomes are an end result of a process. Project management processes apply globally across industries. (Project Management Institute)

A logical grouping of project management inputs, tools and techniques, and outputs are called Project Management Process Groups, which include Initiating, Planning, Executing, Monitoring and Controlling, and Closing. Project Management Process Groups are not project phases.

These process groups provide a framework for organizing and understanding the various project management activities that are necessary to deliver a project successfully.

There are five Project Management Process Groups, which are Initiating, Planning, Executing, Monitoring and Controlling, and Closing. Each of these process groups comprises a set of specific project management activities, and these activities are performed in a particular order throughout the project life cycle. It's important to note that the process groups are not project phases; rather, they are distinct sets of activities that are performed throughout the project life cycle.

The Initiating Process Group is the first process group and includes activities that are performed to define and authorize the project or a phase of the project. These activities include developing the project charter, identifying stakeholders, and defining the project objectives and scope.

The Planning Process Group involves developing a detailed plan for the project that outlines the approach, objectives, timelines, budgets, and resources required to complete the project successfully. The planning process group includes activities such as creating a project management plan, defining project scope, creating a work breakdown structure, identifying and mitigating project risks, and developing a project schedule.

The Executing Process Group is where the project plan is put into action. This process group includes activities such as implementing project management plans, acquiring and managing project resources, managing project work, and communicating project progress.

The Monitoring and Controlling Process Group involves monitoring the project's progress to ensure that it meets its objectives and remains on track. This process group includes activities such as monitoring project performance, managing project changes, ensuring quality control, and managing project risks.

The Closing Process Group involves bringing the project to an orderly conclusion, which includes activities such as delivering project outcomes, closing project contracts, conducting project evaluations, and documenting lessons learned.

Overall, the Project Management Process Groups provide a framework for organizing and understanding the various project management activities that are required to deliver a project successfully. By understanding the process groups and the activities within them, project managers

can effectively plan, execute, monitor, and control their projects, ensuring that they meet their objectives on time and within budget.

1.1.3 Projects, programs and portfolios

Projects, programs, and portfolios are essential components of project management, each serving a unique purpose in achieving organizational goals. While these terms are often used interchangeably, they are distinct in their approach and management. A project is a temporary endeavor with a defined beginning and end, aimed at creating a unique product or service within a specific scope, budget, and timeline; as we can see in Figure 2 a project is about “doing things right”. Projects are managed using a set of processes, tools, and techniques that allow for effective planning, execution, monitoring, and control.

A program, on the other hand, consists of multiple projects that are coordinated and managed in a cohesive manner to achieve a specific strategic objective. Programs involve interrelated projects that work towards a common goal, and the management of these projects is closely aligned with the overall program objectives; referring again to Figure 2 a program is about “realizing the benefits”. Programs allow organizations to address complex issues that require multiple projects and disciplines, and offer a centralized approach to achieving strategic goals.

A portfolio is a collection of projects, programs, and other activities that are managed together to achieve a specific business objective. Portfolios are focused on aligning projects and programs with the organization's overall strategic plan and objectives, ensuring that resources are allocated effectively and efficiently to achieve the desired outcomes. The management of portfolios involves evaluating and prioritizing potential projects and programs, selecting those that align with the organization's strategic objectives, and monitoring their progress to ensure they remain on track; portfolio management is about “doing the right thing”

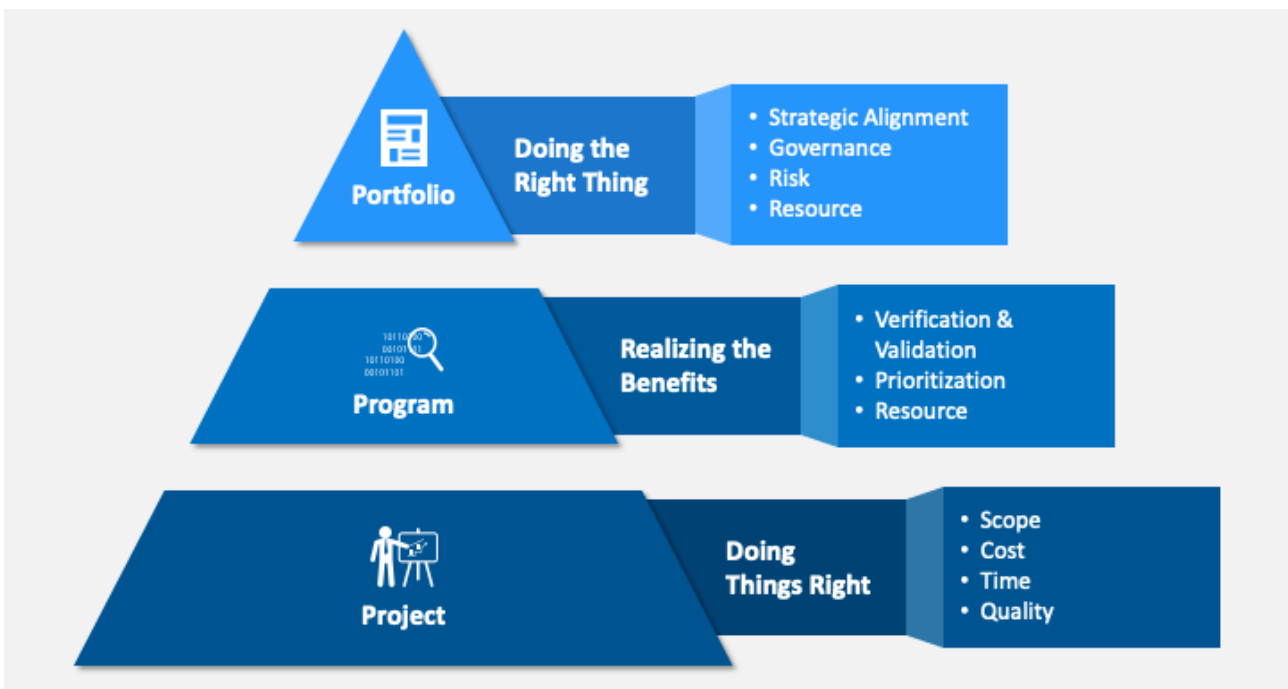


Figure 2 - Portfolio, program and project.

Source: <https://www.sketchbubble.com/en/presentation-portfolio-program-project.html>

The main differences between projects, programs, and portfolios are their scope, objectives, and management. Projects are focused on delivering a specific outcome, while programs are designed to

achieve a strategic goal that requires multiple projects. Portfolios are focused on aligning projects and programs with the organization's overall strategic plan and objectives, ensuring that resources are allocated effectively and efficiently to achieve the desired outcomes.

In terms of management, projects are managed using a set of processes, tools, and techniques that allow for effective planning, execution, monitoring, and control. Program management involves coordinating multiple interrelated projects to achieve a common goal, while portfolio management involves selecting and managing a collection of projects and programs that align with the organization's overall strategic plan and objectives.

In summary, projects, programs, and portfolios are essential components of project management, each serving a unique purpose in achieving organizational goals. Understanding the differences between these terms is critical for effective project management and for aligning project activities with the organization's strategic objectives. By using the appropriate management approach for each type of initiative, organizations can optimize their resources and achieve their desired outcomes.

1.1.4 Project Governance

Project governance is defined in the PMBOK as the "framework, functions, and processes that guide project management decisions and actions." (Project Management Institute)

Governance is a critical aspect of project management, ensuring that projects are executed effectively and efficiently while meeting the required standards and objectives. In essence, project governance is the set of policies, procedures, and structures that guide project decision-making, ensuring that projects deliver the desired outcomes while being executed within the defined constraints.

Effective governance in project management requires a robust framework that outlines the roles, responsibilities, and decision-making processes for all stakeholders involved in the project. This framework should be developed and implemented at the start of the project, with the goal of creating a clear understanding of the project objectives and the governance structure required to achieve them.

A critical aspect of effective governance in project management is communication. Communication is essential to ensure that all stakeholders are informed about the project's progress, risks, and changes. Clear and concise communication channels must be established, and all stakeholders should be kept informed of the project's status through regular reports, meetings, and other communication tools.

Furthermore, governance in project management must address the need for continuous improvement. The project governance framework should include mechanisms for monitoring and measuring project performance against established metrics, identifying areas for improvement, and implementing changes to enhance project outcomes.

In addition to establishing effective project governance, the PMBOK recommends several techniques to implement governance effectively.

These include:

- Developing a project charter that defines the project scope, objectives, and stakeholders.
- Establishing a project management plan that outlines the project management processes, procedures, and controls.

- Defining project roles and responsibilities to ensure clear lines of communication and accountability.
- Conducting regular project reviews and audits to monitor progress, identify issues, and make adjustments as necessary.
- Establishing a project management office (PMO) to provide project oversight, guidance, and support.

By implementing these techniques, organizations can enhance their project management capabilities and improve their overall project success rate.

Overall, effective governance is critical to the success of any project management initiative. It ensures that projects are executed within the defined constraints and deliver the desired outcomes. Effective governance requires a robust framework that outlines the roles, responsibilities, and decision-making processes for all stakeholders involved in the project.

1.1.5 Risk management

There are two main approaches to risk management: qualitative risk management and quantitative risk management.

Qualitative risk management involves assessing and prioritizing risks based on their likelihood and impact. This approach is often used in early project stages when a detailed understanding of risks is not yet available. Qualitative risk management is usually less data-driven and more subjective, relying on expert judgment and experience. Common methods used in qualitative risk management include brainstorming sessions, risk checklists, and cause-and-effect diagrams.

Quantitative risk management, on the other hand, involves quantifying risks and using statistical and mathematical methods to assess and prioritize them. This approach is often used in later project stages when a more detailed understanding of risks is available. Quantitative risk management is based on data and facts and provides a more objective assessment of risks. Common methods used in quantitative risk management include decision trees, simulation models, and expected monetary value analysis.

The first step in risk management, regardless of the approach used, is to identify potential risks. This involves a thorough examination of the project environment and an evaluation of the potential risks that may impact the project. These risks may come from internal sources such as project team members, or external sources such as the market, regulatory environment, or stakeholders. A commonly used method for identifying risks is to conduct brainstorming sessions with project team members, stakeholders, and other experts. Another effective method is to review project documentation and to conduct stakeholder interviews.

Once risks have been identified, they must be assessed in terms of their likelihood and impact. This helps project managers to prioritize their risk mitigation efforts and to focus on the most critical risks. For example, a risk with a low likelihood but high impact may be given a higher priority than a risk with a high likelihood but low impact. In qualitative risk management, this assessment is usually done subjectively and based on expert judgment. In quantitative risk management, the assessment is based on data and mathematical models.

The quantitative analysis is based on the premise that any potential adverse event can be evaluated based on two factors: its impact and its probability. The formula for risk analysis is therefore expressed as the product of impact and probability.

$$\text{Risk} = \text{Probability} \cdot \text{Impact}$$

1.1.5.1

The impact of an adverse event refers to the extent to which it will affect the project, system, or process under consideration. This can range from minor disruptions to catastrophic consequences, depending on the nature of the event and the context in which it occurs. For example, a power outage may cause inconvenience in a residential area, but it could have far-reaching consequences in a hospital or a manufacturing plant.

The probability of an adverse event, on the other hand, refers to the likelihood of it occurring. This can be estimated based on historical data, statistical analysis, expert opinion, or a combination of these factors. For example, the probability of a cyber attack may be higher in industries that deal with sensitive information or have weaker cybersecurity systems.

By using this formula, decision-makers can prioritize their resources and efforts towards mitigating the highest risk events, while accepting the lower risks as part of the inherent uncertainty of the system.



Figure 3 - Risk Matrix example. Source: <https://www.vectorsolutions.com/resources/blogs/risk-matrix-calculations-severity-probability-risk-assessment/>

As the Figure 3 shows, a risk matrix can be a useful tool for visualizing the level of risk associated with different events. A risk matrix is a grid that plots the impact and probability of each event on two axes, with the resulting intersection representing the level of risk. This allows decision-makers to quickly identify high-risk events that require immediate attention and prioritize their resources accordingly. Additionally, a risk matrix can also be used to identify events with low probability but high impact, which may require additional mitigation measures to reduce their potential impact.

The next step in risk management is to develop and implement strategies to mitigate or avoid identified risks. This may involve developing contingency plans, allocating additional resources, or changing project scope or objectives. The type of risk response strategy will depend on the specific risk and the resources available. For example, if a risk involves a delay in the delivery of a critical component, the risk response strategy may involve negotiating a new delivery date with the supplier or finding an alternative supplier.

Once risk response strategies have been developed and implemented, the next step is to regularly monitor the status of identified risks and to take action to address any changes in risk status. This may involve updating risk response plans, adjusting project schedules, or making changes to project resources. Regular risk monitoring is essential for ensuring that risks are effectively managed and that project outcomes are not negatively impacted.

Finally, effective risk communication is critical to the success of risk management. This involves sharing information about identified risks and risk response strategies with relevant stakeholders. This helps to ensure that all stakeholders are aware of the risks and have a clear understanding of the strategies being implemented to manage those risks. Effective risk communication can also help to build trust and credibility with stakeholders and can enhance collaboration and teamwork.

By implementing these risk management techniques, project managers can ensure that they are effectively managing risks and that their projects are more likely to be successful. Effective risk management helps to minimize the potential impact of risks on project outcomes.

1.1.6 Change management

Change management is the process of planning, implementing, and monitoring changes to a project in order to achieve specific goals or objectives. The following are some of the most common change management techniques used in project management.

Change Control Board (CCB) - The Change Control Board (CCB) is a group of stakeholders responsible for reviewing, evaluating, and approving or rejecting changes to a project. The CCB is typically composed of representatives from various project teams, departments, or functions, as well as key stakeholders, such as project sponsors or customers. The purpose of the CCB is to ensure that all changes to a project are assessed, prioritized, and implemented in a controlled and coordinated manner.

When a change request is submitted, it is first reviewed by the CCB to determine if it is relevant to the project and if it aligns with the project goals and objectives. The CCB then conducts an impact analysis to assess the potential consequences of the change on the project scope, schedule, budget, and resources. The CCB also evaluates the risks associated with the change and determines the best course of action.

Once the CCB has assessed the change request and determined that it is necessary and feasible, it approves the change and ensures that it is implemented in a controlled and coordinated manner. The CCB also monitors the progress of the change and ensures that any issues or problems that arise are promptly addressed. If the change request is rejected, the CCB provides feedback to the requester and explains the reasons for the rejection.

The CCB is an essential component of effective change management in project management. By providing a structured and controlled process for assessing, prioritizing, and implementing changes,

the CCB ensures that changes are aligned with the project goals and objectives, and that they are implemented in a way that minimizes the risks and maximizes the benefits.

Impact Analysis - Impact analysis is a technique used in project management to assess the potential consequences of a proposed change to a project. It is an essential step in the change management process, as it helps project teams understand the potential impact of a change on the project's scope, schedule, budget, and resources.

The impact analysis involves identifying all the areas that could be affected by the change, such as project objectives, requirements, deliverables, stakeholders, and risks. It also involves evaluating the potential consequences of the change on each of these areas, such as changes to the project schedule, budget, resources, quality, or scope. The impact analysis also considers the potential ripple effects of the change, such as impacts on other project tasks, dependencies, or stakeholders.

The impact analysis process typically involves the following steps:

- **Identify the change and its purpose:** The first step is to clearly define the change and its intended purpose. This helps ensure that the change is aligned with the project goals and objectives.
- **Identify the areas affected:** The next step is to identify all the areas of the project that could be affected by the change, such as project objectives, requirements, deliverables, stakeholders, and risks.
- **Analyze the impact:** The next step is to evaluate the potential consequences of the change on each of these areas. This involves assessing the impact on the project schedule, budget, resources, quality, or scope.
- **Determine the priority and severity of the impact:** The impact analysis should also consider the priority and severity of the impacts, and identify any potential risks or issues that could arise from the change.
- **Determine the appropriate course of action:** Based on the results of the impact analysis, the project team can determine the appropriate course of action. This may involve revising the project plan, revising the change request, or rejecting the change.

Impact analysis is an essential technique in project management that helps ensure that changes are well-managed, controlled, and implemented in a way that supports the project's objectives. By understanding the potential consequences of a change, project teams can make informed decisions and minimize the risks associated with the change.

Change Request Form - A change request form is a document used to request a change to a project. This form typically includes information about the change, its impact, and its urgency. This technique helps project managers to track and manage changes more effectively.

Communication Plan - A communication plan is a document that outlines how stakeholders will be informed about changes to a project. This plan specifies the frequency, format, and content of communications and ensures that stakeholders are kept informed about project changes.

Risk Management Plan - A risk management plan is a document that outlines how risks associated with a change will be identified, evaluated, and managed. This plan helps project managers to anticipate potential risks associated with changes and to develop strategies to mitigate them.

Configuration Management - Configuration management is a technique used in project management to manage and control the changes to project artifacts, such as requirements, designs, and code. It is an essential part of the project's overall change management process, as it helps ensure that all project artifacts are tracked, controlled, and maintained throughout the project's lifecycle.

The goal of configuration management is to provide a structured and controlled approach to managing project artifacts, ensuring that changes are properly documented, tracked, and communicated. Configuration management involves the following steps:

- **Identification:** This involves identifying all project artifacts that need to be tracked, controlled, and maintained. This includes requirements, design documents, code, test plans, and other project artifacts.
- **Version control:** This involves maintaining a version history of all project artifacts, including the current version and all previous versions. This allows project teams to track changes and revert to previous versions if necessary.
- **Change management:** This involves controlling the changes to project artifacts, ensuring that all changes are documented, approved, and communicated to all stakeholders. This helps prevent unauthorized changes and ensures that all changes are well-managed and controlled.
- **Release management:** This involves managing the release of project artifacts, ensuring that all releases are properly tested, documented, and communicated to stakeholders.

Configuration management is essential for ensuring that project artifacts are well-managed and controlled throughout the project's lifecycle. By providing a structured and controlled approach to managing changes, configuration management helps minimize the risks associated with changes, such as errors, delays, and cost overruns. It also helps ensure that all stakeholders are informed of any changes and can provide input and feedback as necessary. Overall, configuration management is an essential technique for managing changes in project management and ensuring project success.

Overall, these change management techniques help project managers to manage changes to a project effectively, while minimizing the risks associated with these changes. By using these techniques, project managers can ensure that changes to a project are well-managed, controlled, and implemented in a way that supports the project's objectives.

1.1.7 Monitoring and control

Monitoring and control is a critical process in project management that involves tracking project performance, identifying variances from the plan, and taking corrective actions as necessary to keep the project on track. This process is essential for ensuring that the project is completed on time, within budget, and to the required quality standards. The monitoring and control process involves several techniques and tools that project managers use to track project performance, identify issues, and take corrective actions.

One of the primary techniques used in monitoring and control is performance reporting. Performance reporting involves tracking and reporting project performance against the project plan. This includes monitoring progress on project tasks, tracking project costs, and reporting on project risks and issues. Performance reporting helps project teams identify variances from the plan and take corrective actions as necessary.

Another important technique used in monitoring and control is earned value management (EVM). EVM is a technique used to measure project performance and progress in an objective and quantitative manner. It involves analyzing the relationship between project scope, schedule, and cost, and calculating metrics such as schedule variance, cost variance, and earned value. EVM helps project teams identify performance trends and take corrective actions to keep the project on track.

Milestones and targets are also critical components of monitoring and control. Milestones are significant points in the project that mark the completion of major deliverables or the achievement of significant project goals. Targets are specific, measurable goals that are established to track project progress and performance. Both milestones and targets are used to measure project performance against the project plan and identify variances from the plan.

Change control is another important technique used in monitoring and control. Change control involves managing and controlling changes to the project plan, ensuring that changes are properly documented, approved, and implemented. Change control helps prevent unauthorized changes and ensures that all changes are well-managed and controlled.

Risk management is another key component of monitoring and control. Risk management involves identifying, analysing, and managing project risks. This includes identifying potential risks, assessing the likelihood and impact of each risk, and developing risk mitigation strategies. Risk management helps project teams identify potential problems and take proactive steps to mitigate risks and minimize their impact on the project.

Quality control is another critical component of monitoring and control. Quality control involves monitoring and controlling the quality of project deliverables. This includes defining quality standards, monitoring performance against these standards, and taking corrective actions as necessary to ensure that deliverables meet the required quality standards.

In summary, monitoring and control is a critical process in project management that involves tracking project performance, identifying variances from the plan, and taking corrective actions as necessary to keep the project on track. The process involves several techniques and tools, including performance reporting, earned value management, milestones and targets, change control, risk management, and quality control. By using these techniques and tools, project managers can ensure that the project is completed on time, within budget, and to the required quality standards.

1.2 What is National recovery and resilience plan (PNRR)

1.2.1 Next Generation EU (NGEU)

In the aftermath of the COVID-19 crisis, the EU has set out the unprecedented recovery plan, Next Generation EU, to kickstart the European economy and support the green and digital transitions, making Europe more resilient and fit for future challenges.

To provide the EU with the necessary means to address the challenges posed by the COVID-19 pandemic, the European Commission is authorised to borrow funds on behalf of the Union on the capital markets up to the amount of €750 billion (in 2018 prices). All member states ratified the own resources decision by 31 May 2021, thereby empowering the Commission to borrow the money.

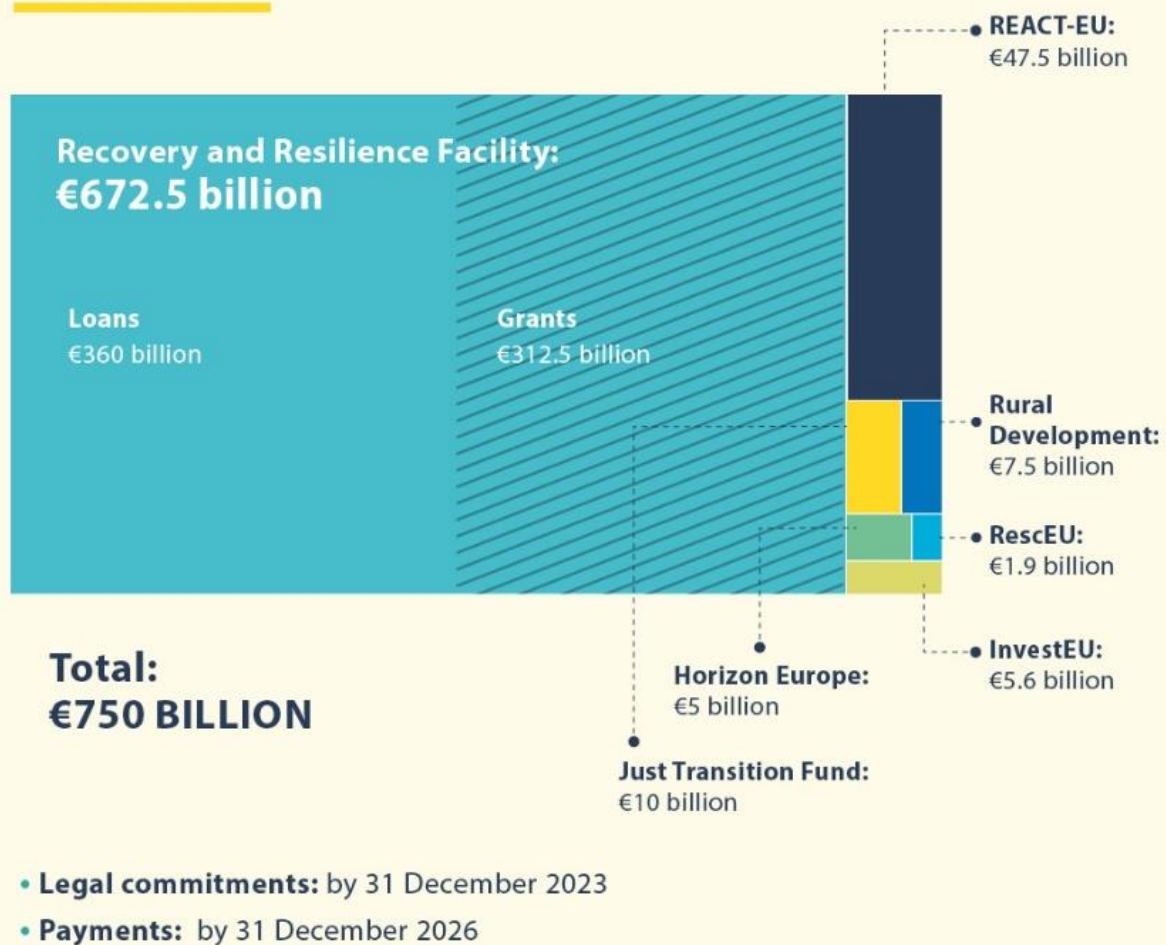
The EU will use the funds for the sole purpose of addressing the consequences of the COVID-19 crisis, via the Next Generation EU recovery effort. The repayment will be scheduled until 31 December 2058.

NGEU will be channelled through seven programmes in the form of loans (€360 billion) and grants (€390 billion):

- Recovery and Resilience Facility (RRF): € 672.5 billion
- ReactEU: €47.5 billion
- Horizon Europe: € 5 billion
- InvestEU: €5.6 billion
- Rural Development: €7.5 billion
- Just Transition Fund: €10 billion
- RescEU: €1.9 billion

Legal commitments will be made by 31 December 2023. Related payments will be made by 31 December 2026. (consilium.europa.eu, 2023)

Investing in a green, digital and resilient EU



1.2.2 Recovery and Resilience Facility (RRF)

The Recovery and Resilience Facility is a temporary recovery instrument, its aim is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions.

It allows the EU Commission to raise funds to help Member States implement reforms and investments that are in line with the EU's priorities and that address the challenges identified in country-specific recommendations under the European Semester framework of economic and social policy coordination. It makes available €723.8 billion (in current prices) in loans (€385.8 billion) and grants (€338 billion) for that purpose.

The RRF helps the EU achieve its target of climate neutrality by 2050 and sets Europe on a path of digital transition, creating jobs and spurring growth in the process.

Joint, coordinated action at the European level is more effective and benefits Member States more than individual national expenditures, not least due to significant spill over effects across countries.

The RRF is also at the heart of the implementation of the REPowerEU Plan, the Commission's response to the socio-economic hardships and global energy market disruption caused by Russia's invasion of Ukraine. In this respect, on 18 May 2022, the Commission proposed to make targeted amendments to the RRF Regulation to integrate dedicated REPowerEU chapters in Member States' existing Recovery and Resilience Plans. This comes in addition to the large number of relevant reforms and investments which are already in the RRFs. It also published a revised Guidance document on Recovery and Resilience Plans in the context of REPowerEU. (Commission.europa.eu, 2023)

1.2.3 RRF Pillars and PNRR Missions

The Facility is structured around six pillars:

- green transition;
- digital transformation;
- economic cohesion, productivity and competitiveness;
- social and territorial cohesion;
- health, economic, social and institutional resilience;
- policies for the next generation.

To apply for the funds, Member States had to submit their recovery and resilience plan to the European Commission which need to comply with these European directives.

In the case of Italy, PNRR was submitted and approved by the European commission and it has a very similar structure which stands on 6 missions:

- Digitalisation, innovation, competitiveness, culture and tourism (M1)
- Green revolution and ecological transition (M2)
- Infrastructure for sustainable mobility (M3)
- Education and research (M4)
- Inclusion and cohesion (M5)
- Healthcare (M6)

Every mission is made of more detailed components:

Mission 1 “Digitalisation, innovation, competitiveness, culture and tourism”:

- Digitalisation, innovation and security in the public administration (C1)
- Digitalisation, innovation and competitiveness in the productive system (C2)
- Culture and tourism 4.0 (C3)

Mission 2 “Green revolution and ecological transition”

- Green business, sustainable agriculture and circular economy (C1)
- Energy transition, hydrogen and sustainable local mobility (C2)

- Energy efficiency and requalification of buildings (C3)
- Protection and enhancement of land and water resources (C4)

Mission 3 “Infrastructure for sustainable mobility”

- High speed rail and road maintenance 4.0 (C1)
- Intermodality and integrated logistics (C2)

Mission 4 “Education and research”

- Enhancement of skills and study support (C1)
- From research to business (C2)

Mission 5 “Inclusion and cohesion”

- Employment policies (C1)
- Social infrastructures, families, communities and the voluntary sector (C2)
- Special interventions for geographical cohesion (C3)

Mission 6 “Healthcare”

- Proximity assistance and telemedicine (C1)
- Healthcare innovation, research and digitalization (C2)

1.2.4 Country access to Funds and allocation

Thanks to the PNRR presented to the commission, €191.5 billion were assigned to Italy by the Recovery and Resilience Facility.

These huge resources were allocated as shown in the Figure 4

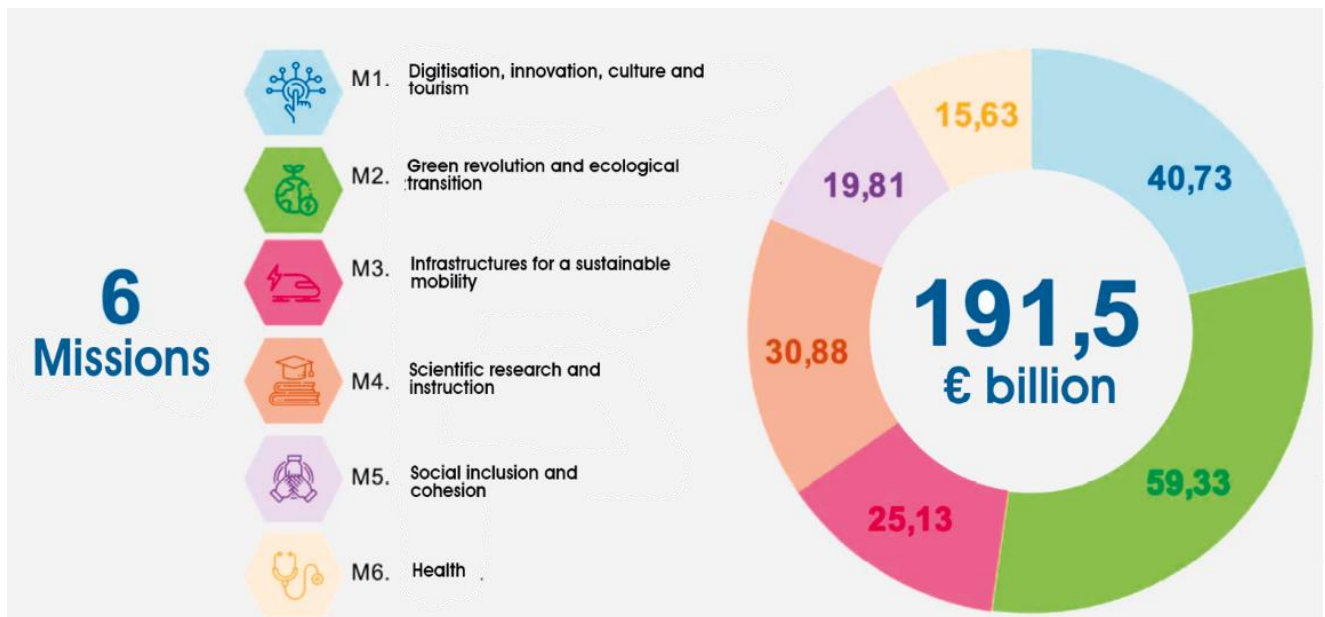


Figure 4 – Allocation of RRF funds in Italy. Source: <https://books.openbookpublishers.com/10.11647/obp.0280/ch4.xhtml>

In addition to that, the Italian government, alongside the grants and funds allocated by the European Union, allocated €30.6 billion as a complementary fund to finance all the projects deemed valid for national renewal and not covered by grants and loans from the RRF (Recovery and Resilience Facility).

This huge amount of resources were allocated as follows:

- M1: Digitalisation, innovation, competitiveness, culture and tourism – €49.04 billion
- M2: Green revolution and ecological transition – €68.66 billion
- M3: Infrastructure for sustainable mobility - €31.46 billion
- M4: Education and research - €31.9 billion
- M5: Inclusion and cohesion – €22.57 billion
- M6: Healthcare - €18.49 billion

1.2.5 Recovery and Resilience Facility performance-based nature

The RRF funds are disbursed to Member States when they have satisfactorily fulfilled key steps in the implementation of the reforms and investments included in their recovery and resilience plans. These key implementation steps are referred to as milestones and targets, with milestones representing qualitative implementation steps and targets representing quantitative implementation steps.

The use of milestones and targets is a performance-based approach to project management that ensures that RRF-funded projects are well documented and carried out properly. The milestones and targets set for each Member State are established in a Council Implementing Decision, and are designed to track progress and measure performance against the recovery and resilience plans. This allows for a transparent and accountable approach to project management, with clear objectives and metrics for success.

Furthermore, the fact that Member States are required to provide proof to the European Commission to demonstrate that the corresponding steps of the reforms and investments have been completed provides additional accountability and ensures that projects are well-documented and properly carried out. This documentation provides evidence of the progress made towards achieving the milestones and targets, and helps to demonstrate that the RRF funds are being used effectively and efficiently.

Importantly, the fact that a milestone or target does not yet show as satisfactorily fulfilled does not mean that it is not being implemented or has not already been completed. This provides flexibility in the management of RRF-funded projects, allowing Member States to adapt to changing circumstances or unforeseen challenges that may arise during the implementation of the recovery and resilience plans.

In summary, the use of milestones and targets in the RRF ensures a performance-based approach to project management that promotes transparency, accountability, and effective use of funds. The requirement for Member States to provide proof of completion for each milestone and target

ensures that projects are well-documented and properly carried out, while the flexibility in the management of the projects allows for adaptation to changing circumstances.

(ec.europa.eu, 2023)

1.2.6 Governance structure and Governance principles

In the context of the Italian Recovery and Resilience Plan (PNRR), there is a precise governance structure and clear governance principles which play a crucial role in ensuring the effective implementation of the plan.

There are three main levels of the Italian PNRR governance structure:

- **Steering responsibility** – this is mainly assigned to the Italian government.
Key elements at this level are:
 - **The National Recovery and Resilience Plan Committee (Comitato PNRR):** This committee is responsible for overseeing the implementation of the PNRR. It is composed of representatives from various government agencies and is chaired by the Minister of Economy and Finance. The committee is responsible for ensuring that the plan is implemented in accordance with the guidelines and objectives set out by the government.
 - **The Technical Secretariat:** The Technical Secretariat is responsible for providing technical support to the National Recovery and Resilience Plan Committee. It is composed of experts from various fields, including economics, finance, and project management. The Technical Secretariat is responsible for analyzing the projects proposed by the regions and ensuring that they are in line with the objectives of the PNRR.
- **Monitoring and reporting** – Monitoring and reporting of the Plan are entrusted to the Central Service for the PNRR, established at the Ministry of Economy and Finance (MEF), which is the national contact point with the European Commission for the implementation of the Plan. (Governo Italiano, 2021)

A key element is the Monitoring Committee of PNRR (National Recovery and Resilience Plan) which is responsible for overseeing the implementation of the plan and ensuring that the objectives set out in the plan are achieved. The Committee is composed of representatives from the Government, the Regions and the Autonomous Provinces, and it is chaired by the Prime Minister or a delegate.

The main function of the Monitoring Committee is to monitor the progress of the projects and initiatives included in the PNRR, and to ensure that they are implemented according to the established timelines and budget. The Committee also evaluates the impact of the projects on the economy and society, and provides feedback on the effectiveness of the plan's implementation.

To carry out its monitoring function, the Monitoring Committee uses various tools and methodologies, including performance indicators, risk analysis, and periodic reporting. Performance indicators are used to measure the progress and success of the projects, while risk analysis is used to identify potential issues and develop contingency plans to mitigate risks.

Periodic reporting is an essential tool used by the Monitoring Committee to track the implementation of the plan. The Committee receives regular updates from the project teams, which include information on progress, issues, risks, and budget. Based on this information, the Committee can take action to address any issues or challenges that arise during the implementation of the plan.

In addition to the above tools, the Monitoring Committee may also conduct site visits to the project sites to evaluate the progress and quality of the work. These visits allow the Committee to gain first-hand knowledge of the projects, to meet with stakeholders, and to identify any issues that need to be addressed.

- Implementation of the interventions, provided by the individual implementing entities, in particular regions, autonomous provinces, and local authorities, which are responsible for proposing projects and programs that are funded by the PNRR. Each region is required to submit a plan that outlines how it will use the funds allocated to it. The plans are reviewed by the National Recovery and Resilience Plan Committee and the Technical Secretariat to ensure that they meet the objectives of the PNRR.

The Governance principles include:

- **Transparency:** The PNRR is a publicly funded program, and as such, it is essential to ensure that all processes and decision-making are transparent. The government has committed to providing regular updates on the status of the plan and its progress, ensuring that the public is informed and engaged in the process.
- **Accountability:** The PNRR is governed by the Italian government, and as such, it is essential to ensure that the government is accountable for its decisions and actions. This is achieved through clear reporting mechanisms, regular monitoring, and evaluation of the plan, and a commitment to take corrective action when necessary.
- **Participation:** The PNRR is designed to support the sustainable and inclusive growth of Italy, and as such, it is essential to ensure that all stakeholders have a say in the decision-making process. The government has committed to engaging with civil society, business, and other stakeholders to ensure that the plan reflects the needs and priorities of the Italian people.
- **Efficiency:** The PNRR is a time-limited program, and as such, it is essential to ensure that the plan is implemented efficiently and effectively. This is achieved through clear and consistent project management practices, a focus on results, and a commitment to continuous improvement.
- **Sustainability:** The PNRR is designed to support the long-term growth and resilience of Italy, and as such, it is essential to ensure that the plan is implemented in a sustainable manner. This is achieved through a focus on environmental sustainability, social sustainability, and economic sustainability.

Governance principles are overarching principles that guide the management and decision-making processes of a project or program. These principles are focused on ensuring that the project or program is conducted in a way that is ethical, responsible, and effective.

On the other hand, PNRR is based on precise transversal principles, such as gender equality and sustainable development, which are cross-cutting themes that need to be integrated into all areas of the PNRR.

These principles are focused on ensuring that the interventions and initiatives included in the PNRR align with broader goals and objectives related to societal and environmental concerns.

1.2.7 PNRR Transversal principles

While governance principles are focused on the management of the project or program, transversal PNRR principles are focused on ensuring that the project or program aligns with broader societal and environmental goals. Both sets of principles are important in the context of project management, as they help ensure that projects and programs are conducted in a responsible and effective manner, and that they contribute to broader societal and environmental objectives.

Here is an outline of PNRR transversal principles:

- **Boosting young people potential** - This principle aims to provide opportunities and resources to help young people reach their full potential in various areas, such as education, employment, entrepreneurship, and social participation. The PNRR recognizes that investing in young people is essential for the long-term social and economic development of the country. To achieve this goal, the PNRR proposes various initiatives, such as increasing investments in education and vocational training, promoting the creation of new job opportunities, supporting young entrepreneurs, and fostering social participation and civic engagement among young people. By focusing on the potential of young people, the PNRR seeks to create a more inclusive and sustainable future for Italy.
- **Gender equality** - The principle recognizes that women and men have different needs and experiences, and that gender equality is a fundamental human right that is essential for sustainable development.

Italy has introduced gender certification (lineaamica.gov.it, 2023) for businesses as a measure to improve women's participation in the labor market, reduce the gender pay gap, and promote transparency in labor processes. The National Plan for Recovery and Resilience (PNRR) and the National Strategy for Gender Equality have equipped Italy with this measure, which provides tax and bonus benefits for businesses. The measure is inspired by an innovative concept of planning that aims at significant and decisive change within enterprises. The expected results of this approach and the incentive policies for women's work are a considerable contribution to the development and growth of Italy.

The certification system has three steps:

- 1) defining the system for certification on gender equality;
- 2) creating an information system for collecting gender-disaggregated data and information on certification
- 3) activating the certification system on gender equality from the second quarter of 2022.

The measure aims to ensure greater participation of women in the labor market and reduce the gender pay gap through the creation of a national system of gender equality certification

that improves women's working conditions in terms of quality, remuneration, and role, and promotes transparency in labor processes.

The National System of Gender Equality Certification aims to incentivize enterprises to adopt appropriate policies to reduce the gender gap in all areas of major critical issues, such as opportunities for career and growth in the company, equal pay for equal tasks, policies for managing gender differences, and maternity protection. The certification system will be open to all enterprises regardless of size, and in the experimental phase, it will be facilitated for medium, small, and micro-sized enterprises.

Italy has reached an all-time high in the female employment rate, demonstrating the importance and foresight of the measures introduced. The expected results of the certification system and the incentive policies for women's work are crucial for the further development and growth of Italy. By implementing this measure, Italy aims to create a fairer and more equal society that recognizes the importance of women's participation in the labor market and promotes their rights and opportunities.

Key Performance Indicators (KPIs) measured in the context of the certification are both quantitative and qualitative and take into consideration:

- 1) Culture and strategy;
 - 2) Governance;
 - 3) HR processes (human resources);
 - 4) Opportunities for growth and inclusion of women in business;
 - 5) Compensation equity by gender;
 - 6) Parental protection and work-life balance..
- Territorial equality - The PNRR has allocated EUR 82 billion to Italy's Mezzogiorno region, which is 40% of the total fund that can be distributed based on territorial criteria.

This allocation aims to contribute to bridging the gap between the Mezzogiorno and the rest of Italy. The Plan's overall impact on national GDP is expected to be around 16 percentage points by 2026, with a higher impact of 24 percentage points for the Mezzogiorno region.

The PNRR is tasked with supporting a new phase of leveling up between the Mezzogiorno and the centre-north to address the historical obstacle to the country's development. Italy has faced a persistent divide between the north and the south, and this divide has remained substantially the same for over forty years in terms of per capita GDP. The COVID-19 crisis has further impacted the south of the country, particularly affecting key sectors such as tourism and services industries, and employment for women and young people.

To address the issue, the PNRR aims to overcome the structural weakness of the Mezzogiorno's production system, in line with the specific recommendations issued by the European Commission. While the Mezzogiorno is the eurozone's largest and most populated underdeveloped area, a third of Italians live in this region, yet it only produces a quarter of the national GDP. Revitalizing the area is important not only for Italy but also for the entire Europe.

To achieve these goals, the PNRR includes a range of measures, such as investment in sustainable infrastructure, digitalization, and energy transition, which aim to create job opportunities, support SMEs and start-ups, and promote research and innovation. The Plan also includes measures to enhance the quality of public services, improve the healthcare system, and promote social inclusion and gender equality.

Moreover, the PNRR includes measures to strengthen the education and training system to provide the Mezzogiorno's workforce with the skills needed for the labour market's changing needs. The Plan aims to enhance the region's capacity to attract investments and support the development of local value chains.

In summary, the PNRR aims to address the issue of territorial inequality, particularly the "Mezzogiorno" issue, by providing significant funding and implementing measures that promote sustainable growth, social inclusion, gender equality, and innovation.

- Do no significant harm (DNSH) - The DNSH principle aims to ensure that the investments made through the PNRR do not cause harm to the environment, human rights, or social and economic conditions. It is an important measure for ensuring that the investments contribute positively to the overall sustainability of the European economy and society.

The DNSH principle is an integral part of the PNRR, which requires member states to conduct sustainability assessments before undertaking any investment projects. This means that the projects proposed under the PNRR must be examined in terms of their environmental, social, and economic impacts, including their potential effects on climate change, the circular economy, biodiversity, and human rights. The principle requires member states to identify and mitigate any potential negative impacts of the projects, and to take measures to ensure that the investments made under the PNRR are sustainable and in line with the EU's climate, environmental, and social goals.

The DNSH principle is particularly relevant to the PNRR's goals of climate neutrality and digitalization. To achieve these goals, significant investments will be made in green technologies and digital infrastructure. These investments must be conducted in a way that minimizes any negative impacts on the environment and society. This means, for example, that investments in renewable energy sources should not have negative impacts on biodiversity or local communities, and that investments in digital infrastructure should not exacerbate social inequalities.

The DNSH principle is also relevant to the PNRR's goals of social and economic resilience. The investments made under the PNRR must contribute to the development of sustainable and resilient societies, which are capable of responding to social, economic, and environmental challenges. This means that investments must take into account the needs and perspectives of all stakeholders, including marginalized and vulnerable groups, and must be designed in a way that contributes to the development of inclusive and equitable societies.

Overall, the DNSH principle is a fundamental component of the PNRR's commitment to sustainability and resilience. It is an essential measure for ensuring that the investments made under the plan contribute positively to the overall well-being of the EU's citizens and the planet, while also promoting economic growth and social progress. By adopting the DNSH principle, the EU is demonstrating its commitment to a sustainable and resilient future, and is setting an example for other countries and regions around the world.

2. PM and PNRR main commonalties and criticalities

The National Plan for Recovery and Resilience (PNRR) is a complex and large-scale project that involves the coordination of various stakeholders, the management of multiple resources, and the implementation of a set of activities to achieve specific goals. In this context, project management practices play a crucial role in ensuring the success of PNRR.

To maximize the success of the plan, it is essential to implement effective project management practices that ensure the plan is executed efficiently and effectively.

2.1 Commonalties

2.1.1 PNRR and portfolio, program and project management

The Italian PNRR is structured as a complex system consisting of six missions, each of which is composed of various components that, in turn, consist of multiple interventions.

As we see in the Figure 5 these missions can be understood as portfolios, encompassing strategic goals and priorities that guide the allocation of resources.

Components are akin to programs, representing clusters of related projects that work towards achieving the overarching mission objectives.

Finally, interventions are individual projects that operate at an operational level, implementing specific actions to achieve the goals set out in the missions and components.

The PNRR can thus be conceived of as a multi-portfolio system that prioritizes resource allocation towards achieving strategic goals through a hierarchical structure of missions, components, and interventions.

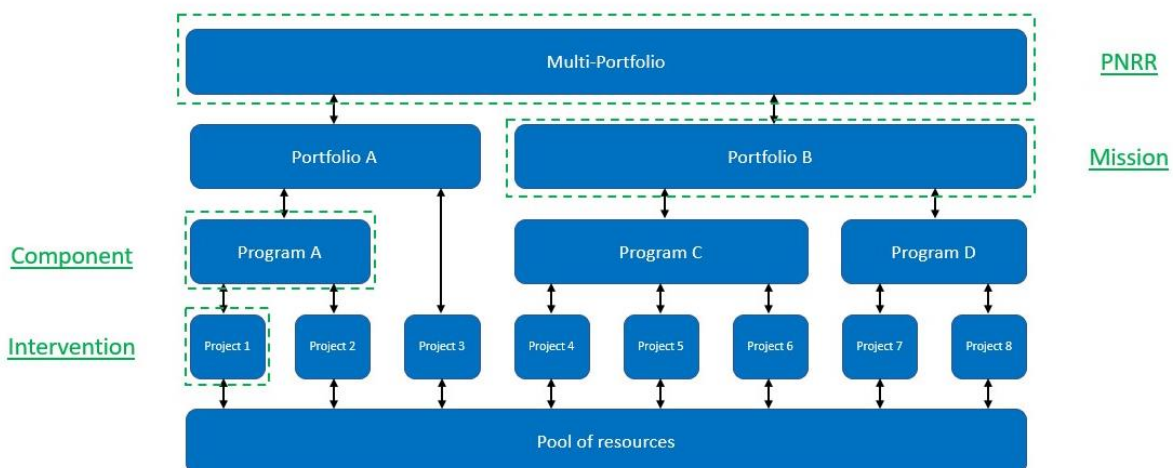


Figure 5 - Correspondence between PNRR and PM structure

For a project to be financed in the context of the PNRR it will need to:

- Deal with an area consistent with one of the policy areas of European relevance, (six missions)
- Have a scheduling in line with milestones and deadlines of the PNRR

- Have costs within the budget
- Grant the quality of final deliveries to reach the main objectives
- Comply with cross PNRR principles (DNSH, Women, etc.) if applicable

Some projects will need to be integrated to ensure that strategically relevant goals are achieved; for this reason it will be necessary to synchronise planning, procurement and supply, execution and reporting.

These are issues studied by program management, and a program is defined as: “a group of related projects, subsidiary programs, and program activities that are managed in a coordinated manner to obtain benefits not available from managing them individually” (Project Management Institute).

The design and implementation of a comprehensive and effective plan such as the PNRR require a clear and coherent vision of the future development of the country. Such a vision helps to ensure that the portfolios, programs and projects included in the PNRR align with the strategic goals of the country and contribute to a sustainable and inclusive recovery.

One of the main advantages of having a clear vision is that it facilitates the identification of synergies among the various programs and projects. By leveraging these synergies, the plan can achieve its goals more effectively and efficiently. For example, the programs related to sustainable mobility and energy transition can be designed to complement each other, such as by integrating electric vehicles with renewable energy sources. This integration would not only reduce carbon emissions but also create new job opportunities in the green economy.

Another critical aspect of managing the PNRR is scheduling. The plan's budget of €222,12 billion must be spent by 2026, which poses significant challenges for the timely implementation of all programs and projects. Therefore, it is crucial to prioritize scheduling management over cost management, especially given the ambitious nature of the program.

By prioritizing scheduling management, the PNRR can ensure that all programs and projects are delivered on time and in line with the program's milestones and deadlines. This requires efficient project management, procurement, and supply chain coordination, as well as effective reporting and monitoring mechanisms.

For example, the program related to digitalization can benefit from a well-planned scheduling approach that prioritizes the implementation of critical digital infrastructure, such as 5G networks, in the areas most in need. This approach would not only accelerate the digitization of the country but also create opportunities for new digital services and job opportunities.

In summary, a clear and coherent vision for the future development of the country is essential for the effective design and implementation of the PNRR. Such a vision helps to identify synergies among programs and projects, ensuring that the plan's goals are achieved efficiently and effectively. Moreover, the management of the program's tight schedule is critical, given that the entire PNRR budget must be spent by 2026. Prioritizing scheduling management over cost management is therefore essential to achieve the program's objectives.

2.1.2 PM and PNRR transversal nature

The PNRR has a broad scope that covers multifaceted issues such as infrastructure, digitalization, innovation, education, and environmental sustainability. This means that there is a need to focus on having everything organized at an horizontal level, letting go of the verticality that characterizes every single technical aspects of projects that will be funded by the program.

In this sense, the PNRR is an example of how a program can be structured with a transversal approach that aims to address complex challenges by fostering collaboration and coordination among different stakeholders. This is exactly what a project manager has to do in project management. Project managers are responsible for ensuring good communication and organization among team members, stakeholders, and suppliers to ensure that project goals are met.

The transversal nature of the PNRR and project management also extends to the concept of synergies. Synergies occur when different components of a program or project work together to achieve greater efficiency or effectiveness. In the case of the PNRR, the broad scope and specific missions of the program provide a good framework for finding synergies among different sectors and stakeholders. For example, the digitalization mission of the PNRR could have synergies with the education mission, as both aim to enhance digital skills and competencies among citizens and students. Similarly, the infrastructure mission could have synergies with the environmental sustainability mission, as both aim to promote green and sustainable infrastructure development.

Another important aspect of the transversal nature of the PNRR and project management is the role of risk management. Both the PNRR and project management require a comprehensive approach to risk management that involves identifying and assessing potential risks, implementing strategies to mitigate or address them, and monitoring and evaluating risk throughout the program or project lifecycle. For example, the PNRR may face risks related to funding constraints, political instability, or unforeseen challenges in project implementation. A project manager in a similar situation would need to anticipate and respond to changes in project requirements, scope, or timelines to ensure that the project stays on track.

Finally, the transversal nature of the PNRR and project management also extends to the concept of monitoring and evaluation. Both the PNRR and project management involve ongoing monitoring and evaluation to assess progress, identify areas for improvement, and ensure that program or project goals are being met. This requires a continuous improvement approach to ensure that resources are being used effectively and efficiently. For example, the PNRR may need to monitor and evaluate progress toward specific missions, such as the environmental sustainability mission, to ensure that the program is meeting its goals and delivering meaningful results.

Overall, the transversal nature of the PNRR and project management is an essential aspect of effective program and project design and implementation. By taking a comprehensive, collaborative, and risk-aware approach, both programs can effectively address complex challenges and deliver meaningful results. Furthermore, a scope so broad and a vision for specific missions provide a good framework for finding synergies, ensuring effective resource allocation, and achieving the ultimate goal of the program or project.

2.1.3 ReGiS System vs Earned value management

ReGiS is a singular platform that serves as a medium for central and peripheral State Administrations, Local Authorities and Implementing Entities to execute a range of operations required to fulfil monitoring, reporting, and control obligations of measures and projects financed by the National Recovery and Resilience Plan (PNRR).

The ReGiS platform was created to cater to the following necessities:

- Validate monitoring data, at least once every month, and communicate them to the Central Service for the PNRR by the central Administrations holding measures.
- Execute the processes of Programming and Reprogramming of the Plan's financial resources and determine the indicators and related performance targets.
- Initiate procedures for selecting projects and accomplish the objectives outlined in the Plan.
- Manage projects and their master information.
- Report expenses incurred on projects, related costs.
- Record in one place the results obtained from verification and control activities to ensure the eligibility of expenditures and the actual attainment of the objectives specified in the Plan.
- Manage the requests for disbursement of resources and the recording of the financial flow.
- Manage monitoring activities at both measure and Project levels.
- Manage the outcomes of system audits, operations audits, and validation tests concerning the actual accomplishment of objectives.

The ReGiS system plays a crucial role in fulfilling the objectives of the PNRR. By providing a centralized platform, it enables various entities to execute their responsibilities efficiently and effectively. The platform ensures that monitoring data is collected and validated regularly and submitted to the relevant authorities for assessment. It facilitates the planning and management of financial resources and project indicators while also enabling the selection of projects that align with the objectives of the Plan. It allows for the monitoring of project progress, financial management, and the verification of compliance with the Plan's objectives. Additionally, the system helps manage disbursement requests and financial flows.

The Earned Value Management (EVM) is a project management technique used to measure the actual progress of a project against the planned project timeline and budget. It integrates the measurements of scope, time, and cost and enables project managers to track the performance of a project effectively.

In EVM, three key elements are measured: planned value (PV), actual cost (AC), and earned value (EV).

- Planned value, PV (or budgeted cost of work scheduled, BCWS) refers to the budgeted cost for the planned work at a specific point in time.
- Actual cost, AC (or actual cost of work scheduled, ACWS) refers to the total cost incurred to complete the work.
- Earned value, EV (or budgeted cost of work performed, BCWP) refers to the estimated value of the completed work at a specific point in time.

By comparing these three elements, project managers can determine whether a project is progressing according to the planned schedule and budget. EVM allows for early identification of

variances in the project plan, which helps project managers to take corrective actions to bring the project back on track.

For the Earned Value Management (EVM) method to work, the following factors are needed:

- Detailed project plan: A detailed project plan with a work breakdown structure (WBS) is necessary to define the scope of work and to break down the project into smaller, manageable tasks.
- Time-phased budget: The budget must be broken down by period, such as weekly or monthly, to allow for tracking of planned and actual costs over time.
- Progress measurement: The progress of work on the project must be tracked and measured regularly against the project plan, so that earned value can be calculated.
- Data integration: Data from cost, schedule, and performance systems must be integrated to provide a comprehensive view of the project status.
- Baseline establishment: A project baseline must be established that includes the budget, schedule, and scope of work. The baseline is used as a reference point for measuring progress and for making forecasts.
- Performance analysis: EVM requires a methodical analysis of the project's performance to determine if it is on track, and if not, where corrective action is needed.

By meeting these requirements, the EVM method can provide valuable insights into project performance and help identify potential issues before they become major problems.

A critical shortcoming of the ReGiS Monitoring and Control System is the absence of Earned Value Management (EVM) principles, which limits the ability to effectively monitor project progress. ReGiS relies solely on reported expenses as an indicator of project advancement, providing limited insight into the actual status of work. This can lead to difficulties in identifying and addressing potential issues that may arise during the course of a project.

While the ReGiS Monitoring and Control System's reliance on reported expenses as the primary indicator of project advancement is an issue, the Milestones and Targets mechanism partially covers this gap by requiring documentation of specific accomplishments to be considered achieved. However, a potential limitation of this approach is that Milestones and Targets are not standardized, which can make it challenging to compare progress across projects or to evaluate project performance consistently.

In contrast, EVM provides a standardized approach for tracking project performance by measuring the earned value of work accomplished relative to the planned value, making it easier to compare progress across projects and to evaluate performance consistently.

Therefore, while the Milestones and Targets mechanism provides some level of insight into project progress, it is limited by its heterogeneity and lack of standardization, underscoring the need for the implementation of EVM principles in the ReGiS Monitoring and Control System.

2.2 Criticalities

2.2.1 Spending capacity

The success of the PNRR will largely depend on Italy's ability to effectively spend these funds in a timely and efficient manner.

One of the main challenges faced by Italy is the country's historically low spending capacity. This has been a recurring problem, with Italy consistently ranking among the lowest in Europe in terms of public investment spending. The country's complex bureaucracy and slow decision-making processes have often hindered its ability to spend EU funds, which has resulted in significant delays in the implementation of past EU investment plans.

There are several reasons why Italy's spending ability has been weak historically:

- One of the main factors is the inefficiency and fragmentation of governance at both the central and territorial levels. This has contributed to a lack of coordination and transparency in the management of public funds.
- Another contributing factor is the persistence of administrative and training limitations, which have impeded the development of skilled personnel capable of managing complex projects effectively.
- Finally, a third factor is the large number of activities and projects that are too ambitious and numerous relative to the actual capacity of public administrations to implement them.

To address these challenges, the Italian government has taken several steps to improve the country's spending capacity. For example, the government has launched a program to strengthen public administration, which includes measures to streamline bureaucracy and increase transparency. The government has also invested in training and development programs to enhance the skills of public sector employees. Additionally, the government has adopted a more strategic approach to project management, focusing on a smaller number of high-impact projects that are more feasible and aligned with the country's development goals. Finally, the government has established a dedicated monitoring and evaluation system to ensure that the resources are being used effectively and efficiently, and to enable timely corrective action when necessary.

This last point is extremely relevant since tranches of payments from Europe are strictly related to the achievement of milestones and targets. This means that timely progress towards the objectives set out in the PNRR is critical to accessing and utilizing the funds allocated to Italy. As a result, monitoring and control are central to ensuring that there are no significant delays in implementing the plan.

The adoption of EVM standard could have provided a solid system for monitoring and controlling the Plan's implementation, and this leaves an open issue about why it was not implemented. The use of EVM could have provided timely and accurate information to the program managers, making it easier to assess whether the Plan was on track to meet its goals and objectives. The failure to adopt this methodology leaves open the possibility of issues with monitoring and control that could lead to significant delays and thus the failure to unlock payment tranches.

In addition, the government has emphasized the importance of transparency and accountability in the implementation process to ensure that resources are used in line with EU guidelines and that there is no misuse or misallocation of funds. These measures are essential to overcoming the issue

of spending capacity and ensuring that Italy can fully leverage the resources available through the PNRR.

Overall, the issue of spending capacity is a critical one in the context of PNRR, and addressing this challenge will be key to the successful implementation of the program. While there are significant challenges to be overcome, the Italian government's efforts to strengthen public administration, enhance the skills of public sector employees, adopt a more strategic approach to project management, and establish a monitoring and evaluation system are important steps in the right direction. By continuing to invest in these areas, Italy can build a stronger foundation for its public sector and ensure that it is better equipped to manage and implement complex programs like PNRR.

2.2.2 Managing risk and managing change

Risk management is an important aspect of project management, yet there seems to be no specific risk management plan or analysis in place for the Italian National Recovery and Resilience Plan (PNRR).

This serious shortcoming could affect the implementation of the entire plan. The absence of risk management is a significant concern as it can impact the plan's scheduling, leading to a reduced spending capacity and a failure to achieve the milestones and targets required for the payment tranches.

Without a proper risk management plan, the implementation of the PNRR is exposed to a significant level of uncertainty. A risk management plan would allow the identification of potential threats, the assessment of their likelihood and impact, and the development of appropriate mitigation strategies. The lack of risk analysis makes the projects vulnerable in the eventuality of critical events, and the absence of a contingency plan may result in misallocation of resources and the absence of contingency resources.

Moreover, the absence of a comprehensive risk management plan may also undermine the quality of the PNRR's implementation, leading to delays and the need for costly revisions. Furthermore, the absence of a risk management plan could also affect the plan's reputation, leading to a loss of credibility among stakeholders.

In the current economic scenario, the need for proper risk management in the implementation of large-scale projects such as the PNRR is crucial. An effective risk management plan would have provided a clear understanding of the risks and uncertainties associated with the PNRR's implementation, thereby enabling the development of appropriate mitigation measures. However, the absence of a comprehensive risk management plan in the PNRR raises significant concerns about the plan's implementation, especially since the plan involves a massive amount of resources and targets a wide range of projects across different sectors.

A change management plan is a crucial element of project management which is also missing in the context of PNRR.

A well structured change management plan has been described in **1.1.6**, it outlines the procedures to follow in the event of significant changes to the project's scope, timeline, or budget. The absence of such a plan leaves the project vulnerable to unexpected changes, which could cause significant disruptions to the project's schedule, budget, and quality.

In the case of PNRR, external factors such as changes in regulations, economic conditions, or political instability could necessitate significant changes to the project's scope or timeline. Without a change management plan, there is no clear guidance on how to manage such changes effectively, which could lead to delays, cost overruns, and reduced quality.

A change management plan would provide a clear framework for evaluating proposed changes, assessing their impact on the project, and developing a plan to implement them effectively. It would also establish protocols for communicating changes to stakeholders, managing risks associated with changes, and ensuring that the project remains aligned with its overall objectives.

In conclusion, the absence of a risk management plan and change management plan could pose significant challenges to the successful implementation of PNRR. While the plan's objectives are ambitious and much-needed, the absence of these critical elements leaves it vulnerable to unexpected changes and risks that could jeopardize its success. It is essential that the Italian government and stakeholders take steps to address these issues proactively, including developing and implementing robust risk and change management plans to ensure that the PNRR is implemented effectively and efficiently.

3. Case study – BIP supporting the largest Italian DSO to get funds from PNRR

The following is an analysis of how a consulting company brought know-how and efficiency in the context of a Distribution System Operator (DSO) applying for huge amounts of PNRR funds.

Business Integration Partners (BIP) is an Italian consulting firm which operates in many sectors like Financial Services, Life Sciences, Manufacturing, Public Sector, Retail and Energy Utilities.

In the energy utilities industry, BIP has a story of several years of support to the largest Italian DSO.

This support consists in bringing value in the principal activities linked to the evolution of the distribution network and the role of DSO.

3.1 Initiating

Every time you need to start a project there are several activities that need to be carried out.

Many of these are preliminary activities, others are bureaucratic and some of them are about negotiation of a contract with a client which are characteristic of a consulting company.

In this last case the approach can be of push or pull type, or an hybrid of the two.

In this case BIP made lots of preliminary scouting activities trying to get an overview of what the requirements of the PNRR could have been and what the normative context could look like.

This was possible because BIP had experience in the context of European funded projects like PON and POR.

3.1.1 Context and objectives

Mission 2, “green revolution and ecological transition” is made of four components, and the M2C2 is “energy transition, hydrogen and sustainable local mobility” which is further divided into 5 measures:

- M2C2M1: Incrementing production of renewable energy
- M2C2M2: Upgrading and digitalising electricity grid infrastructure
- M2C2M3: Promoting the production, distribution and use of green hydrogen
- M2C2M4: Developing sustainable local transport
- M2C2M5: Developing international, industrial and research and development leadership in the main supply chains of the transition

Every measure consists of several investments or reforms, and the M2C2M2 consists of €4,11 billion divided in two main investments:

- Investment 2.1 – Smart Grid strengthening
- Investment 2.2 – Interventions on climate resilience of the electricity grid

Smart Grid represents an unprecedented opportunity to move the energy industry into a new era of reliability, availability, and efficiency that will contribute to our economic and environmental health.

The benefits associated with the Smart Grid include:

- More efficient transmission of electricity
- Quicker restoration of electricity after power disturbances
- Reduced operations and management costs for utilities, and ultimately lower power costs for consumers
- Reduced peak demand, which will also help lower electricity rates
- Increased integration of large-scale renewable energy systems
- Better integration of customer-owner power generation systems, including renewable energy systems
- Improved security

The Smart Grid investment is of €3,61 billion divided as follow:

- Hosting capacity (€ 1 billion): consists in incrementing the hosting capacity of the electricity grid of about 4000 MW.
By 2024 it needs to be guaranteed that the hosting capacity has been brought up by at least 1000 MW.
This is necessary for hosting and integrating the production of energy which is distributed on the territory. This process is called Renewable Energy Sources Integration (RES Integration)
- Electrification of power consumption (€ 2,61 billion): consists in increasing the available power for consumers for at least 1.500.000 residents

Climate resillience is about decreasing the probability of long interruptions of the electrical service and limiting negative social and economic consequences for the interested areas, by preventing damages coming from extreme meteorological events (strong wind, falling of trees, ice, heat waves, flood and hydrogeological risks).

Investment 2.2 has the goal of enhancing the resilience of 4000 km of network, but this value includes the HV network, hence the specific DSO sub-target is of 2500 km.

€350 million of the €500 million allocated for investment 2.2 is the sum that has been allocated for interventions in the distribution network.

45% of this sum is bound to be spent for southern Italian regions such as Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna and Sicilia.

3.1.2 Standard types of interventions

To improve the resilience of the distribution grid, it is essential to address the criticalities that may arise due to various factors such as:

- Ice sleeve formation on cables (MG)
- Plant fall (CaP)
- Heat waves (OC)

Standard interventions can be employed to tackle these issues, including:

- Replacement of bare conductor with overhead heli-cord or underground cable, to prevent ice sleeve and plant fall problems.
- construction of new transversals on an existing line section between two 100% reliable MT nodes to face the heat waves problem

To increase the electrical power consumption, several measures can be taken such as:

- Realization of the new smart primary station
- Refurbishment of MT electrical panels
- Upgrading and realization of new MT lines

Moreover, to increase the hosting capacity, it is important to focus on:

- Smartization of Primary stations
- Digitalization of secondary stations
- Upgrading and realization of new MT lines

It is essential to carefully evaluate and prioritize the list of interventions and determine the most efficient and effective strategies for increasing the resilience and performance of the electrical system.

3.2 Planning

Effective planning is a fundamental strength of consulting firms. In the present case, BIP demonstrated proficiency in devising and organizing a coherent and systematic framework of activities aimed at achieving the primary objective.

The expertise of the consultants at BIP was a result of their ability to amalgamate their analytical and critical thinking capabilities with prior experience gained from analogous projects such as PON and POR. Additionally, BIP's familiarity with the client's organizational structure enabled them to identify and locate relevant information and engage with pertinent stakeholders.

Central to this process is the definition of inputs, whether internal or external, and the clear identification of activities required to achieve the desired output. This approach to planning is a reliable standard that is both logistically and structurally sound.

In essence, BIP's planning process operates according to the fundamental principle that clear inputs and defined activities are critical for realizing a desired output. This approach is both easy to understand and supported by a robust project management framework.

3.2.1 Criteria definition, strategy and perimeter

In this phase, BIP identified and formalized the project team, including the rules of engagement, involvement level, and periodicity of work/coordination meetings.

BIP also defined the project allocation and perimeter criteria, taking into account the targets and scenarios to 2030, and the final targets to 2026, for Hosting Capacity, Electrification, and Resilience.

BIP also defined the technological solutions for Hosting Capacity, Electrification, and Resilience, including the components and connectivity. The output of this phase was a Standard Solutions Catalog, documentary package analysis Public Notice, verification of regulatory/administrative compliance, and in-depth costing before the publication of the Call for Proposals. BIP also identified and defined the evaluation metrics in response to the call criteria and the standard costs for the metric computation.

The first activity was to define the criteria, strategy, and perimeter for the project. BIP had to identify and formalize the project team, including their roles and responsibilities, as well as the rules of engagement, such as involvement-full or on-demand, and the periodicity of work and coordination meetings. This activity was critical in ensuring that everyone involved in the project was on the same page regarding the project's objectives and scope.

Another key activity in the planning process was the definition of project allocation/perimeter criteria and resources. BIP had to make the first macro assumptions based on the targets and scenarios for the project to 2030, taking into account the 2024 milestone and final targets to 2026. The team had to identify and define the type of interventions required for hosting capacity, electrification, and resilience. This activity was crucial in ensuring that the project's goals were met within the set timelines and budget.

The next activity involved the definition of technological solutions required for the project. BIP had to identify the appropriate technologies to adopt in terms of components and connectivity for hosting capacity, electrification, and resilience. The team had to ensure that the solutions identified were appropriate for the project and aligned with the project's objectives.

One of the most important outputs of the planning process was the standard solutions catalog. This catalog documented all the standard solutions that BIP had identified for the project, including the relevant technologies and components required.

In addition to the standard solutions catalog, BIP also conducted a documentary package analysis to ensure regulatory and administrative compliance. This activity involved verifying the power of attorney and other legal documents required to ensure that the project complied with all relevant regulations.

Another critical activity in the planning process was the in-depth costing exercise. Before publishing the call for proposals, BIP had to identify all the costs associated with the project, including the costs of the technologies and components required.

Finally, BIP had to identify and define the evaluation metrics in response to the call criteria. This activity involved identifying the metric bill structure and updated/standard costs for hosting capacity, electrification, and resilience. This was necessary to ensure that the project met all the evaluation criteria and that the project was deemed successful.

3.2.2 Definition of a list of candidable intervention

The Definition of a list of candidable intervention process involved a series of steps to ensure that all necessary data was collected, analyzed, and prioritized to create a list of interventions for Smart Grid and Resilience.

The process began with the definition and sharing of the data collection template to the DSO's Planning Poles. The data received from the Planning Poles was then analyzed, and any necessary

integrations were requested. Next, the integrations were analyzed, and the First Intervention List was defined.

The technical feasibility of the interventions in High Voltage/Medium Voltage (HV/MV) was then verified through a first skimming process. The next step involved working with SVR, the Grid development area of the DSO, to define prioritization criteria (internal criteria) and optimization criteria (call criteria) for the First List of interventions. This allowed for the application of these criteria to create a Second Intervention List.

The Second Intervention List was then shared with the Planning Poles to collect any additional interventions. Feedback from the Planning Poles was analyzed and used to create a final List of Hosting Capacity and Electrification (Smart Grid) Interventions.

The next step involved defining the methodology to calculate Time of Return (TR), for phenomena like ice sleeve (MG), Plants fall (CaP) and Heat waves (OC). SVR shared the First MG , CaP and OC intervention list, which was then analyzed to identify any possible insights.

Criteria for prioritization (internal criteria) and optimization (call criteria) of the First List of MG CaP and OC interventions were defined with SVR, and supporting data was shared.

The Second List of MG, CaP and OC interventions was created by applying these criteria, which was then shared with the Planning Poles and Areas to gather any additional interventions. Feedback from the Planning Poles and Areas was analyzed to create a final list of MG, CaP and OC interventions.

The next step focused on the identification of the list of interventions (aggregated into projects) to be nominated for Smart Grid, which was then shared to all stakeholders.

This step was critical in defining the project boundaries for Smart Grid. The full list of interventions to be nominated was a milestone in this process.

The final steps involved defining the project bidding strategy in terms of the aggregation of Smart Grid and Resilience interventions. The project application strategy was another milestone in the Planning and Drafting Documentation process, marking the end of the process and the beginning of the project implementation phase.

3.2.3 Planning and drafting documentation

The process of planning and drafting documentation involves several steps that are necessary to ensure that the project is executed efficiently and effectively. The first stage involves the confirmation of the proposing party's master data, which includes the definition of the project contact person and legal representative.

This is done to ensure that all necessary information is up to date and that the project has the necessary legal support.

In the technical design phase of the project, the first step involves the definition of the Synthetic Project template for SG interventions. This template outlines the necessary information that will be required from the Areas in order to draft the summary project. The next step is to collect this information from the Areas and draft the Synthetic Projects, including all necessary sections. The Synthetic Projects are then shared and validated, ensuring that they are technically feasible and that they meet all requirements.

The technical design phase also includes the development of guidelines for Resilience interventions and the definition of a Synthetic Project template for each risk factor. This step involves collecting

information from the Areas to draft the Synthetic Projects, including all necessary sections. The Synthetic Projects are then shared and validated, ensuring that they meet all requirements.

The Economic Frameworks are also an essential part of the planning and drafting documentation process. The pre-drafting of Economic Frameworks is done for both SG and Resilience interventions. Once the Economic Frameworks are pre-drafted, they are shared and validated, ensuring that they are accurate and meet all necessary requirements.

The next step is the development and sharing of the Chronoprogram of interventions for both Smart Grid and Resilience. This involves identifying the expenditure distribution of both types of interventions and preparing a self-declaration on the application of DNSH principles. This declaration is necessary to ensure that the project adheres to the DNSH principles and that it is socially and environmentally responsible.

Finally, the entire document set is reviewed and consolidated, ensuring that all necessary information is included and that the project is ready to move on to the next phase. This step is essential to ensure that all aspects of the project have been considered and that it is executed efficiently and effectively.

3.2.4 Packaging and application submission

Firstly, all documents related to a particular project must be carefully packaged together for submission. This includes ensuring that all required documents are present, properly formatted and organized. Once the document package is complete, a digital signature is affixed to confirm the authenticity of the documents.

Overall, the process of packaging and submitting a proposal requires careful attention to detail and adherence to specific guidelines and requirements. By taking the time to carefully package and submit all required documentation, and ensuring that all necessary information is included in the proposal, the chances of success in securing funding or approval for a project can be greatly increased.

3.3 Executing

During the execution phase of the BIP project, it was important to follow a clear technical, economic, and organizational chart to ensure that each team member knew their respective roles and responsibilities. Ad hoc thematic tables were also used to identify pipelines for developing content and other support systems were put in place to ensure that the project was executed efficiently and effectively.

For example, the technical team was responsible for overseeing the implementation of the project's infrastructure, while the economic team focused on budgeting and cost management. The organizational chart helped to ensure that the various teams and departments were coordinated and working towards the same goals.

Ad hoc thematic tables were used to identify areas where additional research and content development were needed. This helped to ensure that the project's deliverables were of high quality and that all necessary information was included.

Throughout the execution phase, other support systems were also used to facilitate communication and collaboration between team members. This included regular meetings, progress reports, and project management software to track tasks and deadlines.

By following a clear technical, economic, and organizational chart and utilizing support systems such as ad hoc thematic tables and other tools, the BIP project was able to be executed successfully and deliver its intended outcomes.

3.4 Monitoring and controlling

During the monitoring and control phase of the BIP project, one of the challenges faced by the team was a delay in the publishing of the call documents. This delay affected the overall timeline of the project and required the team to revise their project schedule accordingly. To address this issue, the project manager worked closely with the relevant stakeholders to put measures in place to mitigate its impact on the project.

In addition to addressing delays, the monitoring and control phase also involved regular check-ins with team members to ensure that they were on track with their assigned tasks and that project objectives were being met. The project manager used a variety of tools, such as Gantt charts and progress reports, to track project progress and identify any potential risks or issues that needed to be addressed.

Furthermore, the team also held regular meetings with the client to provide updates on project progress and discuss any concerns or issues that arose during the project. This helped to ensure that the client was kept informed about the project status and that any changes to project scope or objectives were communicated clearly and promptly.

Overall, the monitoring and control phase was critical to ensuring the successful execution of the BIP project. By closely monitoring project progress, identifying potential issues, and taking corrective action as needed, the project team was able to deliver the project within the agreed timeline and budget, while meeting the client's expectations.

3.5 Closing

In the closing phase of the BIP project, the necessary documentation was sent to the public administration on behalf of the client in order to obtain the funds. A final review of the project was conducted to ensure that all objectives were met and all documentation was in order. Areas of improvement and lessons learned were also identified during this phase in order to apply them to future projects.

A check was made to confirm that the main goals of the project were achieved, and any necessary adjustments were made. Once all requirements were met, the documentation was packaged and sent to the public administration for final approval and closure of the project.

4. CSFs, improving margins and next challenges

4.1 CSFs

4.1.1 Outcome of the application

On December 23rd, the Ministry of Environment and Energy Security (MASE) published two decrees that approved the lists of projects eligible for subsidies. One of the decrees was for Smart Grid interventions while the other was for Resilience interventions. The results of the application were highly favourable for BIP's client as they were able to secure € 3,202,950,709 for the Smart Grid call which is the sum of the eligible and fundable of the approved projects present in the attachment to the MASE's directorial decree of the 23rd of December 2022. Further € 274,991,181 were granted for the Resilience call which is the sum of the eligible and fundable of the approved projects present in the attachment to the MASE's directorial decree of the 16th of December 2022. This success reflects the client's strong commitment to implementing sustainable and resilient projects, and their dedication to working collaboratively with BIP to achieve their goals.

This remarkable achievement is not merely a coincidence but can be attributed to the rigorous organization of work and preliminary activities undertaken by BIP. These measures granted a powerful knowledge base and solid foundation, enabling the BIP team to strategically apply their expertise and effectively allocate resources. This success highlights the critical importance of well-planned and executed preparatory phases in projects, as they can significantly impact the final outcome.

4.1.2 KPI definition

BIP played a pivotal role in defining and managing the key performance indicators (KPIs) that were integral to drafting and achieving the targets set by the public call.

The client had internal priorities that needed to be intersected with an optimization of the list of interventions to be submitted in response to the public call. BIP's approach was fundamental in developing an effective solution that aligned both internal priorities and call requirements, optimizing the interventions list in relation to the evaluation function used to assess the responses submitted by BIP's client. This intersection of priorities and optimization ensured a successful outcome in terms of achieving the targets and securing the necessary funding.

In the context of the Smart Grid call, the following criteria were present in the public notice of the 20th of June 2022:

- Increase in Hosting Capacity (HC) for Distributed Generation (GD): the increase in HC is calculated as the difference post and pre-intervention of the gross rated capacity of the generation distributed that the grid is able to connect, under normal operating conditions, on the portion of grid affected by the interventions.
- Number of inhabitants [num.], affected by the electrification increase interventions where the electrification increase is calculated as the difference post and ante interventions of the maximum power [MW] that the grid is able to supply in withdrawal to connected users, under normal operating conditions, on the grid perimeter affected by the interventions.
- Economic efficiency related to increasing HC is defined as the ratio of total costs of interventions allocated to this purpose to the absolute change in HC
- Economic efficiency related to increased electrification is defined as the ratio of total costs of interventions allocated to this purpose to the number of inhabitants

- The impact on inhabitants of electrification interventions, expressed in kW/inhabitant, is calculated as the ratio of the absolute value of electrification increase

These evaluation criteria are resumed in the Table 1

Evaluation Criteria	Description	Formula
HC increase	Increase in Hosting Capacity (HC) for Distributed Generation (GD): the increase in HC is calculated as the difference post and pre-intervention of the gross rated capacity of the generation distributed that the grid is able to connect, under normal operating conditions, on the portion of grid affected by the interventions.	ΔHC
Electrification increase	Number of inhabitants [num.], affected by the electrification increase interventions where the electrification increase is calculated as the difference post and ante interventions of the maximum power [MW] that the grid is able to supply in withdrawal to connected users, under normal operating conditions, on the grid perimeter affected by the interventions.	$\Delta(\text{Electrified inhabitants})$
Economic efficiency HC	Economic efficiency related to increasing HC is defined as the ratio of total costs of interventions allocated to this purpose to the absolute change in HC	$\frac{\text{Increment HC}}{\text{Cost}}$
Economic efficiency of electrification	Economic efficiency related to increased electrification is defined as the ratio of total costs of interventions allocated to this purpose to the number of inhabitants	$\frac{\Delta(\text{Electrified Inhabitants})}{\text{Cost}}$
Impact on Inhabitants	The impact on inhabitants of electrification interventions, expressed in kW/inhabitant, is calculated as the ratio of the absolute value of electrification increase	$\frac{\text{Power increment}}{\text{Electrified Inhabitants}}$

Table 1 - HC public call, evaluation criteria

In the context of the Resilience call, we need to define the event return time TR, given by the inverse of the probability per year of a service interruption occurring for a specific risk; the following criteria were present in the public notice of the 20th of June 2022:

- Weighted average of the ex-ante TRs of inefficiencies for the risk factors considered on the network km affected by the project intervention
- Weighted average over the affected network km of the changes in the return times of inefficiencies of the lines and/or facilities connected to the network, achieved with the implementation of the project
- Sum of kilometres benefited and/or equivalent kilometres of infrastructure (lines, nodes, new infrastructure) benefiting from the project aimed at increasing resilience, in relation to the length of the project boundary.
- Project cost related to the km of MV line subject to the project.
- Average TR improvements of DSOs of MT nodes in the project boundary for which resilience improves, in relation to the number of MT nodes subject to TR improvement

These evaluation criteria are resumed in the Table 2.

Evaluation Criteria	Description	Formula
Average ex-ante TR	Weighted average of the ex-ante TRs of inefficiencies for the risk factors considered on the network km affected by the project intervention	$TR_{ex_ante} = \frac{\sum(km_i * TR_{ex_ante\ i})}{\sum km_i}$
Average delta TR	Weighted average over the affected network km of the changes in the return times of inefficiencies of the lines and/or facilities connected to the network, achieved with the implementation of the project	$\Delta TR = \frac{\sum km_i * \Delta TR_i}{\sum km_i}$
Percentage consistency	Sum of kilometres benefited and/or equivalent kilometres of infrastructure (lines, nodes, new infrastructure) benefiting from the project aimed at increasing resilience, in relation to the length of the project boundary. <ul style="list-style-type: none"> • Km benefited: total length of the new MT line, or MT lines whose TR increases due to the interventions on MT branches or MT nodes targeted by the project • Length of the project boundary: length of the MT network subtended 	$\frac{\sum km_i}{L_{perim}}$

	by the CPs to which the portion of the network subject to intervention pertains, or length of the MT network of the concession if the DSO does not have a CP (subtended DSOs).	
Project efficiency	Project cost related to the km of MV line subject to the project	$\frac{\sum cost_i}{\sum km_i}$
Average TR improvement of MT nodes	Average TR improvements of DSOs of MT nodes in the project boundary for which resilience improves, in relation to the number of MT nodes subject to TR improvement	$\frac{\sum (TR_{NO_ex_post_i} - TR_{NO_ex_ante_i})}{N}$

Table 2 - Resilience public call, evaluation criteria

The DSO had to take into account a variety of Key Performance Indicators (KPIs), which serve as the foundation for the penalties or rewards imposed by the regulatory authority for energy networks and environment (ARERA). ARERA sets annual targets for both the duration and number of outages in each territorial area, which decrease annually until they converge with the target level in the target year. The two critical KPIs in question are:

- the Duration of long interruptions (DIL),
- the number of long and short interruptions (NILB),

which serve as a measure of the quality of the grid distribution service.

Given the importance of meeting these targets to avoid penalties, it was essential for the DSO to prioritize this objective while also satisfying the requirements of the call. A significant challenge was to create a list of interventions that met both the internal goals of the DSO and the call requirements, while simultaneously ensuring that the KPIs were met. This required careful analysis and optimization of the available interventions to achieve the optimal balance between internal goals and regulatory requirements.

4.2 Next challenges

The allocation of funds from the public call and PNRR represents only the initial phase of a colossal undertaking that is intended to generate significant value, with an approximate budget of €3.5 billion euros. Given the scale of this project, it is by no means a trivial endeavour and it entails a multitude of challenges that must be addressed with careful planning and execution. These include ensuring effective plan implementation, addressing issues related to spending capacity, raw material procurement, timely supply chain management, addressing staffing concerns, as well as meeting the strict deadlines of the public calls. Hence, it is critical to develop a comprehensive strategy that takes into account all of these factors and ensures seamless execution of the project, in order to deliver the desired outcomes and meet the expectations of all stakeholders involved.

4.2.1 Implementation

Once the implementation phase begins, it is necessary to guarantee the right environment for the technical solutions to be implemented.

This means ensuring that the bureaucracy, the organization and the operations are well coordinated.

It is fundamental to monitor the status of the works, the economic progress and the procedural constraints.

BIP could continue to offer its support to the DSO client offering its know-how in project management to implement clear and well organized paths towards an effective and straight to the point strategy.

One of the ways to help a comprehensive and clear view of the works to be done is the clusterization of them in:

- Structural interventions: one example is the insertion of a new HV/MV Primary Station with associated new outgoing MV network which enables to significantly reduce the number of customers disconnected in case of failure and ensure a more prompt resumption of service.
- Renewing interventions:
 - Network renewal on MV lines with obsolete line consistencies (mainly underground cable) and high failure rate
 - Primary plants undergoing renewal of individual components (HV breakers, HV/MV TRs, MV switchgear, etc.) selected by priority based on obsolescence, lack of spare parts; failure rate and service impact.
- TLC and automation interventions:
 - MV telecontrol: increasing the percentage of telecontrol in areas with MV lines having non-standard telecontrol pitch
 - LV telecontrol: enables remote manoeuvring to re-power LV lines following localized and non-localized outages, with benefits on the cumulative duration indicator (DIL) of LV origin
 - Evolved MV Automation: Self Healing Automation (SHA) Fault trunk selection and counter-powering of the healthy network downstream of the fault within 5 seconds.
- Sensors:
 - Installation of sensors in secondary cabin for monitoring network data and environmental conditions
 - Enabling predictive maintenance algorithms while ensuring real time data availability
 - Enabling non-technical loss monitoring algorithms
 - Risk mapping by monitoring external parameters in cabins (e.g., extreme weather conditions)

Clusterization enables project managers to identify potential risks and allocate resources more efficiently, ensuring that the project stays on track and meets the desired objectives. By leveraging clusterization, BIP can help the DSO client to streamline the implementation process and optimize the use of resources, thereby increasing the chances of success for the project.

4.2.2 Critical issues

The implementation of the PNRR funded projects poses several critical issues for the DSO and the Italian administration as a whole. Some of these issues are internal, while others have external sources. Addressing these issues is crucial for the DSO to complete the project on time and within budget, and for the country to seize the opportunity to bring significant value to Italy.

One of the most pressing issues is spending capacity, which is closely linked to staffing issues. Italy has been facing a shortage of technical professional figures, which makes it challenging for the DSO to recruit qualified staff. This issue is not unique to the DSO but is a reflection of the broader challenges facing the Italian public administration. Addressing this issue is essential to ensure that the project is completed efficiently and effectively.

Raw material procurement is another external cause of problems that the DSO has to deal with. The current inflationary environment and the ongoing conflict in Ukraine have led to an increase in raw material prices, making it more challenging for the DSO to manage costs. Moreover, there is a shortage of raw materials, especially those necessary for TLC components. This shortage inevitably leads to project delays, which can further exacerbate the staffing and spending capacity issues.

The problems faced by the DSO in implementing the PNRR funded projects may be a reflection of the challenges facing the broader Italian public administration in managing the money granted by the PNRR. To address these issues, the Italian government needs to ensure that there is adequate funding for training and recruitment of technical professionals. Additionally, greater emphasis should be placed on improving coordination and communication among different stakeholders, including contractors, regulatory bodies, and local communities.

4.2.3 Reporting and disbursement of the grant

In the context of the PNRR-funded projects, it is essential to comply with the rigorous reporting requirements specified in the public call. The disbursement of subsequent instalments of the contribution is subject to the submission of an application for disbursement, which must be accompanied by the accounting analytical statement of the expenses incurred for the implementation of the project, a report on the progress of the interventions envisaged by the project accepted for funding, including the state of progress of the project, and, if quantifiable, the targets in terms of Hosting Capacity and/or electrification of consumption, by the legal representative's statement of adherence to the principle of DNSH, by the legal representative's declaration of no double funding.

Furthermore, the MASE may conduct on-site checks at the administrative headquarters of the beneficiary and at the physical location of the project to verify the veracity of the statements of expenditure, the progress of the project and its commissioning as well as the presence of the reported assets and what has been declared/documentated regarding the achievement of the target interim and final targets. Thus, it is critical to conduct reporting activities with utmost attention and care.

We have already pointed out the issues regarding the non-adoption of EVM standard procedures in par.2.1.3, but there are additional interesting points to go deeper in.

For instance, the beneficiaries must ensure the achievement of the target under penalty of revocation of the grant. The target must be achieved by June 30, 2026, under the same penalty of revocation of the grant awarded. The question then arises as to how the potential failure of the DSO to provide successful outcomes will impact the entire chain of reporting needed to reach the European objectives defined by the European Commission.

It is evident that if the money is revoked from the DSO, which owns 85% of the Italian distribution grid, the works won't be completed, and the European objectives won't be reached. This could lead to two outcomes. Firstly, there may be an enormous increase in the DSO's debt, which will most likely be paid by Italian people in their bills. Secondly, there may be a waiver of the deadline, which will confirm that critical issues have not been correctly addressed.

It is worth noting that the problems faced by the DSO in implementing the PNRR-funded projects could be the mirror of the problems faced by the public Italian administration in managing the money granted by the PNRR. It is crucial to adopt effective project management practices and ensure timely and successful completion of the projects to meet the European objectives and to avoid penalties and potential losses to the Italian economy.

5. Conclusions

This paper conducted a deep analysis of the Project financing scheme of the PNRR and highlighted both its strengths and weaknesses. Through the presented case study, we were able to delve into the logic and mechanisms intrinsic to a PNRR funded project, and observed how critical points and areas of improvement in the particular projects mirror some of the main weaknesses of the large scale Italian Plan.

One of the main takeaways from this analysis is the need for Italy to embrace project management logics more fully, and to trust in the standards that ensure solidity and reliability in the main processes. The PNRR, as it has been structured, presents more than one weakness from this point of view.

While it is true that the context is very complex and external factors are contributing to such complexity, it is probable that these missing outs will result in unforeseen consequences to which the plan is not prepared. Therefore, it is crucial for Italy to improve its project management capabilities in order to ensure the successful implementation of the PNRR projects and to achieve the desired outcomes.

One potential way to address these weaknesses is to focus on adopting standard procedures and reliable techniques that have been proven to work effectively in project management. By embracing these best practices, Italy can mitigate some of the risks associated with complex projects and reduce the likelihood of unforeseen consequences.

Overall, it has been shown that the PNRR is a multi-portfolio of projects that can be managed effectively through the implementation of standard procedures and reliable techniques. By taking these steps, Italy can better prepare for the challenges ahead and ensure the successful implementation of the PNRR funded projects.

6. Bibliography

- The MathWorks, Inc. (2020). *Mathworks.com*. Tratto da Mathworks.com:
<https://it.mathworks.com/help/matlab/ref/legendre.html>
- (2021). Tratto da Governo Italiano: <https://www.governo.it/it/approfondimento/governance-del-pnrr/16709>
- (2023). Tratto da ec.europa.eu: https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/milestones_and_targets.html#:~:text=These%20key%20implementation%20steps%20are,in%20a%20Council%20Implementing%20Decision.
- (2023). Tratto da lineamica.gov.it: https://lineamica.gov.it/docs/default-source/schede-di-approfondimento---pnrr/la-certificazione-di-genere-per-le-imprese.pdf?sfvrsn=846f09a5_5
- Agenda digitale*. (s.d.). Tratto da <https://www.agendadigitale.eu/procurement/pnrr-tra-appalti-e-governance-ecco-come-il-project-management-puo-aiutare/>
- AgID, A. p. (2021). Tratto da https://inapp.org/sites/default/files/NORMATIVA/2021/Statale/20210120_Circolare_n1_Monitoraggio_Esecuzione_Contratti_AgID.pdf
- Barthelmes, F., & Köhler, W. (2016). *International Centre for Global Earth Models (ICGEM)*. Tratto da International Centre for Global Earth Models (ICGEM): <http://icgem.gfz-potsdam.de/home>
- Butkov, E. (1973). *Mathematical physics*. New York: Addison-Wesley publishing company.
- Carlslaw, H., & Jaeger, J. (1959). *Conduction of heat in solids*. Oxford: Clarendon Press.
- Commission.europa.eu*. (2023). Tratto da https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en
- consilium.europa.eu*. (2023). Tratto da <https://www.consilium.europa.eu/en/policies/eu-recovery-plan/>
- Crank, J. (1975). *The mathematics of diffusion*. Oxford: Clarendon Press.
- Forum PA PM & PNRR*. (s.d.). Tratto da <https://www.forumpa.it/manifestazioni/forum-pa-2022/il-project-management-per-la-corretta-gestione-del-pnrr-e-per-garantire-la-realizzazione-dei-progetti-in-linea-con-obiettivi-e-milestone-semestrali/>
- Miller, D. (2019, Maggio 9). *Youtube*. Tratto il giorno Agosto 30, 2020 da Youtube:
<https://www.youtube.com/watch?v=f-7LnHk3PX4&t=6s>
- Project Management Institute, I. (s.d.). *PMBOK Guide, sixth edition*.
- The MathWorks, Inc. (2020). *Mathworks.com*. Tratto da Mathworks.com:
<https://it.mathworks.com/help/matlab/ref/fzero.html>
- The MathWorks, Inc. (2020). *Mathworks.com*. Tratto da Mathworks.com:
<https://it.mathworks.com/help/matlab/ref/besselj.html>
- Young, P. (2009, 23 Ottobre). Tratto il giorno Agosto 29, 2020 da
http://physics.ucsc.edu/~peter/116C/helm_sp.pdf