**ALL.2 _ WOP DOC_ACTIVITIES related to the populating of the platform are those indicated for the II MILESTONE (gennaio 2024-dicembre 2025)**

## MATRICE WORKFLOW_ Action4Action

| **PERIOD** | **UNIVERSITY LABORATORY ACTIVITIES**<br>Report on Corresponding Deliverable/indicate site (Palazzo Bova,<br>Costa Palizzi) | **LABORATORY ACTIVITIES IN SITU (c/o municipalities)**<br>Report on Corresponding Deliverable/indicate site (Palazzo Bova, Costa Palizzi) | OPEN PLATFORM –<br>**Section 1** | OPEN PLATFORM –<br>**Section 2** | OPEN PLATFORM<br>**Section 3** |
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| | | | *(content area)*<br><br>*Definitions and descriptions of RISK TYPES*<br>*(references to the 2 caseprototypes)*<br><br>*data, text, graphics*<br>*Interoperability with access to other databases, platforms, etc.* | *(information area)*<br><br>*A- Presentation of the Themes on structural and environmental safety and CC*<br>*Texts, data, images, references* | *(information area)*<br><br>*A- Contribution to the Presentation of Prototype Cases*<br>*(Dossiers, photos, videos, graphic tables, reference links* |
| | | | | *(content area)*<br><br>*B- MEASUREMENTS AND INTERVENTIONS*<br>*Data, texts, graphics, models, simulations*<br>*Interoperability with access to other databases, platforms, etc.* | *(content area)*<br><br>*B- METHODOLOGIES USED WITH REFERENCE TO SECTION 1,2*<br>*Data, text, graphics, processes, workflows, references, examples*<br>*Interoperability with access to other databases, platforms, etc.* |

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| **ACTION 1, 2 - P. FUSCHI, A. PISANO** | | | | | |
| I milestone<br><br>Trimestre (ottobre novembre dicembre 2023 | Bibliographic research and selection of reference parameters | Surveys (Bova) | Structural safety with particular reference to environmental/structural degradation and seismic hazard in the Municipality of Bova.<br><br>Data given by Regulations; forms for the definition of damage level I, II and III, AeDES, GNDT and Report Reluis forms. | **A-** Reference texts.<br><br>**B-**<br>https://emidius.mi.ingv.it/GNDT2/Pubblicazioni/Bernardini/Man_Aedes /Manuale/Cap1/ManualeCap1.htm<br><br>https://www.protezionecivile.gov.it/it/pubblicazione/manuale-lacompilazione-della-scheda-di-primo-livello-di-rilevamento-di-dannopronto-intervento-e-agibilita-edifici-ordinari-nellemergenza-post/<br><br>http://www.geostrutture.eu/images/download/ministero/reluismeccani smi.pdf | A. Image acquisition and collapse mechanisms identification.<br>B. Automatic drone survey of a sample building. |
| II milestone<br><br>Trimestre (gennaio febbraio marzo) 2024 | Image processing<br><br>Implementation of limit analysis methodologies selected in the literature. | Surveys (Bova) | Structural safety with particular reference to environmental/structural degradation and seismic hazard in the Municipality of Bova.<br><br>Data given by Regulations; forms for the definition of damage level I, II and III, AeDES, GNDT and Report Reluis forms. | A. Survey of the environmental/structural damage scenario also oriented to collapse mechanism identification<br>**B.** Images; numerical results. | A. Image acquisition and processing<br>B. Automatic drone survey and processing of the collected data through specific image management softwares. |
| II milestone<br><br>Trimestre (aprile, maggio, giugno) 2024 | Image processing<br><br>Application of limit analysis to recurrent structural elements | Surveys (Bova) | Structural safety with particular reference to environmental/structural degradation and seismic hazard in the Municipality of Bova.<br><br>Data acquisition through in situ surveys with remote sensing techniques. | A. Interpretation of the environmental/structural damage scenario<br><br>B. 3D models of the analyzed buildings and identification of those prone to collapse; numerical results. | A. 3D models construction for buildings and aggregates starting from images<br>B. Processing through algorithms structure from motion SFM |

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| II milestone<br><br>Trimestre (luglio, agosto, settembre) 2024 | Image processing<br><br>Application of limit analysis to recurrent structural elements | Surveys (Bova) | Structural safety with particular reference to environmental/structural degradation and seismic hazard in the Municipality of Bova.<br><br>Processing of the collected data | A. Reconstruction of the environmental/structural damage scenario and prediction of the collapse mechanisms through limit analysis.<br><br>B. 3D models and images; numerical results. | A. Processing of 3D models and reconstruction of the crack pattern on a single building and on aggregates<br><br>B. Processing through algorithms structure from motion SFM on preprocessed images |
| II milestone<br><br>Trimestre (ottobre, novembre, dicembre 2024) | Data integration on interactive map | Reliability verification of the interactive map (Bova) | Structural safety with particular reference to environmental/structural degradation and seismic hazard in the Municipality of Bova.<br><br>Verification of the effectiveness of the methodology proposed and applied on the case studies taking into account their specificities | A. Definition of the type of risk<br><br>B. Shape files of the interactive map | A. Creation of interactive maps of the places under study<br>B. Verification of the effectiveness of the methodology proposed and applied on the case studies taking into account their specificities |
| **ACTION 3 - D. PORCINO** | | | | | |
| I milestone<br><br>Trimestre (ottobre - novembre- dicembre 2023) | Development and validation of an "open-source software" for feasibility assessment and preliminary analysis of the design of ground improvement technique based on "Compacted granular columns" | Collection of geological/geotechnical data and/or information available for the pilot case to identify situations of greatest interest for the purposes of the effects of climate change on the foundation structures (Palizzi Marina) | STRUCTURAL-ENVIRONMENTAL RISK<br><br>Tables/data and/or references regarding the potential risks, such as wetting and drying cycles in swelling soils, ground water table changes, sea level rise, linked to the effects of climate change on soil interacting on structures, | A-SETTLEMENTS AND STABILITY OF FOUNDATIONS ON SOFT OR PROBLEMATCI SOILS<br>A1- Photos/Data of damages of buildings caused by the phenomena mentioned in section 1<br><br>B-USE OF COMPACTED GRANULAR COLUMNS FOR GROUND IMPROVEMENT<br><br>B1-Tables, figures and photos regarding the execution techniques of compacted granular columns for soil improvement<br><br>B2- Supply of “Granular Columns_v.1.0” software developed for the preliminary design of ground | A- Data/Tables/Figures acquired for Palizzi pilot case regarding geological, geotechnical and seismic risks. |

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| | | | | improvement based on compacted granular columns (including manual and example of calculation report) | |
| II milestone<br><br>Trimestre (gennaio-febbraio-marzo 2024 | Update software “Granular Columns” to take into account the design of compacted granular columns for the mitigation of seismic liquefaction risk. | In-situ geotechnical investigation for the evaluation of the main litho-stratigraphic and mechanical soil properties and groundwater level (Palizzi). | STRUCTURAL-ENVIRONMENTAL RISK | B – DESIGN OF COMPACTED GRANULAR COLUMNS FOR GROUND IMPROVEMENT<br><br>Supply of “Granular Columns_v.1.1” software developed for the design of ground improvement technique based on compacted granular columns subjected to static and seismic loading conditions | A. Data and certificates of in-situ geotechnical tests (MASW) carried out for the characterization of the soil at the Palizzi site.<br><br>B. The software “Granular Columns_v.1.1” is developed through visual basic programming in excel. |
| II milestone<br><br>Trimestre (aprile-maggio-giugno 2024) | Collection of available geotechnical laboratory data relative to the soils present in Palazzi Marina area | Validation of energy- and strain- based approaches to predict seismic excess pore water pressure in sandy soils by nonlinear numerical analysis of available centrifuge tests | EVALUATION OF SEISMIC LIQUEFACTION RISK DUE TO SEA-LEVEL RISE ASSOCIATED TO CLIMATE CHANGES IN SATURATED SANDY SOILS | A – NUMERICAL ANALYSIS OF AVAILABLE SEISMIC CENTRIFUGE TESTS<br><br>- Report presenting the results of numerical analysis<br>-Data access relative to the numerical models | A. Laboratory test data and certificates for the geotechnical characterization of the foundation soils of the Palizzi site provided by municipality authority.<br><br>B. Numerical seismic analysis: conducted by DEEPSOIL software |
| II milestone<br><br>Trimestre (luglio-agosto-settembre 2024) | Analysis of the approaches and methods for the design of “Rammed aggregate Piers (RAPS)” under both static and seismic loading conditions | | STRUCTURAL-ENVIRONMENTAL RISK | **B –** IMPLEMENTATION IN THE “GRANULAR COLUMNS” SOFTWARE OF THE DESIGN METHODS FOR RAPS<br><br>B1 - Final version of the software<br><br>B2 - Technical guidelines for the practitioners and useful links. | |

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| II milestone<br><br>Trimestre (ottobre-novembre-dicembre 2024) | Preliminary design of physical modeling of soils improved by the technique based on “Compacted Granular Columns” | Evaluation of the impact of sea-level rise on seismic liquefaction susceptibility of Palizzi Marina coastal area and risk mitigation | STRUCTURAL-ENVIRONMENTAL RISK | A – RISK OF SEISMIC LIQUEFACTION DUE TO SEA-LEVEL RISE ASSOCIATED WITH CLIMATE CHANGES<br><br>A1 - Plots, data relative to different seismic scenarios in Palizzi Marina ste<br><br>A2 - Plots of liquefaction potential index (LPI) of unimproved soils under current and future climate scenarios at Palizzi area<br><br>B1 – MITIGATION OF LIQUEFACTION RISK<br><br>- Plots of liquefaction potential index (LPI) of improved soils under current and future climate scenarios at Palizzi area<br><br>B2 – PRELIMINARY ANALYSIS OF THE DESIGN OF PHYSICAL MODEL TESTS (SEISMIC CENTRIFUGE TESTS) OF SOILS IMPROVED BY COMPACTED GRANULAR COLUMNS<br><br>- Report on the influence of key factors such as. instrumentation, soil type, layout and number of columns | A. Use of semi-emprirical methods for the prediction of seismic liquefaction potential in coastal areas |
| **ACTION 4 - A. SOFI** | | | | | |
| I milestone<br><br>Trimestre (ottobre - novembre-dicembre 2023) | Activity 1: Modelling of uncertainties in the mechanical properties of historic masonry (D7.1.9; Palazzo Bova) | | | A. References: influence of climate change on the mechanical properties of masonry structures<br>B. Interval model of uncertainty | B. References: modeling of uncertainties in masonry structures |

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| II milestone<br><br>Trimestre (gennaio-febbraio-marzo 2024) | Activity 2: Numerical modeling of a benchmark masonry wall with uncertain mechanical properties aimed at developing an uncertainty propagation procedure applicable to the masonry typology of Palazzo Bova (D7.2.1). | | | B. Finite element model of a benchmark masonry wall with uncertain mechanical properties (images). | B. References: numerical modelling of masonry structural elements with uncertain mechanical properties |
| II milestone<br><br>Trimestre (aprile-maggio-giugno 2024) | Activity 3: Numerical simulations aimed at analyzing the influence of variations in uncertain mechanical properties on the response of masonry walls (D7.2.1). | | | B. Graphics showing the response of a masonry wall under varying mechanical properties | |
| II milestone<br><br>Trimestre (luglio-agosto-settembre 2024) | Activity 4: Definition of a response surface approximation and development of a procedure for propagating uncertain mechanical properties in masonry walls (D7.2.1). | | | B. Validation of the response surface approximation: simulations and graphic visualization. | B. References on the response surface method and the propagation of interval uncertainties |

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| II milestone<br><br>Trimestre (ottobre-novembre-dicembre 2024) | Activity 5: Application of the developed procedure to analyze the influence of the uncertain mechanical properties on the in-plane behavior of masonry walls (D7.2.1). | | | A. Dissemination: participation in relevant conferences in the field<br><br>B. Analysis of the influence of the uncertain mechanical properties on the in-plane behaviour of masonry walls: simulations and graphic visualization. | |
| **ACTION 5 - E. COCCHIARELLI** | | | | | |
| II milestone<br><br>Trimestre (Gennaio febbraio marzo 2024) | | | | A. Papers: state-dependent fragility function for structural typologies available in literature<br>B. Tables: parameters of developed state-dependent fragility functions | A. Algorythm for the assessment of the damage state |
| II milestone<br><br>(Trimestre Aprile-maggio-giugno 2024) | | | | | A. Table: probability each structural typology<br><br>B. Map of the distribution of the structural typology (if data from D7.2.1. are sufficiently datailed) |

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| II milestone<br><br>Trimestre (Luglio-agosto-settembre 2024) | | | | | A. Maps of seismic damage scenarios |
| II milestone<br><br>Trimestre (ottobre-novembre-dicembre 2024) | | | | | A. Maps of seismic damage scenarios for different climatic conditions<br>B. Graphs and table from dynamic identification of the structure in Bova Superiore |
| **ACTION 6/7 - G. FAILLA** | | | | | |
| I milestone<br><br>Trimestre (ottobre - novembre-dicembre 2023) | Design of prototype masonry structure and prototype tuned-massdamper-inerter (TMDI) base isolation system for experimental tests in the structural dynamics laboratory, scale 1:2 (D7.1.5) / Bova, historic centre<br><br>Design of prototype masonry structure and prototype foundation in locally | | Seismic risk of the historical-monumental heritage | A. SEISMIC PROTECTION OF MASONRY STRUCTURES<br><br>A1. Images of earthquake damage on masonry structures<br><br>B. BASE ISOLATION TECHNIQUES<br>B1. Images of traditional base isolation systems (images)<br>B2. Technical drawings of traditional base isolation systems (graphics) | |

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| | resonant metamaterial, aimed at experimental tests in the laboratory of structural dynamics, scale 1:2 (D7.1.6) / Bova, historical centre | | | | |
| II milestone<br><br>Trimestre (Gennaio febbraio marzo 2024) | Construction of a masonry structure prototype and a prototype of a tuned-massdamper-inerter (TMDI) base isolation system for experimental tests in the structural dynamics laboratory, scale 1:2 (D7.2.2) / Bova, historic centre<br><br>Realisation of a masonry structure prototype and a foundation prototype in locally | | Seismic risk of the historical monumental heritage | A. SEISMIC PROTECTION OF MASONRY STRUCTURES<br><br>A1. Images Of Earthquake Damage On Masonry Structures<br><br>A2. Data On Seismic Vulnerability Of Historical-Monumental Heritage In Calabria (Official Data, If Available)<br><br>B. BASE ISOLATION TECHNIQUES<br><br>B1. Technical Drawings Of Prototype Base Isolation System With Tuned-Mass-Damper-Inerter (Graphics)<br><br>B2. Technical Drawings Of Prototype Foundation In Locally Resonant Metamaterial (Graphics) | |

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| | resonant metamaterial, aimed at experimental tests in the laboratory of structural dynamics, scale 1:2 (D7.2.3) / Bova, historical centre | | | | |
| II milestone<br><br>(Trimestre Aprile-maggio-giugno 2024) | Realisation/numeric al modelling of a masonry structure prototype and of a tuned-massdamper-inerter (TMDI) base isolation system prototype, aimed at experimental tests in the structural dynamics laboratory, scale 1:2 (D7.2.2) / Bova, historical centre | | Seismic risk of the historical monumental heritage | A. SEISMIC PROTECTION OF MASONRY STRUCTURES<br>A1. Images Of Earthquake Damage On Masonry Structures<br>A2. Data On Seismic Vulnerability Of Historical-Monumental Heritage In Calabria (Official Data, If Available)<br><br>B. BASE ISOLATION TECHNIQUES<br>B1. Images Of Prototype Base Isolation System With Tuned-Massdamper-Inerter (Images)<br>B2. Numerical Model Of Prototype Base Isolation System With Tuned-Mass-Damper-Inerter (Models)<br>B3. Images Of Prototype Foundation In Locally Resonant Metamaterial (Images)<br>B4. Numerical Model Of Prototype Foundation In Locally Resonant Metamaterial (Models) | |

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| II milestone<br><br>Trimestre (luglio-agosto-settembre 2024) | Dynamic identification of a masonry structure prototype and of a tuned-massdamper-inerter (TMDI) base isolation system prototype, to be performed in the structural dynamics laboratory with a multi-degree-offreedom vibrating table, scale 1:2 (D7.2.2) / Bova, historic centre<br><br>Dynamic identification of a masonry structure prototype and a locally resonant metamaterial foundation prototype, to be performed in the structural dynamics laboratory with a multi-degree- | | Seismic risk of the historical-monumental heritage | A. SEISMIC PROTECTION OF MASONRY STRUCTURES<br>A1. Images Of Earthquake Damage On Masonry Structures<br>A2. Data On Seismic Vulnerability Of Historical-Monumental Heritage In Calabria (Official Data, If Available)<br><br>B. BASE ISOLATION TECHNIQUES<br>B1. Images Of Masonry Structure Prototype (Images)<br>B2. Dynamic Identification Of Prototype Masonry Structure (Data)<br>B3. Images Of Prototype Masonry Structure With Tuned-Mass-Damper-Inerter Base Isolation System (Images)<br>B3. Dynamic Identification Of Prototype Masonry Structure With Prototype Insulation System At The Base With Tuned-Massdamper-Inerter (Data)<br>B5. Images Of Prototype Masonry Structure With Locally Resonant Metamaterial Foundation Prototype (Images)<br>B5. Dynamic Identification Of Masonry Structure Prototype With Locally Resonant Metamaterial Foundation Prototype (Data) | |

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| | of-freedom vibrating table, scale 1:2 (D7.2.3) / Bova, historical centre | | | | |
| II milestone<br><br>Trimestre (ottobre-novembre-dicembre 2024) | Experimental validation in a Relevant environment of a prototype of a tuned-massdamper-inerter (TMDI) foundation isolation system for a masonry structure, to be performed in a structural dynamics laboratory with a multi-degree-offreedom vibrating table, scale 1:2 (D7.2.2) / Bova, historical centre<br><br>Experimental validation in a relevant environment of a prototype of a locally resonant | | Seismic risk of the historical-monumental heritage | A. SEISMIC PROTECTION OF MASONRY STRUCTURES<br>A1. Images Of Earthquake Damage On Masonry Structures<br>A2. Data On Seismic Vulnerability Of Historical-Monumental<br>Heritage In Calabria (Official Data, If Available)<br><br>B. BASE ISOLATION TECHNIQUES<br>B1. Vibrating Table Simulation Of Seismic Action On Masonry Structure Prototype With Tuned-Mass-Damper-Inerter Base<br>Isolation System (Simulations)<br>B2. Simulation On Vibrating Table Of Seismic Action On<br>Masonry Structure Prototype With Locally Resonant<br>Metamaterial Foundation Prototype (Simulations) | A. BOVA PALACE<br>A1. Calculation Report On A Numerical Model Of Palazzo Bova<br>(Dossier)<br>A2. Seismic Response Animation Of<br>The Numerical Model Of Palazzo<br>Bova (Video)<br><br>B. FINITE ELEMENT MODELLING<br>B1. Implementation Of Palazzo Bova Numerical Model On Finite Element Code (Example Of Interoperability<br>With Geometric Survey Database)<br>B2. Structural Calculation Of Palazzo Bova Via Numerical Model<br>On Finite Element Code (Processes) |

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| | metamaterial foundation system for a masonry structure, to be performed in a structural dynamics laboratory with a multi-degree-offreedom vibrating table, scale 1:2 (D7.2.3) / Bova, historical centre | | | | |
| **ACTION 8 - F. GIGLIO- P. FRONTERA_ act.3** | | | | | |
| I milestone<br><br>Trimestre (ottobre - novembre- dicembre 2023) | As document 11.10.2023 | As document 11.10.2023<br><br>D. 7. 1.2 / Palazzo Bova<br>Primo rilievo istruttorio ai fini delle indagini da svolgere | Climate change mechanisms of impact on tangible cultural heritage (report):<br>- Categorization of climate driver and mechanism of impact (tab)<br>- Categorization of climate driver and expected effect (tab)<br>- Categorization of Climate Change Impacts on Buildings and Structures (tab)<br>- Categorization of impacts of gradual changes in climate on outdoor cultural heritage and Climate variableson time horizon (tab) | A-<br><br>B- measures and interventions:<br>Correlation framework between physical and biological impact mechanisms, climate factors, expected effects on cultural heritage, and effects of community impacts (tab)<br><br>Numerical climate vulnerability indices (tab) for tangible cultural heritage, according to types of climate hazards:<br>• Deterioration index<br>• Carbonation index (relative to the reference substrate)<br>• Efflorescence identification<br>• Corrosion index of metal elements<br>Chloride-induced corrosion (in coastal areas). | **A-** Photo survey<br>**B-** Methodology for applying future prediction models (Ciantelli et al. 2018) (running the EC-Earth global earth system model at high horizontal resolution) to climate-induced degradation variables to study different types of material decay that might occur in the future. Specifically, all functions considered indicate an increase in surface recession, biomass accumulation, and alite dissolution and crystallization cycles in the future (2039-2068) compared to the past (1979-2008).https://www.mdpi.com/2076-3263/8/8/296<br><br>Methodology from the Keres project, funded by the German Federal Ministry of Education and Research (2020/2023) to guide climate scientists on how to better adapt climate information to the needs of cultural heritage stakeholders. The methodology would help stakeholders integrate the results of climate projections into emergency prevention and |

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| | | | - Categorisation of damages to/effects on cultural heritage and their causes and related hazards (tab)<br><br>Urgency rate index (Carroll, P.; Aarrevaara, E. 2018) Numerical index of urgency, ranging from 1 to 10. can be applied to different categories of CC (tab)<br>Cultural Heritage Vulnerability Index (CHVI) (Ravan et al. 2023) Vulnerability index for cultural heritage sites potentially exposed to multiple natural hazards, including those with sudden and slow onset, taking into account the influences of climate change (tab)<br><br>Cultural Heritage Risk Index (CHRI) (Forino et al 2016) Risk index for CH, which provides a score from 1 = almost no risk to 10 = maximum risk of loss of cultural heritage property (tab) | | management, particularly for assessing the risk of extreme events https://heritagesciencejournal.springeropen.com/articles/10.1186/s40494-022-00853-9<br><br>B- INDICI:<br>Urgency rate index (Carroll, P.; Aarrevaara, E. 2018) Methodology to gather information on where best to focus resources for the conservation of cultural heritage sites in the future by developing an urgency index. The proposed numerical index, which ranges from 1 to 10, can be applied to different categories of CC (e.g., warmer climate, longer growing season, increased rainfall, heavy rainfall, and extreme winds), to be evaluated both in terms of rate of change (e.g., increase in ◦C/year, days/year, mm/year, mm/hour, or m/s, respectively) and visual inspection of affected structures or materials.https://www.mdpi.com/2076-3263/8/9/322<br><br>Cultural Heritage Vulnerability Index (CHVI) (Ravan et al. 2023) vulnerability index for heritage sites potentially exposed to multiple hazards, including sudden-onset and slow-onset hazards, considering the influences of climate change. Through the determination of particular criteria and indicators, the heritage vulnerability index incorporates structural and nonstructural factors of the heritage site and its local and national contexts. http://www.ijdrs.com/article/doi/10.1007/s13753-023-00463-4?pageType=en<br><br>Cultural Heritage Risk Index (CHRI) (Forino et al 2016) Risk index for CH, provides a score from 1 = almost no risk to 10 = maximum risk of loss of cultural heritage assets. The index is designed to be applied to particular sites and first involves three categories of analysis: hazard analysis, exposure analysis, and vulnerability analysis. The results of |

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| | | | | | these analyses are then combined and subjected to a hazard analysis to obtain the result.<br>Modeling of different types of environmental hazards is also related to disaster risk reduction (DRR) and disaster risk management (DRM) in order to reduce the impact of various disasters, such as the impacts of climate change.https://www.academia.edu/28668077/A_proposed_assessment_index_for_climate_change_related_risk_for_cultural_heritage_protection_in_Newcastle_Australia_ |
| II milestone<br><br>Trimestre (Gennaio febbraio marzo 2024) | D. 7. 2.4/ Palazzo Bova<br>Material characterization tests at TEST MAT & COM Laboratory (resp. Prof. F. Giglio) and MATEES (resp. Prof. P. Frontera) for the purpose of reading the physical constitution of the materials constituting the artifact :<br>- Scanning Electron Microscopy And Sem-Ed Microanalysis.<br>- X-Ray Diffractometry (Xrd)<br>- Tg-Dta Thermal Analysis | D. 7. 2.4/ Palazzo Bova<br>• Microsampling of artifact samples<br>• Portable X- ray Fluorescence Spectrometry Xrf (nondestructive analysis) | | A-<br><br>B- Numerical indices of climate vulnerability for Bova's architectural heritage (from material characterization tests), according to local climate hazard types (tab) | |
| **ACTION 8,9 - C. NAVA_** | | | | | |

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| *I milestone*<br><br>Trimestre OTTOBRE-NOVEMBRE-DICEMBRE 2023 | **Action 8 – Activity 5 – D 7.1.2** (Palazzo Bova, Costa Palizzi): Elaboration of the Atlas structure for the organization of climate scenario data. | | ***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** Comprehensive research report on climate change mechanisms impacting cultural and natural heritage.<br><br>• **Risk Category:** Climate-induced deterioration and damage to heritage sites; Increased erosion due to extreme weather events; risks to structural integrity from temperature fluctuations.<br><br>***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** Clear understanding of prototype requirements and specifications; early-stage designs of 8 prototypes.<br><br>• **Risk Category:** Inadequate design response to climate change; inefficiency in energy use | **INPUT**<br><br>**A - Presentation of Themes on Environmental Safety and Climate Change**<br><br>• **Content (A1):** Overview of climate change impacts on cultural and natural heritage sites, highlighting vulnerabilities.<br>• **References (A2):** Studies and reports on climate change effects specific to heritage structures.<br><br>**B - Measures and Interventions for Environmental Safety**<br><br>• **Data and Texts (B1):** Strategies for mitigating climate change impacts on cultural and natural heritage sites.<br>• **Models and Simulations (B2):** Climate models showing potential future impacts on these sites.<br>• **Interoperability (B3):** Connection with climate databases and platforms for extended data access.<br><br>**OUTPUT** | **INPUT**<br><br>**A - Contribution to the Presentation of case studies Prototypes**<br><br>• **Content (A1):** Dossiers, photos, and videos of climate change impacts on cultural and natural heritage.<br>• **Graphic Tables and Links (A2):** Visual aids and external references to studies on climate change and heritage conservation.<br><br>**B - Methodologies Used (Referencing Sections 1, 2)**<br><br>• **Data and Texts (B1):** Documentation of research methods and findings on climate impacts.<br>• **Graphics, Processes, Workflow (B2):** Visual representations of the research and analysis process.<br>• **Interoperability (B3):** Integration with climate research databases and platforms. |

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| | | | leading to higher CO2 emissions.<br><br>**Data/Product Transfer:**<br><br>reports and climate scenario models; data visualization tools to represent climate change impacts | • **DM - Digital Model - Climate Change Impact Visualization:** Digital 3D model illustrating the effects of climate change on a specific historical building, and on the coastal area. The model would integrate data from climate change reports (A2) and simulations (B2) This would be a tool for understanding and planning strategies to preserve cultural and natural heritage (B1).<br><br>• **Climate Impact Visualization:** This digital 3D model displays the impact of climate change, blending in data from climate reports and simulations to highlight vulnerabilities and potential damage. It serves for exploring and aiding in the preservation of cultural heritage by demonstrating the effects of climate change. | **OUTPUT**<br><br>• **DM - Digital 3D Model for Case Studies:** This model will showcase interactive elements such as dossiers, photos, and videos (A1) to provide a comprehensive view of the impacts. The model would also incorporate graphic tables and links (A2) to external studies, offering deeper insights into the climate change effects and heritage conservation efforts.<br><br>• **Visual Representation:** The model will use various forms of media like images and videos to tell the story of how the prototypes were developed, from their initial concept to the finished product. |

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| | | | | • **MM - Manufactured Model (MM) - Prototype:** By using additive manufacturing, focused on the urban historical centre and on the urban coastal area. The model would represent how these interventions could protect natural heritage sites from rising sea levels extreme weather events, same for the historical building area, as identified in climate models (B2) and connected to climate databases (B3).<br><br>  • **Physical Representation:** The model in additive manufacturing, displays prototypes designed for urban historical centers and coastal areas, demonstrating how they integrates elements from climate models and databases, and how these prototypes respond to various climate challenges. | |

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| *II milestone*<br><br>Trimestre GENNAIO-FEBBRAIO-MARZO 2024 | **Action 9 – Activity 1 – D 7.2.4** (Palazzo Bova, Costa Palizzi): Digital atlas of models, data, and information on transition scenarios with CC neutrality. | **Action 9 – Activity 1 – D 7.1.3**: *(Palazzo Bova, Costa Palizzi)* Development of System and Component Prototypes based on Digital Atlas scenarios. | ***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** Refined high-performing models; preliminary LCA results; documented case studies showcasing digital atlas applications.<br><br>• **Risk Category:** underestimation of climate change impacts; failure to anticipate the severity of environmental changes.<br><br>**Data/Product Transfer:**<br><br>Upload refined models, initial LCA results, and case studies to the platform. Ensure the platform supports interactive models and case study presentations. | **INPUT**<br><br>**A - Presentation of Themes on Environmental Safety and Climate Change**<br><br>• **Content (A1):** Descriptions of prototypes designed to withstand climate-induced environmental challenges.<br><br>• **References (A2):** Research on innovative materials and designs resilient to climate change.<br><br>**B - Measures and Interventions for Environmental Safety**<br><br>• **Data and Texts (B1):** Documentation on prototypes' effectiveness in climate resilience.<br><br>• **Models and Simulations (B2):** Simulated scenarios showing prototypes' performance under various climate conditions.<br><br>• **Interoperability (B3):** Access to tools for environmental impact assessment and resilience planning.<br><br>**OUTPUT** | **INPUT**<br><br>**A - Contribution to the Presentation of case studies Prototypes**<br><br>• **Content (A1):** Media showcasing the development of prototypes for climate resilience.<br><br>• **Graphic Tables and Links (A2):** Diagrams and references to describe materials and design methodologies.<br><br>**B - Methodologies Used (Referencing Sections 1, 2)**<br><br>• **Data and Texts (B1):** Details of the design and testing processes for prototypes.<br><br>• **Graphics, Processes, Workflow (B2):** Workflow diagrams and process maps for prototype development.<br><br>• **Interoperability (B3):** Access to design and simulation tools.<br><br>**OUTPUT** |

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| | | | | • **DM - Digital 3D Model of Climate-Resilient Prototypes:**<br>This model will present a range of prototypes designed to visualize the environmental challenges (A1). It will integrate research on innovative materials and designs that are resilient to climate change (A2). The digital model will also feature simulations (B2) to showcase the performance of these prototypes under different climate conditions, providing a dynamic and interactive way to evaluate their effectiveness.<br>• **Digital Prototypes:** This digital 3D models showcases various prototypes, each designed to address specific environmental challenges, incorporating cutting-edge materials and designs known for their resilience to climate change. | • **Digital 3D Model Showcasing Prototype Development:**<br>This model will feature media (A1) that visually narrates the journey of developing prototypes for climate resilience, including various stages from concept to completion. It will incorporate graphic tables and links (A2) to provide detailed insights into the materials used and the design methodologies behind these prototypes. The model would also present data and texts (B1) related to the design and testing processes, offering a comprehensive view of how these prototypes are conceptualized and evaluated. Interactive elements, such as workflow diagrams and process maps (B2), will be included to illustrate the step-by-step development of these prototypes.<br>• **Visual Narration:** The model features images and videos |

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| | | | | • **MM - Manufactured Model - Environmental Safety Intervention Prototype:** This physical model will embody the documentation (B1) of various prototypes, demonstrating their real-world effectiveness in enhancing climate resilience. It will also illustrate the interoperability (B3) aspect by integrating tools for environmental impact assessment and resilience planning into the model, showing how these prototypes can be incorporated into broader environmental safety strategies.<br><br>• **Physical Prototypes:** The model physically represents various prototypes, each demonstrating how they effectively enhance climate resilience in real-world scenarios, based on detailed documentation. | that chronologically depict the development of the prototypes, from their initial design concepts to the final, completed forms. It includes interactive graphic tables and links, offering deep insights into the materials and design methodologies used, alongside data and texts that explain the design and testing processes of these prototypes. |
| *II milestone*<br><br>Trimestre | **Action 9 – Activity 1 – D 7.2.4** (Palazzo Bova, Costa Palizzi): Continued | **Action 9 – Activity 3 – D 7.2.5**: *(Palazzo Bova)* | ***Palazzo Bova*** | **INPUT** | **INPUT** |

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| APRILE-<br>MAGGIO-<br>GIUGNO<br>2024 | work on the digital atlas including LCA and integration.<br><br>. | Prototype development focusing on integration and parametric design, and data collection | **Type of Content:** Detailed LCA reports for top models; integration strategies; digital atlas with models assessing CC neutrality.<br><br>• **Risk Category:** Inefficient integration strategies for climate neutrality; insufficient strategies to mitigate CO2 emissions in model applications.<br><br>***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** Preliminary performance results; comprehensive dataset informing prototype development.<br><br>• **Risk Category:** Inadequate performance data leading to ineffective climate resilience strategies; prototypes not aligning with rising temperature scenarios. | **A - Presentation of Themes on Environmental Safety and Climate Change**<br><br>• **Content (A1):** Information on the role of digital atlas in climate scenario planning and environmental safety.<br><br>• **References (A2):** Background studies on climate scenario modeling and environmental impact assessment.<br><br>**B - Measures and Interventions for Environmental Safety**<br><br>• **Data and Texts (B1):** Reports on the integration of climate scenarios planning.<br><br>• **Models and Simulations (B2):** Tools demonstrating the use of the digital atlas in environmental safety analysis.<br><br>• **Interoperability (B3):** Links to platforms for climate data sharing and environmental safety resources.<br><br>**OUTPUT** | **A - Contribution to the Presentation of case studies Prototypes**<br><br>• **Content (A1):** Materials related to the digital atlas and its role in climate scenario planning.<br><br>• **Graphic Tables and Links (A2):** Visual presentations and links to resources on LCA and climate neutrality.<br><br>**B - Methodologies Used (Referencing Sections 1, 2)**<br><br>• **Data and Texts (B1):** Descriptions of methodologies used in digital atlas creation and analysis.<br><br>• **Graphics, Processes, Workflow (B2):** Infographics detailing the atlas integration and LCA process.<br><br>• **Interoperability (B3):** Links to related LCA databases and climate scenario modeling tools.<br><br>**OUTPUT** |

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| | | | **Data/Product Transfer:**<br><br>Upload detailed LCA reports, integration strategies, and digital atlas updates; facilitate the sharing of models and integration techniques. | • **DM - Digital Atlas Integration Model:** This digital model will highlight the role of the digital atlas in climate scenario planning and environmental safety (A1). It will incorporate background studies and references (A2) related to climate scenario modeling and environmental impact assessment. Interactive features within the model will showcase how climate scenario planning is integrated using data and texts from various reports (B1). The model will also include tools (B2) that demonstrate the practical application of the digital atlas in conducting environmental safety analyses. Interoperability features (B3) will be emphasized, displaying how the digital atlas connects with various platforms for climate data sharing and access to environmental safety resources.<br><br>• **Digital Prototypes:** It | • DM - **Digital Model - Case Study Visualization for Digital Atlas in Climate Planning:** This digital model will focus on presenting materials (A1) related to the digital atlas, particularly its role in climate scenario planning. It will include graphic tables and links (A2) offering visual presentations and resources related to Life Cycle Assessment (LCA) and achieving climate neutrality. Infographics and visual aids (B2) will be integrated to detail the process of atlas integration and LCA, offering a clear visualization of these complex processes.<br><br>• **Visual Narration:** It integrates graphic tables, links, and infographics to provide detailed visual presentations on Life Cycle Assessment |

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| | | | | features interactive elements that illustrate the integration of climate scenario planning, with tools that demonstrate the digital atlas's application in environmental safety analysis and its interoperability with other climate data platforms. | (LCA) and paths to climate neutrality, clearly illustrating the intricacies of atlas integration and environmental assessment processes.<br><br>• **MM - Manufactured Model - Physical Representation of Digital Atlas Integration:** This physical model will represent the workflow and methodologies involved in the development of the digital atlas. The model will also highlight the interoperability (B3) aspect by including physical representations or markers indicating connections to relevant LCA databases and climate scenario tools.<br><br>• **Physical Prototypes:** The model physically depicts the various stages and methods used in |

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| | | | | | developing the digital atlas, offering a tangible understanding of the entire process. |
| *II milestone*<br><br>Trimestre LUGLIO-AGOSTO-SETTEMBRE 2024 | **Action 9 – Activity 2 – D 7.2.4**: *(Palazzo Bova, Costa Palizzi)* Simulation methodologies for predictive efficiency scenarios regarding sustainable materials.<br><br>**Azione 9 – Attività 3 – D 7.2.5** *(Palazzo Bova, Costa Palizzi)* *Prototype development: models and information* | **Action 9 – Activity 3 – D 7.2.5**: *(Palazzo Bova, Costa Palizzi)* Prototype development with 3D printing and model testing. | ***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** comprehensive database on sustainable materials; initial simulation results.<br><br>**Type of Content:** Physical 3D printed models; on-site performance data; feedback for prototype refinement.<br><br>• **Risk Category:** Evidence of materials that are not durable under extreme climate conditions; prototypes not meeting the demands of increased temperatures and weather variability. | **INPUT**<br><br>**A - Presentation of Themes on Environmental Safety and Climate Change**<br><br>• **Content (A1):** Insights into sustainable materials for climate resilience in construction and heritage conservation.<br>• **References (A2):** Research on the lifecycle and environmental impacts of sustainable building materials.<br><br>**B - Measures and Interventions for Environmental Safety**<br><br>• **Data and Texts (B1):** Database of sustainable materials and their effectiveness in climate adaptation.<br>• **Models and Simulations (B2):** Simulation results for | **INPUT**<br><br>**A - Contribution to the Presentation of case studies Prototypes**<br><br>• **Content (A1):** Documentation of sustainable materials and their applications in climate-resilient construction.<br>• **Graphic Tables and Links (A2):** Graphics and references to studies on sustainable materials and building technologies.<br><br>**B - Methodologies Used (Referencing Sections 1, 2)**<br><br>• **Data and Texts (B1):** Descriptions of the simulation methodologies for sustainable materials.<br>• **Graphics, Processes, Workflow (B2):** Visual guides to simulation |

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| | | | **Data/Product Transfer:**<br><br>Database on sustainable materials with initial simulation results; 3D model designs and testing results, including performance data. | sustainable materials under climate stress tests.<br><br>• **Interoperability (B3):** Connectivity with databases focusing on sustainable construction and climate resilience.<br><br>**OUTPUT**<br><br>• **MM - Manufactured Model - Sustainable Materials and Climate Resilience Prototype:** This model will physically represent various sustainable materials used in construction and heritage conservation, demonstrating their role in climate resilience (A1). It will incorporate elements or segments that depict the lifecycle and environmental impacts of these materials, based on the referenced research (A2). The prototype will also feature a digital database or a visual directory (B1) of these sustainable materials, highlighting their properties and effectiveness in adapting to climate changes. Parts of the model could be designed | processes and material testing.<br><br>• **Interoperability (B3):** Integration with databases and platforms for sustainable construction materials.<br><br>**OUTPUT**<br><br>• **MM - Manufactured Model - Sustainable Construction and Material Testing Prototype:** Physical Prototype Displaying Sustainable Materials in Construction: This model will showcase a variety of sustainable materials used in climate-resilient construction, represented through different prototypes (A1). It will include graphic elements or embedded displays showing tables and links (A2) related to studies on sustainable materials and building technologies The prototype will be designed to illustrate the simulation methodologies (B1) used to test these materials. This might include |

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| | | | | to demonstrate simulation results (B2), showing how these materials perform under different climate stress tests, such as extreme weather conditions or prolonged exposure to environmental factors. Interoperability (B3) would be a key feature, with the model showcasing connectivity options or interfaces with databases and platforms focusing on sustainable construction and climate resilience. This could be represented through QR codes, interactive screens, or symbolic network connections integrated into the model.<br><br>• **Physical Prototypes:** The prototype features an interactive digital database or visual directory that details the properties and climate adaptability of these materials. Parts of the model are designed to show how these materials respond to climate stress tests, like | miniature representations of testing environments or simplified models that demonstrate how simulations are conducted. Visual guides (B2), possibly in the form of flowcharts or process diagrams, will be integrated into the prototype to depict the workflow of material testing and simulation processes. These guides can help in understanding the steps involved from material selection to final application. A key feature of the prototype will be its interoperability (B3) with databases and platforms for sustainable construction materials. This could be represented through QR codes leading to online resources, or physical slots/interfaces that symbolize data exchange and connectivity.<br><br>• **Physical Prototypes:** The model demonstrates its connectivity with databases and |

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| | | | | extreme weather conditions, through dynamic simulation displays. | platforms related to sustainable construction and climate resilience, incorporating QR codes, interactive screens, or symbolic network connections for enhanced user engagement and understanding. |
| *II milestone*<br><br>Trimestre OTTOBRE-NOVEMBRE-DICEMBRE 2024 | **Azione 9 – Attività 2 – D 7.2.4**<br>*(Palazzo Bova, Costa Palizzi)*<br>Simulation methodologies for predictive efficiency scenarios on the performance of innovative sustainable materials cultural heritage and NBS for natural heritage | **Azione 9 – Attività 2 – D 7.2.4**<br>*(Palazzo Bova)*<br>Simulation methodologies for predictive efficiency scenarios on the performance of innovative sustainable materials cultural heritage and NBS for natural heritage<br><br>**Action 9 – Activity 2 – D 7.2.4** *(Palazzo Bova, Costa Palizzi)*: Continuation of simulation methodologies, focusing on validation and achieving TRL5.<br>**Action 9 – Activity 3 – D 7.2.5** *(Palazzo* | ***Palazzo Bova, Costa Palizzi***<br><br>**Type of Content:** Validated simulation results; achievement of TRL5 for sustainable materials.<br><br>***Palazzo Bova***<br><br>**Type of Content:** Finalized and validated prototypes; comprehensive output dataset system.<br><br>• **Risk Category:** Inadequate validation of climate resilience in materials and prototypes. | **INPUT**<br><br>**A - Presentation of Themes on Environmental Safety and Climate Change**<br><br>• **Content (A1):** Finalized designs of prototypes addressing climate change adaptation and mitigation.<br>• **References (A2):** Documentation on the development process focused on environmental safety and climate resilience.<br><br>**B - Measures and Interventions for Environmental Safety**<br><br>• **Data and Texts (B1):** Findings from the | **INPUT**<br><br>**A - Contribution to the Presentation of case studies Prototypes**<br><br>• **Content (A1):** Final reports, images, and videos of prototypes addressing climate change adaptation.<br>• **Graphic Tables and Links (A2):** Visual aids and external links detailing the prototype development journey.<br><br>**B - Methodologies Used (Referencing Sections 1, 2)**<br><br>• **Data and Texts (B1):** Comprehensive documentation of the |

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| | | *Bova, Costa Palizzi)*: Finalization of prototypes and development of output dataset system for digital platform integration. | • **Specific Risks:** Sustainable materials failing to perform as expected under climate change conditions; prototypes not meeting the required standards for $CO_2$ emission reduction and temperature resilience.<br><br>**Data/Product Transfer:**<br>• Share validated simulation results and documentation on achieving TRL5.<br>• Upload finalized prototype designs and comprehensive dataset systems. | prototype testing for climate change resilience.<br>• **Models and Simulations (B2):** Demonstrations of prototype performance in climate-affected scenarios.<br>• **Interoperability (B3):** Access to platforms for climate change adaptation strategies and prototype performance data.<br><br>**OUTPUT**<br>• **DM - Digital Model - Interactive Visualization of Climate Adaptation Prototypes:** This digital model will present an interactive 3D visualization of the finalized designs of prototypes aimed at climate change adaptation and mitigation (A1). It will feature a rich digital library or archive section containing documentation and references (A2) about the development process of these prototypes, focusing on environmental safety and climate resilience. The model will include interactive | testing and validation process for prototypes.<br>• **Graphics, Processes, Workflow (B2):** Detailed workflows and process diagrams of prototype development.<br>• **Interoperability (B3):** Connectivity to platforms for sharing adaptation strategies and performance data.<br><br>**OUTPUT**<br>• **DM - Digital Model - Case Study Visualization of Climate Adaptation Prototypes:** This digital model will showcase final reports, images, and videos (A1) of prototypes designed for climate change adaptation, offering a multimedia narrative of their development and application. It will include graphic tables and links (A2) that provide users with visual aids and direct access to external resources detailing the prototype development journey. The model will |

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| | | | | elements that allow users to explore the findings from prototype testing for climate resilience (B1). Users can click on different parts of the prototypes to see data and insights about their performance under various conditions. Simulations (B2) will be a key part of this digital model. Users will be able to run virtual simulations to see how the prototypes perform in different climate-affected scenarios, such as extreme weather events or long-term environmental changes. The digital model will provide interoperability (B3) by linking to external platforms for climate change adaptation strategies and prototype performance data. These links can be embedded within the model for easy access to additional resources and data.<br><br>• **Dynamic Simulations:** Users can engage with virtual simulations within the model to | feature comprehensive documentation (B1) of the testing and validation processes for these prototypes, allowing users to delve into the specifics of how each prototype was evaluated for effectiveness. Users will be able to interact with detailed workflows and process diagrams (B2) that chronicle the development of these prototypes, offering insights into the methodologies and stages involved. The digital model will also offer interoperability (B3) by providing links or interactive elements that connect to platforms for sharing adaptation strategies and performance data, promoting a collaborative and informed approach to climate adaptation.<br><br>• **3D Prototype Visualization:** The model offers an interactive 3D view of prototypes designed for climate change adaptation and |

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| | | | | observe the prototypes' responses to different climate-affected scenarios, like extreme weather or gradual environmental shifts. The model is designed to connect seamlessly with external platforms, providing access to broader climate change adaptation strategies and detailed prototype performance data, enhancing its utility as a comprehensive tool for understanding and planning climate resilience initiatives.<br><br>• **MM - Manufactured Model - Prototype Demonstrations for Climate Change Adaptation:** This model will feature finalized designs of prototypes that are specifically developed for addressing climate change adaptation and mitigation challenges (A1). Elements of the prototype will reflect | mitigation, providing a realistic and detailed representation of their finalized designs. It includes a rich digital archive filled with documentation and references detailing the development process of these prototypes, emphasizing aspects of environmental safety and climate resilience. The model allows users to interactively explore testing results, with clickable elements on different prototype parts to reveal data and insights about their performance in various conditions.<br><br>• **MM - Manufactured Model - Physical Representation of Prototype Development:** This physical model will represent various stages of the prototype development and testing process, bringing the workflow (B2) and methodologies (B1) used to life in a tangible format. |

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| | | | | the development process, incorporating documentation and references (A2) that detail the steps taken in designing these prototypes with a focus on environmental safety and climate resilience. The prototype will also visually represent findings from testing these designs for climate change resilience (B1), such as sections of the model changing color or texture to indicate different stress test results or performance metrics. Simulated scenarios (B2) will be depicted through parts of the prototype that dynamically demonstrate how these designs perform under various climate-affected conditions, like increased temperatures, higher humidity, or flooding. Interoperability features (B3) will be integrated into the prototype, possibly in the form of interactive interfaces or QR codes that provide access to online platforms for climate change adaptation | It could feature segments or sections that visually and physically depict different stages of prototype development, from initial concept to final testing and validation. The model might include QR codes or interactive points that link to further information or digital resources (A1, A2), enhancing the educational aspect of the prototype. Sections of the model can demonstrate the testing environments and scenarios used for validating the prototypes, offering a physical interpretation of the data and texts (B1) involved in the process. The prototype will also highlight the interoperability aspect (B3) through physical representations of data exchange and connectivity with various platforms, demonstrating the collaborative nature of climate adaptation efforts.<br><br>• **Physical Prototypes:** Parts of the prototype are designed to |

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| | | | | strategies and prototype performance data. The goal of this Manufactured Model is to offer a tangible, comprehensive demonstration of how these prototypes function in real-world conditions, providing an engaging and educational tool that highlights innovative solutions for climate change adaptation.<br><br>• **Physical Prototypes:** The model exhibits the completed designs of prototypes tailored for tackling climate change adaptation and mitigation, visually encapsulating the end results of the development process. The prototype includes features like changing colors or textures to visually indicate the results of different stress tests or performance metrics, making the findings from climate resilience testing apparent and easy to understand. | dynamically show how these designs react under climate-affected conditions, such as changes in temperature, humidity, or instances of flooding, providing a real-time demonstration of their performance. The prototype is enhanced with interoperability features, including interactive interfaces or QR codes, linking to online resources for climate change adaptation strategies and performance data of the prototypes, offering a holistic and interactive learning experience. |

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| *III milestone*<br><br>1° Trimestre | **[act. 1 D7.3.2]<br>Integrare i prototipi digitali (DM) della Milestone 2 in modelli aggiornati per la fabbricazione additiva. Verificare la coerenza con i risultati (es. D.7.3.2).** | | | | |
| *III milestone*<br><br>2° Trimestre | **[act. 2 D7.3.2]<br>- Avviare la stampa 3D di prototipi in scala ridotta (MM) in laboratorio.<br>- Confronto tra materiali innovativi e tradizionali.<br>- Sperimentare soluzioni integrate (edificio + contesto urbano).** | | | | |
| *III milestone*<br><br>3° Trimestre | **[act. 3 D7.3.2]<br>- Perfezionare e convalidare i prototipi su scala più ampia (componenti/sistemi).<br>- Condurre un secondo ciclo di test incentrato sulle sollecitazioni ambientali/strutturali (TRL5→TRL6).** | | | | |
| *III milestone*<br><br>4° Trimestre | **[act. 4 D7.3.2]<br>- Completare gli esperimenti di** | | | | |

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| | **fabbricazione additiva su casi di studio consolidati (TRL6→TRL7).**<br>**- Redigere le migliori pratiche per gli interventi sul patrimonio e sugli insediamenti.** | | | | |