DOCTORATE RESEARCH PROGRAMMES ON SUSTAINABILITY / INNOVATION-RELATED TOPICS
Attachment 6

PhD PROGRAMME IN DESIGN FOR HERITAGE: KNOWLEDGE AND INNOVATION XXXVII CYCLE

Department: Department of Civil Engineering and Architecture

Coordinator: Prof. Carlo Moccia (carlo.moccia@poliba.it)

Places available:

- "Innovation" macro-area: 3 places
- "Sustainability" macro-area: 3 places

Candidates are advised that there are separate application calls for each macro-area. Candidates who intend to apply for both programmes must submit two different applications for each macro-area,

The current document includes attachments regarding specific details for research topic fields for each macro-area.

Admission Requirements

Applicants to the PhD programme in Design for Heritage: Knowledge and Innovation must hold a second level (specialized) degree in one of the following disciplines:

- Degree diploma in Architecture awarded prior to Ministerial Decree 509/99
- LM-2 Archaeology
- LM-3 Landscape Architecture
- LM-4 Architecture and Building Engineering
- LM-4 Single Cycle 5-year degree in Architecture and Building Engineering
- LM-10 Architectural and Environmental Heritage Conservation
- LM-12 Design
- LM-23 Civil Engineering
- LM-24 Building Systems Engineering
- LM-35 Environmental and Land Engineering
- LM-48 Urban and Environmental Land Planning
- LM-89 History of Art
- 2/S Archaeology
- 3/S Landscape Architecture
- 4/S Architecture and Building Engineering
- 10/S Architectural and Environmental Heritage Conservation
- 28/S Civil Engineering
- 38/S Environmental and Land Engineering
- 54/S Urban and Environmental Land Planning
- 103/S Theories and Methods of Industrial Design
- 95/S Art History

- Degree qualifications awarded by foreign universities officially recognised as equivalent to the above degrees.

Where a qualification awarded by a foreign university has not yet been declared equivalent to an Italian university degree, the Selection Committee will decide upon the eligibility of the foreign qualification in line with current Italian regulations and those of the country of study, as well as any international treaties or agreements on qualification recognition for further study.

DOCTORATE RESEARCH PROGRAMMES ON SUSTAINABILITY / INNOVATION-RELATED TOPICS
Attachment 6

Application Instructions

Please note that the information provided in this paragraph **complements and does not substitute** that contained in arts. 2 and 3 of the Call for Applications document.

REQUIRED DOCUMENTATION

Candidates **must** upload the following documentation to their online application. **Failure to do so will result in their exclusion from the selection procedure**:

1. A **CV** following the layout of the **example** provided by Politecnico di Bari on the Politecnico website www.poliba.it in the Ricerca/Dottorati di Ricerca section. This file should be named "01.CV;

2. A **signed, valid identification document.** This file should be named ***"02.Documento riconoscimento". Only the following documents will be considered;***

   - Only ID card issued by an EU member state;
   - Only driving licence issued by an EU member state;
   - In all other cases, a fully valid passport (also non-EU citizens, including the UK);

3. **Degree qualification certification for first (Bachelor) degrees and second (specialization/Master's) degrees (or 5-year Single Cycle degrees)**. A list of all exams taken with their relative marks in both degree courses (or the Single Cycle course) should also be included, following the example prepared by Politecnico di Bari which is available from the Politecnico website in the *Ricerca/Dottorati di Ricerca* section. This file should be named "03.Titoli di laurea".

   Candidates with **a degree qualification awarded by a non-Italian university** must attach the following documents to their application, prepared by the academic institute which issued them. This supersedes any form of self-declaration:

- Degree certificate or diploma showing relative final mark;
- Official transcript of exams taken during all university study programmes, showing relative results;
- Any other type of document which demonstrates the equivalence of qualifications with those required in this application call (Supplementary Diploma, *Dichiarazione di Valore* (statement of value) issued locally).

These documents must be in Italian, French or English or translated into Italian or English and verified by an official Italian diplomatic or consular representative under the responsibility of the candidate. These should follow the guidelines set out in the document "*PROCEDURES FOR ENTRY, RESIDENCY AND ENROLMENT OF INTERNATIONAL STUDENTS AND THE RESPECTIVE RECOGNITION OF QUALIFICATIONS, FOR HIGHER EDUCATION COURSES IN ITALY FOR THE ACADEMIC YEAR 2021/22*" available at the link www.studiare-in-italia.it/studentistranieri;

4. **The candidate's thesis for specialist/Master's degree (or five-year Single Cycle degree), stating the title and name of thesis supervisor;** for graduating students whose thesis is not yet complete (see art.2), a draft version of the thesis which has been completed up to the time of application; (N.B. *draft version* implies a version of the thesis text written by the graduating candidate up to the date of application, which, in terms of chapters and pages, allows the Selection Committee to evaluate its relative content.) This file should be named "04.Tesi";

5. **A motivation letter** (maximum 3,000 characters) outlining the candidate's areas of research interest and justification for their choice of programme, preferably including their proposed research project for the PhD programme. This file should be named "05.lettera di motivazione";

6. **Research project proposal,** which must be completed in the format provided by the Politecnico di Bari; this is available at www.poliba.it/it/dottorati-di-ricerca. The proposal must include:

- research project criteria in line with art.3 of Ministerial Decree 16061/2021 and art.5 of the call for applications document;
- research topics in accordance with the PhD programme selected and relevant macro-area topic (Sustainability/Innovation, refer to attached macro-area details).

Proposals are assessed purely as part of the selection procedure and are not necessarily those which candidates will develop during the programme. This file should be named "06.Proposta di Ricerca".

OPTIONAL DOCUMENTATION

7. **Language certification** demonstrating a knowledge of English which corresponds to at least B2 level. Only non-Italian citizens may attach certification which demonstrates knowledge of the Italian language. This file should be named "07.Certificazione linguistica 1" (2, 3 etc);
8. **A self-certification declaration for any other qualification deemed suitable for evaluation** which must be signed and dated and follow the layout of the example provided by Politecnico di Bari on the Politecnico website www.poliba.it in the *Ricerca/Dottorati di Ricerca* section. In accordance with art. 46 (Statements in lieu of Certification) and art. 47 (Self-Drafted Affidavits) of Presidential Decree 445/2000 (pursuant to art. 15 of Stability Law 183/2011), candidates may not submit certificates and affidavits issued by public administrations or providers of public services for qualifications that are to be assessed. These certificates should be replaced by statements as per arts. 46 and 47 of Presidential Decree n. 445/2000). This file should be named "08. Dichiarazione altri titoli";
9. **Any publications** related to activity carried out and shown on the candidate's CV. This file should be named "9. Pubblicazione 1" (2, 3 etc.). Any such documentation must be in either Italian or English or translated into Italian or English, under the responsibility of the applicant.

All documentation must be in either Italian or English or translated into Italian or English, under the responsibility of the applicant.

In cases of large documents unavailable as electronic files or which exceed the number of MB permitted for documents, applicants may submit these separately (in paper format or as a CD or DVD-ROM), accompanied by a detailed list of contents, by 2 p.m. of the deadline date for admission applications.

Any publications submitted on paper or digital support must be sent in a closed envelope, signed along the seal, to the following address:

Magnifico Rettore del Politecnico di Bari – Direzione Gestione Risorse e Servizi Istituzionali-Settore Ricerca, Relazioni Internazionali e Post-Lauream - Ufficio Protocollo – Via Amendola 126/B, 70126 BARI (Italy)

Envelopes must display the name and surname of the candidate together with the following text: "*Concorso di Ammissione al Corso di Dottorato in*… (name of the PhD programme)". The delivery of the envelope containing publications to Politecnico di Bari - by postal service, private courier or shipping agency – is at the exclusive risk of the candidate.

Admission examination

The admission examination is based on:

1. **an assessment of qualifications held** (average exam marks, final degree mark, theses, Master's degrees, post-graduate courses, language certification, publications, etc.);

2. **an evaluation of the research project proposal**

3. **an interview** to ensure a complete evaluation of the candidate and to verify the applicant's aptitude for research and willingness to undertake experience abroad, as well as areas of research interest.

The Examination Board will assess candidates' qualifications and interview with a mark out of 100 (maximum mark for qualifications 30 and interview 70). Candidates obtaining less than 18 marks for the qualification evaluation will not be admitted to the interview.

The results of the Board's assessment for qualifications and project proposals will be published on the ESSE3 portal in the private area of each candidate.

No other results notification will be sent to the candidates.

At the end of the examination procedure, the Board will carry out an overall assessment and draw up an admission rankings list on the basis of the marks obtained by candidates in each part of the examination.

The assessment criteria for qualifications will be established by each Examination Board.

SCHOLARSHIP N. 1

UNIONE EUROPEA
Fondo Sociale Europeo

Ministero dell'Università e della Ricerca

PON RICERCA E INNOVAZIONE

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

INNOVATION-BASED TOPICS (ACTION IV.4)

SCHOLARSHIP N. 1

A. RESEARCH PROPOSAL	
a. Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and the formation of professional profiles as a response to the requirements of the business sector for innovation and competitiveness. **A development of research on topics of innovation, digital advancement and enabling technology while supporting the enhancement of human capital, determining factors in the progress of research and innovation in Italy.**	*"Meridian development design and models: the construction of a historical-critical tradition for the material culture protection in Southern Italy"* is the title of a research proposal on the issues of knowledge and innovation for the project on the enhancement and protection of cultural heritage. The aim is to stimulate the debate on the disciplinary development of design towards new fields of investigation through the digital and technologies contribution. The research intends to focus attention on the reactivation of the heritage of material and immaterial culture of Southern Italy, as a project for the economic and social safeguard of culture and territories. This research aims not to insist within the limits of local studies, but to reconnect the system of heritage policies in Southern Italy with the national one, so that the potential for development already present in the South of Italy is expressed. In this direction, the research intends to open a new system of approach: aiming at a project of integrated system that on the one hand takes into account the existing national situation, on the other aims to design

	the possibility of re-establishing a system of connection between practices of heritage protection and practices that enable the contexts to recognize their own identities, according to the coordinates dictated by technological innovations. This approach refers to the ability of design to become an active incubator for territorial specialization. The complex role of design in the cultural system can interact strategically with the concept of protection thought to be linked to the existing reality of material culture in which the social and cultural context should recognize itself. The context of southern Italy is a place where traditional artifacts, tools of craftsmanship, oral culture and rituals, assets of material culture, can become the key to understanding a modern concept of heritage protection through design. The design project aims to create new ways of access to heritage and social usability of cultural heritage, which, using the techniques of innovation, acts as a mediator of connections between objects and users. The purpose is to reconstruct around the theme of the culture of the project, a historical-critical tradition addressed to the enhancement and protection of material culture in the South.
b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students, with the aim of fostering innovation and exchange between the field of research and world of manufacturing and the certification of research project contributions within the sector of innovation (Law 240/2010, art. 24, section 3 and subsequent modifications and additions).	The recent entry of design and scientific research into the field of Heritage provides highly innovative perspectives on the practices already developed in this field, which is generally driven by the art historical-critical disciplines of art, architecture, and restoration. The tradition of these studies has privileged the monumental and artistic heritage, often leaving out some aspects that anthropologists and sociologists define as the banal and everyday culture, related to the "poor objects", ordinary and serial (see F. Dei, *Il patrimonio L'antropologia e un complesso di inferiorità*, Marsilio, 2019). This research proposal focuses on these marginal aspects of heritage protection and enhancement policies thanks to the approach developed in the last decade by design disciplines. This thesis aims to demonstrate how these aspects must be held and thought of together and how the modern concept of Heritage can be understood by combining the historical-critical perspective with that related to the

	disciplines involved in material culture (S. Verde, *Le belle arti e i selvaggi. 2019*). These disciplines can determine the appropriate role to cultural and social contexts of heritages considered subordinate. The research proposal can produce a process of social redemption for those territories that have remained on the margins of an idea of development, not only economic but also cultural, such as the areas of Southern Italy. (see. PNR objective 5). It will be able to restore cultural dignity and identity to many areas of Southern Italy, in particular its inland areas (cf. objectives of PNNR) which more than others have preserved their sapiential values. This aim will be achieved by putting on the same level of the "heritage treasures" also the ways of daily life, customs, crafts, traditions and rituals, in short, the material and immaterial artifacts, which the material culture represents. In this way it will provide cultural belonging, to strengthen social cohesion and inclusion, to activate processes to overcome territorial gaps. Therefore, the research proposal consistently intercepts the PNRR objectives with the ability to intersect Mission 1 (Digitization, Innovation, Competitiveness, Culture and Tourism) Mission 4 (Education and Research) and Mission 5 (Cohesion and Inclusion). This action is also in line with the national strategy of specialization SNSI (*Strategia Nazionale di Specializzazione*) corresponding to the sector of Tourism, Cultural Heritage and Creativity Industry, considered high potential by the PNR. In fact, it will interact systems and applications for tourism, the use of culture and the attractiveness of Made in Italy, interchange between the world of research and the productive world. It will take place by intervening on the protection and enhancement of knowledge and craft values of the territories understood as heritage, through the resources of technological innovation for the management of cultural heritage.
c. Research activity proposal, methods and contents	This project aims to develop around the theme of Cultural Heritage, a historical-critical tradition addressed to the enhancement and protection of the heritage of material culture in the South. The research intends to demonstrate the South of Italy as a place where traditional artifacts, handicraft tools, oral culture

	and rituals, assets of material culture, can become through design, the tool to understand a modern concept of heritage protection through the combination of a historical-artistic point of view with the socio-anthropological one. Therefore, what this research intends to do aims at the valorization of an idea of heritage linked to the complex system of material and immaterial culture that characterize the communities of Southern Italy and that today could make the difference also in terms of new logics of heritage protection at a national level. The proposal is to strengthen the project of innovative practices and processes of design enhancement, using the South of Italy as an ideal context. In it is possible to define the connection between the use of advanced technologies and the restitution of sapiential values of the territories, founding complex interdisciplinary practices. The interdisciplinary nature of design is now well known between design and the various fields of innovation techniques. There are already many achievements in this direction, but what this research wants to propose is to define a gap in terms of national and international recognition. The South is the place to imagine inclusive development by bringing the plane of techniques back into the international debate on inclusive societies to investigate the lack of a convincing humanistic perspective of technical civilization. (T. Maldonado, 1963). This opens the field of investigation aimed at the possibility of defining a historical-critical tradition for the protection of material culture in Southern Italy. In order to reconnect heritage policies in Southern Italy with national policies, the field of investigation will concern the action of the training and study Center for Southern Italy, Formez (*Centro di Formazione e Studi per il Mezzogiorno*) for the valorization and management of cultural heritage. Since the sixties, Formez has tried to put in place a series of functional initiatives for the enhancement and management of cultural heritage within the cultural intervention in Southern Italy as tools for economic development and for reducing the distance with the productive north of the country. In particular, the figure of its president, Sergio Zoppi, testifies in a period of time

	that goes from the '60s to the '90s, the foundation of a real strategy of action in this direction. The reference to Formez can provide research with the system of primary and secondary sources, of national and local archives, to produce the necessary apparatus for scientific and documentary research.
B. COMPANY-BASED ACTIVITIES within the Italian territory	
a. Research activity to carry out with the company	The research activity to be carried out with the company concerns the investigation of theoretical and design aspects in the use of technologies applied to archival, historical-cultural and digital heritage in reference to the issues of innovation, potential and new perspectives. In fact, the company deals with the design of installations of museums and exhibitions, with a basic vocation for research and experimentation. The objective shared with the company to conduct the research activity is to generate value, starting from the heritage of the history of our country for the preservation, communication and enjoyment of cultural heritage. The project activity that this research proposes concerns the design of the relations of cultural heritage as a design enhancement. The aim is to investigate digital technological solutions to be applied to the field of culture, museum layouts, exhibitions, tourism and territorial promotion. The research activity to be carried out will concern the category of museum layouts in order to establish a direct connection with the material and immaterial culture and with the history of social identities and typical knowledge. The search for integrated scenic structures and innovative multimedia solutions represent a processual vision of design focused on innovation, understood as a relationship between the user, the cultural heritage and its context.
b. Period of company-based study and research	10 months
c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery	The impact of the research proposal on the measures fielded by RE-ACT EU, “Recovery Assistance for Cohesion and the Territories of Europe”.

SCHOLARSHIP N. 1

Assistance for Cohesion and the Territories of Europe programme (REACT-EU): **quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.**	The goals of RE-ACT are fully intercepted in the research. These are to promote overcoming the effects of the crisis in the context of the COVID-19 pandemic and its social consequences, and to prepare for a green, digital and resilient recovery of the economy. The research intends to exploit Southern Italy as an ideal context in which to define the connection between the use of advanced technologies and the restitution of meaning to the sapiential values of the territories. In order to do this, it is possible to give back the right role to the cultural and social contexts of belonging of the heritages considered subordinate and to implement a real cohesion and social inclusion. The aim is to reconstruct around the theme of Cultural Heritage a historical-critical tradition addressed to the enhancement and protection of material culture in the South. The target placed will have as result indicator: 1. For the first year is planned the logical construction of a database, intended as a reconnaissance base for a digital platform capable of categorizing a first unprecedented reconstruction of the historical-critical tradition for the protection of material culture in Southern Italy. 2. For the second year, the database will be enriched with the system of primary and secondary sources, in order to produce the necessary apparatus for a scientific and documentary research able to open the research to the wider scientific community. The study will be based on the sources provided by the national and local archives of Formez and Svimez. 3. For the third year, the database will be transformed into a tool of divulgation, mainly related to the disciplines of information design, able to give back to communities and territories the value of their material culture. In this way it will be possible to define processes of heritage protection able to regenerate the cultural assets in new collective values for the construction of a new and shared value of material culture. In this phase the artifacts of material and immaterial culture, often seen as "relics" or "treasures" disconnected from the relationship with their own time, become the protagonists of a new phase of cognitive and social re-appropriation. Thanks to the construction of this

	database, the divulgation does not concern the alienating parameters of spectacularisation, but those of knowledge and the re-appropriation of one's own identity. 4. Finally, it is intended to produce at least three publications a year related to the progress of the research.

SCHOLARSHIP N. 2

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

SUSTAINABILITY-BASED TOPICS (ACTION IV.5)

SCHOLARSHIP N. 2

A. RESEARCH PROPOSAL **GreenHouse** *Nature enters the house*	
a. Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and overlap of knowledge and skills to promote the development of innovative products and services with reduced environmental impact, focusing on topics such as; **- protection of the ecosystem;** **- biodiversity;** **- reduction of climate change impact;** **- enhancement of sustainable development** **in order to promote green recovery and overcome the effects of the Covid-19 pandemic crisis**	The condition of isolation in the house, to which we were forced by the COVID -19 pandemic, has made even more evident the 'bleak poverty' of the domestic space that characterizes much of the Italian public housing heritage built in the second half of the Twentieth century. The crisis started by the pandemic has shown the inadequacy of the housing models adopted for the construction of our suburbs. A typological and functional inadequacy of the residential buildings and a morphological and functional inadequacy of the urban spaces on which the houses overlook. The proposed research assumes the directions of recovery plans that require responding to the construction of a new quality of living spaces (SNSI 5.4.3), developing intervention strategies on the private and public residential building heritage that provide for the maintenance and rehabilitation of existing buildings. The *green transition* in the city will also be

	achieved through a new architectural relationship between the spaces of the house and the urban exterior, improving the quality of life and, at the same time, the energy-related economy of residential buildings. The proposed research theme is part of a consolidated tradition of studies that question the ways of establishing the relationship between city and nature, recognized as essential for a progressive condition of contemporary living. In this perspective, the development of research would offer a significant contribution to the improvement of the quality of living - determined by the re-signification of the relationship between the spaces of the house and external spaces -, an energy efficiency of buildings - mainly achieved with 'passive' techniques -, together with to an improvement of the urban environmental welfare, pursued through the re-naturalization of the urban free space. The impact that this study can have is very high when compared to the transformations of the domestic and urban environment and the energy savings that would be activated. For this reason, the results of the research have great relevance to the objectives identified for the *green transition* process. In Europe, the issue is being investigated by researchers who are defining transformation techniques of the building heritage built in the second half of the Twentieth century that do not involve the systematic demolition of buildings. With respect to the saturation of the urban territories of our country, the idea of *building on the built* or of intervening in any case with a transformation of existing building fabrics, avoiding further consumption of land and a large production of material to be disposed of, would strongly interpret the concept of sustainability on the settlement plan.
b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students and grant funding to Sustainability-based research projects.	The problematic nucleus proposed by the research takes on the themes of the *green revolution* and *ecological transition* in the perspective of a renewal of the significant public housing heritage existing in Italy. In accordance with the research priorities expressed by the PNR 2021-27 (5.2.5), the proposed theme arises from the perspective of intervening on the existing residential fabrics in order to establish a new relationship between the places of domestic living and the spaces of nature placed in the city. Taking as a reference some important experiences conducted in Europe - such as those of Lacaton & Vassal, whose work was recently awarded the prestigious Pritzker Prize 2021 - the research intends

	to develop a system of design strategies capable of reconfiguring the spatial characteristics of the house, especially in the 'habitable thickness' which, delimiting the house, separates it from the urban exterior. In this sense, the research aims to elaborate a series of architectural elements and constructive solutions, capable of overlapping and integrating with existing buildings, determining a typological transformation. 'Light' architectural elements such as loggias, greenhouses, *ombracula*, juxtaposing the existing buildings would build new neighboring places in the house, more open and oriented towards the relationship with the outside. These elements, equipped with habitable spatial depth, would have the ability to enrich the life of the house, while at the same time proposing a new way to improve the energy efficiency of existing buildings. In this direction, the reconfiguration of the threshold spaces of the house would propose solutions deeply established in a Mediterranean idea of living. Protecting the house from the winter cold and above all from summer-sun radiation - which as a consequence of climate change will constitute the prevailing environmental problem in the energy economy of the house - these 'light' architectural elements will simultaneously redefine the character of the buildings and the urban 'decor', now neglected, of the suburbs where the buildings are located. The improved energy efficiency of buildings will thus be accompanied by a *new beauty* of the urban space. With reference to the projections of the PNR, the research intends to define transformative actions that offer prospects for intervention on the building heritage that are not univocally achieved with the demolition of the buildings. Starting from the places on the outskirts of the city, we want to define strategies capable of significantly improving the housing quality of the residence, contributing to the creation of a new urban *welfare*. The themes proposed are also included in the SNAI (National Strategy for Inland Areas), which identifies in the research on *Technologies for Living Environments* (5.3.12) and on *Health, Nutrition, Quality of Life* (5.4.3) the opportunity to make living places integrable in more complex systems such as those of the urban environment.
c. Research activity proposal, methods and contents	The research will be developed according to a methodology based on the following aspects:

SCHOLARSHIP N. 2

	- *Multidisciplinarity and interaction for solving complex problems* The research is based on the belief that, in the experience of the architectural discipline, there are housing and settlement models to be updated, capable of responding to the problems of contemporary living. The critical analysis of these models and their renewed interpretation is one of the objectives of the study to be addressed. The typological transformation of the buildings, starting with the reconfiguration of the space of the residence, is defined in the tension between the need to adapt to contemporary lifestyles and the urgent need to reconfigure the collective spaces of the city. The assumption of these issues makes it necessary to implement a complex program that can only be complied with through the involvement of a plurality of disciplinary sectors, going beyond the concept of autonomy of the individual disciplines as a function of an integrated project concept. We intend to conduct this research through a multidisciplinary logic that intersects the disciplines of architectural design, urban planning, the study of type-morphological characters and the history of architecture. - *Multiscalar approach* Understanding the characteristics of the residence requires a systematic analysis that addresses the problem at different scales. It is possible to identify a "micro-scale" corresponding to the apartment, and a "macro-scale" which corresponds to the scale of the building to which it belongs. The relationships between spaces and between the parts of which each building is made up must be rethought with respect to the rituality and sequentiality of the actions of daily living, the needs of the uses, defining the interventions on the public building heritage as integral parts of an urban concept. - *Complementarity between theoretical study and experimental approach* The structure of the research project, in each phase of its development, is articulated on a double work plan, combining the development of theoretical issues of general value with design experimentation, centered on the identified case studies. The complementarity between knowledge and know-how, between theory and practice, constitutes a foundation of the research.

SCHOLARSHIP N. 2

	- *Connection with the territory and with the subjects who work there* The research project is primarily aimed at cities and the local area, at the entities that govern them and at companies in the construction sector active in the field of residential construction. The public housing heritage, to which the project is addressed, constitutes a resource whose recovery and renewal in a 'green' key can reactivate regenerative processes at the social and economic development level with a significant impact on city life.
B. COMPANY-BASED ACTIVITIES within the Italian territory	
a. Research activity to carry out with the company	Part of the research will be developed at company partner, a point of reference for local authorities and construction companies in building innovation and urban transformation projects. This will guarantee the research a concrete relationship with the reality of the building market and with the operators interested in the sector of the recovery and renewal of the existing residential building heritage, which is increasingly growing. Followed by an internal tutor, at the company the student will be able to experiment "in the field" the transformative strategies defined in the design phase. The research activity of the PhD student at this partner will be divided into the following phases: **Phase 1: identification of case studies** Identification, in agreement with the company, of the case studies to be taken for research development. Their identification will be aimed at defining categories of intervention useful for the subsequent experimentation phase of 'pilot' projects. **Phase 2: declination of type-morphological models to case studies** In this phase, the models developed in the theoretical-design phase will be declined with respect to the case studies, assuming all the particularities. Pilot projects will be produced which are useful not only for validating the design strategies defined in the theoretical phase, but above all for demonstrating their transformative capacity in terms of both the housing scale and the urban spatiality in which the building is located. This phase will be useful for demonstrating the effectiveness of these interventions in producing a "passive" improvement in the energy performance of buildings.

SCHOLARSHIP N. 2

	Phase 3: development of the *toolkit* for the actors of transformative processes On the basis of the 'pilot' projects, the PhD student will develop a *toolkit* of solutions and scenarios that the company can take as innovative ideas to be transferred to the governing and management entities of the existing building heritage, as well as to all operators in the sector.
b. Period of company-based study and research	6 months
c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery Assistance for Cohesion and the Territories of Europe programme (REACT-EU): **quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.**	In the short term, the doctoral research would allow to acquire an in-depth knowledge, both quantitative and qualitative, of the public housing districts of the Apulian cities, as well as sensitize the administrations and the inhabitants of the districts to the topic in question, in order to plan coordinated programs of intervention for the future management of the phenomenon. In the medium to long term, the dissemination of the results of the research and cooperation with local government entities would lead to the development of implementation programs aimed at defining the strategies for the restructuring of the aforementioned building heritage. The medium-term period would mainly concern the relaunch of construction activity, strongly supported by the new demand.
C. ACTIVITIES ABROAD	
a. Research activity abroad	The foreign partner will be a significant partner for the PhD student's research. His Research Laboratory is a reference point at the European level for studies on the transformation of the existing building heritage in a "green" key through the use of typological-formal solutions rather than only through the use of advanced technologies. The constant comparison with the design processing procedures of the *partner* firm will offer the opportunity to receive useful feedback to orient and re-orient the theoretical and practical structure of the research. Recent research works show their knowledge and know-how related to the topics covered by the proposed research. The research activity of the PhD student at this partner will be divided into the following phases:

SCHOLARSHIP N. 2

	Phase 1: recognition and interpretation of European good practices Recognition and interpretation of the most significant contemporary European experiences which, through the typological transformation of the buildings, have redefined the forms of the residence, building identity characters capable of restoring a new meaning to the space of the peri-urban city. On this issue, foreign partner is one of the most significant references at European level. This especially for the dialectic in which the search for intervention models and strategies are supported with the real experience of the project. **Phase 2: identification of the transformative strategies and techniques adopted** On the basis of the selected paradigmatic experiences, the PhD student will proceed to the identification, study and interpretation of the main transformative strategies and techniques experimented in them. **Phase 3: development of a 'manual' of formal and technical solutions** The strategies and techniques derived will be interpreted and brought back to some general principles applicable to different conditions and contexts. The work with the the partner and with the research group will be decisive for formulating and validating these paradigms through application to "real" cases.

SCHOLARSHIP N. 3

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

INNOVATION-BASED TOPICS (ACTION IV.4)

SCHOLARSHIP N. 3

A. RESEARCH PROPOSAL	
a. Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and the formation of professional profiles as a response to the requirements of the business sector for innovation and competitiveness. **A development of research on topics of innovation, digital advancement and enabling technology while supporting the enhancement of human capital, determining factors in the progress of research and innovation in Italy.**	The value of this research project is strictly linked to its chances of generating new products with a low environmental impact, thanks to the use of an ecological material, which is able to enhance the architectural aesthetics. These products will also be made using 3d printing and the so called "Open Innovation", responding to the increasing need of customized objects. Through this and through the labor and research systems, PhDs will be allowed: - to have the skills to face the business changes; - to give companies the chance of exploiting the technological innovation of digital manufacturing; - to access to a complex and fragmented labor market which requires flexibility; - to reach new opportunities; - to collect the skills to guide the inclusion in the professional activity; - to face professional obsolescence; - to learn technical skills relating to specific roles of control and coordination of the production cycle within companies. All these steps are now indispensable for the employment of research doctors in the work system.

SCHOLARSHIP N. 3

b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students, with the aim of fostering innovation and exchange between the field of research and world of manufacturing and the certification of research project contributions within the sector of innovation (Law 240/2010, art. 24, section 3 and subsequent modifications and additions).	This research project aims to create a new disciplinary field, in order to define a new design method that takes into consideration geometric, static and constructive principles for the realization of vaulted space and that uses modern additive manufacturing techniques. The final objective is to create innovative fabrication processes for the production of construction components. Both complex innovative materials and traditional ones will be studied. Additive manufacturing can be applied to architecture and design taking advantage of interchangeability and customization possibilities. Thanks to 3D printing every detail can be designed responding to the peculiarities of the project. Moreover, digital files can be easily exchanged and modified by designers all over the world and adapted to the needs of new customers. Another research theme will deal with innovative and sustainable materials and with the use of waste materials. The goal is to use stone powder and clay from Apulian quarries, for the purpose of exploiting local resources and starting a green process in which waste materials become a resource.
c. Research activity proposal, methods and contents	This research aims to realize large scale objects through additive manufacturing. This technique will be used both for stereotomic design installations, producing blocks that will be assembled through dry mounting later, and for monolithic constructions realized printing fluid material. The prototyping phase will take place thanks to the use of innovative systems as a multi-axis system or a robotic arm. Those are able to print fluid material similarly to a standard 3d printer but have more freedom degrees to move in the space. The main idea is to use innovative materials and to renew the traditional ones through AM, in order to build both stereotomic and massive systems that can help enhance and preserve architectural heritage. Some applications may concern, for example: • Architectural design: continuous wall systems, vaulted spaces, bricks, multifunctional ashlars; • Restoration: additions, completions, reconstruction of missing parts of buildings; • Modeling: models for informative purposes, reconstructive hypothesis; • Design: Furniture, components, signage. At the end of this research, complex vaulted spaces, structural integrations and decorative objects must fill the list of possibilities that new materials and

SCHOLARSHIP N. 3

	innovative techonlogies offer to their users, replicating different kinds of objects with the most suitable scale and look for Architecture.
B. COMPANY-BASED ACTIVITIES within the Italian territory	
a. Research activity to carry out with the company	The purpose of the company is to promote a km0 construction, exporting exclusively technology and knowledge. As a matter of fact, AM allows to use local natural materials, reducing both production and transportation costs. The company has been involved in the production of large-scale 3D printers able to extrude fluid materials such as clay, raw earth and concrete. The company presesented the Maker Economy Starter Kit and has produced a modular system conceived for a collaborative 3d printing technique. It has has been used to realize the first 3d printed raw earth prototype. The research activity to do in collaboration with the company will consist of computational design, computational optimization and digital fabrication experiences compatible with the technology developed by the company. Moreover, a robotic arm will be tried and some tests on materials will be conducted.
b. Period of company-based study and research	6 months

SCHOLARSHIP N. 3

c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery Assistance for Cohesion and the Territories of Europe programme (REACT-EU): quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.	The results of this research will be measured in terms of digital transition, environmental impact, enhancement of human capital and sustainability, in accordance with the indicators provided by the reference action of the PON. Due to market globalization, the increase in competitiveness among professionals led to uncertainty and in some cases precariousness. This indicates that the traditional university system is not entirely adequate for a labor market characterized by an “hyper-offer” of services. In response, some institutes such as MIT and Harvard University combine "traditional" courses of study with innovative courses, for example through the mixing of design and computational aspects. Furthermore, previous research in the sector reassures that the training objectives are shared by companies which seek and need expert figures in numerical control and digital manufacturing to be employed in their staff. Their purpose is a more conscious use of production lines already active and/or to be implemented to increase competitiveness. The quantifiable targets will focus on: - obtaining opportunities for professionalization; - acquisition of skills oriented to the inclusion in the professional activity; - learning of technical skills related to the performance of specific roles of control and coordination of the production cycle within companies. - the interest of companies to seize, through this research, more effectively the opportunities offered by the technological innovation of digital manufacturing; - interest of companies to use this research to avoid professional obsolescence. The research topic allows an objective measurability of the results achieved because it is based on theoretical concepts of computational analysis, formal optimization and sustainability. It is substantiated in the development and in the laboratory validation of a specific digital fabrication methodology that aims at obtaining a "Technology Readiness Level" at least equal to 4; this value allows the validation of the research product in a laboratory environment and lays a solid basis for the achievement of further levels.
C. ACTIVITIES ABROAD	
a. Research activity abroad	The main research field will be the use of robotics in digital fabrication and how they can develop a multidisciplinary and multicultural environment that

SCHOLARSHIP N. 3

	aims to train new professionals in the sector. The state of the art of robotic application in architecture will be studied to obtain the theoretical and practical tools of computational design and artificial intelligence.

SCHOLARSHIP N. 4

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

INNOVATION-BASED TOPICS (ACTION IV.4)

SCHOLARSHIP N. 4

A. RESEARCH PROPOSAL

a. **Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and the formation of professional profiles as a response to the requirements of the business sector for innovation and competitiveness. A development of research on topics of innovation, digital advancement and enabling technology while supporting the enhancement of human capital, determining factors in the progress of research and innovation in Italy.**

This higly multidisciplinary doctoral course project aims at giving skills of immediate use in the key of the security of infrastructural networks: road, rail and energy transport.
The research concerns approaches and techniques of structural monitoring and require to combine knowledges of mechanics and structural dynamics with knowledges of measurement instruments based on radar techniques, satellite monitoring, data processing, interoperable data systems according to the paradigm of the Internet of Things (IoT), to the structuring of expert systems that are configured in all respects as Artificial Intelligence (AI) systems.
The expected social impact is the increase of the safety level and the prevention of risks, including natural ones, due to the exercise of the above infrastructures. The economic is strongly related to the early warning of defects, resulting in strong reduction of maintenance and repair costs.

b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students, with the aim of fostering innovation and exchange between the field of research and world of manufacturing and the certification of research project contributions within the sector of innovation (Law 240/2010, art. 24, section 3 and subsequent modifications and additions).
The research concerns the development of innovative structural monitoring techniques for bridges and viaducts based on the use of advanced technologies in the field of information technology and

telecommunications, such as radar interferometry, satellite remote sensing and Artificial Intelligence (AI).
The failures that have affected civil structures and infrastructures in recent decades have made it mandatory to develop appropriate structural health monitoring (SHM) techniques, which can guarantee the early warning of any damage states.
Some aspects of current techniques - requiring the installation of physical sensors, generally leading to the interruption of service of the construction, and entailing high costs - represents a strong obstacle to a widespread diffusion of structural monitoring. The use of advanced technologies might allow to develop new monitoring techniques not requiring to access the structure, working remotely, and therefore envisaging the overcome of the limitations mentioned above.
This research topic is the subject of one of the articulations (A.2 - Methods, techniques and technologies for risk monitoring and prevention) of the strategic objective 3.1 "Security of structures, infrastructures and networks" within the Great area of reresearch and innovation 3 "Security for social systems" of the NRP 2021-27, as well as with the SNSI Regional Specialization Area 5.3.11 "Smart, Secure and Inclusive Communities".
It is also a research topic with immediate applicative impact, consistently with Law 240/2010 and DM 45/2013.

c. Research activity proposal, methods and contents

The proposed research stems from some original results developed at the "Salvati" Laboratory of the Polytechnic of Bari, aimed at expand the applicative horizon of monitoring techniques based on ground radar interferometry through the use of multisensor approaches. In this way, it is possible to significantly increase the accuracy of the possible determinations, resulting in data capable of allowing forecasts on the state of damage.
The further step forward that the project proposes is to integrate information and telecommunications technologies within both the main phases of measuring the structural response and of the data analysis. In the measurement phase, the aim is to appropriately combine the data acquired by terrestrial radar interferometry with those obtained by satellite radar interferometry, in order to calibrate and validate the measurements obtained via satellite, and use them to complement those obtainable from terrestrial observation. In the data analysis phase, the large amount of data deriving from the information network, and the complexity of the problems to be faced, will also require the implementation of physical and mechanical models in Artificial Intelligence (AI) systems that can identify and manage patterns, paradigms and correlations between these data, and therefore allow the deduction of synthetic assessments of interest for the decision support of the infrastructure manager.

B. COMPANY-BASED ACTIVITIES within the Italian territory
a. Research activity to carry out with the company

The company has a consolidated experience in structural diagnostics and monitoring of structures and infrastructures. In particular, it is the reference in Italy for the Ibis radar interferometric system, an advanced and innovative instrumentation for remote and contactless dynamic identification tests.
The company will make available the skills of its technicians, and the instrumental equipment of its laboratories; also the aspect of data acquisition and their analysis will be considered.
In particular, some research goals that the company can efficiently support are:
- to cross the vibrational data measured with the radar interferometric system with data detected by traditional accelerometric systems;
- to combine radar interferometric measurements with measurements of different types aimed at verifying the correct positioning of the target points of the measurement;

- to perform dynamic measurements using two interferometers simultaneously, in order to improve the spatial resolution of the system.

b. Period of company-based study and research

6 months

c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery Assistance for Cohesion and the Territories of Europe programme (REACT-EU):
quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.
The measurability of the expected results and potential impact will be based on the following milestones:
1st year:
- 1.1: analysis of the state of the art on structural monitoring
- 1.2: analysis of the state of the art on radar interferometry as an experimental technique for measuring vibrations, from the ground and from satellite
- 1.3: analysis of the state of the art on the use of data fusion techniques in the field of structural monitoring
II year:
- 2.1: report on research activities carried out at the company
- 2.2: report on research activities carried out at the foreign university
- 2.3: report on the identification of case studies, and on expected results and problems
III year:
- 3.1: report on the application of the monitoring techniques developed to a case study concerning a significant infrastructure
- 3.2: guidelines on the use of techniques developed for monitoring the structural "health" of infrastructures
- 3.3: PhD thesis
The action is part of the initiatives aimed at "promoting overcoming the effects of the crisis in the context of the COVID-19 pandemic and its social consequences and preparing a green, digital and resilient recovery of the economy", also in line with the SDG 11 of the UN Agenda 2030 "Sustainable cities and communities", contributing to the achievement of the safety requirement of places and infrastructures enjoyed by man, with timely implementation times that guarantee a rapid impact on the real economy and on the ability to advance.

C. ACTIVITIES ABROAD
a. Research activity abroad

The aim of this research period is to investigate some theoretical reference models for the identification of damage in buildings, even in the case of buildings composed of several materials (for example, mixed steel-concrete structures), which are very common in the infrastructural field.
In particular, a collaboration already started with the Polytechnic of Bari will continue on a new criterion for the normalization of modal forms, remarkably effective for the purposes mentioned above in the context of OMA (Operational Modal Analysis) analysis.
This period abroad, although not mandatory, is appropriate to broaden the experience and horizons of the PhD student and for giving him the opportunity of connecting with an international research network.

SCHOLARSHIP N. 5

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

SUSTAINABILITY-BASED TOPICS (ACTION IV.5)

SCHOLARSHIP N. 5

A. RESEARCH PROPOSAL THE CONTEMPORARY FORESTRY PROJECT FOR TRANSITIONAL TERRITORIES.	
a. Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and overlap of knowledge and skills to promote the development of innovative products and services with reduced environmental impact, focusing on topics such as; **- protection of the ecosystem;** **- biodiversity;** **- reduction of climate change impact;** **- enhancement of sustainable development** **in order to promote green recovery and overcome the effects of the Covid-19 pandemic crisis.**	This PhD Research aims to address the issue of forestation with a systemic approach that includes spatial, social and cultural issues, as well as cultural, vegetational and ecological. The ecological crisis shows increasingly frequent extreme climatic phenomena. Despite this acceleration, the response to the areas destroyed by forest fires (among the most evident signs of the environmental disaster) prefers quantum responses in terms of tree masses to replant and C02 to absorb. With the same unreal approach far from the territories, we tend to deal with the issue of urban and peri-urban forestation as a 'stopgap solution' of immediate realization to stem the overheating effects in the city, the loss of biodiversity, more generally to stem the *climate change*. In order to understand which ones can be the lasting and sustainable results both from an

	ecological and socio-economic point of view, this reflection aims to investigate the real problems and opportunities of forestry practices of planting new trees that, in addition to being C02 storage basins, they have always been landscape architecture constructive elements. For this reason, they must necessarily be part of a complex project that holds together aspects of configuration, botany, environmental and symbolic, closely related to the territory in which they are located. Knowledge of natural and territorial dynamics can help to address management and restoration forestry policies that must be based on a qualitative-quantitative approach. The aim is to conduct PhD research in which the fusion of urban, landscape and botanical knowledge can produce a complex research forestry model project enjoyable by all the inhabitants – vegetation, animals, men –, the city and the territory. The urban metabolism and the effects of the recent pandemic crisis are the proof of the continuous metamorphosis of the ever-changing context in which we live. This research aims to reflect on the positive effects of the *transition* which, for a sustainable forestry project, constitutes a further level of reflection, considering the new forestation not in a separated way from urban and territorial development, but in a kind of integrated transformation, of co-evolution of processes. It is believed that only with this attitude and developing a conscious *preparedness* in the design models, we can begin to contribute to the maintenance of our terrestrial ecosystem.
b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students and grant funding to Sustainability-based research projects.	Forestation, more extensively called 'sylviculture' in PNR, is one of the means of action of the intervention area 5.2 'Climate change, mitigation, adaptation' of the area 5 'Climate, energy, sustainable mobility'. In the face of bio-physical risks that will affect us in the coming years (forest fires, the increasing

	risk of loss of animal and plant species and reduction of terrestrial biodiversity and ecosystem services), both the forestation practices and the restoration of degraded ecosystems are considered by the Plan among the 'natural ways' of 'mitigation' by which greenhouse gas emissions can be reduced. Furthermore, this research, like the action of forestry, wants to be multi-scale: the forestry project is an opportunity to create 'green infrastructure' - which also the PRN recalls - that connect the city to the territory, the periurban area to urban area, marginal spatiality to consolidated spatiality. The approach of this research aims to expand the concept of the 'green infrastructure net', incorporating the high social, symbolic, spatial value, in addition to the vegetal value that increase biodiversity. Thus, in addition to stemming the high *indoor* and *outdoor discomfort* within the city due to heat waves, wind storms, drought, it is necessary to think about the spatial configuration of the project in terms of aesthetic quality of urban spaces, that only a conscious landscape architecture project can pursue. According to the IPCC (Intergovernmental Panel on Climate Change), the protection of forests and the reduction of forest degradation is, among the others, the highest potential option of 'climate change effects mitigating tools', both in terms of environmental and social benefits. Forestry actions, combined with forest fire protection measures in risk areas, are now a priority that should not be pursued as an autonomous asset, but should be part of a broader project of land design and management. With regard to the prevention of critical or risk events and environmental monitoring, among the technological development trajectories as a national priority of the SNSI, the intention of

	this research is not to reflect on forest projects with a definitive layout, but rather to think of open configurations capable of co-inhabiting with the downturns of the contemporary city - bacterial aggressions, environmental imbalances, social mutations - intending to deal with the unpredictability of future scenarios.
c. Research activity proposal, methods and contents	There are two levels of research to work on: one that takes into account the perception and needs of an almost entirely urban population and cultural influences characterized by global issues that have to do with the concept of sustainability, environmental monitoring and disaster prevention, and the other which looks at the ongoing practices, namely deforestation for the cultivation of new land, over-exploitation due to grazing activities, the intensity of cuts in coal production, and at the same time the planned reforestation, the return of the forest on abandoned agricultural and forest areas with consequent phenomena of wild vegetation, the reforestation of the plains for agricultural purposes. Referring to this, a data survey and statistics of the presence and benefits (ecosystem services) of the forest on the national territory and in the European context, together with a study on the system of authorities, the competences and the plans that manage the forest patrimony and deal with the future one, constitutes the first scientific phase of the research. It will also be necessary to carry out a scientific survey of forest fires in southern Europe to understand their impacts, vulnerabilities and geographies. Together with this scientific phase of the research, the aim is to investigate the forest symbolic dimension and its genesis, demonstrating the cultural matrix of the forest as a place rich in suggestions in which the distinction between landscape, architecture, mythology and ecology fades. The aim is to

	broaden the concept of forestation and capture all its ecological, symbolic and spatial capacity. To trace a territorial political trajectory, the application dimension of the research is part of the directives of the Regional Landscape Plan of Apulia (PPTR) and precisely in the Strategic Scenario of the 'Patto Città-Campagna' that identifies new 'C02 parks' as places of urban reforestation close to the industrial part of the city. Going beyond the vision of the PPTR scenario, this research aims to investigate the space and the quality of a new possible forest landscape, in terms of ecology, beauty, productivity, capable of building new spatial and social transition geographies.
B. COMPANY-BASED ACTIVITIES within the Italian territory	
a. Research activity to carry out with the company	The research activities will be part of the project of the company. The PhD research will be supported by the experimental activities that the agricultural, ecological and social company conducts. Specifically, the involvement will be framed in the experimental realization of an *agroforest* that brings added value to the landscape of the company and the territory, especially in the light of the Xylella crisis in the Apulian olive monoculture. The botanical skills of the host company will be technical support to research and an opportunity for the candidate to experiment in the field a pilot project of agroforestry to be carried out with the multiplicity of criteria that the research model wants to put in place (diversity of plant species, inequality, dynamic spatial configuration). The intention is to address the issue of forestation to that of agroforestry: the integration of trees into the agricultural system diversifies and supports production to increase social, economic and environmental benefits of

SCHOLARSHIP N. 5

	land use at all levels. According to the principles of the farm that are based on practices of organic and regenerative agriculture, the project can experience the greater resilience offered by an agroforest in terms of natural ecosystems and spatial and temporal plants. The project can count on the many skills of which the company - cooperative, multicultural and intergenerational company - is composed: farmers, economists, sociologists, artists, researchers.
b. Period of company-based study and research	6 months
c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery Assistance for Cohesion and the Territories of Europe programme (REACT-EU): **quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.**	In front of REACTEU substantial investment in the green and digital transition initiatives in the metropolitan cities, the theme of forestation is central. Referring to the aims of REACTEU, during the PhD research is intended to verify the adaptability of research models during the internship at the company that is closely connected to the criticality and needs of our territory. Furthermore, it is supposed to compare the model experienced in Puglia with the foreign one during the internship abroad. The activity on the national territory will be part of a consolidated methodology by the company but will be experimental on the agroforestation theme. During the internship abroad, however, the research model can be compared with a model already developed and being tested in the foreign environment. During the PhD course, the 'contamination' of knowledge and skills can be realized both by the candidate in an autonomous form thanks to the urban training and experiences of landscape architecture, both during the activities in situ during the two internships. Both the host company in Puglia

	and the foreign one are in fact composed of multidisciplinary skills that can keep the strategic part and the practical one in a single co-design process.
C. ACTIVITIES ABROAD	
a. Research activity abroad	The intention is to compare the PhD research study model with the one of foreign partner. The methodology that the office adopts, developed during a thesis work, is based on the close correlation between climate adaptation of the urban environment and tree habitats. Sunlight, shade, soil moisture characteristics and soil type determine which natural habitat and plant type are suitable for a specific urban location. After the internship activity carried out at the company in which the research can take place in the specific reality of the Apulian territory, it is of great interest to make a comparison with foreign contexts, to understand all the potentials and differences of study and application models. The foreign partner already follows the construction of a pilot project of forestation in which the entire atelier collaborates. One of the interesting aspects of the research that this PhD project proposes is the founding principle of ongoing projects, that is to consider design and project management as a single process. The design phase in fact, besides the first realization, includes maintenance and monitoring, and together the three are part of a single green policy strategy.

SCHOLARSHIP N. 6

National Operational Programme 2014-2020
PhD programmes for sustainability and innovation-related subjects

Ministerial DECREE N. 1061 (10 Aug 2021)
Academic Year 2021/2022 – XXXVII CYCLE

SUSTAINABILITY-BASED TOPICS (ACTION IV.5)

SCHOLARSHIP N. 6

A. Research Proposal

THE PREFABRICATED HOUSE 4.0: DESIGN, PRODUCTION AND EXECUTION CRITERIA FOR THE DIGITAL CONSTRUCTION OF FLEXIBLE, ANTI-SEISMIC, ENERGETICALLY SUSTAINABLE AND ECOLOGICAL HOUSING MODULES.

a. Relevance of doctorate research project in creating high added value in terms of scientific, social and economic impact on Italy, fostering appropriate research models and overlap of knowledge and skills to promote the development of innovative products and services with reduced environmental impact, focusing on topics such as; **- protection of the ecosystem;** **- biodiversity;** **- reduction of climate change impact;** **- enhancement of sustainable development**	The proposed doctoral programme aims to develop an **innovative, sustainable and flexible project** and to create a prototype for a housing module (isolated or aggregatible), with integrated networks and services. This module must combine standardized components, according to a transdisciplinary approach able to combine **architecture, design and technological research**, for an architecture to support calamitous events, pandemics and immigrations (emergency events), or planned and scheduled (residential, tourist and accommodation; with educational or exhibition function; construction sites, buildings serving protected areas). This solution aims at **a temporary architecture greener thanks to the use of i4.0 technologies**

in order to promote green recovery and overcome the effects of the Covid-19 pandemic crisis.	**that will be tested in the integrated design phase (Cloud based, Bim), industrial prefabrication systems (Off site) in the digital manufacture on site, in the control, management and maintenance systems of the product (Digital Twin)**. The use, with its temporary character, imposes two basic requirements: that of the transience and reversibility of the construction process, or the possibility of a restoration of the original state of the places. The cycle of use of the temporary residence, moreover, does not coincide with the life cycle of the materials and components; therefore, the project must ensure the demountability and reuse, in a short time, of the structure for subsequent occasions, making the process reversible: **from construction to de-construction to "zero residues" in the wake of the circular economy**. **The minimization of environmental impact** will be guaranteed also thanks to the study of integrated solutions aimed at the **energy containment** of the housing module consisting of prefabricated panels made of **recycled and recyclable materials, used in manufacturing processes specific to industry 4.0 (modular prefabrication systems, automated assembly, additive printing, robotic processing)**; experimentation on the most performing system solutions, controlled and managed through the use of **innovative technologies** in the field of artificial intelligence, automatic controls and ICT tools, able to guarantee, at the same time, maximum indoor comfort, depending on internal flows.
b. Adherence of doctorate research project to National Strategies of Intelligent Specialisations (SNSI) and PNR and applicability to Law 240/2010 and Ministerial Decree 45/2013 regarding PhD students and grant funding to Sustainability-based research projects. .	The research proposed aims to identify the design criteria and technical-functional requirements for the realization of the prototype of a sustainable temporary housing module, consisting of prefabricated panels, capable of promoting innovation also in the production process, and having the following characteristics: - modular, foldable or printed in 3D; - consisting of recycled materials; - recyclable at end of life;

	- maximum scalability and flexibility; - seismic; - containable, within the limits imposed by the dimensional standards of means of transport; - with an integrated plant equipment, managed by i4.0 systems. **The proposed research complies with M2C3: ENERGY EFFICIENCY AND UPGRADING OF PNRR BUILDINGS**. In fact, the project developed will be able, on the one hand, to reduce CO^2 emissions; on the other, to improve the comfort of users, optimizing the performance of the plants according to the people present and their flows, within the housing module, thanks to the use of intelligent management systems. For these reasons, the project is consistent with two **SNSI** Thematic Areas: for the first aspect, with the **Thematic Area "Intelligent and Sustainable Industry, Energy and Environment"** and the related Development Trajectories "Innovative production processes with high efficiency and for industrial sustainability", "Evolutionary and adaptive production systems for customized production", “Innovative and environmentally friendly materials”; for the second aspect, with the **Thematic area "Digital Agenda, Smart Communities, Intelligent Mobility Systems"** and the related Development Trajectory "Technologies for smart building, energy efficiency, environmental sustainability".
c. Research activity proposal, methods and contents	The proposed research activity will be divided into seven phases, the first of which is preparatory to the following (2-6) developed at the same time and aimed at prototyping (7): critical analysis of the state of the art in industrial processes and prefabrication systems for housing modules: 1. critical analysis of the state of the art in the field of industrial processes and prefabrication systems for housing modules; 2. architectural design of the housing module, demountable and transportable, and of its spatial components (including furniture), according to the criterion of high

SCHOLARSHIP N. 6

	scalability and maximum flexibility, containability, ease of assembly; 3. studies on typological variations: isolated and aggregatible modules; 4. integrated design of the section of the prefabricated panel, and of the mounting systems, according to the criterion of maximum energy containment and maximum CO^2 reduction; 5. verification and evaluation of technical and functional requirements (energy verification; thermohygrometric comfort verification; environmental comfort verification); 6. experimentation of the productive and executive process with technologies 4.0; 7. production of a prototype on a 1:1 scale.
B. COMPANY-BASED ACTIVITIES within the Italian territory	
a. Research activity to carry out with the company	The research activity to be carried out at the company will concern the design and testing of integrated solutions i4.0 for energy efficiency, building automation and monitoring of the housing module in prefabricated panels. In collaboration with the enterprise, the doctoral student will follow the phases of realization of the prototype.
b. Period of company-based study and research	6 months
c. Measurable nature of expected results and potential impact of implemented actions with reference to the aims of the Recovery Assistance for Cohesion and the Territories of Europe programme (REACT-EU): **quantifiable and measurable targets in doctoral research project in line with indicators set out in NOP reference of actions.**	The proposed research aims at the design of a housing model with reduced impact on the environment, also thanks to the use of i4.0 technologies, through a contamination of knowledge and skills and an approach simultaneously open to both the promotion of sustainable development and innovation. Therefore, it is perfectly in line with the thematic objectives of the **REACT-EU** which supports, among others, investments that contribute to **the transition to a digital and green economy**. The project lends itself to the measurement of results through indicators that may relate to the comparison between the performance of the

	designed modules with the state of the art, represented by the solutions currently developed and marketed. The performance of the housing modules are related to energy consumption, indoor comfort - energy-environmental performance indicators -, but also to the costs of construction, transport and assembly.
C. ACTIVITIES ABROAD	
a. Research activity abroad	Requisition and evaluation of testing of the building automation system.