Research Group

BIM technology and material innovation: from efficiency to environmental compatibility

Reference year:

2025

Scientific Coordinator:

FRANCHINO Rossella / Associate Professor / Dipartimento di Architettura e Disegno Industriale / Università degli Studi della Campania "Luigi Vanvitelli".

Group members:

CANNAVIELLO Monica/ Assistant Professor / Dipartimento di Architettura e Disegno Industriale / Università degli Studi della Campania "Luigi Vanvitelli"
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MAZZONI Elisa / Ph.D. Student / Dipartimento di Architettura / Università degli Studi Firenze
MEROLA Marica/ Research fellow / Università degli Studi della Campania "Luigi Vanvitelli"
PISACANE Nicola / Associate Professor / Dipartimento di Architettura e Disegno Industriale / Università degli Studi della Campania "Luigi Vanvitelli"
ROMANO Rosa / Associate Professor / Dipartimento di Architettura / Università degli Studi Firenze
ZERARI Salima / Ph.D. Student / Dipartimento di Architettura e Disegno Industriale / Università degli Studi della Campania "Luigi Vanvitelli"

Description of research lines:

The interdisciplinary research group is mainly interested in finding solutions oriented to the application of BIM technology at the management of the building process, focusing on the role that this digital platform has in the choice and evaluation of different materials use in relation to their performance over the entire life cycle building. Specifically, the research activity explores the role that BIM technology can play in controlling the environmental dimension of innovative building materials and, therefore, proposes the development of a set of criteria that can describe in terms of compatibility the material quality. These criteria, by putting in system more requirements (from the saving of natural resources to the mitigation and reduction of environmental impact), allow to define for each material the limitation of the footprint and the identification of the load capacity

of the same, that is, the ability to absorb and control the phenomena of environmental changes with a sustainable impact on the ecosystem. The integration between BIM technology and control criteria for the evaluation of innovative materials in the building sector is one of the most significant elements of the research providing a decision-making and control tool of the processes of obsolescence in existing building recovery and in the 'ex-novo' eco-oriented design. The BIM technology, in fact, digitally reconstructing not only the geometry of a building but proposing a virtual clone, is a support tool for the project in all its phases, allowing better control than the established traditional processes. Finally, the technological approach contribution allows to be broadened the dialogue boundaries between the building and the surrounding environmental context, which in this way can also take place through the careful use of materials.

Relationships with other research groups of the University of Campania L. Vanvitelli during the last three years:

Carbon Neutral Buildings - Scientific Responsible: prof. arch. A. Violano/DADI

Participation in research projects during the last three years:

Project title: *Green/blue/grey integration for climate adaptive urban design*
Coordinator: Prof. R. Franchino
Call title: Erasmus+ Call 2024 - Blended Intensive Programmes (BIP)
Abstract: *The proposed work aims to identify strategies for functional and dimensional insertion and adaptation of green/blue infrastructure in urban contexts characterized by high building density and with a focus on the inclusive dimension of design.*
Involved persons: prof. Christian Werthmann - Leibniz University Hannover - Germania and prof. Tobias Baur -Eastern Switzerland University of Applied Sciences (OST) - Svizzera
Partners: Dreiseitl consulting (arch. Herbert Dreiseitl and arch. Bettina Dreiseitl - Wanschura)
Status: funded 2024
Project submission: november 2023

Project title: *Challenges in Circular Construction: Implementing Multisided Procedures for Innovative Connections*
Scientific coordinator: Prof. Monica Cannaviello
Call title: Call for proposal for the funding of fundamental and applied research projects dedidated to researchers not recipients of other funding
Abstract: *The project aims to develop multisided procedures to act as a bridge between the different actors involved to create a collaborative ecosystem and promote circular transition through the development of platforms for the exchange of knowledge and best practices, for the implementation of pilot projects and innovative solutions*
Involved persons: Proff. Lucio Olivares, Manuela Piscitelli, Lorenzo Capobianco, arch. Roxana Georgiana Aenoai, arch. Marica Merola
Partners: Università degli Studi della Campania "Luigi Vanvitelli"
Status: Not funded
Project submission: march 2024

Project title: *Prospective Networks: criteria for responsive micro-environmental urban system (Pro_Nets)*

Scientific coordinator: Prof. Caterina Frettoloso
Call title: Call for proposal for the funding of fundamental and applied research projects dedicated to researchers not recipients of other funding
Abstract: *Urban regeneration projects aimed at reconnecting buildings, people, and the city with nature have shown that increasing biodiversity and continuity of use can be achieved by improving the street system, roofs, building façades, and interstitial micro-spaces. Urban small-scale can be rich in biodiversity, contribute ecological benefits for human health and help create more livable cities by increasing the green component or de-paving, introducing functional elements for collective activities, considering the overall technological-environmental balance on the one hand and the innovation and naturalness of the proposed intervention on the other. Sharing this logic, the main aim is to experiment, through a "micro and interconnected" formula, a methodology based on the definition of meta-design criteria for the preliminary selection of urban system components (micro-spaces and links) in a highly dense city both for ensuring functional continuity and to provide ecosystem services.*
Involved persons: Proff. Marco Calabrò, Claudia de Biase, Marco Francesco Errico, Rossella Franchino, Diego Matricano, Francesca Muzzillo, Nicola Pisacane, Antonella Violano, arch. Salima Zerari
Partners: Università degli Studi della Campania "Luigi Vanvitelli"
Status: Not funded
Project submission: march 2024

Project title: *Geopolymers for Advanced Eco-Architecture: A Chemo-rheology and Thermo-kinetic investigation for the development of 3D Printable formulations - GEA*
Scientific coordinator: Dott.ssa Laura Ricciotti
Call title: PRIN: Progetti di Ricerca di rilevante interesse nazionale - Bando 2022 PNRR
Abstract: *The project deals with optimizing geopolymer formulations, through the alkaline activation of different kinds of aluminosilicate wastes, for their use as materials, in the 3D-printing of advanced housing units in sustainable buildings. The project aims to develop an innovative strategy to overcome the main limits of a large-scale application of 3D printing of geopolymer materials through a systemic and highly interdisciplinary approach*
Involved persons: Proff. Raffaella Aversa, Rossella Franchino, Caterina Frettoloso, Gino Iannace, Nicola Pisacane, arch. Salima Zerari
Partners: Università degli Studi della Campania "Luigi Vanvitelli", Università degli Studi "G. d'Annunzio" CHIETI-PESCARA
Status: funded
Project submission: november 2022

Project title: *RE.VI.VE 4.0 Intersystemic models and digital transcalar meta-design platforms to REstore VIllages attractiVEness 4.0*
Scientific coordinator: Prof. Rossella Franchino
Call title: PRIN: Progetti di Ricerca di rilevante interesse nazionale - Bando 2022
Abstract: *The proposed research activity is oriented to digital platforms use to support the meta-design phase with a tran-scalary approach in order to outline a methodology that can direct the transformation/regeneration processes of small villages in a circular logic*
Involved persons: Proff. Alessandra Avella, Rossella Franchino, Caterina Frettoloso, Nicola Pisacane, Francesca Muzzillo
Partners: Università degli Studi della Campania "Luigi Vanvitelli", Università degli Studi "G. d'Annunzio" CHIETI-PESCARA

Status: not funded
Project submission: march 2022

Project title: GEA - *Geopolymers for Eco-Architecture: A Chemo-rheology and Thermo-kinetic investigation for the development of 3D Printable formulations*
Scientific coordinator: Dott.ssa Laura Ricciotti
Call title: Bando per il finanziamento di progetti di ricerca fondamentale ed applicata dedicato ai Giovani Ricercatori D.R. 509/2022
Abstract: *The project deals with optimising geopolymers (inorganic-based polymer formulations) for their use as materials for the 3D printing of new housing units in sustainable buildings*
Involved persons: Proff. Raffaella Aversa, Marino Borrelli, Rossella Franchino, Caterina Frettoloso, Gino Iannace, Francesca Muzzillo, Nicola Pisacane, Laura Ricciotti
Status: closed
Project submission: July 2022

Scientific products during the last three years:
10 scientific publications in Class A journals and/or indexed in the Scopus/WoS databases:

[1] ZERARI S., FRANCHINO R., PISACANE N., LLATAS C., SOUST-VERDAGUER B. (2024). Addressing the Difficulties and Opportunities to Bridge the Integration Gaps of Bio-Based Insulation Materials in the European Construction Sector: A Systematic Literature Review. SUSTAINABILITY, ISSN: 2071-1050, doi: 10.3390/su16198711 (RIVISTA CLASSE A) (SCOPUS) (WoS)

[2] ZERARI S., FRANCHINO R., PISACANE N. (2024). Industry Experts' Perspectives on the Difficulties and Opportunities of the Integration of Bio-Based Insulation Materials in the European Construction Sector. SUSTAINABILITY, vol. 16, ISSN: 2071-1050, doi: 10.3390/su16177314 (RIVISTA CLASSE A) (SCOPUS) (WoS)

[3] FRANCHINO R., FRETTOLOSO C., GALLO P. (2024). Regeneration of Urban Open Spaces as a Tool for Integrating Nature and Built Environment. In: A.A.V.V. (a cura di): C. Gambardella, For Nature/With Nature: New Sustainable Design Scenarios. SPRINGER SERIES IN DESIGN AND INNOVATION, vol. 38, p. 591-612, Springer, ISBN: 9783031531217, ISSN: 2661-8184, doi: 10.1007/978-3-031-53122-4_36 (SCOPUS)

[4] ZERARI S., FRANCHINO R., PISACANE N. (2024). Cost and Carbon Intensity Analysis of Different Bio-based Insulation Materials across European Countries. In: (a cura di): E. Zervas, 5th International Conference on Environmental Design and Health (ICED2024). E3S WEB OF CONFERENCES, vol. 585, ISSN: 2267-1242, Athens, Greece and Online, October 18-20, 2024, doi: 10.1051/e3sconf/202458501010 (SCOPUS)

[5] VIOLANO A., CANNAVIELLO M., PORTELLA, P. (2024) INTEGRATING INNOVATIVE CONCEPT INTO TRADITIONAL CONSTRUCTION SYSTEMS FOR DRY-STONE WALL. Criteria for circular environmental design, SMC Sustainable Mediterranean Construction, SPECIAL ISSUE N.07 2024 | The Art Of Dry Stone Walling, Knowledge And Techniques, Luciano editore, Napoli, Italy

[6] VIOLANO A., CANNAVIELLO M., FRANCHINO R., FRETTOLOSO C., MUZZILLO F. (2024). From Self-Reliant to Sufficiency Design: Predictive and Forecasting Features of Technology Approach. In: (a cura di): Calabrò F. Madureira L. Morabito F.C. Piñeira Mantiñán M.J., Networks, Markets & People. LECTURE NOTES IN NETWORKS AND SYSTEMS, vol. 1189, p. 115-126, Cham:Springer Nature, ISBN: 9783031747229, ISSN: 2367-3370, Reggio

Calabria, 22-24 May, 2024, doi: 10.1007/978-3-031-74723-6_10 (SCOPUS)

[7] ZERARI S., FRANCHINO R., PISACANE N. (2023). The potential impacts of using bio-based building materials on human health and wellbeing. In: (a cura di): E. Zervas, Proceedings of 4th International Conference on Environmental Design (ICED2023). E3S WEB OF CONFERENCES, vol. 436, ISSN: 2267-1242, Athens, Greece, 20-22 October 2023, doi: 10.1051/e3sconf/202343601006 (SCOPUS)

[8] AVERSA R., FRANCHINO R., FRETTOLOSO C., PISACANE N., RICCIOTTI L. (2023). Geopolymers for Eco-Architecture. Integrated approaches for green strategies activation. AGATHÓN, vol. 13, p. 237-246, ISSN: 2464-9309, doi: 10.19229/2464-9309/13202023 (RIVISTA CLASSE A) (SCOPUS)

[9] FRANCHINO R., FRETTOLOSO C., PISACANE N. (2022). BUILT ENVIRONMENT TRANSFORMATIONS: BIM AND CIRCULAR APPROACH. In: SMC - Sustainable Mediterranean Construction, (16), p. 156-163, ISSN: 2420-8213. (RIVISTA CLASSE A) (SCOPUS)

[10] FRANCHINO R., FRETTOLOSO C. (2022). Eco-innovative approaches as activators of the environmental reconstruction of compromised contexts. In: TECHNE - Journal of Technology for Architecture and Environment, (23), p. 134-145, ISSN: 2239-0243, https://doi.org/10.36253/techne-12109. (RIVISTA CLASSE A) (SCOPUS)

Additional 10 scientific products:

[11] FRANCHINO R., FRETTOLOSO C., PISACANE N. (2024). Open space design: managing urban complexity. Santarcangelo di Romagna (RN) Maggioli Editore, ISBN: 978-88-916-1641-8, doi: 10.30448/UNI.916.16418

[12] FRANCHINO R., FRETTOLOSO C., DE MARTINO (2024). Park am Gleisdreieck: ecological infrastructure to support the city Park am Gleisdreieck: infrastruttura ecologica a supporto della città. In: A.A.V.V. (a cura di): M. Bosone, GOOD PRACTICES FOR THE RECOVERY PROJECT BEYOND THE PANDEMIC. BUONE PRATICHE PER IL PROGETTO DI RECUPERO OLTRE LA PANDEMIA. RECUPERO, MANUTENZIONE E INNOVAZIONE DELL'AMBIENTE COSTRUITO, p. 303-314, Napoli:La scuola di Pitagora Editrice, ISBN: 978-88-6542-953-2, ISSN: 2974-8089

[13] FRANCHINO R., FRETTOLOSO C., (2024). Re-thinking Urban Open Space as a Tool for "Normality". In: A.A.V.V. (a cura di): E. Manahasa F. Naselli A. Yunitsyna, COVID-19 (Forced) Innovations Pandemic Impacts on Architecture and Urbanism. THE URBAN BOOK SERIES, p. 39-47, Springer, ISBN: 9783031566066, ISSN: 2365-757X, doi: 10.1007/978-3-031-56607-3_4 (SCOPUS)

[14] CHAIB F. L., FRANCHINO R., FRETTOLOSO C. (2024). COLLABORATIVE LEARNING IN ENVIRONMENTAL DESIGN: DIDACTIC APPROACHES. In: (a cura di): Luis Gómez Chova Chelo González Martínez Joanna Lees, ICERI2024 Proceedings. p. 3778-3784, Valencia:IATED Academy, ISBN: 978-84-09-63010-3, Seville, Spain, 11-13 November, 2024, doi: 10.21125/iceri.2024.0959

[15] FRANCHINO R., PISACANE N., ZERARI S. (2023). THE TEACHING OF INNOVATIVE SUSTAINABLE MATERIALS ACCORDING TO THE ASPECTS OF TECHNOLOGY AND MODELLING. In: (a cura di): L. Gómez Chova C. González Martínez J. Lees, 16th International Conference of Education, Research and Innovation. p. 7957-7962, Valencia:IATED Academy, ISBN: 978-84-09-55942-8, Seville, Spain, November 13th–15th, 2023, doi: 10.21125/iceri.2023

[16] ZERARI S., FRANCHINO R., PISACANE N. (2023). BIO-BASED LANDSCAPE MATERIALS FOR MITIGATION OF CLIMATE CHANGE IN CITIES. In: (a cura di): O. Zerlenga D. Jacazzi L. Corniello, CLIMATE CHANGE AND CULTURAL HERITAGE. p. 99, DADI Press, ISBN: 9788885556270

[17] DE MARTINO R., FRANCHINO R., FRETTOLOSO C. (2023). A "Stepping Stone" Approach to Exploiting Urban Density. In: AA. VV. (a cura di): E. Arbizzani E. Cangelli C. Clemente F. Cumo F. Giofrè A. M. Giovenale M. Palme S. Paris, EditorsTechnological Imagination in the Green and Digital Transition. THE URBAN BOOK SERIES, p. 639-648, Gewerbestrasse:Springer, ISBN: 978-3-031-29515-7, ISSN: 2365-7588, doi: 10.1007/978-3-031-29515-7_57 (SCOPUS)

[18] ZERARI S. FRANCHINO R., PISACANE N. (2022). An overview of innovative construction materials for enhancing the sustainability of buildings and their integration into BIM. In: JOURNAL OF ENGINEERING RESEARCH, vol. 2, ISSN: 2764-1317, doi: 10.22533/at.ed.3172242226106

[19] FRETTOLOSO C., FRANCHINO R., GALLO P. (2022). Urban environments regeneration. Technological issues for adaptive re-use. In: (a cura di): C. Gambardella, BEYOND ALL LIMITS Proceedings on International Conference on Sustainability in Architecture, Planning, and Design. p. 173-177, DADI _ PRESS, ISBN: 9788885556232, Monumental Complex of the Real Belvedere of San Leucio, Caserta – Italy, 11-12, 13 May_2022

[20] R. FRANCHINO, C. FRETTOLOSO (2022). INTEGRATED GREEN STRATEGIES TO MAKE CITIES MORE LIVEABLE. ABITARE LA TERRA, p. 64-67, ISSN: 1592-8608 (RIVISTA CLASSE A)

Relationships with international and national Companies, Institutions, Research Centers, Universities during the last three years:

Interuniversity Center for Bioecological Architecture and Technological Innovation for the Environment ABITA -Università degli Studi di Firenze (Italy)
Laboratory TAM Technologies for Mediterranean Living -Università degli Studi di Firenze (Italy)
EDIL-TEST S.r.l. -Battipaglia (SA) (Italy)

Collaborations with Consortia, Scarl or other Institutions participated by the University of Campania L. Vanvitelli during the last three years:

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ISI Web of Science Subject Categories:

Architecture
Engineering, Civil
Environmental Studies

Scientific-Disciplinary Sectors:

CEAR-08/C
CEAR-10/A

Keywords:

Data base
Environmental compatibility
Innovative materials
Material load capacity

ERC Categories:

PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics
PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
SH7_5 Sustainability sciences, environment and resources
SH7_6 Environmental and climate change, societal impact and policy