



Main partners



Project partners



Associated partners



ITALIANO



FRENCH

# CUBÂTI

CULTURE DU BÂTI  
DE QUALITÉ :  
RECHERCHE,  
INNOVATION  
ET ENTERPRISE  
POUR LA DURABILITÉ

Technology transfer achievements  
in the CUBÂTI project

edited by  
Maria Luisa Germanà, Manfredi Saeli e Andrea D'Amore

cubati.org

CUBÂTI



The Italy-Tunisia Cross-Border Cooperation (CBC) Programme 2014-2020, adopted by the European Commission, aims to contribute to the overall ENI objective of progressing towards "an area of shared prosperity and good neighbourliness between EU Member States and their neighbours". The objective of the programme is therefore to promote fair, equitable and sustainable economic, social and territorial development in order to foster cross-border integration and enhance the territories and resources of the two participating countries.

**Project No. C-5-2.1-16**

**CUBÂTI Culture du bâti de qualité : Recherche, Innovation et Enterprise pour la Durabilité**

Programme Priority 2.1 - Promotion and Support of Research and Innovation in Key Sectors

Programme Thematic Objective OT2 - Support for education, research, technological development and innovation

Programme Outcome R2.1.b - Strengthening links between the business community and researchers working on innovation in key sectors

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Le Programme de Coopération Transfrontière (CT) Italie-Tunisie 2014-2020, adopté par la Commission Européenne, vise à contribuer à l'objectif global IEV de progrès vers « une zone de prospérité partagée et de bon voisinage entre les États membres de l'UE et leurs voisins ». Le but du Programme IEV de Coopération Transfrontalière Italie-Tunisie 2014-2020 est donc d'encourager un développement économique, social et territorial juste, équitable et durable, en vue de favoriser l'intégration transfrontalière et de valoriser les territoires et les atouts des deux Pays participants.

**Projet N. C-5-2.1-16**

**CUBÂTI Culture du bâti de qualité : Recherche, Innovation et Enterprise pour la Durabilité**

Objectif thématique du programme OT2 - Soutien à l'éducation, la recherche, le développement technologique et l'innovation

Priorité du Programme 2.1 - Promotion et appui à la recherche et à l'innovation dans les secteurs clés

Résultat du Programme R2.1.b - Liens renforcés entre le milieu des affaires et les chercheurs travaillant sur l'innovation dans les secteurs clés

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**The CUBÂTI project: culture of construction and common identity (M. L. Germanà) Technology transfer in the CUBÂTI experience (M. L. Germanà)**

1. The CUBÂTI Technology Library of the UNIPA Architecture Department (M. L. Germanà; A. D'Amore; F. Provenza)
2. Demonstration models on experimental materials (F. Zagarella)
3. Demonstration models on environmental design applications (M. L. Germanà; F. Provenza; F. Zagarella)
4. Adobe (unfired earth bricks) in Tunisia (F. Kharrat; H. Driss)
5. BTC (compressed earth bricks) (F. Kharrat; H. Driss)
6. Adobe (unfired earth bricks) in ancient Sicily (M. L. Germanà)
7. Adobe (unfired earth bricks) in modern Sicily (M. L. Germanà)
8. Scraps from the sea (F. Bertolino; F. Cassarà)
9. Climatic chamber of the Building Laboratory of the UNIPA Architecture Department (M. L. Germanà; M. Saeli; A. D'Amore)
10. Shared process for materials testing/1 (F. Fernandez; K. Mensi)
11. Shared process for materials testing/1 (F. Fernandez; K. Mensi)
12. Material testing: plaster and mussel shells (M. Saeli; T. Campisi; A. Calà; R. Leone)
13. Material testing: limestone and coffee (M. Saeli; A. Calà; R. Leone)
14. Material testing: plaster and prickly pear waste (S. Colajanni; T. Campisi; V. R. Margiotta)
15. Material testing: plaster and pistachio shells (F. Fernandez; M.G. Insinga; R. Basile)
16. Material testing: plaster and orange peel (F. Fernandez; M.G. Insinga; R. Basile)
17. Material testing: clay and pistachio shells (F. Fernandez; M.G. Insinga; R. Basile)
18. Material testing: clay and orange peel (F. Fernandez; M.G. Insinga; R. Basile)
19. Material testing in Tunisia (K. Mensi)
20. Unique archaeological site in Tunisia. The experimental building (B. Mazigh; K. Chaniour)
21. Construction of demonstration buildings in Tunisia (F. Mhiri; K. Mensi)
22. Production of external opus signinum plaster (G. Guglielmino, winner of PRIX CUBÂTI)
23. Production of outdoor opus signinum paving (G. Guglielmino, winner of PRIX CUBÂTI)
24. Production of raw earth plaster (G. Guglielmino, winner of PRIX CUBÂTI)
25. Production of straw bricks (G. Guglielmino, winner of PRIX CUBÂTI)
26. The 'Marcello' Theatre House: wood and straw (D. Schininnà, Olivo s.r.l., winner of PRIX CUBÂTI)
27. Production of compressed raw earth blocks (A. Ghannem SOIB, winner of PRIX CUBÂTI)
28. Technological design for unfinished buildings (M. L. Germanà, F. Anania)
29. Innovative diagnostics in the field of Structural Health Monitoring (SHM) (TEM LAB, vincitore PRIX CUBÂTI - A. Mulone; F. Di Ganci)
30. Recycling of concrete construction demolition waste (Z. Jaouadi, winner of PRIX CUBÂTI)



Maria Luisa GERMANÀ, Manfredi SAELI, Andrea D'AMORE

The CUBÂTI Project made it possible to acquire a climatic chamber that was indispensable for the research activities that the Project itself set out to carry out. Among these, of particular importance was the performance of durability tests on the experimental materials produced in order to validate a real applicability of the products in view of the principles of quality in construction.

The equipment is equipped with a hermetic chamber in mirror-polished AISI 304 stainless steel, totally welded steam-tight with internal lighting. Forced air circulation is obtained by means of helicoidal fans, which allow a constant and uniform flow over the entire volume of the internal chamber, thus guaranteeing an optimal distribution of microclimatic conditions to guarantee the tests being performed. The relative humidity is controlled by means of a high-precision electronic sensor with a high-efficiency thermoregulated humidity producer.

#### APPLICATIONS

- Accelerated ageing tests
- Sample care in a controlled environment
- Laboratory testing in a controlled environment

**MODEL:** Evolution Clima 300

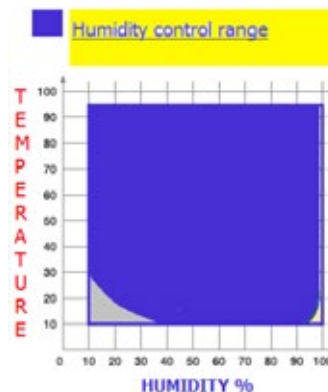
**MANUFACTURER:** MSL srl

**CHAMBER VOLUME:** 300 litri

**TEMPERATURE RANGE:**

-50 - 180 °C

**HUMIDITY RANGE:** 10-98 %



## TESTS CONDUCTED IN THE EXPERIMENTAL PHASE

As part of the activities of the CUBATI project, accelerated ageing tests were carried out in the climatic chamber purchased for this purpose. The procedure followed makes it possible to analyse and predict the possible state of degradation and durability of the products developed during the project under certain conditions. In particular, the products based on common identity waste from Sicily and Tunisia, developed by the project partners (UNIPA, IEMEST and CITET), were exposed to the following microclimatic conditions for one month each: 1) 60°C, 30% RH and 2) 60°C, 75% RH. This made it possible to simulate the extreme temperatures and humidity values found in the two geographical areas, with a view to extreme conditions in order to accelerate the possible degradation of the material. In both cases, the samples showed no appreciable dimensional changes or signs of degradation (e.g. disintegration, cracks, loss of material, etc.).

In the pictures opposite, two sets of tested products showing their excellent state of preservation.



## TECHNICAL SPECIFICATIONS

DESCRIPTION	UNIT	DATA
External dimensions(lx h x p )	mm	910x1800x1170
Inner dimensions(lxhxp)	mm	700x700x620
Usable volume	litri	300
Total load capacity	Kg	280
Temperature range	°C	-50÷ 180°C
Uniformity of time in space	°C	±1
Temperature constancy over time	°C	±0.3
Thermal gradient from180to-35°C*	°C/min	4.5
Thermal gradient from-40to180°C*	°C/min	5.0
Operating range relative humidity	%	10÷ 98
Humidity uniformity	%	± 3
Climatic temperature range	°C	+10÷ +98
Thermoventilation units	n°	2
Insulation	Double-layered, steel woolHD and glass woolHD	
Test Chamber Material	AISI304	
Power supply	V	400/3/50Neutroe GND
Frequency	Hz	50
Maximum Electrical Absorption	KVA	8,1
Medium Electrical Absorption	KVA	5,2
Ecological Refrigerant	R	452a
Demineralised water	Maxlt/hr	20
Condensation	Aria	
Sound emission at 1 metre	dBA	60
Empty chamber net weight	Kg	450

\* the reported values refer to the test conditions in the laboratory, under controlled climatic conditions at 22°C ± 0.5°Ce60%HR, without additional internal charges that are not expressly stated in the standard quota.