

Manuscript

## ITALY-TUNISIA CROSSBORDING COOPERATION FOR SUSTAINABLE BUILDING: ASSESSING THE CONSTRUCTION SECTOR MARKET AND REGULATORY FRAMEWORK

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Received: December 16th, 2024  
Revised: December 16<sup>th</sup>, 2024  
Accepted: December 16<sup>th</sup>, 2024

### Abstract

This paper summarizes the studies carried on in the frame of the project CUBÂTI, funded by Interreg Italy-Tunisia cross-border cooperation on the topic of sustainable building sector and regulatory framework in Sicily and Tunisia. State of the art and insights on possible strategies for empowering the sustainable building sector value chain in the Mediterranean area has been deepened, also considering the market analysis of sustainable construction sector in the two regions. A comparison of their building regulatory frameworks is outlined to identify links towards defining a common sustainable building policy. The study also affords the technology

innovation and intellectual property right management in case of process innovation. Conclusions highlighted that a cooperation is desirable and the exchange of knowledge becomes fundamental for the development of the sector possible with substantial financial aids and a more clarified and robust regulation.

### Keywords

Sustainable building; building innovation; building energy policies; cross-border cooperation; Mediterranean building construction; INTERREG Italy-Tunisia.

## Introduction

The present article summarizes results of studies accomplished in the frame of the project CUBÂTI about the analysis of building energy sector trends and regulatory framework in Italy and Tunisia. CUBÂTI is the acronym of « Culture du bâti de qualité: Recherché, Innovation et Entreprise pour la Durabilité » i.e., a strategic project concerning sustainable building construction [1] issued in the context of the cross-border ENI program INTERREG Italy-Tunisia 2014-2020 [2].

The ENI program INTERREG Italy-Tunisia is co-financed by the European Union (EU) and aims at realizing an area of shared prosperity and good neighborliness between EU Member States and their neighbors, promoting economic, social, and spatial development with a fair, equitable, and sustainable way, supporting integration and resources valorization in Italy (with focus on Sicily) and Tunisia.

The goal of the project CUBÂTI was to promote innovation by strengthening the links between enterprises, research, and designers, exploiting the “baukultur” concept<sup>1</sup> strategic vision and valorizing common building construction identity elements between Sicily and Tunisia. Indeed, as the

building construction is a key sector, with common features due to similar climate and geographic context, in both Italian and Tunisian economies, the project CUBÂTI has pursued and encouraged the technology transfer and know-how share among involved actors on sustainable building practices.

The project CUBÂTI has been accomplished by a consortium made of 7 partners: the Department of Architecture at the University of Palermo, the Consortium Ecodomus in Licata, the University Consortium of Trapani; the Euro-Mediterranean Institute of Science and Technology in Palermo, the National Architecture and Urbanistic School in Sidi Bou Said, the Tunisian Agency for Heritage Enhancement and Cultural Promotion, and the Tunis International Center for Environmental Technologies.

Tunisia and Italy far only 635 kilometres and are historically linked by common political events (Figure 1). Just to give some examples, between the III and II centuries BC, the Punic wars were fought in the Mediterranean Sea area between them. From the XIX century, many Italians emigrated to Tunisia and in Twenties they represented around the 40% of Europeans; while, today, migrants from Africa and Asia leave mainly from Tunisian ports.

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<sup>1</sup> At the Conference of European Ministers of Culture, held in Davos (Switzerland) in 2018, the Davos Declaration “Towards a high-quality Baukultur for Europe” was adopted to highlight pathways for

politically and strategically promoting the concept of high-quality Baukultur, a concept that reminds us that building is culture and creates space for culture [3].

Strong common economic interest and collaborations have been established between the two areas over the last two centuries. Moreover, there is a common cultural background between Italy, and mainly Sicily, and Tunisia exists due to similar geographic and geological conditions, past dominations, gastronomy products, artistic styles, and so on.

Nabeul), North-west (Jendouba, Bèja, Siliana, Kef), Centre-east (Sousse, Monastir, Mahdia, Sfax), Centre-west (Kairouan, Sidi Bouzid, Kasserine), South-east (Gabès, Medenine, Tataouine), and South-west (Gafsa, Tozeur, Kébili). Tunisia has a strategic gate position between the European and African continents, as Tunisian cost lasts Sicilian one by just 140 kilometres. This strong connection is also related to the free trade agreements and the migrants' routes (Italy is the second country in EU by Tunisia migrants [4]). It has one international airport in Tunis-Carthage with more than 4 million passengers annually and 6 commercial ports with averagely 28.5 million tonnes of goods handled every year. A new port in Enfidha is expected to be built as a strategic and game changing investment for the area.



Figure 1. Tunisia and Sicily map [2].

The Tunisian Republic amounts to 12 million inhabitants, a fifth of Italian population, and has a surface of over 160 thousand square kilometres i.e., about half of Italian surface. Tunisia is made of 264 governorates, grouped into 6 regions: North-east (Bizerte, Manouba, Ariana, Tunisi, Ben Arous, Zaghouan,

Italy is the second commercial partner of Tunisia after France: in 2020 it was the second exporter and the first importer. Italian investors are attracted by the Tunisian market due to proximity and competitive production costs (Italian Government, Info External Markets website). About 800 Italian companies are set in Tunisia, have over 60 thousand employees, and represent a third of foreign companies. Most of them is located in the Greater Tunis i.e., the metropolitan area surrounding the capital with around 2.7 million inhabitants. ENI has recently realized a new 10 MW photovoltaic plant in Tataouine (Figure 2) and

the EU has recently approved the investment for the project EIMed to realize a submarine electric cable between Tunisia and Italy (Agenzia Nova magazine website). In 2024, the Italian Government presented the so-called "Piano Mattei", a strategic plan for the construction of a new cooperative partnership between Italy and African States, including Tunisia, about education, agriculture, health, energy and water.



Figure 2. ENI photovoltaic plant in Tataouine.

Italy has 20 regions and 2 greater islands of that Sicily is both the largest island and region. Due to historical and geographic reasons, as other 4 regions in Italy, Sicily has own government and wide political, administrative, and economic autonomy. It has a population of 5 million inhabitants (42% of Tunisian one) and a surface of 25 thousand square kilometre (15% of Tunisia one). It has 3 metropolitan areas with Palermo as the greatest one with 1.2 million inhabitants. It has 6 main ports (18% of Italian ones), the largest of which is the one located in Palermo with about 6 million goods handled in 2023 [5], and 4 airports (8%

of Italy), the largest of which is the one in Catania with about 10 million passengers.

According to the National Statistics Institution (Istat) [6], 84% of companies in Sicily have less than 10 employees while 14.5% less than 50 and most of companies have a family leadership. Collaborations between companies within the same value chain are quite diffuse (48% in 2018) but often enclosed at regional level. Only 1.3% of companies are delocalized, mainly in manufacturing and construction sectors.

According to the Banca d'Italia [7], the Sicilian economy has been being affected by geopolitical situation, inflection, pandemic, higher costs of raw materials and energy. However, a slight enhancement is ongoing, thanks also to dedicated investments and subsidies, like *Bonus Investimenti Sud*, *Fare impresa in Sicilia*, and *Ripresa Sicilia*.

Table 1. Comparison of socio-economic factors of Italy and Tunisia.

	Italy	Tunisia
Territory surface [km <sup>2</sup> ]	302k	163k
Inhabitants	59M	12M
Currency	EURO (€)	Tunisian dinar (DNT)
Equivalent in dollars	1.10 USD	0.32 USD
N° commercial ports	35	6-7
Highway length [km]	3000	600
Railway length [km]	16000	2000
Electricity price [USD/kWh] [8]	0.067	0.428

VAT	22%	18%
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## Materials and Methods

According to the project CUBÂTI proposition, as a preliminary task towards implementation of actions to promote building quality strategies and construction value chain actors' integration in the two involved territories, the assessment and comparison of the status of art of Sicilian and Tunisian resources and needs has been carried on with focus on energy policies for buildings, market analysis of the construction sector, and innovation and intellectual property (IPR).

Regarding the data retrieval, first consulted data sources were the official sectoral reports published by national institutions of statistics or governmental sectoral bodies, and official documents of national standards and regulations. Second type of consulted data source consisted of web sources targeted on professionals (blogs, magazines online, etc.), especially to have a quick look on sectoral updates and trajectories. Other fundamental opportunities to retrieve useful information, especially concerning the Tunisian context, were the technical seminars organized in Tunisia in the frame of the project CUBÂTI, where experts from local institutions were invited to present regulative updates, together

with the transfer of knowledge between the same project partners.

For the assessment, these categories were investigated:

- Construction sector in Tunisia and Sicily
- Building stock in Tunisia and Sicily
- Building energy performances policies in Tunisia and Sicily
- Environmental impact policies in Tunisia and Sicily
- Quality assessment in Tunisia and Sicily
- Innovation management in building construction in Tunisia and Sicily.

## Construction sector market analysis

The Tunisian construction sector amounts to 700 companies [9], mostly located in the governorates of Nabeul, Sfax and Gabes (18%), half of which has at least 10 employees and 18 of them are Italian (Figure 3). In general, the construction sector had an increase in early 2000s, while dramatically decreasing due to the stagnation period after 2012 and more competitive products. Largest construction companies operate in the production and transformation sectors of marble and stones, cement, glass products, gypsum, and lime. Most of products are exported towards Algeria and Libya, Italy

covers 12% of export. Most imported product is ceramic tile (Italy represents 22%). Most relevant cement manufacturers are the *Tunisian Ciments Company of West Jebel "CIMPOR"* and the *Ciments Company* in Enfidha, that represent 26% of investments, the *Cementi Portland di Gabes* and the *Cementi artificiali tunisini – COLACEM*, that represent 22% of investments, and the *SOTACIB* in Kairouan. In 2013 the *Carthage Cement* was begun. Regarding the lime production, the most relevant companies are the *INTERCHAUX* and the *Lime Company of El Hamma (SOCHA)*. Tunisia produces Cement Portland, high resistance sulphite cement “HRS”, natural and artificial hydraulic lime, aerial lime, and lime putty. Gypsum production does not cover the local need. Main companies are the *SOCEM* in Gafsa. Thanks to high quality abundant gypsum resources, it is increasingly exported to African countries, above all Nigeria, Ghana and Libya. The marble manufactory covers 42% of mining sector employees [9]; exportation (mainly to Italy and China) reduced while importation grown, mainly from Italy, Spain, and India. Bricks manufacturing has been a leading sector for years until stagnation period. Innovation in this sector is considered crucial. The tiles manufacturing [9] was an important segment, with great export volume to Libya and Algeria. In this segment two products are: *mosaics (or cement tiles)* i.e., a product typical

of the Gabès and Greater Tunis areas, common until Twentieth century, and made of a not cooked mixture of hydraulic lime, calcined clay, sand and water, and *ceramic tiles*, typical of the areas of Sfax and Nabeul and made of porcelain or sandstone or terracotta. Earth is a traditional material whose production is recently growing due to the climate change debate. Tunisian companies often manufacture stabilized raw earth bricks i.e., with addition of cement for increasing mechanical resistance. Most relevant companies are: *SOIB* in Bizerte, *Genbloc* in Gabes, and *SBB* in the Greater Tunis.



Figure 3. Main productive areas and ports in Tunisia.

Focusing on the construction sector in Sicily, it represents 10% of enterprises in the region and is facing an increment mainly driven by private residential works (based on data from ENEA-Ministry of Ecological Transition data, at the end of March 2023, the total investment of refurbishments on the island amounted to 4.5 billion). The economic resources from the National Recovery and Resilience Plan

(PNRR) should increase the investments in the public sector (according to ANCE Sicilia, the value of the tenders published under the PNRR in 2022 was equal to 10.6 billion). Environmental sustainability is pursued by several Sicilian companies: 69.4% of companies with at least 3 employees begun environmental strategies, especially in the construction sector.

Most relevant segments are marble and stones, bricks, gypsum.

GPS Gattuso and Cus.Mar. are one of main marble manufacturers. Gypsum is a strong traditional material, used in plasters, finishing and boards. Sicilgesso and Gipsos are two main companies in the sector.

Raw earth is a traditional material, mainly used in the past and present in archeological sites. As a recent case story, the Cooperativa Guglielmino in Misterbianco (Catania) converted the family bricks manufacturer company into a new one producing mainly plasters and mortars made of bricks powder (*cocciopesto*) and raw earth.

Grit tiles are a very traditional product. Pavimenti Fogazza and Romano are two main companies. Wood is manufactured usually based on not local resources.

## Building stock

Tunisia has faced an important expansion and urbanization of the building stock going from 750 thousand of houses in 1956, 60% of which placed in countryside, to 2.88 million in 2009, 0.3% of which in rural areas. The Kyoto Protocol principles were introduced in Tunisia thanks to the programmatic law LOI n. 2005-781 which established guidelines for the Tunisian energy policy [10]. The final report signed at the Processo of Marrakech of United Nations defined the concept of sustainable consumption and production (SCP) giving insights and trends for all activities (meetings, working groups, society and enterprises forums, etc.). During the second meeting in Costa Rica four Task Forces were implemented, one of which about cooperation with the African context, led by Germany, in line with the plan approved by the African ministry conference on the environment. In 1992 Tunisia committed to create a sustainable development for environmental protection and issued the “**Commission nationale de développement durable**” (CNDD) as the “Code de l'aménagement territoire urbanisme” (CATU). However, such initiatives remained slight attempts on political and research level with slight effective impact. The **Decree 967/2017**, which replaces the decree 2617/2009, regards buildings construction; article n. 10 establishes that each building intervention must pursue the

adoption of some strategies to ensure certain technical characteristics about safety, accessibility, energy efficiency and use of renewables, water saving, environmental protection, sustainable development, and climate change mitigation.

A strong effort was put in the period 2012-14 to boost ecobuilding empowerment.

Regarding Italy, the 74% of buildings was built before energy laws were enacted. The national association of developers (ANCE) reports that 9 million residential buildings are not energy efficient. While, according to a survey from ENEA-CTI, the 75.4% of recorded building energy labels refers to the three worse classes.

Sicily has an urgent need to implement measures towards RES penetration and decarbonization, as it is one of the 3 Italian Regions which did not achieve the fixed targets on renewable energy share (15.9%) by 2020 (Ministerial Decree “Burden Sharing”). Around 30% of the final energy consumption in Sicily is due to the building sector, which accounts for over 1 million and 700 buildings i.e., 12% of the national building stock, representing the second region in terms of number of buildings after Lombardy.

Despite the large investments allocated to the construction in the last years, only 2.8% of buildings in Sicily were retrofitted, most of which were single family dwellings.



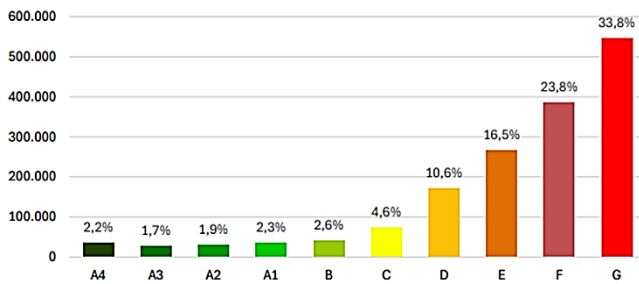


Figure 4. Italian residential buildings by energy class [11].

### Building energy performance

According to the Tunisian regulation [12], the documentation to obtain new/expanded buildings (tertiary over 500 square meters and new public residential) permit is mandatorily annexed with an assessment of their thermal energy demand, elaborated by the designer itself or an authorized consultant through a certified tool by the Agence Nationale de Maitrise de l'Energie (ANME), and approved by an authorized technical inspector. The assessment should ensure that the thermal energy demand is below the thresholds defined by the **Programme de la réglementation thermique des bâtiments neufs (RTBN)** [13]. The RTBN has introduced 8 classes of building energy performance i.e., from 1 (most efficient) to 8 (most energivorous), referred to the annual energy consumption per square meter [kWh/m<sup>2</sup>y] (Figure 5). In order to provide best practices, public buildings should have a class better than 3, while private ones lower than 5. So far

over 95 thousand buildings (equal to 9 million square meters) were certified obtaining an energy saving of 189 kTep, while further standards will regard other building categories like touristic and health.

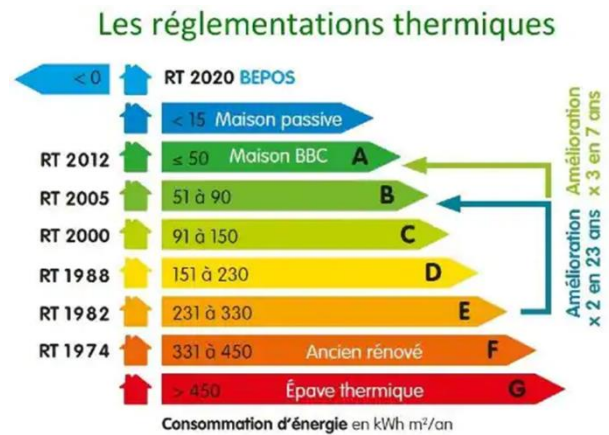


Figure 5. RTBN energy classes.

To encourage a widespread adoption of energy saving measures in buildings, the ANME promoted some initiatives [14], such as the **PROMO-ISOL** [15] i.e., an incentive package made of two contributions mechanisms, intended at new and existing buildings roof thermal insulation (Figure 6).



	Logement existant		Logement en cours de construction	
prime *	21 DT/m <sup>2</sup>		16 DT/m <sup>2</sup>	
Surprime **	6 DT/m <sup>2</sup>		6 DT/m <sup>2</sup>	
Total	27 DT/m <sup>2</sup>		22 DT/m <sup>2</sup>	
Crédit *	Plafond	Taux d'intérêt	Durée de remboursement	Delai de grâce
	7000 DT	5%	7 ans max	2 ans max
(*) FTE				
(**) programme vers les objectifs de la transition énergétique financé par l'Union Européenne				

Figure 6. Promoisol programme fiscal aids.

Over the years, Italian regulation in the energy field has been enacted in compliance with the EU one. More than thirty years ago, the Italian **Law no. 10 of 1991**, still in force, gave indications on the procedure for analysing the energy balance of a building and introduced the building energy certificate. The implementing act **D.P.R. 412/93** [16] divided the national territory into 6 climate zones, based on the degree-day parameter, from the hottest (A) to the coldest (F) for which the limit values relating to energy performance are still indicated today (Figure 7).

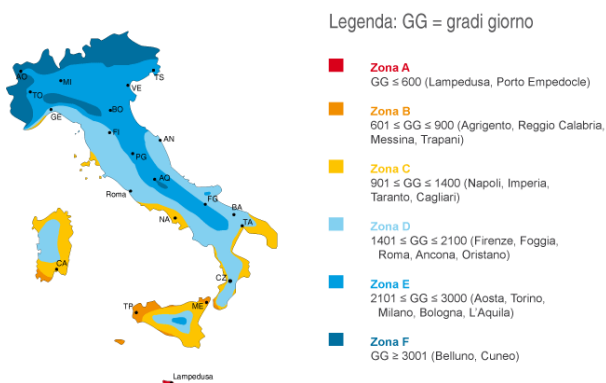


Figure 6. Climatic zones in Italy.

Some years later, the first revision of the **European Directive on the energy performance of buildings (EPBD 2010/31/EU Recast)**, aimed to promote the improvement of the energy performance of buildings in the EU, was implemented in Italy through the **Legislative Decree 63/2013** [17] that introduced the concepts of nearly Zero Energy Building (nZEB) and optimal costs of the intervention, and the Energy Performance Certificate (APE).

On 26/6/2015, the so-called “**Minimum Requirements Decree**”, still in force, [18] modified the classification of energy requalification interventions, assigning the necessary checks and performance requirements depending on the type of intervention and the climate zone in which the property is located:

- new construction, including demolition and reconstruction interventions;
- expansion of existing buildings for more than 15% of the gross volume or 500 cubic meters;
- first-level major renovation, concerning an intervention on the envelope for a surface area greater than 50% of the gross dispersing surface and renovation of the heating system;
- second-level major renovation, concerning an intervention on the envelope for a surface area greater than 25% of the gross dispersing surface;

- energy renovation, concerning an intervention on the envelope for a surface area greater than 25% of the gross dispersing surface or the installation of a new heating system (or its renovation) or the replacement of the generator.

Lastly, the so-called “**Superbonus**”, introduced with **Legislative Decree 34/2020** [19], based on “Minimum Requirements Decree” required performances, introduced a 110% deduction of expenses relating to buildings energy efficiency and anti-seismic interventions, by annual installments. According to data from the Chamber of Deputies, by April 2024, 495 thousand incentivized building interventions were underway for 117.5 billion € investments.

### **Building environmental impact**

To support producers in realizing low-environmental products and improve their image and competitiveness on the market, designers in realizing low-environmental buildings, and customers in orienting their choices with greater awareness, environmental labelling was introduced around in the nineties. Several labelling protocols have been set by different organizations: BREEM, LEED, EDGE, etc. One of the most important method is the Life Cycle Assessment (LCA) introduced by the *Society of Environmental Toxicology and*

*Chemistry* (SETAC) and standardized by ISO 14040 e 14044 as a methodology to account the environmental impacts (resource depletion, human health, and ecosystems) of products, processes, or services along their life i.e., from acquisition of raw materials to their disposal, including the operation phase and the transportation **Errore. L'origine riferimento non è stata trovata.**].

To encourage eco-sustainable products diffusion, worldwide governments enact official national ecolabelling systems.

In the European Union, the **EU Ecolabel** was introduced with the Regulation CEE 880/1992, replaced with the Regulation CE 66/2010 and modified by the Regulation 782/2013 (Figure 7). The EU Ecolabel considers the environmental impact of a good or service throughout its life cycle according to a set of criteria scientifically defined and agreed by the EU Commission (e.g., emissions in atmosphere, water waste, use of chemical toxic compounds, waste production, energy consumption and type of sources, water consumption, safety, noise pollution, biodiversity, etc.). Minimum performance levels of such criteria are to be respected to obtain the certification by a third part (in Italy, the third organization is ISPRA). The EU Ecolabel is voluntary based and can be required by any actor of the value chain: producers, manufacturers, retailers, service

providers, etc. Regarding buildings, different criteria are for new and existing buildings which refer to energy, water and materials exploitation, waste production and recycling, renewable sources integration and not-toxic compounds use; indoor quality and health, education of users.

As an instrument specific for buildings, **the ITACA protocol**, used in Italy, allows evaluating the energy and environmental sustainability of buildings. It refers to energy consumption, energy efficiency, impact on the environment and human health boosting low consumption resources. It bases on indicators which are weighted to obtain a final score. It is used as a tool to support designers, customers, and public administration.

**Green Public Procurement (GPP)** is defined by the EU Commission as an approach based on which Public Administrations (PAs) integrate environmental criteria in a procedure to purchase some products or services preferring those more sustainable i.e., with lower environmental impact throughout their life cycle.

Minimum environmental criteria (in Italian, Criteri Ambientali Minimi, **CAM**) implemented the GPP approach in Italy through the Law 221/2015 and the decree Dlgs 50/2016. The adoption of CAM is mandatory in any Italian public tender.

In Tunisia, the voluntary-based ecolabel for low-consumption buildings **ECO-BAT** was introduced with the Decree 1355/2007. The Centre International des Technologies de l'Environnement de Tunis (CITET) is the third organization in charge of release after evaluation of compliance (Figure 7). It is released by INNORPI after an assessment of compliance to technical criteria along the life cycle. Evaluation is made according to 13 (for residential) and 14 (for tertiary) criteria (thermal energy need, used materials, renewables, green roof, rainwater recovery, etc.) grouped into 3 main categories: envelope; appliances and design; environment. In 2010, the ANME has begun the application of the ECOBAT to a low consumption building and then, together with the ADEME of Paris, it has started a path to implement a new label integrating the ecolabel with results from ALCOR ed ECOTECH [20] for other buildings categories, like hotels.



Figure 7. EU and Tunisian ecolabels.

According to a recent report [9], the **Tunisian decree 1039/2014** gives rules on public

tenders focusing on sustainable development, ecological quality labelling, environmental protection, and sustainable purchasing. The environmental criteria are expected to be integrated in public tenders and offers although the definition of the technical specifications is left to the call writing phase.

## **Innovation and IPR**

Technological innovation is quite relevant for Sicilian enterprises and Research and Development (R&D) unit is often included. According to Istat, in 2016-2018, the 34.5% of companies with at least 3 employees was involved in innovation projects. According to data from Regione Sicilia [21], there are 20 registered productive districts, mainly in the agrifood sector. Concerning the construction sector, the most relevant ones are the District Etna Lava Stone, grouping companies engaged in the basalt extraction and processing, the District Ecodomus, grouping all value chain enterprise engaged in the sustainable construction, energy saving, and renewable-based technologies, the District of Wood and Furnishing Accessories manufacturers, and the District of Marble manufacturers.

According to the EU trajectories, the Sicilian Region government has produced the “Regional Strategy of Innovation for Smart Specialisation S3 Sicily” (update for the period

2021-27) [22]. The strategy promotes a smart, sustainable and inclusive development of the regional productive ecosystem, with a bottom-up approach for identifying the competitive advantages of the area, sustaining the business opportunities in inter-regional new value-chains, and involving the technological transfer infrastructure. The 6 targeted sectors are: agriculture; blue economy; energy; life sciences; smart cities and communities; tourism, culture and cultural heritage.

The study revealed that the productive ecosystem in Sicily is fragmented, like in the rest of Italy, with a scarce attitude in investments in R&D connections with research centers/universities participation in technological innovation programs, patenting and internationalisation [23].

Regarding Tunisia, it ranked 81st among the 133 economies featured in the Global Innovation Index 2024, 9th among lower-middle-income economies, and 14th among Northern Africa and Western Asia economies. Compared to past decade, some indicators dropped down, like number of scientific publications, number of venture capitals and labour productivity, while other indicators increased, like connectivity, patents, R&D investments.

## Conclusions and Perspectives

This study has provided a thorough overview on Italy, with focus on Sicily, and Tunisia status and challenges in the sustainable building sector. Both Tunisia and Sicily are facing challenges due to the economic and pandemic crisis and the positioning in a global market but have some added values in terms of innovative sustainable ecobuilding and a solid cooperative relationship. Hence, as Sicily proposes itself as an economic, trade, and energy hub in the Mediterranean area, it should empower its cooperation with Tunisia, benefitting from targeted investments, in order to act as the bridge between Europe and Africa towards an inclusive and efficient socio-economic equilibrium. Initiatives and projects that involve both subjects from the world of research and production/business, promoting technological transfer, as CUBÂTI, are desirable. The sector can be supported by the sharing of knowledge and information that enhances the common tradition and identity.

Collaboration between companies that leverages territoriality, moreover, is an approach that could give a strong boost to the sector, which, evidently, needs innovation and networking.

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