

# Borboleta and Papagaio: Emergency Unit and Children's Nutritional Center in Farim—Guinea-Bissau



Marco Imperadori, Graziano Salvalai, Marta M. Sesana, Serena Rosa and Consuelo Montanelli

**Abstract** Farim is a city on a deep fjord of the Atlantic Ocean in Guinea-Bissau. The Mission of Padri Oblati di Maria has operated there for many years and the research team has realized two units in recent years: Borboleta, which is an emergency unit for children but also for all those in need, and Papagaio, which is a nutritional center for young children. Due to the salt of the fjord (which also creates an economy), the atmosphere of the environment is typically saline so steel structures have been protected with special nanotechnologies (thanks to Triplex tech by NordZinc) for Borboleta. Papagaio is a nutritional center which provides food for the youngest groups of children who otherwise would have very few possibilities of survival. The structure of the pitched roof space has been developed with a transfer of technology from industrial scaffold elements transformed into columns and beams. Only one section becomes the rule of construction and the whole structure and sandwich panels roof were built in two weeks by volunteers connected to the Padri Oblati di Maria. After the mechanical erection, the envelope (realized in crude earth blocks and plaster) was completed by local people who in those years had been trained to learn basic masonry rules.

**Keywords** Steel construction · Recycling · Local materials · Daylighting

---

M. Imperadori (✉) · G. Salvalai  
Architecture, Built Environment and Construction Engineering—ABC Department, Politecnico di Milano, Milan, Italy  
e-mail: [marco.imperadori@polimi.it](mailto:marco.imperadori@polimi.it)

M. M. Sesana  
Polo Territoriale di Lecco, Lecco, Italy

S. Rosa · C. Montanelli  
Lecco, Italy

## 1 Guinea-Bissau Overview

Guinea-Bissau is situated on the West African coast (latitude  $10^{\circ} 59' N$ , between  $13^{\circ} 38'$  and  $16^{\circ} 43' W$  meridians). It has a surface area of  $36,125 \text{ km}^2$ , maximum latitude of 193 km, and a maximum longitude of 330 km. The country has common borders with Senegal to the north and Guinea–Conakry to the south and east, and faces the Atlantic Ocean to the west. Its territory is divided into a continental zone and an insular one, the latter being composed of a contiguous chain of islands—Jeta, Pecixe, Areias, Caiar, Como e Melo and the Bijagós archipelago, made up of 88 islands and islets of which only 21 are inhabited. Since gaining independence from Portugal in 1974, Guinea-Bissau has been subject to considerable political instability. This political climate combined with mismanagement has contributed to a poor economy, and Guinea-Bissau holding the dubious distinction of being one of the most impoverished countries in the world.

## 2 Health and Welfare

The Republic of Guinea-Bissau is a developing sub-Saharan African country. Since its independence in 1974, there has been considerable socioeconomic instability, leading to disastrous consequences for the population's well-being, including poor access to basic healthcare. Recent data available at the World Bank database reveals that Guinea-Bissau has one of the lowest levels of per capita gross domestic product in the world (CINTESIS). Human development in Guinea-Bissau continues to be weak and precarious. This is gauged by the Human Development Index (HDI) which is a summary measure for assessing progress in three basic dimensions of human development: a long and healthy life, access to knowledge, and a decent standard of living. A long and healthy life is measured by life expectancy at birth. Knowledge level is measured by mean years of education among the adult population, which is the average number of years of education received in a life-time by people aged 25 years and older; and access to learning and knowledge by expected years of schooling for children of school-entry age, which is the total number of years of schooling a child of school-entry age can expect to receive if prevailing patterns of age-specific enrolment rates stay the same throughout the child's life. The standard of living is measured by gross national income (GNI) per capita expressed in constant 2011 international dollars converted using purchasing power parity (PPP) conversion rates. Guinea-Bissau has one of the lowest Human Development Index scores (0.420) ranking 178 out of 188 countries and territories in 2015. Between 2005 and 2015, Guinea-Bissau's HDI value increased from 0.388 to 0.424, an increase of 9.2%.

The two factors that contribute to Guinea-Bissau's low HDI are: widespread poverty with very low monetary income and limited life expectancy resulting from the lack of income-generating opportunities and access to quality healthcare.

Despite all the investment that has been made, overall data regarding maternal and child health worldwide reveal a serious situation. Maternal, neonatal, infant and under-5 mortality in this country far exceed the global average. Not surprisingly, the Guinea-Bissau birth and fertility rates are double the global rates. Furthermore, existing health resources are tremendously scarce, particularly human resources.

About 8.1% of GDP in this country is spent on health expenditures. Health conditions in Guinea-Bissau are among the worst in the world. Many people still suffer from such diseases as tuberculosis, whooping cough, typhoid fever, bacillary dysentery, and malaria. The poor state of health is perhaps best reflected in the country's high infant mortality rate of 101.64 deaths per 1000 live births, and a life expectancy of only 48.7 years of age. It was estimated that up to 20,000 people were living with HIV/AIDs in recent years.

### **3 The City of Farim and the Missionary Oblates in Guinea-Bissau**

The first Missionaries Oblates of Mary Immaculate came in the seventeenth century to Guinea-Bissau, arriving at Farim on the border with Senegal. The Farim Mission serves two towns, Mansaba 30 km to the south and Bigene 40 km to the west, and a few villages.

Farim is located along the course of the Rio Cacheu, which is navigable up to this city, founded in 1641. According to an estimation in 2008, it has a population of 6405 inhabitants. The local population is dedicated to breeding and fishing and horticulture, and there are many women during the dry season who make salt harvest as their primary occupation. In fact, although it is located beyond 100 km from the Atlantic coast, the Farim area is an important center for salt productions and culture: the long stretch of the river Cacheu going from Farim to the ocean is actually an arm of the sea that creeps deep inland, a basin of brackish water subject to the alternation of the tides. This area is fighting against child malnutrition and neonatal and infant mortality remains extremely high (138 and 233 deaths per 1000 born alive).

In the context described in the previous paragraphs, the mission has focused over the years on these huge issues.

Firstly, with the design and then construction of Borboleta and Papagaio: respectively, emergency unit and Children's nutritional center. Both of the projects are presented in detail in the following paragraphs (Fig. 1).



**Fig. 1** Farim village market of the local salt

## 4 Environmental and Climatic Analysis

Despite its limited territorial extension, Guinea-Bissau presents a vast variety of natural environments. Along the coastal plains a dense marsh of mangroves extends, which also dates back to the river estuaries hiding the banks under an intricate network of roots and aquatic plants. Far from the coast, the territory is covered by savannah, with grassy plains interrupted by acacia parasols, bamboo, palm, and banana trees: most of the land has been transformed into plots cultivated with rice, peanuts, corn, and palm oil. Farim has a tropical wet and dry savanna climate (Köppen–Geiger classification: Aw) with a pronounced dry season in the low-sun months, no cold season, and the wet season is in the high-sun months. The annual average temperature is 26.5 °C with an average monthly temperature vary by 2.5 °C: this indicates that the continentality type is hyperoceanic, subtype extremely hyperoceanic (Figs. 2 and 3).

## 5 Borboleta

The Borboleta infirmary (butterfly in Portuguese) is a small steel butterfly, a closed building structure to host children suffering from glaucoma in a space protected from the risk of infections causing blindness. Borboleta—commissioned by the “Gruppo 29 Maggio” Association NGO and supported by the Lecco Campus of the Politecnico di Milano—has also received a contribution from the construction industry, which provided materials and know-how for free (Figs. 4 and 5).

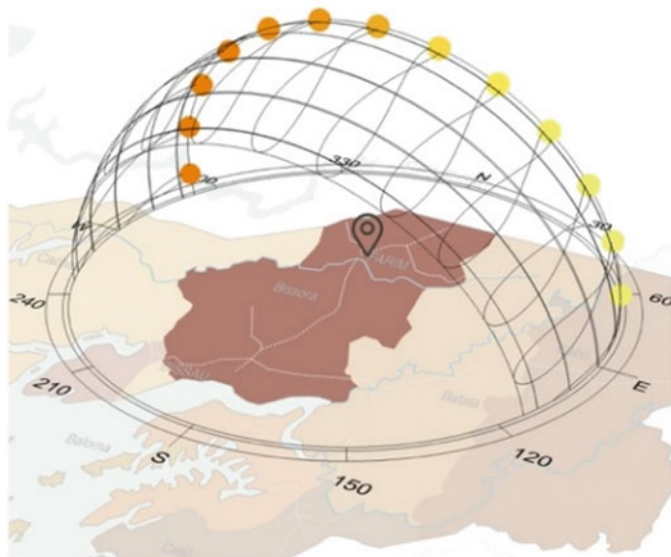


Fig. 2 Farim climate analysis: solar path

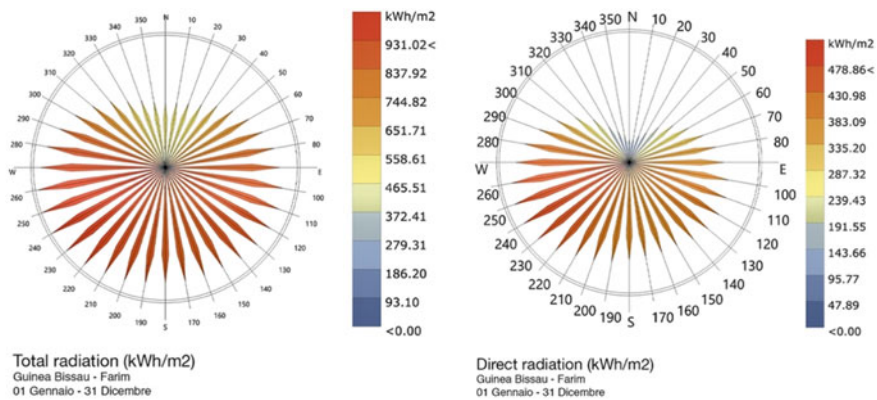
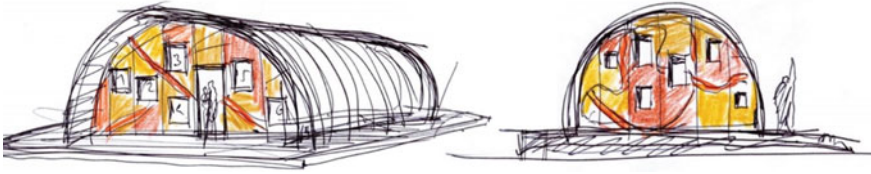
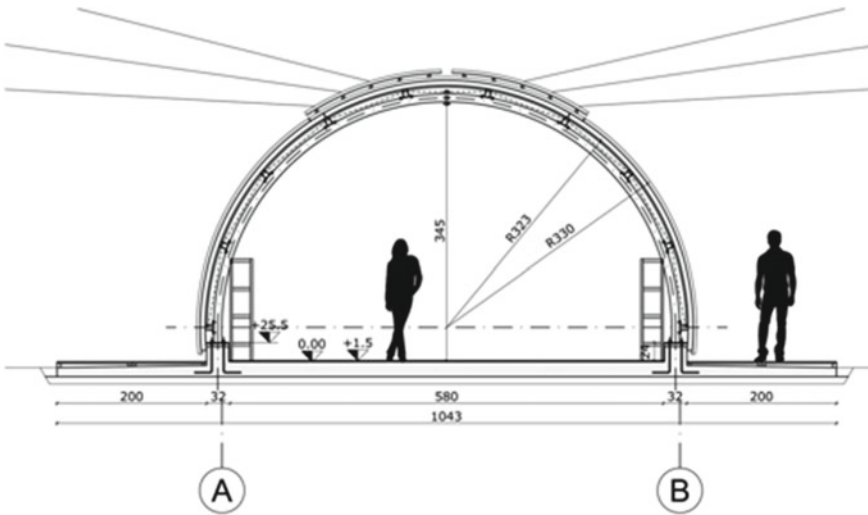


Fig. 3 Farim climate analysis: total, direct, and diffuse radiation



**Fig. 4** First sketch of Borboleta (M. Imperadori)



**Fig. 5** Borboleta section

A key focus during the design phase has been dedicated to daylight analysis with the aim to increase the users' comfort. The daylight factor is guaranteed by two fronts, openings into the building envelope. The system plant foresees an air-handling unit that supplies two internal units and it has been designed to be powered by PV panels, which could be installed on the hull or, alternatively, on the surrounding buildings (Figs. 6 and 7).

Borboleta is a hull structure, which covers an area of 50 m<sup>2</sup>. The deck is supported by a steel structure with three-hinged arches that carry cross-braced tubular braces in steel. The whole structure is hot-dip galvanized, protected by a triplex nanoceramic treatment, on which a powder coloring has been then applied. A recycled teak floor has been realized with a double function of waiting and meeting place for the patient's parents. The project includes the installation on the roof of shading nets, like butterfly wings, with tie-rod connected to the surrounding trees (Figs. 8 and 9).

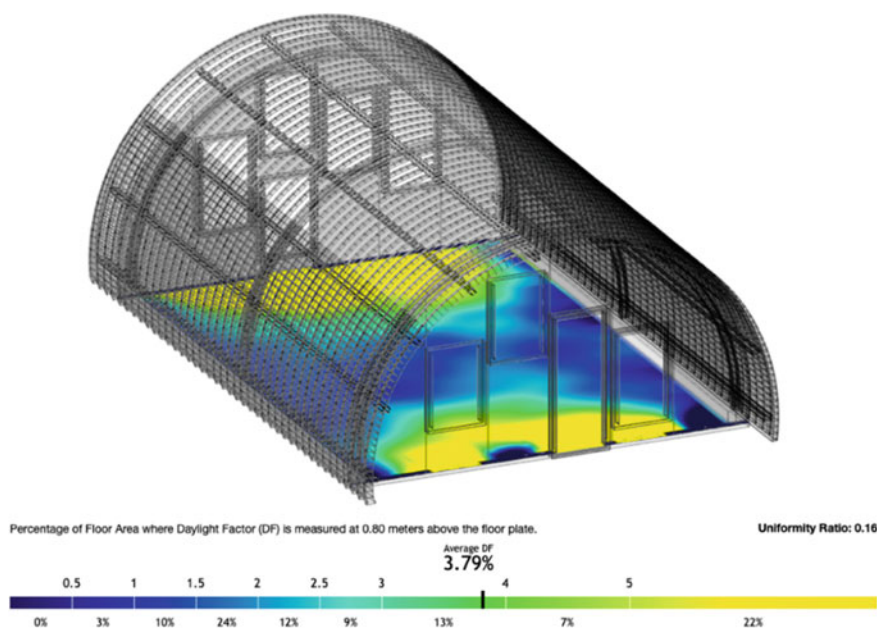


Fig. 6 Daylighting analysis performed with Sefaira

## 6 Papagaio: A Mixture of Commitment, Know-How and Solidarity

The Papagaio nutritional center was created in response to the need for a space to be able to exploit the food resources present on site and to fight child malnutrition. The realization was possible thanks to the partnership between the Politecnico di Milano, Carlo Pesenti Foundation, and sponsoring companies. The building was initially conceived as a block of  $5 \times 9$  m with an entrance patio. During the construction site, due to material availability and the need of a dedicated distribution space, a building extension was realized (Fig. 10). The building structure is composed of ScaffSystem steel frame profiles, cold-shaped, coupled with multilayer insulated panels. The protruding roof shape, which gives the name to the building—recalling the Parrot wings, aims to protect the masonry from high solar radiation and from heavy rainfall in the rainy season. The earth block system wall, realized by local trained workers, allows for an increase in interior comfort. In addition, the small openings shielded by the roof overhang guarantee adequate illumination and respect for comfort even during daylight hours. The structure was assembled by local workers and a group of volunteers in less than a week, then the roof was connected and finally, the earth block system wall was realized (Figs. 11 and 12).

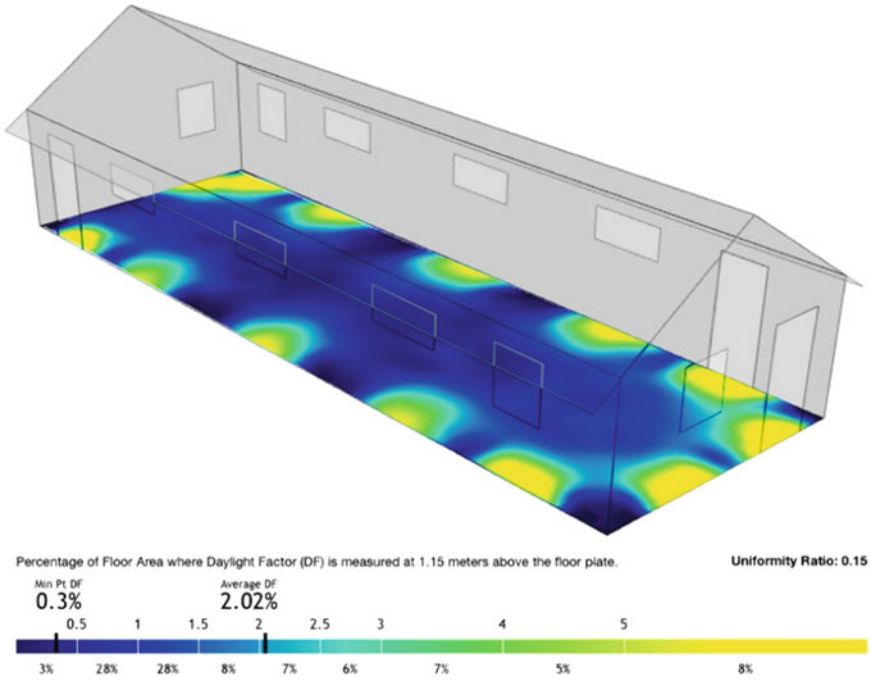


Fig. 7 Daylight factor analysis performed with Sefaira

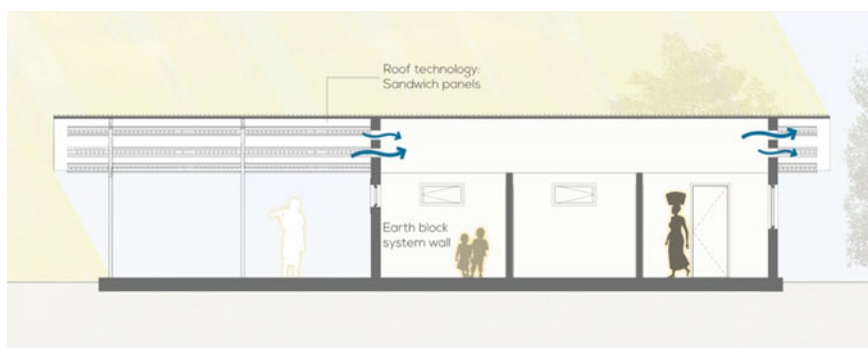


Fig. 8 Borboleta construction phases: structures, non-load-bearing wall, finishing, and interiors





**Fig. 9** Materials selection, transportation, and preparation for the construction site



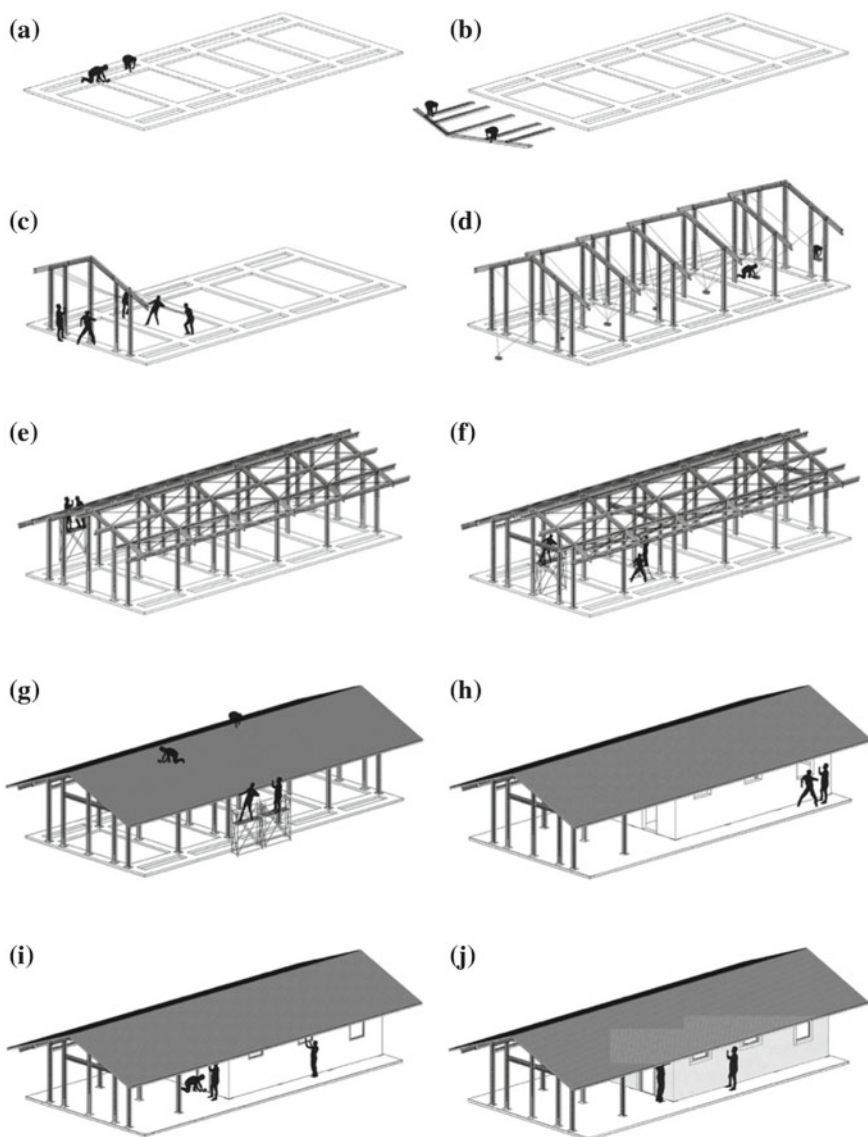
**Fig. 10** Papagaio scheme design

## 7 Conclusions

In Farim's mission, it all began with a "limit-situation": many children died of malnutrition and others were abandoned by their mothers who couldn't provide for them. Borboleta and Papagaio were conceived to respond to those needs and over time became an ever more key sign of hope for the whole region: it hosted severely malnourished and recovering children, as well as any other sick children requiring pediatric care, with their mothers. Papagaio nutritional center has been dedicated to Franca Natta Pesenti of the Pesenti Foundation and Vincenzo Tamborrino, the visionary founder of Scaffsystem. Both of the buildings represent not only concrete results of years of experiences on sustainable built construction studies carried out by the Politecnico di Milano team but also the outcomes of fruitful collaborations between university and industries of the sector. Papagaio has been realized thanks to: the Politecnico di Milano, Scaffsystem, Carlo Pesenti Foundation, Mercegaglia, 3wood, Todeschini construction, Turra Meccanica, SFS, Emilgroup, Office Tamborrino and Kapriol Italia design.



**Fig. 11** Papagaio construction phases: structures earth block system and name plaque fixing



**Fig. 12** Construction phases: **a** foundations, **b** frame ground assembly, **c** vertical fixing of the frame, **d** final fixing of all frames, **e** positioning and fixing beams and bracing on the roof, **f** positioning and fixing of beams and wall bracing, **g** positioning sandwich roofing panels, **h** earth system wall construction, **i** windows fixing, **j** plaster finishing

## References

- Adebajo A (2002) *Building peace in West Africa: Liberia, Sierra Leone and Guinea Bissau*. Lynne Rienner
- Aruffo A (2003) *L'Africa subsahariana: stati, etnie, guerre a sud del Sahara*. Danews Editrice
- Butera M (2014) *Sustainable building design for tropical climates. Principles and applications for eastern Africa*. UN-Habitat
- Centro de Investigação em Tecnologias e Serviços de Saúde (CINTESIS). Departamento de Ginecologia-Obstetrícia e Pediatria, Faculdade de Medicina, Universidade do Porto, Portugal
- Coffman P (2015) *West African tribal sculptures, textiles and artifacts study guide*. American Alliance of Museums
- Crivellaro A (2016) *Africa e dintorni: scritture*. Biblioteca dei Leoni
- Forrest JB (1992) *Guinea Bissau: power, conflict and renewal in a West African Nation*. Westview Press BOULDER
- Imperadori M, Salvalai G, Pusceddu C (2014) Air Shelter house technology and its application to shelter units: the case of Scaffold House and Cardboard Shelter installations. *Procedia Econ Finan* 18:552–559
- Jammal M, Villa G (2008) *Guinea Bissau: camminando nella palude*. FBE
- Mezzana D, Quaranta G (2005) *Società Africane: l'Africa subsahariana tra immagine e realtà*. Zelig editore
- Reynolds A, Zaky A, Moreira-Barros J, Bernardes J (2017) Building a maternal and newborn care training programme for health-care professionals in Guinea—Bissau. *Acta Med Port* 30(10):734–741. <https://doi.org/10.20344/amp.8453>
- Salvalai G, Imperadori M, Scaccabarozzi D, Pusceddu C (2015) Thermal performance measurement and application of a multilayer insulator for emergency architecture. *Appl Therm Eng* 82(5):110–119

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

