

Heritage buildings towards the future: conservation and circular economy for sustainable development

RESEARCH AND
EXPERIMENTATION

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Abstract. Keywords: The issues of energy efficiency and climate change belong to a complex scenario to which contemporaneity is called upon to answer. Architecture can contribute by promoting practices that look at the environment with a view to building the future. As an architectural activity, restoration of heritage buildings can actively participate in this fundamental challenge within the perspective of a circular economy proposing a globally sustainable model. Starting from a state-of-the-art investigation, this paper aims to enucleate the BECK project's contribution in this field, as well as to underline how careful strategies of conservation and contemporary use can have positive effects on sustainable future scenarios.

Keywords: Heritage Buildings; Conservation; Reuse; Circular Economy; Sustainability.

The worrying effects of climate change are increasingly evident. If, as far back as the past century, the United Nations highlighted that they constitute a common concern for the whole of humanity (UN, 1987; UN, 1992; UN, 1997), the most recent documents confirm the urgent need to identify practices that can be useful to contrast the increase of this phenomenon.

The United Nations Framework Convention on Climate Change reaffirmed the need for a common effort to reduce greenhouse gas emissions into the atmosphere (UNFCCC, 2019). Nevertheless, the seriousness of the current situation requires substantial interventions against the increasingly climate change acceleration, such as emissions from manufacturing, transports and building heating and cooling. These measures outline a radical change of perspectives and priorities, compared to the current linear economic model. This leads to shifting the focus to the structural causes of the climate balance perturbation, aiming at correcting the route, not just to replace the vehicle. In this regard, circular economy proposes a globally sustainable model that jointly addresses multiple dimensions, including environmental, energy, social, economic, production, architectural and cultural ones (Mickaityte *et al.*, 2008).

While it may seem inconsistent at times, this approach works best when the hierarchical model is abandoned and a circular perspective is adopted instead (ICOMOS, 2017), assuming that meeting the present needs must not compromise the ability to satisfy those of the future (UNISDR, 2009).

This perspective leads to increasing the values awarded to the heritage inherited from the past (UNESCO, 1972) in its both tangible and intangible contents. Enhancing the heritage tangible values requires reducing the resources needed for its use, slowing down its ageing, preserving its material substance and efficaciously recycling the residues left at the end of each operational cycle of the artefact. Instead, the crucial issues for the intangible heritage address safeguarding and protecting its contribution toward strengthening the specificities and identity of local communities, the transmission of collective memory, and the social sustainability.

Along these lines, «the changes made in contemporary age forced the scientific community to face the challenges of the sustainable growth even within the historical Cultural Heritage, tangible or intangible» as they are fully involved within that «crucial issue for hu-

man activity and behavior» (Magrini *et al.*, 2015).

In this sense, taking care is not only intrinsically coherent with the principles of circularity, but is also positive in cultural and economic terms, as it favours the creation of heritage communities and, in so doing, it feeds a virtuous circle assuring an effective conservation of the assets.

Furthermore, this generates job opportunities and hence well-being, rewarding the development of knowledge, skills and autonomy stimulating the capacity for initiative of both individual and communities.

There is, therefore, an evident need to jointly address the many aspects which are connected to the social, economic and environmental sustainability, by adopting an approach for which the existing heritage represents a physical and cultural resource to be preserved and enhanced.

Having been recognised as a driver for sustainable development, cultural heritage has thus become an essential object of global agendas and guidelines: its protection not only allows the transmission of material and immaterial values, but also fosters the sustainable development, acting as one of its driving forces (ICOMOS, 2011; UN, 2012; MARSH, ICCROM, ICOMOS-ICORP and UNESCO, 2013). The topicality of the issues connecting climate, energy and heritage emerges in this scenario. Among the actions to achieve the UN Sustainable Development Goals (SDGs), the 2030 Agenda for Sustainable Development requires taking urgent measures on climate change, also considering heritage as an enabler of sustainability (UN, 2015; UNESCO, 2015; ICOMOS, 2017) and its conservation as a climate positive action (ICOMOS CCHWG, 2019). Moreover, several international conferences call for an interface between conservation and energy efficiency issues (López *et al.*, 2014; De Bouw *et al.*, 2016; Broström *et al.*, 2018).

Within this framework, a common challenge to all fields of action is the intervention on human resources (UN, 1987). In this regard, the need for actions in capacity building regarding the development policies has been highlighted, involving within them cultural heritage as a driver for sustainable development. In fact, a capacity building programme aimed at increasing expertise constitutes a strategic means to strengthen collaboration and to develop new skills (Della Torre *et al.*, 2020).

This task rests with universities and research organisations, which are called upon to consolidate programs promoting technical and scientific cooperation on these issues. In parallel, a key role is up to local communities, which contribution is crucial in implementing solutions adapted to the individual specificities. Universities can contribute to this synergy also by their teaching activities provided to both students and professionals, while institutional bodies involvement may strongly help in supporting global policies and fostering cooperation between the various concerned players. In turn, local actors not only acquire training, but can actively contribute

through the knowledge of their local region, as well as of its specificities and heritage.

In this scenario, the promotion of a multicultural (ICOMOS CIV-VIH and ICOMOS-Korea, 2017) and multidisciplinary approach (UNESCO and UNDP, 2013) is of great relevance, although the potential inherent in these fruitful relationships still appears to be under-exploited.

Internationality/ interdisciplinarity: synergistic encounters towards the future

Within the aforementioned worldwide reference framework, BECK Project¹ represents a case study of a possible capacity

building strategy, particularly focusing on enhancing motivations and target definition.

The project goal, indeed, is integrating the consumer behaviour relevant to energy efficiency and climate change within the education programs of some Universities of Russia, Sri Lanka and Bangladesh. This transdisciplinary scientific project has two main purposes: on the one hand, to support research on energy efficiency for combating climate change and, on the other hand, to promote capacity building in academic education and third level training.

The project promotes an action of third mission in Eastern European and Far East Asian countries which aims at strengthening the local expertise of teachers, students and future professionals by exploiting the longer experience of European countries in these topics².

Especially, the investigations carried out by the European partners focus on energy efficiency and climate change issues, also deepening the relationship between preserving heritage buildings and improving their energy behaviour³. Since acting on new buildings only is not sufficient to achieve the environmental targets (Battisti, 2016), the heritage buildings conservation is also needed to reach this goal, in addition to the social and cultural needs it meets. In this regard, the aim is to fill technical capacity gaps in energy efficiency improvement and climate change effects mitigation, to stimulate cultural sensitivity for heritage protection, and to integrate the historical buildings conservation strategies according to the most recent international guidelines, including the Faro Convention, the Nara+20 and the Leeuwarden Declaration (Council of Europe, 2005; Nara+20, 2014; Leeuwarden Declaration, 2018).

The third partner countries have been selected accordingly, among those where these actions are needed and appear to be promising. However, the long term expected benefits are not just local.

Specifically, the analysis of the current situation revealed:

- the need to spread awareness of the importance inherent in improving the energy behaviour of historical heritage, which is not yet reached within those contexts;
- the need for operator training in architectural restoration field, including the skills enhancement in intervention planning and management of heritage buildings;

- the strategic role played by capacity building in cultural field for the countries with poor experience of the most up-to-date approaches on this.

The project addresses these issues targeting on the knowledge transfer process strengthening in this specific field, and recognising the pivotal role of consumer, whose continuous interaction with the built environment makes him – more than other players – the spokesperson of a co-evolutionary logic (Pianezze, 2009-2012).

Since the action on human resources thus emerges as an essential leverage for capacity building, the project is oriented to actively increase the design, executive and management capabilities of local realities that can, in turn, feed processes of community involvement (Göttler and Ripp, 2017).

Especially, the project focuses on human resources by addressing the different actors of the process, from the workers to the technicians and specialists, through the development of innovative learning schemes for training the skills needed for the purpose. In particular, the adopted approach couples actions providing people suitable technical contents and measures to support the entrepreneurship centred on offering those knowledge as services. In so doing, the project aims at achieving the double goal of building specialised skills and making them a resource for both heritage and local economy.

In this perspective and with the awareness of the need to interpolate complementary competences (Morin, 2000), several different skills have thus been brought together in the most synergistic way possible. Namely:

- Architectural Restoration, targeting heritage conservation, its effective maintenance and the compatible retrofitting to host contemporary functions;
- Architectural Technology, to provide suitable methods in improving the existing buildings energy behaviour and the environmental profile of the activities needed for their protection and enhancement;
- Business Management, to supply efficient entrepreneurial approaches suitable in promoting the entrepreneurship centred on providing services to the sector.

Involving teachers and researchers of different disciplines ensures multidisciplinary and further project development based on complementary knowledge, as well as the selection of case studies where the different aspects merge and interact.

Global/local: global challenges for innovative approaches to local human resources

In addressing the global challenge of increasing energy efficiency and mitigating the effects of climate change, the project identifies practices and outlines

methodologies empowering the knowledge transfer process in a dual direction.

Firstly, by assuring that information and experiences can be effectively exchanged among the teachers belonging to the different institutions. The means for this are periodic meetings useful to facilitate the transfer of medium- and high-level technical expertise to the involved universities.

The second action line concerns dispensing innovative and distance learning modules⁴ able to reach people within and beyond the limits of academic education.

The compatibility between the building heritage preservation and the improvement of the environmental profile of the activities needed for the purpose is the first scientific problem raised by the research, with the aim to establish a basic set of criteria useful in framing the issue.

The following basic concepts have been identified as the key theoretical pillars in addressing the topic, so representing the core notions to transfer:

- if conservation of cultural heritage allows preserving and transmitting both the tangible and intangible values of a community, the asset protection has significance and generates benefits going beyond the local dimension;
- the intervention on the built heritage is a sustainable operation in itself, as the reuse of existing buildings well complies to the circular economy principles;
- the energy efficiency improvement can act as a protection tool for heritage (Carbonara, 2015) as it leads to the adoption of practices considering climate change, thus preventing its negative effects on the asset too. Additionally, more energy performant buildings are cheaper to maintain and manage, which makes easier their conservation;
- since the needs of architecture conservation, user comfort and energy saving must be suitably balanced when designing an intervention on a heritage asset, a preliminary deep study must be always carried out on the use-related calling of the buildings and the individual spaces inside them;
- a logic of development intended as improvement (Daly, 2001) must drive the building technological and plant engineering integration, avoiding solutions that are totally extraneous to it. The Italian regulations on building consolidation provide a suitable reference for this, suggesting improving the efficiency of the existing architecture instead of forcing it to fully meet the performance requirement (De Santoli, 2015). This approach is less impacting on the building and it also often allows downing both the intervention and management costs;
- a more correct and balanced assessment of the whole intervention environmental impact can be performed by adopting a life cycle perspective. The adoption of LCA (Life Cycle Assessment) and LCC (Life Cycle Costing) tools is thus strongly recommended, as well as the training of skilled

technicians needed to apply those protocols;

- the preliminary analyses on the character, conditions and needs of the building must identify the possible interferences between conservation objectives and improvement of energy behaviour, using the former as a limit to evaluate the compatibility of the latter.

Based on this set of criteria, the project identified a methodology to follow in designing and executing the heritage building energy retrofitting, tailoring the whole process according to the local specificities.

The first step aims at acquiring a deep knowledge of the building, especially concerning its energy behaviour and indoor microclimate conditions, as well as at identifying the transformability levels of its main elements and constituents.

The requirements in terms of thermo-hygrometric comfort can be then established, targeting to the preservation of both the asset and the objects it hosts, as well as, possibly, to the comfort of those living and working inside, too.

Examples in which the same approach and methods have been successfully applied (Borioni et al., 2011; Lucchi and Pracchi, 2013; Pracchi, 2014) are made available by the research project, which also provides to third country partners a collection of the regulations and guidelines on the topic that are in force in Europe and internationally.

The case studies selected by the project refer to buildings of different locations, age (ranging from ancient times to the 20th century) and designated use. Material, morphological and microclimatic characteristics of each building are identified, then an analysis is made of the interventions performed on them over time, by assessing their compatibility. This leads to the classification of the case studies in categories based on the possible actions that can be envisaged on them:

- interventions on opaque envelope, window and door frames, and technical installations;
- interventions on outdoor and surrounding spaces, such as courtyards, green areas and terraces;
- actions of preventive conservation, monitoring and maintenance planning, with an assessment of the impact on climate change (Cassar, 2005).

The further step concerns the skills mapping of the professional profiles to train. The analysis of the expertise needed to plan, realise, manage and promote the envisaged activities has thus allowed to identify the skills to be developed and strengthened.

Regarding the technical capabilities, the main target is the reinforcing of the theoretical and cultural background of designers and builders, in order to provide them a basic knowledge for conscious and responsible actions. Guided exercises on the case studies are useful means to make people understand the connection between theory and practice, as well as good sources from which retrieving

the needed operational tools. This aims at raising the awareness that accurate and creative projects are crucial in enhancing the quality of the work, reducing environmental impacts and optimising costs and time.

On the entrepreneurial skills side, builders and technicians are the core target for capability empowering actions. Due to their intermediate position within the process, they play as a collector for the information coming from the designers upstream and as disseminators towards the workers downstream. This allows them acquiring suitable knowledge and useful experience in implementing specific activities related to the heritage conservation and retrofitting. The project stimulates them to enhance this heritage by becoming entrepreneurs, thanks to the additional skills that it makes available to them in management and marketing within local contexts.

Circular economy and sustainable development are the reference scenarios with respect to which the research has developed both contents and possible methodologies of knowledge transfer to the builders operating in the heritage conservation sector within the third party countries.

At this stage, the approach is accurately defined based on a robust scientific background which has been established in cooperation by the European and third party academic partners of the research. The main strategies have also been shaped and implemented, as well as the practices to disseminate them.

The next steps will concern the launch of the innovative distance learning actions regarding the various above-mentioned scopes.

The more challenging expected result of the project is the building of a double virtuous circle. The first one is that in which the European solid knowledge in heritage conservation and sustainability is shared with less experienced countries, where this transfer both feeds effective asset preservation actions and builds capabilities and skills allowing to practice conservation in the future. The second virtuous circle, closely related the first one, aims at triggering a socio-economic positive dynamic in local communities thanks to the development of entrepreneurial activities in heritage conservation, thus also reinforcing the inhabitant commitment to share and protect the heritage cultural values.

(Provisional) conclusions

The scientific implications of this research involve two main issues. From a technical point of view, the core topics are the assessment of the impacts related to the operations of existing heritage conservation – in terms of environmental and social sustainability – and the definition of efficient strategies and intervention methods for their reduction. From a socio-economic point of view, the optimisation of the capacity building processes in this specific field is the more challenging topic, especially regarding the development of effective tools able to provide suitable technical skills, as well as to generate forms of entrepreneurship suitable to enhance them.

The collaboration between the different expertise involved in this scientific path highlighted the opening of scenarios of great relevance, starting from the stage of project definition. The result is an approach that has assigned a crucial role to the context analysis, extending its object to a plurality of phenomena present in the local situation and finalising it not only to achieve a knowledge increase, but also to identify strategies for its improvement. The barriers hindering the strategy implementation have also emerged as topic to address, as well as the possible actions to mobilise and increase the local capabilities and resources which can facilitate it.

The first package of actions carried out within this framework showed the need to include specific measures to raise the awareness of the combined cultural, environmental and economic benefits of heritage conservation, as part of the training paths for local capacity building of both individuals and communities.

Finally, a crucial issue is worth mentioning (Fabbri, 2013): as energy saving is a major challenge for sustainable development impacting on global dynamics, this represents a priority for the heritage buildings too, but it must integrate – not compete with – the primary need to preserve the heritage of humanity.

In this perspective, sprawling the awareness of the heritage potential can contribute to sustainable development and climate change effects mitigation. If managed according to the concepts of conservation and reuse and by promoting careful practices of energy saving and environmental impacts downing, heritage is, indeed, an added value within the circular economy perspective, leading towards the future the witnesses of our past.

NOTES

¹ BECK - Integrating education with consumer behaviour relevant to energy efficiency and climate change at the Universities of Russia, Sri Lanka and Bangladesh is a project co-funded by the Erasmus+ Programme of the European Union. Project Reference no. 598746-EPP-1-2018-1-LT-EPPKA2-CBHE-JP. Grant Agreement no. 2018-2489/001-001. Key Action 2: Cooperation for innovation and the exchange of good practices. Action Type: Capacity Building in the field of Higher Education. 2018-2021. See: <http://beck-erasmus.com> (accessed 11 January 2020).

² The BECK project coordinator is the Vilnius Gediminas Technical University (Lithuania). The European partners involved come from Italy (University of Bologna), United Kingdom and Estonia, while the Asian partners come from Russia, Sri Lanka and Bangladesh.

³ The contribution of the University of Bologna is related to this precise aspect.

⁴ The reference is to the Massive Open Online Courses (MOOCs).

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