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Technological Imagination in the Green and Digital Transition

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Chapter 60
Sustainable Reuse Indicators for Ecclesiastic Built Heritage Regeneration

Maria Rita Pinto, Martina Bosone, and Francesca Ciampa

Abstract In the context of anthropogenic impacts on pollution and global warming scenarios, reject from the construction sector accounts for 36% of European waste. This waste percentage includes disused and abandoned buildings that have lost the value of their function over time. In order to reduce the ecological footprint they generate, the paper rethinks Recovery in its circular meaning to put these buildings back into a normal circuit of usability, improving the creation of resilient urban habitats. In particular, decommissioned ecclesiastical buildings constitute a huge quantity and significant quality heritage, as by cultural, perceptive, morphological and material values. The sustainable reuse of this heritage must act on its double impacting value: the tangible one linked to the material culture of the buildings and the intangible one, linked to the identity values of sediment instances. Through a comparison desk research of more than 140 cases of reuse on a European scale, the contribution arrives at a system of indicators that allow evaluating the reuse sustainable compatibility of these buildings, able to promote prosperity, inclusiveness and social equity. These indicators make it possible to assess the appropriateness of design actions aimed at mediating between the conservation of the built heritage and the transformative needs of contemporary instances. The results provide scenarios tool of sustainable recovery, capable of transforming waste into a resource, extending the life cycle of the ecclesiastical heritage and thus mitigating its environmental impact, as well as the cost related to the loss of cultural values and identity for the community.

Keywords Sustainable reuse indicators · Recovery · Ecclesiastic built heritage

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60.1 Introduction

In the European context, the role attributed to culture and its testimonies is consolidated into the Treaty on European Union (TEU). It referred to the desire to be inspired "by the cultural, religious and humanistic heritage of Europe, from which the universal values of the inviolable and inalienable rights of the person, freedom, democracy, equality and the rule of law have developed" (De Medici 2021). As indicated by the ex art. 2 of the Treaty (Article 3 in the current text), the European Union respects the richness of its cultural and linguistic diversity and supervises the preservation and development of European cultural heritage. In line with these principles, cultural heritage represents a strategic resource, able to determine positive externalities in the four sectors of sustainable development: economy, culture, society and environment (Pinto, 2004). To reduce the ecological footprint they generate, the contribution rethinks the rehabilitation, in its intrinsic circular meaning, to design scenarios capable of putting churches back in a normal circuit of usability, with the creation of sustainable urban habitats (Caterina 2013). The reuse of churches simultaneously affects the cultural heritage in cities and European cultural landscapes in the perspective of the circular economy as a model of sustainable development. The functional recovery of churches is able to generate positive impacts.

As highlighted in the Leeuwarden Declaration on Adaptive Reuse of the Built Heritage (ACE (Architects' Council of Europe) 2018), adaptive reuse interventions have positive impacts on the circularity of sustainable development processes, simultaneously managing to preserve and strengthen the original cultural values and the physical consistency of the heritage. The complex interrelationships between culture, economy, society and environment make adaptive reuse a necessarily multidimensional process in which new forms of economy, promotion of social cohesion, well-being and environmental protection can be tested and adopted (Bosone and Iodice 2021). Interpreting the adaptive reuse of cultural heritage as a "restorative, regenerative and sustainable form of conservation" (Gravagnuolo et al. 2017) requires the adoption of a circular development model capable of achieving economic growth and well-being, "by separating growth from resource consumption" (Foundation 2013). Moreover, such a model, by fully aware a new use value to the reused assets, allows extending their useful lifecycle, reflecting exactly one of the characteristics of the circular economic model. The reuse of churches can bring benefits in environmental and socio-economic terms, limiting the consumption of non-reproducible material resources, handing down the traditional construction culture, favoring the use of labor, limiting the processes of industrial production of materials and components compared to what is required by the construction of new buildings (Pinto et al. 2017). The original values system represents the so-called "intrinsic value", as accredited in the Burra Charter (Australia ICOMOS 1979). Intrinsic value is linked to the "spirit of place" and reflects the specific identity of a place, expressing the physical-spatial relationship that, over time, has bound communities to their environmental context. It is thus the result of a 'social construction' whose interpretation and evaluation require the participation of the local community in its various components.

In the processes of territorial enhancement and regeneration, the role of intrinsic value is fundamental in that it allows a direction to be set for the development and management of a site, a historic center, a city, consistent with the local history and with the value-bearing heritage embodied in its cultural heritage (Pinto et al. 2017). In these terms, reuse is an economic challenge for the construction sector, requiring a previous evaluation of the rehabilitated product through decision criteria for project (Robert 1991). The system of values attributed the potential for use identified in it, meanings for the church reuse process and contributing to the quality of location (construction, esthetic and dimensional) of existing buildings (Bianchi and De Medici 2023). The difficulties of reusing this type of building depend on the characteristics (for example, the presence of large rooms, the efficient thermal behavior, the reliability of lighting and natural ventilation systems, the use of durable materials), the skills of the workforce and the materials used not available on the market (Fitch 1990). This makes clear the need to identify suitable tools for the sustainable reuse of churches; therefore, the paper returns a system of indicators that allow evaluating the adequacy of the project actions, aimed at mediating between the conservation of the built heritage and the transformative needs of contemporary instances. These results provide scenarios of sustainable recovery, capable of transforming waste into a resource, lengthening the life cycle of the ecclesiastical heritage, and thus mitigating its environmental impact, as well as the cost linked to the loss of cultural and identity values for the community.

60.2 Methods and Materials

The care of building systems is the strategy of protection for the conservation and transmission of common goods to future generations. Based on the essential role of maintenance and reuse operations, they are guarantors of the ideal choice of a new functional purpose compatible with the character and meaning of the building on which to intervene (Bosone and Ciampa 2021).

In this research, the adoption of an analytical-making process aims at highlighting the necessity of adopting a systemic perspective to understand the complex interrelationships between culture, economy, society and the environment. In this perspective the adaptive reuse is considered as an interdisciplinary process, in which the creative and collaborative dialogue between different professions of expert and common knowledge leads to the elaboration of a tool able to re-interpret the needs expressed by the stakeholders as requirements for the reuse project (Pinto, 2004). This first co-design phase ensures that the tool can be used by the experts not only to preserve the building but also to valorize tangible and intangible values linked to the new use. The elaboration of an analytic tool becomes the opportunity to facilitate not only the involvement of religious and civil communities in knowledge and decision-making processes, but also the dialogue between them and expert knowledge, overcoming the traditional view of top-down projects imposed on passive and unaware communities. The opportunity to elaborate a preferred choice, through the analysis of a wide range

of cases, derives from the ecclesiastical building witnessed as growing disposal of churches abandonment (Bullen and Love 2011). For this reason, the research focuses on a selection of 140 church reuse cases, considered good experimental practices of the literature, starting from the observation of experiences that stimulate a reflection on the contribution of the built environment rehabilitation project with respect to contemporary instances. The selected cases refer to virtuous practices of reuse of churches carried out in the last 30 years. These are case studies that, for the design made, have been awarded or indicated in literature and in international scientific journals as best practices. In particular, this selection of cases was also chosen to meet the current guidelines and guidelines described and addressed in the previous paragraph. These case studies have led to the triggering of transformation processes with experimental consequences and significant repercussions on the rehabilitation project innovation in the built environment management. The selection of these good practices has been structured with the aim of returning a scenario of the appropriate uses to safeguard and, when possible, increase the values of a disused church. This is aimed at deepening practices and behavioral correspondence to the adoption of different uses. Each card highlights the need to establish a previous description of the church to be reused, in order to study the opportunities for intervention offered and the criteria adopted for the new function inclusion (Fig. 60.1).

The card returns the system of requirement categories and features attributed to the intervention and the image of the potential use expressed by the function, this in order to provide useful indicators for the reuse design of deconsecrated churches. The terms of investigation that make up the structure of each individual intervention, return and discrete the card-type of four parts. The data relating to the first part are a particular report established for each own case. It concerns the location site, useful information to analyze the type of territorial geography distribution about the interventions conducted; the period of construction, useful information to indicate the time interval of existence of the building; and the typology, information aimed at understanding the original planning structure. The original use and any changes of it can be deduced from the type of cult in reference before the intervention, information necessary to understand any choices imposed by previous operations; the features of the building, information necessary for the description of the intervention following the insertion of the new function.

The second part contains data relating to the framework of the reuse project with reference to the period of intervention; the commission, given that it influences the interests acting on the choice of the new function inserted. It concerns also the new use, given that it affects the type of interventions to be carried out to adapt the structure to the new function; the presence of volumes added above ground or underground, given that it determines a transformation of the envelope of the structure and therefore of the image perceived by its users. The third part of the card consists of dimension the reuse project, which inevitably generates a new identity for the church deriving from the integration between the original characteristics of the building and the new use

S. GIUSEPPE CHURCH | *Spazio Kor*

Piemonte, Asti (AT)

THE BUILDING

Period of contruction
1660

Typology
Latin cross with rectangular single-nave church

Original use
Church

Previous use
Military building

Building features
The church has a rectangular floor plan with a single nave, punctuated by two deep communicating chapels on each side.

REUSE PROJECT

Commission
Asti Municipality

New use
Theatre and Museum

Additional volumes above or below ground level
yes ☐ no ☒

Period of reuse
2016

DIMENSION

Environmental Sustainability	Social-Cultural Sustainability	Technological-Economic Sustainability

REQUIREMENT

Morphological-dimensional features

– Preservation of the interior spaces original geometric configuration:
yes ☒ no ☐

– Preservation of the existing building dimension:
yes ☒ no ☐

– Preservation of aesthetic relationships with the context:
yes ☒ no ☐

Perceptive-cultural features

– Recognisability of the transformation:
yes ☒ no ☐

– Reversibility of transformation:
yes ☐ no ☒

– Acceptance of transformation:
yes ☒ no ☐

– Respect for collective memory:
yes ☐ no ☒

Material-constructive features

– Compatibility of transformation:
yes ☒ no ☐

– Conservation of technic elements:
yes ☒ no ☐

– Respect for the construction system:
yes ☒ no ☐

– Life-length of transformation:
yes ☒ no ☐

DESCRIPTION

The church has been reused as a theatre: the chancel welcomes the tribune and the nave the stage. The sacristy has been reused as foyer, ticket office and toilets for the audience; the rectory as dressing rooms, actor rooms and toilets. The elongated block behind the presbitery is a stagecraft museum.

ENVIRONMENTAL SYSTEM		TECHNOLOGICAL SYSTEM	
ENVIRONMENTAL UNIT	ORIGINAL SPATIAL ELEMENTS	TECHNOLOGICAL UNIT	NEW TECHNIC ELEMENTS
Theatre Hall	Single nave	Closure	Exterior vertical fixtures
	Presbytery		Ground floor
Foyer + Ticket Office + Toilets	Sacristy		Roofs
		Vertical int. partition	Vertical internal walls
Dressing rooms + Artist rooms + Toilets	Rectory		Vertical internal fixtures
			Protective elements
Exhibition Hall	Chapel	Inclined int. partition	Internal stairs

Fig. 60.1 Example of church card

that is made of it about Environmental, Social-Cultural and Technological-Economic Sustainability.

The acquisition of data, schematized within the previous parts of the card, allows analyzing each case through a decomposition into respective three features: Morphological-dimensional, Perceptive-cultural and Material-constructive (De Medici and Pinto, 2012).

The first one features, attitude of the building or its parts to represent stylistic and artistic canons recognized. The limitations concern the preservation of the interior spaces about the original geometric configuration and preservation of the existing building dimension. In addition, the preservation of the interior spaces original geometric configuration, in order not to change the balances present in the area, altering the vocations of development that determine its recognizability. In particular, the preservation of aesthetic relationships with the context, in order not to vary the morphological, dimensional and proportion relationships between the building and the environment surround.

The second one features, aptitude of the building or its parts to constitute evidence of historical events or periods; in many cases, the changes that over time have affected the built—due to variations in use or the changing needs of users—constitute overlapping stratifications, which highlight its role as a historical document. The limitations aimed at the permanence of this feature in the choice of new functions and in the interventions that follow concern the recognizability of the transformations in order to ensure the clear distinction between the new and the elements, avoiding camouflage. This principle aims to preserve the identity of the asset, allowing a clear dating of the interventions suffered by it. Also, the reversibility of the transformations, aimed at allowing the possibility of removing the added elements or materials or restoring those removed. In fact, it is necessary to provide both that the development of technological research makes available, over time, intervention solutions with a greater degree of compatibility, and that the changing needs of use of the good requires new changes. In these cases, it is necessary to be able to bring the building back to a condition as close as possible previous to the transformation, limiting the loss of matter and identity. The acceptance of the transformations, to ensure that variations in use, is shared not only by the client and the designers, but also by the direct, indirect and potential users of the building. This must be verified during the planning through the respect for collective memory, aimed at ensuring that transformations do not alter the recognizability of the good as a representative element of the identity of social groups, which attribute specific symbolic values to it.

The third one features, attitude of the building or its parts to represent the material and constructive culture of a place or an era. The limitations imposed by the compatibility of transformation concerns conserving technic elements in order to respect the technological and construction system. It aimed at ensuring the permanence of the materials present using building products compatible with them and technological solutions that allow minimizing the loss of material. In addition, it concerns the respect for the construction system, in order to protect the construction techniques present and the system of relationships that binds the elements that make up the building organism, testimonies of the material culture of a given historical moment

or its evolution over time. The possibility to recognize the constructive conception of the asset, using materials and techniques that do not hide its traces. Moreover, the life-long transformation, with the aim of avoiding that the interventions carried out are subject to a rapid process of degradation, induces negative effects on up-cycling the elements (Figs. 60.2 and 60.3).

The fourth card part concerns the breakdown of the project description according to the systemic conception of Architectural Technology, divided into Environmental and Technological systems. The first one describes the link between the Environmental Unit and the original spatial elements, specifically what use are located into

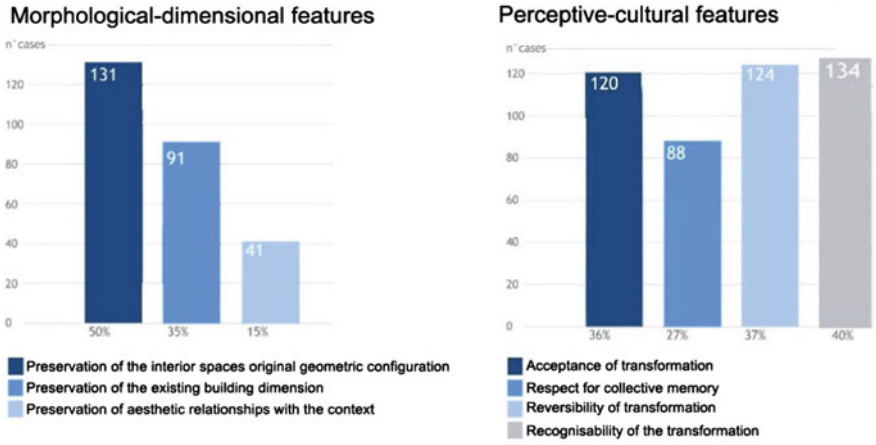

Fig. 60.2 Reuse features analysis (morphological-dimensional and perceptive-cultural)

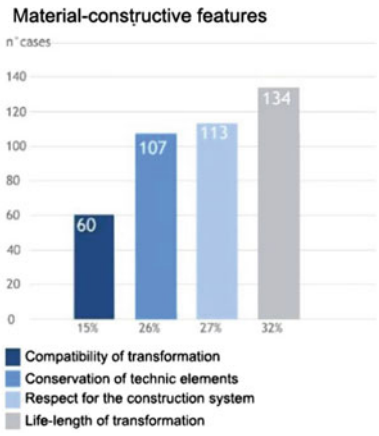

Fig. 60.3 Reuse features analysis (material-constructive)

original spatial elements, connoting new activities established and the physical transformations. The second one describes the link between technological unit and new technic elements, respectively returned by the physicality of the functional compartments and by the elements that allow their transformation. This comparison allows relating how spatial elements are more predisposed to accommodate certain functions rather than others.

They aimed at ensuring the compatibility of transformations to avoid that the use of inadequate materials and technologies or the variation of elements or spaces configuration can cause damage or accelerate its degradation process preserving the life-long transformation (Figs. 60.4 and 60.5).

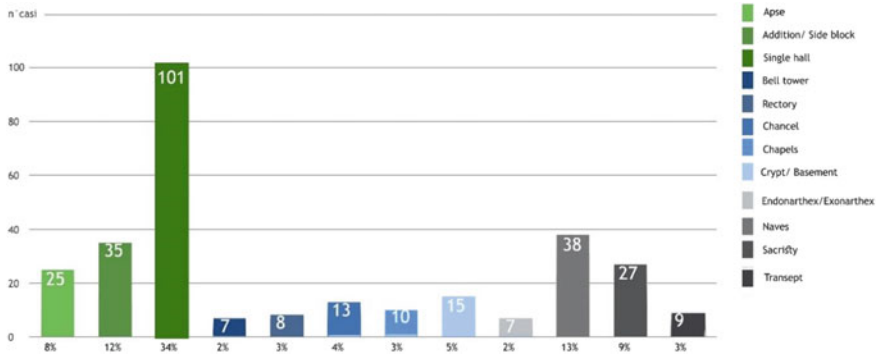

Fig. 60.4 Most frequent original spatial element analysis

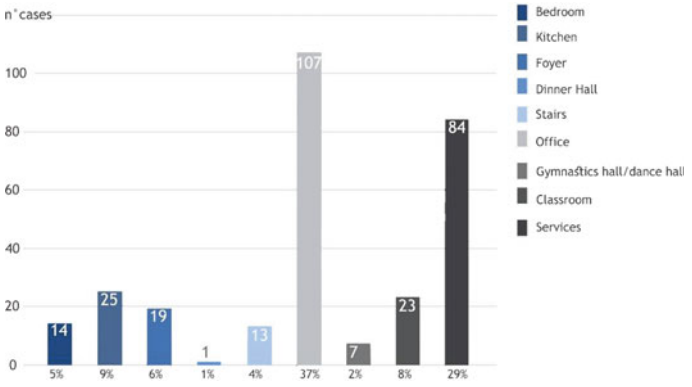

Fig. 60.5 Most frequent environmental unit analysis

This relationship in the functional field of space reuse is inextricably linked to the dominant technological units used in the reuse project to perform the function, detailed in the dominant technic elements to meet the performance requirements related to the new use (Figs. 60.6 and 60.7).

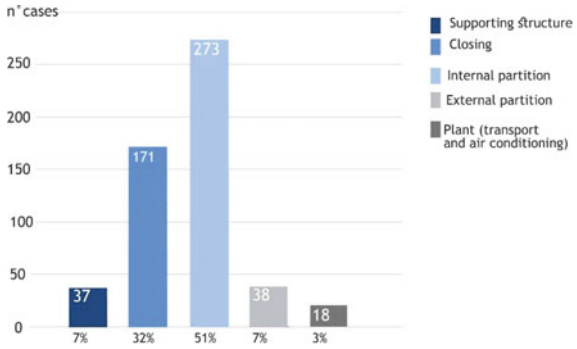

Fig. 60.6 Most frequent technological unit analysis

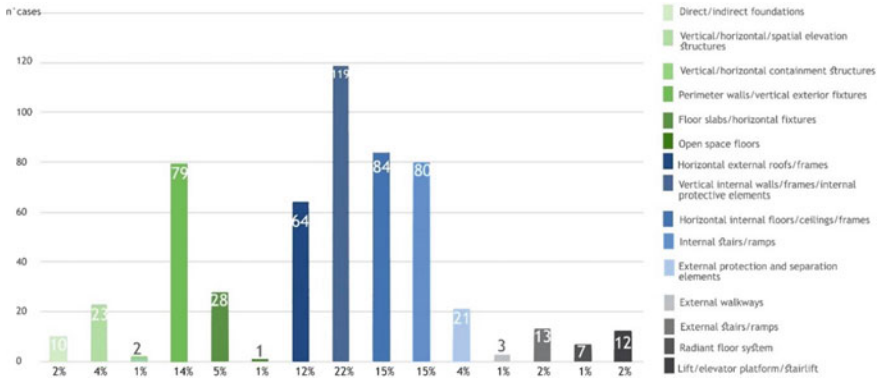

Fig. 60.7 Most frequent technic element analysis

60.3 Results and Discussion

These analyses reveal the existence of a link between the intended reuse and its transformative impact on the built cultural heritage. From the elaboration, the original spatial elements have been reused in accordance with the vocations of the environmental units, using technical elements not detrimental to the cultural image of the site, the techniques and materials existing in it. There is, therefore, the possibility of identifying and preferring certain design rather than others based on the new use and the environmental and technological units that derive from it. The insertion of a new function must inevitably consider the significance of the patrimony of ecclesiastical religious architecture as this value could remain also after the intervention of reuse. It is a meaning that is not abandoned with the ruse but influences the physical transformations of the heritage, determining appropriate project and compatible with the sacred character of the place. In particular, the church can also be deconsecrated and used with a new profane purpose, but it is this intrinsic value of the cultural heritage built to guide the most appropriate transformation.

The experimentation allows creating a comparison matrix from which sustainable reuse indicators for ecclesiastic built heritage regeneration can be extrapolated (Fig. 60.8). By using sustainability factors as dimensions, you can determine the requirement category associated with their features. The latter, compared with the actions determined by the design, referring to the more frequent technic and environmental elements determine the system of indicators. The latter present different forms of measurement demonstrating the degree of mixture and complexity of the processing obtained. The ability to aggregate them allows you to also dissociate them, using them if necessary only for the verification of a certain dimension of the project or at the end to compare its verifiability.

Dimension	Requirement Category	Features	Indicators	Unit of Measure	Actions: Intervention Project Choice	
					More frequent Technic Elements	More frequent Spatial Elements
Social-Cultural Sustainability	Perceptive-cultural	Recognisability of the transformation	Materials, finishing, technic elements or construction techniques clearly distinct from the original ones	%	Vertical exterior fixtures/ Vertical and horizontal internal walls/frames Floor slabs/horizontal fixtures	Chancel Endonarthex/Exonarthex
				n./sqm	External and internal/protection and separation elements	
		Reversibility of transformation	Materials, finishing or technic elements without permanently transform the existing building	%	Internal stairs/ramps	Sacristy
					Radiant floor system	Single hall
				n./sqm	Vertical internal walls/frames/internal protective elements	Transept
					External protection and separation elements	Addition/Side block
		Acceptance of the transformation	Materials, finishing, technic elements or construction techniques which preserve the geometric configuration and the aesthetic value of the existing building	%	Vertical exterior fixtures/ Vertical and horizontal internal walls/frames Floor slabs/horizontal fixtures	Chancel Endonarthex/Exonarthex
				n./sqm		
		Acceptance of the transformation	Materials, finishing, technic elements or construction techniques which preserve the geometric configuration and the aesthetic value of the existing building	%	Vertical exterior fixtures/ Vertical and horizontal internal walls/frames Floor slabs/horizontal fixtures	Chancel Endonarthex/Exonarthex
				n./sqm		
		Respect for collective memory	Aesthetic elements characterizing the building identity value in the time	%	Vertical internal walls/frames/internal protective elements/exterior and internal decorative	Naves
				n./sqm		
Environmental sustainability	Morfological-dimensional	Preservation of the existing building dimension	Volume preserved	%	Vertical and horizontal exterior walls/frames Vertical and horizontal internal walls/frames	Addition/Side block
				n./sqm		
		Preservation of aesthetic relationship with the context	Spatial elements which integrate the building into its context	%	Perimeter walls/vertical exterior fixtures	Bell tower
				n./sqm		
Technological-economic Sustainability	Material-constructive	Compatibility of transformation	Materials, finishing, technic elements or construction techniques without compromise the existing building degradation	%	Open space floors	Naves
				n./sqm		
		Conservation of technic elements	Previous technical elements	%	Vertical exterior and internal fixtures	Bell tower
				n./sqm		
		Respect for the construction system	Traditional techniques	Yes/No	Perimeter walls/vertical exterior and internal fixtures/ Vertical and horizontal internal walls/frames	Rectory
			Innovative construction system without compromise the existing building performances	Yes/No	Perimeter walls/vertical exterior and internal fixtures/ Vertical and horizontal internal walls/frames	Naves Chapels Apse
		Life-length of transformation	Sustainable and eco-friendly materials	Yes/No	Radiant floor system	Single hall
			Reused technic elements	%	External stairs/ramps	Bell tower
				n./sqm		
			Recycled technic elements	%	External protection and separation elements	Addition/Side block
				n./sqm		

Fig. 60.8 Sustainable reuse indicators for ecclesiastic built heritage regeneration

60.4 Conclusion

The indicators deriving from the elaboration of the cards have highlighted, in most cases, the need to mediate between the operations of conservation, often reason of its abandonment, or otherwise the inappropriate functions that determine the loss of the church identity. From this develops the need to recognize these indicators as elements guaranteeing the balance to be maintained between transformation and permanence.

The reuse intervention through these indicators can also represent a tool for revealing the hidden values of the property, revitalizing not only the potential of the building but reactivating dynamics lost over time.

Considering the cultural heritage as the result of the interaction between people and their living context, consequently it is the bearer of both tangible and intangible values (environmental, social/cultural, economic, symbolic, aesthetic, historical, spiritual, etc.) between which symbiotic relationships exist (Fusco Girard 2019). In fact, in turn, the environment shapes people's behavior as the quality of places, infrastructures, human and social capital and institutions affects the entire productivity of an urban system, influencing the quality of life of the people who live there. This circular, symbiotic and reciprocal process between man and the built cultural heritage represents a permanence factor in the transformative dynamics of cultural heritage and landscape, ensuring an evolutionary continuity based on the co-evolution and regeneration of material and immaterial values. The reuse project must also be based on this process, so that the regeneration of disused assets contributes to the reconstruction of symbiotic relationships between people and the environmental and cultural contexts in which they live, preserving and regenerating existing values and generating new ones.

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