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## **Circular economy and cultural heritage conservation: a proposal for integrating Level(s) evaluation tool**

The paradigm shift towards a more humanistic and ecological paradigm evoked by United Nations and the Green Deal is increasingly required in this period of growing unsustainability, especially during ongoing COVID-19 pandemic. The challenge today is to reduce poverty and inequalities, while preserving the vitality of natural ecosystems and ensuring inclusive economic growth and wellbeing, both now and in the future, thus including future generations. To this end, new models for city development and new tools for operationalizing them are necessary. This paper is focused on the circular economy model and, in particular, on the functional reuse of cultural heritage as the entry point for triggering circular processes in the cities. The attention is focused on the evaluation tools and a methodological proposal is presented starting from the Level(s) tool (developed by European Commission) for assessing the multidimensional impacts of cultural heritage functional reuse projects in the circular economy perspective.

### **1. Introduction**

The paradigm shift towards a more humanistic and ecological paradigm evoked by United Nations (§§ 15, 24, 25 of the New Urban Agenda) (United Nations, 2016) and by the European Commission (in the Green Deal) (European Commission, 2019c) is increasingly required in this period of growing unsustainability. Furthermore, the health emergency due to the COVID-19 confirmed (and is still confirming) the need to move towards this new paradigm, requiring a new balance between natural and man-made ecosystems. It has highlighted that “people and nature are interlinked” and thus the necessity to “renew” the “humanity’s broken relationship with nature” (World Wide Fund for Nature WWF, 2020).

The humanistic dimension, in particular, is related to human wellbeing, health and living conditions, issues that in this period of health emergency due to COVID-19 are even more at the centre of international debates.

The crisis due to the pandemic has also demonstrated that the ecological, economic and social dimensions are interconnected and dividing them has been a great mistake. This leads us to rethink the processes of the current economy, linking them more closely to those of ecology and society. People’s health has to be also interrelated with the health of the ecosystem and the “health” of the economy (that is an economy characterized by a positive evolutionary dynamic able to generate and/or regenerate, and conserve value over time).

The pandemic due to COVID-19 has produced negative impacts not only in terms of disease and illness but, as highlighted by the General Director of WHO,

it has revealed today's inequalities, injustices and contradictions, highlighting strengths and vulnerabilities of our society (World Health Organization WHO, 2020b). The health and wellbeing of people depends also on factors and actions taken in sectors other than health (World Health Organization - WHO, 2018). In particular, the WHO recognizes many factors as "health determinants", including both natural biological factors (age, gender and ethnicity), and also behaviours and lifestyles, the physical and social environment, and access to health care and services (World Health Organization - WHO, 2019). So, there are different factors impacting the human health.

Cities cover 3% of the earth's surface and are home to more than half of the world's population ([www.metabolic.nl](http://www.metabolic.nl)), consume 78% of the world's energy, produce more than 60% of greenhouse gas emissions and 50% of global waste (UN-Habitat). Considering these data, it is clear that cities play a key role in achieving (or not) sustainable development and in fighting the challenges of our time (climate change, social inequality, environmental crisis, economic crisis). Many researches and studies are demonstrating that human activities are producing polluting substances (Coker et al., 2020; Ripple et al., 2019; Watts, 2019) that are contributing to climate changes with negative impacts on the air, land, sea, weakening also the immune system and making people prone to diseases (as that due to COVID-19 pandemic) (Wu et al., 2020). This necessary requires a new equilibrium (Zeleny, 2021) and a change of the way in which the human being lives, produces and consumes.

According to the documents of the United Nations (2015b, 2016), if well-planned and managed, the cities can contribute to achieve sustainable development. So, the urban organization and transformation model are recently increasingly investigated and questioned. Furthermore, cities today have also to be "reviewed" in the light of all the needs and changes in lifestyles arising from the COVID-19 pandemic.

The urban development strategies should place the human being at the centre of its processes, and thus his health and wellbeing, considering that the human right to the highest attainable standard of health is recognized by the Charter of the United Nations (United Nations, 1948).

The challenge today is to reduce poverty and inequalities, while preserving the vitality of natural ecosystems and ensuring inclusive economic growth and wellbeing, both now and in the future, thus including future generations. Considering the changes and challenges that cities are facing today, we are called and "forced" to transform and plan cities in a different way than we have done so far. So, new urban development models are required in order to implement the above paradigm shift and to move towards a more sustainable world.

Furthermore, some international organizations, such as UNESCO and ICOMOS, emphasize the crucial role that culture can play in the achievement of sustainable development (Hosagrahar et al., 2016; ICOMOS Climate Change and Heritage Working Group, 2019; Potts, 2016). The economic, social, cultural and environmental systems are not isolated, but they are "interconnected" (principle of interconnectedness (Throsby, 2008) and cultural heritage can represent the "glue"

among these different dimensions of sustainable development (Srakar and Vecco, 2016). Furthermore, the intersection between cultural heritage and climate change is recognized as an “urgent need” by ICOMOS, which highlights that cultural heritage is able to contribute to many Sustainable Development Goals and climate goals (ICOMOS Climate Change and Heritage Working Group, 2019). It recognizes that while the impacts of climate change on heritage are clear, the value of cultural heritage as an asset in the response is not.

The debate on urbanization and that on culture are intertwined, as also the UNESCO Recommendations highlighted (UNESCO, 2011). Furthermore, unlike the 2030 Agenda in which cultural heritage plays a marginal role, in the New Urban Agenda (NUA) cultural heritage is recognized in many points (i.e. points 10, 26, 38, 45, 60, 124) as an important factor for urban sustainable development. Culture is recognized as “a priority component of urban plans and strategies in the adoption of planning instruments, including master plans, zoning guidelines, building codes, coastal management policies, and strategic development policies that safeguard a diverse range of tangible and intangible cultural heritage and landscapes” (point 124). This makes it necessary to protect it from potential disruptive impacts of urban development. Culture “provide an important contribution to the sustainable development of cities, human settlements and citizens, empowering them to play an active and unique role in development initiatives” (point 10). It is considered as a key element in the humanization of cities and human settlements (point 26), playing an important role in “rehabilitating and revitalizing urban areas, and in strengthening social participation and the exercise of citizenship” (point 38). Furthermore, the role of cultural heritage in developing vibrant, sustainable, and inclusive urban economies is highlighted (point 45 and 60).

In the aforementioned paradigm shift and implementation of more sustainable urban development strategies, the circular economy can play a key role. In fact, it is the economy in which nature co-evolves with the city. At the same time, it is the economy of relationships: it helps generate and regenerate the relationships between human-beings and nature and between people, contributing to the creation of community. This relational dimension of the circular economy means that it contributes to the humanization of cities.

This paper is focused on the circular economy model and, in particular, on the functional reuse of cultural heritage as the entry point for triggering circular processes in the cities. In particular, here the attention is focused on the evaluation tools, which are essential to understand the effectiveness and efficiency of these new model and thus to assess the multidimensional impacts it produces. After an overview of the official documents by European Union about the above issues (§1.1), the circular economy model is introduced (§2) and cultural heritage is proposed as key element for triggering urban circular processes (§§2.1; 2.2). The attention is focused, in particular, on the evaluation tools (§3) and, starting from the Level(s) tool (by European Commission) (§3.1), a methodological proposal is presented for assessing the multidimensional impacts of cultural heritage functional reuse projects in the circular economy perspective (§§4, 5, 6).

### *1.1 How Europe is moving towards a more sustainable future*

As a response to the challenges linked to climate changes, environmental degradation and socio-economic crisis, the European Union (EU) has approved a number of documents to promote measures to make our country more sustainable.

In particular, the EU recognizes the role that cities played in achieving a more sustainable future, as already highlighted by the United Nations in the 2030 Agenda and in the New Urban Agenda (United Nations, 2015b, 2016)

In 2016, the EU has adopted the principles, the commitments and the actions of the New Urban Agenda approving the Pact of Amsterdam (European Union, 2016). This document identifies 12 challenges which our cities are called to face. These challenges are linked to the following themes: inclusion, air quality, urban poverty, housing, circular economy, employment, adaptation to climate change, energy transition, sustainable land use and nature-based solutions, urban mobility, digital transition, innovative and responsible public procurement. Therefore, the Pact of Amsterdam considers, among its priorities, the “circular economy” and the “sustainable use of land and nature-based solutions” as two important themes that will guide actions of the EU Urban Agenda for a smart, sustainable and inclusive growth.

In December 2019, the European Commission (EC) approved the European Green Deal (European Commission, 2019c). It is a “new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. It also aims to protect, conserve and enhance the EU’s natural capital, and protect the health and well-being of citizens from environment-related risks and impacts. At the same time, this transition must be just and inclusive. It must put people first, and pay attention to the regions, industries and workers who will face the greatest challenges” (European Commission, 2019c).

In the context of contemporary cities, that are characterised by high density and increasing unsustainability, we are called to face many problems related to the redevelopment of the existing asset. In particular, in our cities, facing the challenges of our time (that is the ecological, social and economic crisis) is an issue more related to the sustainable use, management and transformation of the existing asset than to the planning of the new one. These are issues related to the energy efficiency, the efficient use of water and of construction materials. The redevelopment of the existing asset is also related to the use of biomass - natural capital, green roofs, urban greenery, etc.

In the Green Deal there is an explicit reference to the built heritage. In fact, the need to start a “wave of renovations” of existing public and private buildings is highlighted to face the double challenge of energy efficiency and affordability of energy (currently the annual renovation rate in the Member States varies only from 0.4% to 1.2%). Indeed, the construction, use and renovation of buildings absorb significant amount of energy and mineral resources (such as sand, gravel, concrete). Buildings are also responsible for 40% of energy consumption. In March

2020, the European Commission adopted a new Circular Economy Action Plan (European Commission, 2020) as one of the main building blocks of the European Green Deal. It provides “a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens and civil society organisations”. In this Communication

the construction sector is among the key product value chains highlighting the necessity to promote circularity principles throughout the lifecycle of buildings in order to reduce climate impacts. To this end, the Commission is launching a new comprehensive “Strategy for a Sustainable Built Environment” (European Parliament, 2021).

Efficient building renovation would reduce the amount of energy bills, as well as boosting the building sector, thus providing an opportunity to support small and medium-sized enterprises and employment at local level. The EC with the Green Deal is committed to strictly enforce the legislation on energy performance in the building sector. In addition, it is committed to reviewing the Construction Products Regulation which should ensure that all phases of the design of new and renovated buildings are in line with the needs of the circular economy and lead to an increasingly climate resilient asset.

The EC also plans to set up a platform that brings together different “players” in the construction sector to collaborate and jointly tackle the obstacles to restructuring. In addition, forms of financing are envisaged for interventions aimed at energy improvement of buildings and specific actions for the removal of regulatory constraints in the matter.

Among the built asset, there is a specific asset characterized by particular values (historic, aesthetic, intrinsic, etc.), that is cultural heritage. This unique subset of the building sector is “expression of the ways of living, developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values” (ICOMOS International Cultural Tourism Committee, 2002, p. 21). It assumes a key role in sustainable development of the city, in achieving simultaneously economic, ecological and social goals, in the circular economy perspective.

## **2. The circular economy and circular city models**

The circular economy model, based on the principle that nothing in nature is waste and everything can become a resource (Ellen MacArthur Foundation, 2015), aims to make the principles of sustainable development operational. The circular economy can be defined as “the restructuring the industrial systems to support ecosystems through the adoption of methods to maximize the efficient use of resources by recycling and minimizing emissions and waste” (Preston, 2012). Reference is made to how resource flows can be closed (Chertow, 2000).

To date there are 114 definitions of circular economy existing in literature (Kirchherr et al., 2017). The United Nations have introduced in the Goal 12 of the 2030 Agenda (United Nations, 2015b) and in paragraphs 71-74 of the New Urban

Agenda (United Nations, 2016), the final document of the Habitat III conference (October 2016), the notion of circular economy as a general development model that produces impacts on natural and social systems, while generating economic wealth. This stimulates an indefinite extension of the life of the resources and their use values and promotes cooperation circuits between the different actors.

The circular economy model, not intended in a limited sense (that is strictly linked to waste management or the use of renewable energy sources) and therefore by expanding its field of action, can contribute to reduce the trade-off between environmental health, community health and economic "health". The circular economy model can be assumed as a way for re-integrating the economy into ecology (Fusco Girard, 2020). Therefore, among the measures to make the country more sustainable, the circular economy offers a great potential also thanks to this capacity.

In this perspective, the EC has adopted in 2015 a first package to support the EU transition towards the circular economy, including legislative proposals aimed at stimulating the European path towards this new model (European Commission, 2015). This is an essential contribution of the EU's efforts to develop a "sustainable, low-carbon, resource-efficient and competitive" economy. The aim of this package is to stimulate economic growth, making it more sustainable and competitive in the long term. It considers the circular economy as a mean for contributing to innovation, growth and job creation (European Commission, 2015).

In March 2019, the EC published a Communication on the implementation of the Action Plan for the circular economy adopted in 2015 (European Commission, 2019a). It presents the main results of the implementation of the Action Plan and outlines the open challenges for the implementation of the circular economy model. This Communication shows some results of the 54 actions (implemented or in progress) envisaged by the 2015 Action Plan. From 2012 to 2016 there was, for example, a 6% increase in workers employed in the circular economy (four million workers in 2016). As highlighted by the Communication, the circular model has also opened up new job opportunities, gave rise to new business models and developed new markets, both inside and outside the EU. In 2016, circular activities such as repair, reuse or recycling generated nearly 147 billion euros in added value, while investments amounted to around 17.5 billion euros.

As emerges from international documents on the topic of the circular economy and especially from some good practices at different scales in which the implementation of circular processes has produced benefits, the circular economy offers a great opportunity to make our country sustainable and increase urban productivity. There are several cities that are moving in this direction linked to the circular economy as development model. Some of these cities explicitly define themselves as "circular cities" and are elaborating reports in which they define and systematize their action plan for the transition towards this new model of city (Agenda Stad, 2015; Circle Economy, 2019; Gemeente Rotterdam, 2016; LWARB, 2017; Mairie de Paris, 2017). In Europe, the circular city model is more widespread than in Italy: London, Amsterdam, Rotterdam, Brussels, Paris are just a few examples (Fusco Girard and Nocca, 2019).

These cities recognize the importance of organizing the city system in analogy with natural systems and are undertaking a series of strategic actions aimed at transforming the processes that characterize cities from linear to circular. These actions concern various sectors, from construction to agri-food, to textiles, etc. However, the closure of cycles should not only refer to technical issues (as emerges from most of the good practices of circular cities), but should refer to a systemic change of the city, its organization, its economy, its community, its governance (Fusco Girard and Nocca, 2018).

Most of the circular processes can be implemented in the urban space through urban planning. The latter can promote the conditions of spatial proximity between resource flows, encourage multi-function and flexibility of buildings and spaces, support the greenery of the spaces, etc. representing the institutional tool able to change the organization of the city in a new one based on circular flows.

### *2.1 The circular economy model and cultural heritage*

The entry points for the implementation of the circular economy model in cities can be various. As emerges from the case studies of circular cities, these are mainly linked to those production chains that include greater flows of resources in cities: food chain, construction sector, energy, etc. (Circle Economy, 2016a, 2016b; Gemeente Rotterdam, 2016; LWARB, 2017; Mairie de Paris, 2017). In fact, one of the first steps for the implementation of the circular city is the definition of its urban metabolism and the identification of resource flows.

However, one entry point that is not considered in any circular city and that can play a key role in the implementation of this model is cultural heritage, that can be a significant “cyclifier” (Fusco Girard et al., 2014) in triggering circular processes.

Although not formally expressed, many principles that characterize the circular economy model are also evoked in the UNESCO Recommendations of the Historic Urban Landscape (HUL). In fact, in the paragraph no.11 of the Recommendations the need for a productive and sustainable use of space resources is stressed. In the paragraph no.19 reference is made in particular to the efficient use of the environmental resources represented by water and energy and the second paragraph calls for a strategic vision that goes beyond the short term: it stresses the importance of a long-term vision, which is typical of the circular economy. In addition, HUL stresses (in the paragraph 24/d) the need for self-financing, i.e. self-regeneration of financial resources in order to preserve the regenerated heritage over time. Furthermore, paragraph no. 22 insists on the need for “harmonious” cooperation between different private and public actors. These are two typical characteristics of the circular economy model.

Today there are many abandoned and underused cultural heritage buildings because public administrations do not have enough resources to maintain them “alive”, although cultural heritage is recognized as a driver of sustainable development (European Commission, 2014). Heritage buildings play a crucial role in

transferring cultural identity to future generations: conserving cultural heritage can be helpful to future generations to understand where they are coming from (Fusco Girard and Vecco, 2021; Mısırlısoy and Gunce, 2016).

City buildings can have a life span of up to hundreds of years. When a cultural building can no longer have its original function, it has to be adapted to new needs and identifying a new function is inevitable to preserve it. However, cultural heritage that no longer has its original use still has its historical, social and cultural values. Functional reuse is a strategy for preserving those values while adapting the function to the new community needs. According to the Leeuwarden Declaration, “new functions are thus brought together with heritage values in an active and meaningful dialogue” (Architects’ Council of Europe - ACE, 2018). An appropriate new use for an abandoned or underutilized historic building needs to simultaneously both respect its intrinsic value and meet the needs of the local community, helping to improve its quality of life (Aigwi et al., 2020; Fusco Girard et al., 2019).

So, when heritage buildings are adopted to new functions, it is important preserve as much as possible the originality and architectural feature of the building (Mısırlısoy and Gunce, 2016), that is to identify the limit in the management of change. This new use has to be appropriate in terms of preserving its cultural significance, its intrinsic value (Fusco Girard, 1987; Fusco Girard and Vecco, 2019).

The restoration, rehabilitation and functional reuse of cultural heritage and cultural landscape are part of the circular economy processes. Here the attention is focused in particular on the functional reuse.

In the perspective of the circular economy, functional reuse is different from the one in the linear model, both in terms of design and in operational and management terms (Fusco Girard, 2020). The organization/management of a reused cultural asset should be interpreted in a way similar to the organizational structure of the nature and requires a particular attention to all dimensions and values included in cultural heritage. The issue of cultural heritage functional reuse in urban environment requires a transdisciplinary approach as it raises issues that cut across many disciplines (restoration, sociology, technology, etc.) (Foster and Saleh, 2021).

Both circular economy and the functional reuse of cultural heritage aim to prolong the lifetime of resources, that is the use values in an indefinite time. The functional reuse allows to extend the use values of cultural heritage, preserving its integrity and authenticity, so that it can continue to be enjoyed by both present and future generations. So, it can represent an important contribution in “decoupling growth from resource consumption”; cultural capital is preserved, regenerating values for many stakeholders.

The functional reuse has to be interpreted in a systemic logic: each spatial and functional transformation produces multidimensional impacts in environmental (link with the European Green Deal), economic, social and cultural terms. In addition, there are different values to keep at stake when dealing with cultural heritage. Functional reuse allow to bring back to life a dead heritage. It can be interpreted considering the centrality of the ecological dimension and thus considering this activity as source of environmental values (Fusco Girard, 2020). It represents



a valid alternative to the demolition and replacement or to the new construction, reducing energy consumption and waste production and, at the same time, also provides social benefits thanks to the revitalization of traditional landmarks and giving them new life (Conejos et al., 2011; Foster and Kreinin, 2020; Mısırlısoy and Gunce, 2016).

Furthermore, through the functional reuse of cultural heritage, a symbol of community is conserved “alive” (cultural benefits) and the construction of new assets – and the consequent use of other resources – is reduced (environmental benefits). Moreover, the functional reuse is able also to produce economic benefits (in terms of increase of productivity, touristic attractiveness, real estate values, etc.) and social benefits (in terms of employment, social relationships, etc.) (Conejos et al., 2011; Foster and Kreinin, 2020; Nocca, 2017; Sowinska-Heim, 2020). Therefore, it can produce multidimensional benefits in the perspective of the circular economy. It allows conserving all values of the cultural heritage, among which the use values and the intrinsic value. The multiple benefits of re-using built heritage (economic, environmental, social and cultural benefits) are highlighted also in the Leeuwarden Declaration (Architects’ Council of Europe - ACE, 2018).

## *2.2 The multidimensional benefits of reuse of cultural heritage*

In literature there are some authors that are highlighting the benefits from the reuse of cultural heritage. Circular economy in built environment is mainly still related to waste recycling and minimization. However, there are many researches highlighting the environmental benefits, although they are not widespread (Assefa and Ambler, 2017; Bullen and Love, 2010; Foster, 2020; Foster and Kreinin, 2020; Mahpour, 2018; Munarim and Ghisi, 2016; Pereira Roders and Van Oers, 2011).

One of the most recognized environmental benefits is that related to the “embodied energy”, which is the “cumulative energy inputs that were required to construct the building initially” (Hammond and Jones, 2008) and “process/operational energy consumed during the building’s use” (Cabeza et al., 2013). Historic buildings have a significant amount of embodied energy. It is strictly linked to environmental impacts as it is referred to the “energy expenditure associated with the extraction, transportation, processing, on-site assembly, and performance of materials, over their expected life cycle” (Gaspar and Santos, 2015).

By making buildings more energy efficient, there are avoided costs that can be invested in other ways, such as supporting creative activities related to heritage reuse.

Functional reuse of historic buildings promotes sustainable communities because it significantly reduces the use of building materials, energy consumption, and pollution (in terms of carbon dioxide emissions) produced from the construction process (Itard and Klunder, 2007); at the same time, it preserves the unique heritage features and cultural identity of the building (Boarin, 2016).

As previously mentioned, historic buildings have a great amount of embodied energy and thus reusing them helps conserve this energy. As also Foster and

Kreinin (2020) underline, although water and energy are common circular economy indicators, they emerge few times by the analysis they conducted on the literature review (168 journal articles from 2008 to 2017) of environmental impact indicators of cultural heritage buildings (from a circular economy perspective).

Functional reuse of a building could also contribute to changes in the amount of water used, such as increased demand due to increased occupancy or plumbing system upgrades. Although indicators related to water quantity are easier to measure, more emphasis in the literature is given to indicators related to water quality and eutrophication (Moraga et al., 2019). The emphasis on water efficiency related to the reuse of a building is little highlighted when dealing with environmental aspects, despite the global importance of the water issue. The low awareness that emerges related to water and rainwater recycling implies the need to undertake actions to increase awareness and culture related to water. Water saving programs linked for example to optimization and modification of consumption models are necessary.

In addition, functional reuse is also a way to reduce negative soil impacts from dust when compared to new construction activities (Aigwi et al., 2018; Bullen and Love, 2010).

Cultural heritage can represent an opportunity to face climate change and thus contributing to limit global warming to below 2 degrees, preferably to 1.5 degrees Celsius, compared to pre-industrial levels, as recommended in the Paris Agreement (ICOMOS Climate Change and Heritage Working Group, 2019; IPCC, 2019; United Nations, 2015a).

Although there are many studies highlighting the environmental benefits of the reuse of cultural heritage, many of them deal with the environmental impacts only from a narrative point of view, lacking in operational perspective, that is without identifying specific indicators and quantitative data. Even though often not addressed in operational terms, it is important to highlight a certain awareness among researchers regarding the link between the environmental issue and cultural heritage.

However, from an environmental perspective, heritage buildings extend the lifespan of buildings while preserving cultural values, reduce and avoid demolition waste, prevent the extraction of new materials, and provide opportunities to improve environmental quality through, for example, improving energy efficiency, expanding green spaces, and shifting from fossil fuels to renewable energy sources.

Sometimes regulatory requirements can limit the environmental performance of reused buildings (for example, in terms of acoustic and thermal insulation), resulting in lower performance than new buildings (Wilkinson et al., 2009). However, other benefits from reuse, such as social benefits, can balance these disadvantages (Aigwi et al., 2020; O'Donnell, 2004).

In addition, as most historic buildings usually do not promote passive environmental systems, functional reuse could represent an opportunity to test innovative technologies and new solutions for promoting sustainable development models.

Furthermore, the new use to be attributed to an abandoned or underutilized historic building should be able to stimulate a vibrant economy for the community

and produce a “profit” capable of self-sustaining it. This is a “circular process”: the functional reuse is able to produce impacts that partially “come back” to cultural heritage itself (Fusco Girard and Nocca, 2019).

From an economic point of view, in most cases the reuse of heritage buildings can result cheaper and faster if compared to demolition and rebuild (Aigwi et al., 2018; Bullen and Love, 2011a; Douglas, 2006), except in cases in which total structural reconstruction of the building is required (Shipley et al., 2006).

In addition, redeveloping a heritage building rather than demolishing and rebuilding it often takes much less time, and this reduction in time can also mean lower costs (Highfield and Gorse, 2009). The latter are also reduced because most of the structural components of the building that serve as raw materials are already on site and this reduces the duration of the work (Shipley et al., 2006).

Some studies also recognize that reusing cultural heritage produces positive impacts in terms of property values, both of the building itself and of the buildings in the surrounding area (Aigwi et al., 2020; Nocca, 2017). However, this increase in value sometimes can turn in an increase in housing cost and gentrification.

Sometimes regulatory requirements and structural complexities can reduce the economic and financial benefits of heritage reuse compared to new construction. Furthermore, in reuse, labor and material costs can often be higher (Bullen, 2007; Kohler and Yang, 2007).

If on the one hand functional reuse reduces the amount of materials to be used compared to demolition and reconstruction, thus reducing embodied energy and carbon dioxide emissions, on the other hand it should also be taken into account that existing buildings have more difficulty in achieving energy standards than new buildings (Baker et al., 2017; Ball, 2002; Bullen and Love, 2011b). Existing buildings could still be brought to a similar energy level as new buildings, for example compared to zero-emission buildings. However, this would result in a significant increase in costs.

However, this increase in costs can be balanced if, in addition to the economic dimension, also the dimensions related to other heritage values, such as social and cultural values, are taken into account. In fact, although reuse can sometimes be more expensive than demolition and reconstruction, it is “winner” from a cultural (Fusco Girard, 2020) and environmental (Foster, 2020) point of view. For example, Baker et al. (2017) explain how decision makers chose to implement a project to adapt and reuse the Fort Dunlop (United Kingdom) despite the fact that it was technically complex due to the physical condition of the building that it did not comply with certain regulations (such as fire safety). However, this choice of conservation was linked to the awareness that this heritage has a high importance for the local community that finds in it a symbol of its identity.

Furthermore, Aigwi et al. (2020) underline the importance to consider the multidimensional impacts of functional reuse projects. They elaborate a holistic performance-based framework to prioritise underutilised or abandoned cultural heritage buildings for functional reuse intervention. It is based on five main priority aspects: economic sustainability, built-heritage preservation, socio-cultural aspects, building usability, and regulatory.

### 3. Evaluation tools for the circular economy model

The implementation tools play a fundamental role in making the circular economy/city model operational. The focus here is in particular on the evaluation tools to assess and monitor the efficiency and effectiveness of the circular model, that is, to assess the impacts (positive and/or negative) of the projects and initiatives of the circular agenda.

Although interest in the circular economy model is growing, the debate around it remains more on a theoretical level, while the tools to implement it is still a fertile field of research (de Jesus and Mendonça, 2018; Foster, 2020; Fusco Girard and Nocca, 2019). Knowledge about how to implement this new model is still confusing and lacking. There are some studies on circular economy indicators in literature, but they are rather sectoral and do not include simultaneously all the key principles of the model.

In Europe, the sustainability of cultural buildings is driven by indicators mainly related to Life Cycle Analysis-based standards; environmental impact assessment; and green building certifications (Foster et al., 2020). However, a commonly recognized system of indicators for evaluating cultural heritage from a circular economy perspective, including simultaneously all the impacts related to environmental, social, economic, and cultural dimensions does not yet exist to date.

The decision-making process of cultural heritage reuse cannot be focused only on financial issue (on the basis of which reuse can often be more expensive than demolition and reconstruction). Given the particularity of the object of evaluation, other impacts (i.e. social, cultural, environmental), in addition to financial ones, need to be necessarily considered in the evaluation framework.

Less importance is often given to the socio-cultural impacts of reuse during decision-making processes (Aigwi et al., 2020; Bullen and Love, 2011b). Instead, to fully understand the convenience of a reuse project, its multidimensional impacts have to be considered.

The challenge is to identify the functional reuse solutions able to integrate the economy with the ecology and the human dimension. To do it, tools are necessary, from management to financial, to business, to evaluation tools.

The evaluation framework for circular economy projects should be based on two levels. On the one hand, it has to be able to capture the level of circularity of the project itself, while on the other hand it has to be able to capture the impacts that the implementation of such a project produces on the city.

An integrated evaluation framework for assessing new uses is fundamental to identify the satisfactory compromise solution (Simon, 1976) between conservation and transformation, that is between the logic of change and of permanence.

Foster et al. (2020) elaborate a Circular Environmental Impact Indicator Framework for assessing the reuse of cultural heritage, but focussing this framework only in the environmental dimension. This framework identifies environmental indicators that could be used for any "circular" renovation of existing buildings.

Baker et al. (2017), comparing five case studies, argue the decision-making process for choosing the demolition or adaptation of buildings. They analyze the

advantages and disadvantages of adaptation versus demolition. Benefits of adaptation include saving embodied energy and preserving heritage values. They state that demolition may be encouraged if the building is in poor physical condition or if there are difficulties in complying with building regulations, as this can increase the financial risk and overall cost of the project.

Foster (2020) develops a new comprehensive circular economy framework for the reuse of historic buildings to reduce environmental impacts. The framework, starting from the relevant literature about this issue, integrates methods and techniques from the construction literature that aim to reduce the environmental impacts of the life cycle of buildings based on a circular approach. This framework aims to be flexible and easy to understand in order to provide a guide both for technical and non-technical stakeholders. However, this rich and interesting framework is focused only on the environmental impacts.

Della Spina (2020) proposes an integrated evaluation model to assess and compare different scenarios of the potential reuse of some historical fortifications in Sicily (Southern Italy). Starting from focus groups with expert actors, she identifies a matrix of criteria and multidimensional impact indicators (3 criteria and 11 indicators) according to the systemic perspective of the landscape proposed in the HUL Recommendation by UNESCO (2011). A limited number of criteria and indicators has to be chosen otherwise the evaluation process becomes overly complex and less effective.

Sheata et al. (2015) propose a comprehensive assessment framework for evaluating the reuse projects of cultural heritage in Cairo, starting from the awareness that many of them did not report success also because they have been analysed from a singular perspective. The interdisciplinary nature of functional reuse of cultural heritage instead requires an integrated evaluation framework. They, in particular, identify many criteria divided into three main themes: building preservation, success of the new function and local community development. However, they have not associated specific indicators to these criteria.

As Aigwi et al. (2020) highlight, there are many indicators to assess the economic impacts of the projects of heritage building reuse. For example, they identify indicators related to employment (in terms of the creation of new businesses and new jobs), increased property values of surrounding buildings, and increased revenue from tourism activities related to the building under reuse.

The increase in economic value of reused buildings is also transferred over time to the surrounding buildings as an indirect spillover effect. In addition, among the indirect effects related to the reuse of cultural heritage there is also the potential increase in income from the growth of cultural tourism due to a greater attractiveness of the area (Gravagnuolo et al., 2017). Other economic benefits arising from the functional reuse of cultural heritage are related to new job opportunities related to the new function attributed to the asset, savings arising from the reuse of construction materials (Aigwi et al., 2018; Bullen and Love, 2010; Conejos et al., 2011) and savings due to the shorter working period because the structural elements are already existing (Douglas, 2006).

The historic environment and the economic activity are strictly linked considering the many economic activities that depend on it, take place within it and it

attracts (Historic England, 2019). Tangible cultural heritage secures thousands of jobs (European Spatial Planning Observation Network - ESPON, 2020). The historic rehabilitation is the activities producing more jobs for each \$1 million of activity compared to other ones, as automobile manufacturing, computer manufacturing, air transportation, poultry processing, new construction (Rypkema and Hin, 2019).

The study conducted by Foster and Krenin (2020) highlights that the most widely used circular environmental impact indicators in the reuse of historic buildings are the embodied energy of building materials and CO<sub>2</sub> emissions, both during the construction and the operation phase. The assessment of energy and greenhouse gas emissions is crucial to face the climate change that represents one of the main goals of decision-making processes related to construction sector. The assessment field of historic buildings today is strongly influenced by a number of both international and national evaluation and certification schemes, such as BREEAM and LEED certifications.

An evaluation tool that integrates the “traditional tools” – born and used in the field of linear economy – with tools characterized by a matrix linked to the circular economy model is certainly necessary. The role of evaluation is critical to show the differential benefits between the circular model and the linear model, that is to demonstrate that the benefits of the circular model overcome the costs. In fact, the benefits that the circular model produces are both tangible and intangible. Although implementing the circular economy model can have additional financial costs, these would be balanced by the benefits produced (throughout the life cycle of the building), considering these not only in economic terms, but also environmental, social and cultural.

The evaluation framework should be characterized by an iterative learning process through three stages: evaluation, monitoring and adaptation. In fact, considering that cities, and therefore its elements (as cultural assets), evolve and transform over time, a “dynamic” evaluation framework is necessary to be able to grasp the impacts in changing conditions in the short, medium and long term and to continuously monitor to understand if you are moving in the right direction. In this way, if the results are not as expected, interventions can be reviewed and adapted to better address the challenges. This could lead to several feedback loops over time (dynamic aspect of evaluation). The discipline of evaluations helps not only to compare the alternatives already given, but also to produce new solutions by aiming at a positive sum game in which all subjects obtain benefits (Fusco Girard et al., 1989).

The starting point for the proposed evaluation framework is the Level(s) as it is the only officially recognized evaluation tool to date. However, it needs to be revised and adapted to be used for cultural buildings.

### *3.1 Level(s) tool*

In 2018, the European Commission has identified a first framework for assessing the circular economy by identifying a series of indicators divided into four cat-

egories: production and consumption, waste management, secondary raw materials, competitiveness and innovation (European Commission, 2018). These indicators certainly represent a starting point, but not a sufficient framework to evaluate and monitor the complex framework of the circular economy that involves different sectors, different actors and different “flows”.

The only more detailed and specific official evaluation tool adopted by the European Commission (in collaboration with various stakeholders, including different producers, associations and organizations) in the context of the circular economy is the Level(s), a tool referring only to the construction sector. Level(s) provides a set of indicators to assess the environmental performance of office and residential buildings, considering impacts throughout its life cycle. It is not currently mandatory, but can be adopted on a voluntary basis.

The construction sector is one of the sectors that consumes the largest amount of resources: it represents half of all extracted materials, half of total energy consumption, one third of water consumption and one third of waste production (European Commission, 2017a). It therefore represents a key objective for the European Commission’s policies on sustainability and circular economy.

Since the testing phase began (2018), the Level(s) tool has been applied to 136 construction projects (of which 74 residential and 62 non-residential) (European Commission, 2019b).

The purpose of the Level(s) tool is to standardize the assessment framework of environmental sustainability in Europe by means of a system of indicators to assess the sustainability of buildings during their life cycle, both with reference to residential and office buildings, refurbished or newly built. Each indicator is developed to link the impact of the individual building with the sustainability priorities at European level.

The sustainable buildings use less energy and materials, and are healthier and more comfortable spaces for occupants. Together with the lower environmental impact, they require lower management costs. Level(s) encourages operators both to implement the Life Cycle Assessment (LCA) and the Life Cycle Cost Assessment (LCCA), or the assessment of life cycle costs.

The Level(s) tool, currently still in the testing phase, promotes a holistic logic based on life cycle assessment as a tool for assessing sustainability, promoting an overall view of the building rather than a compartmentalized vision of individual performances.

Level(s) allows to evaluate various aspects: environmental aspects, performance related to issues such as health and wellbeing, life cycle costs and potential future risks of performances.

The Level(s) framework is based on six macro-objectives that correspond to three following different thematic areas:

- environmental performances of life cycle;
- health and comfort;
- cost, value and risk.

Each of the above thematic area includes some macro-objective, for a total of six macro-objectives, shown in Table 1.

Table 1. Thematic areas and macro-objectives of the Level(s) tool (European Commission, 2017b).

Thematic area 1	Macro-objectives
1 Environmental performances of life cycle	greenhouse gas emissions along a building life cycle resource efficient and circular material life cycles efficient use of water resources
2 Health and comfort	healthy and comfortable spaces
3 Cost, value and risk	adaptation and resilience to climate change optimised life cycle cost

The achievement of these macro-objectives is the desired result, so that buildings can contribute to the achievement of European environmental policies (European Commission, 2017b).

Level(s) is structured in different phases ranging from the collection, estimation, evaluation and analysis of data regarding the performances of the building under study. Furthermore, as the name suggests, this tool is made up of three levels of increasing depth of performance evaluation (European Commission, 2017b, 2017c).

- common performance assessment; the simplest level, a common reference guide for building evaluation;
- comparative performance assessment; the level that allows the comparison between two or more equivalent buildings from the functional point of view;
- optimized performance assessment; the more complex level, which allows to perform a more detailed analysis and calculation models aimed at optimizing performances.

The levels show how to reduce the environmental impacts and can prepare operators for more challenging performance evaluation schemes and tools.

The assessment of the impacts of circular economy projects on health represents an added value to the decision-making process, considering that human health is significantly influenced by policies and actions in many other fields (including those involved in the transition to a circular economy) that go beyond the health sector and influencing health through different pathways. Health conditions represent a fundamental aspect in the circular model of the city because they reduce costs which, in the perspective of human-centered development, are linked to morbidity, malaise, etc.

From the perspective of the circular economy, the reference to the construction sector is certainly fundamental as this sector is the greatest producer of interdependencies. This, in addition to contributing to economic productivity and environmental sustainability, at the same time also contributes to “social” productivity, producing employment.

Therefore, the construction sector certainly represents an excellent entry point for the implementation of a model that can simultaneously satisfy economic, environmental and social sustainability, reducing the trade-off between the green economy and the social economy.



The Level(s) tool, although quite comprehensive, does not explicitly mention cultural heritage. However, considering also that the European Union itself recognizes the key role of cultural heritage as one of the drivers in sustainable development, it is necessary that the EU specifically addresses the issue related to implementation tool for the functional reuse of cultural heritage, providing a comprehensive and adequate list of indicators (economic, environmental, social, and cultural).

#### **4. An integrated evaluation tool for assessing cultural heritage functional reuse projects**

##### *4.1 The contribution of cultural heritage to the macro-objectives identified by the Level(s) tool*

Among the built asset, there is cultural heritage, that is an asset characterized by particular values and historical, cultural and aesthetic characteristics. Since, as mentioned above, there is not yet an evaluation framework for assessing cultural heritage conservation and regeneration projects from a circular perspective, in this research study it is intended to move in the direction to fill that gap. The idea is to move towards the creation of a common language for the evaluation framework of cultural heritage conservation and regeneration projects.

A framework for this integrated evaluation is here proposed starting from the tool adopted by the European Commission (Level(s) tool). The integrated evaluation (Lichfield, 1989; Lichfield and Lichfield, 1986) is here interpreted integrating the humanistic dimension, with the ecological, economic, technological and social dimensions. The functional reuse is considered not only in a green perspective, but in an integrated logic that includes all the different dimensions and values.

The Level(s) tool can be adopted, with the appropriate modifications and integrations, to cultural heritage, as a particular type of built asset. Unlike Level(s) that is used for both new construction and rehabilitation projects, in the case of cultural heritage, this tool is clearly only used for existing assets.

As emerged from previous researches and as highlighted in the previous paragraphs, cultural heritage functional reuse projects produce multidimensional impacts, covering both the environmental and the economic/financial, social and cultural dimensions (CHCfE Consortium, 2015; Nocca, 2017). Furthermore, cultural heritage cannot be considered separate from its context (UNESCO, 2011) and thus its evaluation framework has to include both impacts of the projects on the asset itself, but also the impacts that it is able to produce on its context, that is on the city.

Indeed, cultural heritage is able to contribute to the achievement of almost all the macro-objectives identified by the Level(s) tool, as shown in the following paragraphs.

#### 4.1.1 The contribution of cultural heritage to the macro-objective “Greenhouse gas emissions along a buildings life cycle”

The aim of this objective (included in the thematic area “Life cycle environmental assessment”) is “to minimise the total greenhouse gas emissions along a buildings life cycle, from cradle to cradle, with a focus on emissions from building operational energy use and embodied energy” (European Commission, 2017c).

Cultural buildings have a long lifespan; so, assessing their environmental impacts is important to achieving a sustainable, low-carbon economy. Functional reuse of cultural heritage contributes to reduce greenhouse emissions because it avoids new construction and the resulting emissions of polluting gases and resources consumption. Furthermore, contrary to the construction process which requires high energy expenditure (linked to the different phases, from extraction to assembly), in the functional reuse the materials are maintained and reused and, consequently, less emissions are produced (Gravagnuolo et al., 2017; Rayman et al., 2017).

In the functional reuse, conserving the tangible asset means also preserving its embodied energy (CHCfE Consortium, 2015; Foster, 2020; Itard and Klunder, 2007). The built environment has great potential for energy savings and the investments made pay back throughout the life cycle of the asset. Energy savings can be achieved both through investments in technology (i.e. using renewable or high energy efficiency energy systems) and through management systems and lifestyle change (Nocca and Fusco Girard, 2017). Through the protection and revitalisation of the huge embedded energy in the historic building stock, cultural heritage can contribute to facing climate change challenges (CHCfE Consortium, 2015; Foster, 2020; ICOMOS Climate Change and Heritage Working Group, 2019; Itard and Klunder, 2007).

#### 4.1.2 The contribution of cultural heritage to the macro-objective “Resource efficient and circular material life cycles”

This objective (included in the thematic area “Life cycle environmental assessment”) is related “to optimise the building design, engineering and form in order to support lean and circular flows, extend long-term material utility and reduce significant environmental impacts” (European Commission, 2017c).

Considering that the purpose of cultural heritage functional reuse is to preserve the integrity and authenticity of the asset, it prevents the use of new raw materials trying to use materials already extracted during the past. Furthermore, considering the aforementioned purpose, also demolition waste are minimized. The parts that inevitably have to be demolished to adapt the building to its new use can be reused, in a circular economy perspective, as “raw material” for the construction of other parts.

Furthermore, as underlined in the previous paragraphs of this paper, functional reuse prolongs the values of the resources extending, at the same time, the life cycle of materials because materials are maintained and preserved to allow joining

the asset. In addition to saving materials, functional reuse also reduces land consumption that would be caused if a new building were to be built.

#### 4.1.3 The contribution of cultural heritage to the macro-objective “Efficient use of water resources”

This objective (included in the thematic area “Life cycle environmental assessment”) is related “to make efficient use of water resources, particularly in areas of identified long-term or projected water stress” (European Commission, 2017c).

Considering the reduction in demolition works (but also during the construction phase) compared to new construction, functional reuse contributes significantly to reduce water consumption. Furthermore, as water is considered as a precious resource that cannot be wasted, water self-sufficiency should be the characteristic of every re-use project (Fusco Girard, 2020). Specific water-saving strategies (from optimization to changing consumption models) can be included in reuse projects to reduce the amount of water used during the life cycle of the building compared to before the reuse project was implemented.

#### 4.1.4 The contribution of cultural heritage to the macro-objective “Healthy and comfortable spaces”

This objective (included in the thematic area “Health and comfort”) is related “to create buildings that are comfortable, attractive and productive to live and work in and which protect human health” (European Commission, 2017c).

In this thematic area, references to the health conditions and to comfort (as concept related to wellbeing) are considered.

Here the definitions of health and wellbeing provided by the Italian National Institute of Statistics (ISTAT, 2019) are assumed. In particular, the health dimension is principally associated to the medicine and has always the same parameters; the wellbeing dimension, instead, is a multidimensional concept related both to the economic wealth but also to happiness, quality of life, to ensure social cohesion, human rights and needs fulfilment, etc. However, health and wellbeing are interconnected. In fact, a good health contributes to the perception of greater wellbeing and, on the contrary, a feeling of malaise can lead to a worsening of health.

Historical buildings can contribute to a good health also thanks to their wise features. An effective orientation and the physical characteristics, for example the walling’s gauge, contribute to guarantee lesser temperature inside and outside the buildings, improving the general microclimatic condition. This contributes to health and wellbeing of the occupants. Furthermore, there is a relationship between quality landscape variation and wellbeing variation (Nocca and Fusco Girard, 2017). The landscape is important for our wellbeing and this link is intuitive. In fact, we tend, even unconsciously, to be more attracted by places that communicate harmony, balance and serenity while, on the contrary, we move away from those that communicate disorder, imbalance and insecurity. To this end, it is im-

portant to consider that the BES Report by the Italian National Institute of Statistic (ISTAT, 2015, 2019), among the 12 dimensions of wellbeing, make an explicitly reference to “landscape and cultural heritage”, recognizing its contribution to the achievement of a state of wellbeing and a better quality of life. Furthermore, the ISTAT recognizes the health as a domain of the wellbeing, highlighting once again their close relationship. Finally, cultural heritage contributes to improving the quality of life in different ways by providing, for example, new job opportunities, new spaces for living or doing activities through reuse.

#### 4.1.5 The contribution of cultural heritage to the macro-objective “Adaptation and resilience to climate change”

This objective (included in the thematic area “Cost, value and risk”) is related “to futureproof building performance against projected future changes in the climate, in order to protect occupier health and comfort and to sustain and minimise risks to property values” (European Commission, 2017c).

The World Bank has recognized the role that cultural heritage can play in the fight against climate change, identifying investment in cultural heritage as one of the solutions for CO<sub>2</sub> reduction. Activities that are related to cultural heritage represent a model of land use, consumption and production that is intrinsically more sustainable, as it has developed over time through continuous adaptation between community and environment. Cultural heritage can help face the challenges of our time, such as climate change, for example, “through the protection and revitalization of the huge amount of embedded energy in the historic building stock”, aspect already highlighted many times in this paper (CHCfE Consortium, 2015).

The reduction of greenhouse emissions, of waste production and the efficiency use of resources related to cultural heritage functional reuse contribute to reduce negative environmental impacts and thus to face climate change. Also in the 19GA 2017/30 Resolutions, ICOMOS recognizes the relationships between cultural heritage and climate change engaging to strengthen the efforts for supporting the implementation of the Paris Agreement emphasizing the contribution of cultural heritage and landscape-based solutions for reducing the global average temperature to well below 2°C. ICOMOS emphasizes the role of cultural heritage community to help meet the challenge of climate change (ICOMOS, 2017; ICOMOS Climate Change and Heritage Working Group, 2019).

#### 4.1.6 The contribution of cultural heritage to the macro-objective “Adaptation and resilience to climate change”

This objective (included in the thematic area “Cost, value and risk”) is related to “optimise the life cycle cost and value of buildings to reflect the potential for long term performance improvement, inclusive of acquisition, operation, maintenance, refurbishment, disposal and end of life” (European Commission, 2017c). This objective refers to the Life Cycle Costing (LCC), that is “particularly relevant

to achieving an improved environmental performance as higher initial capital costs may be required to achieve lower life-cycle running costs, higher residual property values and improved workforce productivity. It therefore represents a method for making effective, long-term investment decisions" (European Commission, 2017c). It refers to the cost over the life cycle of the asset, also including "the 'intangible' benefits, which may include factors that influence the users' comfort and productivity" (European Commission, 2017c). This objective is also related to the impacts that the enhancement of environmental performances can have on the real estate market. In the case of the functional reuse, the re-functionalization of the building and the regeneration of its values contribute to the increase of the real estate values, both of the regenerated building itself and of the surrounding buildings, producing economic benefits for the city. The impact on the real estate dimension is one of the most immediate impacts of such projects (Nocca, 2017). Furthermore, attention to consumption models such as energy and water in reuse projects certainly contributes to reducing costs over the life cycle of the building.

#### *4.2 The macro-objectives of cultural heritage functional reuse projects: the evaluation framework*

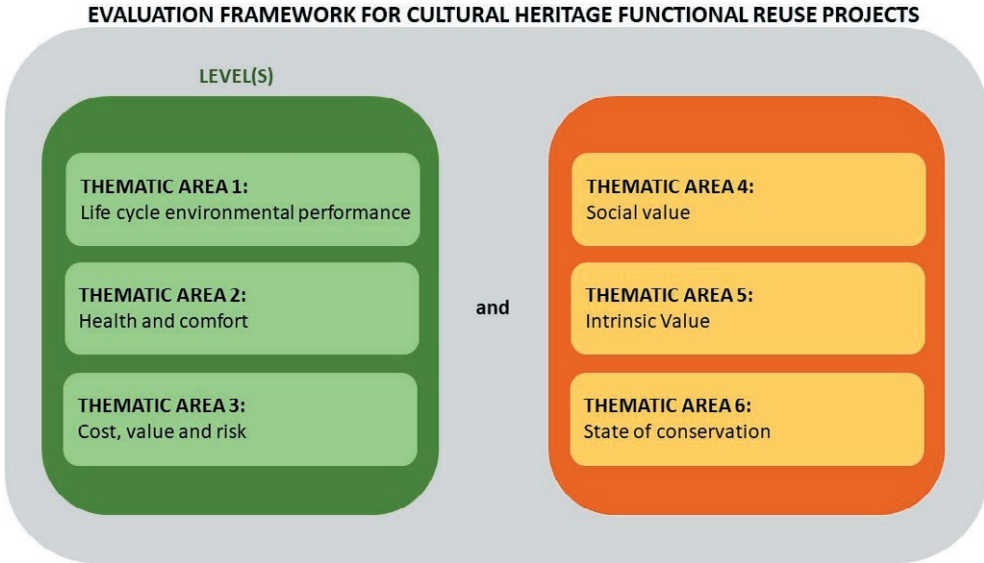
As the table 1 shows, the functional reuse of cultural heritage is able to contribute to the achievement of all objectives identified by European Commission in the evaluation framework for building construction (that is the Level(s) tool).

However, the Level(s) framework is more focused on environmental and economic dimensions, resulting weak from the human and social point of view, except for the thematic area on "health and comfort". The health dimension is fundamental in this period of great unsustainability, of sanitary emergency due to COVID-19 and in which the aforementioned paradigm shift (towards a more humanistic and environmental paradigm) is required.

The human dimension should be integrated in the evaluation framework putting the human-beings at the centre of the objectives. The three thematic areas proposed by European Commission are maintained and other three thematic areas are added (more specific to cultural heritage values). The "Health and comfort" thematic area identified by Level(s) is here modified in "Health, comfort and wellbeing" considering health and wellbeing as two different (but linked) concepts (according to ISTAT definition) and that cultural heritage conservation and regeneration projects can contribute to achieve better conditions for both of them.

Furthermore, starting from the three thematic areas of the Level(s) tool, other three thematic areas have been included in the evaluation framework in order to enrich it and to consider all the aspects and different values related to cultural heritage projects. Therefore, the proposed evaluation framework includes both the three thematic areas (no.1,2,3) identified by the European Commission (that are still relevant also for the evaluation of the functional reuse of cultural heritage and for which the contribution of cultural heritage has been highlighted in paragraph

Figure 1. The thematic area of the evaluation framework proposed for cultural heritage functional reuse projects.



§2) and three thematic areas (no. 4,5,6) that capture also the social and cultural dimensions (closely linked to cultural heritage and that escapes in the Level(s) tool).

The proposed thematic areas are:

- social value;
- intrinsic value;
- state of conservation (and related use value).

The total of the six thematic areas intends to cover all dimensions (Fig. 1): environmental, social, cultural and economic dimensions. The environmental and the economic ones were already included in the Level(s) by European Commission and they are here declined in relation to cultural heritage. The social and cultural ones are lacking in the European Commission's framework, but they need to be included in the evaluation framework for cultural heritage, considering its particular characteristics and values.

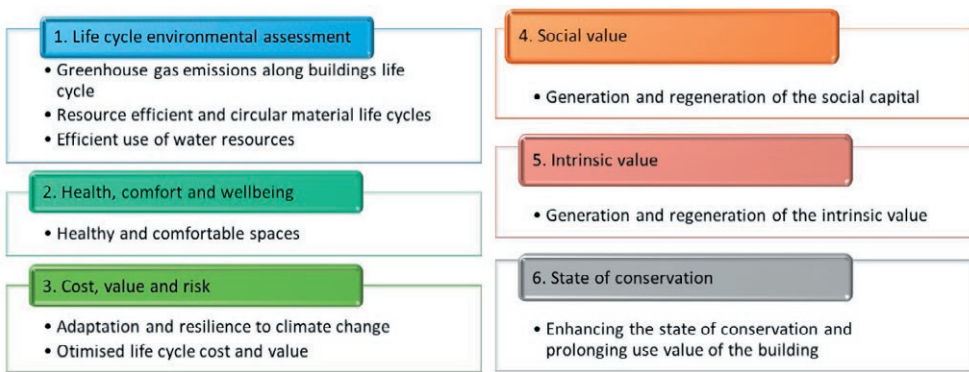
Furthermore, for each thematic area, related macro-objectives and specific indicators are identified.

Regarding the thematic areas already existing in the Level(s) tool, the corresponding macro-objectives identified by the European Commission have been considered. Instead, regarding the three proposed thematic areas, three new macro-objectives strictly related to cultural heritage have been identified.

The macro-objectives related to the new identified thematic areas are (Figure 2):

- generation and regeneration of the social capital (thematic area 4);
- generation and regeneration of the intrinsic value (thematic area 5);

Figure 2. Thematic areas and related macro-objectives of the evaluation framework proposed.



- enhancing the state of conservation and prolonging the use value of the building (thematic area 6).

The indicators are partly those identified by the European Commission in the Level(s) tool and partly those deduced starting from previous studies about cultural heritage conservation and regeneration projects. Here the following studies are considered: the research by Fusco Girard and Nocca (2019), about the contribution of cultural heritage in implementing the circular city; the research by Nocca (2017), about the multidimensional impacts of cultural heritage conservation and regeneration projects of 41 case studies, and the research by De Medici et al. (2020), about impacts of two projects of cultural heritage functional re-use. So, unlike the research analyzed in the literature review which mainly include indicators from other theoretical studies (paragraphs §§2,3), the indicators (that will be show in §6) included in the proposed evaluation framework are deduced and referred to concrete experiences. However, some of the indicators deduced from the case studies were also found to match those highlighted in the literature.

#### 4.2.1 The thematic area “social value”

Since the 1970s there has been a strong emphasis on the social values of cultural heritage. There is a clear increase in awareness of the importance of the intangible values of cultural heritage and the need to take them into account alongside (with the same importance) the tangible values in a decision-making process of the reuse of the asset itself (Fusco Girard, 2020; Nocca, 2017; Sowinska-Heim, 2020).

When dealing with cultural heritage, it is inevitable to include the social dimension, considering that cultural heritage has positive impacts on social capital generating and regenerating synergies, bonds and collaborative relationships (the “glue value” of cultural heritage) (CHCfE Consortium, 2015; Department for Culture Media & Sport, 2016; Fusco Girard and Vecco, 2019).

In cultural heritage there is a potential as a “connective infrastructure” (Fusco Girard, 2018; Fusco Girard and Nocca, 2019), that is an infrastructure able of keeping society cohesive, which is today greatly fragmented especially in large urban agglomerations, generating and re-generating bonds and relationships. It is fundamental for social cohesion as it expresses the values and identity of the community and organizes the community itself and its relationships through its symbolic power and aesthetic dimension. These relationships generated and regenerated by functional reuse can represent an input for implementing other activities related to cultural heritage.

Cultural heritage contributes to build social capital and social cohesion (CHCfE Consortium, 2015; Hosagrahar et al., 2016; Throsby, 2010, 2016), providing a context for participation and engagement and also fostering integration (CHCfE Consortium, 2015; European Association of Historic Towns and Regions - EAHTR, 2007). Furthermore, it encourages associations, new forms of economy (i.e. crowd-funding, municipal bonds, etc.) that, in turn, contributes to local economy.

Cities are characterized by amount of waste related to industrial activities, to land use, to household, to building sector, etc., but also to “waste” of human and social capital. Circular economy related to cultural heritage contributes to minimize waste of different kinds of capital: natural capital, manmade capital but also human and social capital. The latter is referred to unemployed, marginal people, poor people, etc.

Circular economy is focused not only on flows and recycling, but it is also linked to the relational capital, thus incorporating the avoiding “waste” of human capital, of skills, knowledge, creative, entrepreneur capacity of human beings (Fusco Girard, 2019). In this perspective, a key aspect related to social capital is the employment. It represents a very significant indicator of social inclusion, considering that it not only contributes to make people “feel good”, but also because it represents “the bridge” between the individual and society. Through the production of job opportunities, cultural heritage contributes to the improvement of wellbeing and quality of life. This aspect becomes, in a circular perspective, an input for economic productivity considering that a state of wellbeing makes people more productive (Zamagni et al., 2015), as also understood from some entrepreneurs, as Olivetti, Bata and Ferrero.

The indicators emerged from the study of concrete experiences of cultural heritage conservation and regeneration projects and that are proposed for this thematic category are (Fusco Girard and Nocca, 2019; Nocca, 2017):

- number of new jobs related to functional reuse projects (employment sub-category);
- number of associations, number of volunteers, number of cooperative enterprises related to functional reuse projects (social cohesion sub-category).

#### 4.2.2 The thematic area “intrinsic value”

Cultural heritage is an integral part of community life and is expression of its culture, identity, religious beliefs, etc. It is involved in social, economic and en-



vironmental processes. It is the element in which the community can recognize itself, today and tomorrow, becoming crucial for transferring cultural identity to future generations (Misırlısoy and Gunce, 2016). The reuse of cultural heritage is important to preserve the identity of a community, to strengthen it and to help future generations in “learning” where they came from.

Conservation and reuse aim not only at preserving material values, but also intangible values, the cultural significance that cultural heritage has for past, present and future generations, as values can change from individual to individual (and between different social groups).

This value-based approach requires careful reflection and investigation on what values are important to a community, its development and its quality of life. This investigation has to be carried out by experts (scientific knowledge) with the support of the community itself (communal knowledge).

Cultural heritage is characterized by an intrinsic value (Fusco Girard, 1987; Fusco Girard and Nijkamp, 1997). The notion of intrinsic value draws its foundation from ecological economics and in the recognition of the system’s autopoietic capabilities (Costanza et al., 2014; Maturana and Varela, 2001; Turner, 1993; Zeleny and Hufford, 1992). In fact, John Ruskin and Williams Morris had already introduced this notion (Morris, 1889; Ruskin, 1989), later taken up by Riegel as a value of memory (Riegl, 1903). It was the Burra Charter (ICOMOS, 1979, 2013) that opened the perspective of intrinsic value in the field of conservation of cultural heritage.

The formulation of intrinsic value was recently taken up in the European Commission (2014) which considers the dual dimension of culture as a value “in and of itself”, distinguishing it from the instrumental one (such as economic and social values).

This value reflects the specific and unique character, meaning, identity and beauty of a place, creating a sense of connection among people and between the community and cultural heritage. The intrinsic value reflects the way a community has lived, worked and organized itself over time.

The intrinsic value of cultural heritage, unlike that of the natural ecosystems, is produced by people over centuries of history and therefore also has a subjective aspect (Callicott, 1989; Elliot, 1992). Therefore, it does not exist in itself, but depends on the subjects who have recognized that value, that uniqueness, beauty, meaning in that cultural heritage. In this perspective, the subjective intrinsic value remains linked to an anthropocentric and not eco-biocentric approach, eliminating the dichotomy between anthropocentric and eco-biocentric values.

Cultural heritage expresses the values and traditions of a city and its community, linking present, past and future. However, its meaning may differ among diverse communities and even among different members within the same community. In fact, different social groups can have different values and perceptions, thus attributing different values to heritage.

Cultural heritage is a source of local identity, integration and cohesion. In a period of rapid transformation and urbanization like the one we are living, it expresses the memory of a community, its roots, and represents the “means” by

which each generation can communicate with the others. While serving as shared memory, a successfully adapted historical building will help to link residents to their roots. Furthermore, reusing cultural heritage allows preserving the sense of place (Aigwi et al., 2020).

Functional reuse allows cultural heritage to continue “to live” both for present and for future generations, prolonging its use values and preserving the intrinsic one. It contributes to keep alive a symbol of the community identity.

The intrinsic value helps to identify a direction for the use and management of the assets. In this sense, by offering a perspective to new strategies of local regeneration, the intrinsic value is the foundation on which to articulate any new use value (or combination of several use values) connected to a new project/strategy. In this way, the new project is in continuity with a territorial urban history and offers the “energy” for a creative synthesis, for processes of hybridization between memory and innovation. The intrinsic value offers the “insuperable” limit in the management of change (Fusco Girard et al., 2019).

Therefore, also this important value should be considered in the evaluation framework of cultural heritage functional reuse projects. In this perspective, some indicators can be proposed starting from the analysis of concrete experiences of cultural heritage conservation and regenerations (Fusco Girard and Nocca, 2019):

- place attachment and local identity (following the implementation of projects related to cultural heritage);
- sense of place in sites/area.

#### 4.2.3 The thematic area “state of conservation”

When a cultural building is no longer able to fulfil its functions, but needs to be adapted to different functions, it is necessary that the interventions do not alter the originality and architectural character of the building “in order to not give wrong or missing information for the further generations” (Misirlisoy and Gunce, 2016).

Considering the role of cultural heritage at different level (economic, environmental, social and cultural), indicators about the state of conservation of landscape values are fundamental in the proposed evaluation framework. They are related to the physical conditions of the asset and thus, indirectly, also to its use value.

The state of conservation is linked to the building usability that, in turn, is linked to three factors, that is effectiveness, efficiency, satisfaction related to the new use (Aigwi et al., 2020). In the perspective of the circular economy, the functional reuse projects contribute to prolong the use values of the asset and thus to preserve its state of conservation from the state of degradation due to abandonment. Functional reuse allows functionally obsolete or underutilized historic buildings to adapt to new needs and serve new functions (Douglas, 2006), while retaining their original features and existing building structure (Aigwi et al., 2020; Bullen and Love, 2010).

By preserving the cultural heritage, we build the memory of ourselves and therefore identity. So, through the cultural heritage that has been handed down to us, we can react to the risk of loss of identity in a period of strong globalization

like this one we are experiencing today and, at the same time, we can pass it on to future generations.

Cultural heritage is subject to continuous adaptation to changes that occur throughout history. It is subject to continuous processes of hybridization and each “graft” represents new lifestyles, new styles, etc. It is able, thanks to functional reuse, to adapt to changing context, as it happens in living organisms.

A place where historical and cultural values are preserved for longer is characterized by a greater sense of belonging. In such places, the attractiveness of the place will also be greater (increasing also the tourist flows that in turn feed the local economic productivity) and the civic and individual attention to the preservation.

The use value of the cultural heritage depends also on the state of preservation. Cultural heritage has to be conserved also for future generations that have the right to enjoy that particular asset.

Cultural heritage can be preserved by maintaining its function, or by identifying a new function that meets the needs and requirements of a society in continuous transformation. The use value can therefore change and it is linked to the type of heritage (public building, private building, castle, church, etc.), its location and the type of ownership and management. The threshold within which a new use value is admissible, therefore the threshold of change, is given by the intrinsic value of the assets itself (Fusco Girard et al., 2019).

In this perspective, the approach proposed by HUL implies the ability to identify the limits (the threshold) within which the change is admissible. The “change management” (UNESCO, 2011) has to ensure consistency (continuity) with the past, with identity, with memory, that is with the intrinsic value. It is necessary to identify the structural and cultural constraints to re-functionalization.

Through the conservation and regeneration of cultural heritage, new use values are attributed to adapt it to the dynamism and changing needs of the community. These use values are consistent with the value independent of use and therefore do not produce loss of identity of the heritage. The functional reuse of cultural heritage is considered here as a way to enhance the identity of the territory as it is based on its history, its values, etc. It is an entry point to regenerate cultural, community and collaborative values, in the awareness that the challenge to development can only be faced together.

In this perspective, some indicators, starting from concrete experiences of cultural heritage conservation and regeneration, can be identified:

- state of conservation of the building (Nocca, 2017);
- conservation of the geometric features (De Medici et al., 2020; Pinto et al., 2017);
- recognizability and acceptability of the transformations (De Medici et al., 2020; Pinto et al., 2017).

Furthermore, the enhancement of the state of conservation of a cultural asset can contribute to increase the real estate values in the surrounding area. So, an indicator related to the positive impact produced by functional reuse not directly on the asset itself, but on the asset placed close to it can be:

- real estate value in the surrounding area (Fusco Girard and Nocca, 2019).

## 5. The indicators for assessing cultural heritage functional reuse projects

The proposed evaluation framework, including thematic areas, macro-objectives and indicators, covers the economic, environmental and socio-cultural dimensions, highlighting the multidimensional impacts that cultural heritage conservation and regeneration projects are able to produce. It has been elaborated considering all values characterizing cultural heritage and thus it considers indicators related to environmental and economic dimensions (as the Level(s) tool), but also social and cultural ones.

For each thematic areas and related macro-objectives, key indicators have been identified (already anticipated in the previous paragraphs). The starting point are the indicators identified by Level(s) tool that have been modified to better adapt to cultural heritage which is not a new asset like the object of the tool proposed by the European Commission.

Some indicators are those of the Level(s) tool (that provide indicators, scenarios and LCA tool); the others are those identified and explained in the previous paragraphs (§4) deduced from previous researches on the issue (De Medici et al., 2020; Nocca, 2017; Fusco Girard and Vecco, 2019; Pinto et al., 2017). The indicators included in the proposed evaluation framework are deduced from concrete case studies. However, it was found that some of these indicators are assonant with those identified by the literature review (discussed in §§2,3).

The Level(s) tool has a micro and not territorial approach. Its scale of reference should be broadened by considering that the cultural asset itself cannot be considered independent from the context it belongs to, with which it interacts. The indicators, referred to the life cycle of the building, are here identified considering three reference scale: micro-scale (Mi) related to building level, citizens level; meso-scale (Me) related to neighbourhood level, city level; macro-level (Ma) related to regional level, national level, international level.

The indicators are listed in the table below, identifying the related unit of measure, reference scale and source (Table 2).

The proposed assessment framework is thus structured into six thematic areas (Figure 1) nine macro-objectives (Figure 2) and twenty performance indicators (Table 2) for measuring the achievement of the objectives.

The above identified indicators cover all the impact dimensions of cultural heritage functional reuse projects. The proposed tool includes also the community perspective, since it is the addressee of the project. In fact, in the proposed evaluation framework there are some indicators (perception indicators) that allow to bring into the evaluation process also the community point of view.

It could be useful to compare some of these indicators (i.e. construction and demolition waste and materials) between the scenario of the functional reuse and the scenario of new construction in order to demonstrate the major benefits of the first scenario, that is that reuse is better rather than demolish and of construct a new building.

These indicators are multidimensional and concern both short and medium- and long-term impacts. They are both quantitative and qualitative, including objective and subjective indicators (related to the perception of stakeholders).

Table 2. Indicators for cultural heritage functional reuse.

**1.THEMATIC AREA 1 – Life cycle environmental assessment**

Indicator	Unit of measure	Territorial scale	Source
<i>Greenhouse gas emissions along a buildings life cycle</i>			
Use stage energy performance	kWh/m <sup>2</sup> /yr	Mi	(European Commission, 2017b)
Life cycle Global Warming Potential	CO <sub>2</sub> e/m <sup>2</sup> /yr	Mi	(European Commission, 2017b)
<i>Resource efficient and circular material life cycles</i>			
Indicator	Unit of measure		Source
Construction and demolition waste and materials	kg waste and materials per m <sup>2</sup> of total useful floor area	Mi	(European Commission, 2017b)
Reuse of materials in projects related to cultural heritage	% of total waste reused in the project	Mi	(Fusco Girard and Nocca, 2019)
<i>Efficient use of water resources</i>			
Use stage water consumption	m <sup>3</sup> /occupant/yr	Mi	(European Commission, 2017b)

**THEMATIC AREA 2 – Health and comfort and wellbeing**

Indicator	Unit of measure	Territorial scale	Source
<i>Healthy and comfortable spaces</i>			
Indoor air quality a. Ventilation rate (air flow) b. CO <sub>2</sub> c. Particulates d. Relative humidity	a. Litres per second per square metre (l/s per m <sup>2</sup> ) b. Parts per million (ppm) c. µg/m <sup>3</sup> d. % ratio of partial to equilibrium vapour pressure	Mi	(European Commission, 2017b)
Time out of thermal comfort range	% of the time out of range of defined maximum and minimum temperatures during the heating and cooling seasons	Mi	(European Commission, 2017b)
Lighting and visual comfort	Useful Daylight Illuminance (UDI)	Mi	(European Commission, 2017b)
Acoustics and protection against noise	Yes or not	Mi	(European Commission, 2017b)
Perception of wellbeing	% Percentage of people feeling in a wellbeing condition inside the building	Mi	(Nocca, 2017)

**THEMATIC AREA 3 – Cost, value and risk**

Indicator	Unit of measure	Territorial scale	Source
<i>Adaptation and resilience to climate change</i>			
Life cycle tools: Scenarios for projected future climatic conditions	Protection of occupier health and thermal comfort. Simulation of the building's projected time out of thermal comfort range for the years 2030 and 2050.	Mi	(European Commission, 2017b)
<i>Optimised life cycle cost and value</i>			
Indicator	Unit of measure		Source
Life cycle costs	€/m <sup>2</sup> /yr	Mi	(European Commission, 2017b)
Real estate value of surrounding buildings	€/sqm	Me	(Nocca, 2017; Fusco Girard and Nocca, 2019)

**THEMATIC AREA 4 – Social value**

Indicator	Unit of measure	Territorial scale	Source
<i>Generation and regeneration of the social capital</i>			
Number of new jobs related to functional reuse projects (employment sub-category)	N./project	Me	(Fusco Girard and Nocca, 2019; Nocca, 2017;)
Number of associations, number of volunteers, number of cooperative enterprises related to functional reuse projects (social cohesion sub-category)	N./project	Me	(Fusco Girard and Nocca, 2019; Nocca, 2017)

**THEMATIC AREA 5 – intrinsic value**

Indicator	Unit of measure	Territorial scale	Source
<i>Generation and regeneration of the intrinsic value</i>			
Place attachment and local identity (following the implementation of projects related to cultural heritage)	Qualitative (scale 1–5)	Me	(Fusco Girard and Nocca, 2019)
Sense of place in sites	Qualitative (scale 1–5)	Me	(Fusco Girard and Nocca, 2019)

**THEMATIC AREA 6 – State of conservation**

Indicator	Unit of measure	Territorial scale	Source
<i>Enhancing the state of conservation and prolonging use value of the building</i>			
Overall state of preservation of the building	Qualitative (very low, low, moderate, high, very high)	Mi	(Nocca, 2017)
Conservation of the geometric features	Qualitative (Yes or Not)	Mi	(De Medici, De Toro and Nocca, 2020; Pinto et al., 2017)
Recognizability and acceptability of the transformations	Qualitative (high-medium-low)	Mi	(De Medici, De Toro and Nocca, 2020; Pinto et al., 2017)

This evaluation framework can be used both *ex-ante* (in forecasting terms during the design phase) and *ex post* as a monitoring of results in order to check the impacts that the project is producing and, if necessary, make changes or additions.

## 6. Discussions and conclusions

The pandemic due to COVID-19 has highlighted the close relationship existing among social, natural and economic systems. It has confirmed the relationship between people and nature and thus how human activities negatively impact nature. “We do not need to choose between life and livelihood, or between health and economy. It is a false choice. On the contrary, the pandemic reminds us that health and economy are inseparable” (World Health Organization WHO, 2020a).

Post-COVID recovery plans need to go beyond the health sector, that is seeking to reduce the risk of disease at source by reducing, for example, the impacts of human activities on the environment. In this perspective, new models of city development play a key role.

As also the World Health Organization (2018) recognized, the circular economy is able to produce benefits on health and to contribute to the achievement of Sustainable Development Goals (United Nations, 2015b). It offers “an avenue to sustainable growth, good health and decent jobs, while protecting the environment and its natural resources” (World Health Organization - WHO, 2018).

Most urban areas today are saturated in terms of the built environment. Therefore, in the development of cities, greater attention is given to the recovery of the existing building stock (abandoned or underused) and disused areas, rather than to further urban expansion (De Toro et al., 2021). This also includes the reuse of cultural heritage buildings.

The functional reuse of cultural heritage can play a key role in the achievement of sustainable development of cities, contributing to its economic growth,

social and ecological wellbeing (European Commission, 2014; CHCfE Consortium, 2015). Interpreted through the lens of ecology (re-integrating economy into ecology) (Fusco Girard, 2020), it is consistent with the principles of the Green Deal (European Commission, 2019c) and the WHO approach (Watts, 2019; World Health Organization - WHO, 2020c).

Current approaches to the evaluation of cultural heritage are mostly sectoral, focusing on individual dimensions (economic, social, environmental) and, to a lesser extent, on their interrelationships (de la Torre and Mason, 1998; Gravagnuolo et al., 2017; Historic England, 2016).

This methodological proposal wants to represent a first step for the elaboration of a general evaluation framework for assessing cultural heritage conservation and regeneration projects in the circular economy perspective and going beyond the sectoral approaches. It integrates the Level(s) tool by European Commission, elaborated for built environment in general, with specific studies on cultural heritage.

The aim is to create a common language by using a common framework of indicators for dealing with sustainable conservation and valorisation of cultural heritage, going beyond the mere economic aspects and considering all values and impacts involved in the process. In this way, it is allowed a greater understanding of the whole process of conservation and regeneration of cultural heritage by giving better support to the decision-making process and making the comparable impacts between projects related to different buildings, geographical areas or between alternative scenarios for the same cultural building.

A decision-making process for functional reuse of cultural heritage based only on economic/financial aspects would give a “distorted and narrow” assessment. Certainly, financial return is a benefit commonly linked to reuse; however, some significant issues related to the environmental, social and cultural values of such activity are taking an increasingly important role in the evaluation of reuse projects related to urban regeneration. Quantitative and qualitative data are both relevant in the evaluation process for the functional reuse of cultural heritage and an integrated evaluation method/methodology allows to manage the complexity of the entire assessment process.

The recipients of this evaluation framework are different actors who intervene in different phases of the project: from the owners of the property to the technicians involved in the design, to construction companies, managing bodies, government institutions, community, etc. It has to be understandable, comparable among different experiences, and, at least in part, accessible not only to the experts, but to all stakeholders involved in the process.

Due to the multiplicity of actors and stakeholders involved, a common and officially recognized language is even more necessary. The development of guidelines for the use of this evaluation framework (as developed for the Level(s) tool) is therefore necessary. In addition, it is appropriate to invest in staff training so that the various subjects can acquire the right mastery and awareness of these tools.



Moreover, it is necessary to consider that cultural heritage is not only consisting of built heritage, but there are also many natural assets that have a cultural-historical, aesthetic, symbolic value ([www.clicproject.it](http://www.clicproject.it)). The evaluation framework to date does not include this type of heritage, which often also has an intrinsic value. As far as possible, evaluation of reuse projects should also include those of natural heritage (public parks, historic gardens, etc.), as the two heritages are often in synergy (i.e. gardens pertaining to asset). Furthermore, the assessment framework requires some reflections and adjustments (for example for the aspect related to intrinsic value) to assess also heritage that, although recognized as valuable cultural heritage, is not recognized as “exceptional” (that is it is not outstanding universal value - OUV).

Furthermore, it should be considered that in implementing reuse projects, there are often some “barriers” due also to external factors. Regulatory aspects (as governance restrictions, seismic retrofit, building code, etc.) play an important role in the prioritization for the new use of heritage building. However, they could represent a barrier in the functional reuse implementation. Moreover, also the physical conditions of the building itself, its internal organization and layout (which often does not meet/differ from that which meets the current tastes and needs of the community/demand) can represent an obstacle.

Another barrier can be the lack of financial resources to implement the project, that is public financial resources, incentives and/or private investment. This is often compounded by high retrofit costs.

The proposed evaluation framework although complete, is not exhaustive and will need to be expanded to include other aspects related to circularity. Further research step is to test the proposed framework on a concrete functional reuse project of cultural heritage in order to verify its efficiency and any possible limit to be corrected.

### **Author contributions**

The paper is the result of a joint effort by all authors. In particular, conceptualization: Francesca Nocca, Pasquale De Toro; methodology: Francesca Nocca, Pasquale De Toro, Viktoriya Voysekhovska; writing-draft, Francesca Nocca, Pasquale De Toro, Viktoriya Voysekhovska; writing-review and editing, Francesca Nocca, Viktoriya Voysekhovska. All authors have read and agreed to the published version of the manuscript.

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