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Circular Models for Systemic Adaptive Reuse of Cultural Heritage and Landscape

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EVALUATION CRITERIA FOR A CIRCULAR ADAPTIVE REUSE OF CULTURAL HERITAGE

Antonia Gravagnuolo, Luigi Fusco Girard, Christian Ost, Ruba Saleh

Abstract

This article aims to develop a structured reasoning and a first proposal of evaluation criteria to assess the impacts of cultural heritage adaptive reuse projects in the perspective of the circular economy model. Adaptive reuse of cultural heritage can be key in the implementation of circular economy and circular city/territory models. The article explores and clarifies why and how cultural heritage adaptive reuse is key to implement a circular economy in cities and regions, stressing the "multidimensional productivity" of heritage reuse and its contribution to the achievement of a "human sustainable development". The article addresses first the theoretical aspects comparing and discussing the literature on circular economy and its applications, while proposing a first set of evaluation criteria able to express what can be interpreted/chosen as relevant in this context.

Keywords: adaptive reuse, cultural heritage, circular economy.

CRITERI DI VALUTAZIONE PER IL RIUSO ADATTIVO DEL PATRIMONIO CULTURALE NELLA PROSPETTIVA DELL'ECONOMIA CIRCOLARE

Sommario

Questo articolo ha l'obiettivo di sviluppare un ragionamento strutturato e una prima proposta di criteri di valutazione per valutare gli impatti dei progetti di riuso adattativo del patrimonio culturale nella prospettiva del modello di economia circolare. Il riuso adattivo del patrimonio culturale può essere fondamentale nell'attuazione dell'economia circolare e dei modelli di città/territorio circolare. L'articolo esplora e chiarisce perché e come il riuso adattativo del patrimonio culturale può avere un ruolo chiave nell'implementazione di un'economia circolare territoriale, sottolineando la "produttività multidimensionale" del riuso del patrimonio e il suo contributo ad uno "sviluppo umano sostenibile". L'articolo affronta in primo luogo gli aspetti teorici sulla base della letteratura sull'economia circolare e le sue applicazioni, e successivamente propone un primo set di criteri di valutazione in grado di esprimere i fattori rilevanti della valutazione.

Parole chiave: riuso adattivo, patrimonio culturale, economia circolare.

1. Introduction

Cultural heritage adaptive reuse is a restorative, regenerative and a sustainable form of conservation that extends the life of our cherished heritage, stimulate civic pride and responsibility, and preserve cultural values for future generations. It is not only a value bearer and a cost-efficient strategy, but also a sustainable approach that enables the reduction of depletion of raw materials, decrease transport and energy consumption and dispersion, contributes to lower waste and landfill environmental costs and to scaling down the production of carbon emissions.

According to the 2014 Revision of the World Urbanisation Prospects report, produced by the Department of Economic and Social Affairs of the United Nations, 54% of the world population lives in urban areas and it is expected to increase to 66% by 2050 (United Nations, 2014, 2017). Considering the growing climate change threat and resource deficiency and in order to ensure long-term sustainability, cities must decouple their social wellbeing and economic growth from resource depletion (UNEP, 2013; European Union and UN-Habitat, 2016; Roy, 2016). How? By enforcing a multidimensional and multisectoral resource-efficiency approach applied to the natural system and built environment in cooperation and through the active engagement of the multiple actors at stake; individuals (users and producers) and public and private institutions (UNEP, 2009). Adopting a more sustainable footprint is beneficial at all scales (macro, meso and micro), in terms of reducing raw materials extraction and exploitation, energy consumption, CO2 emissions, etc. (Ellen MacArthur Foundation, 2015a; O'Neill *et al.*, 2018). Moreover, it offers a better quality of life to local residents and improves the city's attractiveness for new residents and tourists.

The adaptive reuse of abandoned and underused cultural heritage and landscapes can be a key driver of economic growth, social wellbeing and environmental preservation, contributing to sustainable development of cities and regions (European Commission, 2014, 2015b; CHCfE Consortium, 2015; European Parliament, 2017). Methodologies and approaches for the assessment of the impacts of cultural heritage conservation and adaptive reuse have been identified in recent research, considering the multiple interrelated dimensions of sustainability: economic, social, environmental, and finally the cultural dimension, highlighted as the fourth pillar of sustainable development (CHCfE Consortium, 2015). Other studies place the cultural dimension in a more central place as the foundation of sustainable development (Dessein *et al.*, 2015). Although comprehensive approaches to the assessment of multidimensional impacts of cultural heritage conservation have been developed (CHCfE Consortium, 2015; Fusco Girard *et al.*, 2015), many studies focus on the sectorial economic impacts (de la Torre and Mason, 1998; Davies and Clayton, 2010; Historic England, 2016b), other studies highlight the benefits of heritage conservation for society (Bertacchini, 2016; Historic England, 2016a), but less attention has been devoted to the complex interrelationships between culture, economy, society and the environment. The highly specialized and sectorial knowledge on impact assessments produced in the fields of heritage preservation, economics, social science, and ecological economy, have reached well-validated and reliable methodologies in each respective scientific field. However, on the operational perspective, working in silos hinders the possibilities of inter-disciplinary knowledge exchange and dialogue, preventing scientists from developing complex multi-dimensional impact assessment frameworks for cultural heritage conservation. Moreover, the adaptive reuse of cultural heritage, which necessarily foresees certain levels of

transformation to allow adaptation to new functions (Douglas, 2006; Bullen and Love, 2011), is mainly approached from a pure "conservative" perspective, underestimating the potential positive impacts that minimum levels of transformation can generate on local economies, social cohesion, wellbeing, and environmental preservation, opening the field to the innovative uses of heritage resources.

This paper approaches the assessment of multidimensional costs and benefits of cultural heritage adaptive reuse practices, from an ex-post evaluation perspective, proposing a first step to the development of a multi-criteria impact assessment framework based on the concept of multidimensional productivity of cultural heritage (Hosagrahar *et al.*, 2016), which has been grounded into the theory and practice of the circular economy as way to achieve economic growth and wellbeing "decoupling growth from resources consumption" (Ellen MacArthur Foundation, 2012, 2013a; Le Moigne, 2014; Wijkman and Skånberg, 2015; Ghisellini *et al.*, 2016; Geissdoerfer *et al.*, 2017).

This study represents the first step of a broader research on the multidimensional impacts of cultural heritage adaptive reuse as contribution to the implementation of a circular economy in cities and regions.

The aim of this paper is to propose a structured framework for the analysis and ex-post evaluation of the impacts of cultural heritage adaptive reuse practices in the perspective of the circular economy, based on Multi-Attribute Utility Theory (MAUT) identifying evaluation goals, objectives and criteria in multiple interrelated dimensions.

Conclusions highlight the potential and limitations of the proposed criteria set for the operational application of the evaluation framework to heritage management decision-making.

1.1. United Nations Sustainable Development Goals and the New Urban Agenda

In 2015, the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development (hereinafter the agenda). This agenda represents a universal framework for jointly tackling global challenges that cannot be fought individually.

"This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom… We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind" (UN 2015, p. 5).

By pledging to the agenda, the international community commit to fulfil the 17 Sustainable Development Goals (SDGs) and 169 targets in order to achieve a more equal, inclusive, sustainable, safe and prosperous future of the peoples and of the shared planet:

"The 17 Sustainable Development Goals […] are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental" (UN 2015, p. 5).

The New Urban Agenda embraces the sustainable development agenda and exploits the city as a resource and medium of inclusive, equitable and sustainable development: "in this unprecedented era of increasing urbanization, and in the context of the 2030 Agenda for Sustainable Development, the Paris Agreement, and other global development agreements and frameworks, we have reached a critical point in understanding that cities can be the source of solutions to, rather than the cause of, the challenges that our world is facing

today. If well-planned and well-managed, urbanization can be a powerful tool for sustainable development for both developing and developed countries" (UN Habitat 2016, IV).

Moreover, it explores SDG Goal number 11, sustainable cities and communities, and highlights the fact that good urbanization and development are interdependent:

"The New Urban Agenda incorporates a new recognition of the correlation between good urbanization and development. It underlines the linkages between good urbanization and job creation, livelihood opportunities, and improved quality of life, which should be included in every urban renewal policy and strategy" (UN Habitat 2016, IV).

However, urban sustainability depends upon complex and cross-scale interactions between the natural system, the built environment, the communities (users and producers), and public and private institutions (Ramaswami *et al.*, 2012). Moreover, the city needs to be optimized on all scales, and efforts need to be coordinated at different levels of governance, from local and regional to national and international. In a world where social and spatial segregation, uneven distribution of wealth and access to resources, discrimination, inequalities and climate change challenges are growing, new "culturally sensitive urban development models" (United Nations, 2015a) can play a vital role in rehumanizing the urban environment and in leading it towards fulfilling the sustainable development goals.

The objective of "humanization" is embedded in the paragraph 26 of the New Urban Agenda as its foundation.

2. Culture and sustainable development

Culture, is intended as mindset, ways to approach life, lifestyle, and thus as ways of behaving and taking choices. It represents the most peculiar human product and expresses the relationship between man and nature. In this sense, culture expresses the way through which man approaches nature, or interprets nature, or acts on it (as a private good or a common good).

Culture becomes thus the foundation of humanity, its root. Highlighting culture as the foundation for a sustainable development means introducing the perspective of a human development. More precisely, it means introducing the perspective of human sustainable development (Fusco Girard and Forte, 2000).

It means to set the objective of promoting a human horizon of development, interpretable in the perspective of a new humanism in the era of globalization, founded on reciprocal inter-subjective relationships and man-nature relationships.

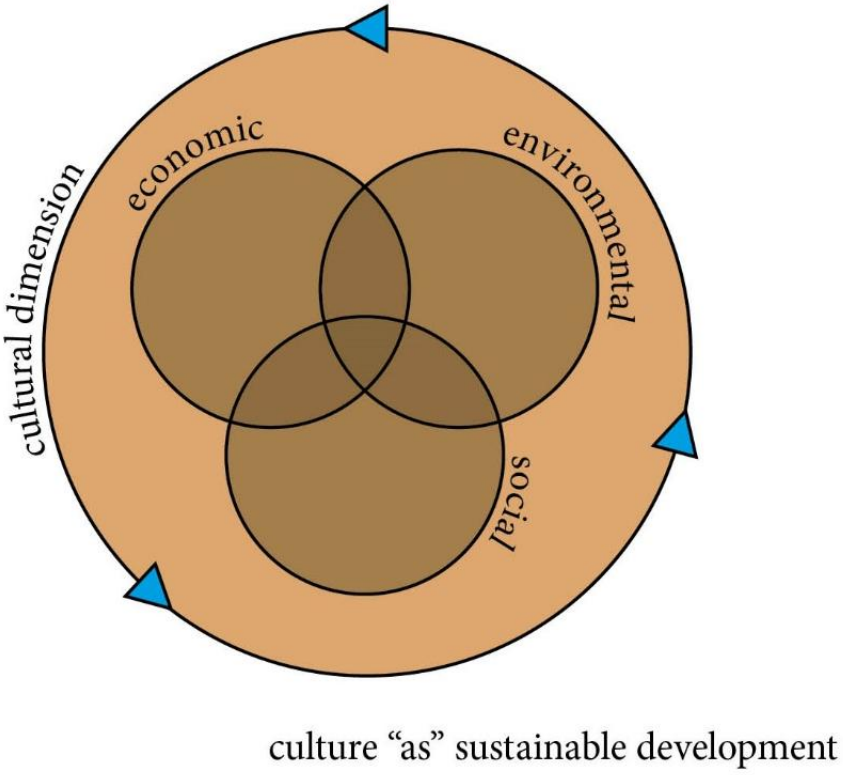
The above reflection, on a conceptual/theoretical sphere, views culture as the element unifying the three dimensions of sustainability. On the operational sphere, it positions the three dimensions in a reciprocal relationship and systemic interdependence, based on the external effects to the economic dimension (social and environmental impacts). The consequence is to avoid that choices that are rational in the economic dimension, determine negative impacts (irrationality) on the ecological/environmental and social dimensions.

More precisely, it intends to verify in which way an economic value is generative and re-generative also of ecological and social values. Finally, the above argumentations introduce a co-evolutive perspective between the economic dimension, environmental dimension, and social dimension.

After reviewing a number of graphs and visual representations of the relationships and systemic interdependences between culture and the three dimensions of sustainability, and

for the purpose of this paper, we propose culture as the foundation for sustainable development (Fig. 1). According to this approach, culture is perceived as the foundation for sustainable development and thus it embodies the three dimensions of sustainable development.

Fig. 1 - Proposed approach: culture as the foundation for sustainable development



Source : adapted from Dessein et al. 2015

2.1. The recent endorsement at the international level: a chronology

Since UN Habitat II which was held in Istanbul in 1996, UNESCO continued to advocate for humanizing the city and urging the International community to adopt a new urban paradigm (see the Foreword of the New Urban Agenda of Joan Clos, as well as the paragraphs 15-24). This urban paradigm shift embraces a human centred city where people and their wellbeing are crucial for achieving development. However, people are not perceived as passive actors in the process, on the contrary, their participation in humanizing

the city throughout culture is key.
In 1998, the intergovernmental conference on cultural policies for development which took place in Stockholm, shed the light on the interactions between culture and development and the need to reflect this finding in the cultural policy and decision-making mainstream. Building on the previous efforts, the declaration on cultural diversity in 2001, affirmed the crucial role of cultural diversity in sustainable human development.
In the last eighteen years, the UN General Assembly has repeatedly acknowledged the role of culture for sustainable development through several resolutions: UN resolution on culture and development 2010 (A/RES/65/166) and 2011 (A/RES/66/208), culture and sustainable development 2013 (A/RES/69/230); 2014 (A/RES/68/223); and 2015 (A/RES/70/214).
In 2013, the UNESCO International Congress "Culture: Key to Sustainable Development" which took place in Hangzhou, draw a line on the correlation between culture and sustainable development. As a consequence, the UN recognized in 2015 the role of culture as crucial enabler of sustainable development:
36. We pledge to foster intercultural understanding, tolerance, mutual respect and an ethic of global citizenship and shared responsibility. We acknowledge the natural and cultural diversity of the world and recognize that all cultures and civilizations can contribute to, and are crucial enablers of, sustainable development (United Nations, 2015b, p. 5).
The UNESCO global report, culture urban future, offers a global picture of the role of culture as a basis for a sustainable urban development backed with case studies from all over the world. The previous DG, Irina Bokova, states in her foreword:
Culture lies at the heart of urban renewal and innovation. This Report provides a wealth of insights and concrete evidence showing the power of culture as a strategic asset for creating cities that are more inclusive, creative and sustainable. Creativity and cultural diversity have been the key drivers of urban success. Cultural activities can foster social inclusion and dialogue among diverse communities. Tangible and intangible heritage are integral parts of a city's identity, creating a sense of belonging and cohesion. Culture embodies the soul of a city, allowing it to progress and build a future of dignity for all... This vision has received new energy with the explicit recognition of the role of culture as an enabler of sustainable development, and as one of the key conditions to achieve Sustainable Development Goal 11 to "Make cities and human settlements inclusive, safe, resilient and sustainable" (UNESCO, 2016, p. 6).
The New Urban Agenda, takes into consideration UNESCO's global report recommendations and addresses the crucial role of culture in the urban context:

- (§ 10) The New Urban Agenda acknowledges that culture and cultural diversity are sources of enrichment for humankind and 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. The New Urban Agenda further recognizes that culture should be taken into account in the promotion and implementation of new sustainable consumption and production patterns that contribute to the responsible use of resources and address the adverse impact of climate change. (United Nations, 2016, p. 10).
- Moreover, the New Urban Agenda, addresses Goal n.11, Make cities and human settlements inclusive, safe, resilient and sustainable, and in particular Target n.11.4, Strengthen efforts to protect and safeguard the world's cultural and natural heritage, and

recognizes cultural heritage as a lever for development:

- (§125) We will support the leveraging of cultural heritage for sustainable urban development and recognize its role in stimulating participation and responsibility. We will promote innovative and sustainable use of architectural monuments and sites, with the intention of value creation, through respectful restoration and adaptation. We will engage indigenous peoples and local communities in the promotion and dissemination of knowledge of tangible and intangible cultural heritage and protection of traditional expressions and languages, including through the use of new technologies and techniques (UN Habitat 2016, 32).

Under the framework of the European Year of Cultural Heritage, the Davos Declaration in 2018, emphasised the role of culture in shaping the living environment in a sustainable way:

- (§1) Culture enables and drives economic, social and environmental sustainability. It shapes our identities and defines our legacies. Therefore, culture must be placed at the centre of development policies and its contribution to the pursuit of the common good must be emphasised. There can be no democratic, peaceful and sustainable development if culture is not at its heart (Davos Declaration, 2018, p. 2).

More specifically, the declaration affirms the crucial role of cultural heritage in developing a sustainable built environment:

- (§ 9) Cultural heritage is a crucial component of high-quality Baukultur. The way we use, maintain and protect our cultural heritage today will be crucial for the future development of a high-quality built environment (Davos Declaration, 2018, p. 3).

2.2. Nature and Culture relationships: circular economy and circular city in the Encyclical "Laudato Si"

Culture has a central role in the achievement of sustainable development: without a culture of responsibility, the Goals of the UN 2030 Agenda for Sustainable Development remain unattained.

The major challenges of sustainability, ranking from issues of climate change to poverty alleviation, from improving productivity to social inclusion, interdepend, call for and require strong commitment from the Scientific and Academic Institutions. In this regards, the UNESCO Director-General recently pointed out that: "Science becomes the very heart of sustainable development strategies". To meet these challenges, it is deemed necessary to contribute to the scientific knowledge production by developing new approaches, methods and technical tools that incentives and inspires the reconfiguration of didactic paths, scientific research and vocational training.

Not surprisingly, it has been noted repeatedly that "the challenge of sustainability is won or lost in the city". Indeed, the New Urban Agenda presented at Quito by UN Habitat suggested a series of indications to achieve sustainable development in the concrete space of cities. This New Urban Agenda, while reaffirming the call to the category of responsibility, it emphasizes on the central role of culture (§124) before introducing the idea of civic responsibility (§156).

The role of culture, and the necessity of a cultural revolution, was already anticipated by the Encyclical "Laudato Si'" of the Holy Father Francis of May 2015 (Papa Francesco, 2015). This Encyclical comes just before the UN Agenda 2030, COP21, and the New Urban Agenda.

Starting from the question: "What kind of world do we want to leave to those who come after us?" (§ 160), it is developed the urgency of awareness of the tremendous challenges that the humanity must tackle in the XXI Century.
The recurring question can be expressed in these terms: do we have the necessary culture to address the actual crises, and thus to govern the transformations promoted by science, technics and technology, or will we be subjected to them?
The culture of consumerism and "disposable" goods is repeatedly denounced as producer of entropy on the economic, ecological and social dimensions, generating a depletion of the Earth system.
Circular processes of the Mother Earth and their promotion are incorporated in all parts of this Encyclical, when it is advocated for a symbiotic process between humanity and the Earth.
The circular economy is proposed in many points (§§22, 180, 223, 192, 211) as a co-evolutive approach between economy and ecology, but also between the economy and the social system: it is interpreted as reducer of entropy.
Substantially, the circular economy offers not only an economic development model characterized by the minimization of wastes in all dimensions (economic, ecological, social, human, cultural) but it offers also a way of reasoning in systemic terms, on the basis of a rationality that goes much beyond the instrumental rationality of the economy: it proposes a multidimensional and relational rationality that promotes, and in turn is funded, on complementarities, coordination, cooperation.
A recurring element is the care for "common goods" that contribute to pose in a relational dynamic the "personal" and the "communitarian", the subject and the object, valorising rights in a relational perspective. Examples of common goods are earth, landscape, cultural goods… In fact, the circular economy is the economy of common goods, and vice versa.
The notion of circular economy offers thus a different perspective in the interpretation of "value" that introduces the "intrinsic" value (and the existence value) between the individual use values, social use values, market values, independent of use values.
The culture of circular economy is thus the precondition, but also the result, of a cultural approach that makes resistance to the growing entropy in different dimensions.
The city, the product for excellence of human creativity, needs not only new material, technological and digital infrastructures, but it needs also a cultural infrastructure and in particular a civic infrastructure able to transform inhabitants into active citizens because responsible of their actions (and not passive subjects).

3. Cultural capital and cultural heritage

3.1. A definition of cultural heritage in terms of cultural capital

The theoretical basis for Culturally Sustainable Development derives from the theory of cultural capital as it is understood in economics. Tangible and intangible assets which embody or give rise to cultural value in addition to whatever economic value they possess can be interpreted as items of cultural capital. Such cultural assets may be long-lived, inherited from the past, and valued for their cultural significance. Alternatively, cultural goods and services being created in the present by artistic or cultural endeavours may endure as eventual contributions to the tangible or intangible cultural capital stock. However, it arises, the stock of cultural capital available to a community or a nation

comprises a valued resource that has somehow to be managed, and it is this management function that can be interpreted within a sustainability framework (Throsby, 2017, p. 136).
In urban context, cultural capital is made of different categories of urban cultural assets, which include tangible and intangible heritage assets, with possible extension to natural assets (riverfront, green areas, gardens, parks) and other urban assets (schools, creativity and innovation centers, markets, historic places, universities, landscapes, public squares).
Setting then cultural capital zone (boundaries of the physical space of analysis) is not neutral with regard to the identification of cultural capital (a process similar to the definition of historic urban landscape, or heritage buffer zone). A mapping process seems to be inevitable to handle such process, and to clarify identification of the urban cultural capital.
The cultural capital of a place generates over time a flow of economic values (private, public, externalities) for all kind of stakeholders, in addition to the cultural values that express the significance of the place. Because it is not always possible to link economic values of a place to a specific monument or urban cultural asset, it is assumed that economic values are generated collectively (macro-economically) to a specific cultural capital zone.
Cultural capital is said to be activated when its urban cultural assets are turned into economic values, in terms of land uses (building functions, public services, tourism facilities, shops, restaurants) and mobility (public transportation, parking, pedestrian streets, bicycle paths). Activation of cultural capital results mainly from spatial integration of urban cultural assets, economic and urban resources, which should also be visualized through a mapping process.
Many factors may enhance spatial integration. Among such factors: heritage values of cultural assets, their recognition by local community and public authorities, the types of urban cultural assets, their state of conditions, and contribution to liveability of the place (mixed-use, proximity, walkability). Such definitions are consistent with the Historic Urban Landscape approach.
A strategic analysis relative to cultural capital and its spatial integration can contribute to make recommendations for new investments in cultural capital, in heritage conservation works, adaptive reuses, and urban planning considerations. Improvement of spatial integration of cultural heritage and urban economic resources are also an important contribution to processes of circular economy and objectives of urban sustainable development.

3.2. Investing in cultural capital

Adaptive reuse is defined as "any building work and intervention aimed at changing its capacity, function or performance to adjust, reuse or upgrade a building to suit new conditions or requirements" (Fitch, 1982; Douglas, 2006). Considered as a critical economic condition for heritage conservation, adaptive reuse is not only economic in terms of relative costs of resources allocated in existing places from the past and new contemporary places (Shipley *et al.*, 2006). Adaptive reuse is clearly a trigger for sustainable, inclusive and circular processes of tomorrow's economic system.
From an economic perspective, adaptive reuse of cultural heritage is embedded in a three-tier framework:
1. Heritage with cultural significance constitutes a cultural capital, or an economic asset

yielding a flow of services over time that in turn generates both economic and cultural values (Throsby, 2001). As a capital, cultural heritage fits in a particularly long timeline, deteriorates over time unless resources are devoted to maintenance and upkeep, and unless its uses is adapted on a regular basis.

2. Urban conservation presents a specific challenge of adapting complex, diversified, and spatially integrated cultural capital. Adaptive reuse in urban settings fits in a new "up-stream" paradigm that starts with global challenges and considers cultural heritage as a resource subject to the creativity of technological innovation and contemporary cultural production, such to have a better chance of surviving the threats of mass-tourism or modern urban development. Adaptive reuse aims to prioritize, exemplify, and integrate circular, inclusive, and sustainable values in the processes of heritage conservation.
3. Cultural heritage is made of tangible and intangible assets that require appropriate methodologies in terms of adaptive reuse. The growing interest for intangible heritage, in particular in non-Western context of conservation, implies to reflect on what to conserve, and for whom. Multi-criteria and multi-stakeholders' analysis provides insight on best compatible reuses of tangible heritage in close connection to owners and users, to social practices and intangible concerns.

4. Circular economy: brief definition

Circular economy is a sustainable economy that enables a continuous positive development cycle that preserves and enhances the created values, in an indefinite time, of cultural and natural capital, optimises resource yields and minimises system risks by managing finite stocks and renewable flows (Ellen MacArthur Foundation, 2013b, 2015b; Wijkman and Skånberg, 2015; Ghisellini *et al.*, 2016; Kirchherr *et al.*, 2017; Korhonen *et al.*, 2018). Thus, it is a win-win-win regenerative approach where economic growth and heritage conservation (tangible and intangible) and community co-exist and co-evolve (Fusco Girard and Gravagnuolo, 2017). It focuses on closed loops especially in recovering (and recycling) values in order to keep materials circulating through the economy and by considering the potential of cultural heritage in adaptive re-use that includes, socially and environmentally responsible use, innovative sourcing and designing to address human needs and well-being. It adopts a whole system perspective (consider value in a broader view) and longer, multiple and cascade cycles and it addresses all sectors of society at all levels (European Commission, 2015a; European Commission and Eco-innovation observatory, 2016).

Fig. 2 – The circular economic model: a conceptualization

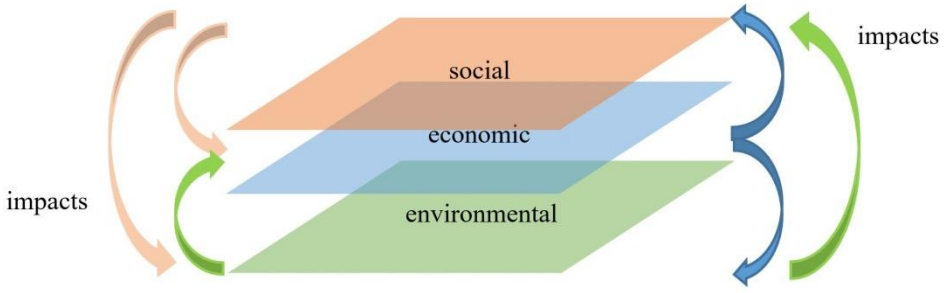


Figure 2 expresses in different terms the circular economy model, where each value in one dimension is generative of impacts/values/externalities (disvalues) in other dimensions. The symbolic dimension becomes attractor of economic activities. The environmental value becomes attractor of economic activities as well, which in turn enhance livelihoods income and employment in a reciprocal process.
The circular economy model, in this sense, projects the economic dimension into a multidimensional space, and thus requires a multidimensional/complex notion of value.
The co-evolutive model of ecological economics sees in culture a fundamental filter: culture influences the quantity of wastes discharged in the ecosystems, the quantity of resources extracted from ecosystems, and the percentage of wastes reused/recycled, the perception of economic needs, the consumption patterns, etc. (Fig. 2).

4.1. Approaching the multidimensional productivity of cultural heritage adaptive reuse in a circular economy perspective

Within a circular economy, the adaptive reuse and regeneration of abandoned and underused cultural heritage and landscapes can be seen as a fundamental contribution to "decoupling growth from resource consumption". In fact, the reuse/ recycle/refurbish/recovery/repurpose of abandoned heritage buildings, sites and landscapes, practically contributes to a circular urban-territorial economy, enlarging the lifetime of heritage assets providing new uses, economic opportunities and jobs from wastes.
For the purpose of developing a structured framework for the assessment of "multidimensional productivity" of cultural heritage adaptive reuse, before identifying the dimensions and related criteria that will characterize the evaluation framework, it is necessary to clarify some premises about the productivity of the reuse in terms of added value and added values: "productive" reuse as generative action.
The productivity of the reuse reflects the attractive capacity that is determined by the intensity of functions, their typology and reciprocal synergistic combination. In other terms, it is needed to focus on the complex and multidimensional nature of the impacts of the conservation of cultural heritage, that is represented by the "external effects" that are generated by the conservation. This added value is certainly linked to the type of conservation intervention, that can vary from adaptive reuse to restoration and preservation. The added value tends to be higher in the adaptive reuse, compared to other conservation interventions. With the adaptive reuse, the concrete regeneration of cultural heritage is realized, in the sense that a new use value is recognized to the cultural heritage, both from the private and the social perspective, that tends to last in the longer-term. This reflects exactly one of the characteristics of the circular economy model (de Jesus *et al.*, 2017; Kirchherr *et al.*, 2017).
The impacts, thus the external effects of the adaptive reuse, have to be evaluated on different dimensions, since they are expressed in the cultural dimension (e.g. education, communication, etc.), in the economic dimension (on touristic attractiveness, on the real estate market), in the social dimension (on labour market, on social networks and relationships), and in the physical-spatial-urban context in which the cultural heritage is localized (Brito *et al.*, 2012). The evaluation framework here developed aims to make explicit this multidimensional productivity that arises from the adaptive reuse of cultural heritage, highlighting the complex notion of value embedded in sustainable development (Fusco Girard, 1987; Fusco Girard and Nijkamp, 1997).

5. Towards an evaluation framework for a *circular* adaptive reuse of cultural heritage

5.1. Criteria and criteria categories

To avoid any doubt on what is to be considered a "criterion" in the evaluation, and to provide a unifying definition useful also for non-technical stakeholders, we adopt the definition of criteria as proposed and largely accepted since the 70s in the scientific field of the Multi-Attribute Utility Theory (MAUT). This theory represents the foundation of the multicriteria evaluations (Farquhar, 1977).

In the literature it does not exist a univocal definition of these terms: objectives, goals, criteria, attributes (Keeney and Raiffa, 1976).

Some scholars as MacCrimmon (1973) distinguish these 4 terms. Others, such as Fishburn (1977), prefer less precise definitions.

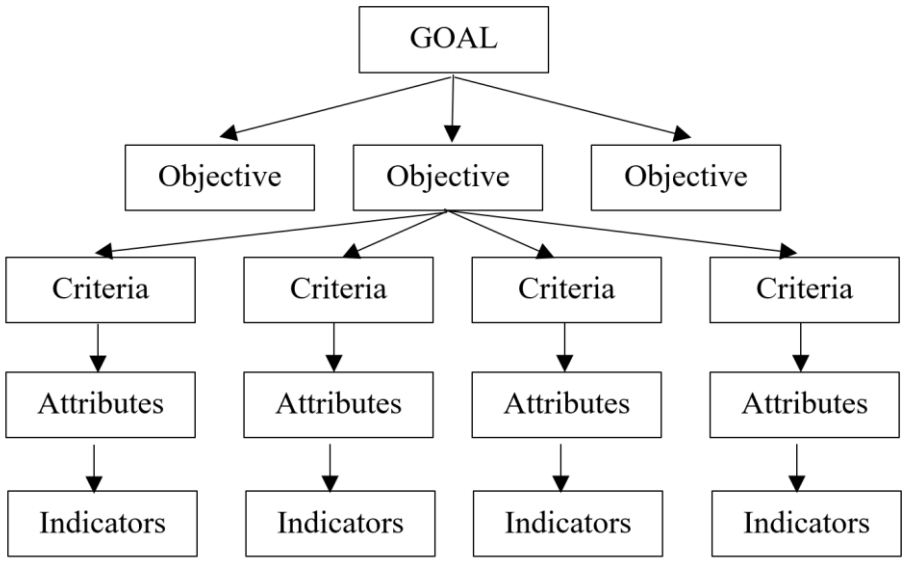
More in general:

- Attributes are related to the description of objective reality (and its characteristics)
- Objectives express the direction towards the enhancement of current conditions and are subject to processes of maximization or minimization
- Goals are intended as more general/strategic objectives

Zeleny (1982) affirms that "attributes, objectives, goals and perhaps also criteria, are synonymous". Then, he specifies that "the term criterion is a more general term that includes the others".

Criteria express what is interpreted/chosen as relevant in a certain context.

Fig. 3 - The general evaluation framework structure



The evaluation problem can be thus structured by defining the Goals, Objectives, Criteria and Attributes.
Moreover, in order to assess the level of achievement/compliance of the reality (practices) with all the objectives and criteria that we ideally wish to fulfil, the next step will be to identify a set of relevant and measurable indicators.
The problem is to identify a series of criteria in relation to which, the ex-post evaluation is expressed. The indicators used can be quantitative and/or qualitative. The choice of these indicators depends also from the concrete availability of data/information.
In general, the structure of the evaluation (ex-ante and also ex-post) is defined by its elements: Goals, Objectives, Criteria, Attributes, and finally Indicators and their related quantitative, qualitative and spatial data.
Each of these elements contributes to orient the overall evaluation framework toward a specific direction. The overall evaluation structure can be shown as follows (Fig. 3).
The definition of all the above-mentioned elements becomes a fundamental step, because the definitions adopted will influence the results of the evaluations. It shows how the general elements of the evaluation framework can be declined for the aims of this study.

5.2. Cultural heritage adaptive reuse in the perspective of the circular economy

Cultural heritage adaptive reuse can be considered an integral part of the CE, first of all because both ensure the enlargement of use values for the longest time possible (Arup and Bam, 2018). Next sections explain more in particular how adaptive reuse fulfils the principles of the CE. We consider different frameworks that define the principles of the circular economy: the 9 Rs of the circular economy (van Buren *et al.*, 2016; Potting *et al.*, 2017); 12 principles identified through analysis of literature reviews on circular economy (Ghisellini *et al.*, 2016; de Jesus *et al.*, 2017; Kirchherr *et al.*, 2017); and the ReSOLVE framework proposed by Ellen MacArthur Foundation (2015b).

1. The 9R's approach
   - Reuse: preventing the use of raw materials
   - Reduce: reducing the construction waste and landfill
   - Reuse: product reuse (second-hand, sharing of products)
   - Repair: maintenance and repair
   - Refurbish: refurbishing a product
   - Remanufacture: creating new products from (parts of) old products
   - Repurpose: product reuse for a different purpose
   - Recycle: processing and reuse of materials
   - Recover: energy recovery from materials
2. CE principles - synthesis from scientific literature review sources
   - Decoupling growth and resource consumption
   - Close loops/close metabolisms - short loops able to stimulate symbioses and cooperation
   - Enhancement of productivity (less inputs, more outputs; Factor 10, Factor 5, etc.)
   - Optimization in the use of existing resources
   - Conservation of use values and of the performances of building in the long horizon
   - Prolongation of the life of goods (durability)
   - Adaptability over time (e.g. open buildings, etc.)
   - Transition to the service economy (profit comes from effective maintenance over

time)
- Management of wastes as a resource
- Sharing economy, cooperative economy, social and solidarity economy
- Capacity of regeneration of cooperative relationships (relational economy)
- Interdependences economy: ecological economy

3. Ellen MacArthur Foundation ReSOLVE framework
   - Regenerate
   - Share
   - Optimize
   - Loop
   - Virtualise
   - Exchange

The aim is to develop the tables as a tool for the evaluation of circularity in adaptive reuse projects. A two-fold tool that can help city administrators select the project/s to which grant incentives and/or give access to public co-financing. But also, a tool for setting up local regulations.

The authors are aware that the circular economy model addresses the sustainability of the environmental dimension. We consider this initial identification as an evolutive process and it is not intended to be neither exhaustive nor a definitive listing.

5.2.1. The 9 R's approach

- R0: Refuse

  Reike, Vermeulen and Witjes (2017), argue that a preventive R0 precede the 9R's which is Refuse. According to the scholars, this preventive measure applies both to consumers and producers. In the case of adaptive reuse, it applies to the concept and design life cycle but it embodied by default since conservation architects refuse to use materials not compatible with the integrity of the built environment and thus refuse a priori the use of hazardous materials (Murzyn-Kupisz, 2010).
- R1: Reuse

  In order to preserve and transmit the existing cultural heritage to future generations, conservation architects are concerned with prolonging the life and preserving the integrity and authenticity of the architectural character of the built environment. Thus, s/he safeguard, preserve, and reuse the largest portion possible of the built environment (Hebel, 2015; Arup and Bam, 2018). In doing so, not only the cultural values are preserved but also the same building materials are maintained and preserved and reused. Moreover, another relevant advantage is the saving in embodied energy.
- R2: Reduce

  According to DG Environment of the European Commission, Construction and demolition waste accounts for approximately 25% - 30% of all waste generated in the EU (European Commission, 2016a). Adaptive reuse projects reduce the amount of construction waste and landfill because the ultimate goal is to preserve the buildings integrity and authenticity and demolitions occur only if extremely needed i.e. for safety reasons.
- R3: Reuse

  As stated by Jane Jacobs, "new ideas must use old buildings" (1961, p. 188) and adaptive reuse is ideal not only for the reuse of product and materials (second-hand,

sharing of products) but also for space sharing and introducing new entrepreneurial initiatives.

- R4: Repair
  The construction cycle involves high energy expenditure related to the take, make dispose model (extraction, transportation, processing, assembly) while in adaptive reuse projects materials are repaired, thus embodied energy is maintained and as a result, less carbon dioxide emissions are released (Rayman *et al.*, 2017).
- R5: Refurbish
  Refurbishing is linked with product design and future proof vision. The designer has to broaden his/her imagination towards new ideas, new uses and synergies. But s/he should also consider current and future challenges in terms of sustainability and users' preferences. Finally, needless to say that the product needs to be appealing aesthetically but also from a health-safety perspective (Arup and Bam, 2018).
- R6: Remanufacture
  In order to be able to create new products from parts of old products, a long-term business model based on a take back program has to be developed. This program should be built on an agreement with a local network of: designers, remanufacture facilities, logistics (transportation, tracking facilities, sell and buy-back) and construction companies, that values sharing, products performance and innovation. The ultimate goal is to guarantee the remanufacturing of safe and healthy materials that can be unlimitedly reused and remanufactured (Arup and Bam, 2018).
- R7: Repurpose
  Repurposing is very much linked with construction waste. So in order to avoid landfill, designers need to engage with new inspiring ideas for repurposing waste and upgrade it on demand (Wood, 2006). For example, stones can be repurposed for historic centres roads paving.
- R8: Recycle
  The concept of recycling and upcycling is the hard core of the 9 R's approach since its prerequisite is to avoid using precious virgin materials. For the sake of this process waste/demolition materials need to be classified according to quality level and future users within the local network loop. Therefore, a traceable database with relevant information concerning the cost and condition, ownership, life cycle and warranty of materials is crucial (Arup and Bam, 2018).
- R9: Recover
  According to Reike et al. (2017), this concept is three-fold and its linked to collecting, recovering and reusing materials at end-of-life for new uses; extraction of waste materials from landfill site; and recovering energy embodied in waste by "linking it to incineration in combination with producing energy or use of biomass" (2017:13). In the case of adaptive reuse, preserving the built environment per se means saving its embodied energy and enhancing its cultural value (CHCfE Consortium, 2015).

  Adaptive reuse of cultural heritage has been explored as a practice fulfils of the 9R's principles of the circular economy (Tab. 1).

Tab. 1 - The 9 R's approach in relation to the adaptive reuse of cultural heritage

Circular economy principle	**How adaptive reuse fulfils the principles**
Reuse: preventing the use of raw materials	Adaptive reuse of cultural heritage prevents the use of raw materials because it reuses a large part of the materials already extracted in the past. Moreover, it ensures resource efficiency; maintains material productivity over the lifecycle of development; and reduces loss of non-renewable materials. Thus, it makes best use of new materials developed to enhance renewable energy, bio-based, less resource intensive or fully recyclable materials.
Reduce: reduce the construction waste and landfill	Adaptive reuse reduces greenhouse gas emissions along a building's life cycle and reduces the construction waste and landfill. The demolished parts of heritage buildings for the adaptation to new uses can be recovered and reused as part of a circular economy process which optimize the life cycle cost and value of buildings
Reuse: product reuse (second-hand, sharing of products)	Reused heritage buildings can be considered as "second-hand" buildings. They can have a mix of functions and their usage can be shared by different users.
Repair: maintenance and repair	Maintenance and repair are an integral part of the adaptive reuse project. Also a concept of maintenance and recovery of embodied energy is here considered. Adaptive reuse design creates healthy and comfortable spaces, and enhances adaptability and resilience to climate change.
Refurbish: refurbishing a product	The concept of "refurbishing" is defined by Reike et al. (2017): "The use of the concept 'refurbish' seems to be most adequate in cases where the overall structure of a large multi-component product remains intact, while many components are replaced or repaired, resulting in an overall 'upgrade' of the product (…). Applied in this way, the concept refurbish is also known from common language in the context of an overhaul of buildings (…)". It is clear that adaptive reuse of cultural heritage is integral part of city "refurbishment". However, a concept of innovative design is to be addressed as well, a design meant at deconstruction and reassembly while keeping in mind flexibility for future re-use. Thus, introducing also innovative and sustainable materials such as biocomposite materials. In addition, the new design has to take into consideration the state-of-the-art technology which helps moving towards a Circular Economy such as digital platforms, product passports, 3D printing and tagging sensors. Finally, the design and new materials have to guarantee a positive health and well-being of the users.
Remanufacture: creating new products from (parts of) old products	In some cases, historic buildings have been realized using parts of existing, more ancient buildings (for some examples, the use of roman columns, or capitals, in medieval buildings). This "remanufacture" of existing buildings contributed to the conservation of many historic arts and architectural pieces. Today, it is preferred to not dismantle historic buildings, although some specific parts that

	must be dismantled for adaptation to new uses can be reused to create new products. An example is the Palace Viscounts of Balsemão in Porto, Portugal, where the characteristic "Azulejos" are collected from dismantled buildings in the city of Porto, and reused as models for contemporary productions. A take back program has to be in force which guarantees that materials are safe, healthy and their life cycle is extended in a way that they can be unlimitedly reused. For example: steel. A number of industries are re-designing materials in a way that they can be returned after use and repurposed.
Repurpose: product reuse for a different purpose	Repurpose is essentially a synonym of adaptive reuse, which confirms that adaptive reuse of cultural heritage can be considered as integral part of the circular economy.
Recycle: processing and reuse of materials	Materials and technological parts from selective dismantling of cultural heritage buildings can be recycled and reused in other industries. One example is the strategy of the city of Amsterdam for the building sector. That's why a traceable database has to be kept re the cost and condition, ownership, life cycle and warranty of materials. Also a network of industries and logistics enterprises has to be mapped. Keeping materials ownership incentive developers to invest in safe, healthy and better quality materials that they can sell, reuse and exchange with others in the future.
Recover: energy recovery from materials	In cultural landscapes, especially rural traditional landscapes, many materials are used to recover energy. However, there is a more indirect correlation between recover and adaptive reuse.

5.2.2. CE principles - synthesis from scientific literature review sources

The identified 12 principles from the literature (Tab. 2), summarize the philosophy and vision of the Circular Economy and its potential application on adaptive reuse. The vast majority of the principles are already in symbiosis with the practice principles namely: 1, 3, 4-7, 10-12. However, principles 2, 8 and 9 represent a new addition in the process of conceptualizing and implementing the practice. Thus, innovative models have to be collected, analysed and tailored to adaptive reuse projects in order to fulfil the principles of close loops; the transition to the service economy; and the management of waste as a resource (Baker *et al.*, 2017; Circle Economy, 2018).

Tab. 2 - CE principles in relation to the adaptive reuse of cultural heritage

	Circular economy principle	**How adaptive reuse fulfils the principles**
1	Decoupling growth and resource	Adaptive reuse contributes to boost growth while preserving natural resources.

	consumption	
2	Close loops/close metabolisms – short loops able to stimulate symbioses and cooperation	Adaptive reuse of cultural heritage can be supported by multi-actor partnerships, stimulating symbioses and cooperation – it closes the loops of urban metabolism especially at local level.
3	Enhancement of productivity (less inputs, more outputs; Factor 10, Factor 5, etc.)	Adaptive reuse realizes less land consumption, less materials and energy consumption, reducing inputs to realize new functions in the city for contemporary social needs. It can also be argued that the single investment in cultural heritage adaptive reuse can have positive impacts in multiple dimensions (social, environmental, cultural…) and in this way it fulfils the request of enhanced productivity of the CE, promoting a "multidimensional productivity".
4	Optimization in the use of existing resources	Existing resources are used in an optimal way through adaptive reuse. They are cultural resources, but also social, economic, and environmental resources.
5	Conservation of use values and of building performances of in the long horizon	Use values and building capacity of fulfilling changing societal needs are conserved in an indefinite time through adaptive reuse, contributing also in this way to the circular economy.
6	Enlargement of the life of goods (durability)	Adaptive reuse is able to give new life to abandoned or underused buildings. Ideally, cultural heritage can last for an indefinite future time.
7	Adaptability over time (e.g. open buildings…)	Adaptive reuse is a concept of adaptability of cultural heritage.
8	Transition to the service economy (profit comes from effective maintenance over time)	Adaptive reuse adopts often a model of "use" above "ownership", when the 'owner' gives the use of the building/site to users that are asked to maintain it in a good conservation state. Suppliers and manufacturers have an opportunity to recover materials but also to allow for a second source of income through reselling or repurposing and to offer new specialized jobs to new personnel.
9	Management of wastes as a resource	"Waste" buildings/sites are reused as a resource, rather than being a cost for the owner and the society. Demolition companies can revise their business models and become material reuse providers and disassembly experts
10	Sharing economy, cooperative economy, social and solidarity economy	New models for cultural heritage adaptive reuse, based on community and multi-stakeholder engagement, are emerging as effective models for cultural heritage adaptive reuse.
11	Capacity of regeneration of	The reuse of heritage buildings stimulates "heritage communities" (Council of Europe, 2005). It regenerates relationships and

	cooperative relationships (relational economy)	contributes to create relational economies.
12	Interdependences economy: ecological economy	The approach of reusing and transforming (to an acceptable level) cultural heritage, instead of conserving empty "containers" or leaving them in abandonment, is based on the recognition of the interdependencies between the cultural dimension of SD and the economic, social and environmental dimensions, thus recognizing that conservation without use, regeneration and transmission of cultural values is useless in the economic, social and environmental dimension. These interdependencies find their ground in the ecological economy.

5.2.3. Ellen MacArthur Foundation ReSOLVE framework

The Ellen MacArthur Foundation identified three principles for defining the circular economy:

1. "Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows;
2. Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles; and
3. Foster system effectiveness by revealing and designing out negative externalities".

Applying these principles means creating an economy that is restorative and regenerative, that preserves ecosystems and increases their return over time, that creates prosperity, and that fuels growth by capturing more value from existing infrastructure and products" (Ellen MacArthur Foundation, 2015b, p. 23).

The foundation delineates primary and secondary metrics to monitor and measure the application of each principal. Moreover, it translates these three principles into a framework of six concrete actions for businesses' and countries willing to convert to a circular economy. The first three actions: regenerate; share; and optimise, are already embodied in the adaptive reuse perspective. Nevertheless, the remaining three: loop, virtualise; and exchange, are interesting innovative actions related to among others, organising the design-buy-sell back materials loop; virtualising practices and processes; and integrating materials passports in building design, etc. Adaptive reuse of cultural heritage is explained as a practice fulfils the principles of the ReSOLVE framework (Tab. 3).

Tab. 3 – The Ellen MacArthur ReSOLVE framework in relation to the adaptive reuse of cultural heritage

	ReSOLVE Model	Circular economy principle	How adaptive reuse fulfils the principles
1	**Regenerate**	It implies the shift to renewable energy and material, as well as reclaim, retain, and regenerate	In adaptive reuse, cultural capital is preserved and enhanced by offering a new use that regenerates values for

		health of ecosystems and the return of recovered biological resources to the biosphere.	stakeholders.
2	**Share**	It refers to slow the product loops by maximising its utilization, by sharing them among different users (e.g. peer-to-peer sharing of privately owned products or public sharing of a pool of products), by reusing them (e.g. second hand), and by prolonging their lifetime through maintenance, repair, and design for durability.	In adaptive reuse, the endless reuse of the same asset creates lasting relationships with the asset owner/s and user/s
3	**Optimize**	An organization can optimize by increasing the performance and efficiency of a product, by removing waste from the production process and supply chain and by leveraging big data, automation, remote sensing and steering. These actions are carried out without changing the actual product or technology.	Products are designed with future uses in mind and only components that retain the highest value throughout the entire lifecycle of the product are used in order to minimize losses of row materials. Thus, by developing new fully recyclable materials, not only performance is improved but also the safety and environmental friendly standards are future proof and waste is eliminated from the process
4	**Loop**	This means to keep components and materials in closed loops, prioritizing inner loops. In case of finite materials in the technical nutrients cycle, it relays in remanufacturing of products or components, as well as recycling of materials. While in the natural nutrients cycle, activities that loop the material are anaerobic digestion and extracting biochemical from organic waste.	A take back system and collection services to recover useful resources from disposed products or by-products in coordination with entrepreneurs and logistics services.
5	**Virtualise**	It refers to the dematerialization of resources by delivering utility virtually directly (e.g. books and music), or indirectly (e.g. online shopping, virtual offices, etcetera).	Through the help of digital innovations such as bespoke apps, adaptive reuse can make the project accessible to impaired citizens to engage with cultural heritage more closely and in different ways but also potential visitors or interested stakeholders that wish to visit the project from distance can access virtual reality

			tours and 360° photography and videos and additional interactive apps.
6	**Exchange**	It implies the replacement of old materials with advanced non-renewable, as well as the application of new technologies. (e.g. 3D printing) and the selection of new products or services (e.g. multimodal transport).	The adaptive reuse design has to take into consideration the state-of-the-art technology which helps moving towards a Circular Economy such as digital platforms, product passports, 3D printing and tagging sensors.

6. Multidimensional criteria in ex-post evaluation

6.1. Multi-criteria evaluation of adaptive reuse in the perspective of sustainable development

Table 4 aims to define criteria for adaptive reuse of cultural heritage in a framework of sustainable development. The classical sustainable development paradigm is built on three different pillars: social, economic, and environmental (Brundlandt, 1987), extended to culture as the 4th pillar by the Hangzhou Declaration (UNESCO, 2013). Although there are still discussions on the relevance of this approach, it is commonly accepted as a practical way to identify different kind of contributions to the common goal of sustainable development.

When dealing with complex situations of adaptive reuse in urban context, the four pillar approach for sustainable development provides decision-makers with a useful thinking tool that enables to test how pillars interact with themselves. Correlation tests as applied to criteria from different categories will reveal two-by-two connections, like joined outcomes from cultural and economic pillars (adaptive reuse that provides simultaneously more cultural values from the preserved heritage, and more jobs and income from its preservation, or its reuse). Correlations between pillars will indicate three forms of (in)compatibility between components of sustainable development:

- transversal connection, when a positive correlation between criteria from two different pillars reveals that adaptive reuse contributes positively to the two pillars (example in the previous paragraph);
- conflicting connection, when a negative correlation between criteria from two different pillars reveals that adaptive reuse contributes positively to one pillar, and negatively to another (example of gentrification –loss of social development- due to adaptive reuse of buildings in high class apartments);
- no connection, when no correlation does exist between criteria from two different pillars.

Some criteria are suggested as related to categories based on two or three different pillars of the 4-pillar sustainable development paradigm (Tab. 4). It emphases potential correlation between pillars, hence combined contributions to sustainable development.

It also suggests a spatial definition of these criteria (macro, meso, and micro), as such criteria addresses outcomes in small or large urban areas. We consider macro as the

regional level, meso as the neighbourhood/district level and micro as the building scale.

Tab. 4 – Evaluation of adaptive reuse in the perspective of sustainable development

SD dimensions and interrelations		**Criteria**	**Scale**
CULTURAL The reuse practice contributed to maintain/ increase heritage values	1	Skills/techniques/knowledge/ intangible	Ma
	2	Visual quality/beauty of landscape	Me
	3	Authenticity/integrity	Mi
	4	Hybridization historic and contemporary artistic values	Me
	5	Historic Urban Landscape perspective (HUL)	Me
CULTURAL/ SOCIAL The reuse practice contributed to maintain /increase heritage values and also contributed to social values through circular economy processes	6	Creation/regeneration of micro-communities	Me
	7	Civic pride, identities and sense of the place	Ma
	8	Enhancement of education	Ma
	9	Cultural heritage as common good	Me
	10	Urban safety/security	Me
	11	Transparency, accountability by stakeholders	Me
	13	Housing affordability, access to cultural, health, mobility	Mi
	14	Migration trends due to climate change, rural exodus	Me
CULTURAL/ ECONOMIC The reuse practice contributed to maintain /increase heritage values and also contributed to economic values through circular economy processes	15	Cultural tourism has been increased because of circular economy processes	Ma
	16	Creative industries	Ma
	17	Accessibility to cultural service and amenities	Mi
	19	Output, income, jobs, growth	Ma
	21	Alternative, socially innovative economic models	Ma
	22	Attractiveness of the area	Ma
	23	Efficient land uses	Me
	24	Real estate values	Me
	25	Fiscal spill-overs	Ma
	26	Financial tools	Mi
	27	Flexible & responsive governance mechanisms	Me
CULTURAL/ ENVIRONMENTAL The reuse practice contributed to maintain/increase heritage values and also contributed to environmental values	28	Climate resilient materials and construction techniques	Mi
	29	Planning including blue and green infrastructure	Me
	30	Awareness raising for environmental issues	Ma
	35	Ecosystems preservation and regeneration	Ma
	36	Reduction of construction waste and landfill	Mi
	37	Halt/reverse biodiversity loss	Me

through circular economy processes	

6.2 Multi-criteria evaluation of adaptive reuse in the perspective of the circular economy

Adaptive reuse of cultural heritage in urban context implies to consider a cultural capital perspective, where any building considered is part of many urban cultural assets which together contribute to urban sustainable development, in particular through circular economy processes across the place taken into consideration.

Criteria need to be considered with special emphasis on how adaptive reuse maintains cultural values preservation for the heritage (for example in terms of authenticity and integrity), to such extent that cultural values and best practices of conservation are prerequisites to any decision of adaptive reuse.

Criteria need also to be considered relative to the conservation works themselves, as they could reveal processes of circular economy. Such criteria will be closely related to the previous tables in this research note, since circular economy in conservation is intrinsically a similar issue to circular economy in construction and building industry.

Finally, criteria need also to be considered to adaptive reuse, to how activation of the building can contribute to sustainable development goals through circular economy processes. Decisions about the use or the function of the building determine the flow of social and economic outcomes provided by the conserved/protected/reactivated cultural capital.

Notwithstanding the importance of each section of criteria and/or each criterion in the three sections, methodological steps in analysing adaptive reuse in a perspective of circular economy should be as it follows (Tab. 5):

1. Criteria for preservation of authenticity and integrity of the cultural capital through adequate conservation works;
2. Criteria for circular economy processes of conservation works;
3. Criteria for circular economy processes of outcomes from the future use of the building, in the cultural capital zone considered (on site and in surroundings).

Tab. 5 – Evaluation of adaptive reuse in the perspective of the circular economy

Criteria	Description
1. Cultural values preservation	
Authenticity/Integrity	The reuse practice preserved the authenticity/integrity of the building/place
2. Circularity of conservation intervention	
Local skills	The reuse practice made use of local skills/techniques/knowledge
Design of new components and systems	The reuse practice designed components and systems to improve service life of the building
Efficiency	The reuse practice made use of efficiency measures (e.g. energy,

	materials and water)
Ecosystems	The reuse practice contributed to ecosystems preservation and regeneration
Waste and landfill	The reuse practice contributed to reduce construction/management waste and landfill
Biodiversity	The reuse practice contributed to halt/reverse biodiversity loss
Optimization	The reuse practice achieved optimization in the use of existing resources
Long term	The reuse practice took into consideration performances of the building in the long horizon
New innovative models	The reuse practice has enhanced new innovative models for financing, business, governance.
Local return on investment / jobs	The reuse practice has contributed to higher and long-term local return on investment and on employment
3. Circularity of outcomes from the use	
Cultural visitors	The reuse practice has increased the number of cultural visitors
Common good	The reuse practice has provided commons to the local community
Spatial integration	The reuse practice has improve spatial integration of cultural capital
Adaptability	The reuse practice has increased future flexibility and adaptability of the building
Raising awareness	The reuse practice has improved local awareness for heritage and circular economy
Real estate market	The reuse practice has provided circular economy processes in real estate market
Productivity	The reuse practice has contributed to higher productivity (less inputs for more output)
Creativity	The reuse practice has enhanced creativity and innovation
Public good	The reuse practice has generated long-term free use concession
Wellbeing	The reuse practice has improved local health/wellbeing
Micro communities	The reuse practice contributed to the creation/regeneration of micro communities
Identity	The reuse practice contributed to enhance civic pride, identities, and sense of the place

7. Discussion and conclusions

Adaptive reuse of cultural heritage and landscapes fulfils in tandem cultural, economic, and social sustainability requirements for humanizing our lived environment. From a cultural perspective it safeguards important elements of our cultural heritage and identity; it unravels hidden or sometimes forgotten chapters of our multi-layered history; and it informs research. From an economic perspective: investments in adaptive reuse creates jobs, income, attracts new investments, attracts creative and innovative start-ups, boosts tourism; and its tangible externalities on shops, coffee shops, restaurants, cinemas, nearby theatres, etc., regenerate the urban fabric. From a social perspective, it is not only a value bearer of a building but it preserves the character of the neighbourhood as a whole and thus,

enhances the sense of pride and the engagement of the local community in its protection and preservation; moreover, it impacts the quality of services and the sense of safety and security. From an environmental perspective, it reduces the depletion of raw materials, it decreases transport and energy consumption and dispersion, it retains the embodied energy; it lowers waste and landfill environmental footprint; and it scales down the production of carbon emissions in line with the sustainability agenda.

Although not exhaustive, the above delineated sustainability benefits demonstrate that cultural heritage adaptive reuse fulfils the concepts of regeneration, sharing and optimisation of the circular economy. However, the research challenge is to investigate and analyse all kinds of flows within the urban environment and therefore, inquire about how cultural heritage adaptive reuse be can integrated within the framework of the circular city / territory model of sustainable development at all scales (micro, meso and macro). In doing so, we need to build knowledge on how to achieve the principles of looping (sell back chains), virtualizing (dematerialising resources through digital innovations i.e. resource data banks) and exchange (selection of new products and services i.e. products passports). These technical and technological innovations deemed necessary for regenerating the city walks hand in hand with the need to regenerate the "civil culture" of its inhabitants. Thus, additional research questions/challenges revolve around how society can cooperate to achieve common goals if there is no civil education/ training. More importantly, how can we better promote and enhance active citizenship with reference to the common good, self-organization and subsidiarity?

As highlighted by this research, cultural heritage adaptive reuse has been recognised by a number of key international players, as an enabler and driver for sustainable development. On this subject, this research aims to advance new epistemological findings with regard to the benefits of positioning adaptive reuse as a win-win circular model. For this purpose, the authors reviewed the existing literature on circular economy and explored its potential assimilation into the practice of adaptive reuse of cultural heritage/landscape. We argue that adaptive reuse of cultural heritage can drive a new European development model based on the circularization of processes (the circular economy): exploiting synergies in the business/financing sector, in the social, cultural and institutional dimension through innovative public-private-civic partnerships for the management of commons, and environmental synergies through adaptive reuse of buildings and landscapes, of their embodied energy and local materials (Fusco Girard and Gravagnuolo, 2017).

Ultimately, it can be argued that the adaptive reuse of abandoned and underused cultural heritage/landscapes substantially contributes to the implementation of emerging development strategies based on the idea of "circular cities" or "circular city-region" (UNEP, 2013; ESPON *et al.*, 2016; Lindner *et al.*, 2017b, 2017a), especially by reducing soil consumption, valorising the embodied energy of existing built assets and reintroducing the urban-territorial "wastes" into a multidimensional value-production cycle.

The criteria developed in this paper are meant to constitute a basis for an evaluation and monitoring framework that would strategically include the adaptive reuse of cultural heritage in circular cities/circular city-regions, towards a multi-dimensional productivity that would focus on the regeneration of natural capital considering closing-the-loops of water, energy, soils and materials (EEA, 2015), but also on the regeneration of the cultural capital and the achievement of the broader objectives of the New Urban Agenda (European Commission, 2016b; Partnership Circular Economy, 2017, 2018).

Hence, this research aims at setting the scene for a specific agenda for cultural heritage adaptive reuse in a circular economy perspective. In this regard, this research offers a methodological multicriteria approach for evaluating best practices of circular adaptive reuse of Cultural Heritage, towards the implementation of the New Urban Agenda, the Encyclical "Laudato Sii for the Care of the Common House" and the emerging circular city/territory development model.

The production of new knowledge on the multidimensional benefits of heritage and landscape reuse/regeneration and the promotion of a culture of responsibility for the achievement of Sustainable Development are here proposed as necessary conditions to conserve, safeguard, regenerate and valorise cultural and natural heritage and make it a driver of sustainable growth strategies. Through knowledge production and a renewed civil culture, new business opportunities can be exploited in the perspective of the civil economy/sharing economy/circular economy.

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