

RESEARCH ARTICLE

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Circularity-based decision-making framework for the integrated conservation of built heritage: the case of the Medina of Tunis

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Abstract

Several factors overlap in making urban heritage conservation vulnerable in terms of long-term sustainability. The purpose of this study is to offer insights into the dynamic role that heritage governance plays in the current sustainability debate. This purpose is achieved by investigating the shift from a 'governing for culture' approach to a 'governing through culture' approach in heritage conservation. Subsequently, a case is built for a circularity-based conservation strategy applicable to the governance of historic cities. Different indicators of the circular governance approach are considered, and useful data are collected in comparative form. The cross-matching relationship between the factors is then evaluated by employing the analytic hierarchy process (AHP) on the collected data. As a test case, the conservation strategy of the Medina of Tunis is presented. For a more general conservation model, case-specific data are acquired. Finally, the same framework is applied to compare the case-dependent and case-independent data to define an integrated conservation framework. The obtained results show that the knowledge and data exchange factor, carries the highest significance. This result translates into heritage-led urban regeneration through knowledge sharing and the effective redistribution of cultural activities in historic city centres.

Keywords Circular governance, Integrated conservation, Built heritage, Analytic hierarchy process (AHP), Conservation model, The Medina of Tunis historic city

1 Introduction

In the debate around the abundance of risks in the heritage sector, continuity of urban built heritage has gained more importance due to the intrinsic role it can play in securing more sustainable futures (ICOMOS 2021; Rodwell 2022). Over the last three decades, conservation activity has shifted from being characterised as an act of preservation to being a part of a broader scheme for urban regeneration and economic development (Skinner 2022). Restoration and recovery plans in historic cities no longer focus solely on the material aspect of

built heritage; instead, they are inscribed in more extensive and integral processes (Gustafsson and Ripp 2022). Regeneration processes are shifting towards a more exhaustive dependence on the importance of culture and cultural heritage (CH) in cities as a way to enhance place changes (Wise and Jimura 2020). Looking back to Geddes's (1982) insights, he believed in the importance of culture in the life of a city (Veldpaus and Colenbrander 2013). The conservation theory that he initiated in the old town of Edinburgh consisted of complementing the built heritage of the historic centre with the careful inclusion of new buildings (Rodwell 2007). This approach translates the conservation surgery theory of Geddes. He initiated a holistic approach to heritage conservation that enhances the economy, introduces social inclusion in urban regeneration projects, and oversees the overlapping relationship between urban conservation and sustainability.

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On a broader scale, the historic urban landscape (HUL) approach is seen as the current form of Geddes's theories on urban conservation (Bandarin and Oers 2012). The HUL approach was developed to become a heritage management approach based on the recognition and identification of the layering and interconnectedness of natural, cultural tangible, and intangible international and local values present in a city. It represents a response to the need to integrate heritage management into sustainable urban development (Veldpaus and Colenbrander 2013).

In line with HUL recommendations, several integrated conservation approaches have been initiated. The integrated territorial and urban conservation (ITUC) programme at the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) is one example of an integrated heritage conservation attempt (Rodwell and Turner 2018). The Open Heritage project (European Commission, Horizon 2020), The Global Cultural Districts Network (GCDN) (Kim 2020), historic districts for all initiative, and community-led urban strategies in historic towns (COMUS) (Ripp 2017) are some of the other integrated conservation approaches executed at the European level. The aforementioned conservation principles have been evaluated as vulnerable and ineffective in reaching long-term sustainability aims (ICLEI 2020). Developing an integrated built heritage conservation framework inscribed in an overall sustainable development approach has become imperative in several historic cities.

Pioneers in adopting a similar approach in heritage-led projects at a European level are the Regeneration and Optimisation of Cultural Heritage in Creative and Knowledge Cities (ROCK 2019). A study by Giulio et al. (2021) claims that the ROCK initiative helped develop innovation in CH through a collaborative and systemic approach promoting CH-led regeneration strategies for historic centres (Giulio et al. 2021, 837). A similar project in the adoption of a holistic conservation-based urban policy aiming at a long-term sustainability framework is the Circular models Leveraging Investments in the Cultural heritage adaptive reuse (CLIC) project (ICLEI 2020).

The present paper builds the case for a decision-making process concerning the integrated conservation of tangible and intangible heritage in historic centres. As a test case, it explores the conservation strategy of the Medina of Tunis, a UNESCO heritage centre. While the study tries to develop the core of the conservation framework built regardless of context, the Medina of Tunis historic city is chosen as a case study to support the argument around the defined approach.

2 Circular governance theoretical framework for the integrated conservation of historic cities/districts

2.1 The shift to 'the heritage for governance' principle in the circular city debate

In the paradigm shift to more sustainable urban development policies, the circular economy (CE) can play a pivotal role (Nocca 2017). Each city has unique characteristics and its own social and economic structure. Thus, to implement the circularity approach to its different assets, each city needs to assess the appropriate starting point. Based on the Sustainable Development Goals (SDGs) and the EU's 2050 target of 0% emissions, the EU launched the Green Deal strategy (EC 2019) based on CE principles. Covering all sectors of the economy, including transport, energy, buildings, agriculture, and industries, the initiative showed that the circularity concept can go beyond the economic sphere and that cities can also adopt it to attain a long-lasting sustainable future (EC, December 11, 2019). According to the European Green Deal, the transition to a holistic integrative circular approach in cities is among the key European priorities (EC 2019).

Putting culture at the heart of the Green Deal means adopting CH as an entry point to reach Europe's 2050 goal (EC, 11 December 2019). Historic city regeneration and renewal approaches are seen as an effective entry point for the implementation of a circularity-based sustainable future (Nocca et al. 2021). Implementing the CE model in cities varies and depends on a number of factors. However, CH, which is not yet considered in any circular city, can play a key role in triggering circular processes (Nocca et al. 2021). As claimed by Nocca et al. (2021), regardless of the growing interest in CE implementation, the debate around it remains more on a theoretical level. Knowledge about how to implement the circular approach is still confusing (Nocca et al. 2021). Many studies highlight the relationship between the CE concept and the heritage sector (Girard 2020). However, while the contribution of CE implementation in the heritage conservation process is clear from its role in adaptive reuse projects (Gravagnuolo et al. 2021a,b; ICLEI 2020), few studies have considered it from a more holistic perspective. Girard and Nocca (2019) explored how the CE can be implemented at an urban scale through a cultural landscape-based approach assuming that there are interdependence relationships between specific landscapes and CE/city models (Girard and Nocca 2019). In another recent study, Girard (2020) discusses the possibility of implementing a holistic circular approach in cities through the complex adaptive reuse of dead heritage (Girard 2020).

Several European contexts illustrate the shift from governing heritage to the holistic governance of heritage assets through the circular city debate. Pioneers in adopting the circularity approach in heritage-led projects are the ROCK and CLIC initiatives (ICLEI 2020). These studies are based on the idea that CH is used as a tool to experiment with collaborative models of urban development (Garzillo et al. 2018; ROCK 2019). Both of these examples applied CE principles to CH regeneration, achieving environmental, social, cultural, and economic sustainable urban development. One example of a ROCK model city is Lyon with its light festival. Lyon has been transformed from a ‘historic city’ to a ‘city project’ where UNESCO recommendations on the HUL have been put into practice in heritage as a whole, tangible and intangible (ROCK 2019). An assessment of the festival’s current form has been conducted to answer questions from ROCK project partners about the factors of success (Mattia and Gallot-Delameziere 2019).

It follows from this that the circular paradigm not only concerns economic growth but also promotes human development (ICLEI 2020). The circular governance approach is a value-based, principled approach for valorising, protecting, and sustaining

CH assets as a common good for society (Garzillo et al. 2019).

2.2 The selection method for circular governance indicators

In light of the Horizon 2020-funded European experience in introducing the circular approach to the conservation of heritage cities/districts (ROCK 2019; ICLEI 2020) (Tables 1 and 2), theoretical model building has been carried out (Onwuegbuzie et al. 2012). Therefore, in addition to the selection/classification of the indicators on the basis of the academic literature (Appendix A), an effort has been made to select on-ground, real-life, and scientifically measurable activities and initiatives that can contribute to circularity in heritage conservation. As the application of the circular debate to heritage conservation is still relatively new, the ‘inductive category development’ method (Mayring 2000) was used to select indicators/sub-indicators.

Mainly used for categorising/classifying factors or indicators for qualitative content analysis, the following selection tool made it possible to identify the main categories included. Subsequently, these initiatives were grouped into sub-indicators on the basis of their broader

Table 1 The CLIC project’s main principles (by the authors, adapted from ICLEI 2020)

Circular Governance Indicators (CLIC)	Opportunities
Participatory	Crowd funding for CH, membership subscriptions for access to heritage assets
Inclusive	Creating participatory voluntary labour for the community’s benefit
Collaborative	Public–private partnerships (PPPs) for heritage site revitalisation, cooperation between educational institutions and municipalities, collecting public donations for renovation projects, tourism and business improvement for long-term sustainability
Accountable (Transparent)	Participation-based local cultural policy development The public right to purchase a space Adaptive reuse, giving public authorities the right to acquire high-value heritage sites
Circular	Temporary urbanism, tourism and business improvement, energy performance assessment Arts and crafts enhancement for job creation, preserving traditions, and enhancing social integration
Just and Fair	Creating neighbourhood councils and voluntary bodies

Table 2 The ROCK Circle’s main indicators (by the authors, adapted from: ROCK 2019)

Circular Governance Indicators (ROCK)	Embedded sub-indicators
Knowledge	Peer dialogue (heritage as a platform for co-creation), data exchange (literary events, lending libraries)
Culture	Open access (levering cultural events through historic cities’ potential; theatrical performances, festivals, visual arts, free access), new uses of a space (ephemeral urbanism)
Creativity	Artist mobility (increasing public space through residents and artists’ involvement, making creative living labs as a culture-led urban regeneration), new products (making urban heritage observatories)
Regeneration	Local users (PPPs, democratic community participation, sustainability plans for the heritage regeneration), the start-up industry (public participation, revitalisation initiatives)
Security	Community involvement, tools for security
Green Circle	Climate services, green procurement

Table 3 Circular governance indicators for long-term sustainability-based heritage policy (developed by the authors)

Main Indicators	Sub-indicators	Explanation following the literature
The Knowledge and Data Exchange Circle	Smart Data Exchange Tools	(Raid, September 27, 2016; ROCK 2019; Giulio 2021; Choudhury 2022). Examples are augmented reality technologies to enhance people's perception of a heritage site, large crowd monitoring tools, and 3D laser surveys
	Cultural Corridors	Planning a district connecting multiple cultural attractions (ICLEI 2020)
	CE Step-By-Step Co-Planning Solutions	CE-based participative co-planning solutions, considering heritage assets as an entry point for circular city planning
	Urban Seeds	Implementing a step-by-step low-cost co-planning solution aimed at attracting people to use a space (Acri et al. 2021)
The Cultural Circle	Open Access	Providing full access to high-quality cultural content to the community (ROCK 2019)
	New Uses of Space	Organising temporary cultural programmes with open events including photography exhibitions, performances for adults and children, and different thematic workshops (ROCK 2019)
	Creativity	Increasing public places through small artwork interventions where abandoned space becomes a place of community and an incubator of creativity The ability of people to access culture while appropriating their right to participate in cultural life and their freedom of cultural expression, including artistic and creative freedom (UNESCO 2019, p. 79; Kaddar et.al. 2022; Tricarico et.al. 2022; Pratt 2022)
The Regeneration Circle	Social Trends	Affording better building and streetscape conditions suitable for a modern lifestyle and job creation (Said et al. 2013)
	Economic Trends	Creation of more investments (ROCK 2019; ICLEI 2020)
	Environmental Trends	Resource efficiency, climate change and urban resilience
	Political Governance Trends	The commitment from the authority to ensure heritage sustainability Improvement of the relationship between the government and the private sector Decentralisation, cross-sectorial administrative work, integration, and multilevel coordination between stakeholders (Blanco et al. 2011)
	Technological Trends	Building a participative methodology for the development of a smart framework to define the needs and requirements of heritage-led regeneration actions (Turillazzi et al. 2020)
The Safety and Security Circle	Protection by National and Municipal Executives	Rule of law, a policing system (DCAF 2019)
	Social, Physical, and Psychological Equity	Considering the individual and the social psychology 'in understanding the ontological (in)securities of the societies' (Grenville 2007)
	Control by National and Municipal Executives	Democratic governance, land use planning, urban lighting, risk mitigation, disaster resilience, ownership clearance, and safe mobility (DCAF 2019; Marra et al. 2021)
The Environmental Circle	Green Climate Services	Promoting the slow use of the city relying on HUL regeneration (Acri et al. 2021) Mitigating climate change through adaptive reuse (Conejos et al. 2016) Access to adaptive reuse reflecting CE concepts (Foster and Kreinin 2020)
	Green Procurement	'The acquisition of goods, works [...] whose results have the least possible harmful effects on the environment' (McFarland 2018)

definitions. Each of these indicators is described in detail in Table 3.

Ultimately, the sub-indicators are grouped into 5 main indicators based on their contribution to:

- (1) New technologies, digitisation and the Internet of Things (ENEL 2020 on the new layers of the circular city).
- (2) Community welfare (NUA 2017).
- (3) Local economic development (UNESCO and WORLD BANK 2021 on leveraging culture for sustainable urban development).
- (4) Climate action [EU Green Deal by EC (2019); ICLEI on the circular development of cities].
- (5) Local identity and pride [EU Green Deal by EC (2019); The Cultural Deal of Europe by Culture Action Europe, European Cultural Foundation, and Europa Nostra (2020); ICOMOS and Europa Nostra 2021: The European Cultural Heritage Green Paper].

Based on the defined indicators and sub-indicators of circular governance, a theoretical framework diagram is proposed (Fig. 1). The value of each indicator will be tested and described in more details through the case study.

3 Case study: the medina of Tunis Historic City

3.1 History, urban context, and significance

The Medina of Tunis has been a UNESCO-protected heritage site since 1979. Its central protected area lies at the very heart of the capital Tunis, and it occupies an area of approximately 150 hectares (Municipality of Tunis 2004). It saw different changes spanning a history of several civilisations, i.e., Roman, Byzantine, Aghlabid,

Almohad (12th century), Ottoman (from the end of the 16th century to the beginning of the 18th century), and, finally, Husainid (from the beginning of the 18th century to the beginning of the 20th century). From its very beginning to the 16th century, the Medina of Tunis had the structure of an Arabic city. Its history dates back to the seventh century and refers to the establishment of the *Al-Zaytuna* Mosque in 695 (Santelli 1992; Doulatli 2009). Possessing the characteristics of a typical Arabic Islamic city, the Medina of Tunis's surroundings expanded following Western urban development principles. It was a gated community with defined city limits and gates. The connection axes between these gates follow cardinal directions and intersect at the central point of the central Medina, *Al-Zaytuna* mosque. This makes its layout focus inwardly, as seen in the closed-off cul-de-sac and the Arab residential houses, where the interior is arranged around the centre, as shown in Fig. 2 (Escher and Schepers 2008).

Following the building and planning principles in historic cities that were under Muslim rulers, the Medina of Tunis is characterised by horizontal housing units where commercial spaces neighbour the central Friday Mosque and are separated from residential spaces. The housing typology in historic Medina is characterised by low-rise courtyard traditional homes (Abddelkafi 2012).

The most significant period in the Medina of Tunis's urban evolution was between the beginning of the 19th century and the mid-20th century. It was around this period that the Medina of Tunis had its ways paved and its sanitation, lighting, and policing systems improved and defined by a municipal council and several decrees (Ammar 2017). The Medina of Tunis's overall

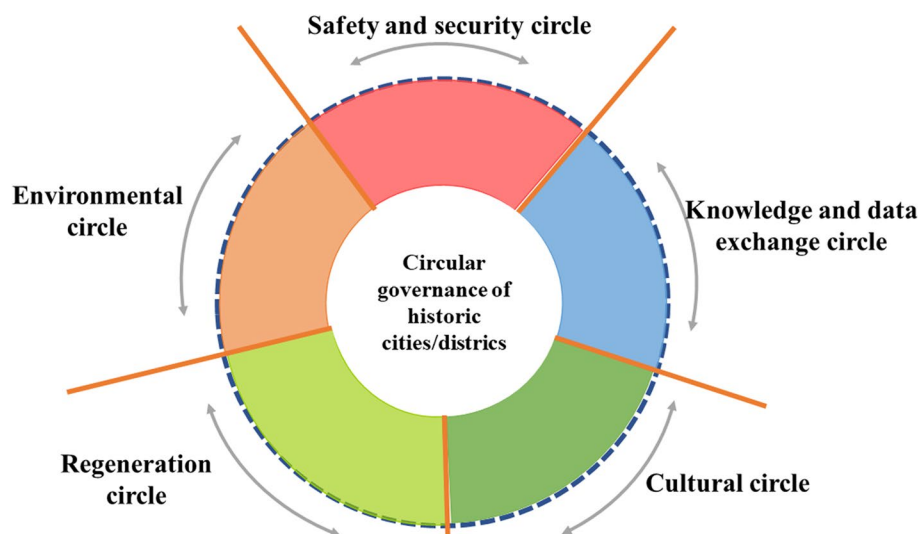


Fig. 1 Theoretical framework diagram of circular governance of historic cities/districts (Source: the authors)



Fig. 2 The urban context and spatial configuration of the central Medina of Tunis (Source: the authors)

development was mostly influenced by the French protectorate of Tunisia (at the end of the 19th and beginning of the 20th century). After the 1850s, the urban form of the Medina of Tunis started to change (Ammar 2017). A new Westernised city occupied by Europeans started to evolve neighbouring the central Medina (Mouhli 2015). This new city initiated a French way of life and enhanced Tunisians' attachment to the central Medina, which became a symbol of resistance against colonial efforts (Tira 2018).

3.2 Heritage conservation strategy in the Medina of Tunis

The Medina of Tunis has a management structure specified by the National Institute of Heritage (INP) and the Association for the Safeguarding of the Medina (ASM). The heritage conservation strategy in Tunisia has always been related to the country's political history and land ownership practices (Halleb 2018). Medina of Tunis revitalisation initiatives have followed an integrated area development strategy. However, the contribution of the private sector has remained modest (Steinberg 1996).

The conservation of the Medina of Tunis shows that political events have always influenced changes in the conservation strategy. Therefore, because of the 2011

revolution, the status of the ASM changed, creating an abrupt discontinuity in heritage conservation projects (Table 4). Clashes of interest also emerged between the main conservation actors, i.e., the ASM, the municipality and the INP. These clashes led to serious coordination problems that remain to this day. Several old monuments have become endangered since their ownership status could not be cleared and the proposed actions against their decay have to date not been implemented (interview with Faïka Bejaoui, March 15, 2022).

The preservation, planning method, and urban policy doctrine for the Medina of Tunis have been defined by the 1976 UNESCO recommendations (Abdelkafi 2012). Therefore, in its entire strategy of adaptability to contemporary modes, the historic building stock should adapt to the contemporary lifestyle without compromising the traditional authenticity (Abdelkafi 2012). The planning bureaucracy and the administrative approval process in the southern and eastern realm of Mediterranean historic cities, particularly in Arab countries, constrain safeguarding practices (Abdelkafi 2012). Currently, Tunisian legislation for heritage asset conservation regroups international laws (UNESCO 1972), national laws (*National Code of Protection of the Archaeological, Historical Heritage and Traditional Arts of Tunisia*, CDP), and specific

Table 4 The development timeline of the Medina of Tunis's conservation strategy (Source: Ammar 1010; Nardella and Cidre 2016; Abdelkafi 1989)

Period	Changes in the Conservation Strategy
From the end of the 17th century to the beginning of the French protectorate	<i>Vakif</i> system for the maintenance, restoration, and management of public buildings (known as <i>Habous</i> in Tunisia, it is an institution derived from Islamic law to regulate 'the donation of an individual property in perpetuity for the public welfare and under the possession of God' (Nardella and Cidre 2016)
1880s	French protectorate: establishment of the <i>Service des Antiquités</i> in 1885, which operated until the 1970s
1953–1956	The 1953 Decree of heritage site protection Rupture with the past through <i>Bourguiba's</i> regime based on modernisation and Westernisation (resort tourism) Establishment of the National Institute of Archaeology and Art (INAA) in 1957
1960s–1970s	Establishment of the ASM by the municipality of Tunis in 1964 The Medina of Tunis became a world heritage site (WHS) in 1979
1980s	Urban rehabilitation and renewal attempt in the Medina of Tunis directed by the National Agency of Urban Rehabilitation and Renewal (ARRU) By the end of the 1980s, the regime of Ben Ali started, promoting the activation of national pride through heritage and cultural tourism
1990s	Establishment of: • <i>L'Agence de mise en valeur du patrimoine</i> , Heritage Revitalisation Agency (AMVP) • Agency for the Enhancement of Heritage and Cultural Promotion (AMVPPC) • Heritage Code and Urbanism Code (1994)
2000	EUROMED Heritage and the World Bank funded revitalisation projects in the Medina of Tunis
2011	Arab Spring and the short-term abrupt rupture with conservation projects
The post-revolution era	The change in status of the ASM and the clashing of interests in the conservation and management of responsible public actors The establishment of the municipality of Tunis's conservation department

norms and municipal regulations specific to each Medina (UNESCO 2009).

Currently, the conservation strategy for the Medina of Tunis is striving to put forward the role of culture in the Medina's heritage sustainability. In addition to the already achieved cultural corridors (Fig. 3), a suggestion of a new cultural corridor has been made as a call for international cooperation projects (interview with Souad Abderrahim, February 08, 2022). The suggested corridor is located towards the extreme northeast of the Medina of Tunis and neighbours the main public buildings of the inner city. Several buildings located in the defined path run the risk of degradation. Thus, if implemented, the cultural corridor has the potential to revive built heritage under threat by combining adaptive reuse and restoration attempts and following an inclusive participative planning approach.

4 Data and methodology

The present study tries to develop a circularity-based decision-making framework for the conservation of historic cities elaborated through experts' opinions. This research takes the Medina of Tunis as a case study. Based on the literature, this aim is attained by proposing the main indicators of historic cities' circular governance. The defined indicators are then prioritised using the analytic hierarchy process (AHP) (Saaty 1990), which is realised through a survey method leading to collected expert

data (from both Tunisian and international experts). To test the defined result with the given case, case-specific data are collected through in-depth interviews with Tunisian experts. To the best of the authors' knowledge, an integrated conservation strategy for the Medina of Tunis aimed at its long-term sustainability, and based on data collected from local as well as international experts, has not been provided until now.

4.1 Data pre-processing: a multi-layered method for a circularity-based decision-making framework for heritage conservation

In this study, the multi-layered method, that was followed started from semi-structured interviews with experts. This method was adopted as a research strategy since expert interviews have a role to play in cultural studies where field experience is noteworthy (Libakova et al. 2015, 117). The selection of respondents was based on expertise in the field, geographical location (to ensure a non-Tunisian perspective as well), experience in policy-making, interaction with the general public, and completed projects. Therefore, among the 18 respondents, 6 were from Tunisia, 5 were from Turkey, 2 were from Germany, 2 were from Pakistan, 1 was from Egypt, 1 was from Italy, and 1 was from Estonia.

To strike a balance between theoretical assumptions on the circular governance principle and its practicability,

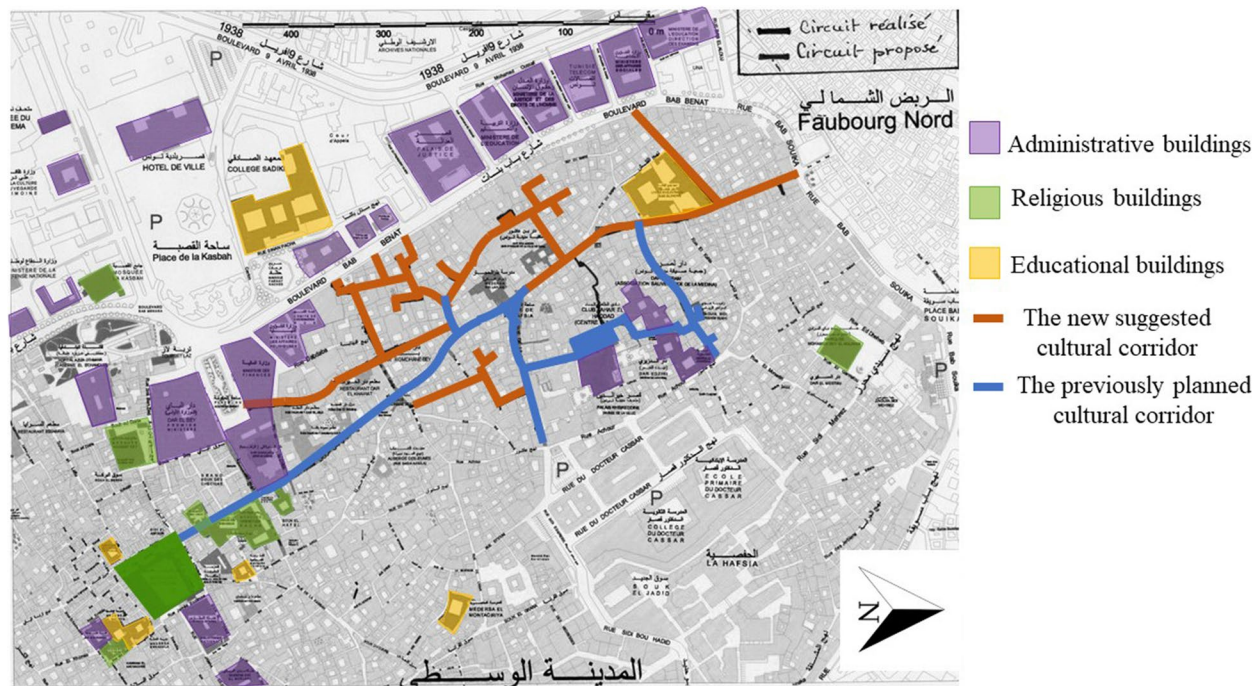


Fig. 3 The recently suggested Ottoman cultural corridor in the Medina of Tunis (Source: the authors, adapted from the municipality of Tunis)

the AHP was adopted to evaluate the weights of the indicators. In this regard, based on the defined hierarchy (Fig. 4), coded survey questions were developed. The respondents were asked to choose the relative importance of an indicator compared with another indicator by marking only one numerical value from 1 to 9 on a scale line (Table 5).

4.2 Data post-processing: application of the AHP to the questionnaire results

The results of the respondents' input were quantitatively interpreted following the AHP method. The evaluation process requires a matrix calculation aimed at establishing the weights of the given branch. The semantic scale of Saaty (1990) (Table 5), which relates the first nine integers with judgements that express the possible results of the comparison, is applied to obtain the comparisons in pair matrices (Piñero et al. 2017). The pairwise comparisons of variables at five levels are organised into matrix A. The elements of the matrix are as follows:

$$A = \begin{bmatrix} & C1 & C2 & C3 & C4 & C5 \\ C1 & & & & & \\ C2 & & & & & \\ C3 & & & & & \\ C4 & & & & & \\ C5 & & & & & \end{bmatrix}$$

From the aforementioned pairwise comparison matrix, the eigenvector and the maximum eigenvalue can be calculated by using the eigenvector equation:

$$MW = \lambda_{max} W$$

where M is the pairwise comparison matrix, λ_{max} is the maximum eigenvalue, and W is the column vector of the indicator weights (Yau 2009).

Finally, the consistency of judgements is checked by evaluating the consistency ratio. Saaty proposed that a consistency ratio less than or equal to 0.10 is acceptable in the decision-making process (Ribera et al. 2020). The consistency ratio is given by the following formula (Saaty 1994):

$$CI = \frac{(\lambda_{max} - n)}{n - 1}; CR = \frac{CI}{RI}$$

where:

λ_{max} : maximal self-value (eigenvalue) of the comparison matrix of rank-n

n : number of compared characteristics

CR: consistency ratio.

CI: consistency index.

RI: random index, dependent on the matrix degree.

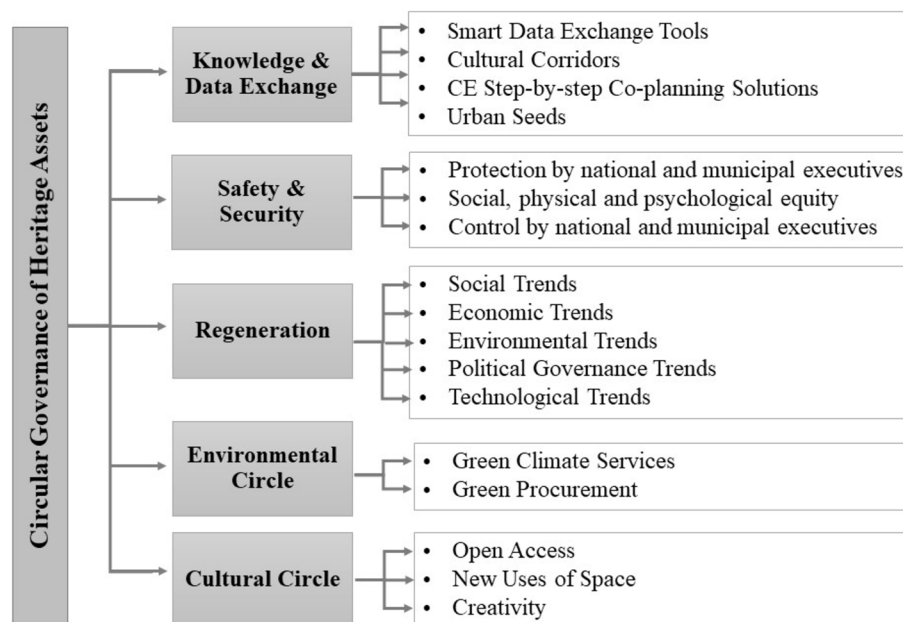


Fig. 4 Hierarchy of the circular governance of historic centres (Source: the authors)

Table 5 The importance scale in the pairwise comparison of two criteria (Saaty 1990)

Indicator A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Indicator B
Importance Scale Increases ◀									Equally Important	▶ Importance Scale Increases								

5 Results

5.1 Prioritisation of the circular governance indicators by expert respondents

The questionnaire results were analysed to obtain the prioritised indicators based on the AHP method. To encourage the respondents to expound on their opinions on the present topic, a semi-structured questionnaire guide was prepared.

The interview protocol was divided into six main parts in line with the main indicators already presented in the defined circular governance hierarchy (Figs. 4 and 5). Each part of the protocol has detailed questions related to the circular governance sub-indicators in the heritage conservation field.

5.2 Comparison between the case-dependent and case-independent prioritisation of circular governance indicators

For Tunisian respondents, the prioritised main indicators of circular governance are knowledge and data exchange and regeneration, with percentages of 28.24% and 25.41%, respectively (Fig. 6; Table 6).

The cultural circle is prioritised by 21.52%, which means that it ranks third among all the indicators. According to the case-independent respondents (CIRs¹), knowledge and data exchange are more prioritised (27.45%), with a value almost equal to that given by Tunisian respondents (TRs²). They, however, prioritised the Environmental Circle second, with an importance value of 21.25%. Among CIRs, the cultural corridors and urban seeds sub-indicators were more prioritised in the knowledge and data exchange circle (Fig. 7).

In the prioritisation of the cultural circle, for TRs, the creativity sub-indicator is approximately 57% more important than the new uses and open access sub-indicators. However, for CIRs, the defined sub-indicators of the cultural circle are of almost equal importance (Fig. 8). In the prioritisation of the regeneration sub-indicators, remarkable importance is attached to political governance trends by TRs (43.18%) (Fig. 9). TRs saw social trends as the least important (9.45%). The sub-indicator least valued by CIRs is economic trends (9.67%).

¹ CIRs: Case-independent respondents.

² TRs: Tunisian respondents.

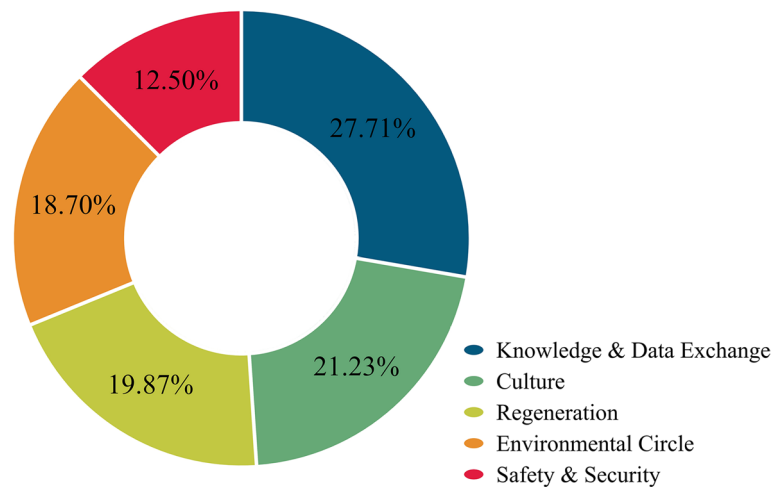


Fig. 5 Prioritisation of the circular governance indicators by expert respondents (Source: the authors)

In the environmental circle, both the case-dependent and case-independent interviewees saw the green climate service sub-indicator as approximately 77% more important than the green procurement sub-indicator (Fig. 10).

In the safety and security circle, TRs attached more importance to control by national and municipal executives (41.76%) (Fig. 11). For the 12 other respondents, social, physical, and psychological equity was 40.34% more important than the other sub-indicators.

5.3 Interpretation of the in-depth case-dependent interviews

In light of the defined circular governance guidelines, it is suggested to develop a case-specific framework for CH conservation. The framework can be elaborated based on the results of the in-depth interview with experts

ranging from investors active in local economic development (Laila Ben Gacim, investor in tourism retail in the Medina of Tunis), government actors (Souad Abderrahim, mayor of the municipality of Tunis), and academics (Inchirah Hababou, Zoubeir Mouhli, Faïka Bejaoui) active in the ASM, which is the main heritage preservation, conservation and protection institution in the Medina of Tunis (Table 7).

In light of the case study and the in-depth interview interpretation, some issues the conservation of the Medina of Tunis faces can be listed as follows:

1. After the 2011 revolution, the status of the ASM changed, and the municipality of Tunis established a heritage conservation department, which caused an overlap of interests between the corps responsible

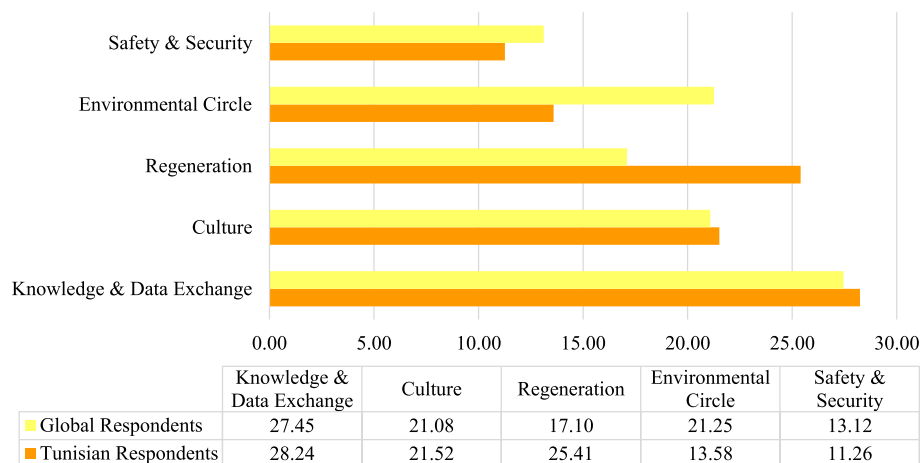


Fig. 6 Comparison of the prioritisation of circular governance indicators by Tunisian and Case-Independent Respondents (Source: the authors)

Table 6 Normalised weights and values by category of respondent obtained using the AHP

Circular Governance Indicators	Normalised Weights		Sub-indicators	Normalised Weights	
	TRs	CIRs		TRs	CIRs
Knowledge and Data Exchange	0.2823	0.2745	Smart data exchange tools	0.2700	0.1700
			Cultural corridors	0.2200	0.3000
			CE step-by-step co-planning solutions	0.2500	0.2600
			Urban seeds	0.2700	0.2700
Culture	0.2152	0.2108	Open access	0.2369	0.3222
			New uses of space	0.1936	0.3126
			Creativity	0.5693	0.3650
Regeneration	0.2540	0.1710	Social trends	0.1658	0.1000
			Economic trends	0.0944	0.2100
			Environmental trends	0.1309	0.1200
			Political governance trends	0.4317	0.2800
			Technological trends	0.1770	0.3000
Environment Circle	0.1358	0.2125	Green climate services	0.7944	0.7714
			Green procurement	0.2055	0.2285
Safety and Security	0.1125	0.1312	Protection by national and municipal executives	0.2747	0.3200
			Control by national and municipal executives	0.4176	0.2800
			Social, physical and psychological equity	0.3075	0.4000
Total	1.000	1.000		5.000	5.000

for protecting, managing and conserving the Medina's heritage.

2. There is no application text for the heritage conservation law, which makes the legislation not applicable.
3. After the 1956 emancipation, the Medina of Tunis became a dangerous ghetto and a sign of poverty. Thus, many buildings were abandoned by their owners until the present day. This constrained the state's decisions concerning the ownership clearance of decaying old monuments.
4. There are no legislative texts monitoring international cooperation in heritage conservation. The existing cooperations are not sustainable in the long term regardless of the funding that they can offer.
5. The conservation strategy for the Medina of Tunis needs a comprehensive vision that includes all sustainability factors, i.e., economic, social, environmental, and cultural.
6. The Medina's heritage-led regeneration projects are facing a funding problem, as state subsidies are insufficient.
7. Regarding security, at night, there is still a lack of control by the state.
8. There is a lack of coordination and cooperation between the main conservation actors in the Medina of Tunis.

5.4 Circularity assessment and recommendations for the conservation strategy for the Medina of Tunis

To be able to elaborate a circularity assessment for the conservation of the Medina of Tunis, a word cloud generator was applied to the interview transcripts. The results led to the proposal of several concepts and terms at stake in the test case. Combined with the AHP results, a circularity-based decision-making framework has been developed (Fig. 11). This study shows that the Medina of Tunis's community-based revitalisation initiatives have the potential to contribute to the circularity debate. From an environmental perspective, the *Trash to Treasure*³ initiative and adaptive reuse projects can be given as examples.

In the given circularity-based decision-making framework (Fig. 12), prioritisation values have been applied to obtain the importance of each main indicator and sub-indicator in the decision-making circle. For TRs, the knowledge and data exchange circle, has an importance value of almost 30%, and it is presented in the blue section extending around more than 1/3 of the decision circle. In this same main indicator, urban seeds and smart

³ *Trash to Treasure*: a new call for PPPs (by the municipality of Tunis) that aims to enhance CE implementation under the umbrella of (ENI CBC MED): Promoting Upcycling in Circular Economy through Innovation and Education for Creative Industries in Mediterranean Cities Project.

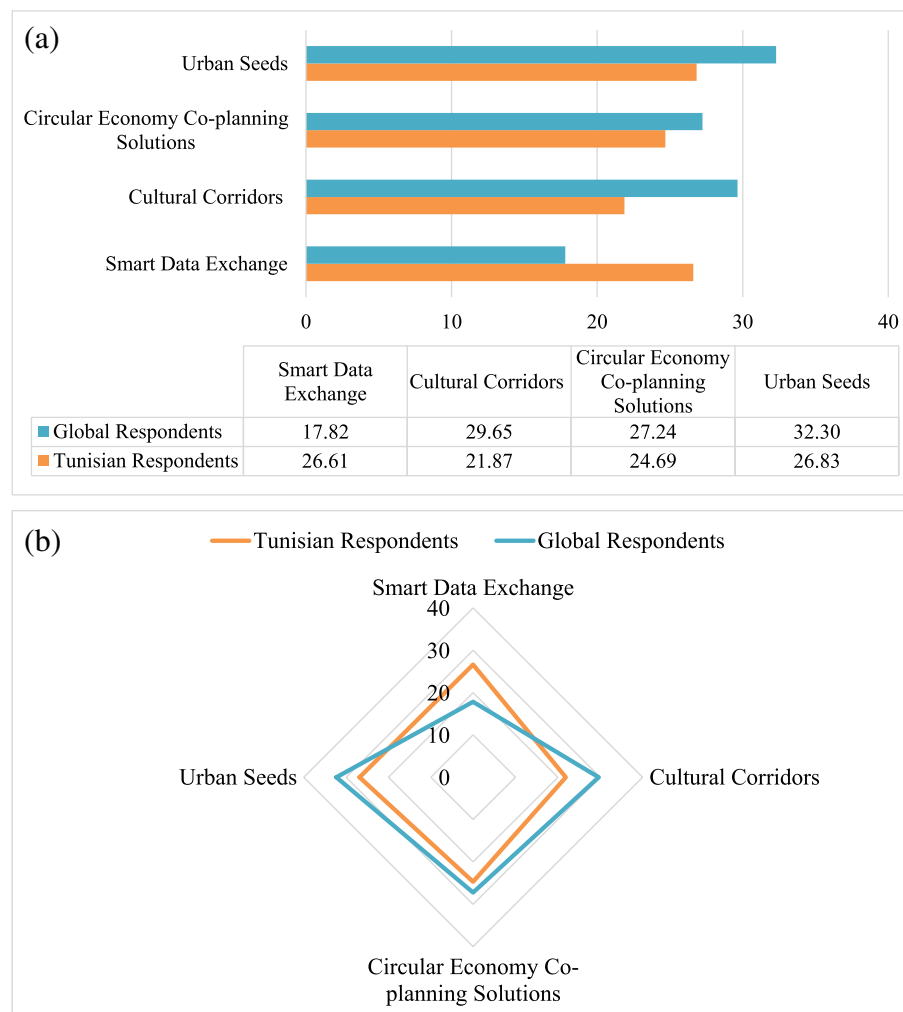


Fig. 7 Comparison between TRs' and CIRs' prioritisation of the knowledge and data exchange sub-indicators: **a** individual values, **b** radar chart (Source: the authors)

data exchange tools have an equal importance of 27% causing them to be put forward in the decision-making process.

For the text appearing in each section of the decision circle, the most frequent words that appeared in interpreting the in-depth interview transcripts have been mentioned as an overview about prospective actions to be taken regarding each indicator. Therefore, terms such as 'new', 'create', and 'strategy' appeared approximately 16 times when talking about knowledge and data sharing-based matters in the conservation strategy for the Medina of Tunis (Table 8).

To complete the decision-making chain and respond to the Medina's conservation issues, a guideline for actions has been developed (Table 9). The given conservation/development plan comprises five interwoven

phases following a circular process breaking with the conventional hierarchical systems for heritage governance. Since for the Medina of Tunis more importance has been attached to knowledge and data exchange and the cultural circle, the suggested guidelines put forward smart technologies and data sharing, particularly in tourism and cultural activities.

Based on the definition of intangible cultural heritage (ICH) provided in the 2003 UNESCO convention for the safeguarding of intangible cultural heritage, ICH comprises knowledge, skills, know-how and handcrafts. It is mainly manifested in performing arts and festivals in/through historic scenery (Wijesuriya 2008). Thus, more than one circle from the given framework is an enabler of ICH safeguarding as well (Table 9).

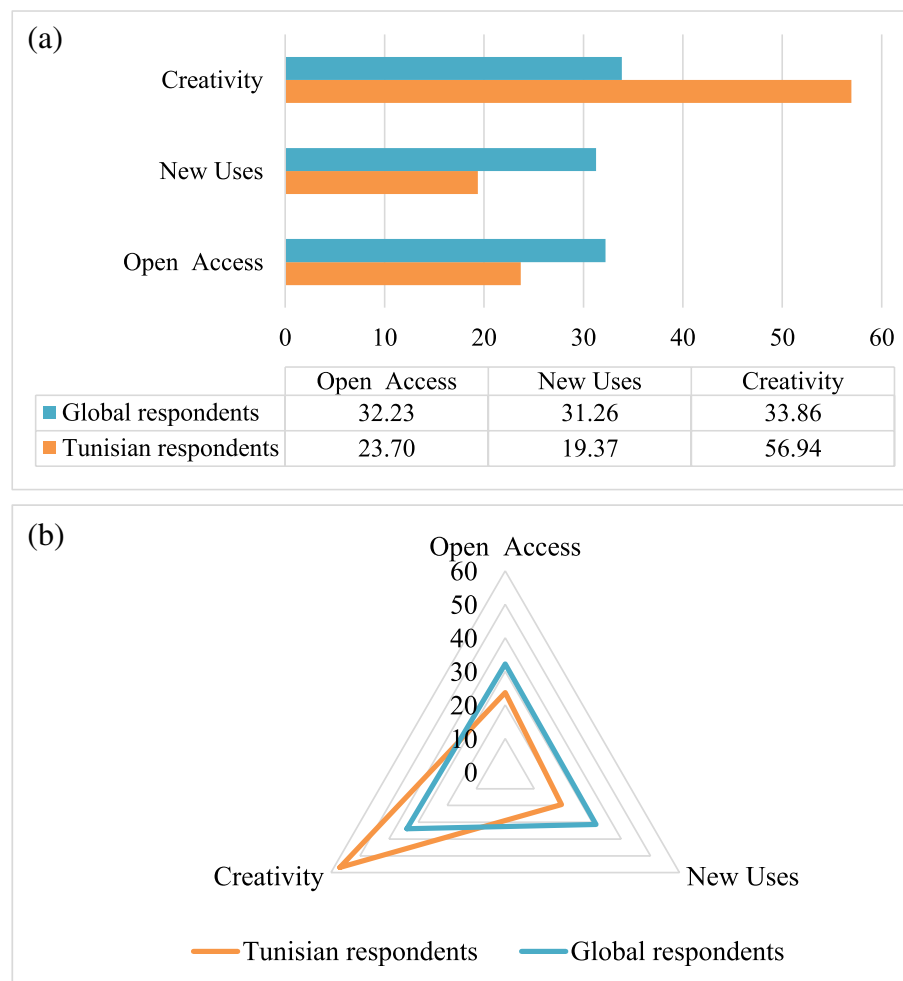


Fig. 8 Comparison between TRs' and CIRs' prioritisation of the cultural circle's sub-indicators: **a** individual values, **b** radar chart (Source: the authors)

6 Conclusions

The Medina of Tunis is a dynamic historic city centre that saw its core evolving to meet the needs of contemporary urban life. This attitude of the city represents a rich background for merging the circular city governance principle with heritage integrated conservation in light of expert opinions. The challenge in the shift of the integrated conservation strategy for the Medina of Tunis from a linear evolution and vertical relationship between stakeholders to a circular inclusive strategy is to associate the circular nature of heritage assets with the linear nature of the current conservation projects.

The forgoing research offers insights into a circularity-based heritage governance framework in accordance with the Medina of Tunis's need for an integrated conservation strategy. The following conclusions can be drawn from the data collected and processed, as mentioned in the preceding sections. Comparing the opinions of case-dependent and case-independent experts

on decision making concerning the circular governance indicators showed that for both groups of interviewees, the prioritised main indicators of circular governance are knowledge and data exchange and regeneration, with percentages of 28.24% and 27.45%, respectively.

Tunisian experts' second most important factor is the regeneration circle (25.40%). However, the case-independent group's second priority is the environmental circle (21.25%). This result explains the need that the Tunisian experts expressed for the political governance trends, which has been clearly reflected in the interpretation of the in-depth expert interviews.

Under the Knowledge and data exchange circle, TRs assigned equal importance value of 27% to both urban seeds and smart data exchange tools. For future policy instruments, these metrics relate to the importance of spatial enhancement through the implementation of step-by-step low-cost co-planning solutions aimed at attracting people to use the

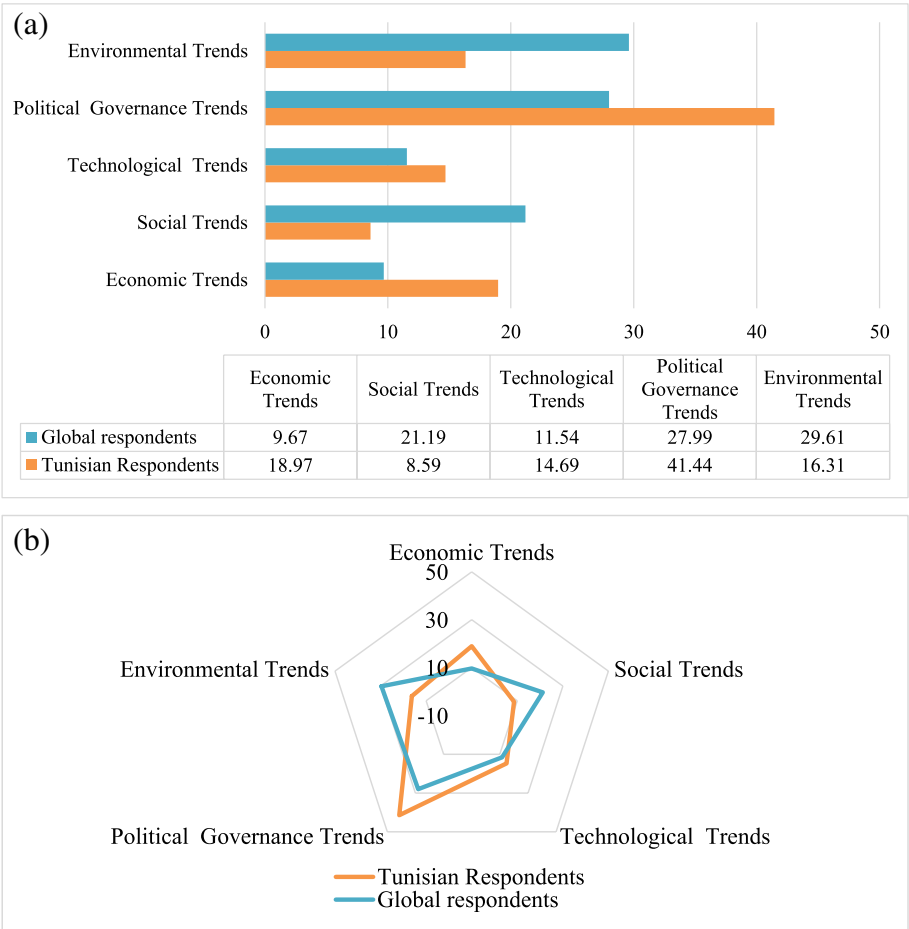


Fig. 9 Comparison between TRs’ and CIRs’ prioritisation of the regeneration sub-indicators: **a** individual values, **b** radar chart (Source: the authors)

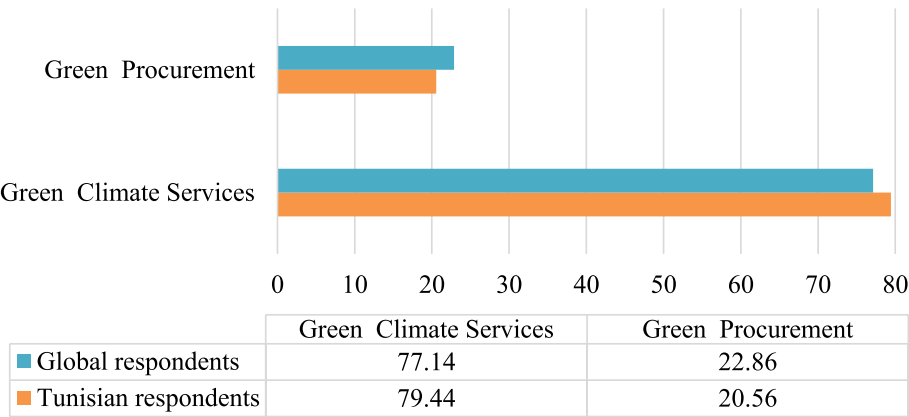


Fig. 10 Comparison between TRs’ and CIRs’ prioritisation of the environmental circle sub-indicators (Source: the authors)

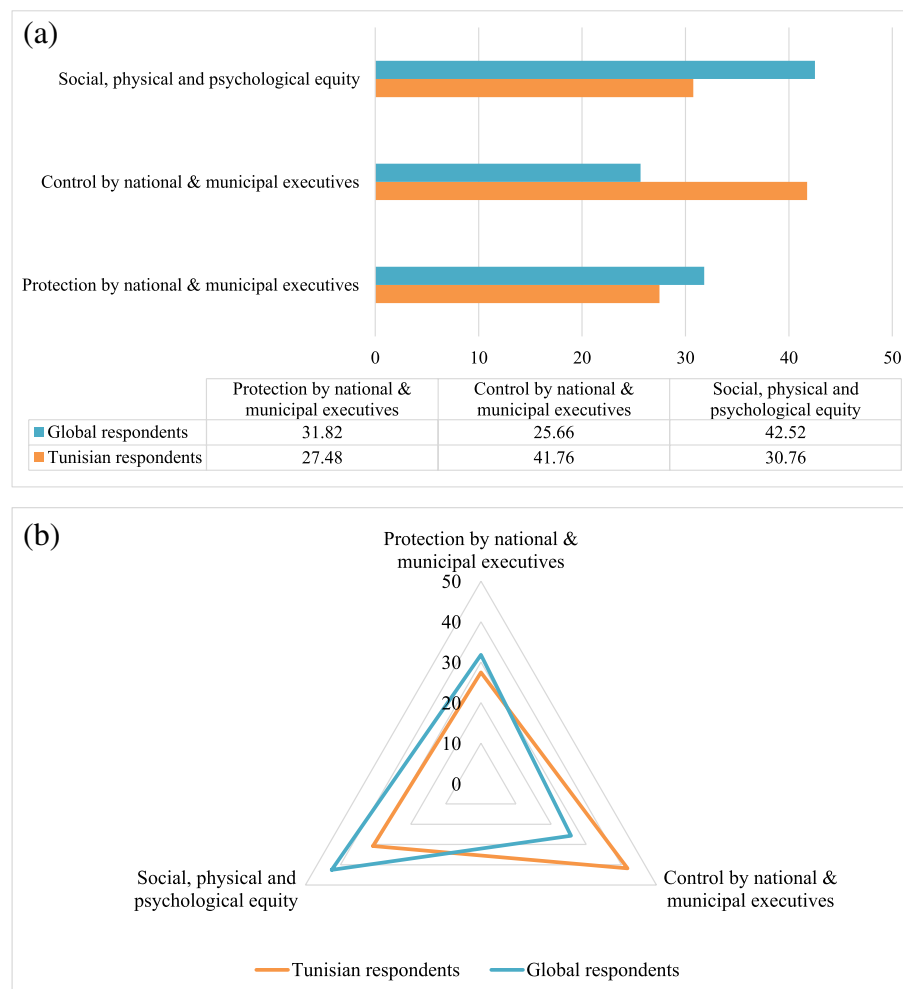


Fig. 11 Comparison between TRs' and CIRs' prioritisation of the safety and security sub-indicators: **a** individual values, **b** radar chart (Source: the authors)

space and revitalisation through the effective distribution of ICT usage in historic cities. Awareness of the significance of smart data Exchange tools in the decision-making process for the long-term sustainability of the Medina of Tunis is already witnessing an increasing interest in several city branding initiatives, e.g., INTERFERENCE.⁴

In the cultural circle, TRs assigned creativity sub-indicator a value of 56.93%, and CIRs assigned it a value of 36.50% against the other sub-indicators. This indicates the need for an increase in artist mobility, promotion of the site's folklore and tradition, and most importantly, enhancing creative core productivity. For the Regeneration indicator, political governance trends in heritage-led regeneration projects

have been prioritised by Tunisians by an importance value close to 50%. As previously explained, political governance trends refer to the integrated management of CH and sustainability solutions for CH co-planning policies. This level of the heritage governance strategy calls for a participatory horizontal approach. Thus, the results explain that the Tunisian government's commitment has a role to play in ensuring the adoption of sustainability policies for CH management and conservation. However, among CIRs, technological trends have been prioritised the most, with a value of 30%, over the other four trends. For CIRs, funding, investment support, and state subsidies for the conservation strategy are acquired facts.

In the case of the safety and security indicator, social, physical, and psychological equity is considered more

⁴ INTERFERENCE: <https://2022.intunis.net/about/>

Table 7 Challenges and opportunities in the conservation of the Medina of Tunis from a circular approach perspective

Challenges facing circular governance adoption by the Medina of Tunis		Suggestions to improve the state of conservation in the Medina of Tunisian
Knowledge and data exchange	Gap in the knowledge and data exchange circle No means for attracting skills	'The Rambourg Foundation's digitisation of all the artisans' work can be a good example to follow' (interview with Zoubeir Mouhli, February 16, 2022)
Culture	The safeguarding and enhancement plan for the Medina of Tunis makes it difficult to localise new uses of the space	'To be able to get people to participate in cultural life, there should be an organisation of meaningful cultural activities' (interview with Zoubeir Mouhli, February 16, 2022) 'It can be interesting to make well-located guest houses and try to plan their location with a long-term vision. We should think about the Medina as a whole.' (interview with Inchirah Hababou, February 15, 2022)
Regeneration	Land use regulation problems and legacies that have never been resolved	'What has to be done is that the legislations force owners to sell or renovate their properties' (interview with Zoubeir Mouhli, February 16, 2022) 'To solve the funding problems and the Medina's management conflicts, almost all the interviewees agreed that PPPs should be increased'
Environmental Circle	The Medina's compact urban pattern does not permit the creation of green public spaces. The Medina's UNESCO-protected status constrains the use of green building technologies	'Green terraces can be made only in a few places and with the condition of prohibiting water infiltration' (interview with Zoubeir Mouhli, February 16, 2022)
Safety and Security	Absence of application texts concerning safety and security regulations	'The creation of job vacancies for the community through PPPs Pedestrianisation and urban lighting' (interview with Souad Abderrahim, February 08, 2022) 'Involving the Medina's community in providing security is a must' (interview with Laila Ben Gacem, February 16, 2022)

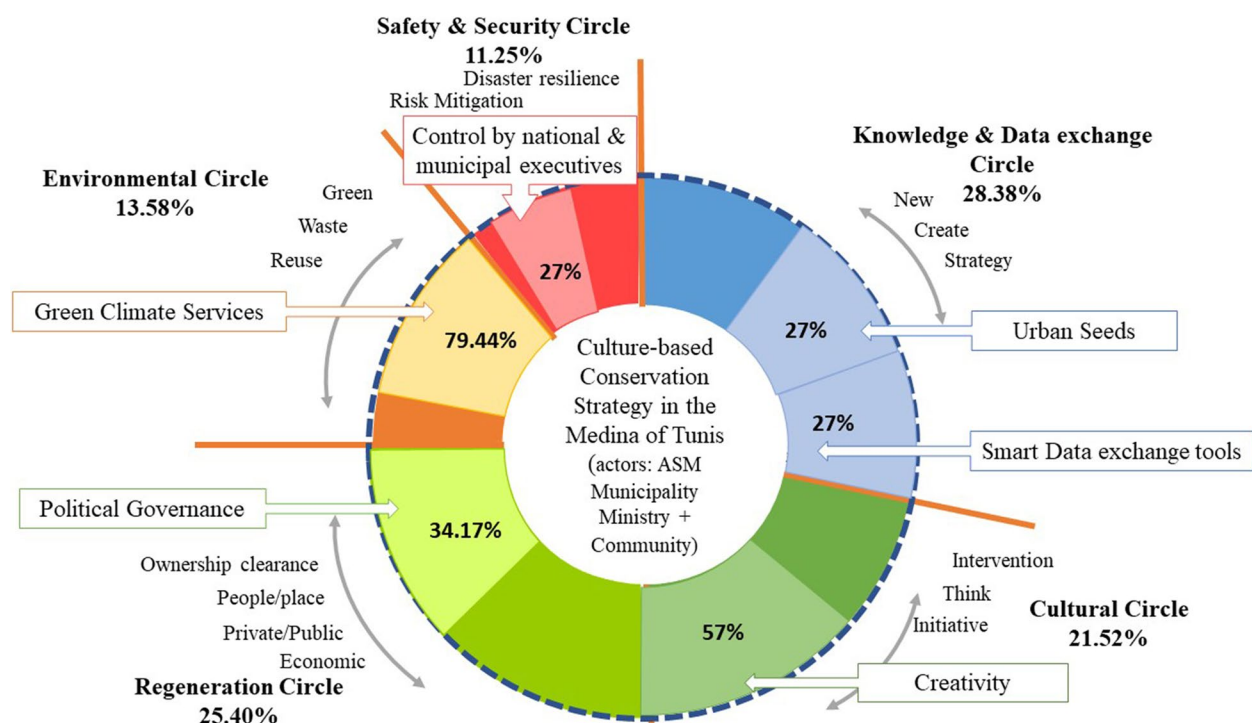


Fig. 12 Circularity-based decision-making framework for the integrated conservation of the Medina of Tunis (Source: the authors)

Table 8 Interpretation of the in-depth interview results with word cloud generator

Frequency	Word
More than 150	157 the Medina
More than 70	74 conservation
60–70	68 heritage
40–30	36 ASM
	34 cultural
	33 municipality
30–20	28 old
	25 ministry
	23 circular
	22 economic
20–15	20 urban
	19 rehabilitation, security
	17 parking, property, INP
	16 create, new, strategy, green
	15 making, people
15–10	14 projects, public, private, plan
	13 economy
	12 reuse, projects, waste, intervention, building, attempts, initiatives, problems, municipality, study

important, receiving a score of 40% from CIRs. However, among TRs, control by national and municipal executives has been assigned an importance of 41.76%. This indicates the need for better democratic governance of heritage assets, better land use planning, improved urban lighting, risk mitigation, disaster resilience, ownership clearance, and safer mobility in the Medina of Tunis.

Although circular governance is by definition a reflexive governance intended as a ‘self-critical governance that analyses and monitors its own results’ through continuous feedback processes (Girard and Nocca 2019), assessing the effectiveness of circular approach implementation for decisions on historic city conservation is currently an approach open for debate. To assess the overall effectiveness of the suggested decision-making chain for the integrated conservation of the Medina of Tunis, long-term monitoring of the suggested approach (and the indicators/sub-indicators included therein) is already in place for long-term assessment of the framework. Some of the ongoing projects in the case area have shown the potential to contribute to circularity-based heritage conservation (Trash to Treasure). However, these

Table 9 Circularity-based guidelines for conservation planning in the Medina of Tunis

Phases of the conservation policy planning	Recommendations concerning each phase
Knowledge and Smart City	Strengthening the capacity to innovate through information and communication technology (ICT) services in heritage-based artistic and tourism activities Enhancing the digitisation of culturally significant buildings for better heritage protection
City of Art and Culture	City branding Determining themes for creative placemaking (vibrant nightlife) Developing potential cultural events (ephemeral urbanism) Performing art/music centres, bookstores, and museums
Inclusive and Sustainable City	Increasing the sustainability-based government objectives in heritage conservation Identifying stakeholders contributing to policy-making Solving funding problems by advancing the city's creative economy to attract inner-city investments and supporting entrepreneurship Solving management conflicts through PPPs Promoting stakeholders' engagement Mixed use enhancement to avoid the segregation of some areas
Environmentally Friendly City	Easing commercial traffic in narrow streets and increasing pedestrianisation Mitigating environmental pollution by legalising the waste collectors' activity
Secure City	Electronic surveillance of streets and blind streets Organising sensitisation programmes against drug usage and delinquency Supporting nocturnal activities (tourism retail) through energy-efficient urban lighting (smart lighting control system)

projects are planned to conclude in the next few years, after which a repeat of the data collection can be carried out and the quantitative and qualitative results of the state of existing problems (and their solution) can be evaluated. As part of this assessment, an inventory

of the created cultural corridors and their contribution to funding future regeneration projects, the number of job vacancies they created, and the level to community participation they afforded can also be elaborated.

Appendix

Table A: Literature sources on the impact factors, indicators and sub-indicators of heritage assets conservation from a Circular Governance perspective (Year: 2013-2022)

Source	Year	Source Typology	No. of factors	Dimensions: Cultural (Cl), Knowledge (Kn), Security (Se), Environmental (En), Regeneration (Re), Creativity (Cr)	Imbedded sub-indicators and their details
Aciri et al.	2021	Article	1	Kn	Urban seeding: a Step-By-Step Low-Cost Co-Planning Solution aimed at attracting people to use the space
Bartolomei and Ippolito	2015	Article	1	Kn	Smart Data exchange tools
Blanco et al.	2011	Article	6	Re	Political Governance Trends
Chau, Choy, and Lee	2018	Article		Re	Political governance Trends
Conejos et al.	2016	Article		Re	Adaptive reuse of heritage buildings
DCAF	2019	Research Report	9	Se	Protection by national and municipal executives - Social, physical and psychological equity - Control by national and municipal executives
Foster and Kreinin	2020	Article	6	En	The six defined circular environmental indicators for adaptive reuse of cultural heritage (ARCH) buildings from a circular economy perspective
Garzillo et al.	2018 2019	Article Research Report	7 7	Re, Cl, Kn, Se and En	The seven governance principles of the CLIC horizon 2020 funded project:

Source	Year	Source Typology	No. of factors	Dimensions: Cultural (Cl), Knowledge (Kn), Security (Se), Environmental (En), Regeneration (Re), Creativity (Cr)	Imbedded sub-indicators and their details
Giulio et al.	2021	Article	4	The kn. Circle of the ROCK (2019) project	ICTs for cultural heritage: Immersive Virtual and Augmented reality experiences, and Gaming applications
Gravagnuolo et al.	2017	Article	23	Re, Cl, Kn, Se and En	Integrity, authenticity, identity preservation Encouraging local skills and New uses Local return and job creation Green climate services (efficiency measurements for energy) Creativity, well being Circular economy processes in real estate market
Grenville	2007	Article	1	Se	Social Physical and Psychological equity
ICLEI	2020	Research Report	7	Cl, Kn, Se, En, Re, Cr	The seven governance principles of the CLIC horizon 2020 funded project
Kim and Doser	2020	Institutional Report	7	Kn, Re, Cl, Se	Creativity and free accessibility to cultural events (Cl), Community involvement (Re), PPPs (Re & kn), Accountability (Re), Democratic Governance Trends (Se), Stakeholders' communication (Re) (GCDN: Global Cultural Districts Network)
Kaddar et al.	2022	Article		Cl.	The ability of people to access culture – public participation in culture - freedom of cultural expression
Lai, Chau, and Cheung	2018	Article	2	Se	Social Physical and Psychological equity: social justice and property rights
Marra et al.	2021	Article	2	Se	Disaster resilience and risk mitigation in heritage sites as security tools
McFarland	2018	Article	1	En	Green procurement
Nocca	2017	Article	177	Kn, Cl, Re, En, Se, and Creativity	Tourism and recreation, Creative, cultural and innovative activities, Typical local productions, Environment and natural capital, Social capital/cohesion and inclusion, Real estate, Financial return, Cultural value of properties/landscape, Wellbeing
Nocca et al.	2021	Article	6	Re: social trends and political governance trends	Job creation and social cohesion, place attachment, local identity, sense of place Enhancing the state of conservation
			7	En : Green Climate services	Waste management, water researches management, thermal comfort, lighting and visual contort,
			1	Se : social equity	Wellbeing
Raid	2016	Website	1	Kn	Smart Data Exchange tools: augmented reality in heritage sites
ROCK	2019	Project Report	6	Kn, Cl, Re, En, Se, and Creativity	Outcomes of the ROCK project (https://rockproject.eu/), co-financed by the European Union within the H2020 framework programme under grant agreement no. 730280.
Said et al.	2013	Article	1	Re	Social trends in heritage revitalization
Salazar Cota et al.	2018	Article	1	En	Green procurement
Skinner	2022	Article	6	Re	The Environmental, economic, social, cultural, symbolic and political dimension of heritage conservation.
Shao et al.	2019	Article	1	Cl	Creativity as a part from the Cultural Circle
Tricarico et.al.	2022	Article	3	Cl	The ability of people to access culture – public participation in culture - freedom of cultural expression

Source	Year	Source Typology	No. of factors	Dimensions: Cultural (CI), Knowledge (Kn), Security (Se), Environmental (En), Regeneration (Re), Creativity (Cr)	Imbedded sub-indicators and their details
Turillazzi	2020	Article		Kn and Re	Digital platforms for supporting the heritage-led regeneration
UNESCO	2019	Research Report	7	CI	Open access, new uses, creativity

Abbreviations

AHP	Analytical Hierarchy Process
ARRU	National Agency of Urban Rehabilitation and Renewal
ASM	Association for the Safeguarding of the Medina of Tunis
CDP	National Code of Protection of the Archaeological, Historical Heritage and Traditional Arts of Tunisia
CE	Circular Economy
CH	Cultural Heritage
CIrs	Case-independent respondents
CLIC	Circular models Leveraging Investments in the Cultural heritage adaptive reuse
COMUS	Community-led Urban Strategies in Historic Towns
GCDN	Global Cultural Districts Network
HUL	Historic Urban Landscape
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
INAA	Institut National d'Art et d'Archeology
INP	Institut National du Patrimoine
ITUC	Integrated Territorial and Urban Conservation
ROCK	Regeneration and Optimisation of Cultural heritage in creative and Knowledge cities
SDGs	Sustainable Development Goals
TRs	Tunisian respondents

Acknowledgements

The authors would like to express their gratitude to all the experts who participated in this research.

Authors' contributions

The authors read and approved the final manuscript.

Funding

Not applicable.

Availability of data and materials

Not applicable.

Declarations

Competing interests

No potential conflict of interest is reported by the authors.

Received: 2 December 2022 Accepted: 3 June 2023

Published online: 09 August 2023

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