Exploring Impact of Historical and Cultural Heritage on the Sustainability of Urban and Rural Settlements

Elena Shcherbina*, Ali* Salmo[1]

Moscow State University of Civil Engineering, 26, Yaroslavskoye shosse, Moscow, 129337, Russia

Abstract. Sustainable development of urban and rural areas is a key focus in urban planning and socio-economic planning. While the scientific literature extensively discusses socio-economic, environmental, and anthropogenic factors that contribute to the sustainability of cities, the significance of cultural heritage often receives insufficient attention. This study addresses this gap by employing a multi-criteria model to evaluate the impact of tangible and intangible cultural heritage on the sustainability of cities in Syria for example Homs. By utilizing public domain materials and statistical data from municipal organizations, the study incorporates parameters based on the Sustainable Development Goals (SDGs). The objective of the research is to determine the influence of these factors on the sustainability of Syrian cities and the role of cultural heritage in promoting socio-economic development and urban reconstruction after the military conflict. The multi-criteria model, developed through a systematic approach and qualimetry analysis, demonstrates that the preservation of cultural heritage positively impacts the sustainability of urban and rural settlements. The study reveals a decrease in the development level of settlements due to the loss of cultural heritage, while emphasizing the potential for increased development through the preservation of cultural heritage.

1 Introduction

Under the influence of development and urbanization trends, urban and rural settlements are undergoing rapid transformation, often resulting in neglect and loss of valuable historical and cultural heritage. In recent years, however, there has been a growing recognition of the intrinsic value and potential benefits that historical and cultural heritage brings to the sustainability of these settlements [1].

Sustainability issues have become one of the most important aspects of urban and rural planning, incorporating economic, social, and environmental aspects [2].

Efforts to create sustainable settlements have traditionally focused on various issues such as energy efficiency, transportation and waste management, yet the role of historical and cultural heritage in sustainability is often overlooked. Cultural heritage sites can improve

[1] Corresponding author: alisalmorussia1993@gmail.com

the structure of urban and rural areas by stimulating a sense of place, identity, and social cohesion [3].

In addition, the preservation and integration of heritage into the environment can also provide economic benefits, such as income from tourism and increased property values [4].

Historical and cultural heritage includes a variety of tangible and intangible objects that are important to communities and regions, these objects include historic buildings, archaeological sites, cultural landscapes and traditional customs But the rapid pace of development, wars and earthquakes have posed significant challenges to cultural heritage preservation, resulting in the loss of non-recoverable cultural resources and a reduction in the potential contributions of heritage to sustainable development [5].

There is now a growing understanding of the importance of historical and cultural heritage in maintaining the sustainability of urban and rural settlements. However, there is a gap in understanding the specific mechanisms through which heritage sites affect sustainability, especially in developing countries such as Syria. [6,7].

The main purpose of this study is to examine the impact of historical and cultural heritage on the sustainability of urban and rural settlements. Applying a systems approach, this paper aims to identify the multifaceted relationship between cultural heritage preservation and sustainability, exploring environmental and socio-economic, architectural and urban planning aspects.

Additionally, the study seeks to address the knowledge gap between sustainability and cultural heritage preservation by using a mathematical model to identify vulnerabilities in the development process of Syrian cities.

2 Materials and methods

The article used publicly available materials and statistical data of municipal organizations of cities in Syria [8]. Systematic analysis and the method of qualimetry have been combined to solve the current research problem.

The method of qualimetry can be defined as the science of measuring the quality of products [9]. And the product in this case study is cultural heritage sites under the influence of sustainable development.

Cultural heritage sites in Syria have been affected by a number of factors that have put them under the influence of losses, including war, earthquakes, organizational and administrative errors [10].

The concept of sustainable urban development in Syria is a complex and multifaceted issue that involves a balance between the preservation of cultural heritage and the need for economic development and modernization. The historic territories and cities of Syria are some of the oldest and culturally rich places on earth, with a long and varied history spanning thousands of years. The concept of sustainable development includes 6 main directions, which form a system [11], which is a model for the sustainable development of the historic territory (see figure 1). According to this system, each direction of development can be evaluated using a system of evaluation criteria. This system will also allow more effective and objective consideration of all factors and obtain solutions for sustainable development.

The improvement of sustainability is based on the unity of many factors, for example, the system of critical and motivating factors includes anthropogenic (physical), social, economic, environmental and administrative systems [12]. To facilitate expert evaluation, the numbering of factors was given, see Table 1

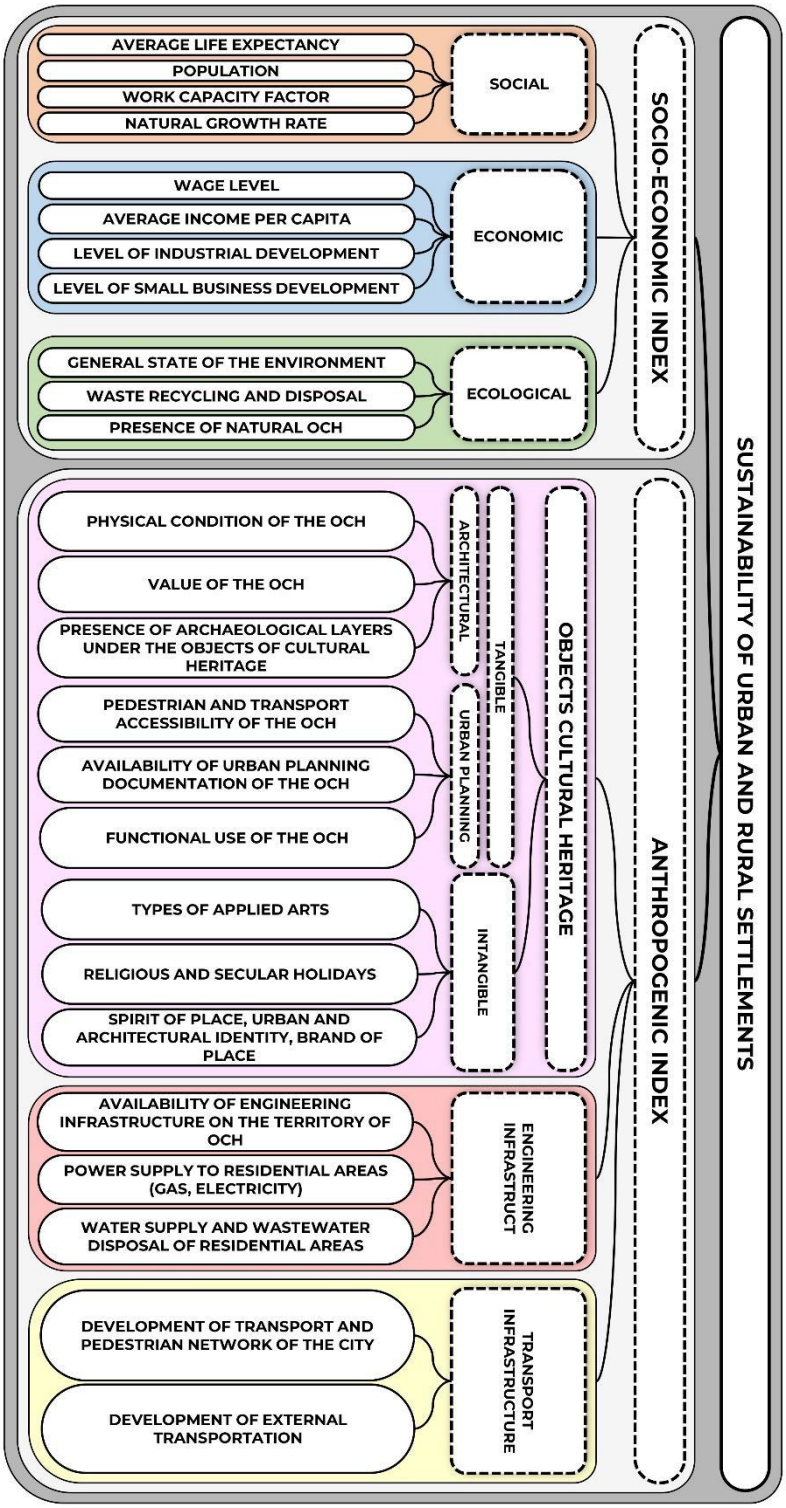

Fig.1. The tree of indicators of urban sustainability

Table 1. Numbering of sustainability indices and subindices of urban and rural settlements

Sustainability of urban and rural settlements	socio-economic index 35	Social 29	Average life expectancy 1		
			Population 2		
			Ability to work coefficient 3		
			Rate of natural increase 4		
		Economic 30	Wage level 5		
			Average income per capita 6		
			Level of industrial development 7		
			Level of small business development 8		
		Environmental 31	General state of the environment 9		
			Waste recycling and disposal 10		
			Presence of natural OCH (Objects of Cultural Heritage) 11		
	Anthropogenic index 36	Objects cultural heritage 32	Intangible 27	Types of arts and crafts 12	
				Religious and Secular Holidays 13	
				Spirit of place, urban and architectural identity, brand of place 14	
			Tangible 28	Architectural 26	Physical condition of the OCH 15
					Value of the OCH 16
					Presence of archaeological layers under the objects of cultural heritage (yes, no) 17
				Urban Planning 27	Pedestrian and transport accessibility of the OCH 18
					Availability of urban planning documentation for the protection of the OCH 19
					Functional use of the OCH 20
		Engineering Infrastructure 33	Availability of engineering infrastructure on the territory of the cultural and recreational area 21		

			Power supply to residential areas (gas, electricity) 22
			Water supply and wastewater disposal of residential areas 23
		Transport Infrastructure 34	Development of transport and pedestrian network of the city 24
			Development of external transportation 25

After receiving responses from 25 experts, who rated each indicator from 0 to 1 in accordance with the instructions in the questionnaire, the calculation process began with determining the weight of the indicators suggested by the formulas using the qualimetry method.

A point scale from 0 to 1 was used for the expert evaluations, with the beginning of the scale - 0 points - meaning no significance of the indicator, and the upper limit - 1 point - corresponding to the maximum probable significance of the indicator.

The consistency of expert assessments can be evaluated by the coefficient of variation, which determines the relative measure of deviation of measured values from the arithmetic mean (formula 1).

$$C_{xj} = \frac{\sigma_{xj}}{X_j} \qquad (1)$$

where C*xj* is the coefficient of variation, %; σ xj is the standard deviation of the experts' estimates for the j-th indicator; x1 is the average estimate of the indicator.

The standard deviation shows the absolute deviation of values from the arithmetic mean. The standard deviation of the experts' assessments for the j-th indicator σ*xj* is determined by (formula 2):

$$\sigma_{xj} = \sqrt{\frac{\sum_{j=1}^{n} (x_{ij} - x_j)^2}{n}} \qquad (2)$$

where x*ij* are the experts' evaluations for each indicator
;n is the volume of the statistical population.

As a result, the distribution of weighting coefficients in order of increasing importance is shown in Figure 2.

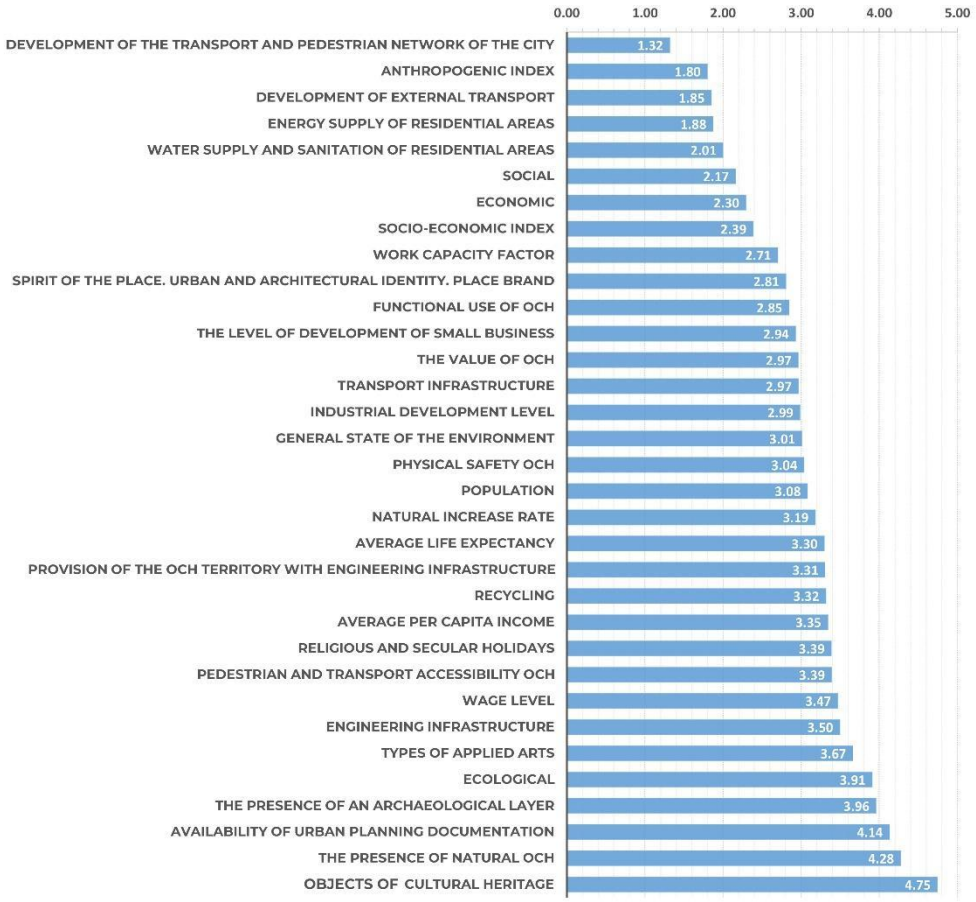

Fig. 2. Diagram of the weighting coefficients distribution

The method of qualimetry is the considering on of the most important analytical tool for identifying relationships between events. At the same time, not separate indices are used, but their systems.

The index of city's sustainability IS is a comprehensive assessment of the quality of the option, so it can be obtained as a weighted arithmetic mean of relative assessments with weighting coefficients by (formula 3)

$$IS = \sum_{J=1}^{n} K_{ij} \cdot M_j \qquad (3)$$

где $\sum_{J=1}^{n} K_{ij}$ the total value of relative indicators;

M_j - Weight coefficient values. The best quality of the compared options is considered to be the one with the highest IS value.

3 Results

The maximum value of the sustainability index in the presented model can be 100%. The calculations showed that the index of resilience of the city of Homs before the war was 64.5%, which allows us to evaluate it as high enough. After the war, its value is 31%, which characterizes the reduction of sustainability by almost half. Analysis of the diagram (Fig.3) shows all the decrease in the indicators of the second level (social, economic, ecological, objects of cultural heritage, engineering and transport infrastructure). At the same time, the transport infrastructure and the ecological index decreased insignificantly, while the OCH (Objects of Cultural Heritage) and the economy decreased almost twice. This shows the significant importance of the economy in the sustainability of the city, and, consequently, the need for additional investment in the period of its reconstruction. And it also demonstrates that the significant damage caused by OCH affects the sustainability of the city, and requires the development of special urban planning measures during its restoration [13]. In the case of insufficient attention, the OCH may be completely lost, which will have a negative impact on the sustainability of the city, even with the full restoration of its engineering and transport infrastructure and residential areas. Any increase in the index of cultural heritage will effectively contribute to the development of the overall index of the sustainability of the city.

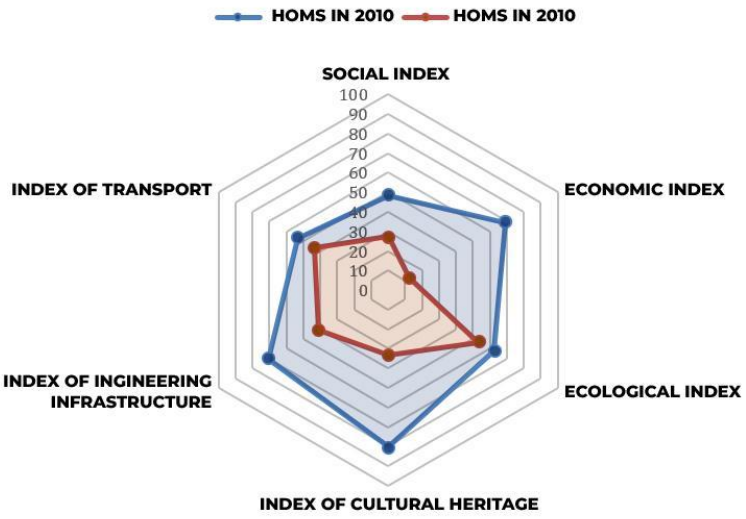

Fig.3 Radar chart of the Homs city development index before and after the war.

4 DISCUSSION AND CONCLUSIONS

The distinctive feature of the study is the assessment of the importance of OCH in the context of sustainable development, which is a development of numerous studies on this issue, in which this factor has not been investigated.

The proposed model showed that, in assessing the sustainability of the city, OCH has a significant impact. Comparing the results before and after the war, showed a significant decrease in the sustainability index from 64 (before the war), which justifies the validity of the proposed mathematical model.

The development of the research appears to be an assessment of the current situation and future directions of further development of Syrian cities and rural settlements.

The proposed model will help in assessing the level of development of Syrian cities by obtaining a comprehensive model of development and identifying critical points and what is suitable for use in the design of urban development projects.

References

1. Naheed, S., & Shooshtarian, S. (2022). The role of cultural heritage in promoting Urban Sustainability: A brief review. Land, 11(9), 1508. https://doi.org/10.3390/land11091508
2. Zulauf, K., & Wagner, R. (2021). Urban and rural sustainability: Divergent Concepts and their consequences for marketing. Frontiers in Sustainability, 2. https://doi.org/10.3389/frsus.2021.670866
3. Salmo, A., Scherbina, E. V., Alibrahim, L. Y. (2021). Architectural and urban identity of Homs City. Vestnik MGSU, (10), 1285–1296. https://doi.org/10.22227/1997-0935.2021.10.1285-1296
4. Brooks, C., Waterton, E., Saul, H., & Renzaho, A. (2023). Exploring the relationships between heritage tourism, Sustainable Community Development and host communities' Health and Wellbeing: A systematic review. PLOS ONE, 18(3). https://doi.org/10.1371/journal.pone.0282319
5. Ahmad, R. (2022). The legal role of government in protecting cultural heritage and archaeological sites in the war-affected countries: The case of Iraq and Syria. Journal of Liberty and International Affairs Institute for Research and European Studies - Bitola, 8(2), 281–292. https://doi.org/10.47305/jlia2282281a
6. Kousa, C., Pottgiesser, U., & Lubelli, B. (2021). Post-syrian war residential heritage transformations in the Old City of aleppo: Socio-Cultural Sustainability Aspects. Sustainability, 13(21), 12213. https://doi.org/10.3390/su132112213
7. McCafferty, J. D. (2023). The state heritage institutions of Yemen, Syria and Iraq. Studies in Art, Heritage, Law and the Market, 43–89. https://doi.org/10.1007/978-3-031-19675-1_3
8. The website of the Central Bureau of Statistics in the Syrian Arab Republic, website http://cbssyr.sy/
9. Azgaldov, Garry G. The ABC of Qualimetry : The Toolkit for measuring immeasurable / Garry G. Azgaldov, Alexander V. Kostin, Alvaro E. Padilla Omiste ; interpreter Eric Azgaldov. — Ridero, 2015. — 167 p. — http://www.labrate.ru/books/20150831_the_abc_of_qualimetry-text-cc-by-sa.pdf
10. Scherbina, E. V., & Salmo, A. (2022). Urban Planning Risks of Losing Cultural Heritage. Stroitel'stvo: Nauka i Obrazovanie [Construction: Science and Education], 12(4), 46–63. https://doi.org/10.22227/2305-5502.2022.4.4
11. Harbiankova, A., & Scherbina, E. (2021). Evaluation model for sustainable development of settlement system. Sustainability, 13(21), 11778. https://doi.org/10.3390/su132111778
12. Gorbenkova, E. V., & Scherbina, E. V. (2017). Methodological approaches for modeling the Rural Settlement Development. Vestnik MGSU, (10), 1107–1114. https://doi.org/10.22227/1997-0935.2017.10.1107-1114
13. Shcherbina, E. V., Belal, A. A., & Salmo, A. (2020). Historic Centres of Syrian towns ruined by the war: Restoration through urban planning. Vestnik MGSU, (5), 632–640. https://doi.org/10.22227/1997-0935.2020.5.632-640