Work title

Application of Pro-environmental Solutions and New Ecological Technologies in the Adaptation of Buildings Under Conservation Protection on the Example of the Historic Park-Palace Complex in Rzuchów

Abstract

The doctoral dissertation titled *Application of Pro-environmental Solutions and New Ecological Technologies in the Adaptation of Buildings Under Conservation Protection on the Example of the Historic Park-Palace Complex in Rzuchów* addresses the issue of sustainable revitalisation of heritage sites, considering the legal, environmental, and technical aspects associated with cultural heritage protection and mitigating the effects of climate change. Discrepancies between the conservation approach and contemporary socio-economic needs cause tensions and conflicts between the owners of historic buildings and heritage protection services. The work's central thesis assumes that developing and implementing a management model for revitalisation, understood as a complex scheme of procedures based on the principles of sustainable development, can significantly support the protection of cultural heritage. The proposed implementation is intended as a procedural template. It aims to fill the gap in the catalogue of heritage protection tools, offering a management scheme for the investment process that considers the interests of architectural heritage owners and conservation services.

The scheme assumes dialogue and cooperation between various stakeholders, leading to a complementary satisfaction of needs regarding the protection of the historic substance and the improvement of the functionality of historic buildings. By analysing the impact of implementing new technologies in monuments, the model enables the identification of potential threats and opportunities for historic objects. The structure of the work is the result of the implementation character and the adoption of the ecological effect as an indicator of the effectiveness of sustainable revitalisation of monuments. The study consists of three parts: theoretical, research, and implementation. The theoretical part provides the substantive basis for further research and implementations, covering legal aspects of monument protection at the international and national levels, spatial planning, revitalisation, and climate policy. Based on this, the author defined sustainable revitalisation of monuments as a thoughtful, comprehensive set of actions aimed at restoring the historical, architectural, and aesthetic values of historic objects, considering the improvement of functionality, user economy, pro-environmental solutions, and positive impact on the social environment, leading to the preservation or restoration of the continuity of use of historic buildings.

The theoretical part also highlights the positive and negative examples of implementing environmental solutions in historic buildings. Emphasis is placed on the term modernisation and energy efficiency of monuments, as well as the use of greenery and elements of blue-green infrastructure. The research part describes the study and field research. Contextual survey research was directed at the owners of historic residential objects throughout Poland. The survey was conducted to examine the potential and conditions for implementing modern technologies in historic buildings that increase the utility value of these objects and improve their energy efficiency. The study was conducted using an electronic questionnaire developed using the eBadania platform (https://www.ebadania.pl).

For the implementation part, study and empirical research were conducted for the park-palace complex in Rzuchów. Detailed historical, geophysical, and climatic studies were carried out, and the architectural and landscape values of the implementation site were analysed. The results of these studies and analyses served to develop a complete diagnosis of the palace's revitalisation potential. Using W. Terlikowski's method, a comparative analysis of the original and current potential of the object and the

forecasted result of the revitalisation was conducted. The results showed that the original shallow level of potential (35.7%), resulting from the deplorable technical condition of the palace, increased to a high level (71.3%) due to the conducted works. These results indicate the importance of the investor's motivation to prioritise intangible factors over technical and economic conditions.

An essential element is geophysical research to confirm historical oral reports about underground tunnels that could threaten the stability of the object located in the area of active mining exploitation. Meteorological observations were conducted from 15.02.2022 to 24.10.2023 using the Vantage PRO2 station. Heating Degree Day (HDD) and Cooling Degree Day (CDD) indices were determined and used in planning solutions to support the palace's energy efficiency. The implementation part focuses on analysing the conditions for sustainable revitalisation of the park-palace complex in Rzuchów. It also includes the concept of energy renovation of the palace based on RES and the author's management model. The original assumptions (from the construction time) and innovative contemporary solutions aimed at the palace's energy independence were considered when planning energy solutions.

Water management efficiency solutions for the object were also characterised, including greywater and rainwater utilisation systems. The final element is the sustainable revitalisation project management model. This scheme is recommended to investors planning to revitalise or adapt historic buildings to new needs. The crucial role of pre-investment diagnosis, which forms the foundation for practical actions that increase monuments' utility value and energy efficiency without harming their authenticity and historical values, was emphasised.

The study synthesises interdisciplinary knowledge necessary for implementing pro-environmental solutions and new ecological technologies in the revitalisation and adaptation process of buildings under conservation protection, offering a comprehensive approach to managing cultural heritage in sustainable development.

Keywords

sustainable revitalisation of monuments, residential monuments, energy efficiency, landscape and environmental protection, cultural heritage, green technologies