

structure of the connection graph that is making the problem of efficient decoding highly relevant [2, 3].

Existing LT code decoding methods were analyzed, and key issues related to graph representation were identified. Based on this analysis, optimization methods for the graph structure were proposed, which are crucial for improving decoding efficiency. Additionally, a visualization of the optimized graph was presented and analyzed. The results of this research demonstrate that optimized graph representation enables LT codes to function faster, more reliably and more efficiently.

As a conclusion, the application of the proposed methods will enhance the decoding algorithm's efficiency, allowing for the quick and reliable recovery of lost packets — an especially important factor for lossy communication channels and wireless network environments.

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THEORETICAL AND METHODOLOGICAL FRAMEWORK FOR THE RENOVATION OF INDUSTRIAL ZONES IN THE CONTEXT OF POST-WAR DEVELOPMENT

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In the context of Ukraine's post-war reconstruction, the renovation of industrial zones plays a vital role in spatial development, economic reintegration, and the creation of a sustainable urban environment. Modern challenges require a reconsideration of approaches to the use of post-industrial areas with regard to ecological safety, economic efficiency, and social inclusivity.

The *aim* of this study is to define the theoretical and methodological foundations of industrial zone renovation under post-war conditions, based on international experience and the specific needs of Ukraine.

Industrial zone renovation refers to a comprehensive set of measures aimed at transforming abandoned or inefficiently used areas into functional urban spaces. The process relies on an interdisciplinary approach, combining urban planning, environmental assessment, economic justification, and institutional support. Its

theoretical foundations are rooted in the concepts of sustainable development, revitalization, circular economy, smart growth, and urban recycling. Strategic planning is particularly important, focusing on the adaptive reuse of infrastructure, attracting investment, and encouraging public participation.

International best practices demonstrate diverse renovation models: in Germany, former industrial areas are repurposed into cultural and creative clusters (e.g., Landschaftspark Duisburg-Nord); in France, industrial land is integrated with housing and green infrastructure (ZAC Clichy-Batignolles); in Poland, innovative technology parks emerge on the grounds of former factories. The success of such projects is closely linked to the coordination of state policy, private investment, and local community initiatives.

In Ukraine, the renovation of industrial zones should address the consequences of infrastructure destruction, environmental contamination, social inequality, and lack of capital. Key priorities include the development of a legal framework regulating the renovation process, the implementation of public-private partnerships, and the creation of transparent mechanisms for land inventory and planning. Integration of spatial planning tools into the national recovery strategy is also essential.

Therefore, the renovation of industrial zones in the post-war period may become a critical instrument of spatial reorganization, sustainable development, and regional economic transformation. Its theoretical and methodological basis must be grounded in a synergy of scientific approaches, international practices, and adaptive governance within a post-crisis reality.

Given the modern trends in spatial development, an essential aspect of industrial zone renovation is the implementation of green construction principles and energy efficiency. Systems for resource reuse, the integration of renewable energy sources, environmental monitoring, and eco-certification are becoming key factors in evaluating the success of renovation projects. These measures help minimize environmental impact while creating a comfortable and safe environment for living and working.

In the post-war context, it is also appropriate to consider renovation as an element of social policy. Renovated industrial zones may incorporate temporary or permanent housing, educational, medical, and cultural infrastructure, thus supporting the integration of internally displaced people, veterans, and vulnerable population groups. This approach strengthens social resilience and reduces the risk of marginalization.

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