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Modelling the impact of martial law on regional infrastructure and the role of public administration in its restoration

Modelización del impacto de la ley marcial en la infraestructura regional y el papel de la administración pública en su restablecimiento

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Abstract

The study aims to identify effective approaches to managing the processes of restoring regional infrastructure during martial law and post-war reconstruction. The type of this study is a case study based on the analysis of Ukrainian realities. The research procedure involved collecting scientific literature and expert opinions through semi-structured interviews. The inclusion of scientific literature was based on the following criteria: relevance, thematic relevance, time range from 2019 to 2024, regional criterion: Ukraine and the EU. The study involved 25 experts from various fields with experience in public administration. The main tool used in the study was a semi-structured interview that did not contain strict formal restrictions. The findings

Resumen

El estudio se centra en identificar enfoques eficaces para gestionar los procesos de restauración de infraestructuras regionales durante la ley marcial y la reconstrucción de posguerra, tomando como base un análisis del caso ucraniano. La investigación empleó una metodología cualitativa basada en la recopilación de bibliografía científica y la realización de entrevistas semiestructuradas con expertos. La selección de la literatura se realizó conforme a los criterios de relevancia temática, temporalidad (2019-2024) y regionalidad (Ucrania y la UE). En total, participaron 25 expertos con experiencia en restauración de infraestructuras y administración pública. Las entrevistas semiestructuradas, principal herramienta del estudio, permitieron obtener una visión profunda sin

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identify the optimal approaches to restoring regional infrastructure: creating strategies and implementing reforms, financial regulation, supporting businesses and implementing social projects, monitoring the situation and responding to challenges. The results, based on the analysis of experts' responses, established the following infrastructure problems of martial law for Ukraine: energy crisis (52%), destruction of social infrastructure (31%), reduction of the transport network (16%), problems in the functioning of information and communication infrastructure (1%). The conclusions indicate that an integrated approach should be implemented to develop the public administration system and restore the infrastructure.

Keywords: regional infrastructure, public administration, recovery, socio-economic changes, crisis management.

restricciones formales estrictas. Los resultados, basados en el análisis de las respuestas de los expertos, establecieron los siguientes problemas de infraestructura de la ley marcial para Ucrania: crisis energética (52%), destrucción de la infraestructura social (31%), reducción de la red de transporte (16%), problemas en el funcionamiento de la infraestructura de información y comunicación (1%). Sin embargo, se destacan importantes obstáculos, como la destrucción de infraestructuras de transporte, la crisis energética y los daños a la esfera social. El estudio concluye que un enfoque integrado es esencial para desarrollar el sistema de administración pública y lograr una restauración sostenible de las infraestructuras, considerando tanto los retos actuales como las perspectivas futuras.

Palabras clave: infraestructura regional, administración pública, recuperación, cambios socioeconómicos, gestión de crisis.

Introduction

General contextualization

Since the beginning of the full-scale invasion of Ukraine, the stable functioning of the state has become a challenge for state managers. The effectiveness and efficiency of public administration today are important issues that require in detail analysis and prompt resolution. The role of public administration has expanded and has become an important sector of ensuring the national security of Ukraine, especially in conditions of martial law.

One pressing research problem is the impact of martial law on regional infrastructure. This issue is particularly relevant in the context of the Russian-Ukrainian war, which has caused significant destruction to the economy and undermined social stability in affected regions. Studies reveal that energy systems, transport networks, and municipal infrastructure – key components of regional functionality – are among the sectors most severely affected during military operations.

Research problem

For this reason, public administration plays a crucial role in coordinating efforts to mobilise resources, restore damaged infrastructure, and attract international assistance. In this process, the formation of special strategies for sustainable development to return the regions to a successful and peaceful life is of great importance. On the other hand, several scholarly works argue that public administration under martial law has its own typical features and development mechanisms. Thus, they require a separate scientific analysis to develop effective proposals on the main priorities and directions for improving the efficiency of the country's governance in the face of Russian aggression. At the same time, in order to solve this complex problem, it is also necessary to adequately assess the current institutional changes taking place in Ukraine and identify a number of priority changes required by the management decision-making system and mechanisms for developing strategic plans at the regional level. In other words, rebuilding infrastructure after military conflicts requires the development and implementation of effective governance models that consider local needs and conditions and, most importantly, ensure transparency and sustainability of reconstruction processes. The main research problem is to identify effective approaches to restoring the regional infrastructure of Ukraine under martial law and post-war reconstruction and to analyze the impact of military actions on critical infrastructure and information and communication networks. In addition, it should also be recognised that the current system of public administration in Ukraine is facing particularly challenging conditions - the country is in the midst of a war, which is an important threat to national security. For this reason, highlighting the main factors affecting the effectiveness of public administration in wartime is now a particularly important task.

Objectives

Accordingly, *this study aims* to find effective approaches to managing the processes of regional infrastructure restoration during martial law and post-war reconstruction and to determine the role of local authorities, NGOs and the private sector in this process. For this reason, taking into account and studying these aspects will allow the restoration of infrastructure facilities and the formation of important theoretical and methodological foundations for further socio-economic development of the region.

Therefore, this study will be valuable for developing further strategic decisions in the field of regional infrastructure restoration, taking into account the maximum potential of public managers' capabilities.

Hypotheses of the article:

1. Engaging local communities and the private sector contributes to the sustainability of regional infrastructure.
2. Public administration is critical in restoring regional infrastructure during war.

Research questions:

1. What comprehensive approaches to regional infrastructure restoration can be identified?
2. What are the current infrastructure challenges facing martial law in Ukraine?
3. What is the role of public administration in the restoration of regional infrastructure?

Structure of the article

The structure of the article consists of a introduction, which outlines the main purpose of the article, namely to find effective approaches to managing the processes of regional infrastructure restoration during martial law and post-war reconstruction and to determine the role of local authorities and the main hypotheses, a literature review, which includes a critical analysis of scientific sources, outlining the main trends, debates and controversies in the literature. An important section is the methodology, which describes the involvement of 25 experts and the features of conducting interviews with them. The results present the main optimal approaches to restoring regional infrastructure: creating strategies and implementing reforms, financial regulation, supporting businesses and implementing social projects, monitoring the situation and responding to challenges. The conclusions summarize the information obtained and outline the following directions for research.

Literature Review

The problem of improving the mechanisms of public administration development in Ukraine has long received considerable attention from researchers. In particular, Buriak et al. (2023) identified the current problems of the public administration sector through the prism of modern globalist trends. Kutsyk et al. (2020) pointed out the critical aspects of the digital transformation of the public administration sector. In general, the digitalisation of governance in Ukraine is a common topic among scholars who have identified both the advantages and disadvantages of this process (Konovalchuk & Kovalov, 2023; Maslova & Mirko, 2023). Modern works present several modules of electronic interaction: between the state and citizens: G2C (Government-to-Citizen); between government and business G2B (Government-to-Business); between different branches of government G2G (Government-to-Government); between government and government G2E (Government-to-Employees). Since the beginning of the full-scale invasion, this problem has become even more intense in contemporary scholarship. Bohun et al., (2024) assessed the impact of Russian aggression on Ukrainian infrastructure. This study found that Ukraine's infrastructure was one of the areas most affected by the scale of the war. At the same time, there are separate discussions in the scientific literature on whether efforts should be directed towards restoring damaged facilities to their original form or modernizing them according to innovative sustainability standards. Those authors who argue for modernization point to aspects of restoration without significant renovation, since prolonged war increases the risk of repeated destruction. Also, those scholars who point to the importance of restoration believe that a quick return to functionality is more important than the introduction of new technologies in a crisis period.

Demotivating factors for investment activity are the destruction of production and industrial facilities, increased security and logistics, and, most importantly, the destruction of vital energy infrastructure (Bozhko, 2024; Iefimova & Pavlova, 2023). Such factors do not contribute to the effective implementation of investment activities. In particular, the destruction of production and industrial facilities during martial law is an essential problem for investment. The loss or damage of such facilities significantly increases business risks, as their restoration requires financial expenditures. Thus, martial law is one of the critical factors that demotivates investors in production and industrial facilities. The loss or damage to such facilities significantly increases business risks, as restoration requires significant financial costs and time and is sometimes impossible due to limited material and human resources. According to a study by Bohun et al., (2024), the estimated direct damage caused by the hostilities to Ukraine's infrastructure as of early January 2024 was about $155 billion. The implementation of public financial policy in Ukraine is described in detail in the study by Chubka et al. (2019). The authors pointed out the importance of creating a State Innovation Bank that would provide preferential loans for creative ventures and exempt businesses from taxes in the event of a merger with a loss-making business (Chubka et al., 2019).

As a result, the state will help to create favourable conditions for the technical development of the industry and increase its ingenuity and attractiveness to investors. Therefore, the process of rebuilding infrastructure after the hostilities requires the development and implementation of effective management models that take into account local needs and conditions. For this reason, studies have pointed out that effective preventive measures are needed to prevent the collapse of the state during crises but also against the backdrop of major wars (Babaieva, 2023). Therefore, the main trends are increased attention to the resilience of critical infrastructure, the resilience of the energy sector, the role of decentralization in the reconstruction of regions. The events that followed Russia's military invasion of Ukraine in 2014 highlighted the particular need for a strategic response, as evidenced by a number of contemporary works (Brovko, 2024; Grynchuk et al., 2024; Gryshchenko et al., 2021). According to Brovko (2024), as a result of Ukraine's successful decentralisation reform, local governments have been empowered at the grassroots level, and state and local authorities have coordinated their efforts to stop Russian aggression. As a result, local administration was important for the survival of Ukrainian cities and villages after the full-scale Russian invasion in February 2022. However, some studies insist on the need for centralization of management decisions to coordinate resources. Therefore, there is a debate about the implementation of a centralized or decentralized management system (Safarli et al., 2024). Those who point to the importance of decentralization believe that this mechanism allows local communities to act more autonomously (Bobro, 2024).

Another scientific trend is the analysis of the integration of innovative experience, in particular, as can be seen from the literature review, the number of studies that analyze the experience of infrastructure restoration in other countries, which should be applied in Ukraine, is increasing (Gryshchenko et al., 2021; Bobro, 2024) . An important area in modern studies has been the assessment of the difficulties faced by the public administration sector, which should be taken into account for post-war adaptation (Kalmykov et al., 2024; Kuczabski et al., 2023). In particular, scientists identify such factors as bureaucratisation, lack of funding, corruption, difficulties in the digital transformation system, the influence of political factors, and information challenges (Demikhov et al., 2020; Yusifov, 2024).

However, the studies under review cover these difficulties superficially, and the authors do not pay due attention to a broader analysis of these challenges. In particular, it is important to describe not only general state problems but also to clearly identify the main infrastructural challenges of martial law for Ukraine. This paper will try to address this gap using not only theoretical analysis of works but also expert opinion.

Methodology

Research Design

The type of this research is a case study, which involves an in-depth study of the chosen topic, taking into account expert opinions. The case study has several important aspects that are essential for analysing regional infrastructure in times of war. This applies to both the in-depth study of the research problem and the contextual approach. In particular, case studies allow for immersion in the specific context of the region, taking into account the unique factors of war. The case study approach allowed for an in-depth analysis of the impact of martial law on regional infrastructure and the role of public administration, which made it possible to characterise the dynamics and specific aspects of the problem under study. The study uses a comprehensive approach to collecting and processing information, including analysis of certain legislative

documents and survey data. Therefore, this approach is important for this study, as it allowed us to obtain valuable information that may be lost in theoretical or purely empirical studies.

Materials and Equipment

Expert group

A purposive sample was selected to involve experts in the study. Information about the recruitment of participants was disseminated on social media. This information dissemination tool was chosen because it allows potential participants to learn about the main purpose of the study remotely. The selection of the main inclusion criteria for analysing the processes of infrastructure recovery in the war was based on their relevance to the research objective and their potential to identify key factors that affect the effectiveness of reconstruction in a crisis situation. In turn, the inclusion criteria covered the following aspects:

1. Experience in public administration, participants must have at least 3 years of experience.
2. Providing informative consent to data processing.
3. Participants must understand and identify the main challenges in rebuilding infrastructure.
4. Experts from different regions of Ukraine, including those most affected by hostilities, will be involved.
5. Participants must consent to the processing of personal data.

Experts were identified through purposive sampling. They were invited to participate through professional networks and academic institutions. In this way, 31 potential experts were identified. However, 4 of them refused to provide informed consent, and another 2 refused to undergo semi-structured interviews.

In total, 25 experts from various fields with experience in infrastructure recovery and public administration took part in the study. The study includes representatives from local governments, construction companies, NGOs and international governance experts (see Table 1).

Table 1.
Demographic data of the experts involved in the study

H	Gender	Age	Education	Specialisation (for now)	Position	Region of operation
1	Ч	46	Engineering	Transport infrastructure	Chief Engineer	Kyiv region
2	Ч	38	Management	Local self-government	Director of the department	Lviv region
3	Ж	47	Economic	Finance	Manager	Odesa region
4	Ч	52	Economic	Infrastructure financing	Expert of the international foundation	Odesa region
5	Ж	29	Sociology	Civil society	Project coordinator	Kharkiv region
6	Ч	60	Ingerne	Construction and architecture	Chief architect	Kharkiv region
7	Ж	34	Public administration	Public administration	Advisor	Mykolaiv region
8	Ж	48	Ecology and engineering	Energy and renewables	Head of the department	Vinnytsia region
9	Ч	33	Engineering and ecology	Energy and renewables	Secretary	Vinnytsia region
10	Ч	31	Management	Local self-government	Secretary	Lviv region
11	Ж	42	Political Science	Humanitarian aid	Programme coordinator	Zaporizhzhya region
12	Ж	26	International relations	Diplomacy	Secretary	Kyiv region
13	Ч	47	Engineering	Transport infrastructure	Chief Engineer	Sumy region
14	Ч	51	Management	Local self-government	Director of the department	Lviv region
15	Ч	33	Economic	Financing infrastructure	Expert of the international foundation	Odesa region
16	Ж	41	Ecology and engineering	Energy and renewables	Head of the department	Vinnytsia region
17	Ч	31	Management	Local self-government	Secretary	Dnipropetrovska oblast

18	Ч	50	Architectural	Architecture and planning	Architectural consultant	Poltava region
19	Ж	32	Management	Project management	Project manager	Kyiv region
20	Ч	55	Economic	The economy of recovery	Deputy Director	Cherkasy region
21	Ч	36	Public administration	State security	Security advisor	Kyiv region
22	Ж	47	Historical	Social work	Head of social service	Sumy region
23	Ж	28	Ecology	Environmental Service	Environmental assessment expert	Zhytomyr region
24	Ч	34	Historical	State security	Security advisor	Kyiv region
25	Ж	44	Law	Legal organisation	Lawyer	Rivne region

Source: compiled by the authors

Expert opinions have become important in identifying key factors affecting infrastructure restoration and identifying effective mechanisms in this process.

Materials of scientific research and legislative acts

The research involved various sources: scientific articles, monographs, chapters from monographs, etc., and legislative acts. The study used a criterion-based sample.The sample was formed by considering aspects such as relevance to the research topic, content, and the availability of a research methodology. Language: English and Ukrainian. Timeframe: 2019-2024. This was done to include the most relevant scientific literature and legislation.

Procedures

The research procedure was a step-by-step process involving processing material from scientific studies and expert interviews. Google Scholar was used to search for sources. Keywords such as: regional development, wartime, Ukraine, public policy, challenges, difficulties, and recovery were entered into the search database. The system also selected the type of research: review articles. A total of 967 items of scientific literature were found. The inclusion criteria were based on the following aspects:

1. Thematic relevance. The research should relate to the functioning of public policy in Ukraine.
2. Region: Ukraine and Europe. Inclusion of research that is primarily relevant to Ukrainian realities.
3. Time range: from 2019 to 2024 This was done to ensure that the literature is up-to-date and relevant (-516 results).
4. Availability of research methodology. The study should specify the methods and approaches for data processing.

Using these 4 criteria, 42 items were found in the scientific literature, international reports, and legislation (see Table 2).

Table 2.
Search and collection of relevant literature

Criterion	Initial number of articles	Excluded results	Quantity after selection
Thematic relevance	967	-213	754
Regional relevance (Ukraine, EU)	754	-167	587
Time frame (2019-2024)	587	-516	71
Availability of the research methodology. Information on methods and approaches to data processing	71	27	44
Overall			44

Source: compiled by the authors

Interview

The research procedure consisted of collecting expert opinions through semi-structured interviews. This tool was chosen because the interviewees were able to express their own opinions. Unlike closed-ended surveys, semi-structured interviews had no restrictions on participants' answers. The interviews were

conducted remotely using the Zoom platform. The questions concerned different approaches to public administration, analysis of the current situation, and characterisation of certain difficulties.

1. What changes did public policy undergo during martial law?
2. What are the most effective approaches to rebuilding regional infrastructure?
3. What are the most pressing infrastructure challenges facing martial law in Ukraine?
4. What is the role of public administration in rebuilding regional infrastructure?

Special discussion focus groups (5 people each) were also organised. In these groups, experts were able to discuss interrelated issues affecting the speed and quality of restoration work. The topic of this roundtable was: “Challenges and Prospects for Public Policy and Infrastructure Restoration under Martial Law”. This topic synthesised key issues related to changes in public policy and effective approaches to restoring regional infrastructure in Ukraine.

Thus, in this step-by-step manner, the relevant literature was collected, and a survey was conducted among experts.

Data Analysis

Qualitative interview data were transcribed and coded. Transcription was done manually by reviewing the Zoom recordings several times. The study used NVivo software to systematically code and generate themes. Excel software was used to analyse the data. The use of this software for data processing in the study is due to its versatility and ease of use. In addition, this programme has a wide range of functions for analysing and visualising information. Data such as the author, title of the publication, year of publication, and conclusions are included in the first table. This made conducting a content analysis of the scientific literature possible to form a holistic picture of best practices in recovering regions after military conflicts. After that, another table was made: expert number - main statements - voting results. This allowed us to summarise the experts' opinions. The data obtained was subjected to a comparative analysis based on the opinions stated in the scientific literature. To carry out this comparative analysis, the following components were taken into account: challenges (destruction of transport infrastructure, critical situation in the energy sector, need to restore the housing and utilities sector and the communications industry), roles (distribution and coordination of resources, establishing partnerships with international funds and organisations, transparency in the work of government agencies).

Results

The war has destroyed infrastructure facilities at the national and regional levels. The destruction not only creates additional difficulties in ensuring the country's defence capability but also affects the socio-economic situation in Ukraine. Using public administration tools in such circumstances determines the best approaches to recovery: strategy development and reforms, financial regulation, business support and social projects, monitoring the situation and responding to challenges. It is necessary to formalise its functions to improve the efficiency of the government's functions in the public administration system. Increasing the efficiency of the bureaucracy, improving administrative procedures, and raising the professional level of ministries and agencies will help the government to perform its tasks better and take on additional responsible functions. However, the risks of concentrating power in the government should also be considered. Thus, decentralisation is needed to balance powers, ensure transparency, and avoid excessive centralisation of power. Attention to the regions in times of martial law is no less important than to the structure of the central government (Figure 1).

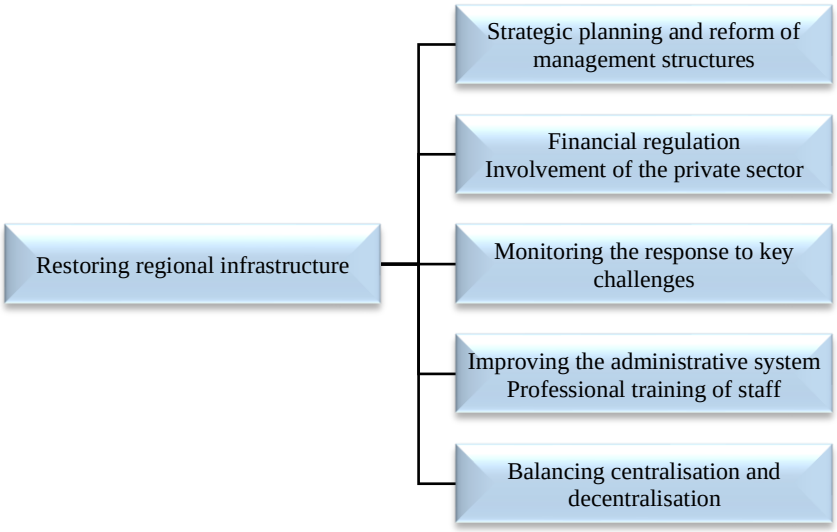

Figure 1. Integrated approaches to regional infrastructure rehabilitation.
Source: compiled by the authors

Accordingly, the decentralisation of recovery processes (12 expert votes, 48%) allows for the rapid and efficient identification of local needs that can be addressed using local resources. This makes it possible to increase the efficiency of management, as local authorities know the specifics of their region's development. The use of proactive strategies (8 expert votes, 29%) is aimed at the rapid restoration of critical infrastructure facilities in a period when active hostilities have recently ceased. Taking into account investments in technological solutions (5 expert votes, 23%) contribute not only to the restoration but also to the modernisation of damaged regional infrastructure. Each strategy has its own speed of application, consideration of resilience to possible future threats, and calculation of economic feasibility. Obviously, these aspects also need to be taken into account when modelling the impact of martial law on regional infrastructure.

The proposed modelling makes it possible to outline the complex impact of the martial law imposed in Ukraine. First of all, we are talking about the impact on the functioning of various infrastructure sectors and the possibility of predicting long-term consequences for each sector. Based on the study of scientific literature, the main problems in the functioning of infrastructure caused by Russian aggression have been identified (see Table 3).

Table 3.
Infrastructure challenges of martial law

Challenge	Problem
Destruction of transport infrastructure	1. The war has caused enormous damage to road transport. The destruction of roads and bridges has made moving goods, supply chains, passenger transport and logistics difficult. 2. Losses to the railway infrastructure are not as critical, although key junctions have been damaged, significantly reducing the capacity of export and import operations. Problems with rail transport slow down national GDP growth (Yevsieiev et al., 2024). 3. Air transport has not been used for passenger transport for a long time. The maritime transport infrastructure has been critically damaged. Port areas are frozen, significantly reducing Ukraine's economic opportunities (Restoration of Ukraine, n.d.)
Energy crisis	1. During the war, electricity grids suffered enormous losses in transportation and, most importantly, production capacity. Interruptions in power supply and restrictions on access to electricity reduce the quality of life and the production capacity of the national economy (Yevsieiev et al., 2024) 2. Many regions' Gas (transport and production) infrastructure is severely damaged or destroyed. This challenge is extremely relevant for energy security and increases dependence on external electricity supplies. 3. The loss of coal mines leads to a new arrangement of energy, metallurgical, light and other industries (Steffen & Patt, 2022).

Destruction of social infrastructure	1. The destruction of schools, public services, hospitals, and residential buildings is the reason people are moving to safer regions or abroad. The destruction of social infrastructure makes it impossible to return to the affected areas, which are thus in a state of social crisis (Restoration of Ukraine, n.d.). 2. The destruction of social infrastructure also leads to difficulties in functioning the municipal infrastructure. On the one hand, there is a problem with water supply and sanitation problem in the affected areas, which threatens public health. The lack of heat generation is a critical problem for urban centres (Verkhovna Rada of Ukraine, 2020).
Problems with the functioning of the information and communication infrastructure	1. The loss of telecommunications infrastructure leads to problems with communication and the operation of relevant services. Complicates communication between regions and disrupts the operation of relevant services (Chugunov et al., 2023). 2. The destruction of the Internet connection and the loss of mobile communications infrastructure are sensitive for economic activity, telecommuting, telecommuting, etc. The need for more reliable sources of communication hampers production and business structures.

Source: compiled by the authors

Although Russia's aggression against Ukraine has become the largest conflict in Europe in the 21st century, similar problems have already been encountered in other states that have found themselves in the epicentre of hostilities. The experience of Israel, which is under constant pressure from Arab countries, is illustrative. The practice introduced in Croatia, which was recovering from the Serbian aggression in the 1990s, should also be considered. With this in mind, the experts were asked to identify the most pressing challenges for Ukraine's infrastructure. The results are presented in Table 4.

Table 4.
The most pressing infrastructure challenges of martial law for Ukraine

№	Challenge	Number of expert votes (max - 25, 100%)	Some remarks drawn from the in-depth interview
1	Energy crisis	13 (52%)	**Expert 1:** The destruction of the energy infrastructure exacerbates the problem of dependence on imported energy resources. **Expert 4:** The massive destruction of energy networks will require a priority response. Attention should be paid to the regions that have suffered the greatest losses. **Expert 5:** Energy networks need not only restoration but also modernization. **Expert 17:** There is a need to take into account the possibility of a new Russian offensive, so increasing the resilience of energy facilities to attack is an extremely important task. **Expert 23:** Development of alternative energy sources, decentralisation of energy sector management and dispersal of energy facilities - a way to ensure energy security.
2	Destruction of social infrastructure	7 (31%)	**Expert 2:** The massive resettlement of people from dangerous or war-torn regions creates a problem of population decline in some areas, and vice versa - increases overpopulation in areas that are safer for life. **Expert 13:** One of the top priorities for government officials is to restore the social infrastructure of war-affected areas. **Expert 15:** There will be a problem with the temporarily occupied territories. One of the regional challenges is to ensure an adequate standard of living for the temporarily displaced persons so that they do not leave the territory of Ukraine.
3	Destruction of transport infrastructure	4 (16%)	**Expert 10:** Restoration of road infrastructure, railways, and airports are significant social and psychological markers of the country's recovery. The attention of state managers to this area is significant. **Expert 20:** Reconstruction of the logistics infrastructure is a priority, but it will require attracting financial resources that would be explicitly used for reconstruction. **Expert 24:** Regarding its importance in the country's economy, road transport is inferior to rail transport. Air transport is not as relevant for recovery. **Expert 25:** Public administration in the reconstruction of transport infrastructure should also address the issue of combating corruption. Rebuilding roads is a long-standing corruption problem for the Ukrainian authorities.
4	Problems with the functioning of the information and communication infrastructure	1 (1%)	**Expert 6:** When it comes to ensuring the sustainable operation of the information and communication infrastructure, there is a need to increase the role of alternative mobile communication channels. A possible option is to develop and implement a strategy of backup capabilities in the field of mobile communications .

Source: created by the authors

Therefore, experts pointed out the importance of overcoming the challenges in the following order: working on the consequences of the energy crisis, rebuilding the destroyed social infrastructure, restoring transport infrastructure, and solving problems with the functioning of the information and communication infrastructure. The survey also identified some crucial markers: overcoming energy dependence, decentralisation of energy management, new location of energy facilities that will take into account the security factor, the role of public administration in restoring housing and communal services, implementation of the transport infrastructure rebuilding project, overcoming corruption challenges, and work to ensure stable communications. Accordingly, public administration will have a role to play in restoring regional infrastructure. The results of the survey are shown in Table 5-6.

Table 5.
The role of public administration in the restoration of regional infrastructure

Role	Characteristics
Allocation and coordination of resources	Given that the state must ensure centralised control over financial expenditures and technological support for the restoration of critical facilities, there is a need to pay more attention to public administration tools in this area (Tytykalo et al., 2022; Järvis, 2023)
Establishing partnerships with international foundations, organisations, etc.	Rebuilding Ukraine is a costly process that the war-torn Ukrainian economy will not be able to undertake on its own. For this reason, there is a clear need to raise funds from international partners, primarily the United States and the European Union (Anghel & Jones, 2023). This is not only about the financial resources needed for reconstruction, but also about technological cooperation that will allow for the restoration of war-affected regions (Yevsieiev et al., 2024)
Transparency in the work of state institutions	The use of transparent mechanisms of work and reporting becomes a guarantee of fair use of funds (Petrukha et al., 2024). It is also important to increase the trust of Western partners.

Source: compiled by the authors of the article on the basis of scientific literature

Therefore, the content analysis of the scientific literature and the Recovery Plan for Ukraine has pointed to the need to implement operational solutions that will restore Ukraine's regional development, ensuring the stability of regional systems in the future. Scientists' attention is focused on the relevance of resource allocation and coordination, establishing partnerships with foreign donors (according to the Recovery Plan, the cost of all projects will be more than USD 700 billion), and the transparency of public authorities), and transparent work of public authorities. Experts were asked to identify the most relevant roles, which are shown in Table 5, along with some comments.

Table 6.
The role of public administration in the restoration of regional infrastructure (expert assessment)

№	Role definition	Number of expert votes (max - 25, 100%)	Some remarks drawn from the in-depth interview
1	Transparency in the work of state institutions	12 (48%)	**Expert 2:** Transparency in work is a unique tool for restoring trust in the government in the post-war reconstruction **Expert 22:** According to the State Strategy for Regional Development, the main task of reintegration is to restore the public administration system in the de-occupied territories and ensure its sustainability. Transparency is one of the pillars of sustainability along with security.
2	Allocation and coordination of resources	10 (40%)	**Expert 4:** An important aspect is the work with human resources, in which public administration plays a significant role.
3	Establishing partnerships with international foundations, organisations, etc.	3 (12%)	**Expert 10:** Establishing contacts with foreign partners is only partially within the sphere of influence of regional authorities and, accordingly, regional public administration. The position of the central government in this matter is much more important.

Source: created by the authors

Therefore, the role of public administration in the restoration of regional infrastructure is considered to be quite high. Experts say that ensuring the transparency of public institutions is one of the most important elements.

Discussion

Based on the research problem, namely determining the impact of martial law on regional infrastructure and the importance of public administration in the restoration process, it was found that the reform process is important to optimise the management process. The survey of experts indicates the importance of governance reforms: strategy development and reforms, financial regulation, business support and social projects, monitoring the situation and responding to challenges. These findings are consistent with the work of other academics who have highlighted the necessity of implementing creative solutions in the public administration system, especially those that draw from advancements in digitalization (Melnychuk & Voinalovych, 2023). According to the studies, under these situations, government personnel play a crucial role as the primary players in public administration (Lohvynenko & Savenko, 2019; Kozlovskyi et al., 2024). This study shows, however, that such a development may involve the risk of a monopolization of the government, which could start to disregard the efficiency and public interest of judgments in favor of its own. Decentralization of the recovery process is therefore crucial, according to the study (48% of experts said so), which enables the qualitative identification of local needs.

It also confirmed the 1st hypothesis of the study, which was that involving local communities and the private sector contributes to the resilience of regional infrastructure. This is also identified in other studies, which indicate that decentralisation allows for more effective governance, as local authorities know the specifics of their region's development (Pukhtynskyi, 2020; Tytykalo, 2023; Kumar, 2024). In addition, the results also correlate with a comparative analysis of sociological studies organised by the Kyiv International Institute of Sociology in 2021-2023 to determine the level of public trust in the functioning of local government (Okunovska & Prymush, 2024). The study showed a stable positive support for the activities of local authorities by citizens. Thus, this indicates a positive attitude of Ukrainians towards decentralisation reforms, even though during the military invasion, some processes of constitutionalisation of the decentralisation system were suspended (Okunovska & Prymush, 2024; Kliuchnyk, 2023; Olzacka, 2024).

However, the results, which emphasized the necessity of strategic planning, align with the suggestions made in World Bank publications on the rehabilitation of infrastructure in crisis situations (World Bank Group, 2023). According to the World Bank research, the system of infrastructure development under crisis conditions necessitates flexible funding and management mechanisms in addition to clear strategic planning. The study's conclusions also highlight the necessity of a flexible strategy that acknowledges the value of both professional centralization and decentralization. The study also identified the main infrastructure challenges of martial law for Ukraine: the energy crisis, the destruction of transport and social infrastructure, and problems with the functioning of the information and communication infrastructure. At the same time, the experts pointed out the importance of addressing the challenges in the following order: resolving the energy crisis, rebuilding the destroyed social and transport infrastructure, and solving problems with the functioning of the information and communication infrastructure. Thus, the study found that the highest priority is to resolve the energy crisis and rebuild social and transport infrastructure. These results also correlate with the World Bank's reports and individual studies that emphasise the importance of addressing energy, transport and infrastructure problems in regions affected by military operations (World Bank group, 2024; Sheludiakova et al., 2021; Lavrov et al., 2022). It also confirmed the 1st hypothesis of the study, which was that involving local communities and the private sector contributes to the resilience of regional infrastructure. The study also identifies a particularly important role of public administration in restoring regional infrastructure. This confirms the 2nd hypothesis of the study, which was that public officials played a critical role in the reconstruction of regional infrastructure during the war. The role of public administrators concerns such important aspects as the allocation and coordination of resources, the establishment of partnerships with international funds and organisations, and transparency in the work of public institutions. This also coincides with the UNDP's research, which states that when rebuilding infrastructure in crisis regions, successful projects must demonstrate a clear accounting of financial and material resources (UNDP in Ukraine, 2024; Safarli et al., 2024).

The study also identified the importance of implementing international partnerships in the recovery system. This is also in line with the studies by Kuzmenko et al. (2023), who highlighted the role of international partnerships in attracting funding and knowledge exchange. However, these results confirmed that cooperation with international organisations helps obtain financial and technical support. The latter is particularly valuable for regions affected by war or with limited resources. The results also highlight the importance of transparency. This is also in line with other recent work that has indicated that a system of public scrutiny is an important component for successful recovery in the context of regional development

(Petrukha et al., 2024). Implementation of transparency is important in restoring trust, as working with financial flows and public control over their use will increase public trust in state institutions in general. To summarise the study's theoretical significance, we draw attention to an integrated approach to developing the public administration system to restore the infrastructure system. The latter should enhance the process of efficient resource allocation, sustainable international partnerships, and transparency. However, this study also has certain limitations. First, as this paper is a case study, it considers local Ukrainian specifics. Thus, it is difficult to interpret these results for other countries or regions affected by wars. A notable limitation was the choice of English and Ukrainian literature, which means that the study does not consider the works of foreign language authors that present the realities of infrastructure reconstruction.

Conclusions

The war poses challenges to regional infrastructure and has a noticeable impact on energy systems, transportation networks, social facilities, and information and communication technologies. The respondents noted the importance of public administration in restoring regional infrastructure. The survey also identified certain markers of public managers' involvement: reducing energy dependence, decentralising energy management, re-locating energy facilities to take into account the security factor, the role of public management in restoring housing and communal services, implementing a transport infrastructure rebuilding project, overcoming corruption challenges, and working to ensure stable communications. Accordingly, public administration will have a role to play in rebuilding regional infrastructure. Experts say that ensuring transparency in the functioning of public institutions is one of the most important elements. However, the issue of resource allocation and control is only a few points behind transparency.

The study highlighted that public administration needs to evolve to effectively address the challenges of war and post-conflict recovery and focus on principles such as adaptability, transparency and local stakeholder engagement.

Therefore, this study contributes to the field of public administration and post-conflict recovery by:

1. Identifying key priority areas where public administration can improve resilience and efficiency in infrastructure recovery.
2. Stressed the importance of decentralized energy systems and regional planning that should be geared towards adapting to local security needs.

However, this study also opened up new areas of research.

1. Future research should focus on broader community engagement. In particular, effective models for engaging local communities and the private sector in infrastructure restoration should be explored.
2. Since this study was largely focused on domestic transformations, the researchers missed the aspect of international cooperation. Therefore, the next area for analysis is the role of international organizations and donor agencies in supporting Ukraine’s post-war reconstruction.

These findings and recommendations are aimed at ensuring that public administrators continue to use effective, reliable, and transparent strategies for restoring Ukraine’s regional infrastructure.

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