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Legal framework for environmentally sustainable urban development: The Canadian model and directions for reforming Ukrainian legislation

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Abstract

This article examined the legal regulation of environmentally sustainable urban development through a comparative analysis of Canadian and Ukrainian regulatory approaches to green construction and spatial planning. The purpose of the study was to identify the key elements of effective sustainable construction governance and to assess the prospects for their implementation within Ukrainian urban planning legislation, particularly in the context of post-war reconstruction, climate adaptation, and European integration. The study was based on an analysis of regulatory frameworks and enforcement practices in Canada, including federal environmental legislation, model building codes, provincial regulatory instruments, and municipal planning acts. Particular attention was paid to mechanisms for integrating environmental requirements into planning documentation, permitting procedures, whole-building life-cycle assessment, zoning regulation, and green public procurement instruments. The results of the study demonstrated that the effectiveness of the Canadian regulatory model was ensured by the systematic integration of environmental requirements into strategic planning, building standards, zoning policies, and permitting procedures, operating within a multi-level governance system and supported by preventive regulatory control at the design stage. It was established that the effectiveness of sustainable construction governance depended not only on the formal establishment of standards, but primarily on their integration across all stages of construction activity, including the application of life-cycle assessment, staged energy performance standards, and environmentally oriented public procurement instruments. At the same time, the analysis indicated that the Ukrainian legal framework remained fragmented and predominantly focused on the technical aspects of energy efficiency, which limited the effective implementation of sustainable development principles in the construction sector. The findings suggested that improving the effectiveness of legal regulation in Ukraine required a transition from a formally oriented regulatory model to one focused on practical effectiveness, the systematic integration of environmental criteria, and institutional support for their implementation

Keywords: green building regulation; environmental law; urban planning law; multi-level governance; building lifecycle assessment; energy efficiency regulation; environmental zoning

Introduction

In the context of global climate change, rapid urbanisation, and increasing anthropogenic pressure on the environment, the issue of legal regulation of environmentally sustainable urban development has become particularly relevant. The construction sector is one of the largest consumers of energy resources and a major source of greenhouse gas emissions worldwide. According to international environmental research, buildings and the construction industry account for approximately one-third of global carbon emissions, which necessitates the transformation of legal mechanisms regulating urban development in accordance with the principles of sustainable development and environmental safety (World Green Building Council, 2022; Organisation for Economic Co-operation and Development, 2025).

This issue is particularly significant for Ukraine in the context of post-war reconstruction, infrastructure modernisation, and integration into the European legal space. The reconstruction of destroyed cities creates a unique opportunity to develop a new model of urban regulation focused on energy efficiency, climate resilience, and rational use of natural resources. At the same time, the current system of legal regulation of construction activities in Ukraine is characterised by fragmented environmental requirements and insufficient integration of environmental policy into spatial planning (Hoshovskyi, 2025).

Scientific studies by T. Sartori *et al.* (2022) and M. Bowick *et al.* (2024) demonstrate a growing scholarly interest in the legal regulation of sustainable construction and green architecture. These authors emphasise the interrelationship between environmental policy and urban development, in particular examining the mechanisms for implementing energy efficiency standards, building lifecycle assessment, environmental certification systems, and spatial planning instruments. Research by the World Economic Forum (2024) and K. Feickert *et al.* (2025) analyse legal instruments for integrating climate policy into building regulations and construction governance frameworks, highlighting the importance of multi-level regulation that combines strategic planning, technical standards, and municipal urban planning tools. Further studies by M. Lewis *et al.* (2022) and Clean Energy Canada (2022) address the role of public procurement as a mechanism for promoting the use of low-carbon building materials, as well as the impact of environmental zoning on sustainable urban development.

Ukrainian academic literature also addresses issues related to building energy efficiency, legal regulation of environmental safety in urban development, and the development of green architecture. However, most domestic studies focus primarily on technical aspects of building standards or environmental impact assessment procedures, while comprehensive analyses of the integration of environmental policy into urban planning regulation remain insufficiently developed (Andreytsev, 2020; Topazly, 2024; Makarova *et al.*, 2025). Comparative legal research examining international experience and providing practical recommendations for reforming national legislation is particularly limited.

The purpose of this article was to examine the Canadian model of legal regulation of environmentally sustainable urban development and to identify opportunities for implementing its key elements within Ukrainian legislation. To achieve this purpose, the following research objectives are defined:

- to analyse the multi-level system of legal regulation of sustainable construction in Canada;
- to examine mechanisms for integrating environmental policy into spatial planning and building standards;
- to assess the current state of legal regulation of green architecture in Ukraine.

Literature Review

Contemporary research on the legal regulation of environmentally sustainable urban development is developing at the intersection of environmental law, urban planning regulation, and sustainable development policy. An analysis of international and Ukrainian scholarly literature demonstrates the gradual formation of an integrated approach to incorporating environmental standards into the legal regulation of construction activities and spatial planning (World Green Building Council, 2022; Organisation for Economic Co-operation and Development, 2025).

In international academic discourse, research on sustainable construction and green urban development can be grouped into three main research directions. The first research direction is technical and regulatory in nature and

focuses on the development of methodologies for whole-building life-cycle assessment and the standardisation of environmental characteristics of construction materials. A significant contribution to this field has been made by T. Sartori *et al.* (2022), who systematised international approaches to the application of Whole-Building Life-Cycle Assessment (WBLCA) as a tool for evaluating the environmental impacts of buildings throughout their entire life cycle. Further development of practical WBLCA standards is reflected in the work of M. Bowick *et al.* (2024), who formulated national methodological guidelines for integrating life-cycle assessment into architectural design and urban planning regulation in Canada. Comparable methodological approaches are also advanced by research conducted at the University of British Columbia, which produced applied guidelines for incorporating WBLCA into building project planning (University of British Columbia, 2023). At the international level, research by the World Green Building Council (2022) emphasises the importance of Environmental Product Declarations and harmonised life-cycle inventory databases as prerequisites for legally enforceable low-carbon construction standards.

The second direction is political and regulatory and concentrates on the development of economic and normative mechanisms aimed at stimulating environmentally sustainable construction. In this context, studies conducted by BC Housing (2021) are particularly relevant, as they analyse the effectiveness of step-based energy efficiency standards under the BC Energy Step Code as a regulatory pathway for transitioning the construction sector towards net-zero emission buildings. Research by Clean Energy Canada (2022) substantiates the role of green public procurement policies, particularly Buy Clean mechanisms, as effective tools for creating market demand for low-carbon construction materials. Similar regulatory and policy instruments are examined by M. Lewis *et al.* (2022) and K. Feickert *et al.* (2025), as previously mentioned.

The third direction of international research is associated with the development of institutional models of multi-level governance in sustainable construction. Practical mechanisms for integrating environmental performance requirements into urban planning regulation have been implemented at the municipal level in cities such as Vancouver, where environmental building criteria are embedded in rezoning approval procedures (City of Vancouver, 2024). Broader analytical perspectives on multi-level governance are provided by studies by the World Economic Forum (2024) and the Organisation for Economic Co-operation and Development (2025), which emphasise the necessity of coordinated environmental policy implementation across national, regional, and municipal levels in order to achieve climate and sustainability objectives.

In Ukrainian scholarship, the legal regulation of environmentally sustainable urban development is predominantly examined within the broader framework of sustainable territorial development, environmental safety, and spatial planning. Research is generally structured along three main directions: (1) the integration of environmental requirements into territorial planning and natural resource use (Shemshuchenko & Malysheva, 2005; Yevstihnieiev, 2019; Andreytsev, 2020); (2) the development of a legal framework for sustainable territorial development and the coordination of environmental and urban planning policies (Martynova, 2016; Ustymenko, 2019); and (3) the development of institutional and legal mechanisms for ensuring environmental safety and integrating environmental criteria into urban planning regulation (Ilina, 2008), including compliance control, institutional monitoring, regulatory supervision, and the harmonisation of Ukrainian legislation with international environmental and climate

standards (Pidtserkovna, 2013; Cherp *et al*., 2018; Petretska & Mashika, 2024).

Overall, the analysis of international and Ukrainian scholarly literature demonstrates that global practice has developed comprehensive legal mechanisms for regulating environmentally sustainable construction that combine technical standards, economic incentives, and institutional frameworks of multi-level governance. At the same time, Ukrainian academic research remains largely focused on theoretical foundations of sustainable development and environmental law, while legal mechanisms for implementing modern instruments such as lifecycle assessment, step-based energy efficiency standards, and green public procurement remain insufficiently explored. This gap substantiates the need for further comparative legal research aimed at adapting international regulatory experience to the reform of national urban planning legislation.

Materials and Methods

The methodological basis of this study is formed through a combination of general scientific and special legal approaches, which made it possible to examine the legal regulation of environmentally sustainable urban development as a complex, multi-level phenomenon. The conceptual framework of the research is grounded in the integration of environmental law, urban planning regulation, and sustainable development theory, with particular attention paid to the relationship between regulatory design and the actual effectiveness of legal norms.

The key research method employed in this study is comparative legal analysis, which was used to examine the Canadian model of sustainable construction governance and to assess the possibilities for its implementation within the Ukrainian legal framework. This method enabled the identification of structural differences between regulatory systems, in particular with regard to multi-level governance, the integration of environmental requirements into spatial planning, and the role of preventive regulatory mechanisms. Through this approach, it became possible to evaluate not only formal legal provisions but also their functional effectiveness in practice.

The formal legal (dogmatic) method was applied to analyse the content and structure of regulatory legal acts governing urban development and environmental regulation. Its application made it possible to identify internal inconsistencies, regulatory gaps, and the degree of integration of environmental criteria into construction-related legislation. The systematic method, in turn, enabled the examination of interconnections between environmental policy, building standards, planning instruments, and public procurement mechanisms, thereby revealing the place and role of sustainable construction within the broader system of public law regulation.

The study was conducted in several consecutive stages. At the first stage, Canadian regulatory frameworks were analysed, including federal environmental legislation, national model building codes, provincial regulatory instruments, municipal planning acts, and policy strategies. Particular attention was paid to mechanisms integrating environmental requirements into planning documentation, permitting procedures, and building standards. At the second stage, Ukrainian legislation in the field of urban development, environmental impact assessment, and building regulation was examined in order to determine its structural characteristics and identify existing regulatory gaps. At the third stage, a comparative analysis was carried out, making it possible to identify key differences in regulatory approaches and assess their effectiveness.

In addition, the method of legal modelling was used to conceptualise directions for improving Ukrainian legislation in the field of sustainable construction. This method facilitated the formulation

of proposals regarding the integration of environmental criteria into urban planning regulation and the development of performance-based regulatory instruments. Analytical and synthesis methods were applied to generalise the obtained results and identify key trends in the development of sustainable construction governance.

The empirical basis of the study consists of several categories of sources. First, regulatory legal acts at various levels, including Canadian federal legislation, building codes, provincial and municipal regulatory instruments, as well as Ukrainian laws and building standards. Second, analytical reports and policy documents of international organisations and governmental institutions were used to assess contemporary regulatory trends. Third, materials reflecting enforcement practice, including official reports and publicly available case descriptions, were analysed in order to evaluate the practical effectiveness of regulatory mechanisms. The use of this methodological framework ensured a consistent and structured analysis of the research problem and provided a reliable basis for the comparative legal assessment of environmentally sustainable urban development regulation.

Results

Multi-level regulatory model of sustainable construction in Canada. The Canadian experience in regulating environmentally sustainable urban planning and green building provides an important reference model for the modernisation of Ukrainian urban development legislation. The relevance of this regulatory model is particularly pronounced in the context of post-war reconstruction, climate adaptation, and Ukraine's European integration processes. Canadian regulatory practice demonstrates a systemic governance framework in which environmental protection, spatial planning, and architectural design are integrated through multi-level governance mechanisms and performance-based regulatory instruments (Treasury Board of Canada Secretariat, 2023; Natural Resources Canada, 2024).

A. Federal level. At the federal level, sustainable construction governance is primarily shaped by strategic policy instruments and environmental legislation. The Canada Green Buildings Strategy establishes national climate targets for the construction sector, including lifecycle assessment requirements for large-scale development projects and commitments to achieving net-zero emissions in federal real property by 2050 (Natural Resources Canada, 2024). Similarly, the Greening Government Strategy establishes public procurement requirements prioritizing low-carbon construction materials through Buy Clean procurement mechanisms (Treasury Board of Canada Secretariat, 2023).

Legislative regulation is further strengthened through amendments to the Canadian Environmental Protection Act (1999), which formally recognizes the right to a healthy environment and expands regulatory control over toxic construction materials and environmental pollutants. In addition, the Impact Assessment Act (2019) requires comprehensive environmental assessment of major infrastructure and development projects at early planning stages, thereby reducing reliance on post-construction mitigation measures and reinforcing preventive environmental regulation.

The federal regulatory framework plays a strategic coordinating role by establishing national sustainability objectives, financial instruments, and procedural standards, including public procurement requirements and lifecycle inventory database development, which stimulate transformation in construction markets and building standards (Clean Energy Canada, 2022). International regulatory practice increasingly incorporates embodied carbon limits and environmental performance requirements into building codes and performance-based regulatory systems, reflecting

the transition from purely technical construction standards toward integrated sustainability governance frameworks (ASHRAE, 2021). The National Building Code of Canada (2020) and the National Energy Code of Canada for Buildings (2020) provide the technical foundation of sustainable construction governance. These model codes establish minimum performance requirements related to building energy efficiency, thermal performance of building envelopes, and engineering system efficiency. The National Energy Code of Canada for Buildings (2020) introduces a performance-based regulatory pathway toward net-zero energy-ready buildings by 2030, offering multiple technical compliance options. However, research indicates that model codes primarily establish baseline sustainability requirements and achieve regulatory effectiveness only when complemented by provincial and municipal implementation mechanisms (Efficiency Canada, 2022).

B. Provincial level. Provincial governments perform a critical intermediary function by translating federal climate objectives into enforceable regulatory frameworks adapted to regional construction markets. A notable example is the British Columbia Energy Step Code (2017), which introduces progressive performance-based energy efficiency requirements through stepwise compliance levels leading to net-zero operational carbon targets by 2030 and net-zero energy-ready buildings by 2032. Unlike traditional regulatory approaches that impose uniform performance thresholds, the step-code model introduces incremental compliance stages, allowing the construction industry to gradually adapt to increasingly stringent sustainability requirements. Comparative research demonstrates that stepwise regulatory models significantly improve market readiness and reduce resistance to regulatory reform (BC Housing, 2021; Feickert *et al.*, 2025).

C. Municipal level. Municipal governments serve as primary operational regulators of sustainable construction through zoning bylaws, rezoning approval procedures, and development permitting systems. The City of Vancouver (2024) provides one of the most advanced examples of municipal sustainability regulation, requiring WBLCA during rezoning applications and offering alternative compliance pathways based on near-zero or low-emission building performance standards. Similarly, the Toronto Green Standard (2025) establishes mandatory minimum environmental performance requirements while encouraging higher sustainability tiers through financial incentives, development bonuses, and density adjustments. These instruments allow municipalities to integrate environmental performance directly into urban planning decision-making processes, linking development feasibility to sustainability outcomes.

Municipal zoning regulation also incorporates green infrastructure requirements, including green roofs, stormwater retention systems, biodiversity corridors, and density-based sustainability incentives, thereby transforming environmental standards into economically relevant development parameters. Canadian regulatory practice actively integrates market-based and technological instruments supporting environmental performance measurement and compliance monitoring. Environmental Product Declarations, Whole-Building Life-Cycle Assessment methodologies, energy modelling tools, and digital monitoring platforms such as ENERGY STAR Portfolio Manager provide quantifiable sustainability metrics that enhance regulatory transparency and accountability (World Green Building Council, 2022). Environmental Product Declarations and harmonised lifecycle databases are essential regulatory tools enabling embodied carbon assessment and compliance monitoring across construction supply chains (Circle Economy, 2022).

Voluntary certification systems, including LEED and the Zero Carbon Building Standard

(Canadian Green Building Council, 2025), function as complementary market-driven regulatory mechanisms that encourage sustainability innovation beyond mandatory legal requirements. Public procurement policies, particularly Buy Clean programs, further stimulate the development of lifecycle inventory databases and promote low-carbon construction material supply chains (Lewis *et al.,* 2022).

These instruments enable performance-based regulatory governance by introducing measurable indicators such as embodied carbon metrics, lifecycle emissions values, and energy use intensity benchmarks, thereby strengthening evidence-based regulatory decision-making. Monitoring and enforcement mechanisms constitute an essential component of Canadian sustainable construction regulation. Federal and provincial regulatory authorities actively apply enforcement notices, stop-work orders, and financial penalties to ensure compliance with environmental and building standards. Public disclosure systems, including mandatory energy performance reporting and stakeholder participation procedures, further enhance regulatory accountability and transparency (Environment and Climate Change Canada, 2001)

Empirical evidence indicates that regulatory compliance is reinforced through reputational risk, financial sanctions, and administrative enforcement mechanisms, which collectively create strong incentives for early integration of environmental standards into project design and development planning. Canadian authorities also publish enforcement decisions, issue stop-work orders, and impose administrative penalties to ensure compliance with environmental and construction standards. Public disclosure of enforcement decisions and access to performance data significantly strengthen regulatory compliance across the construction sector. Moreover, public consultation procedures and Indigenous rights protection mechanisms incorporated within the Impact Assessment Act (2019) provide additional participatory oversight instruments and reinforce accountability in infrastructure and development decision-making processes (Environment and Climate Change Canada, 2021; Environment and Climate Change Canada, & Health Canada, 2025).

The Canadian experience in sustainable construction demonstrates an effective multi-level regulatory model that integrates environmental protection, spatial planning, and architectural design. At the federal level, strategic goals and standards are established, forming the basis for implementing environmental requirements in construction. Provincial governments adapt these national objectives to regional conditions using stepwise and flexible mechanisms to ensure energy efficiency. Municipal authorities implement practical measures through zoning regulations, building permits, and incentives to achieve high sustainability standards. This comprehensive approach ensures the effective integration of environmental, economic, and technical aspects in the planning and execution of construction projects.

Comparative effectiveness of the Canadian regulatory model and its adaptation potential for Ukraine. The Canadian regulatory framework for sustainable construction is frequently regarded as more institutionally coherent and operationally effective than both European and Ukrainian regulatory approaches due to several structural characteristics. First, Canada demonstrates a high level of policy integration combining national sustainability strategies, technical building codes, and local implementation mechanisms, commonly conceptualised as "front-to-back regulatory integration." Regulatory development follows a clearly structured hierarchy: federal strategic policy objectives and procurement instruments → national model building codes → provincial step-based regulatory pathways → municipal performance-oriented

planning requirements. In contrast, the European Union primarily establishes directive-based policy targets, including those provided by the Energy Performance of Buildings Directive, while implementation mechanisms vary considerably among member states, resulting in regulatory diversity but often lacking consistent phased transition frameworks (Directive of the European Parliament and of the Council No. 2018/844, 2018).

Second, step-based building codes function as an effective instrument for managing construction market transformation. The regulatory experience of British Columbia demonstrates that incremental performance-based pathways provide clear compliance deadlines and allow the construction sector to adapt progressively to increasingly stringent energy efficiency and carbon reduction standards. Although the European Union establishes long-term climate neutrality objectives, the absence of unified staged implementation frameworks across regions reduces the predictability of regulatory transition mechanisms (British Columbia Energy Step Code, 2017; BC Housing, 2021).

Third, Canadian regulatory policy places significant emphasis on environmentally oriented public procurement as a market transformation driver. The Buy-Clean procurement framework explicitly prioritises embodied carbon performance in public construction and infrastructure projects, thereby rapidly stimulating market demand for low-carbon construction materials and supporting the development of sustainable supply chains. While comparable procurement initiatives exist within the European Union, their coordination and uniform implementation across national procurement systems remain comparatively less consistent (Clean Energy Canada, 2022).

Fourth, the Canadian regulatory model combines mandatory baseline requirements established through technical building codes with market-oriented incentive mechanisms, including voluntary certification systems, financial subsidies, and performance-based development bonuses. This dual regulatory architecture ensures baseline safety and performance standards while simultaneously encouraging higher sustainability performance through economic incentives and competitive market advantages (Efficiency Canada, 2022).

A key element of Canadian legislation that demonstrates strong adaptation potential for Ukraine is long-term strategic planning of environmentally sustainable construction. Canadian federal policy frameworks establish clearly defined targets for achieving zero-carbon buildings and energy-efficient urban development (Treasury Board of Canada Secretariat, 2023; Natural Resources Canada, 2024). In contrast, Ukrainian urban planning legislation currently contains fragmented environmental provisions primarily implemented through environmental impact assessment procedures and technical building standards.

Ukraine already has a foundational regulatory framework supporting sustainable construction, including the the Law of Ukraine No. 3038-VI "On Regulation of Urban Development Activity" (2011), the Law of Ukraine No. 2118-VIII "On Energy Efficiency of Buildings" (2017), and the Law of Ukraine No. 2059-VIII "On Environmental Impact Assessment" (2017). However, the key limitation of Ukrainian regulatory policy lies in the absence of an integrated national sustainable construction strategy. Unlike the Canadian regulatory system, which integrates construction governance, climate policy, and energy regulation, Ukrainian environmental regulation remains fragmented across sectoral domains.

The proposed reform model envisages the development of a National Green Building Strategy establishing climate targets for the construction sector, introducing low-carbon construction performance standards, and integrating environmentally oriented public procurement instruments into urban development governance.

Ukrainian State Building Norms perform a function similar to Canadian national building codes; however, they primarily establish minimum technical performance requirements and do not provide phased regulatory pathways for progressive sustainability performance improvement.

Urban planning regulation remains one of the least developed levels of sustainability governance levels in Ukraine. In Canada, municipalities serve as the primary drivers of green building policy implementation. In contrast, Ukrainian zoning regulation often remains predominantly formal, rarely incorporates climate adaptation considerations, and exerts limited influence on architectural sustainability performance. Accordingly, the research proposes the introduction of environmental zoning frameworks, mandatory green infrastructure requirements, and density regulation based on environmental performance indicators.

Environmental performance requirements in Ukraine are often evaluated only after the completion of project design. The proposed regulatory reforms include the introduction of mandatory life-cycle assessment of buildings, verification of environmental performance of construction materials, and integration of sustainability performance criteria into urban planning conditions and development restrictions. Green building certification in Ukraine remains predominantly voluntary and receives limited governmental support. Therefore, it is recommended to introduce financial incentives, tax benefits, and preferential public procurement eligibility criteria for certified sustainable construction projects. Furthermore, regulatory control in Ukraine largely terminates following building commissioning. Consequently, the study proposes the introduction of operational energy performance monitoring, periodic building sustainability certification procedures, and digital energy efficiency registers to ensure long-term compliance with environmental performance standards.

Empirical enforcement practice in Canada demonstrates that preventive regulatory governance supported by administrative, civil, and criminal liability mechanisms significantly enhances environmental compliance in the construction sector. Numerous enforcement cases are documented in both regulatory authority reports and media publications. One of the most common areas of regulatory enforcement involves occupational and environmental safety compliance related to asbestos handling during demolition and construction activities. The provincial regulator WorkSafeBC actively imposes substantial financial penalties and issues stop-work orders against companies violating hazardous materials management regulations. For example, in Williams Lake, a construction operator was fined CAD 467,496.80 for repeated high-risk asbestos violations, including engaging unlicensed contractors and failing to implement appropriate exposure control measures (Williams Lake company fined nearly $500,000 for asbestos-related issues, 2025). A comparable enforcement case occurred in Esquimalt, British Columbia, where a contractor was fined more than CAD 61,000 for unsafe demolition activities involving asbestos-containing materials (Island firm fined $61,000 for high-risk asbestos violations during demolition work, 2025). Earlier enforcement actions further demonstrate systematic use of administrative penalties and stop-work orders for hazardous materials violations, reinforcing regulatory compliance and occupational safety standards across the construction sector (Asbestos risk leads…, 2021; Wilson, 2022; WorkSafeBC, 2024).

A Montreal-based holding company, 4422236 Canada Inc., was fined CAD 260,000 after pleading guilty to violations of the Environmental Protection Act of Canada (1999) and PCB Regulations. The investigation revealed that the company had used equipment containing PCB concentrations exceeding legal limits and failed to comply with

a federal environmental protection compliance order. As a result, the company was added to the Environmental Offenders Registry, reinforcing regulatory transparency and enforcement accountability (Wilson, 2020). Another significant enforcement area concerns the regulation of residential development companies. In Ontario, the Home Construction Regulatory Authority (HCRA) has initiated disciplinary proceedings against developers who systematically violated licensing requirements and housing warranty regulations. The regulator is authorised to impose administrative sanctions, initiate licence suspension or revocation procedures, and prohibit non-compliant developers from conducting construction activities or marketing residential properties, thereby ensuring regulatory compliance and consumer protection within the housing sector (Global News, 2025).

In several high-profile cases, the regulator commenced licence revocation procedures that effectively prohibited developers from conducting construction activities and marketing newly built residential units. Some investigations also resulted in judicial proceedings against corporate executives responsible for regulatory violations (Global News, 2025). Public disclosure of enforcement cases performs an important regulatory function. First, it generates significant reputational risks for companies, directly affecting investment attractiveness and eligibility to participate in public infrastructure procurement. Second, media coverage of enforcement sanctions strengthens the preventive effect of environmental regulation by encouraging construction industry actors to improve compliance practices. Third, substantial financial penalties and court decisions contribute to the development of enforcement jurisprudence and increase the expected economic costs of regulatory non-compliance.

The Canadian enforcement system incorporates several key mechanisms designed to influence non-compliant developers. The most frequently applied instrument is the issuance of stop-work orders requiring the immediate suspension of construction activities until regulatory violations are corrected. These orders are often accompanied by significant financial penalties. Additionally, administrative sanctions and compensatory payments may be imposed depending on the scale of environmental harm and regulatory breach severity. In cases involving deliberate misconduct or serious risks to public health and safety, criminal prosecution may be initiated, potentially resulting in substantial fines or imprisonment.

Another important enforcement mechanism involves licence revocation or restrictions on professional activity. Regulatory authorities such as the Home Construction Regulatory Authority may initiate procedures to suspend or revoke developer licences, particularly in cases involving repeated or systemic violations. Such sanctions effectively prevent companies from continuing construction operations or selling residential properties. Public pressure and civil litigation also play a significant role in enforcement practices. Local communities, affected residents, and environmental non-governmental organisations frequently initiate lawsuits or participate in administrative review procedures, thereby increasing the likelihood of project delays, modification requirements, or cancellation.

Circumvention of mandatory regulatory requirements in Canada is generally considered a high-risk strategy. The expected financial and reputational costs associated with regulatory sanctions, construction suspension, litigation, and public disclosure often significantly exceed any short-term economic benefits derived from non-compliance. Enforcement practice demonstrates numerous cases involving substantial penalties for asbestos safety violations and licensing breaches enforced under WorkSafeBC regulatory authority, HCRA disciplinary procedures, and federal environmental

enforcement proceedings under the Environmental Protection Act of Canada (1999).

Canadian regulatory authorities increasingly rely on a combination of financial sanctions and regulatory measures, including stop-work orders and licence revocation procedures. In certain circumstances, criminal liability may also be imposed. Consequently, compliance strategies must be integrated into construction project governance at the earliest stages of design and planning.

From a professional practice perspective, two operational implications are particularly important. First, comprehensive documentation of environmental compliance is required, including Environmental Product Declarations, building energy modelling documentation, and construction waste management plans. Second, proactive engagement with regulatory authorities and local communities significantly reduces litigation risks and minimises the probability of stop-work enforcement actions.

The analysis of the Canadian sustainable construction regulatory framework demonstrates that its effectiveness is determined not only by the existence of technical standards but primarily by the integration of environmental policy into urban planning legislation, construction codes, public procurement policy, and permitting procedures (World Economic Forum, 2024; Organisation for Economic Co-operation and Development, 2025). In contrast, Ukraine's green construction regulatory framework currently relies predominantly on technical energy efficiency requirements and remains structurally fragmented, which limits its practical effectiveness. Consequently, adaptation of the Canadian experience requires not only amendments to individual building standards but also structural transformation of the overall construction governance model.

In particular, provisions of DBN V.2.6-31:2021 "Thermal insulation and energy efficiency of buildings" (2021) require further development. The current regulation establishes minimum technical requirements for thermal performance of building envelopes and engineering systems but does not incorporate progressive performance pathways comparable to those implemented through the BC Energy Step Code in the Province of British Columbia (BC Housing, 2021). Contemporary research demonstrates that step-based energy standards represent an effective regulatory instrument for facilitating gradual market transition toward net-zero buildings (Feickert *et al.*, 2025). Therefore, alignment with international sustainability governance models requires the introduction of staged energy performance standards, including defined long-term targets for achieving net-zero-ready buildings. Additional regulatory amendments should incorporate mandatory airtightness testing and building energy modelling during the design stage as prerequisites for obtaining construction permits, which has been recognised as an effective compliance mechanism in performance-based regulatory systems (Simonen *et al.*, 2017).

Significant revision is also required for DBN V.2.2-15:2019 "Buildings and structures. Residential buildings. Basic provisions" (2019) which establishes spatial and technical parameters for residential development. While the current regulation emphasises sanitary and functional requirements, it contains limited provisions regarding environmental performance of construction materials. International research confirms that embodied carbon in construction materials constitutes a substantial proportion of total building emissions throughout the building life cycle (World Green Building Council, 2022). Research demonstrates that material selection significantly influences embodied carbon emissions, with low-carbon structural materials such as timber providing substantial climate mitigation potential (Himes *et al.*, 2020). Accordingly, regulatory reform should incorporate embodied carbon

assessment requirements and mandatory application of Environmental Product Declarations for publicly funded and large-scale development projects. Such regulatory mechanisms enable environmental performance monitoring beginning at the material production stage and contribute to lifecycle-based sustainability governance (Sartori *et al*., 2022).

Comparative regulatory analysis further demonstrates that environmentally sustainable architectural development is most effective when environmental requirements are directly embedded within urban planning legislation and permitting procedures (Organisation for Economic Co-operation and Development, 2025). The Law of Ukraine No. 3038-VI "On Regulation of Urban Development Activity" (2011) establishes the fundamental legal framework for territorial planning and construction governance; however, environmental provisions remain largely declarative and lack systematic implementation mechanisms. Therefore, targeted legislative amendments are required to strengthen environmental integration into urban development regulation.

Article 1 of the Law of Ukraine No. 3038-VI (2011), which defines core terminology of urban development activity, requires supplementation. The introduction of definitions such as sustainable construction, green architecture, and building life-cycle assessment would create a legal foundation for further regulatory development of environmental construction standards and ensure consistency with internationally recognised sustainability governance frameworks.

Article 2 of the Law of Ukraine No. 3038-VI (2011), which establishes principles of urban development activity, should incorporate provisions requiring mandatory integration of environmental criteria into territorial planning and construction design processes. These principles should include building energy efficiency, reduction of construction carbon footprint, rational use of natural resources, and climate change adaptation. International regulatory practice demonstrates that embedding sustainability principles at the legislative level significantly increases regulatory effectiveness and enforcement capacity (Organisation for Economic Co-operation and Development, 2025).

Substantial improvement is also required for Article 16 of the Law of Ukraine No. 3038-VI (2011), which regulates the structure and content of urban planning documentation. Comparative planning research confirms that environmental performance assessment integrated into master planning and zoning processes improves long-term urban sustainability outcomes (World Economic Forum, 2024). Therefore, master plans, detailed territorial plans, and zoning documentation should incorporate mandatory environmental performance assessments, including analysis of building energy characteristics, microclimate impacts, and renewable energy utilisation potential.

Article 29 of the Law of Ukraine No. 3038-VI (2011), regulating issuance of urban planning conditions and restrictions, should be supplemented with provisions enabling the establishment of environmental development requirements. Municipal authorities could be authorised to define mandatory building performance indicators, green roof implementation requirements, stormwater management systems, and minimum landscaping standards. Similar regulatory mechanisms are widely implemented in Canadian municipal planning systems and have proven effective in integrating sustainability standards into local development governance (City of Vancouver, 2024).

Article 31 of the Law of Ukraine No. 3038-VI (2011), defining the composition of construction project documentation, should require inclusion of building life-cycle assessment results for publicly funded and large-scale development projects. Lifecycle-based regulatory approaches allow evaluation of environmental impacts

throughout the entire operational lifespan of buildings and significantly improve sustainability governance effectiveness (Bowick *et al.*, 2024).

Article 34 of the Law of Ukraine No. 3038-VI (2011), regulating procedures for obtaining the right to perform construction works, should incorporate requirements for verification of environmental compliance of construction materials. Developers should be required to submit Environmental Product Declarations or equivalent documentation confirming compliance with environmental safety and energy performance standards. Such regulatory requirements have been identified as key instruments for controlling embodied carbon emissions within construction supply chains (World Green Building Council, 2022).

Further improvement is required for Article 40 of the Law of Ukraine No. 3038-VI (2011) regulating developer participation in infrastructure development. The introduction of investment incentives for developers implementing green technologies, including reductions in development contributions and urban planning performance bonuses, reflects international best practices for stimulating sustainable construction markets (Organisation for Economic Co-operation and Development, 2025).

In addition, the Law should incorporate a dedicated article establishing environmental construction standards, including the development of a national green building certification system and defining its application within public and municipal construction projects. Certification-based regulatory mechanisms function as effective market-driven instruments encouraging voluntary compliance with sustainability performance benchmarks (World Green Building Council, 2022). Implementation of these legislative reforms would contribute to the development of a comprehensive legal framework for green architecture, facilitate integration of environmental standards into spatial planning regulation, and establish legal preconditions for sustainable construction development in Ukraine. Adaptation of Canadian regulatory experience would strengthen environmental safety in the construction sector and support effective and climate-resilient post-war territorial reconstruction.

Discussion

The findings obtained in this study generally confirm that the legal regulation of environmentally sustainable urban development cannot be effective under conditions of fragmented normative influence and instead requires the integration of multi-level governance, technical standards, building life-cycle assessment procedures, environmentally oriented public procurement (EOPP), and mechanisms ensuring actual compliance with environmental requirements. In this respect, the position advanced in this study partially aligns with the conclusions of A. Miroshnychenko (2025), who substantiates the necessity of a comprehensive, multi-level governance design in the housing and construction sector, as well as with the approach of Ye. Fareniuk & H. Fareniuk (2025), who emphasise the importance of unified methodologies for energy efficiency assessment and the integration of European standards into national legal frameworks. However, the analysis conducted above reveals a somewhat different picture: well-designed regulatory models, in and of themselves, do not guarantee the achievement of environmentally significant outcomes unless they are supported by effective implementation instruments, measurement systems, market-based incentives, and adequate institutional capacity. For this reason, the conclusions of the aforementioned authors regarding normative and institutional modernisation are generally supported; however, they are insufficient to explain why certain regulatory models lead to tangible transformations in construction practices, whereas others remain largely declarative. This

divergence may be explained by differences in analytical perspective: while Ukrainian scholars predominantly focus on the "design of rules", the present study is primarily concerned with the "effects of rules", that is, the actual effectiveness and practical outcomes of legal regulation.

A similar correlation may be observed between the findings of this study and the works of T. Kryvomaz (2020) and V. Hrachuk *et al.* (2024). V. Hrachuk *et al.* (2024) rightly emphasises the need to reorient legal regulation from a traditional energy paradigm towards renewable energy sources and energy efficiency, while T. Kryvomaz convincingly demonstrates the importance of the institutional environment, investment climate, and state support for the development of green building. These conclusions generally correspond with the findings of the present study, as both the Canadian regulatory experience and the proposed directions for adaptation in Ukraine confirm the decisive role not only of formal environmental standards, but also of the broader governance and economic context within which they are implemented. At the same time, arguments that reduce the success of the green transition primarily to the modernisation of the regulatory framework or to general improvements in the institutional environment appear somewhat incomplete, since the above analysis demonstrates that particular importance should also be attributed to specific procedural mechanisms – namely, stepwise energy codes, the mandatory application of WBLCA, Buy Clean procurement instruments, environmental zoning requirements, digital registries, and post-occupancy monitoring. Therefore, in this respect, the results of the present study both develop and further specify earlier findings, translating them from a general theoretical framework into the domain of concrete legal instruments.

A comparison with international scholarship provides grounds for a more precise delineation of the novelty of the findings obtained. Thus, C.J. Circo (2008) substantiates that the scaling of green building requires coordination at higher levels of governance, as local fragmentation reduces regulatory effectiveness. D. Matisoff *et al.* (2016), proceeding from the logic of market failures, demonstrate the necessity of employing a broad portfolio of policy instruments, while E. Choi (2010) empirically shows that a combination of regulatory and incentive-based mechanisms is more effective than their separate application. D. Dickson (2025), in turn, aptly draws attention to the asymmetry between the relatively well-regulated domain of operational energy and the significantly weaker institutionalisation of embodied carbon (i.e., greenhouse gas emissions associated with the production, transportation, and installation of building materials). The conclusions reached by these scholars are entirely pertinent and are largely supported by the findings of the present study, as the Canadian regulatory model analysed in this article effectively confirms the efficiency of precisely such a combined and multi-level approach to legal regulation. At the same time, in contrast to the aforementioned authors, this study shifts the analytical focus from examining individual policy or economic mechanisms to their legal integration within a coherent model of urban planning regulation. Therefore, while international scholars predominantly explain why a policy mix is effective, the analysis conducted herein demonstrates how such a combination of instruments may be legally structured within the system of urban planning legislation and adapted to the Ukrainian context.

Within the body of research devoted to whole-life carbon (WLC) and life-cycle assessment (LCA), the findings of this article most closely correspond to the several works. In particular, T. Lützkendorf & M. Balouktsi (2022) convincingly demonstrate that, in the absence of harmonised system boundaries, modules, and

databases, the assessment of embodied carbon (i.e., greenhouse gas emissions associated with the production, transportation, construction, and end-of-life stages of building materials) remains highly context-dependent. F. Pomponi & A. Moncaster (2018) emphasise the existence of a "performance gap" between design-stage projections and actual building performance. M. Röck *et al.* (2023) substantiate the need to shift from an operational energy-centred approach to a whole-life perspective; S. Lousada *et al.* (2025) demonstrate the significance of LCA not only as a measurement tool but also as a basis for policy justification; I. Hetman (2025), in turn, highlights that European integration and post-war reconstruction create a window of opportunity for the institutionalisation of LCA in Ukraine. At the same time, recent international studies further reinforce these conclusions. M. Bowick *et al.* (2024) demonstrate that lifecycle-based regulatory approaches enhance sustainability governance effectiveness by enabling the assessment of environmental impacts across the entire lifespan of buildings. A. Himes *et al.* (2020) show that material selection significantly influences embodied carbon emissions, with low-carbon materials such as timber offering substantial mitigation potential. T. Sartori *et al.* (2022) emphasise that the mandatory use of Environmental Product Declarations (EPD) enables environmental performance monitoring already at the material production stage. In this respect, the results of the present study are broadly aligned with the aforementioned approaches, as they likewise proceed from the growing importance of embodied carbon, the dependence of regulatory decisions on data quality, and the need to transition from voluntary to mandatory instruments. However, in contrast to predominantly methodological or conceptually critical studies, the present article does not confine itself to the question of what should be measured and how, but rather addresses how these methodologies should be embedded within the system of legal regulation of urban planning activity. It is precisely here that the principal distinction lies: while international scholars primarily construct the theoretical framework of whole-life carbon, this study seeks to propose a legal mechanism for its institutionalisation in Ukraine, taking into account the Canadian regulatory experience.

The findings of this study should also be considered in relation to research devoted to green public procurement (GPP) and the market for safe and environmentally sustainable materials. V. Khalina *et al.* (2020) aptly conceptualise GPP as a component of the public governance system and emphasise the need to integrate the life-cycle principle into procurement procedures. V. Psota (2020) substantiates that, in the absence of a unified methodology for applying life-cycle costing (LCC) in tendering procedures, the burden of assessment is excessively placed on contracting authorities, resulting in the fragmented operation of the mechanism. These conclusions are, in general, supported by the authors of the present study. At the same time, the analysis conducted above demonstrates that the problem lies not only in the absence of methodologies or data, but also in a broader deficit in the operationalisation of procurement policy in the construction sector. For this reason, international approaches that link GPP not merely to the formal articulation of environmental requirements, but to concrete implementation instruments, appear more persuasive. Thus, M. Ahmed *et al.* (2024) show that GPP is effective only when integrated with LCA, life-cycle costing (LCC), and digital tools; A. Kozuch (2025) convincingly explains the "intention-action gap" by reference to deficits in organisational capacity, market readiness, and bureaucratic barriers; Ch. Senseney *et al.* (2023), together with co-authors, propose an applied, instrument-oriented approach – namely, Buy Clean – based on the use of environmental

product declarations (EPD) and clearly defined rules of material comparability. Additional support for the proposed regulatory approach is provided by research on performance-based building standards. K. Feickert *et al.* (2025) demonstrate that step-based energy standards constitute an effective regulatory instrument for facilitating a gradual transition towards net-zero buildings, while K. Simonen *et al.* (2017) confirm the effectiveness of airtightness testing and energy modelling as compliance mechanisms. In this respect, the findings of the present study are more closely aligned with the international line of argumentation, as they support the conclusion that the key obstacle is not the absence of environmental benchmarks as such, but rather the lack of procedures, data, standardised comparison formats, and institutional capacity to implement the relevant requirements in practice. Accordingly, the conclusions of Ukrainian scholars regarding the fundamental importance of LCC and life-cycle approaches are supported; however, in light of the findings of this study, they should be considered within a broader framework – as part of a comprehensive system of instrumental support for GPP/Buy Clean, rather than as a self-sufficient solution.

Thus, the comparative analysis conducted provides grounds for arguing that the findings of this study, on the one hand, develop existing Ukrainian scholarship on normative harmonisation, institutional coherence, and the greening of urban planning policy and, on the other hand, bring the research closer to the international paradigm oriented towards empirically validated instrument effectiveness, multi-level governance, and the measurability of regulatory impact. This also explains the principal divergences from a number of previous studies: they stem not so much from disagreement over ultimate objectives as from the distinction between a normative, design-oriented logic and a results-oriented analytical logic of research. In this sense, the conclusions drawn in this article do not contradict earlier scholarly approaches; rather, they refine them by shifting the discussion from a general justification of the need for sustainable construction to the question of which specific legal mechanisms effectively ensure its implementation within the framework of contemporary urban planning policy.

Conclusions

This article examined the legal regulation of environmentally sustainable urban development, with particular emphasis on the Canadian model and the possibilities for its implementation in Ukraine. The stated research objective – namely, to identify the key elements of effective sustainable construction governance and to assess the prospects for their incorporation into national legislation – was generally achieved. The study showed that the Canadian regulatory model was characterised by a high degree of integration and multi-level governance. The analysis of legislation and enforcement practice made it possible to establish that the effectiveness of environmentalisation in construction was ensured through a combination of strategic policy frameworks, model building codes, step-based regulatory instruments, and municipal planning tools. The results indicated that sustainable construction was achieved not solely through the establishment of technical standards, but primarily through the integration of environmental requirements into spatial planning procedures, permitting processes, and economic regulatory instruments. It was found that the application of whole-building life-cycle assessment, staged energy performance standards, and environmentally oriented public procurement served as a key factor in ensuring the actual effectiveness of regulatory impact. At the same time, enforcement and liability mechanisms played an important role by shaping the preventive nature of

legal regulation and encouraging compliance with environmental requirements.

The analysis also led to the conclusion that the Ukrainian legal framework in this field remained fragmented and predominantly focused on the technical aspects of energy efficiency. Environmental criteria remained insufficiently integrated into urban planning documentation and permitting procedures, which, to a certain extent, limited the practical implementation of sustainable development principles in the construction sector. Summarising the results obtained, it was stated that effective legal regulation of environmentally sustainable urban development required not only the formal establishment of relevant standards, but also their systematic integration across all stages of construction activity. Conceptually, this pointed to the need to move from a model focused on the formal design of legal norms to one oriented towards their practical effectiveness, institutional support, and the measurability of regulatory impact.

Prospects for further research lay in the development of legal and organisational mechanisms for integrating life-cycle assessment into the system of urban planning regulation, the analysis of economic instruments for stimulating sustainable construction, and the assessment of the institutional capacity of public authorities to ensure the implementation of these approaches in the context of post-war reconstruction.

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None.

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Правова основа екологічно сталого міського розвитку: канадська модель та напрями реформування законодавства України

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Анотація

У статті досліджено правове регулювання екологічно сталого міського розвитку шляхом порівняльного аналізу канадських та українських нормативних підходів до зеленого будівництва і просторового планування. Метою дослідження було визначення ключових елементів ефективного регулювання сталого будівництва та оцінка можливостей їх імплементації у законодавстві України у сфері містобудування, зокрема в умовах післявоєнної відбудови, кліматичної адаптації та європейської інтеграції. Дослідження ґрунтувалося на аналізі нормативно-правових актів та правозастосовної практики Канади, включаючи федеральне екологічне законодавство, модельні будівельні кодекси, провінційні регуляторні

інструменти та муніципальні акти планування. Особливу увагу приділено механізмам інтеграції екологічних вимог у містобудівну документацію, дозвільні процедури, оцінку життєвого циклу будівель, зонування та інструменти «зелених» публічних закупівель. Результати дослідження засвідчили, що ефективність канадської регуляторної моделі забезпечується системною інтеграцією екологічних вимог у стратегічне планування, будівельні норми, політику зонування та дозвільні процедури, що функціонують у межах багаторівневої системи врядування та підтримуються превентивним контролем на стадії проєктування. Встановлено, що ключову роль відіграє не лише формальне закріплення стандартів, а їх інтеграція у всі етапи будівельної діяльності, включаючи застосування оцінки життєвого циклу будівель, поетапних стандартів енергоефективності та інструментів екологічно орієнтованих публічних закупівель. Водночас з'ясовано, що українська правова система залишається фрагментарною та переважно орієнтованою на технічні аспекти енергоефективності, що обмежує ефективність впровадження принципів сталого розвитку у сфері будівництва. Узагальнення отриманих результатів дозволяє стверджувати, що підвищення ефективності правового регулювання в Україні потребує переходу від формально-нормативної моделі до моделі, орієнтованої на практичну ефективність, системну інтеграцію екологічних критеріїв та інституційне забезпечення їх реалізації

Ключові слова: регулювання «зеленого» будівництва; екологічне право; містобудівне право; багаторівневе врядування; оцінка життєвого циклу будівель; регулювання енергоефективності; екологічне зонування