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Housing environment as a tool for strengthening urban resilience to climate change: ESG good practices in sustainable development

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Abstract. This article aims to identify adaptive solutions in housing investments and demonstrate their role in enhancing urban resilience. The research, based on an analysis of ESG (Environmental, Social, Governance) strategies and reports from real estate sector entities, indicate that adaptive practices are being implemented in housing projects, and their impact extends beyond the buildings themselves, contributing to the resilience of neighbourhoods, public spaces, and cities. These practices, though still infrequently implemented, include green roofs, rainwater harvesting, rain gardens, photovoltaic panels, heat pumps, and biodiversity protection, and they mitigate climate risks, support energy security and circular economy. Findings indicate that while 95% of companies address GHG emissions, only 40% explicitly consider adaptation, often with fragmented reporting. Four reporting approaches to adaptation were identified: complete, partial, basic, and missing. It is also concluded that the growing importance of ESG will unlock the adaptive potential of housing investments, which will strengthen cities' resilience to climate change.

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1. Introduction

Cities are areas characterized by a distinct dualism. On the one hand, they are a source of greenhouse gas (GHG) emissions that contribute to climate change and the occurrence of extreme climate events. On the other hand, they are areas with high concentrations of buildings, infrastructure, and populations, making them particularly vulnerable to the impacts of these events, such as loss of life, health, property, the environment, cultural heritage, and economic activity (Kikstra et al., 2022). According to United Nations forecasts, the global urbanization rate, currently at 55%, will reach 68% by 2050. In the face of growing challenges related to climate change, a key goal for modern cities is to adapt to the changing environment, which presents both a challenge and an opportunity to implement a more sustainable model of development for urbanized areas (Aboagye & Sharifi, 2024; Diaz et al., 2024; Szymańska et al., 2024; Abdillah et al., 2025).

Developing urbanized areas so that they have the capacity for mitigating and adapting to climate phenomena requires innovative; e solutions in both public and private spaces, particularly in housing buildings. Housing buildings constitute the largest portion of building resources in urban areas and continue to grow in response to increasing housing demands. For example, in Poland, residential areas covered 287,014 hectares in 2011, and by 2021, this area had increased to 378,004 hectares (Central Statistical Office, 2024).

The role of housing buildings in addressing climate change is twofold. On the one hand, they offer significant potential for reducing GHG emissions, which, in general, accelerate climate change. On the other hand, they are crucial for ensuring the safety and quality of life of residents in the face of extreme climatic events. Therefore, it is essential that housing projects take adaptive needs into account, as this will help build cities that are resilient to climate change.

The adaptation of housing buildings impacts the resilience of their surroundings, including other structures, public spaces, and entire cities. Adaptive measures implemented in public spaces enhance the safety of housing buildings, indicating that there are feedback loops and interdependencies between private and public spaces (Susca et al., 2011; Santamouris, 2014; Basu et al., 2021; Peinhardt, 2021; Cristiano et al., 2023; Forczek-Brataniec & Jamioł, 2024). The symbiosis of adaptive actions in private areas, such as housing buildings and public areas (e.g., green spaces, transport infrastructure): presents an opportunity to strengthen the resilience of cities to climate change.

The development of housing buildings in urban areas is largely driven by real estate investments. Developers ultimately decide on the design of the projects, making their choices crucial for the implementation of adaptive solutions. Therefore, the article aims to identify adaptive solutions that have been incorporated into housing developments and demonstrate that these solutions can elevate the city's resilience, creating spaces that are conducive to both residents and the environment.

2. Literature review and research gap

The literature on the subject examines issues related to urban adaptation and resilience to the effects of climate change in various areas. It focuses on shaping urban policies, pointing to the need to develop and implement plans and strategies for adaptation and resilience to climate change (Esenarro et al., 2024). It also highlights the importance of a multilevel governance perspective in climate change adaptation. Developing cooperation at both the vertical and horizontal levels, including local authorities, organizations, institutions, and society, enables the formulation of appropriate directions and solutions to strengthen urban resilience (Betsill & Bulkeley, 2006; Revi et al., 2014). This research also addresses the role of innovation and social innovation in supporting urban adaptation to climate change (Campos et al., 2016; Wieteska-Rosiak et al., 2022).

The literature also emphasizes spatial planning as a key support for climate change adaptation (Roggema et al., 2012; Zhou et al., 2023; Juschten et al., 2025). The literature extensively discusses the role of blue-green infrastructure in urban adaptation to climate change (Depietri & McPhearson, 2017; Carter et al., 2018; Jones & Russo, 2024; Seidu et al., 2025). It also discusses the impact of adaptation on the social plane, addressing the problem of climate gentrification and the need to incorporate social policy into climate change adaptation policies (Shokry et al., 2022; Anguelovski et al., 2023; Friesenecker et al., 2025).

Meanwhile, several publications clearly indicate how adapting residential buildings and implementing climate-friendly solutions translate into urban adaptation and resilience to climate change. The literature also explores the adaptation of residential buildings in the context of urban flooding, sea level rise (Stagrum et al., 2020; Dottori et al., 2023) and

high temperatures (Hooff et al., 2014; Kingsborough et al., 2017). Research has also addressed the impact of blue-green infrastructure, including green roofs, on reducing urban heat islands (Susca et al., 2011; Santamouris, 2014) and urban flooding (Basu et al., 2021; Cristiano et al., 2023). This means that urban adaptation and resilience are influenced by both private and public spaces adapting to climate change (Peinhardt, 2021; Forczek-Brataniec & Jamioł, 2024). Residential development, as the dominant form of urban development, is crucial in shaping the resilience of public spaces and surrounding buildings. The implementation of adaptation solutions by key investors, particularly developers, has a direct impact on the climate safety of residents and the stability of urban areas.

In summary, while the literature broadly discusses various aspects of urban adaptation and resilience, the perspective of combining Environmental, Social, and Governance (ESG) principles with adaptation practices in the housing sector remains underdeveloped. A research gap has been identified in combining an ESG perspective with adaptation practices in the housing sector and their impact on urban resilience to climate change. Some studies have examined the importance of ESG in the real estate market (Olteanu & Ionascu, 2023): ESG reporting (Robinson & McIntosh, 2022): financial aspects (Morri et al., 2024; Zheng & Lee, 2025): investment decisions, and the role of ESG in mitigating climate change (Biasin et al., 2024).

Nonetheless, there remains a lack of research connecting ESG perspectives with actual adaptation implementations and their potential to strengthen the resilience of neighborhoods and entire cities. To address this research gap, we analyzed the adaptation solutions implemented by developers in residential developments, using data from ESG strategies and reports to assess their importance for urban resilience to the impacts of climate change.

This study makes a significant and original contribution to the literature by integrating the potential of ESG to develop urban resilience to the impacts of climate change. This approach not only fills the existing research gap but also opens a new area of research that combines adaptation policies, development practices, and ESG frameworks. The findings enrich the theoretical foundation of urban resilience by incorporating the private sector's perspective and potential. They also offer practical guidelines for integrating adaptation policies into housing investment processes and address the need to combine adaptation measures in the housing sector with solutions in public spaces. ESG analysis is innovative because it identifies actual adaptation practices implemented by key investors in cities and assesses their importance in strengthening urban resilience.

3. Research materials and methods

To achieve the article's objective, both qualitative and quantitative methods were utilized. The research was based on a review of the relevant literature and ESG (Environmental, Social, Governance) reports and strategies of entities in the real estate sector. The focus was on companies listed on the WIG-real estate and WIG-construction indices of the Warsaw Stock Exchange. Between May and October 2024, a study was conducted on companies listed on both indices, which identified a total of 59 companies. Among them, 20 companies, including 11 real estate developers (WIG-real estate) and nine construction companies (WIG-construction): had an ESG strategy or report for 2022 and 2023. These companies carry out investments, including housing projects, in Polish cities and regions. The available strategies and reports were subjected to a detailed content analysis regarding climate change adaptation solutions, allowing us to identify good practices in this area.

The content analysis process comprised three stages. The first stage involved an in-depth review of the documents to identify content related to the companies' approaches to climate change adaptation. The second stage categorized the implemented solutions and linked them to the existing literature. The third stage allowed for the identification of good practices and the quantitative summarization of climate change adaptation solutions in the context of ESG issues.

4. Research results

4.1. ESG as a tool for supporting urban adaptation to climate change

ESG strategies serve as a key tool for supporting sustainable development and implementing adaptive solutions in the face of climate change, particularly in the housing sector. These documents allow businesses to organize their strategic goals and actions within ESG areas. Companies measure and present the implementation of these objectives in reports, ensuring transparency and credibility in

the process of applying ESG strategies. Recently, the importance of ESG strategies and reports has grown, especially in light of new regulations. The Corporate Sustainability Reporting Directive (European Union, 2022) requires that businesses disclose their sustainability efforts. The regulations apply to large public interest entities, as well as companies with over 500 employees (January 1, 2024): large listed and non-listed companies with more than 250 employees (January 1, 2025): and small and medium-sized enterprises listed on the EU regulated market that employ over 10 people (January 1, 2026) (Warsaw Stock Exchange, 2024).

The directive resulted in the creation of the European Sustainability Reporting Standards (ESRS). Among these standards, the thematic standard ESRS E1 Climate change was designed, which addresses the issues of climate change mitigation and adaptation to climate change (European Financial Reporting Advisory Group, 2023). The new regulations and general trends based on the growing significance of ESG present an opportunity for increased implementation of climate adaptation solutions in housing buildings. The gradual introduction of these solutions in cities represents an opportunity and potential to elevate cities to a higher level of resilience to climate change.

4.2. Risks in housing investments

For this study, ESG strategies and reports from real estate sector companies, such as developers and construction companies, which directly influence the shaping of urban housing buildings, were reviewed. The analysis allowed us to collect diverse data. The research findings indicated that the most frequently addressed issue in these documents is the reduction of GHG emissions, which was included by 95% of companies. By contrast, a significantly smaller portion of companies (40%) addressed climate change adaptation and extreme climate events.

The analysis revealed that information regarding the adaptation of buildings to climate change is not as uniform as that related to actions for reducing GHG emissions. In the documents, there are sporadic direct references to the need to adapt to climate risks threatening cities, such as strong winds, intense rainfall and flash floods, high temperatures and urban heat islands, drought, water shortages, pollution, and biodiversity loss. Additionally, the information presented on climate change adaptation is often narrow in scope or omitted.

The research results allowed us to identify four approaches to addressing adaptation and climate risks:

1. A complete approach – includes a comprehensive reference to the need for climate change adaptation, a discussion of climate risks, and a presentation of specific adaptive solutions.
2. A partial approach – refers to the need for climate change adaptation, discusses selected climate risks, and presents some adaptive solutions.
3. A basic approach – there is a general reference to climate change, indicating solutions that have a positive impact on the environment.
4. A missing approach – does not refer to climate change, climate risks, or environmental or adaptive solutions.

The study allowed us to identify good practices in presenting climate risks and their impact on housing investments, including buildings and their surrounding areas, construction sites, and construction workers. The details are presented in Table 1.

4.3. Adaptive solutions introduced in housing investments

In the next stage of the research, good adaptive practices implemented in housing investments were identified. The collected practices were classified according to proposed categories, such as: sustainable water management and flood risk minimization; strengthening resilience to strong winds; enhancing resilience to high temperatures and droughts; reducing urban heat islands; energy efficiency and energy security; biodiversity protection and development; and sustainable urban development. Additionally, the number of entities that disclosed such practices in their ESG reporting was indicated. The results are presented in Table 2.

In the context of sustainable water management and flood risk minimization, good practices include rainwater harvesting, which can be used to irrigate plants and rain gardens. Additionally, important solutions are green roofs, the construction of retention tanks, bioretention basins, infiltration swales, drainage systems around buildings, as well as emergency drainage systems and the introduction of protective elements in investments located near the sea.

Table 1. Climate risks and their consequences identified in ESG documents of real estate sector entities

Risks	The Impact of Climate Phenomena on Housing Investments	
Heavy rainfall, flooding (urban floods), rising sea levels	Housing buildings and the surrounding area	• Submerged garages and basements • Increased load on stormwater drainage • Rise in exposure of façades to rainwater, leading to potential moisture damage • Impact on the durability of structures and materials used • Interruptions in energy and water supplies • Dieback of vegetation
	Construction site	• Increased insurance costs for assets and equipment • Interruptions in energy and water supplies
	Construction workers	• Threats to life and health
Extremely high temperatures and droughts.	Housing buildings and the surrounding area	• Deterioration of thermal comfort in rooms, impacting the health and safety of users • Danger of building structure damage • Interruptions in the supply of energy and water • Increased demand for energy for cooling • Fire hazards • Soil dehydration • Plant decay • Changes in the availability and prices of resources, such as water and electricity
	Construction site	• Delays in construction work • Changes in the availability and prices of resources, such as water and electricity
	Construction workers	• Threats to life and health
Strong winds and hurricanes.	Housing buildings and the surrounding area	• Damage to architectural elements and façades • Impact on building structures and façade stability • Power outages • Failures and damage to buildings and infrastructure • Safety risks for building users and surrounding areas
	Construction site	• Difficulties in assembly work • Possibility of temporary fences shifting on construction sites • Damage to equipment on construction sites • Delays in construction work and deliveries • Increased insurance costs for assets and equipment on the construction site
	Construction workers	• Threats to life and health

Source: Own elaboration based on the analysis of reports and strategies from entities listed on the WIG-Real Estate and WIG-Construction indices.

Table 2. Adaptive best practices disclosed in ESG documents implemented in investments

Category	Disclosed adaptation practices in investments
Sustainable water management and flood risk minimization	• Rainwater harvesting (4 companies) • Retention tanks (2 companies) • Rain gardens (5 companies) • Green roofs (4 companies) • Drainage systems around buildings (1 company) • Emergency drainage systems (e.g., storm overflow) (1 company) • Protection for investments located near the sea (1 company)
Enhancing resilience to strong winds	• Proper construction site security (1 company) • Building façade safety (2 companies) • High durability of materials (2 companies)
Enhancing resilience to high temperatures and drought, and reducing the urban heat island effect	• Light-colored façades and surfaces (2 companies) • Energy-efficient devices (1 company) • Introduction of drought-resistant plants (4 companies) • Reduction of water consumption on construction sites (1 company) • Water-saving devices (1 company) • Use of greywater (1 company) • Water leak detection systems (1 company)
Energy efficiency and energy security	• Energy-efficient buildings (12 companies) • Renewable energy (8 companies)
Protection and development of biodiversity	• Protection of fauna and flora (14 companies)
Sustainable city development	• Employee education on sustainable development (9 companies) • Building certification (6 companies) • 15-minute city concept (4 companies) • Investments in urban areas to counter urban sprawl (2 companies) • Mixed-use development (1 company)

Source: Own elaboration based on the analysis of reports and strategies from entities listed on the WIG-Real Estate and WIG-Construction indices.

Good practices for strengthening the resilience of investments against strong winds include proper construction site security. These practices also involve maintaining building façades through more frequent inspections and repairs, as well as eliminating external elements from designs that could pose a risk of detachment during strong winds. Additionally, incorporating durable materials into designs that enhance resilience to strong winds, floods, and high temperatures is considered a good practice.

Another group of best practices includes those that build resilience to high temperatures and droughts, as well as reduce the urban heat island

effect. These practices involve the use of light-colored façades and surfaces, as well as energy-efficient devices that help reduce the demand for air conditioning in response to climate warming. Other actions include reducing water consumption on construction sites by monitoring its usage and implementing water-saving devices in buildings, water leak detection systems, and the use of greywater.

In the context of energy efficiency and energy security, actions to reduce energy demand both in buildings and on construction sites were identified. Regarding the development of energy-efficient buildings, practices focus on appropriately insulating building envelopes, efficient ventilation, cooling and heating systems, as well as energy management. Among the best practices identified, the introduction of renewable energy (RE) sources in housing investments, such as photovoltaic panels, heat collectors, and heat pumps, should be highlighted.

Another identified category is the protection and development of biodiversity. In investments, actions are taken to reduce lawn areas in favor of mini-habitats, prevent the spread of invasive plants, and minimize monoculture areas of flora while aiming to achieve a balance between native flora and beneficial fauna. Green roofs are also being introduced, along with plants that are suitable for local conditions (hydrophilic, drought-tolerant): and birdhouses and bee hotels are installed. A particularly important role is played by a broader and strategic approach based on the creation of Biodiversity Management Plans. On construction sites, companies care for fauna and flora, including the protection and preservation of shrubs during construction work, transplanting trees when they conflict with the investment, and implementing compensatory plantings. Best practices also include collaborating with a dendrologist or ecologist.

The companies analyzed in the documents also highlight solutions that contribute to the sustainable development of cities. These primarily include educational activities on sustainable development, climate change, and the circular economy. Promoting knowledge among employees and future users fosters pro-ecological actions and raises awareness of the importance of implementing sustainable solutions in investments. The research results indicate that companies focus on certifying investments through systems such as BREEAM (Building Research Establishment Environmental Assessment Method) or LEED (Leadership in Energy and Environmental Design). A building's certification confirms the use of modern technologies in areas such as energy, water, waste, space quality, climate change, and the circular economy. The companies studied aim not only to increase the number of certified investments but also to achieve higher certification levels.

The documents disclose the practice of developing the 15-minute city concept as well as investments in urban areas to counter urban sprawl. Investors focus on optimizing the location of investments in terms of accessibility to public transportation, services and trade, recreation and sports facilities, healthcare, education, and green spaces. The disclosed practices also include the development of mixed-use spaces, i.e., areas that combine at least two primary functions, such as housing and commercial services. The aim of these projects is to meet the needs for living, working, and leisure in one place. For the city, this means reducing road traffic, decreasing pollutant emissions, and improving the quality of life.

5. Discussion

Adapting to climate change is one of the key challenges faced by modern cities. A crucial element in building resilience is the implementation of sustainable housing investments. Research findings suggest that the solutions incorporated into investments support cities' adaptation to climate change. Investors are increasingly opting for green roofs and rain gardens, which are part of blue-green infrastructure. This infrastructure plays an important role in addressing issues related to flooding, drought, the urban heat island effect, and biodiversity (Kimic & Ostrysz, 2021; O'Donnell et al. 2021). Rain gardens reduce the risk of flooding (Wanitchayapaisit et al. 2020) and mitigate the effects of drought (Kasprzyk et al., 2022): while green roofs help retain water on-site and slow down the runoff to stormwater drains (Palla & Gnecco, 2018). In this way, they reduce the risk of flooding housing buildings (basements, window wells) and public areas such as streets, bike paths, and pedestrian walkways.

The increase in blue-green solutions in housing development supports urban actions that are primarily focused on public spaces, creating a symbiosis between adaptive solutions in both public and private spaces. Green roofs also present an opportunity to reduce building temperatures (Tseng et al., 2022) and decrease the demand for energy needed for cooling (Bevilacqua, 2021). In a broader context, they help reduce the urban heat island effect (Jahangir et al., 2024): improve air quality,

and reduce GHG emissions. Moreover, they create the potential to develop and protect biodiversity (Wooster et al. 2022): serving as locations for ecosystem services in built environments (Droz et al., 2021).

Rainwater harvesting and the use of greywater in housing investments can help cities increase their resilience to water shortages and droughts. Greywater, which comes from everyday activities in buildings is a resource that, after proper treatment, can be reused. Greywater and rainwater serve as complementary water sources (Kilinc et al., 2023): and their collection and reuse enable the implementation of circular economy principles in water management.

In the face of high temperatures and droughts, a best practice in urban areas is the introduction of vegetation that is resistant to prolonged water shortages. Greenery plays an important environmental and social role, and planting drought-tolerant plants is a key element of climate change adaptation. An example of best practices is the protection and planting of trees, which serve to purify the air and provide shade for buildings, infrastructure, and users of the space on hot days (Global Center on Adaptation, 2020).

Among the best practices implemented in response to high temperatures is the use of light-colored façades and surfaces. The so-called Cool roofs represent a solution that can help reduce temperatures in buildings, lower cooling costs, and mitigate the urban heat island effect (United States Environmental Protection Agency, 2025). Strengthening the resilience of housing buildings to high temperatures helps protect the lives and health of residents, including the elderly. This, in turn, strengthens the resilience of residents and the healthcare sector.

Best practices include improving the energy efficiency of buildings and incorporating renewable energy sources, especially photovoltaic panels and heat pumps. Improving the energy efficiency of buildings contributes to the development of a low-emission and resource-efficient economy in urban areas (Polesello & Johnson, 2016; Fang & Zhou, 2025). On-site energy generation provides an opportunity to strengthen the resilience of housing resources and cities in terms of energy security. In cases of disruptions in energy supply from the city grid caused by strong winds, hurricanes, or floods, households are able to generate energy for their own needs. Similarly, the use of high-quality, durable materials in investments enhances the technical safety of buildings and supports the development of a circular economy (Ramakrishna & Jose, 2022).

The implementation of adaptive solutions in housing investments is beneficial for cities and residents, which is why including adaptive actions in investors' ESG strategies is becoming increasingly important. Research shows that despite growing awareness of climate change, adaptation still takes a backseat to reducing GHG emissions. This is a result of progressing regulations at the EU and member state levels, such as the Energy Performance of Buildings Directive, which focuses on developing zero-emission buildings. Climate change adaptation is generally treated as a secondary issue. Research has shown a lack of a uniform approach to reporting adaptive actions. This highlights the importance of the ESRS E1 – Climate Change thematic standard, which provides reporting frameworks for companies. It represents an opportunity for the development of actions in this area.

Climate change adaptation is local in nature, in contrast to mitigation policies, which require global actions. It is important that new housing developments incorporate adaptive solutions that address local adaptation needs and do not lead to maladaptation, meaning situations where the introduced solutions bring both benefits and negative consequences (Schipper, 2022). Investors should rely on locally created climate adaptation strategies for cities. These strategies present a diagnosis of the city's situation regarding current and predicted climate changes, an analysis of the city's exposure (i.e., climate hazard analysis): vulnerability (an assessment of the potential negative and positive impacts on the city): adaptive capacity (an evaluation of possible actions in response to climate change consequences): and susceptibility. It is a function of the type, intensity, scale, and speed of changes to which the city is exposed, its vulnerability, and its adaptive capacity. Furthermore, these strategies provide area- and sector-specific analyses and include concrete adaptive actions (called adaptation options) (Kassenberg et al., 2019).

Furthermore, investors should consider adapting housing investments at the micro level, taking into account their impact on surrounding areas. For example, introducing a new development can increase the vulnerability of surrounding areas to risks such as flooding. The new development may cause changes in the water balance, groundwater levels, and rainwater runoff paths (McGrane, 2016; Kowalczyk, 2017, Geng et al., 2024). It may also affect the city's ventilation and exacerbate the urban heat island effect. Therefore, there is a need to consider the impact of new investments on the resilience of the neighborhood and the city while

involving and incorporating the views of the local community.

Investing in adaptive solutions may involve financial risks. The costs of modern technologies are an important factor for investors, as they directly impact property prices and market appeal. Support for such investments can come from government programs that subsidize photovoltaic installations, heat pumps, or energy storage systems (Ministry of Climate and Environment, 2024). Additionally, financial instruments such as tax exemptions, subsidies, and preferential loans can promote the implementation of ecological solutions.

A supporting instrument is the introduction of adaptive regulations. For example, Copenhagen's Green Roof Policy has required green roofs on buildings with roof slopes of less than 30% since 2010. Meanwhile, in France, the Biodiversity Act and Green Roof Statement (2015) oblige developers to construct green roofs or install solar panels on all new commercial buildings (Savarani, 2019). Meanwhile, Colombia has incorporated cool roofs into its building and energy codes (United States Environmental Protection Agency, 2025).

6. Conclusions

Climate change is one of the key challenges facing modern cities. High temperatures, hurricanes, and floods require local authorities, urban planners, and designers to take action to strengthen resilience to climate change. There are many adaptation strategies that can help minimize the negative effects of these phenomena. The strategy proposed in the article involves treating housing development as a tool for building resilience through properly designed buildings and spaces.

The role of housing buildings in socio-economic life is evolving. Initially, buildings were only meant to provide housing and a sense of security. Today, however, their significance takes on new dimensions. Housing buildings are becoming places of work, as well as a key element in reducing greenhouse gas emissions and adapting to climate change. This new role supports the strengthening of climate resilience in cities and solving urban environmental problems.

The standardization and growing importance of reporting on climate change adaptation by real estate and construction companies represent a huge opportunity to implement modern ecological solutions in new urban developments. This, in turn, can enhance the resilience of neighborhoods, public spaces, and entire cities. It is important that the introduction of adaptive solutions is well thought out, coordinated, and aligned with local needs and community expectations. This will help eliminate greenwashing, which is a significant issue in the contemporary shaping of sustainable development.

Introducing adaptive solutions in new housing developments can, over the long term, improve the image of cities. Buildings that meet high ecological standards are increasingly becoming attractive not only as places to live but also for businesses and institutions seeking sustainable spaces to work in. Such development aligns with sustainable city development concepts such as green city, smart city, and resilient city.

In conclusion, the implementation of adaptive solutions in housing resources contributes to the increased resilience of the city. It is also essential to consider introducing adaptive solutions in public and commercial spaces. The synergy of the actions taken forms the foundation for sustainable and resilient urban development.

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