

EMPIRICAL ANALYSIS OF FINANCIAL BARRIERS IN THE TRANSITION TO SMART CITIES IN BULGARIA

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Abstract: *The transition to smart cities in Bulgaria is particularly important for sustainable urban development. However, it is being delayed due to serious financial barriers and market imperfections. Traditional budget subsidies have been exhausted, which necessitates the exploration of new market mechanisms. The article identifies the severity of financial constraints facing Bulgarian municipalities based on an empirical survey among 43 experts and the definition of a working strategic framework of alternative financial instruments. The analysis outlines six main problems. The most serious are the lack of targeted state funding, limited access to European programs due to lack of capacity and weak interest from private capital. A complex set of green bonds, social impact bonds and shared venture capital funds tied to performance indicators (KPI) is proposed as a solution.*

Keywords: *Intelligent Cities, Smart Cities, Financial Barriers, Green Bonds, Urban Innovation*

JEL: H72, O18

1. Introduction

In the current context of globalization and urbanization, the concept of smart cities has emerged as a leading concept for achieving sustainable development. The integration of digital technologies, the Internet of Things (IoT) and big data management systems in the urban environment is crucial for addressing the environmental and infrastructure challenges of the 21st century. (Harrison, 2010, 54 (4)) (Hall, 28 September 2000) (Kuntsman, 2024) (Marchesani, 2022, 26(24)) In the context of Bulgaria, however, this transition is taking place with a significant delay. The main inhibiting component is the presence of deep market imperfections and financial barriers to local authorities. Traditional models of public financing, relying primarily on state subsidies and direct European funds, prove to be insufficient. This determines the relevance of the research aimed at decomposing these economic constraints and the search for alternative market mechanisms applicable in Bulgarian municipalities.

The subject of this empirical study is the process of economic and digital transformation of large Bulgarian cities on the path to building an intelligent and sustainable urban environment.

The subject of the study is the specific financial and economic barriers, market defects and potential alternative financial instruments that determine the effectiveness of this transition in Bulgaria.

The main goal of the article is, based on an empirical analysis of the opinions of a wide range of experts (conducted in 2025), to identify the burden of individual financial constraints facing Bulgarian municipalities and to define a working strategic framework of alternative financial instruments and KPIs that will accelerate the transition to smart cities in the country.

2. Theoretical framework: market imperfections and urban innovation

To understand why smart cities are lagging behind, we need to look at how funding is allocated. In economics, there is a concept called “market failure.” This occurs when the free market and trade alone cannot direct money to the things that are most beneficial to people. In the case of smart cities, these market failures are very clearly visible through several key obstacles: (Moolngearn & Kraiwanit, 2024, 5 (2)) (Shahrour, 2024) (Huszar & Gyura, 2026)

- Long wait for returns. Individuals and buyers are looking for a quick and secure profit. However, urban innovations require too much financial resources at the very beginning, and their fruits come after many years. This stops entrepreneurs.
- Public goods without direct profit. Cleaner air, better waste management, and less traffic congestion are good for absolutely everyone. However, a private company cannot take money directly from every citizen for making the air easier to breathe.
- There is a lot of uncertainty about the new. Technology is changing too quickly. Investors are afraid that what they are paying for today will be obsolete and unnecessary tomorrow.

For these reasons, intervention by the state and the authorities is necessary. The basic thing is to provide funds from the general state budget. In addition, the state must create new ways of sharing the burden and risk (Grozeva, 2012).

This is where special monetary instruments come in. The state or municipality can issue targeted environmental debt securities and debt securities for public good. In these, associations and citizens lend funds for clean and useful urban events, and the government guarantees their return. Another way is to create common funds for shared risk capital, where the state and private companies participate with equal strength (Грозева, 2024).

But for these tools to work, they need very precise reporting with metrics for success . They need to accurately measure how much pollution has been reduced, how much electricity has been saved, and how much traffic congestion has been reduced. Only then can the people who give their money be sure that their money is delivering real social, economic, and environmental benefits (Веселинова, 2012).

3. Methodology of empirical research

This article is part of a much larger and more comprehensive scientific study. This large study was conducted between August and November 2025. Its goal is to outline the opportunities and obstacles to the transformation of Bulgarian cities.

43 people took part in the overall study. These are people from four main groups who are directly related to the topic:

- Local government officials responsible for urban planning and the introduction of new technical means;
- Representatives of the business community and businesses who create and offer smart solutions;
- Scientists and researchers in the field of sustainable urban development and urban planning;
- Representatives of civil society organizations that express the voice and needs of people in cities.

Data collection with these 43 participants was conducted as semi-structured in-depth interviews. This way of working allowed for great flexibility. It allowed for a common framework of questions to be followed, but also gave people the freedom to explain their views in depth. The questions in the large study were divided into three main sections: obstacles, government readiness and development opportunities (Грозева, 2019).

It is important to note that in this article we focus specifically on one key question. This is the question of the economic and financial constraints that stop urban renewal. Through this targeted look, we want to unravel in detail the deepest and most important obstacle to smart cities in Bulgaria, by stepping on the precise answers of the interviewees.

4. Results and analysis of financial and economic constraints

The primary data collected from the 2025 survey provide a very accurate and clear picture of the financial obstacles facing Bulgarian municipalities. The responses of the 43 experts outline six main groups of problems. Each of these responses shows a different side of

the market failures in Bulgaria. Below is a detailed analysis of the results obtained, ordered by their severity (Веселинова, 2025).

Lack of targeted government funding for smart city projects (34.7%)

This is the most frequently mentioned answer in the survey and collects over a third of the votes of the participants. This high share reveals a very deep and difficult to overcome problem in our country. Local authorities in Bulgaria are used to being highly dependent on the decisions of the central government and the money allocated from the state budget (Веселинова, 2025).

The big obstacle here is that smart cities are not yet included as a separate and important item in national development plans. State money usually goes to urgent repairs of old infrastructure - roads, water supply networks and building repairs. Since there are no specially allocated state funds just for smart technologies, municipalities fall into constant inactivity. They are not sure that if they start a smart project, they will have the money to complete it. This gives rise to a constant shortage of funds and general inertia in local self-government.

Limited access to European and international funding programs (23.8%)

Almost a quarter of the responses point to this problem. At first glance, it seems strange that municipalities cannot take money from the European Union, since such funds exist. However, the data reveals a hidden deficiency in the capacity of both local governments and Bulgarian businesses.

To get money from an international program, a lot of preliminary preparation is needed. It turns out that our municipalities lack trained people who can write a competitive and competent proposal. The administrative requirements are very complex, and the bureaucratic obstacles and heavy documentation scare away local experts. Thus, many good ideas for smart cities remain only “on paper” because there is no one to go through the difficult process of applying and reporting foreign funds (Веселинова, 2009).

Insufficient interest from private investors and businesses (20.8%)

Every fifth responsible expert notes the lack of interest from private capital. This confirms what was said in the theoretical framework - the market sees too much risk in urban innovations. Private companies and entrepreneurs want to know exactly when they will get their money back and what their profit will be.

In smart cities, however, the benefits are often public and difficult to measure in value. The state and municipalities have not yet created any economic incentives (e.g. tax breaks or lower administrative fees) to attract entrepreneurs. Without such incentives, private capital

prefers to invest its financial resources in traditional industries. There is no risk of long-term renewal of the urban environment.

Lack of public-private partnership mechanisms (10.9%)

This result shows a serious legal gap. In advanced countries, joint work between the municipality and private business is the main way to build expensive facilities. In this model, the company provides the money and equipment, and the municipality provides the land and guarantees its use by citizens.

However, this model does not work in Bulgaria. The participants in the study emphasize that there is a lack of clear and secure rules for such cooperation. There is no working legal framework that would equally protect the rights of both the municipality and the private company. The fear of corruption or failure of the agreements makes both parties stay away from each other. This closes the door to sustainable and shared financing.

High initial costs for technology implementation (5.9%)

Although smart technology, sensors, and computer systems are extremely expensive, this answer garners a very small share of the votes. This gives us a very important conclusion, namely that the people who make decisions are not afraid of the cost of technology itself. They are aware that new things cost money.

The problem is that there are no paths for these funds to reach the municipality. If the issues with state and private funds were resolved, the cost of the technologies would not be an obstacle.

Other financial challenges (3.0%)

The smallest share of responses covers problems internal to the municipalities. These include difficulties in arranging local budgets, poor planning of expenditures by year, and the complete lack of monetary rewards or incentives for municipalities that achieve good environmental results.

The results of our study prove that financial obstacles in Bulgaria are systemic in nature. They are interconnected. Without changing the rules and without creating new ways to attract money, smart cities in our country will remain in pieces. This will doom our country to lagging behind other European countries.

5. Alternative financial instruments to overcome barriers

To overcome the defined market defects and the chronic shortage of budget funds, it is necessary to move from traditional subsidies to innovative financial instruments. They allow the transformation of public risk into shared. They provide access to diversified private capital.

Table 1 presents a detailed structural matrix of the proposed alternative instruments, their mechanisms, applicability, risk profiles and relevant KPIs.

Table 1

Matrix of alternative financial instruments and KPI framework for smart city projects in Bulgaria

A financial instrument	Source of capital	Areas of application	Risk profile	KPIs
Green bonds	Issuance of target debt securities by municipalities on the Bulgarian Stock Exchange (BSE). Investors are pension funds, commercial banks and citizens.	- Decarbonization of public transport; - Energy efficiency of public buildings; - Construction of renewable energy sources for local needs.	Low to moderate risk. Guaranteed by municipal revenues and taxes. Risk of "greenwashing", subject to independent audit.	- Reduction of CO₂ emissions (t/year); - Energy saved (MWh); - Share of RES in the municipal mix (%).
Social Impact Bonds	Private investors finance the project initially. The municipality pays the principal and premium only upon achieving predefined social results.	- Smart traffic management systems; - Smart city security and lighting.	Moderate to high risk for the investor. Risk is minimized through precise design.	- Reduction in travel time (%); - Reduction in incidents in urban areas (%); - Efficiency of urban lighting.
Shared venture capital funds	Joint funds between the Fund of Funds (public resource) and private venture capital associations. Financing of project companies (SPV) on a market basis.	- Development of urban software platforms and Big Data systems; - IoT sensor networks; - Urban innovation startups .	High risk. Technological uncertainty. Minimized through portfolio diversification and professional management by private partners.	- Number of implemented patents and innovations; - Additional private capital attracted; - Return on investment (ROI).
Hybrid financing	Combining EU grants (up to 30%) with low-interest loans from international financial institutions (EIB, EBRD) and commercial co-financing.	- Large-scale infrastructure projects; - Regional waste landfills with smart separation.	Moderate risk. Risk of administrative delay and non-recognition of costs under EU programs. Requires experienced management.	- Percentage of reduction in water losses in the water supply network; - Share of recycled waste; - Financial leverage .

Source: own summary

The financial sustainability and efficiency of these projects are assessed through the socio-economic return coefficient, which extends standard financial analysis. Traditional investors only calculate direct cash savings or revenues for the municipality. New tools now also take into account the estimated social value.

This includes environmental benefits (such as saved healthcare costs and carbon credits thanks to cleaner air) and social benefits (such as time saved by citizens due to the absence of traffic jams).

With a traditional market approach, smart city projects often seem unprofitable due to the long payback period. However, through the implementation of green bonds and social impact bonds, these social and environmental externalities are transformed into a real economic stimulus. All this provides a solid rationale for their long-term and sustainable financing.

6. Conclusion and strategic recommendations

The empirical analysis of financial and economic constraints reveals that the barriers to the transition to smart cities in Bulgaria are systemic, structural and institutional in nature. The data from the in-depth interviews clearly prove that the main obstacle is not the high cost of modern technologies. It is the lack of functioning market channels and financial instruments through which capital can reach municipalities.

Market defects are most strongly manifested through the chronic dependence of local authorities on the central state budget and the limited opportunities for attracting private and public investments. In the conditions of modern economic reality, the traditional model of financing entirely through subsidies has been exhausted. In order for Bulgarian cities not to lag behind European standards for sustainable development, a radical change in approach is necessary.

Based on the results of the study, the following three strategic recommendations are formulated:

- Establish a National Fund for Urban Innovation and Technical Assistance. Since limited access to European programs is mainly due to the lack of administrative capacity in municipalities, the state should provide a specialized unit. This fund should help local experts in preparing complex smart city projects, removing heavy bureaucratic obstacles and preparing ready-to-implement innovative proposals.
- Updating the regulatory framework for public-private partnerships. To overcome the low interest from business and the lack of working mechanisms for cooperation, a clear and secure legal framework is urgently needed. The new rules should ensure

predictability for private capital, share risk between the municipality and the company, and introduce tax breaks for companies investing in smart cities.

- Shifting to alternative market financing. Bulgarian municipalities should actively pursue the issuance of municipal green bonds and social impact bonds. These instruments allow raising funds directly from citizens, pension funds and banks, tying payments to real results (energy saved, pollution reduced or less congestion) measured through transparent KPIs .

In conclusion, the transition to smart cities in Bulgaria is only possible by opening local governments to private capital and innovative financial instruments. The successful implementation of these recommendations will allow Bulgarian municipalities to transform into modern, clean and economically sustainable urban systems.

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