

**UNIVERSITY OF ECONOMICS – VARNA
FACULTY OF ECONOMICS
DEPARTMENT OF BUSINESS, INVESTMENTS, REAL ESTATE**

Neli Atanasova Dimitrova

SUSTAINABLE CONSTRUCTION IN BULGARIA

**A B S T R A C T
of a dissertation**

**for the acquisition of an educational and scientific degree
“Doctor” in the professional field of 3.8 “Economics”, doctoral
program “Economics and Management (Construction and Real
Estate)”**

**Varna
2025**

The dissertation consists of 294 pages including:

- Introduction – 4 pages;
- Main text (three chapters) – 195 pages;
- Conclusion – 4 pages;
- List of references – 80 sources;
- List of electronic sources (websites) – 188;
- Tables – 26;
- Figures – 57.

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SUPERVISOR:

Assoc. Prof. Dr. Katya Nedelcheva Antonova

SCIENTIFIC JURY:

1. Prof. Dr. Teodorina Zhelyazkova Turlakova
2. Assoc. Prof. Dr. Todor Stoyanov Raychev
3. Assoc. Prof. Dr. Emil Krastev Papazov
4. Assoc. Prof. Dr. Lyudmila Mihaylova Mihaylova
5. Assoc. Prof. Dr. Yana Georgieva Stoencheva

RESERVE MEMBERS:

1. (Internal) Prof. Dr. Tanka Vasileva Milkova
2. (External) Assoc. Prof. Dr. Dragomir Zhelchev Stefanov

REVIEWERS:

1. A
2. B

**Varna
2025**

The dissertation has been reviewed and approved for defense by the Department of Business, Investments, and Real Estate at the University of Economics – Varna.

The author is a doctoral student at the Department of Business, Investments, and Real Estate at the University of Economics – Varna. The research and development of the dissertation were carried out at the same university.

Author: Neli Atanasova Dimitrova

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I. GENERAL CHARACTERISTICS OF THE DISSERTATION

1. Relevance of the Topic

The rapid pace at which the world around us is developing imposes the need to rethink of how we live and how our actions impact the environment and the quality of life. The development of construction and the growing demand for housing require the implementation of more sustainable and environmentally conscious practices and approaches in every aspect of life. Nowadays, sustainable construction is established as an inevitable process that successfully integrates environmental, social, and economic aspects in the planning, design, construction, operation, and eventual deconstruction of buildings and infrastructure. It serves as a key tool for mitigating adverse environmental impacts, increasing overall energy efficiency, and optimizing the use of scarce natural resources. In this context, sustainable construction is gaining increasing importance as a fundamental factor in reducing the carbon footprint and achieving long-term sustainability.

Numerous European and international organizations demonstrate a high degree of commitment in terms of imposing environmental standards, applying innovative technologies, and promoting the use of eco-friendly and recycled building materials. The European Union has developed a number of documents and legislative acts to guide member states in their efforts to achieve carbon neutrality by 2050. Although Bulgaria follows the guidelines of the European Union and successfully implements energy efficiency mechanisms, there are also some challenges that need to be addressed. The lack of a Bulgarian certification system for sustainable construction, the low level of public awareness, and insufficient legal regulation and incentives from the state are the main obstacles that the state must overcome.

2. Object and Subject of the Research

The object of the dissertation is sustainable construction in Bulgaria, examined in the context of its development, regulation, and application in the practice of Bulgarian construction enterprises.

The subject of the dissertation research includes the development of sustainable construction and building sustainability certification systems, the influence of European and national legislation on the stage of development of sustainable construction, as well as the opportunities for adaptation and application of international best practices in Bulgaria in order to promote the concept and ensure a better quality of life for future generations. with the aim of promoting the concept and ensuring a better quality of life for future generations.

3. Aim and Objectives of the Research

The aim of the author of the dissertation is to examine the state of construction enterprises in Bulgaria and to propose pathways for increasing the volume of sustainable construction at national level. In addition, it is necessary to analyze and monitor the current state of sustainable construction in the country and to propose specific steps for its improvement and promotion.

To achieve the defined aim, the author sets the following applied research objectives:

1. To study the theoretical foundations, conduct an analysis, and refine the conceptual framework by examining the essence and key characteristics of sustainable construction in the context of the sustainable development concept.

2. To carry out a comparative analysis of the most established international certification systems for sustainable construction, evaluating their advantages and disadvantages, and on this basis, to propose a Bulgarian certification system for sustainable construction that is competitive with the international models and adapted to the Bulgarian legislation, traditions, customs, and needs.

3. Based on statistical information, survey data, and the applicable European and Bulgarian legislation, to analyze the development of sustainable construction in Bulgaria and compare its status with that of other European countries.

4. To formulate conclusions and recommendations for improving professional education and training in the field of sustainable construction by proposing a Bulgarian training program in sustainable construction aimed at developing competent professionals for the construction sector.

4. Research Thesis of the Dissertation

The main thesis supported in the research is that there are opportunities for a broader application of sustainable practices within the activities of construction enterprises across Bulgaria, as well as for increasing the number of certified buildings according to some of the existing international standards. The potential for growth in

the number of certified buildings depends on the presence of incentive policies, institutional support, awareness among participants in the construction process, and market demand. For investors, sustainable construction offers a wide range of benefits such as higher property value, lower operational costs, and better access to finance.

5. Research Methodology

In-depth theoretical and empirical analysis, including comparative studies, assessment of existing regulations and practices at national and international level, are the basis of the dissertation. A variety of research methods have been employed, such as comparison, generalization, analysis and synthesis, survey research, and others. Various research methods are used, such as: comparison, generalization, analysis and synthesis, survey research, etc. The study is based on statistical information for the period 2013 – 2023, as well as on the results of a survey conducted in 2023 among Bulgarian construction companies. The aim is to track the state of sustainable construction in Bulgaria during the period under review and making forecasts for its future development.

6. Research Limitations

The dissertation is developed under the following restrictions:

- Time constraints of the survey caused by the availability of statistical data.

7. Approbation

The dissertation has been discussed at meetings of the Department of Business, Investments, and Real Estate. Three publications (two articles and one conference paper) on the topic have been published in specialized academic journals.

8. Structure of the Dissertations

INTRODUCTION

Chapter One

THEORETICAL AND METHODOLOGICAL ASPECTS OF SUSTAINABLE CONSTRUCTION

- 1.1 Essential Characteristics of Sustainable Construction
- 1.2 Sustainable Building Certification Systems
- 1.3 Influence of European Legislation on National Policy in the Field of Sustainable Construction

Chapter Two

ANALYSIS OF THE SUSTAINABLE APPROACH TO PROJECT IMPLEMENTATION IN THE CONSTRUCTION SECTOR IN BULGARIA

- 2.1 General characteristics of the Construction Sector
- 2.2 Assessment of the State of Sustainable Construction in Bulgaria
- 2.3 The State of Sustainable Construction in Other Countries

Chapter Three

OPPORTUNITIES FOR IMPROVING SUSTAINABLE CONSTRUCTION IN BULGARIA

- 3.1 Implementation of Good Business Practices in Sustainable Construction: A Case Study of Belgium
- 3.2 Bulgarian Sustainability Certification System in Construction as a Prerequisite for Stimulating Projects in the Sector
- 3.3 Measures to Enable Vocational Education and Training in the Field of Sustainable Construction

CONCLUSION

REFERENCES

APPENDICES

II. SUMMARY OF THE DISSERTATION

INTRODUCTION

The introduction substantiates the relevance of the research topic. It defines the object and subject of the study, the scientific aim, the applied research objectives, and the main research thesis. The applied research methods, the scope limitations, and the sources of information used in the study are presented.

CHAPTER ONE THEORETICAL AND METHODOLOGICAL ASPECTS OF SUSTAINABLE CONSTRUCTION

Chapter One of the dissertation is devoted to the theoretical foundations of construction and sustainability in this field. It examines the essence of these concepts and specifies some basic concepts in this field. The chapter presents an analysis of the most established international building certification systems, examining the interrelations between them. A comparison is made of the evaluation criteria, their relative weighting in the final score, the types of certificates awarded, and the systems' areas of application. Chapter One concludes with a detailed analysis of the existing European legislation and its impact on national policy in the field of sustainable construction.

The first section of Chapter One presents the theoretical foundations of sustainable construction. This section examines the construction sector in Bulgaria, highlighting its specific characteristics. Various definitions of the concepts of "construction," "sustainability," "sustainable development," and "sustainable construction" are clarified. This allows for the identification of the core aspects of these definitions and their analysis within the context of the current study. The focus of the first section is aimed at carrying out a comprehensive and in-depth analysis of the existing specialized literature on the concept of sustainable construction. For this purpose, the views of various authors and organizations are discussed as a summary of the definitions of sustainable construction in Table 1.

Table 1

Definitions of "sustainable construction"

Definition	Author/Source
A holistic process aimed at restoring and maintaining harmony between the natural and built environments and establishing agreements that promote human dignity and promote economic equality ¹ .	<i>Agenda 21 for Sustainable Building in Developing Countries</i> (1992)
Creating a healthy environment through the application of resource-efficient and environmentally based principles ² .	<i>Kibert, C. J.</i> (1994)

¹ United Nations (UN). (1992). *Agenda 21*. New York: United Nations.

² Kibert, C.J. Final Session of First International Conference of CIB TG 16 on Sustainable Construction, Tampa, Florida, 6-

Sustainable construction as a process also includes the stages of maintenance of buildings during their existence and the eventual demolition and recycling of the materials used in order to reduce the volume of waste as a result of their deconstruction ³ .	<i>Wyatt, D. P. (1994)</i>
A method of construction, the purpose of which is to reduce the (negative) effects on health and the environment caused by the construction process, or by buildings, or by the built environment ⁴ .	<i>Lanting, R. (1998)</i>
The sustainable production, use, maintenance, demolition and reuse of buildings and structures or their constituent parts ⁵ .	<i>International Council for Research and Innovation in Construction and Urban Planning (CIB) (2004)</i>
Sustainable construction, through its processes and products during their service life, aims to reduce the use of energy and emissions that are harmful to the environment and health, as well as providing appropriate information to customers in their decision-making process ⁶ .	<i>Huovila, P. & Richter, C. (2007)</i>
The planning and management of a construction project in accordance with the contract documentation in order to minimize the impact of the construction process on the environment ⁷ .	<i>Glavinich, T. (2008)</i>
The way forward lies in achieving a balance between the need to continued development and the responsibility to protect the natural environment, while simultaneously creating healthy, comfortable, and economically prosperous places for people to live, work, and enjoy life ⁸ .	<i>Zainul Abidin, N. (2010)</i>

Source: Compiled by the author based on a review of specialized literature

The analysis of existing definitions shows significant diversity, with each one covering different aspects of sustainable construction. The fundamental principles of sustainability in the context of construction are examined in order to explore the potential opportunities for its implementation (Table 2).

9 November 1994.

³ Wyatt, D.P. Recycling and Serviceability: The Twin Approach to Securing Sustainable Construction. In Proceedings of First International Conference of CIB TG 16 on Sustainable Construction, Tampa, Florida, 6-9 November 1994, pp. 69-78.

⁴ Lanting, R. Sustainable Construction in the Netherlands. Report 9 in CIB Sustainable Development and the Future of Construction. A Comparison of Visions from Various Countries, CIB Report Publication 225. Rotterdam: CIB, 1998.

⁵ International Council for Research and Innovation in Building and Construction.

⁶ Huovila, P. and Richter, C. Life Cycle Building Design in 2010. In: Proceedings of the 11th International Conference on Engineering Design ICED 97, Tampere University of Technology, 19-21 August 1997, Vol. 2, pp. 635-643.

⁷ Glavinich, T. Contractor's Guide to Green Building Construction Management, Project Delivery, Documentation, and Risk Reduction. Illustrated ed. *John Wiley & Sons*, 2008. ISBN 9780470137406.

⁸ Zainul Abidin, N. Investigating the Awareness and Application of Sustainable Construction Concept by Malaysian Developers. *Habitat International*, 2010, Vol. 34, №4, pp. 421-426.

Table 2**Fundamental Principles of Sustainable Construction**

№	Principle
1	Minimal energy consumption during construction and operation
2	Minimal water consumption during construction and operation
3	Minimal environmental impact
4	High living comfort
5	Aesthetic appearance
6	Durability
7	Maximum reuse of materials
8	Safety and security of buildings and facilities
9	High quality
10	Room for improvement

Source: Antonova, K. Impact of the Strategy for Sustainable Development of the European Union on the Bulgarian Construction Sector. Varna: Univ. Izd. Nauka i ekonomika, 2016.

Thus, the principles of sustainability in construction create conditions for the harmonious interaction between the building stock and the natural environment, meeting the modern requirements for sustainable development.

On the basis of the comparative analysis of the existing definitions and the study of the principles of sustainability, the author's refinement of the concept of "sustainable construction" for the purposes of the dissertation has been carried out, which defines it as "a process that covers all stages from the birth of the project idea to the completion of the construction site and its subsequent operation and demolition, using sustainable technologies and materials throughout the entire life cycle, which would prevent the imbalance of nature and pollution of the environment, while enabling current and future generations to meet their needs in an equally good way."

Based on the discussion presented in the first section of Chapter One, the author draws the following conclusions:

1. There is a wide variety of definitions of sustainable construction, but no unified definition has been established that is universally accepted by all authors and organizations.
2. Sustainable construction remains more of an exception in construction practices than a widely adopted standard not only in Bulgaria, but also globally.
3. The fundamental principles that characterize sustainable construction form the basis for developing strategies to achieve a balance between economic efficiency, environmental responsibility, and social sustainability.
4. Sustainable construction is a vital component for enhancing sustainable development, as it contributes to the preservation of ecological balance in nature.
5. The theoretical understanding of sustainable construction has been expanded, providing a foundation for identifying its role in the process of achieving sustainable development.

6. A refined definition of the concept of “sustainable construction” has been proposed by the author.

The second section of Chapter One is devoted to sustainable construction certification systems, highlighting their key characteristics and comparing the advantages and disadvantages of each of them. Their development at the international level began in the 90s of the twentieth century in response to the growing need for care and protection of the environment, the need for significant changes in the construction sector due to high levels of pollution, that it causes, as well as the excessive use of raw materials, building materials and electricity.

The variety of established sustainability assessment systems aims to recognize and reward organizations and companies that have committed to environmentally responsible (green) construction, and to encourage them to continue and expand their efforts in this direction. Certification can be applied during planning and design, construction, operation, maintenance, renovation, and eventual demolition of a building. The interrelationships between the different building certification systems are presented in Table 3.

Table 3

Relationship between different building certification systems

Certification System	Country	Year of establishment	Based on
BREEAM	UK	1990	- The first certification system established
HQE	France	1996	BREEAM
LEED	United States	1998	BREEAM
Green Globes	Canada	2002	BREEAM
CASBEE	Japan	2001	BREEAM, LEED
Green Star	Australia	2003	LEED, BREEAM
GBAS	China	2006	LEED, BREEAM, CASBEE
DGNB	Germany	2008	BREEAM, LEED, CASBEE, HQE, Green Star
Protocollo ITACA⁹	Italy	2004	SBTool
TQ (Total Quality)	Austria	1998	SBTool
SBTool Portugal	Portugal	2009	SBTool
SBTool CZ	Czech Republic	2010	SBTool
VERDE	Spain	2009	SBTool

Source: Compiled by the author based on a review of specialized literature

The various types of sustainability certification systems in the field of construction have been examined, among which only three stand out as internationally established: BREEAM (Building Research Establishment Environmental Assessment Method), LEED (Leadership in Energy and Environmental Design), and DGNB (German Sustainable Building Council), the

⁹ Iiritano, G., Petrunaro, G., Corasaniti, B., Bagagli, M., Federiconi, L. and Di Perna, C. ITACA Protocol: A Possible Path to Sustainability in the Governance of the Building Process. *The Sustainable City XV*, 2021, Vol. 253, pp. 111-122. DOI: 10.2495/SC210101. [online]. 2022. Available at: <https://www.witpress.com/Secure/elibrary/papers/SC21/SC21010FU1.pdf>.

latter gaining increasing popularity in recent years.

Although other certification systems such as Green Globes, CASBEE, Green Star, and Protocollo ITACA possess the potential and qualities to become internationally recognized standards, they are not as widely used on the global market. The only system beyond the aforementioned leaders that shows a strong global presence is HQE (High Environmental Quality standard).

BREEAM is the world's first building certification system, established in 1990 with the aim of improving the environmental performance of office buildings and providing high levels of comfort and a healthy environment for their occupants. In 2008, its international version was launched, followed by measures to facilitate its adaptation to local conditions in different countries. A distinctive feature of BREEAM is its exceptional flexibility, which allows it to be applied across a wide range of locations and building types worldwide.

The LEED standard has a broader international scope compared to the British BREEAM standard. Its goal is to assist owners and managers in making the most appropriate management decisions regarding environmental design, construction, and operation of buildings.

Both certification systems share the use of nine sustainability assessment criteria, each weighted differently in the calculation of the final rating.

DGNB also strives to become an international standard and has successfully established partnerships with several strategically important European countries. Local sustainable building councils have adapted the original DGNB certification system to their national requirements and operate as independent certification bodies. Depending on the nature of the certified project and the stage of its life cycle during which the assessment is conducted, the criteria and thematic areas vary and have different weights.

Despite Bulgaria's efforts to promote and stimulate the application of the principle of sustainability at every stage of the life cycle of buildings, the country has not yet developed its own certification system. The Bulgarian Green Development Council (BGBC) has not fully adapted the German DGNB system to the Bulgarian conditions under the cooperation agreement with the German Green Building Council, nor have the Bulgarian representatives further developed and implemented it on the territory of the country.

At the end of the second section of Chapter One, we come to the conclusion that there is an urgent need to develop an international assessment system supported by stakeholders and experts worldwide. According to Antonova and Kalchev¹⁰, the system should have 5 main characteristics:

- It should be transparent and flexible;
- It should be supported by research;
- It should consider all relevant factors;

¹⁰ Antonova, K. & Kalchev, R. Integrating LCA, LCC and S-LCA in the Assessment of Building Sustainability within the Framework of the Circular Economy. // Real Estate & Business Journal, University of National and World Economy Publishing House, Vol. 7, 2023, Issue 2, pp. 89–97. ISSN (print): 2603-2759, ISSN (online): 2603-2767.

- It should stimulate the design and construction of sustainable buildings, and
- It should maintain a quality-assured standard.

Based on the main characteristics and advantages and disadvantages of the individual sustainability certification systems in construction, we can summarize the following:

1. There is a wide variety of sustainability certification systems in construction, with only three of them established internationally.
2. Despite the potential and positive qualities of some of the systems, they are still not as widely used as BREEAM, LEED and DGNB.
3. The need for the creation of a unified international system for assessment of sustainable performance in construction has been identified. It must have 5 key characteristics. Its construction will facilitate the process of comparing different projects, and more generally will contribute to the transformation of our society into a more sustainable and environmentally conscious society.
4. Potential has been identified for the creation of a Bulgarian certification system for building sustainability in response to other member countries of the International Sustainable Building Council that have already adopted their own systems.

The third section of Chapter One focuses on European legislation and its influence on national policy in the field of sustainable construction.

The analysis begins with defining the EU legal framework, which includes two main types of legislation – primary and secondary. Primary legislation is based on the founding treaties, while secondary legislation is applied in accordance with the objectives of those treaties and includes regulations, directives, decisions, as well as non-binding legal acts such as recommendations and opinions.

The European Union, as a supranational organization vis-à-vis its member states, has the right to take action in certain areas in which the parties have conferred on it the relevant powers under the treaties concluded with them. It is established that there are three principles that determine in which areas and how the EU can carry out activities – delegated competence, the principle of proportionality, and subsidiarity. The powers held by the European institutions are grouped into three categories: the EU can legislate independently, with assistance from member states, or merely support member states in their activities related to adopting new legal acts. Sustainable construction, considered in the context of the internal market and environmental policy, falls within the scope of shared competence between the European Union and the member states. In this area, both the EU and national governments have the authority to adopt legislative acts, which must comply with the existing law of the Union.

When applying the ordinary legislative procedure, also known as the co-decision procedure, the EU follows specific steps for adopting European legislation. The relationship between the European institutions and all stakeholders is analyzed in the third section of Chapter One. It is noted that all citizens, businesses, and organizations play an important role, as they can clearly express their positions on a

given initiative through opinions. National parliaments also have this opportunity and right, which is crucial under shared competence, since national parliaments can analyze legislative proposals and assess whether certain actions would yield better results if applied at the national or regional level rather than at the EU level. The analysis reveals that coordination between EU institutions, all affected parties, and national parliaments is aimed at achieving maximum efficiency in the development and implementation of European legislation. The European Commission monitors its implementation by the member states and, in case of deviations, takes appropriate corrective measures.

It is identified that intergovernmental and international organizations play a key role in the policy formulation and adoption of regulatory acts aimed at achieving sustainable development and long-term environmental protection. The European Union stands out as a pioneer in efforts to institutionalize sustainable development, having taken the first significant step in this direction in 2001 through the adoption of a Sustainable Development Strategy.

Among the main strategic and normative documents at European level, which have a direct impact on sustainable construction, stand out: Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings; the European Strategy for the Sustainable Competitiveness of the Construction Sector and its Enterprises (2012); The European Green Deal, which includes the European Climate Law, the Renovation Wave for Europe initiative and the Affordable and Secure Energy for Europe (REPowerEU) Plan.

As a temporary but significant tool to address the economic and social consequences of the COVID-19 pandemic, the EU establishes a Recovery Plan for Europe – Next Generation EU. Combined with the EU's long-term budget, this instrument contributes to promoting sustainable construction through investments in energy efficiency, digitalisation, sustainable materials, and innovative technologies, supporting the transition to a low-carbon and resource-efficient economy. At the heart of the Recovery and Resilience Facility, which serves as a key financial instrument under NGEU, lie the national recovery and resilience plans. They identify priority investments, including the renovation of buildings, energy efficiency, and sustainable construction.

In support of the European Union's efforts to achieve sustainability in both the construction sector and broader contexts, the National Recovery and Resilience Plan (NRRP) of the Republic of Bulgaria plays a vital role. Closely linked to the European Recovery Plan – Next Generation EU, the Bulgarian NRRP is structured around four main pillars. It includes measures and policies aimed at sustainable development, decarbonization, increasing energy efficiency, as well as improving competitiveness through strategic investments in education, research, and innovation.

The National Recovery and Resilience Plan outlines three key objectives relevant to the construction sector:

1. Achieving global competitiveness of construction enterprises located within the EU member states;

2. Ensuring equal conditions between European companies and those outside the EU when competing for public procurement contracts;
3. Renovating and achieving a fully decarbonized building stock – including both residential and non-residential buildings – by 2050.

To support the achievement of these objectives, Bulgaria establishes a National Decarbonization Fund (NDF) and launches a National Programme for Energy Efficiency of Multifamily Residential Buildings (NPEEMRB).

Additionally, the introduction of Eurocodes as standards aiming to unify construction norms across EU member states ensures a common approach to designing buildings and other civil engineering structures. Their successful implementation in Bulgaria began in 2012.

In the third section of Chapter One, the following key conclusions are summarized:

1. It is considered that the European Union, through its institutions, makes targeted efforts to develop European legislation and effectively monitors its implementation by the Member States.

2. In the scientific literature, there is a widespread opinion that the term "sustainable development" is conceptually multi-layered, and there are different, sometimes contradictory interpretations depending on the theoretical framework and the point of view of the particular author.

3. The Recovery and Resilience Facility, part of Next Generation EU, will support Member States in their transition toward a sustainable economy, aiming to accelerate the implementation of the Green Deal in the construction sector.

4. According to the National Recovery and Resilience Plan of the Republic of Bulgaria, the largest share of financial resources is expected to be allocated under the pillar "Green Bulgaria," which includes the construction sector.

5. It has been confirmed that Bulgaria, through the implementation of its National Recovery and Resilience Plan, undertakes targeted actions to promote sustainable construction, enhance sector competitiveness, and decarbonize the building stock through specific mechanisms such as the National Decarbonization Fund (NDF) and the National Programme for Energy Efficiency of Multifamily Residential Buildings (NPEEMRB).

6. It was found that the introduction of Eurocodes aims to contribute to the realization of the sustainable approach in construction, by enhancing safety in the sector and increasing the competitiveness of European companies.

7. EU Member States, including Bulgaria, actively work towards renewal and convergence of sustainable construction policies and legislation, with national legislation being gradually harmonized in accordance with the requirements of sustainability standards in construction at European level. The provisions of EU directives and standards are reflected in national laws and secondary legislation for their implementation.

8. The analysis of the regulatory framework in the field of sustainable construction shows that efforts are being made towards the introduction of requirements related to different aspects of the sustainable approach. However, there

is still no single regulatory provision that would unite all the indicators characterizing sustainable construction.

CHAPTER TWO

ANALYSIS OF THE SUSTAINABLE APPROACH TO PROJECT IMPLEMENTATION IN THE CONSTRUCTION SECTOR IN BULGARIA

In the second chapter of the dissertation, an analysis is conducted of the sustainable approach to project implementation in the construction sector in Bulgaria, with an emphasis on its significance as a prerequisite for effective investment planning and execution.

The first paragraph of Chapter Two is dedicated to defining the scope of the construction sector by examining its main characteristics and regulatory framework. The analysis begins with a review of the existing legislative acts and strategic documents governing the sector in the Republic of Bulgaria. Definitions of the terms "construction works," "buildings," and "construction facilities" are examined.

At the forefront among these regulations stands the Spatial Development Act (SDA), which stipulates that all construction works in Bulgaria can and must be carried out only if permitted under this law. Chaparov¹¹ notes that the SDA defines restrictions on property for spatial development purposes and contains fundamental provisions regarding construction requirements, procedures for the coordination and approval of investment projects, the issuance of building permits, participants in the construction process, and the regulation of relations between them. The SDA contains an expanded definition of the term "construction," which includes all "above-ground, semi-underground, underground, and underwater buildings, structures, extensions, superstructures, reinforcement, restoration works, conservation, restoration, reconstruction based on authentic data and adaptation of immovable cultural assets, fences, networks, landscaping and sports facilities, as well as their major repairs, reconstructions, and conversions with or without change of purpose."

The study showed that there are currently two classifications for construction works, the first of which is the *Classification of Buildings and Construction Facilities – version 2001*. It provides definitions of the categories "buildings" and "construction installations," organized into four hierarchical levels. Buildings are defined as covered structures that can be used independently, built for permanent use, and serve to shelter people and/or animals or to store objects. They are subdivided into two main categories – residential and non-residential. It is important to note that buildings are not classified based on criteria such as location, ownership, or institutional affiliation. Construction facilities are defined as all construction structures that are not classified as buildings.

The second classification is found in *Ordinance No. 1 of 30 July 2003 on the*

¹¹ Chaparov, B. (2012). State and trends in the development of construction in the Republic of Bulgaria. Varna: University Publishing House "Science and Economics". p. 43. ISBN 978-954-21-0588-6.

Nomenclature of Types of Constructions in accordance with Article 137, paragraph 1 of the Spatial Development Act (SDA). It includes six main categories and aims to define various administrative and legal requirements applicable to each type of construction. This classification is of practical significance and serves as the basis for determining the procedures for designing, permitting, constructing, and commissioning different types of construction works.

The opinions of various authors have been studied, according to whom the development of the construction sector can be traced through changes in several key index indicators of high analytical significance. According to P. Iliev¹², it is necessary to examine changes in the number of enterprises and employees in the sector, output, turnover, value added at factor cost, purchases of goods and services, personnel and wage expenses, expenditures for the acquisition of tangible fixed assets (TFA), foreign direct investment (FDI), revenues from construction and installation works (CIW), new construction and improvements and ongoing repairs, the national housing stock, and the number of issued building permits. According to Kalchev¹³, the indicators that need to be studied in order to analyze the development of the construction sector are 11 in total – number of enterprises, employees, GVA at current prices, GVA at base-year prices, turnover, production, revenues from construction company' activities, foreign direct investment (net transactions), expenditures for acquisition of TFA, purchases of goods and services, and personnel costs. E. Aleksandrov¹⁴ proposes a slightly different approach to studying the sector's development at national level. He points out that the most significant indicators are the construction production index, the construction cost index, the number of building permits issued for new buildings by region, and the number of new buildings started by region.

For the purposes of the present research, the indicators proposed by P. Iliev have been adopted, as they emphasize the production and economic activity of the construction sector as a whole. In our opinion, the author's approach is more comprehensive compared to other existing models, as it incorporates both quantitative and structural indicators. This allows for more in-depth and holistic assessment of the state and dynamics of sustainability in the sector. The selection of these specific indicators is driven by their capacity to reveal significant interdependencies, trends, and challenges that affect not only the internal efficiency of construction enterprises in Bulgaria but also external environmental factors such as investment activity. For this reason, the analysis in the present study is based precisely on these indicators.

The second part of the first paragraph contains an analysis of the construction sector in Bulgaria for the period 2013–2023, focusing on tracking the levels of GDP in Bulgaria, changes and trends in the labor market, average annual wages in the

¹² Iliev, P. (2018). *Razvitie na stroitelstvoto v Bulgaria v konteksta na noviya programen period 2014–2020*. Varna: Univ. Izd. Nauka i ikonomika. ISBN 978-954-21-0971-6.

¹³ Kalchev, R. (2013). *Razvitie na choveshkite resursi v stroitelstvoto*. Varna: Univ. Izd. Nauka i ikonomika. ISBN 978-954-21-0631-9.

¹⁴ Aleksandrov, E. (2023). "Analiz na sustoyaniето i tendentsiite v bulgarskia stroitelen sektor." *Scientific Atlas*, No. 7, ISSN 2738-7518.

sector and their comparison to the national average, the volume of foreign direct investments, the number of construction enterprises during the analyzed period, as well as an overview of investment activity over the past 10 years.

The analysis begins with information on GDP levels at current prices in the period 2013–2023, showing a continuous and steady growth in GDP size, with a slight stagnation observed in the 2019–2020 period, reaching a value of BGN 183,743 million in 2023. Real GDP growth declines from 4.0% in 2019 to -4.0% in 2020, which can be interpreted as a result of the COVID-19 pandemic and the restrictive measures imposed during that period, the inability of enterprises to operate under usual conditions and pace, shortages of supplies of various raw materials, goods, and consumables, and limited available financial resources for households and businesses in the economy. The indicator recovers sharply in 2021.

The construction sector is characterized by a high share of employment, as it provides jobs for individuals with diverse professions and specializations who contribute to the successful implementation of projects of varying scope and complexity. Approximately one-fifth of all employees under labor and civil service contracts in the country are engaged in this sector, once again confirming its strong influence on the economy and employment levels.

Another factor examined to assess the state of the construction sector is the level of the average annual salary of employees under labor and service contracts and its comparison with the national average. Both values show growth, but the rate of increase differs. The final result is an average annual salary in the construction sector that is BGN 5,610 lower than the national average, making the sector less attractive in terms of annual remuneration compared to other sectors in the economy.

Investment activity also affects the development of the construction sector and in particular foreign direct investment (FDI). Compared to this indicator, there is no clear upward or downward trend during the period under review.

Changes in the number of construction enterprises in Bulgaria, based on the number of employees, were also tracked for the period 2013–2023. A slow and gradual increase is observed, with the first group (0–9 employees) maintaining the largest relative share (approximately 90%) of the total structure throughout the entire period. The conclusion is that the construction sector is characterized by extreme heterogeneity, with a predominance of numerous small enterprises employing between 0 and 9 people.

The analysis concludes with a review of overall construction activity for the period 2019–2023, focusing on several key indicators. The value of total construction output remained relatively stable, with a decline observed only in 2021. The number of building permits issued and the number of new buildings during the period under review grew at a constant pace, with the only deviation occurring in 2020, when both indicators experienced a slight decline. Residential construction showed a very positive trend, with the number of residential buildings commissioned continuously increasing until 2023. The number of public procurement contracts increased throughout the entire period, doubling in 2023 compared to the base year both in terms of volume and value. The largest number of contracts signed in the

construction sector, by source of funding, were financed by the state budget, followed by contracts financed through operational programs.

Based on the findings presented in the first paragraph of Chapter Two, the following conclusions have been drawn:

1. Despite the dynamic changes in the market, influenced by factors such as economic conditions, the regulatory environment, technological innovations, and the disruptions caused by the COVID-19 pandemic, the construction sector demonstrates resilience, flexibility, and adaptability to external changes.

2. It has been identified a need for increasing the energy efficiency in the construction sector in Bulgaria, which would contribute to transforming it into a highly efficient, energy-saving, environmentally carbon-neutral, and more competitive industry.

3. Direct investments from both domestic and foreign sources influence the development of the sector and the national economy as a whole. When such investments are at high levels, they further stimulate the quantitative growth of the building stock and overall economic growth.

4. A decline in construction output was observed only in 2021, which can be interpreted as a consequence of the COVID-19 pandemic, the resulting shortage of construction materials and raw materials, and a withdrawal of foreign direct investments, which that year even had negative values.

5. Financial inflows to the country will primarily come from the European Structural Funds and the Recovery and Resilience Facility under the “NextGenerationEU” initiative.

6. Despite the increase in wages in late 2023 and early 2024, remuneration in the construction sector still lags behind national averages. Labor shortages are more likely the result of an unfavorable demographic situation and continued labor emigration than of rising unemployment levels.

7. The construction industry is expected to grow as a result of the easing of restrictions introduced during the COVID-19 pandemic, as well as the growing need of the population for residential and public buildings.

8. We believe that the collective efforts of citizens, the government, and construction enterprises in the country could accelerate the implementation of best construction practices applied in the European Union and the world as a whole.

The second paragraph of Chapter Two presents the results of a survey on sustainable practices in construction companies in Bulgaria.

The concept of sustainable construction is being established on a global scale, including in Bulgaria, with its main objective being to minimize all inefficient practices while ensuring a healthy and comfortable environment for building occupants. On the other hand, the initial construction costs of such buildings are significantly higher, as they require the use of specialized materials and the integration of renewable energy sources. Nevertheless, these costs are minimal compared to the savings that are realized once the building is completed and made operational.

The analysis carried out at the beginning of the paragraph reveals that the

dominance of a purely market-driven approach in the Bulgarian construction sector, the lack of an active housing policy, and insufficient regulation of construction activities hinder the implementation of ecological and sustainable practices in the industry. On the other hand, despite the absence of government incentives for building certification and a clearly well-developed legal framework, there is a noticeable increase in the number of certified buildings in the country as this trend also influences the real estate market.

According to the results of a survey for the period 2022–2023 of cities in Central and Eastern Europe (CEE), it becomes clear that an increasing share of investment is being directed toward buildings with green certification. Bucharest holds the leading position among all other capitals, with 60% of its total building stock certified as green. Although the Bulgarian capital significantly lags behind with only 9%, there is a positive trend in the successful certification of projects mainly for commercial buildings. The predominant type of buildings being certified in Sofia are multifunctional, combining retail, residential, and office spaces which suggests that the focus on mixed-use developments is intended to ensure higher return on investment and profitability for investors.

The analysis continues with interpretation of the results of the survey on the state of sustainable construction in Bulgaria.

The data collection instrument includes both open- and closed-ended questions aimed at gathering information on how the construction sector is segmented. The survey assesses construction companies' attitudes toward investments in sustainable practices, preferred types of buildings, and directions for future investment. In addition, it examines the key factors influencing these processes, as well as the main motivators behind such decisions. The final part of the research focuses on identifying the factors that could hinder the development of construction companies in Bulgaria in the direction of sustainable construction.

The survey shows that half of the respondents hold managerial positions, while one-quarter are owners of the respective companies, which qualifies this study as an expert assessment. Furthermore, the majority of respondents (81.3%) have over 21 years of experience, with the majority of them (50%) being employed in the construction sector over 30 years. This gives grounds to assert that the findings are based on the views of highly qualified and long-term professionals and experts engaged in the sector, which gives additional credibility and weight to the conclusions drawn.

Another important aspect addressed in the survey is the respondents' awareness of the sustainable approach in construction. In this regard, there is a positive trend – 62.5% of all survey participants claim to be familiar with the concept of sustainable/green building, while a lack of awareness is reported by only 12.5% of respondents.

The respondents' investment behavior regarding sustainable construction is also examined. More than half of them (62.5%) indicate that they do not currently invest in acquiring knowledge or developing new skills in the field of green building, with only 6.3% of all respondents categorically stating that they undertake such

investments. On the other hand, 66.7% of individuals who don't currently invest in new knowledge or skills at the same time of the survey are inclined to do so in the future.

With regard to the sources that respondents use to obtain up-to-date information about green projects and initiatives that take place on the territory of the Republic of Bulgaria, it is not surprising that most often this happens through the Internet (75%), industry associations, trade exhibitions and manufacturers of building materials (31.3%), and enterprises in the construction sector (25%).

Our analysis reveals that there is an information imbalance between the company owners/managers in the construction sector and their employees concerning the concept of sustainable construction. A large proportion of employees in construction companies (68.8%) don't understand the essence of sustainable construction. Companies whose employees are already familiar with the sustainable approach in construction use different approaches to raise awareness among their staff, with the most commonly used method being through interviews (55.6%).

In Fig. 1 data are presented regarding the percentage of green projects implemented in Bulgarian construction enterprises.

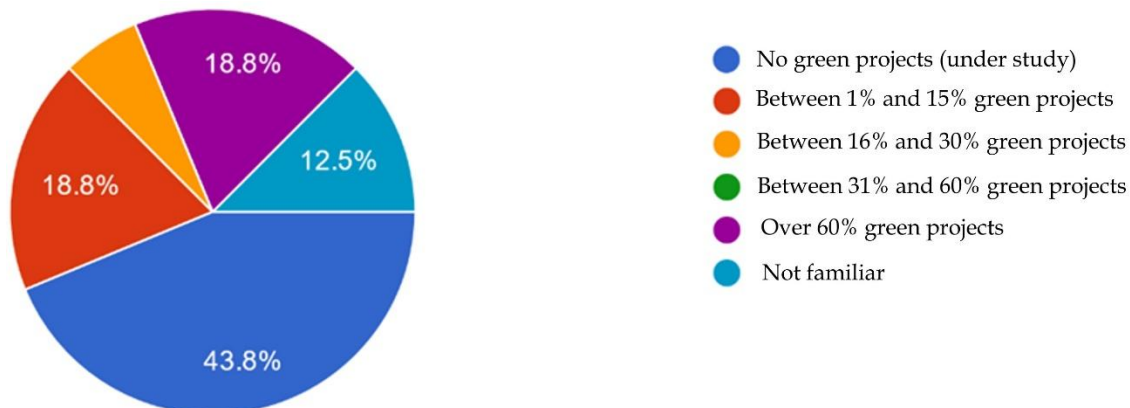


Figure 1. Relative share of green activities carried out in individual organizations

Source: Author's online survey

Results indicate that approximately half of the surveyed companies (43.8%) were not engaged in green activities at the time of the survey but were in the process of exploring the opportunities, conditions, and potential benefits of implementing such practices. A considerable share of respondents were also unaware of whether the organization they work for supports the transition toward sustainable construction. On the other hand, 18.8% of the surveyed companies reported that between 1% and 15% of the total number of projects of the organization include green activities. The same percentage of construction firms stated that more than 60% of their projects are sustainable.

One of the factors that could influence the share of environmental activities in organizations is the expected average payback period for investments made. Half of the construction companies believe that it takes more than 10 years for the

investments to pay off, while less than one-tenth of the respondents think that green investments pay off within 1 to 2 years.

The attitudes of construction companies toward investing in sustainable buildings is another important component that needs to be examined. The majority of respondents (68.8%) indicate a willingness to invest financial resources in the construction of sustainable buildings. The preferred areas for such investments are presented in Figure 2.

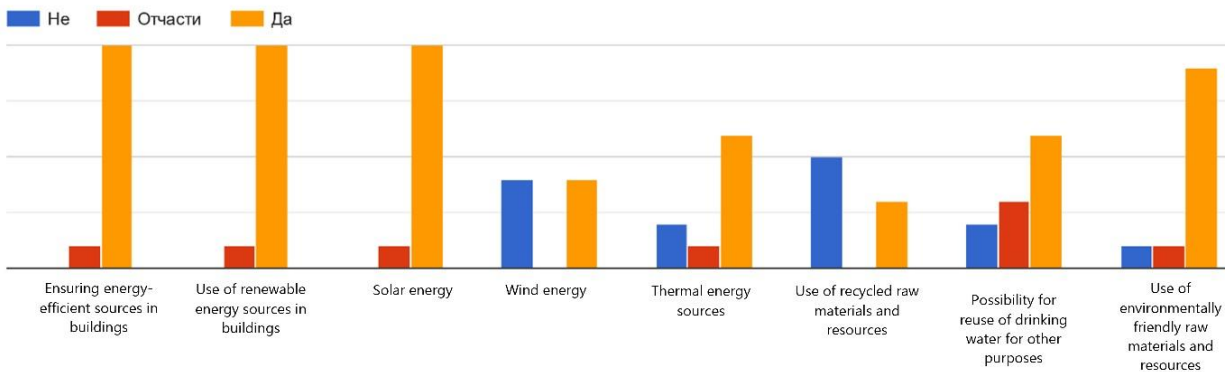


Figure 2. Preferred Investment Areas for Categorizing Buildings as Sustainable

Source: Author's online survey

The three most frequently indicated categories by 90.9% of respondents are the provision of energy-efficient sources in buildings, the use of renewable energy sources and solar energy in buildings, followed by the use of recycled raw materials and construction materials (81.8%).

Regarding the areas in which respondents would take action to switch to sustainable construction, the implementation of measures to reduce energy consumption stands out in the first place (72.7%).

The analysis continues with an assessment of the type of construction in which companies plan to carry out green activities. Undoubtedly, the most preferred is new low-rise residential construction (41.7%), followed by new high-rise residential construction and the reconstruction of existing buildings.

The factors that most significantly influence companies in their decision to implement a green/sustainable construction project are market demand and the expected return-on-investment period. The third key factor is "coercion" – half of the surveyed construction companies in Bulgaria would implement a green project only if it is related to compliance with regulatory requirements such as EU Directives, state regulations, or other documents of a mandatory nature.

Identifying the main incentives driving construction companies to implement green projects is of critical importance. According to the collected data, the most influential factor is client demand (62.5%), followed by the necessity to comply with environmental protection regulations (50%). Financial considerations—such as lower operating costs and the higher sales/market value of buildings—are also among the key incentives for pursuing sustainable projects, as indicated by half of the respondents.

The analysis of the state of sustainable construction in Bulgaria concludes with the identification of the main barriers for the transition to sustainable construction. The survey data shows that there are five main obstacles that significantly hinder construction companies. Among them, inconsistent legislation (75%) stands out as a major concern, creating uncertainty and complicating long-term investment planning. Additionally, the unstable political situation in the country (87.5%) is seen as a serious impediment to the successful implementation of strategic company plans. The shortage of qualified professionals including both workers (68.8%) and managers (75%) particularly in the field of sustainable construction is also identified as a major limitation, restricting the capacity for efficient execution of such projects. The fifth deterrent is the lack of solvency on the part of the customers, indicated by 3/4 of the respondents. This is largely due to the high initial investments for energy-efficient and environmentally friendly solutions, which often exceed the financial capabilities of many of the potential buyers.

Based on the analysis carried out in the second paragraph of Chapter Two, we have made the following conclusions:

1. The results of the analysis at the beginning of the paragraph are consistent with the economic theory presented in Chapter One, highlighting both the numerous advantages and the main obstacles to the transition toward sustainable construction.

2. The construction sector is characterized by a relatively high degree of stability in terms of management/leadership positions held in construction companies. In other words, extensive professional experience is a necessary/mandatory condition for occupying a senior position.

3. The degree of low awareness among employees in companies about the sustainable approach in construction indicates that more efforts are needed on the part of the management of construction companies in the direction of integrating all employees down in the hierarchy by conducting explanatory work on the long-term development plans of companies and the need to apply a sustainable approach in their operations.

4. Low-rise residential buildings is the most preferred area for the application of sustainable practices. We believe that this is due to the smaller scale of projects, which allows for greater flexibility in design and execution, increased demand for sustainable solutions from clients, and availability of subsidies in the residential sector, especially for low-rise construction.

5. Five main barriers have been identified that hinder construction companies in Bulgaria to the greatest extent in their efforts to switch to sustainable construction. These are: inconsistent legislation, political instability in the country, a shortage of qualified specialists, both workers and managers, and the lack of solvency on the part of clients.

The third paragraph of Chapter Two presents an analysis of the state of sustainable construction in an international context. The final part includes a comparison between the development of the construction sector in Bulgaria, with a focus on sustainable construction, and the relevant practices in other countries, outlining the main trends and providing forecasts for its future development.

First of all, the share of environmentally friendly projects within individual enterprises is examined. Data from the global survey show that the largest part of participants (42%) plan more than 60% of their projects to be green, while only 8% do not intend to include such initiatives in their activities. These results sharply contrast with the data from the survey conducted in Bulgaria, where the majority of construction companies still do not implement green projects, and only 20% declare a significant share of sustainable initiatives. This clearly shows that, despite the efforts made, the country lags behind global trends and it is necessary to take more active measures to promote sustainable construction. Leaders in this indicator are Australia/New Zealand, Canada, and the USA, followed by Mexico and Singapore.

The analysis continues with identifying the types of construction in which respondents intend to carry out green projects. Globally, the largest number of sustainable initiatives are envisaged for the construction of new commercial (49%) and institutional buildings (41%), and the renovation of existing buildings (40%). With global averages of 49%, Cameroon and India intend the share of green projects for new commercial building construction to reach a significant 70%. In the construction of new institutional buildings, Cameroon along with Saudi Arabia is again ahead of the world levels to the greatest extent. Construction of new low-rise residential buildings (32%) ranks in the middle of the list, while the smallest share of sustainable projects is related to the creation of green commercial interiors. Compared to this indicator, there is some discrepancy with the results from the survey among Bulgarian construction companies, where low-rise residential construction stands out as the most preferred area for implementing sustainable projects.

Regarding the current and expected use of green building products and systems, the most preferred solution remains the use of sustainable and renewable energy sources, with 62% of respondents planning to implement them in the future. Mass timber structural systems are emerging as a growing trend — although currently used by only 15% of participants, expectations are that this share will double over the next five years. Bulgarian companies also identify the use of renewable energy sources as the most preferred area for implementing sustainable solutions, which aligns with the results of the present survey.

Despite the efforts of many companies to integrate sustainable practices into their operations, the realization of these intentions is often hampered by several significant barriers. Among the most serious obstacles are higher initial costs, a lack of political support or government incentives, and insufficient public awareness of the benefits of sustainable construction. Finally, the shortage of trained/qualified green building professionals is indicated. The results partially align with those from the survey among Bulgarian construction companies, which also emphasizes the important role of the state in each stage of project implementation, as well as the shortage of qualified personnel in the field of sustainable construction.

Next, the main approaches to enhance sustainability in design and construction over the next five years are examined. Leading roles are attributed to strategies aimed at reducing energy consumption (47%) and implementing control over so-

called “embodied carbon.” The use of artificial intelligence, generative design, and machine learning during the design and construction phases is emerging as a growing trend, with 21% and 28% of respondents respectively indicating intentions to integrate these technologies into their future practices.

Based on the analysis presented so far in the third paragraph of Chapter Two, the following conclusions can be drawn:

1. In the context of existing challenges, the trend towards sustainable construction is irreversible. We believe that more and more companies will focus on green projects, with overcoming financial and regulatory barriers playing a key role in accelerating this process.

2. The sector demonstrates strong commitment to sustainability, which we expect to lead to significant economic, environmental, and social benefits in the long term.

3. The results of the analysis at international level correspond with the data obtained from the survey conducted among Bulgarian construction companies regarding the state and development of sustainable construction in the country. Based on this, it can be concluded that despite the growing global focus on sustainable approaches in construction, their implementation in the Bulgarian context is still in its early stages. Nevertheless, with the presence of adequate tools, strategic policies, and targeted efforts, both the construction sector in Bulgaria and internationally has the potential to achieve remarkable results and sustainable progress toward broader and more effective implementation of good practices in the near future.

CHAPTER THREE

OPPORTUNITIES FOR IMPROVING SUSTAINABLE CONSTRUCTION IN BULGARIA

Chapter Three explores the possibilities for improving sustainable construction in Bulgaria through three interrelated areas. First, it analyzes good business practices from Belgium with the aim of adapting and implementing them within the Bulgarian construction sector. Secondly, it presents a concept for the creation of a national sustainability certification system in construction, which would support the promotion and monitoring of sustainable projects. Finally, it includes an analysis of the state of education and training in sustainable construction in Europe and Bulgaria, proposing the development of a master's program for the preparation of highly qualified professionals to meet the needs of both the domestic and international markets.

The first section of Chapter Three presents a ranking of 100 cities worldwide that stand out for their active and consistent efforts toward achieving sustainable development. It is no coincidence that it is Europe, and in particular the cities in Western Europe, including Brussels (Belgium), that occupy leading positions in the ranking, since sustainability is a priority both at the national and supranational levels, stimulated by the joint and consistent efforts of the European Union to promote

sustainable development across all Member States. Emphasis is placed on the potential for good practices to be adapted to the Bulgarian context, taking into account local economic, regulatory, and technical conditions. The aim is to demonstrate how the transfer of knowledge and successful models from leading European countries can accelerate the transition toward a more sustainable and socially and environmentally responsible construction sector in Bulgaria.

A good practice from Belgium is presented, with particular attention paid to one aspect of sustainability, namely the assessment and certification of the energy performance of the building stock. This focus is not accidental, since, as established in the third section of Chapter Two, the respondents of the study identified the construction of buildings with zero or positive energy balance as a leading approach for enhancing sustainability. Among the main advantages of this approach are the low operational costs, which make it especially attractive to both investors and end users.

Belgium has successfully implemented the provisions of the Energy Performance of Buildings Directives through various legislative acts, due to the country's administrative division into three regions. In all three regions, there is a requirement to assess the energy performance of existing buildings when undergoing major renovations or in case of new construction. This enables competent authorities to set efficiency and performance standards. The sale or rental of a property (house, apartment, studio, or other type of property) requires the presence of an EPC certificate, whose main function is primarily informative. It is issued for a period of 10 years by a recognized energy expert. There are various measures used to determine efficiency, with the full package of all currently developed metrics applied only to new construction projects. Minimum efficiency thresholds are also set at regional level and are periodically increased in order to achieve the EU's long-term energy efficiency goals.

The EPC certificate (Energy Performance Certificate) plays an important role in the decision-making process when renting or purchasing real estate, as it provides information about the level of energy efficiency and the degree of thermal insulation. This enables potential buyers, tenants, or investors to make an informed judgement of the expected energy costs and the extent to which the property meets modern energy efficiency standards. The requirements regarding the content and scope of the EPC certificate vary depending on the region and are determined based on the type of building, its area, as well as whether the property is newly built, renovated, offered for sale, or for rent. Certificates are issued for residential, non-residential (administrative), and buildings of public importance. Additionally, the certificate includes guidelines for improving the energy performance of the building or dwelling to which it applies. These recommendations are not binding, but are only advisory in nature. However, they provide a valuable starting point for owners and investors, incentivising the voluntary implementation of energy-efficient measures. This supports the transition toward sustainable construction by raising awareness and creating opportunities for the gradual improvement of the existing building stock. Such a practice would have a positive impact in the Bulgarian context, where the lack of structured and comprehensible recommendations often hinders building

renovation processes.

Another important tool through which the state aims to ensure transparency and increase public awareness about the energy performance of owned or rented properties is a website that contains passports for all dwellings in the Flanders region. The purpose of creating this web platform is to serve as a starting point for residents in the process of renovating their homes. The site provides information about the amount of energy used by a particular property, renovations carried out so far, the condition of the soil, water and sewerage systems, flood risk, degree of sustainability, dwelling quality, and all permits issued so far. Such a digital platform enables informed decision-making, facilitates the planning of sustainable actions, and supports a more efficient allocation of public resources. The implementation of a similar tool in Bulgaria would contribute to the digitalization of the sector and provide the public with better access to essential information.

The practice of indicating the result of the EPC certificate already at the stage of publishing or advertising a property is considered positive, as it provides potential buyers or tenants with clarity regarding energy consumption levels and possible areas for improvement before closing the deal. This not only supports informed decision-making but also stimulates the demand for more energy-efficient buildings, thus creating market pressure for sustainable investments. The introduction of such a practice in Bulgaria would encourage competitiveness among real estate market participants and contribute to an accelerated transition towards a sustainable building stock.

With regard to improving the energy performance of all buildings in Belgium – both privately owned and administrative or public, specific deadlines have been set for the renovation of housing in each region. In this way, the state draws a roadmap to follow in the direction of achieving sustainable development and ensuring healthier living and working conditions for its citizens. Setting clear timeframes for improvements provides the necessary impetus for the systematic modernization of the building stock and sustainable construction. Introducing a similar strategic approach in Bulgaria would accelerate the transformation of existing buildings and contribute to an improved quality of life and a reduced carbon footprint in the long term.

In addition to everything outlined so far, it is necessary to establish a specialized regulatory body responsible for monitoring the existence and validity of issued EPC certificates, as well as for promoting their wider implementation. Following the example of Belgium, this body may also be entrusted with the accreditation and certification of experts authorized to assess and issue certificates for different types of buildings. This would contribute to higher quality and reliability of the certification process, as well as to the establishment of sustainable standards within the construction sector.

Based on the information presented in the first paragraph of Chapter Three, the following conclusions can be drawn:

1. The implementation of good sustainable construction European practices in Bulgaria, following the example of Belgium, should be seen not merely as an

opportunity but rather as a necessity for achieving long-term economic, social, and environmental sustainability.

2. The imposition of stricter requirements on the existing building stock in Bulgaria, specifically carrying out renovations to improve energy efficiency in all types of buildings (residential, non-residential, administrative, public, and others) will support the reduction of harmful gas emissions emitted during construction process and subsequent use of housing, as well as improve the quality of life of citizens.

3. As a result of the analysis, it emerged as the most appropriate and applicable for the Bulgarian government to require all stakeholders (individuals, legal entities, and construction companies, etc.) to make improvements to their properties within specific timeframes, and to provide potential buyers/tenants with information about the energy class of the properties and other data directly related energy consumption levels in the home, climate, and insulation.

4. The creation of a web platform that contains passports for all dwellings in the country would enable informed decision-making and facilitate the planning of future renovation actions for these properties.

5. It is necessary the establishment of a specialized control body in Bulgaria, following the Belgian model, in order to monitor the presence and validity of issued EPC certificates, encourage their wider application, and accredit experts authorized to conduct assessments and issue certificates for different types of buildings.

In the second section of Chapter Three is proposed an adapted to Bulgarian conditions certification system for sustainability in construction. This system aims to promote the implementation of projects that meet high environmental, social, and economic standards. Through clear and specific criteria for building assessment, it will stimulate the innovations in construction sector with a focus on sustainable development.

It was found that at the time of the study, there was no unified, internationally recognized sustainability certification system in construction that is equally applicable in all countries.

The partial hardship for the integration of sustainable principles into construction practices and the difficulties in implementing sustainable projects in Bulgaria are mainly due to the lack of an officially adopted national system for environmental building assessment. To address these and other challenges in the sector, the BEST system is proposed. It incorporates established best practices drawn from the international systems discussed in Chapter One. Some of the criteria for design and exploitation of buildings are adapted to national specificities and the existing legal and regulatory framework in Bulgaria.

The adapted system allows assessment of buildings based on six main criteria, each of which has a different relative weight in the final evaluation. The assessment is performed using a ten-point scale, where the higher score indicates a better building performance in the respective category. Table 4 presents the assessment criteria used to categorize buildings as sustainable.

Table 4

Criteria for building assessment according to the Bulgarian certification system BEST

№	Criteria	Indicator
1	Energy Efficiency (30%)	Primary Energy Consumption (kWh/m ² /year)
		Share of Renewable Energy Sources (Percentage of Total Consumption)
2	Carbon Footprint (20%)	CO ₂ Emissions (kg CO ₂ /m ² /year)
3	Water Management (15%)	Drinking Water Consumption (L/m ² /year)
		Rainwater Recycling (%)
4	Sustainable Materials Usage (10%)	Share of Recycled and Eco-Friendly Materials (%)
5	Comfort and Well-being of Residents (15%)	Indoor Air Quality (ppm CO ₂)
6	Economic Efficiency and Sustainability (10%)	Building Life Cycle (Years until Major Renovation)
	Total: 100%	

Source: Compiled by the author

Points are awarded for each indicator, which are subsequently adjusted according to the respective weight that the criterion has in the overall score. In the adapted system, the criterion "Energy Efficiency" carries the greatest significance, accounting for 30% of the final score.

The assessment process concludes with the calculation of a final result using a weighted score based on the individual categories. Depending on the total score achieved, the building is certified in one of the following categories:

- Bronze Certificate – 30–49 points;
- Silver Certificate – 50–69 points;
- Gold Certificate – 70–84 points;
- Platinum Certificate – over 85 points.

The Platinum Certificate represents the highest level of sustainability, awarded to buildings with outstanding environmental and energy performance. The Gold Certificate is granted to buildings that largely meet the criteria of the certification system. The Silver Certificate is issued to buildings that have achieved a total score between 50 and 69 points. These buildings fulfill the main environmental and energy requirements, demonstrating a good level of sustainability. Construction projects

that meet the minimum sustainability criteria but still require improvements in areas such as energy efficiency, water resource management, and the increased use of eco-friendly construction materials receive a Bronze Certificate.

Buildings with a final score less than 30 points do not meet the minimum requirements of the Bulgarian sustainability certification system BEST. They demonstrate unsatisfactory results in the main assessment categories and do not implement meaningful sustainability measures, and therefore are not eligible for certification.

Based on the proposed adapted certification system for sustainable construction in Bulgaria in the second paragraph of Chapter Three, we have made the following conclusions:

1. The structure and evaluation methodology within the BEST system have been adapted to reflect the complex nature of sustainable construction in the Bulgarian context, covering key dimensions of sustainability.

2. The expected benefits from implementing a national certification system for sustainability include the promotion of sustainable practices in the processes of design and construction, improvement of building environment quality and occupant health, optimized use of natural and energy resources, as well as the creation of opportunities for objective comparison, monitoring, and public accountability regarding the sustainable features of buildings.

3. The proposed BEST system can be verified through a pilot application on real or simulated projects. Conducting such tests would allow for empirical validation of the relevance and weight of individual criteria, as well as feedback on the system's practical applicability prior to its official introduction on a national scale.

In the third paragraph of Chapter Three it has been developed a master's program for professional education in the field of sustainable construction.

To clarify the need for creation of a professional education program in the field of sustainable construction in Bulgaria, an initial review was conducted of the available educational programs on this topic.

In Bulgaria, only a few universities offer master's programs with a study period ranging from 2 to 4 semesters, but none of them provides a program for obtaining a bachelor's or master's degree specifically in the field of sustainable buildings construction and other types of construction projects.

The Master's programs are mainly focused on acquiring knowledge and practical skills in the field of sustainable development, engineering, and ecology. This leads to the conclusion that the acquired knowledge and skills do not correspond to the needs of the construction industry in Bulgaria and actions are necessary to offer appropriate training programs.

Subsequently, a study was conducted on the sustainability-related programs offered in Europe. For the academic year 2024–2025, 12 European countries offer training in 73 different programs with an emphasis on sustainability for acquiring a bachelor's degree. The form of education in most cases is face-to-face, in English, and for a period of two for a master's degree and three years for a bachelor's degree.

The variety of master's programs is significantly larger, with their size numbering

423 in the 2024–2025 academic year. The analysis was narrowed down and focused only on programs that most closely align with the needs of the industry and practical application. Five programs from different universities were compared — two in Italy, one in Spain, one in the United Kingdom, and one in Germany. The duration of study ranges from 1 to 2 years, and the language of instruction is predominantly English.

Based on the information presented so far, it can be concluded that the choice of master's programs in the field of sustainable construction at the European level remains quite limited, while in Bulgaria there is currently no program that adequately meets the specific needs of the construction sector and the growing demands for sustainable practices.

A master's degree program entitled “Sustainable Construction and Energy Efficiency” is proposed, aimed at preparing specialists in the field of sustainable and energy-efficient construction. The program includes a set of disciplines that provide the necessary knowledge, skills, and competencies for successful professional realization both on the Bulgarian and international labor markets. Additionally, a detailed curriculum is presented, including a list of courses, awarded credits, forms of assessment, as well as the volume of classroom and extracurricular workload.

The planned duration of the program is four semesters. In the first academic year, the focus is on getting to know the fundamental principles of sustainable construction. In the first semester of the second year, more specialized and practice-oriented disciplines are studied, such as “Project Management and Sustainable Construction Processes” and “Life Cycle Assessment (LCA) in Construction”, which emphasize advanced aspects of sustainable construction and provide the knowledge necessary for practical application in the field — for the development and implementation of sustainable and energy-efficient construction projects.

The program concludes with the development of a master's thesis or a sustainable project, involving the design of a net-zero energy building or a simulation of the energy efficiency of a building using the learned methods and certification standards. The longer period of study compared to some other programs implies the possibility for prospective students to be persons who have previous education in a different professional field than the currently chosen. The tuition fees for the Master's program will be determined in accordance with the current legislation and practices in Bulgarian higher education institutions at the time of the creation of the program.

Based on the content of the third paragraph of Chapter Three, the following conclusions have been drawn:

1. Higher education institutions in Bulgaria offer master's programs in the field of sustainability, environmental management and protection, and the use of renewable energy sources. However, none of the educational structures currently prepare specialists specifically in sustainable construction.

2. Despite the efforts of Bulgarian educational institutions to personnel who successfully complete these programs remain general and insufficient for application in the construction sector, particularly with regard to the implementation of sustainable building practices.

3. A review of the offered higher education programs at European level in the

field of sustainable construction shows that the choice is extremely limited. However, these programs provide a solid foundation of theoretical and practical knowledge and skills, preparing the staff for their future professional realization in the construction sector.

4. The proposed Master's program "Sustainable Construction and Energy Efficiency" has the potential to become a central educational platform for training experts capable of leading the process of sustainable renovation of the building stock and implementing innovative technologies in the construction industry.

CONCLUSION

The results obtained from the research conducted in this dissertation allow us to draw the general conclusion that the stated objective and the related tasks have been successfully accomplished.

The analysis of the construction sector in Bulgaria, and in particular of the initiatives related to building sustainability, reveals a clear need for the implementation of new approaches to the design, construction, management, and deconstruction of buildings and infrastructure projects.

After studying the available literature from Bulgarian and foreign sources regarding the essence and main characteristics of sustainable construction in the context of the concept of sustainable development, an original author's definition of the term was formulated, which fully covers the processes behind this term.

Following a review of the available literature from Bulgarian and international sources regarding the essence and main characteristics of sustainable construction in the context of the sustainable development concept, an original author's definition of the term was formulated, comprehensively encompassing the processes underlying this concept.

International certification systems such as BREEAM, LEED, and DGNB play a vital role in promoting environmentally friendly practices while also encouraging innovation and investment in the sector. Due to their significance, a comparative analysis of the most established international systems was conducted, evaluating their main advantages and disadvantages. In order to attract investments in the construction sector and increase its competitiveness, the BEST system is proposed specially adapted to Bulgarian legislation as well as to the country's local economic, social, and climatic conditions.

The results of the empirical study conducted in 2023 on the state of sustainable construction in Bulgaria support the findings of international research. The main challenges faced by construction companies include higher initial investment costs, the absence of a consistent regulatory framework, limited political and financial support, a shortage of qualified professionals, and low public awareness of the benefits of sustainable construction. These obstacles hinder the widespread implementation of sustainable construction despite its proven economic, environmental, and social advantages.

It was confirmed that the implementation of good international practices following the example of Belgium, where the energy performance of buildings is mandatorily assessed upon sale, rental, or renovation, can serve as a model for creating a national real estate database in Bulgaria.

A Master's program "Sustainable Construction and Energy Efficiency" with a duration of two years has been proposed as a result of the identified need for educational and professional programs in the field of sustainable construction at international level. Its goal is to prepare highly qualified specialists who meet the demands of the labor market both in Bulgaria and internationally. This, in turn, will

contribute to promoting green construction in the country and will facilitate the transition toward a more sustainable economy.

In conclusion, it is pointed out that Bulgaria possesses a significant potential for the development of sustainable construction, provided it overcomes the existing barriers and creates a favorable economic environment for this process. The proposed solutions focus on addressing these fundamental issues within the construction sector. The implementation of targeted policies and investments can further accelerate the transition to sustainable construction.

III. SUMMARY OF CONTRIBUTIONS IN THE DISSERTATION

The dissertation presents the following theoretical and practical contributions:

1. Within the context of the overall scientific research, a precise selection and analytical presentation of the essence and key certification systems for sustainable construction have been carried out, resulting in the formulation of an original author's definition of the term.
2. The European legislation in the field of sustainable construction has been comprehensively presented and analyzed, along with its impact on national policy in this area.
3. Based on an extensive survey, an original assessment has been developed regarding the state of sustainable construction in Bulgaria, identifying both strengths and weaknesses, while also providing an analytical comparison with the situation in other countries.
4. Through the interconnection between the certification systems discussed in the dissertation, the main provisions in the European and/or Bulgarian legislation, the principles of our national policy in the field of sustainable construction, the survey conducted and familiarization with good practices, an exemplary Bulgarian certification system is proposed.
5. Based on an analytical review and systematization of their condition, measures have been proposed to create and/or improve the conditions for vocational education and training in the field of sustainable construction in our country.

IV. PUBLICATIONS RELATED TO THE DISSERTATION

Articles

1. **Dimitrova, N.** *Sustainable Construction – Essence and Development Principles* [Устойчиво строителство - същност и принципи за развитие]. *Engineering Sciences: Journal of the Science Department Engineering Sciences at the Bulgarian Academy of Sciences*, Sofia: Institute of Metal Science, Equipment and Technologies, BAS, Vol. 61, 2024, No. 2, pp. 15–29.
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2. **Dimitrova, N.** *European Legislation and National Policy in the Field of Sustainable Construction*. *Engineering Sciences: Journal of the Science Department Engineering Sciences at the Bulgarian Academy of Sciences*, Sofia: Institute of Metal Science, Equipment and Technologies, BAS, Vol. 61, 2024, No. 1, pp. 58–76.

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<http://es.ims.bas.bg/Abstracts/A2024/a1/01-07.pdf>

Conference Proceedings

3. **Dimitrova, N.** *The Impact of Information Technology and Artificial Intelligence on Human Resource Management* [Влияние на информационните технологии и изкуствения интелект върху управлението на човешките ресурси]. In: *Human Resource Management: Proceedings of the International Scientific and Practical Conference organized by the University of Economics – Varna, 6 October 2023*. Varna: Science and Economics Publishing House, 2024, pp. 290–298. ISSN (online): 2815-5084. Available at: https://ue-varna.bg/uploads/filemanager/303/publishing-complex/2023/Conference_HR_ISPC-2023.pdf