LEGISLATION AND POLICIES FOR DIGITALIZATION SUPPORTING CONSTRUCTION INNOVATION

Silvia Parusheva* and Yanka Aleksandrova

University of Economics – Varna,
77, Knyaz Boris I Blvd, 9002 Varna, Bulgaria,
e-mail: parusheva@ue-varna.bg
yalexandrova@ue-varna.bg

Abstract. The structural role of construction predetermines the importance of the processes of its digitalization. Legislation and policies for the digitalization of construction are essential for stimulating digital transformation. Specific legislative policies and digital initiatives have been taken at European and national level to stimulate the penetration of information and communication technologies and digitalization processes in construction. The leading importance of European initiatives such as Digital Single Market Strategy for Europe, Digitizing European Industry initiative, Strategy for the sustainable competitiveness of the construction sector, etc. should be emphasized. They contribute to strengthening the processes of digitalization in construction and to overcome its lag in the perception of innovation from other sectors.

Keywords: Construction 4.0, digital construction platforms, digitalization, digital platforms for construction, green construction technology.

1. INTRODUCTION

Construction has a structural role in the development of the national economy of Bulgaria. It also has a significant impact on the competitiveness of the entire European economy. It creates the material basis on which other economic sectors and activities function [1]. Construction products affect the well-being of citizens and their standard of living. In recent years, in an increasingly global market, the European economy has been actively developing its competitiveness, with digitalization at the forefront of these processes.

The following can be cited as indicators of the importance of the construction industry: the sector provides 18 million direct jobs, and its share of EU gross domestic product is around 9% [2]. In addition, it should be

* Corresponding author.

DOI: 10.7546/EngSci.LIX.22.01.06

borne in mind that buildings account for the largest share of total final energy consumption in the EU (40%) and that they are responsible for producing around 35% of all greenhouse gas emissions. All these indicators prove the importance of construction both for the development of the European economy and its competitiveness and show how important the sector is for the overall transformation of the European economy through innovative technologies. It is necessary for the digital transformation to cover the whole value chain in construction and to become an integral part of the whole economic process.

It should be emphasized that construction has a complex value chain, which includes many economic activities, including extraction of raw materials, production and distribution of construction products, as well as design, construction, management and control of construction works. At the next stage, the activities for maintenance, renovation, and demolition, as well as recycling of construction waste are included. All of them should be involved in digitalization processes. Achieving the final effects of the digitalization of the construction industry depends on this, including increasing labour productivity, shortening deadlines for construction projects, improving the quality of buildings, improving safety and working conditions, and environmental protection.

In order to achieve the effectiveness of the processes of digitalization and digital transformation, they need to be managed by certain policies, subordinated to the related strategies, as well as to be reflected in the relevant legislation.

This paper examines the role of national and European legislation and policies for digitalization in construction, which are incentives for the implementation of innovations and new information technologies in the sector. The first part of the article examines European policies and digital initiatives that stimulate innovation in construction. The second part of the article is devoted to national policies and initiatives in the field of construction, which are factors in these processes.

2. EUROPEAN POLICIES AND DIGITAL INITIATIVES AS AN INCENTIVE FOR INNOVATION IN THE CONSTRUCTION SECTOR

Innovation in the construction sector is stimulated at European level by a number of policies to digitize European industry, and they are implemented through the following initiatives:

- A Digital Single Market Strategy for Europe – COM/2015/0192 [3]. It

was launched in 2015 and aims to achieve sustainable economic and social benefits from the digital single market.

- Digitizing European Industry – Reaping the full benefits of a Digital Single Market COM/2016/180 [4]. This initiative was launched in 2016. It is a key element of the digital single market strategy. It introduces a set of measures that builds on and complements the various national initiatives to digitize all industrial sectors and related services.
- European Cloud Initiative COM/2016/0178 [5]. The initiative is about building a competitive economy in Europe based on data and knowledge.
- Strategy for the sustainable competitiveness of the construction sector and its enterprises COM/2012/433 [6] – the strategy was official in 2012. It sets five key objectives: (i) stimulating favourable investment conditions; (ii) improving the human-capital basis of the construction sector; (iii) improving resource efficiency, environmental performance and business possibilities; (iv) strengthening the Internal Market for construction; (v) fostering the global competitive position of EU construction enterprises.
- Views on Construction – 2020 and beyond. Several top priorities are outlined in this article: (i) energy efficiency; (ii) sustainable use of natural resources; (iii) circular economy; (iv) internal market regulation; and (v) digitalisation [7]. Researchers also stress that these priorities, including digitalization, are particularly important for future sustainable development in the EU [8].

The paramount importance of digitalisation is taken into account in the construction sector at European level. Special emphasis is placed on it by the European Construction Industry Federation (FIEC), which considers digitalization as a key priority. This view is reflected in the federation's work program from 2016. Together with other European associations working in the construction industry, FIEC is working together and preparing The European Construction Industry Manifesto on Digitization [9]. On the Bulgarian side, the European Manifesto is supported by the Union of Civil Engineers in Bulgaria, which is a member of the European Council of Civil Engineers (ECCE).

The main institutions representing the construction industry at European level are calling in the manifesto for serious action by the European Union institutions concerning policies in the European construction industry. These include the following [9]:

1. The European Union should take the political lead on digital construction – the digitalization of the construction industry is expected to be a top political priority for all European institutions. It should be part of the Digitalization of European Industry initiative. The European in-

stitutions must respond with policies that facilitate and support research ecosystems, including IT, academia and the construction sector to develop market-oriented programs.

2. Need for an appropriate regulatory framework for data policy – this framework should ensure better data quality and management, help address the challenges of intellectual property rights, on the one hand, and cybersecurity, on the other, and be responsible for ownership of data and avoid abuses of monopolization and ensure equality of access for Small and Medium-sized Enterprises so that they can evolve and take advantage of digitalization opportunities.
3. The new EU budget must focus on digital skills, Research and Development and IT development – the construction industry itself has developed several initiatives to drive the digital transformation. However, it is clear that financial access and support are crucial to accelerate the transformation process and mitigate the impact of the initial low return on investment. With this in mind, the financial framework after 2020 should focus on:

- increase the digital skills needed for digital construction, support quality training, increase the qualification and retraining of workers, etc.;
- stimulating research in the construction industry in order to facilitate the implementation of innovations;
- development of IT infrastructure – to invest in well-designed, intelligent and connected assets that ensure the creation of optimal infrastructure for high-speed Internet.

European digital platforms are being set up to support the development of the construction industry. They are operating systems that integrate various technologies, applications, and services. In construction, they aim to meet the challenges of using digital tools to support the digital development of the sector, as well as construction information modelling, creating passports of buildings and more.

An example is the Digital Platform for Construction in Europe (DigiPLACE Project) under the Horizon 2020 European program [10]. At the heart of this project is the idea that the construction sector is key to the economy, but it lags far behind in terms of productivity and innovation, as it is slow in the process of adopting digital technologies. In this regard, the EU-funded DigiPLACE project of nearly € 1 million is based on the idea of creating a common ecosystem of innovation, standardization, and trade to increase the productivity of the construction sector and the quality of finished products in terms of buildings and infrastructure. It explores what kind of digital transformation can improve productivity and efficiency. The results of the

project should affect the development and competitiveness of the value chain in construction. DigiPLACE relies on an established consortium of cooperation between the EU construction industry and professional representatives, academic partners, and the support of the public authorities of three countries. Five main areas for project work have been identified – common language, interoperability, standards; regulations, public services; data and knowledge sharing; environmental indicators and business, market, and cooperation. Regarding the implementation of the project, researchers point out that with the increase in digitalization and the use of digital tools and applications, the construction sector is faced with the need for digital platforms and centers that should allow the development and synthesis of common digital services and data for all stakeholders in the value chain in all phases of construction processes [11]. These digital platforms must provide flexible communication of semantic data models and computer-based systems, seamless integration of third-party services and ensure data management based on the agreed standards. The H2020 DigiPLACE project aims to build a consensus at European level on the framework for reference architecture for the construction of digital platforms and a road map for their future rapid deployment and use.

It is possible to use a cloud environment to ensure the accessibility of the platforms. It can help achieve universal access and greater efficiency in their operation [12].

3. BULGARIAN POLICIES AND DIGITAL INITIATIVES SUPPORTING INNOVATION IN THE CONSTRUCTION SECTOR

The EUROPE 2020 initiative – National Reform Program for Improving the Business Environment is being implemented in Bulgaria. Under the measure "Encouraging investments in facilities, systems and business models for the use of waste as resources in support of the circular economy", in the field of construction, regulations were adopted for construction waste management and for the use of recycled construction materials.

Within the framework of the National Reform Program, the Third Action Plan for Reducing the Administrative Burdens for Business is being implemented in Bulgaria, as part of the policies for improving the business environment in Bulgaria. The administrative burden for business has been reduced by 30%, which corresponds to saved costs annually totaling about BGN 144.5 million. This is achieved by changing regulations, increasing the number of

institutions that have created a technical opportunity for electronic exchange of information on measures.

In the context of digitalization and innovation in the construction sector, the concept of Construction 4.0 as a branch of Industry 4.0 for digitalization of the construction industry should also be mentioned. Bulgaria has developed a "Strategy for Bulgaria's participation in the fourth industrial revolution" (Industry 4.0), which considers various aspects and sets an action plan based on its typical technological solutions [13]. Building Information Modelling (BIM) is central to the Construction 4.0 concept but includes other components. It is a process of creating and managing data for a building throughout its life cycle. BIM is at the center of the digital transformation in construction. The progressive development from traditional modelling to open BIM model goes through four levels [14], and many authors add further levels. A number of European governments require projects to be implemented at a certain level (currently level 2) of BIM.

Under the Operational Program "Human Resources Development" co-financed by the European Social Fund of the European Union, projects are launched such as Project: BG051PO 001-7.0.07-0263-C0001 "New model of cooperation for new skills" to increase the digital competencies of the specialists working in construction.

Important for the digitalization of the construction sector in our country is Bulgaria's participation in the European project ProductInfoX. Bulgaria is involved in this project, which is being implemented under the EU's Seventh Framework Program. It involves partners from Norway, Italy, and Bulgaria. The initiator of the project is the Norwegian Institute of Technology. On the Bulgarian side, the Bulgarian Construction Chamber (BCC) is a participant in it, which partners with nine leading European organizations. European participants include the FIEC and the Norwegian company Cobuilder. The aim of the project is to deal with the growing need to digitize product information in the construction sector. A new ProductXchange platform has been created, which serves to categorize and digitize product information in construction. The software product was developed in Bulgaria by the Bulgarian company InterConsult Bulgaria on behalf of Cobuilder. With the help of ProductInfoX, companies in the construction industry can more effectively control the use of materials used in construction and monitor their compliance with European and national regulations.

The policies in the field of digitalization of the construction sector are implemented with the support of the BCC. It has developed a long-term strategy for the digitalization of the construction industry until 2050. In 2019, a working

group "Digitalization and innovation in construction" is established. It involves various construction experts, scientists, representatives of business and non-governmental organizations and many interested construction companies. The objectives set in the strategy include the following [15]:

- reduction of production costs for the entire life cycle of the construction site;
- achieving resource efficiency through efficient use of resources and better waste management;
- improving the quality of the final construction product and increasing the competitiveness of construction companies;
- realization of green and sustainable investments by financing new products and solutions for the construction industry;
- improving the professional qualification and improving the process of making managerial decisions in construction.

An important step in the implementation of the strategy is the creation of a "European digital innovation hub in the construction sector", which aims to support the introduction of digitalization in construction processes, as well as through it to gain access at European level, including to apply for European projects.

Among the goals mentioned above in the strategy, the application of green technologies in construction deserves special emphasis. Some authors point out that green technologies have an impact on a number of economic sectors [16]. These technologies are becoming one of the latest trends in construction. Researchers point out that green building technologies have been applied in recent years to minimize the negative impact of the construction industry on the environment, the economy and society [17]. Their benefits have a significant impact on the creation of new buildings and facilities, as well as on the transformation of existing ones. Some authors point out that the introduction of the latest technologies in architecture and construction will lead to the construction of better homes and buildings with green standards [18]. Their impact, particularly on construction, is manifested through the construction of more energy-efficient and sustainable buildings, which means that they have a lower carbon footprint and therefore have a more environmentally friendly impact. The main direction through which the positive effects of green technologies are achieved is through the realization of greater energy efficiency. Green technologies have an impact on each phase of development in connection with the construction of a new building – in relation to location, design, construction materials, information systems used to support business processes, etc., and therefore they should be selected so to be as sustainable and energy efficient as possible.

4. CONCLUSION

The paper highlights the essential role of policies and digital initiatives for digitalization and innovation in the construction sector. It is accepted that they are divided into two main directions – European and Bulgarian.

Leading European initiatives include the Digital Single Market Strategy for Europe, the Digitizing of European Industry initiative, the Strategy for the sustainable competitiveness of the construction sector and its enterprises, etc., as well as the key importance of the European Construction Industry Manifesto on Digitalization, announced by the FIES. From the point of view of the Bulgarian digitalization policies, the leading importance of various programs and initiatives is emphasized, including initiated by the BCC as a leading branch organization in the construction sector.

European and Bulgarian policies and digital initiatives contribute to the progress of the digitalization of the construction sector and the implementation of innovations. They are a guarantee for its effective development, and in recent years special emphasis has been placed in compliance with green construction technologies.

REFERENCES

[1] B. Chaparov, Status and Problems in the Development of Construction in the Republic of Bulgaria, *Izvestiya Journal of University of Economics – Varna*, Science and Economics (2011) **4** 131–143, ISSN 2367-6361 (in Bulgarian).

[2] European Commission, *The European Construction Sector, A Global Partner* (2016), https://ec.europa.eu/docsroom/documents/15866/attachments/1/translations

[3] European Commission, *A Digital Single Market Strategy for Europe*, COM/2015/0192 final, 6.5.2015, Brussels (2015), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=ES

[4] European Commission, *Digitising European Industry Reaping the Full Benefits of a Digital Single Market*, COM/2016/0180 final (2016), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016DC0180

[5] European Commission, *European Cloud Initiative – Building a Competitive Data and Knowledge Economy in Europe*, COM/2016/0178 final (2016), https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52016DC0178

[6] European Commission, *Strategy for the Sustainable Competitiveness of the Construction Sector and Its enterprises*, COM final (2012) 433, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0433:FIN:EN:PDF

[7] European Commission, *Views on Construction – 2020 and beyond* (2020), https://ec.europa.eu/docsroom/documents/40706

[8] J. Michalak, External Thermal Insulation Composite Systems (ETICS) from Industry and Academia Perspective, *Sustainability* (2021) **13** 13705, ISSN: 2071-1050, https://doi.org/10.3390/su132413705.

[9] FIEC, *The European Construction Industry Manifesto on Digitalisation* (2018), http://www.fiec.eu/en/news/news-2018/the-european-construction-industry-manifesto- on-digitalisation.aspx, 22/05/2018.

[10] European Commission, *Digital Platform for Construction in Europe*, *Building the Construction Sectors' Digital Future* (2021), https://cordis.europa.eu/project/id/856943

[11] A. David, A. Zarli, C. Mirarchi, N. Naville, and L. Perissich, DigiPLACE: Towards a Reference Architecture Framework for Digital Platforms in the EU Construction Sector (Eds V. Semenov and R. J. Scherer), in: Proceedings of the 13th European Conference on Product & Process Modelling, CRC Press, Moscow, Russia, London, 15–17 September, 2021.

[12] M. Armiyanova, Design Patterns Suporting Application Development in Cloud Computing Environment, *News of the Journal of the Union of Scientists – Varna, Economic Sciences Series* (2016) **2** 134–145, ISSN: 1314-7390.

[13] Ministry of Economy, *Strategy for Bulgaria' Participation in the Fourth Industrial Revolution* (Industry 4.0) (2018), https://www.bia-bg.com/uploads/files/events /Industry_4.0/Strategy_Industry%204.0_draft_30%20March%202018.pdf (in Bulgarian).

[14] M. Srefanova, *Digitalization of the Construction Industry, European Initiatives and Standards for Building Information Modelling* (2018), http://www.bef.uceb.eu/wp-content/uploads/2018/05/08-MARIA-STEFANOVA-Industria.pdf (in Bulgarian).

[15] Bulgarian Construction Chamber, *Digitization in Construction*, https://ksb.bg/deynosti/digitalizatsiya-v-stroitelstvoto/

[16] S. Blagoeva and R. Jordanova, Algorithm for Studying the State of the Green Logistics in the Enterprises of Group 23.1 "Manufacture of Glass and Glass products", in: Proceedings of the First Scientific and Business Conference on Supply Chain Management "Knowledge on Logistics and Supply Chain Management in Bulgaria: Education, Business, Science", UNWE, 2019, ISBN 978-619-232-241-0 (in Bulgarian).

[17] A. Darko, A. P. C. Chan, D-G. Owusu-Manu, and E. E. Ameyaw, Drivers for Implementing Green Building Technologies: An International Survey of Experts, *Journal of Cleaner Production* (2017) 1–29, DOI: 10.1016/j.jclepro.2017.01.043, ISSN: 0959-6526.

[18] S. Mohanty, A. L. Skandhaprasaad, and S. S. Samal, Green Technology in Constructions, *IEEE*, *2010 Recent Advances in Space Technology Services and Climate Change* (RSTSCC 2010), Chennai, India (2010) 452–456, ISBN: 978-1-4244-9184-1.

Received January 04, 2022