Application of digital standards in construction

Pavel Kagan1* and Evgeniy Babushkin1

1Moscow State University of Civil Engineering, Department of Information systems, technologies and automation in construction, Yaroslavskoe shosse, 26, Moscow, Russia

Abstract. The article describes the global trend of industrial transition to the concept of “Industry 4.0” and the prerequisites for its influence on the field of industry standardization, in particular construction. The need to reorganize the current standardization system, which does not keep up with the pace of digital development of production, is outlined. The authors analyzed the modern standard-setting system in the construction industry, identified its main problems, which consist in a large volume of requirements for construction products and processes, an outdated approach to standardization in general, as well as a weak and ineffective existing standardization system and the difficulty of harmonizing Russian national standards with international standards. The described problems are relevant today, since right now the standardization system in the Russian construction industry is experiencing a new round of development, the abandonment of the prescriptive and target method of construction regulation and the transition to the parametric method. The study proved that the use of such modern technologies as digital standards (SMART standards) can solve the identified problems in the field of standardization, which in turn will affect the quality and efficiency of the regulatory system in construction.

1 Introduction

The rapid development of industry in the last decade is inevitably associated with the introduction of a huge number of new technologies, as well as the digitalization of many processes. Global industry is now facing the so-called fourth industrial revolution, which will affect manufacturing (industry 4.0) and serving human needs (work 4.0). It is predicted that the vast majority of business processes will be automated and digitized through the introduction of cyber-physical systems (CPS), the use of the Internet of Things (IoT) and the Industrial Internet of Things (IIoT), artificial intelligence (AI) [1].

However, due to the fact that the activities of industrial enterprises are heavily regulated by many external and internal regulations, the digitalization of global industry lags far behind advanced technological innovations in the field of information technology (IT) [2]. Thus, the current standardization system and standards application methodology will have to undergo comprehensive further development and digital transformation in order to be able to support the growing demands of modern industry and become digital standards.

* Corresponding author: kagan@mgsu.ru
This new approach to digital standards offers the potential to significantly increase the efficiency of industrial production.

2 Methods

Construction is one of the most important sectors of the Russian economy. According to data for 2022, construction and the housing and communal services sector account for about 11% of Russia’s GDP [3]. At the same time, at the time before September 1, 2022 (before the entry into force of RF PP No. 914 [4]), in accordance with RF PP No. 815 [5], 5 GOSTs and 69 sets of rules containing more than 10,000 requirements were applied on a mandatory basis in the construction industry to construction processes and products. There are also many other sources of requirements within the scope of standardization in the construction industry. The general hierarchical scheme of regulatory and technical standardization in construction is presented in Fig. 1.

Fig. 1. Hierarchical structure of the regulatory system in construction.

Another important feature of standardization in the construction industry is that the fund of documents on standardization in construction is rather poorly structured [6]. First of all, this is due to a rather complex approach to standardization in the Russian Federation, which combines prescriptive and targeted methods of construction standardization [7].

The development of national standards is a multifaceted and labor-intensive process. The main participants in the rule-making process are (Fig. 2):
The Technical Committee TC 465 “Construction” brings together industry leaders and the government to organize and carry out standardization in urban planning activities. TC 465 currently includes 378 member organizations [8]. Also, in addition to the activities of TC 465, the area of standardization of the construction industry may include the activities of related technical committees (for example, TC 400 “Work in construction. Typical technological and organizational processes”, TC 418 “Road management”, TC 209 “Elevators, escalators, passenger conveyors and lifting platforms for the disabled,” TC 505 “Information Modeling,” etc.). Thus, the problem arises of building a system of interaction between all technical committees and their members whose activities are related to construction.

3 Results

In addition, the Russian Federation is quite deeply integrated into international relations, which also leaves its mark: technical regulation in the construction industry should develop taking into account international principles and approaches. First of all, this concerns products for the construction industry (materials and products), which are still a large-scale subject of international trade in Russia with the countries of the EU, Customs Union, EurAsEC, CIS and China [7].

Summarizing the results of the analysis of problems in the field of construction standardization, we obtain the following (Table 1):

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<tr>
<th>The problem in the field of standardization in construction</th>
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4 Discussion

In connection with the identified problems of standardization in construction, the question of taking measures to build an effective standardization system arises. One of the possible modern tools for solving this problem could be the use of so-called machine-readable documents; in our case, we are considering machine-readable standards. Machine-readable standards (digital standards, SMART standards) are documents that, in addition to human-readable text, contain structured data in the form of formulas, tables, 3D and 2D graphics, program code, databases, etc., which can be interpreted and executed by a machine without the participation of a human operator. The abbreviation SMART in this case stands for Standards Machine Applicable, Readable and Transferable [9].

According to S. Tikhomirov, General Director of Codex JSC and Chairman of PTC 711 “Smart (SMART) Standards”, smart standards can be used for the purposes of machine search and analysis, implementation of human-oriented and machine-oriented information services for working with the content of standards [10].

As part of the development of the global concept of Industry 4.0, the first issues of digital standardization have been raised. Based on the intermediate results, we can conclude that the primary tasks of creating and implementing digital standards in industry (including construction) are state standardization and the development of uniform international standards [11]. Regarding the use of digital standards in Russian industry, a number of scientific works confirm the positive effect of using this technology, including automation of industries, development of production and enterprises, standardization of technological operations at all stages of the product life cycle, increasing production volumes and product quality [11].

In relation to the construction industry, the use of SMART standards should also have all the noted positive effects, as well as solve the problems identified during this study in the field of construction standardization (Table 2):

<table>
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<tr>
<th>The problem in the field of standardization in construction</th>
<th>Possible method to solve the problem when using SMART standards</th>
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<tr>
<td>A huge number of disparate and multi-level requirements</td>
<td>Automation of the analysis of standard texts, automated selection of requirements in the text of the standard and their marking</td>
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<td>Difficulty in transitioning to a parametric approach to standardization</td>
<td>Formation of a requirements management system (RMS) from the selected requirements</td>
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<td>Weak structuring of the fund of documents on standardization in construction</td>
<td>Automated markup of all existing standards, identification of expired standards, harmonization of standards among themselves in an automated system for using standards, interconnection of parts of various documents through hyperlinks and markup</td>
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<td>Ineffective system of interaction between standardization participants</td>
<td>The ability to collaborate on SMART standards using special automated systems</td>
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<tr>
<td>The difficulty of harmonizing Russian national standards with international standards</td>
<td>Support for international standards in the field of digital standardization for seamless integration of foreign standards into the Russian system</td>
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</table>
5 Conclusions

Thus, the authors analyzed the modern rule-making system in the construction industry and identified its main problems. For each of the five identified problems, the authors proposed a possible method for solving it using SMART standards technologies. The solution to the problems identified during the study will, in turn affect the quality and efficiency of the regulatory system in construction.

References

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