Standardization and metrology in the period of digitalization of the economy

V V Okrepilov, A G Gridasov and I V Chudinovskikh

Institute for Regional Economic Studies Russian Academy of Sciences, 38 Serpukhovskaya St., Saint-Petersburg, 190013, Russia

E-mail: okrepilov@test-spb.ru

Abstract. The article is devoted to the new challenges facing standardization and metrology in the digital economy. The need to improve the practice of developing standards, more active involvement of business in this process is emphasized. Attention is drawn to the preservation of the best achievements of Russian metrology, its leading positions in the world in the context of digitalization.

Summing up the results of 2020, which is in many ways unique for humanity, we can confidently say that it clearly marked the changes taking place in the world. More precisely, it significantly accelerated these changes. And one of the main ones is the growing digitalization of the economy. Of course, in many respects it is of a forced nature, but, nevertheless, today it is clear that there will be no reverse movement. This is evidenced by the sharp rise in sales in the digital industry. Therefore, the contours of the new digital economy are already clearly distinguishable today.

A characteristic feature of such an economy is the huge amounts of data with which it operates, the high rate of exchange of them, as well as the extremely dynamic changes taking place in them. The structure of the economy itself is also changing, in which the main stage in achieving surplus value is transferred to the design and creation of digital resources and digital processes [5].

It can be said with complete certainty that today information is of the same high importance for civilization as oil. The literature has already described the key trends in the development of the production of products and services. Among them are [8]: mass introduction of "smart" sensors, robotic technologies, creation of a single (covering all production and post-production service) intelligent ("smart") system; rejection of "paper" technologies; building digital models for design and forecasting; rejection of the so-called "cutting technologies" and the transition to "extension technologies" (nanotechnologies); use of the Internet for monitoring, control and management of processes.

Of course, the digitalization of the economy provides tremendous opportunities for improving quality both in industrial production and in other sectors of economic activity. However, for this, it is necessary to develop the appropriate regulatory framework, including standardization. And this is not only the transfer of the entire existing base of standards into electronic form, but also the creation of new standards that correspond to the conditions of the new economy.

Russia has adopted a program for the transition to the digital economy [2], which also includes measures to develop the technical regulation system so that it not only corresponds to the achieved level of the digital economy but can also act as a leading factor in its development. One of the directions of
such development is the digitization of the standards fund, which is being successfully carried out. According to plans, by 2027 at least 80% of standards should be digitized (figure 1).

As you know, the standards fix the best technical and management solutions that can be applied by all interested parties. In other words, standards are at the same time a consequence of the progress of society and production, but also contribute to their further development. It has been proven that the application of standards contributes to an increase in labor productivity, competitiveness, demand, and, consequently, income growth. As a result, a new stage of development - the digital economy - urgently requires new standards.

Many leading domestic enterprises, responding to the challenges of the time, have already developed their own standards that meet the conditions of the digital economy. Moreover, some of these standards have already been tested not only at the level of individual enterprises, but also at the level of entire corporations. Now the task is to bring these developments to the national level. By 2027, the share of standards approved during the year, the development of which is financed by business, should reach 75% (figure 2).

**Figure 1.** Share of standards in the Federal Information Fund of the Standards presented in a computer-readable form (according to the report on the status of work in the field of standardization in the Russian Federation following the results of 2019).

**Figure 2.** The share of standards approved during the year, the development of which is funded by business (according to the Report on the status of work in the field of standardization in the Russian Federation at the end of 2019).
The experience of the leading countries of the world - Germany, USA, Japan, South Korea - shows that it is business in them that is the leading factor in the development of standardization, including in the digital economy [4]. Domestic enterprises, developing international cooperation, are adopting this experience. However, unfortunately, it has not yet found its development in the actions of domestic producers, and new standards have not yet gone beyond the walls of enterprises.

Of course, to a certain extent, this is due to the lack of unity in the outlook on the prospects for the development of digitalization of the economy. So far, each company and corporation is developing its own digital standardization program. This cannot but cause concern, since in this case there is a danger of lagging behind in this area. It is no secret that leading manufacturers and developers strive to approve the use of their own standards in international markets, which gives them serious competitive advantages.

Proactive action must be taken promptly to engage business in standards development. It is very important to overcome the archaic stereotype that the development of standards is solely a matter for the state. The modern standard is a product of consensus that takes into account the interests of all stakeholders. And its application is a factor of development.

Truly cardinal changes taking place in the world, of course, cannot but affect the economy of quality and its components - metrology, standardization, quality management. In particular, in metrology, such changes began already before 2020. In 2019, figuratively speaking, the physical standard of the kilogram was “archived”. Now the standards of the kilogram, kelvin, mole are determined using the constants of Planck, Boltzmann, Avogadro, and amperes - through the characteristics of the flow of elementary electric charges [7]. We can also mention the "smart" electricity meters, which independently send data via the Internet. Today all new houses are equipped with them without fail.

But the data arrays used by the digital economy need to be obtained and analysed somehow. That is, we will soon observe a sharp increase in the demand for sensors, counters, other measuring instruments and their processing programs. It is they who will make it possible to create a “digital model” of the object. On the one hand, this is a positive phenomenon, since constant monitoring allows you to accurately know the state of equipment or structures, and, therefore, to take preventive (repair) measures in advance. But on the other hand, the dimensions of measuring instruments (SI) are becoming smaller, which allows them to be placed in the most appropriate places. However, sometimes such an arrangement makes it difficult to verify the device, which, in extreme cases, necessitates rechecking and duplicating measurements. Consequently, new sensors must already provide for the possibility of self-checking in order to give a warning signal if necessary.

Already today, the so-called "Internet SI" is being created, that is, any interested party can get acquainted with the characteristics of the SI - its name, date and place of manufacture, date and performer of verification. Work is underway to create a unified database of believers in order to give the enterprise a freedom of choice.

The development of digitalization is fraught with many pitfalls. Our country is one of the world leaders in the metrological field. Therefore, it is especially important to pay attention to the upcoming "growth difficulties" in order not to lose their leading positions. In other words, digitalization in metrology should take place in a qualitative evolutionary way, preserving the best achievements and avoiding losses and rollback. Thoughtless demand for digitalization of information in the absence of proper software and hardware can lead to significant difficulties in the work of centres of standardization and metrology. In particular, during verification and calibration of measuring instruments [6]. In addition, the question of what to do if the SI has not passed the verification has not yet been resolved? Moreover, when such a measuring instrument has already been discontinued and an appeal to the manufacturer will give nothing.

The successful implementation of the digitalization program will contribute to the high level of development of domestic metrology. Our country is firmly holding leading positions in the world in the field of ensuring the unity and accuracy of measurements. Russia has no equal on electrical and acoustic measurements, thermometry, measurements associated with radioactive substances, and a number of others. According to the calibration and measuring capabilities of the National Metrological Institutions
of our country included in the base of the International Bureau of Weights and Measures, Russia is the
world leader, ahead of the United States, China and Germany (figure 3).

Figure 3. Measurement and calibration capabilities of different countries (in units, according to the
Ministry of Industry and Trade of the Russian Federation).

At the same time, one of the significant problems in the digitalization of the economy is the lack of
highly qualified specialists. In such an economy, it is the person who becomes the main productive
force, and investments in the knowledge economy become one of the main factors of economic growth.
According to academician A.G. Aganbegyan, if by 2025 to ensure the share of investments in fixed
assets at 25-28%, and in the knowledge economy at 22%, then this will lead to 4-5% of GDP growth,
and the level of investment, respectively, in 30-33% and 30% by 2030 year will provide 6% growth [3].

The digitalization of the economy is objective and massive and is developing at an ever faster pace.
Digital technologies are rapidly being introduced in the social sphere and in everyday life, causing the
need for their development by almost every person. Standardization and metrology are designed to help
this process develop most effectively, ensuring the competitiveness of the economy, the dynamic socio-
-economic development of Russia.

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