

Regulatory Aspects and Practical Approaches to Data Visualization

L. A. Maksimenko^{1,A}

Siberian State University of Geosystems and Technologies, Novosibirsk

¹ ORCID: 0000-0003-0351-6363, maksimenko_la@mail.ru

Abstract

The article examines the role and importance of data visualization in the modern information society. The regulatory aspects of the application of the visualization method are considered, including issues of classification, security, confidentiality and ethics of data use. Special attention is paid to the use of visualization techniques to work with open information and open data to present graphs, charts, big data, datasets, dashboards and interactive reports. When performing the work, the ESCD and SPDS standards were taken into account, containing rules and recommendations for the graphic design of objects; BI tools for creating dashboards were considered. At the same time, it is emphasized that modern trends in digitalization and automation put forward additional requirements for information processing, which can be interpreted as a new stage in the field of data visualization.

Keywords: subject visualization, BI tools, Power BI Desktop, visualization method, open information, open data, graphs, charts, big data, datasets, dashboards.

1. Introduction

Currently, there is a rapid accumulation of information, which amounts to large amounts of data. Informally, information and data can be considered synonymous, although they are not identical. Information always has a certain form of representation and is transformed into data through its processing. When working with information, procedures for collecting and storing information; processing and preparing information for placement; distributing information; updating (regular updating) information should be defined. The digital environment opens up new opportunities for visual modeling of information, and the presence of advanced graphical tools allows you to effectively solve the problems of data mining with a choice of convenient options for displaying the results.

The graphical form of information display is carried out through various methods and tools, including graphs and diagrams, maps, interactive visualizations, dashboards and infographics. Infographics (information graphics), as a rule, is a combination of graphic elements, text and images to convey complex information in a simplified and attractive form. Research data visualization is created algorithmically based on representative samples covering large amounts of data, and represents complete analytical solutions from data extraction from various sources to reporting. The main difference between the concepts of visualization and infographics is the large amounts of data that visualizers can work with; infographics, on the contrary, creates images that do not contain a large amount of data.

2. Problem formulation

The purpose of the work is to study the regulatory support and application of data visualization methods that affect the choice of an effective way to present data in a user-friendly format based on modern software. The normative support of the data visualization method is

aimed at establishing standards and rules for the use of data visualization in various fields. Some aspects of regulatory support for the data visualization method may include:

- setting standards for the presentation and interpretation of data in graphical format;
- establishment of objects for the application of data visualization methods;
- regulation of the use of specific data visualization tools and technologies;
- defining rules for the preservation and security of data visualized in different formats;
- ensuring confidentiality and data protection when using various visualization methods.

To achieve maximum efficiency and understanding in the presentation of data and information, it is important to follow the rules for the design and use of appropriate visualization methods. By now, both in the educational and in the work process, the issues of using specialized software for creating three-dimensional models, visualization and animation prevail, at the same time, the rules for the design of drawings, graphs and diagrams are practically not considered.

The relevance of the work was determined by the issues of comprehensive training of specialists not only for working with software, but also for the skills of registration and documentation of work results in accordance with the requirements of standards. In connection with the introduction of the Decree of the Government of the Russian Federation dated December 21, 2021 No.3759-r "On approval of the strategic direction in the field of digital transformation of science and higher education" [1], the article discusses the application of the information visualization method using graphs, diagrams and dashboards in the framework of updating and expanding the educational process.

3. Theory

Openness of information as a conceptual direction for the development of information systems is regulated by information systems in the field of standardization, which operate on the basis of information technologies and technical means that ensure the collection, processing, storage, distribution, use and provision of information related to the planning of standardization activities, including the formation and implementation of programs for standardization, development, editing and testing of draft documents on standardization in accordance with the Federal Law "On Standardization in the Russian Federation" dated June 29, 2015 No. 162-FZ "On Standardization in the Russian Federation".

The national standard of the Russian Federation GOST R 56907-2016 "Lean manufacturing. Visualization" was introduced by the Technical Committee for Standardization TC 076 "Management Systems", approved and put into effect by Order of the Federal Agency for Technical Regulation and Metrology dated March 31, 2016 N 232-st 4. This standard is a guide for the use of the visualization method based on recommended principles in accordance with GOST R 56407. The rules for the application of this standard are set out in Article 26 of the Federal Law of June 29, 2015. No. 162-FZ "On Standardization in the Russian Federation".

In accordance with GOST R 56907: "Visualization method: A systematic set of actions for visualizing objects. The visualization method is used in an organization in order to present information in a visual form (drawing, photograph, graph, diagram, diagram, table, map, etc.) and bring it to the attention of staff in real time to analyze the current situation and make informed and objective decisions."

Federal Law No. 149-FZ of 27.07.2006 (as amended on 12.12.2023) "On Information, Information Technologies and Information Protection" defines the norms of legal regulation of relations in the field of information, information technology and information protection [2]. The standards of graphic symbols used for technical documentation for products are presented in [3].

The objects of the visualization method are defined in [4] and shown in Fig. 1.

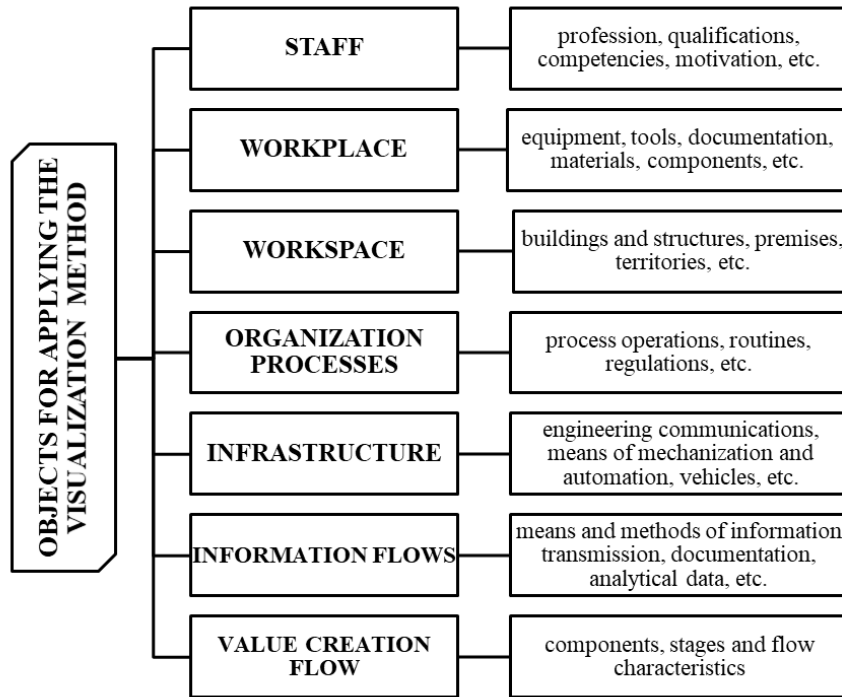


Fig. 1. Objects of the data visualization method

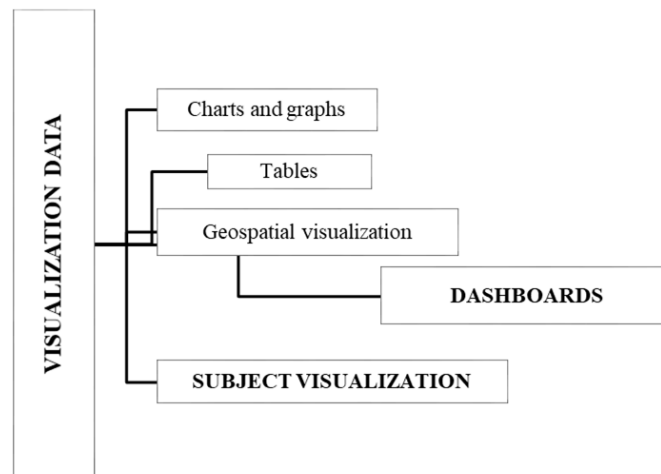


Fig. 2. Classification of data visualization methods

Data visualization in terms of classification by subject areas, as shown in Figure 2, can be represented by graphs and diagrams, tables and diagrams, dashboards, and with the development of computer modeling programs, "Subject" visualization can be represented as a separate type.

Object or 3D visualization, which creates a copy close to a real object, is widely used in many areas of human activity. Creating a high-quality object model is a laborious process that requires high professional skills from developers to select and customize textures, colors, fonts, lighting, rendering and other parameters when working with software. The levels of graphical detail of the project at different stages of design are currently systematized according to the LOD methodology of the English standard (Level Of Details) or according to the methodology of SP 333.1325800.2020 - A, B, C1, C2, D, G. The correct choice of visualization tools and techniques at each stage of design can increase the efficiency of project development processes. The initial stage of design is associated with the choice of a conceptual direction, the main ideas of which can be fixed with the help of a mood board. The mudboard is

assembled from images and photographs, without specifying the style, typography, colors, textures, etc. in the form of a collage that conveys the overall vision of the project. The volume and shape of the object is transmitted by creating 3D models with subsequent visualization in CAD. Physical and virtual prototypes, presentation renderers, if necessary, allow you to "see" the project before its implementation. The main problems in working with subject visualization include such factors as the complexity of creating models, the quality of textures, interoperability (the ability of two or more information systems to exchange and use information), software licensing, etc. The quality standards of 3D object visualization are actively discussed on the Internet among developers and users of the corresponding software.

Visualization and application of conventional graphical symbols for visual identification of information depend on the functionality defined by CAD and may vary depending on the automated system used, but the preparation of 2D graphical documentation is always carried out in accordance with the requirements of standards [5]. The rich functionality of graphic primitives of modern programs [7] for users who are not familiar with the requirements of GOST creates the illusion of their free choice, which leads to errors in the design of graphs, diagrams, choosing the scale of the drawing display, line outlines, etc. In this regard, during the study period, regardless of the specialty, it is important to study the above-mentioned standards within the framework of a particular discipline. The basic ESCD standards containing rules and recommendations for graphical visualization of objects recommended for study are shown in Fig. 3.

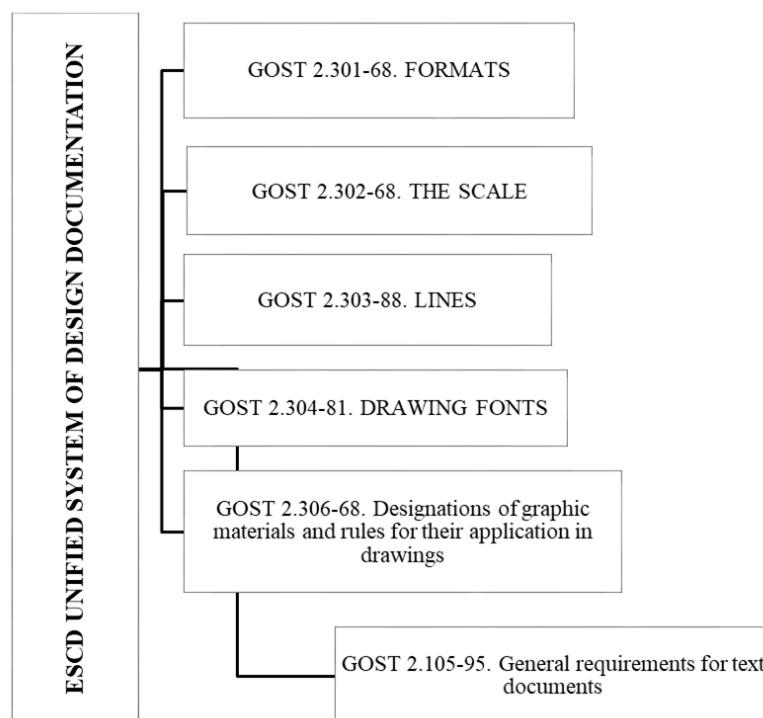


Fig. 3. Basic ESCD Standards

Among the graphic programs adapted to the domestic regulatory framework of the ESCD and SPDS, the nanoCAD graphic editor (developed by Nanosoft) stands out. nanoCAD software is included in the Russian software database. The modular structure of nanoCAD software allows users to move from the basic level of work to BIM design technologies.

4. Experimental results

As follows from Fig.1, documentation refers to visualization objects [4]. In project activities, documentation is divided into graphic and textual. Text documentation includes all types of tables, the design of which is regulated by GOST 2.105 [6], and graphic documentation in-

cludes drawings and diagrams. The rules for registration of construction documentation are regulated in the SPDS standards 21.1101[7]. New technologies of computer modeling of real estate objects have linked a 3D model and drawings based on a 3D model into a single block. The complex of issues related to the design of the results of such works is more or less related to the graphical visualization of the real estate object.

According to SP 331.1325800.2017 "Information modeling in construction. Rules of exchange between information models of objects and models used in software complexes", interoperability is formed at three levels: technical, semantic and organizational. GOST R 10.0.02-2019/ISO 16739-1:2018 "System of standards for information modeling of buildings and structures. Industry-specific base classes (IFC) for the exchange and management of data on construction sites. Part 1. The Data Schema" defines the IFC standard as an international format with open specificity for the information model of construction facilities (IM) data intended for exchange and sharing in software applications used by participants in the construction and operation of buildings and structures industry. It is important to note that the IFC format is constantly being improved. New attributes and properties are added to it, allowing you to transmit additional important information. Every year, IFC demonstrates increasing efficiency in creating projects using information modeling, being the main format for data exchange in the field of design.

To present the results of 3D modeling, in the form necessary for the preparation of the graphic part of the technical plan, it is required to prepare drawings of floor plans of the real estate object. IFC format files can be used as a base for the design of floor plans. For example, if the floor plan is drawn up in Renga, then it is enough to open the IFC format file, go to the "Drawings" section and transfer the desired floor plan to the drawing view. The nanoCAD software also provides for the completion of these actions Fig. 4.

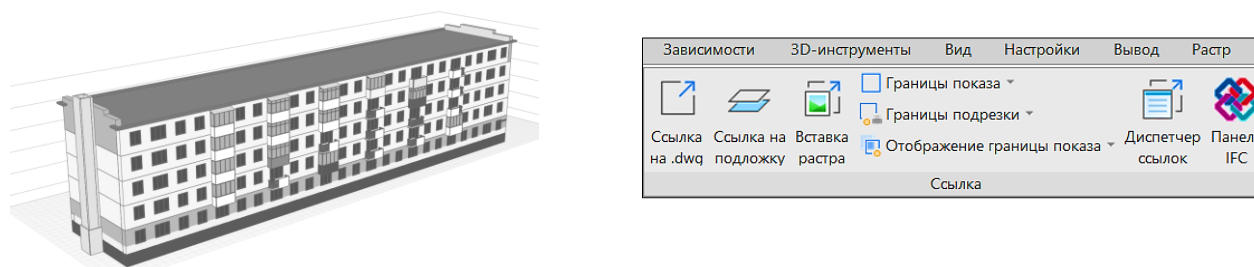


Fig. 4. The IFC Panel

Figure 5 shows a fragment of the floor plan formed from a 3D model in Renga.

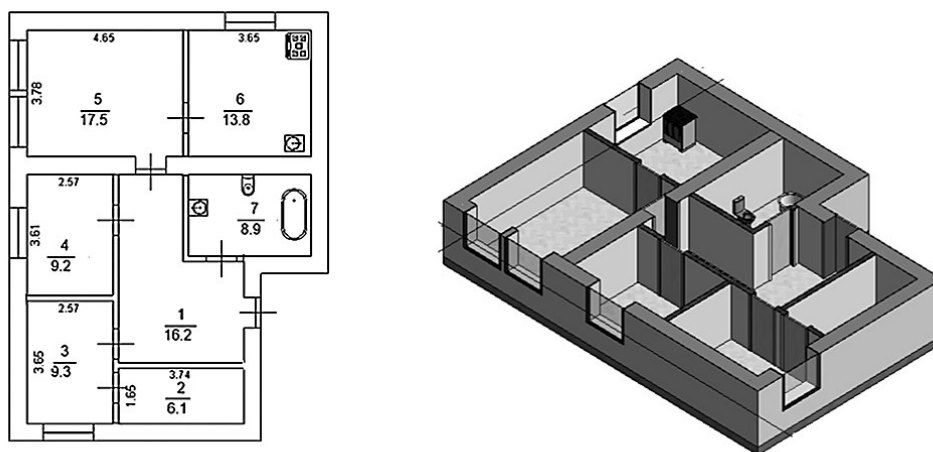


Fig. 5. Formation and design of the floor plan

Summarizing the above material, it can be noted that the processes of preparation and design of drawings, in particular floor plans, have now reached a new level of digital subject visualization of graphic documentation.

Another equally important aspect of the regulatory support and application of visualization methods are the issues of data visualization. Graphs and charts are an integral part of almost any report. With the increase in the volume of data, there is a need for their effective processing. Visualizing the results is key to understanding the information. Practically no time is devoted to the issues of preparation for such activities in the educational process. Basic skills in Excel and Word allow students to perform simple tasks on building graphs and diagrams, but working with big data requires working in more professional systems such as Microsoft Power BI, Tableau, Qlik Sense, DataLense, Metabase, Google Data Studio, etc.

In GOST R ISO/IEC 20546-2021 "Information technology. Big data. Overview and dictionary" reveals the terminological apparatus, gives concepts to terms such as dataset, data lake, etc., explaining the processes accompanying the accumulation of digital information in the world. Resources such as the National Spatial Data System (NSPD), OpenStreetMap Geodata (OSM), and NASA Geospatial data represent a huge field of activity for updating and supplementing information in cadastral databases, identifying new trends and patterns. Real estate databases such as CION (Real Estate Information Center), Avito Real Estate, they can be used to provide a general view of real estate on the market and to analyze price and supply trends. Cadastral information is also presented in the sources [9-17].

Taking into account the emerging trends in data growth and new technologies for their processing, the most effective data visualization techniques should be noted. Dashboards are increasingly appearing on the websites of government agencies and institutions. To prepare such documentation, knowledge, skills and abilities in the preparation and processing of data, visualization techniques and publication of information are required. The advantages of information processing in BI systems are shown in Fig. 6.

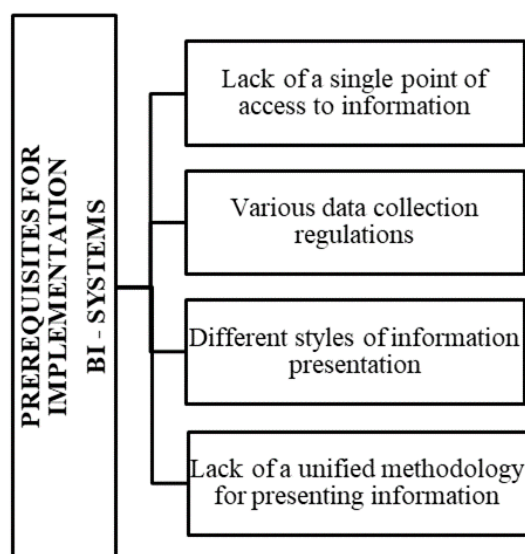


Fig. 6. Advantages of information processing in BI systems

Examples of prepared dashboards within the framework of studying the discipline "Systems of intellectual processing of cadastral information" are given in [19-20].

5. Discussion of the results

Often, specialists working in specialized software do not have the skills to design the results of their work, in accordance with the standards of the ESCD and SPDS. The reasons why

this happens may be as follows: insufficient understanding of the ESCD and SPDS standards; orientation towards visual aspects, ignoring documentation standards; lack of practice and experience in documentation design, considering documentation design less important than creating models and visualizations. It is also important to note that the possibilities of modern information, communication and digital technologies for the visualization of real estate objects are still underutilized.

Visualization standards and regulations, as shown in the article, exist in many industries. The development of standardization of visualizations concerning the practical advantages of designation standards in business communication and business processes is obvious, but is carried out only in individual organizations. Ensuring the unity and systematization of the development of visualization standards in business processes is an important step to increase the efficiency of the company and improve the understanding of processes by all participants. The use of uniform visualization standards ensures consistency in the presentation of data and information at all levels of the organization. This is important for creating a unified information space and maintaining a corporate style

6. Conclusion and inference

In accordance with the stated purpose of the study of regulatory support and the use of data visualization methods that affect the choice of an effective way to present them in a user-friendly format, recommendations on the use of information visualization methods have been developed based on modern programs, including the following aspects:

- defining visualization goals and objectives (improving communication, simplifying process analysis, increasing transparency, etc.);
- researching best practices in the field of visualization (including business processes);
- creation of a working group of representatives of all stakeholders (analysts, managers, IT specialists, etc.);
- definition of the procedure for data collection and storage (processing and preparation of information for distribution and its placement);
- choosing the method of updating information (frequency of data collection and placement, responsibility for data reliability, data presentation format, etc.);
- identifying the most effective way to present information (interactive reports available for joint data updating and decision-making, dashboards, etc.).

The study of theoretical issues of regulatory support and the application of visualization methods allows us to generalize and draw conclusions about data visualization objects, consider modern classifications of visualization methods that affect the choice of an effective way of presenting information.

References

1. Decree of the Government of the Russian Federation dated December 21, 2021 No. 3759-r "On approval of the strategic direction in the field of digital transformation of science and higher education" – Access from the reference.- the legal system "Consultant Plus".
2. On Information, information technologies and information Protection [Electronic resource] : Federal Law No. 149-FZ of 07/27/2006 (as amended on 07/14/2022). – Access from the help.-the legal system "Consultant Plus".
3. Standards of graphic symbols used for technical documentation for products. <https://www.muayene.com/ru/standartlar/genellemeler-terminoloji-standardizasyon-dokumantasyon-standartlari/grafik-sembooller-standartlar/teknik-urun-dokumantasyonlari-icin-kullanilan-grafik-sembooller-standartlari>
4. The national standard of the Russian Federation GOST R 56907-2016 "Lean manufacturing" is one of the references.- the legal system "Consultant Plus".
5. A unified system of design documentation. General requirements for GOST 2.301 - 2.321 – Access from the help.- the legal system "Consultant Plus".

6. A unified system of design documentation. General requirements for text documents. GOST 2.105-2019– Access from the help.- the legal system "Consultant Plus".
7. Catalog of data visualization [Electronic resource]. – Access mode: <https://datavizcatalogue.com/RU/>.
8. The system of design documentation for construction. The main requirements for project and work documentation. GOST R 21.101-2020 Update date: 01.01.2021– Access from the help.- the legal system "Consultant Plus".
9. Fedotova V. S. Professional training of future specialists in the field of cadastral registration and registration of rights to graphic visualization of real estate objects / V. S. Fedotova // Pedagogy. Questions of theory and practice
10. Real estate Agency CIAN [Electronic resource]. – Access mode: <https://www.cian.ru/analiz-rynka-nedvizhimosti-b2b/>.
11. Real Capital Analytics [Electronic resource]. – Access mode: <https://app.rcanalytics.com/>.
12. On State Registration of Real Estate [Electronic resource] : Federal Law No. 218-FZ dated 07/13/2015 (as amended on 10/20/2022). – Access from the help.- the legal system "Consultant Plus".
13. Rosreestr. Statics and analytics [Electronic resource]. – Access mode: <https://rosreestr.gov.ru/open-service/statistika-i-analitika/>.
14. The open data portal of the Russian Federation [Electronic resource]. – Access mode: <https://data.gov.ru/>.
15. The website of the Federal State Statistics Service [Electronic resource]. – Access mode: <https://rosstat.gov.ru/>.
16. The set of open data of the Ministry of Education of the Russian Federation [Electronic resource]. – Access mode: <https://opendata.edu.gov.ru/opendata/>.
17. Open data on the website of the Ministry of Labor [Electronic resource]. – Access mode: <https://mintrud.gov.ru/opendata>.
18. Microsoft Power BI Desktop. A free application for creating reports and data analytics developed by Microsoft [Electronic resource]. – Access mode: <https://powerbi.microsoft.com/ru-ru/desktop/>.
19. Evstifeeva A. A. Data visualization and dashboarding for displaying cadastral information [Electronic resource] // Collection of abstracts: at 2 o'clock – Novosibirsk : Sgugit, 2023. Part 1. – C. 33-34. – Head: L. A. Maksimenko. – Access mode: <https://sgugit.ru/student/research-work/issc/> / Collection of RNC 2023-1.pdf (accessed: 07/04/2023).
20. Maksimenko L. A. Collection and processing of cadastral information in the field of real estate management / L. A. Maksimenko. – DOI 10.33764/2411-1759-2024-29-1-118-126. – Text : direct // Bulletin of Sgugit (Siberian State University of Geosystems and Technologies) – 2024. – vol. 29, No. 1. – pp. 118-126/