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A Conceptual Model for Evaluating Digital Intellectual Assets

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ABSTRACT

The **object** of the study is the valuation and commercialization of digital intellectual assets. The **subject** of the study is a conceptual model for assessing the value of digital intellectual assets, reflecting the regulatory framework, objects, subjects, principles, approaches and methods of evaluation involved in civil turnover. The **relevance** of the study is related to the development of the digital economy and emerging new types of digital assets, including digital intellectual assets, which require their identification and the formation of a theoretical and methodological basis for valuation. The **purpose** of the study is to build a conceptual model for estimating the value of digital intellectual assets for subsequent commercialization with consideration of the identified identification characteristics, substantiated principles, factors, approaches and methodological tools. The **methods** of comparative analysis, generalization, classification, logical, semantic and functional modeling, cost estimation are used in the paper. The trends of digitalization of the economy are analyzed, the identification features of digital intellectual assets are determined based on the study of the concepts of "digital asset", "intellectual asset", "object of valuation". A semantic model of the valuation of digital intellectual assets is proposed, illustrating the relationship of its conceptual elements. A process-functional model for estimating the value of digital intellectual assets in IDEF0 notation is constructed. It is **concluded** that digital intellectual assets as objects of valuation in the conditions of the current regulatory regulation are: 1) the results of intellectual activity created with the use of digital technologies, for which digital rights are fixed in the information system in the form of NFT tokens; 2) digital rights to use intellectual property objects that exist in digital or other forms. Their cost can be determined by the method of analogues, the method of discounted cash flows or the cost of creation method, depending on the purpose of the assessment, the identified factors and taking into account the principles of evaluation.

Keywords: digital intellectual assets; semantic model; functional model; value; commercialization; approaches and methods of valuation

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INTRODUCTION

The relevance of the study of digital intellectual assets as objects of valuation for purposes of commercialization is due to the recent intensification of digitization processes in all spheres of life of society, both worldwide and in the Russian Federation.

If we discuss global trends, according to the international portal Statista,[1] in 2023 revenue in the digital asset segment will reach 1 965,00 mln USD, and the number of users in the Digital Asset segment by 2027 will be 37 520 thous. people. According to the analysts of the portal, the market of digital assets in the coming years will continue to rise. Factors like the active adoption of digital technology (mainly blockchain), the rising interest in decentralized finance, and the acceptance of irreplaceable tokens contribute to enable this. However, as in any developing market, there are also risks and challenges related to regulatory uncertainty and potential volatility. Furthermore, the functioning of the digital asset market requires the creation of a favorable digital environment — widespread adoption of digital technologies, development of digital competences of the population and formation of a scientific and methodological base for the management of new asset types.

In Russia, gross expenditure on the digital economy in 2021 amounted to 3.7% of the country's GDP, or 4 848 bln rubles, which is 19% higher than in 2020. At the same time, the internal costs of organizations for the creation, dissemination and use of digital technologies and related products and services increased to 2 947 bln rubles, i.e. by 30.3%, and the corresponding expenses of households exceeded 1.9 trn rubles. In the context of the digitization of everyday life, the population is increasingly interested in acquiring relevant competences. Almost 82% of Russian citizens aged 16–74 use the Internet on a daily basis, including 53% for financial transactions and 46.6% for ordering goods and services.[2]

The development of digital technologies in the economy and digital competences of the population provides the necessary ground for the use of new digital assets, but without appropriate regulation their inclusion in the civilian circulation and subsequent gain from ownership is impossible.

Russia has chosen a model of direct regulation of digital assets, providing for their allocation to a separate object of civil circulation with special legal status. In particular, legal conditions have been created for the release and circulation of new digital instruments —digital utility rights (hereinafter — DUR) and digital financial assets (hereinafter — DFA), that can be issued and circulated in information systems using distributed registry technology. Digital utility rights within the meaning of the Federal Law No. 259 from 02.08.2019[3] mean digital rights, including:

- right to demand the transfer of the thing (things);
- right to demand the transfer of exclusive rights to the results of intellectual activity and/or the rights of use of the outcomes of intellectually activity;
- right to demand the execution of works and/or the provision of services.

In essence, the acquisition of digital utility rights has become a way of investing in digital assets, including digital intellectual assets using various investment, including crowdfunding platforms. At the fundamental level and within the framework of the specific regulation of the law, it is required that the holder has direct (without intermediaries)

[1] URL: https://www.statista.com/outlook/dmo/fintech/digital-assets/russia (accessed on 07.05.2023).

[2] Abdrakhmanova G., Vasilkovsky S., Vishnevskiy K. et al. Digital Economy 2023: a brief statistical collection. Moscow: HSE; 2023. URL: https://issek.hse.ru/mirror/pubs/share/802513326.pdf (accessed on 07.05.2023).

[3] Federal Law No. 259 from 02.08.2019 "On attraction of investments using investment platforms and on introduction of amendments to separate legislative acts of the Russian Federation". The Russian Federation Code. 2019. No. 31. Art. 4418.20.

access to his digital rights using information technology (including a unique code for the DFA), including the right to obtain information about the digital rights that the individual possesses and the ability to dispose of them.

A key role in regulating the digital asset market was played by the adoption of the Federal Law No. 259 from 31.07.2020,[4] which introduced the concept of a distributed register, as well as the regulation of relations arising from the issuance, accounting and circulation of DFA.

According to a number of experts, these innovations will lead to the fact that the Russian market of digital financial assets in 2023 will amount to more than 1 trn rubles, and by 2028 will grow to 3.5–4 trn rubles.[5]

Despite the fact that the majority of digital assets currently belong to DFAs, the role of digital intellectual assets (hereinafter —DIA) as objects of valuation and commercialization is also increasing in connection with the increasing importance of intellectual property for the competitiveness of the Russian economy as a whole and in particular. So far, the share of intellectual property in the country's GDP is extremely small and seems insignificant against the background of the growth of intellectual property share in the GDP of other countries. Meanwhile, the issue of classifying digital assets to DIA as objects of civilian circulation remains unresolved. The problems of scientific and theoretical justification of the valuation of these assets are poorly studied. his reduces the commercialization potential of DIA and increases the lost profit of Russian entrepreneurs, which ultimately negatively affects the global competitiveness of the Russian economy in difficult geopolitical conditions.

Thus, the purpose of the study is to develop a conceptual model of the value of digital intellectual assets for subsequent commercialization, taking into account identified characteristics, substantiated principles, factors, approaches and methodological tools. The tasks that follow must be performed in order to achieve the goal:

- identify the key features of digital intellectual assets, identify those DIAs that may be valued;
- identify the subjects, principles, factors, approaches and methods of valuation of digital intellectual assets for the purpose of subsequent commercialization;
- develop a semantic and functional model for the valuation of digital intellectual assets.

RESEARCH MATERIALS AND METHODS

The information base for writing the article was the results of the own research conducted in 2022 within the framework of the first phase of implementation of the grant of RSF on the topic "Formation of concept of valuation and commercialization of digital intellectual assets" [1, 2], as well as the work of domestic and foreign lawyers, economists, IT-specialists on the relevant subject, regulatory and legal acts of digital property relations, intellective property objects, valuation activities, data from open sources and specialized sites, including the Ministry of Economic Development, Rostat, Rospatent, the Bank of Russia, business internet portals, etc.

The emergence of digital assets would not have been possible without the development of blockchain technology, which is based on the protocol first proposed by American cryptographer David Chaum in his thesis "Computer systems established, maintained and trusted by mutually suspi-cious groups" [3]. In developing this idea, the researchers, focusing on the emerging commercial possibilities of the described technology,

[4] Federal Law No.259 from 31.07.2020 "On digital financial assets, digital currency and on amendments to individual legislative acts of the Russian Federation". The Russian Federation Code. 2020. No. 31 (Part I). Art. 5018.

[5] URL: https://zakon.ru/blog/2023/03/31/intellektualnaya_sobstvennost_kak_cifrovye_ finansovye_ aktivy_cfa_informacionnoj_sistemy_centralnogo_ (accessed on .05.2023).

focused on the application of blockchain for financial markets, banks, IT-companies, real-sector companies, gaming business and even government registers and personal data personification [4–6]. Finally, Russian and foreign scientists addressed the problem of identifying digital assets, primarily in terms of their legal regulation [7–10]. Much less attention is paid to the economic nature and types of digital assets in Russian and foreign sources. For example, the paper [11] defines as: "digital asset is a virtual object of civilian circulation with real financial value and operating in a distributed register as a unique identifier". As types of digital assets are listed cryptocurrencies, tokens, as well as "any file on a computer, storage device or website and any online account or subscription". It is difficult to agree to such a division, because not all files can be used in a distributed registry and have value. The number of studies of foreign and Russian authors devoted to digital non-financial assets — 3D-models [12, 13], digital art[6] [14], NFT-tokens in the sphere of intellectual property [15].[7] However, the papers devoted to the comprehensive study of digital intellectual assets as objects of valuation for the purposes of commercialization, related basic categories, disclosure of their specific characteristics, is practically absent. Comparative analysis, generalization, classification, logical, semantic, and functional modeling techniques, as well as cost analysis, were all used to fill this gap.

RESULTS OF THE STUDY

Digital Intellectual Assets as Objects of Valuation for Commercialization

To define a digital intellectual asset as an object of valuation, it is necessary to examine the relationship between the concepts of "digital asset", "intelligent asset" and "object of valuation".

For all these concepts is the economic characteristic of any asset — the ability to benefit the owner from realization or use, including in the form of income.

Digital asset (hereinafter — DA) and any object of valuation (OV) are objects of civil (property) turnover, as defined in the Civil Code of the Russian Federation following the adoption of the Federal Law No. 34 from 18.03.2019[8] and the Federal law No. 135 from 29.07.1998[9] "On valuation activities in the Russian Federal Federation". According to existing Russian legislation, digital assets include some instruments (*Fig. 1*).

The most important feature of a digital asset is the possibility of its existence exclusively in intangible (electronic) form. Digital assets issued on the blockchain may not have any connection to real assets and values outside the blockchain, but at the same time give their owner certain rights. Or, on the contrary, they may be related to financial and non-financial assets and, for example, be reserved in a traditional accounting system (depositary, custodian) or be deposited with the responsible persons.

Intellectual activity results, which are objects of valuation, also have an intangible form. However, not every DA is the subject of civil rights. In particular, virtual (game) property, although established by the creative work of the developer or the player himself, at the moment has no legal regulation, while it can bring its owner quite real income.

We note that digital intellectual assets created by artificial intelligence or with the application of machine learning (Big Date)

[6] Mario 3D Modeling Costs — 5 Factors That Affect Project Pricing. URL: https://www.cadcrowd.com/blog/3d-modeling-costs-5-factors-that-affect-project-pricing/ (accessed on 05.04.2023).

[7] A World's Largest NFT Data Resource. Nonfungible.Com. URL: https://nonfungible.com/market/history (accessed on 01.05.2023).

[8] Federal Law No. 34 from 18.03.2019 "On amendments to one, two parts and article No. 1124 of the third Civil Code of the Russian Federation" (on digital rights). URL: https://www.consultant.ru/document/cons_doc_LAW_320398/ (accessed on 16.05.2023).

[9] Federal Law No. 135 from 29.07.1998 "On appraisal activities in the Russian Federation". URL: https://www.consultant.ru/document/cons_doc_LAW_19586/ (accessed on 16.05.2023).

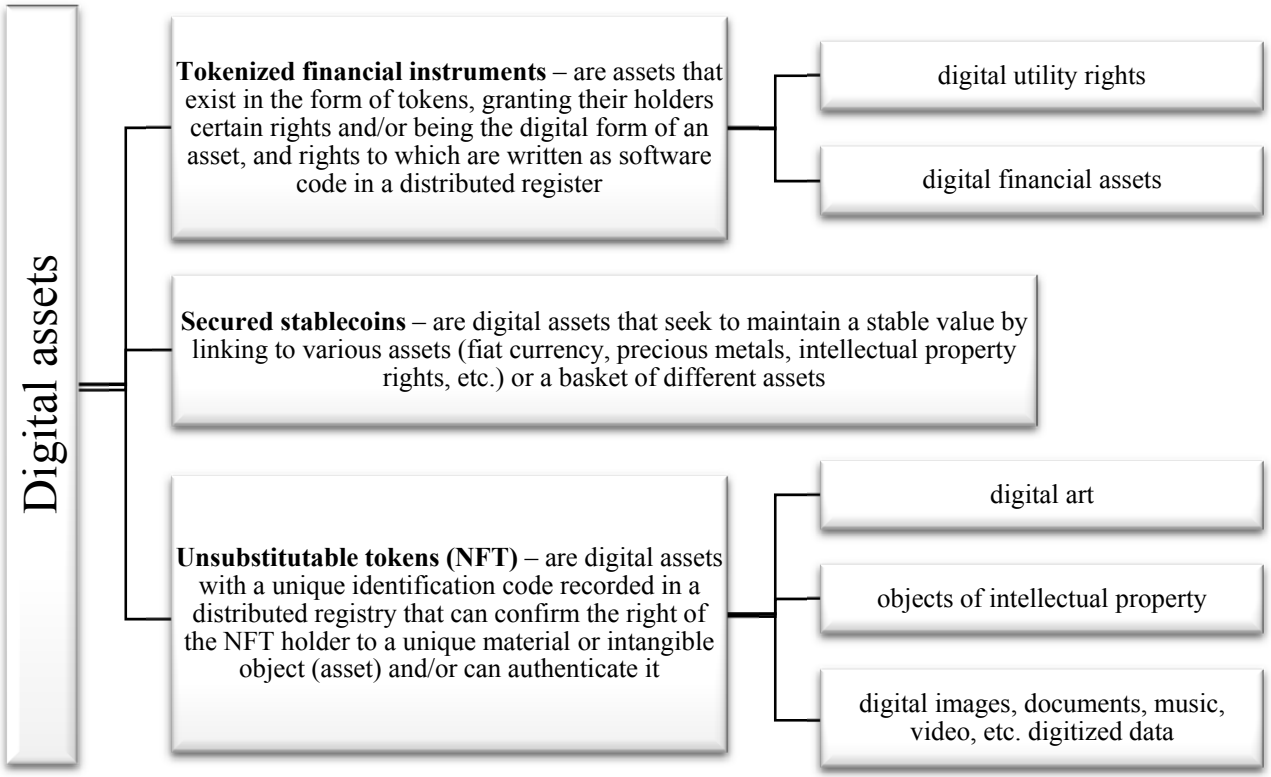

Fig. 1. **Types of Digital Assets in Russian Legislation**

Source: Compiled by the authors.

because of the uncertainty of their legal status, as well as intellective assets not regulated as objects of intellectually owned property are not the subject of our research — scientific discoveries, inalienable human intellectual capital in the form of knowledge, competences, experience, etc.

According to the results of the analysis on *Fig. 2*, we present the ratio of the desired concepts in the form of Euler's diagram.

Fig. 2 shows that a digital intellectual asset has the characteristics of all three component elements: has an intangible nature as an IA, is the object of civil circulation as IA and VP, is created and functions as a digital asset in an information system, in which it is possible to establish ownership and disposal of the digital right without resorting to a third party, brings economic benefit to its owner as any asset. In other words, it refers to the economic, legal and technological essence manifested in the information system [1].

Since DIA assume exclusive digital rights to the results of intellectual activity (intellectual property objects in accordance with Art. 1225 of Part IV of the Civil Code of the Russian Federation), they can be classified as objects of intellectually owned property: DIA of copyright (literary and artistic works, software for computer); DIA of industrial property (inventions, industrial designs, utility models, trademarks and other means of individualization); specialized DIA (know-how, selection achievements, integral chip topology); complex DIA, including several protected results of intellectual activity (audiovisual works, multimedia products, databases, etc.)

At the same time, it is important to establish DIA, which are unique objects that can only exist in electronic (digital) form and whose commercialization is only possible through complete transfer of ownership rights. NFT-tokens, which are a type of digital certificate that can only be issued in a single copy, are the most suitable form of commercialization in this situation. Digital art objects (Digital Art — digital painting,

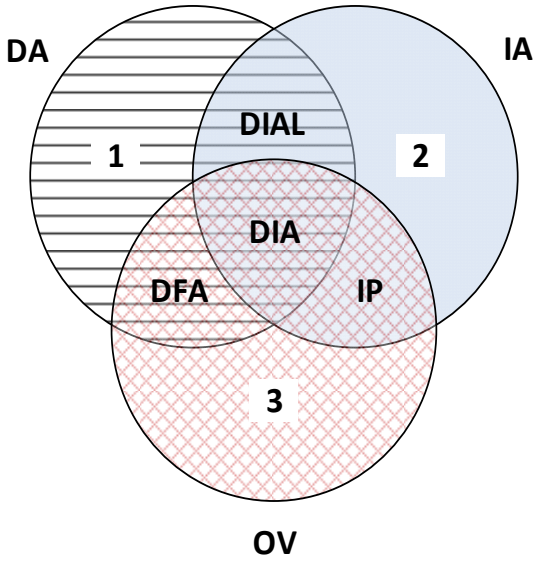

Fig. 2. **The Relationship Between the Concepts of "Digital Asset", "Intellectual Asset", "Object of Valuation"**

Source: Compiled by the authors.

Notes: DA — digital assets; IA — intellectual assets; VP — valuation objects; DIA — digital intellectual assets; IP — intellectual property; DFA — digital financial assets; DIAL — digital intellectual assets without legislative regulation. Examples of undeveloped assets: 1 — digital currencies; 2 — scientific discoveries, intellectual capital of the employee; 3 — real estate, etc. material objects.

electronic music, computer animation, etc.), which are produced using software, are an excellent instance of such assets. The creators record their ownership of digital works by issuing NFT-tokens and recording them in the blockchain. In the form of NFT-tokens can also be commercialized unique 3D models, accounts, content of sites (NFT-domains[10]), performances of works, trademarks and other unique digital intellectual property objects that do not have a material "prototype" (bearer) and/or do not imply "fragmentation" of intellective rights when alienated, i.e. the presence of several DIA owners at the same time.

Other DIA, although created in an elective form, may have a material prototype (the same 3D-models recognized as copyright due to their originality) or be embodied on material media (CDs, flash drives, design documentation, etc.). At the same time, DIA copyright holders are interested in their commercialization by type of simple (non-exclusive) license. In this context, the most appropriate form of commercialization of DIA is tokenized financial instruments in the form of digital utility rights, involving the right to demand the transfer of exclusive rights to intellectual activity results and/or rights to use intellective activity results. These rights are also exercised using distributed registry technology, which allows digital asset market participants to certain positive effects and benefits (*Fig. 3*).

It is necessary to distinguish between the results of intellectual activity in digital form, which can be attributed to DIA when recording digital rights on them in the information system, and digitized data (copies of material analogues). The last one could turn into, for example, an NFT token that contains a copy of a famous project of art and attests to the owner's digital rights to that copy, but it won't become a digital intellectual asset because "digitalization" isn't a creative project.

Thus, for the purposes of our study, all DIAs with the identified characteristics above, i.e. intellectual property objects capable of civilian circulation, on which digital rights are established in an information system operating on the basis of distributed registry technology, can be attributed to the objects of valuation.

This approach combines the DIA of two types (*Fig. 4*):

1) IPOs in digital form, created and circulating exclusively in the information system in the form of NFT-tokens, i.e. are digital property and relate to other objects of civil rights, in respect of which the legislation of the Russian Federation established the possibility of their participation in civil circulation;

2) other types of IPOs in digital or other form, for which digital rights are recorded in

[10] NFT-domain (non-replaceable domain) — is a domain in the public blockchain that allows the user to have full ownership of their stored data

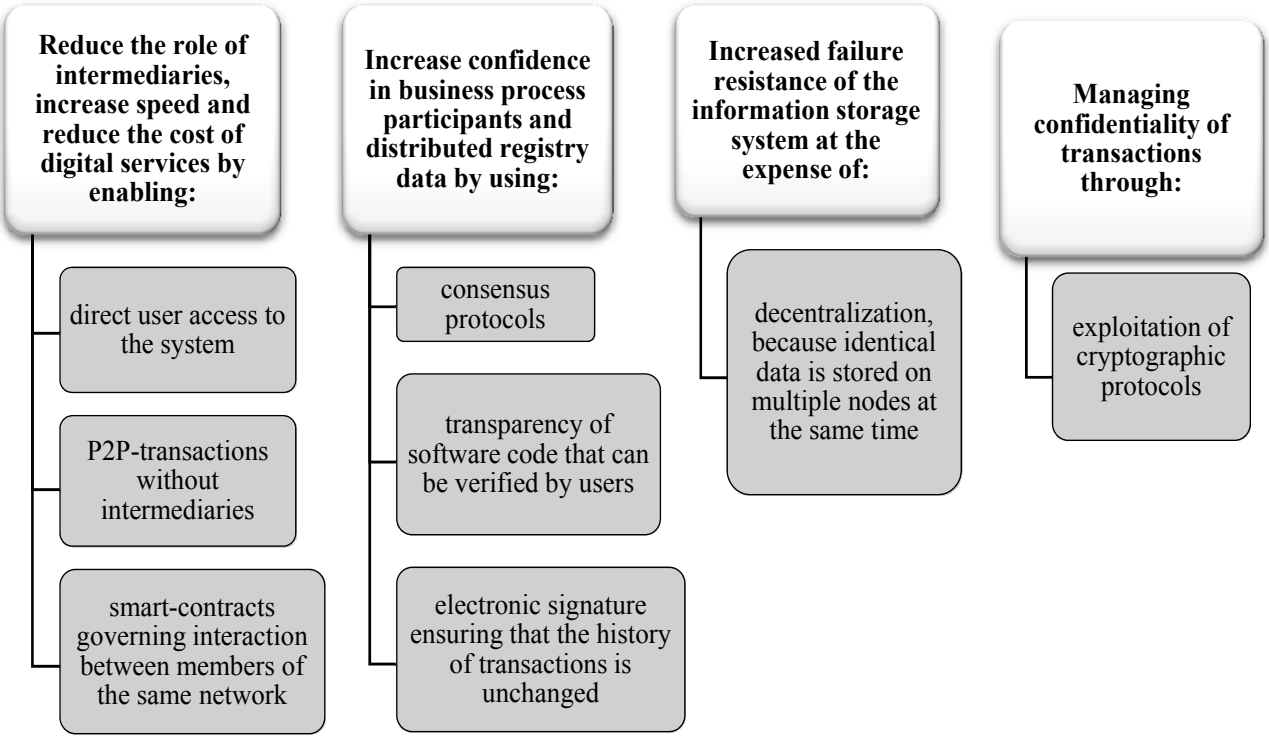

Fig. 3. **Advantages of Using Distributed Registry Technology for the Digital Intellectual Assets Market**

Source: Compiled by the authors.

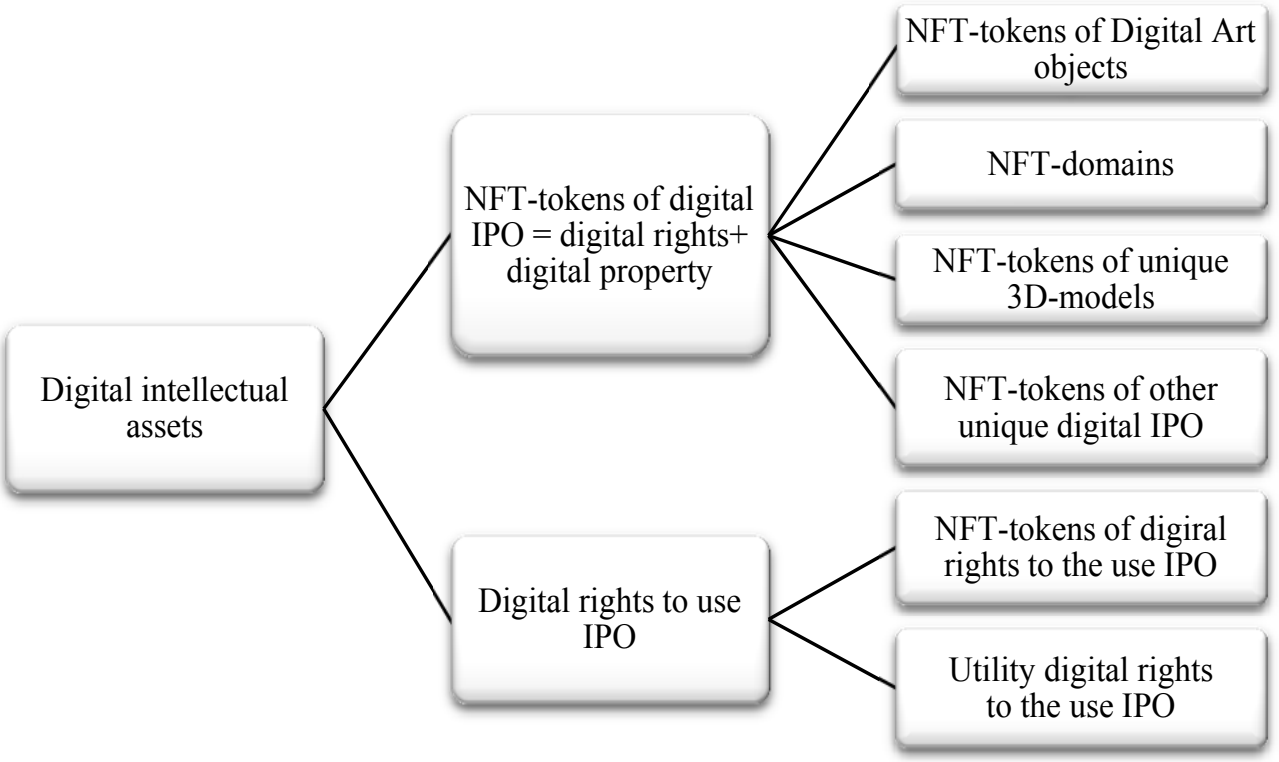

Fig. 4. **Types of Digital Intellectual Assets as Valuation Objects**

Source: Compiled by the authors.

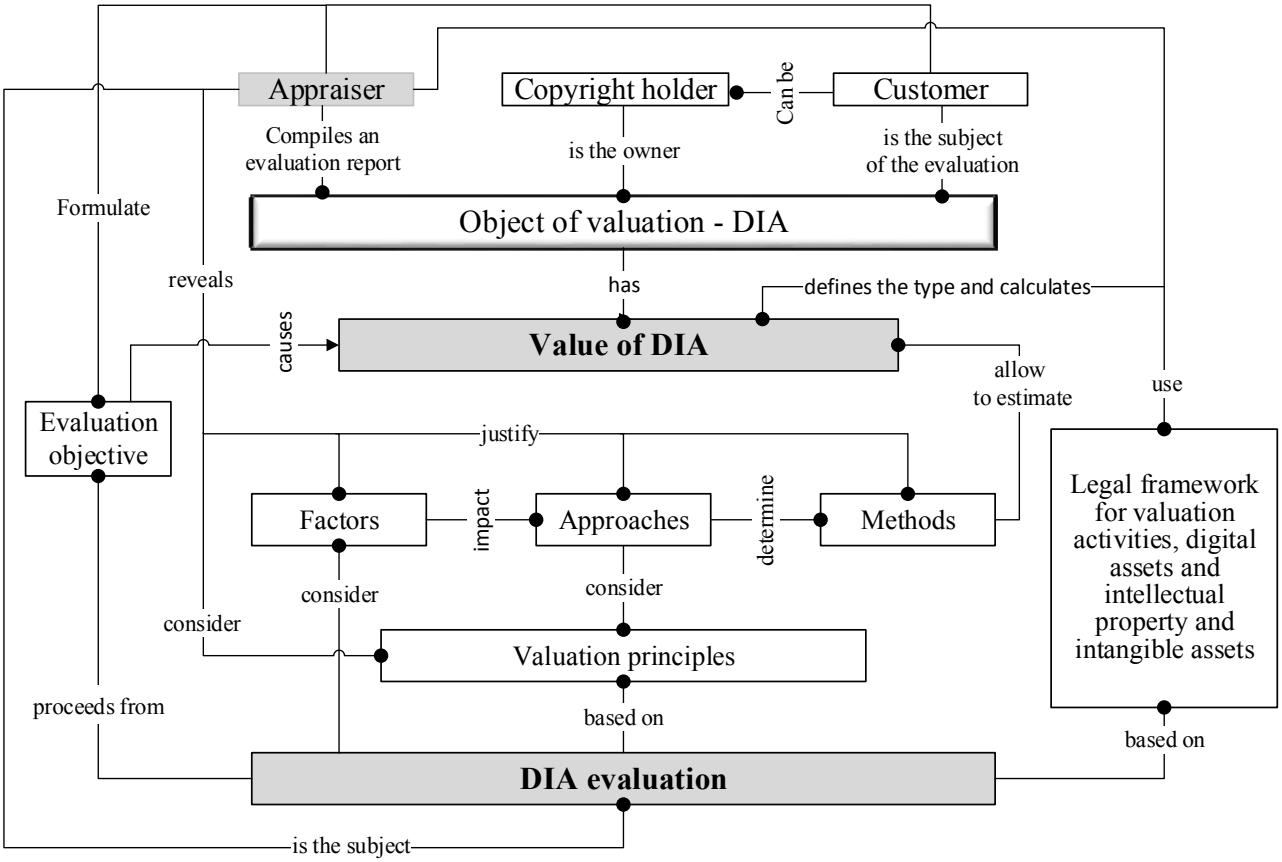

Fig. 5. **Semantic Model for Evaluating Digital Intellectual Assets**

Source: Compiled by the authors.

the information system through the issuance of digital certificates (NFT-tokens, utility digital rights), only certifying the right of the owner to a specific IPO or the right to use it (similar to a license agreement) and not generating a new object of civil rights in the form of digital property, i.e. being digital rights to use IPO and, therefore, objects of evaluation in accordance with the new FSO No. XI.[11]

Construction of a Conceptual Model of Valuation of Digital Intellectual Assets

The conceptual model of value assessment of DIA is based on the basic categories of valuation activities and should reveal the subjects, objectives, types and factors of value, the principles, approaches and methodological tools of evaluation taking into account the specificity of the object being valued, i.e. represent a kind of semantic network describing the relationships between the specified categories. On the other hand, since evaluation is a process, it is logical to present it in the form of a functional model, for example in the IDEF0 notation.

Conceptual and semantic model of evaluation DIA, reflecting the relationship between the object, the subject and the evaluation process, is presented on *Fig. 5*.

The main task of the appraiser — is to determine the value of DIA on the basis of professional judgment, depending on the purpose of appraise, formulated jointly with the customer, who may be the owner of DIA at the same time. In order to address this

[11] Order of the Ministry of Economic Development of the Russian Federation No. 6259 from 30.11.2022 "On approval of the Federal standard of evaluation "Evaluation of intellectual property and intangible assets". URL: https://smao.ru/files/content/FSO/prikaz_minekonomrazvitiya_rossii_ot_30.11.2022_n_659__fso_xi.pdf (accessed on 01.06.2023).

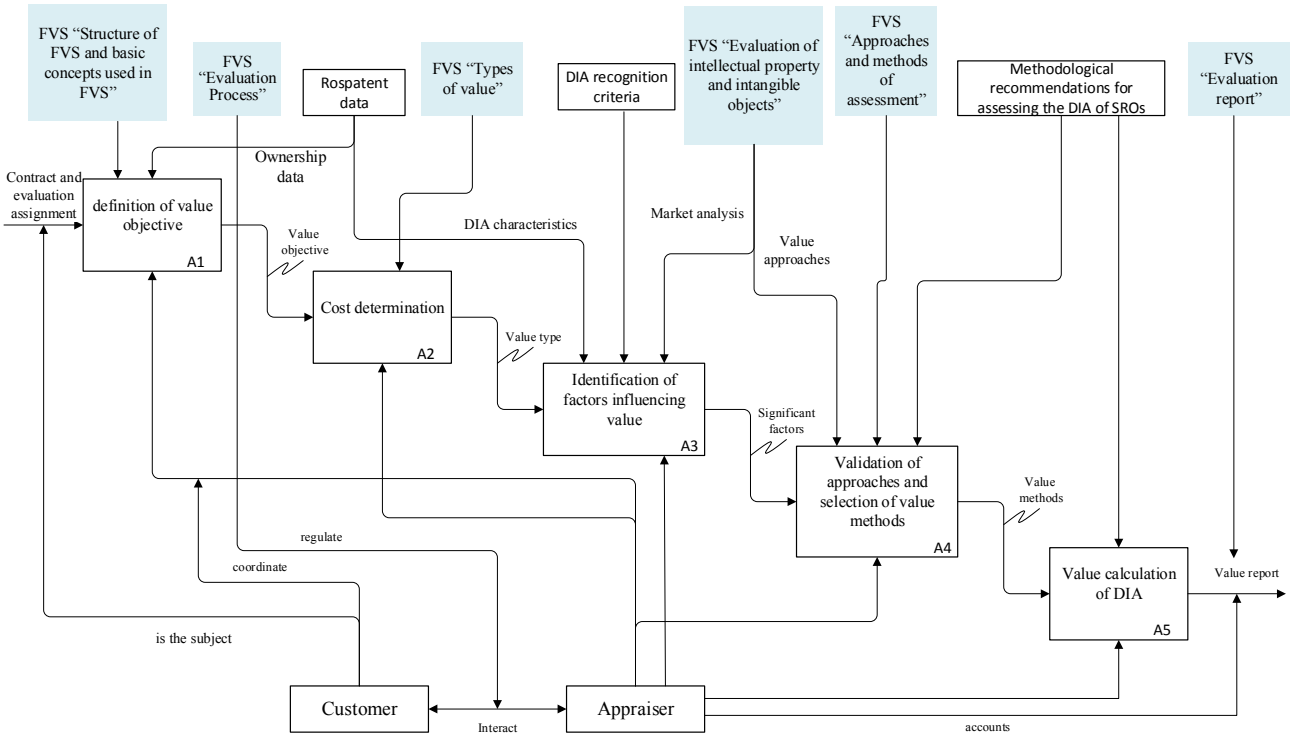

Fig. 6. **Process-Functional Model of Valuation of Digital Intellectual Assets**

Source: Compiled by the authors.

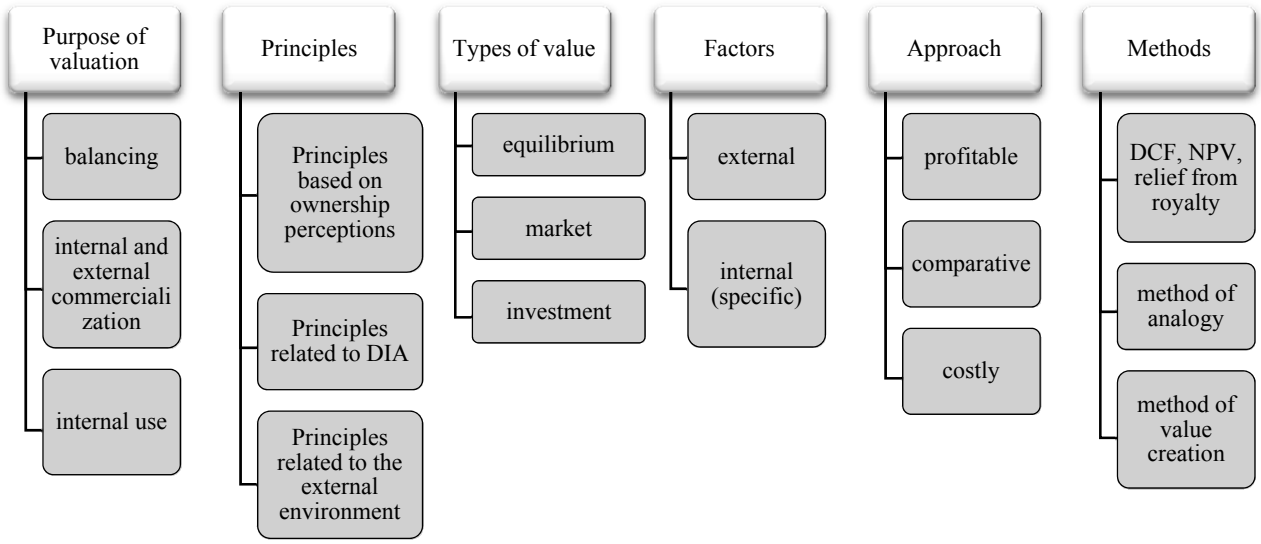

Fig. 7. **Basic Elements of the DIA Conceptual Model**

Source: Compiled by the authors.

challenge, the appraiser must, based on the appraisal principles and the legal framework in the area of appraising activities, digital assets and intellectual property, determine the type of value of the DIA, identify the factors affecting the value of DIA, justify the application of the approaches and methods to appraise DIA, calculate the cost of DIA and prepare a report on the evaluation of DIA. The process-functional model for solving this problem is presented in the IDEF0 notation on *Fig. 6*.

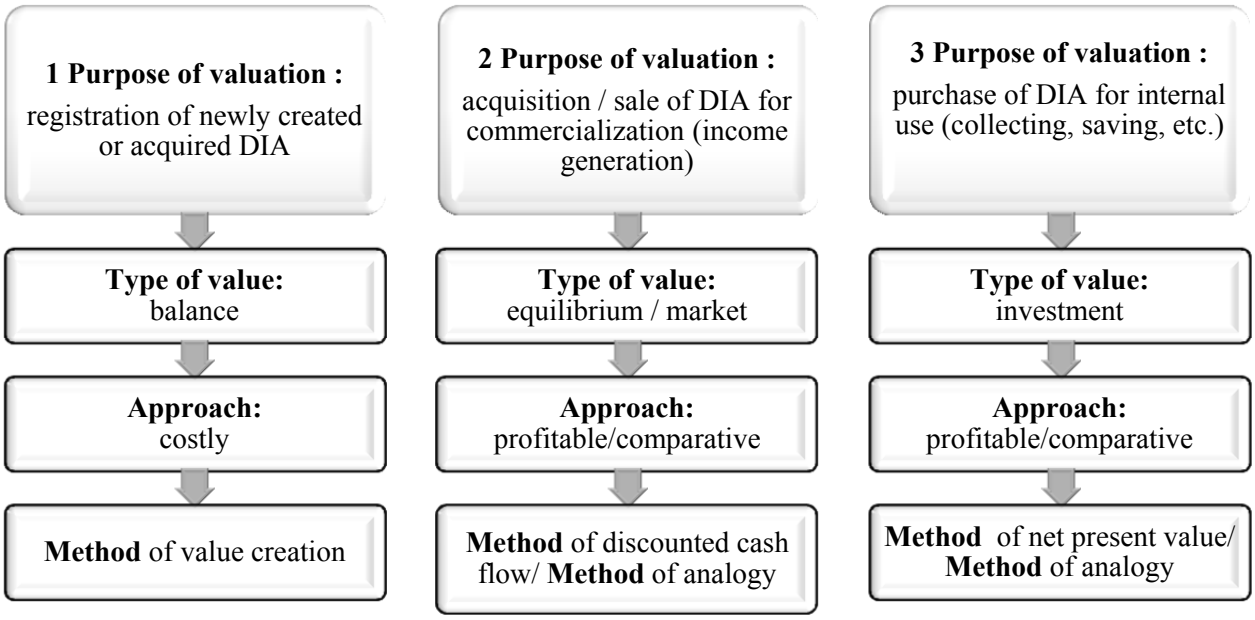

Fig. 8. **Relation of the Objectives of the DIA Cost Assessment, Types of Cost, Approaches and Methods**

Source: Compiled by the authors.

Consider the basic elements of these models in detail (*Fig. 7*).

Fig. 8 shows possible options for the DIA's assessment objectives with relevant value types, applied approaches and assessment methods.

Consider the application of conceptual provisions to the estimation of the cost of DIA on a conditional example. Suppose an IT-company needs to raise the rating or attract additional players to a previously created computer game to increase sales revenue. For this purpose, the purchase of a unique 3D model of the car for use as a new character in the game may be considered. In this case, the purpose of valuation is to extract profits from internal use for the specified investment purposes, hence, the type of value — investment (if the specific features of the transaction are taken into account, then — balance value). The profitable approach and method of net present value (NPV) will be used, where the initial investment will be the purchase of the NFT-token with the selected car model or the acquisition of the rights to use the digital model on a digital platform, as well as the cost of introducing the character to a computer game. Future cash flows will be obtained by estimating the growth of revenue and risks from the use of the new computer character, taking into account macroeconomic factors as well as internal factors characterizing the extent of DIA rights and specific factors for the digital 3D-model:

- Animated (static or animated model) — to use animation significantly increases the final time of work, and consequently, the cost of the model;
- Rigged (internal "scaffolding")— to separate object control system is created for models with animation, which increases their cost;
- VR models (virtual reality) / AR-models (augmented reality) / Poly (polygonal models) — drawing quality decreases as the chain of patterns is transitioned;
- PBR (physically correct rendering) — reflects the quality of light interaction with the model;
- Textures (model texture) — different options of choice of possible textures increase the cost of the model;
- Materials (model materials) — different options of choice of possible materials increase the cost of the model.

If the revenue flows from the introduction of a digital model in a computer game are difficult to predict, then you can use a comparative approach and find suitable analogues of the model using open data from different digital platforms.

The result of the valuation is expressed in rubles or other currency in accordance with the assignment for valuation with the indication of the equivalent of rubles and can be presented in the form of a number, a range of values, be the result of mathematical rounding.

After defining the theoretical basis and conceptual model of assessment of digital intellectual assets, it is further necessary to move to methodological recommendations for assessing the cost of specific types of DIA taking into account the specific factors characteristic of a particular digital asset. With regard to the assessment of digital rights to use IPOs, the value of such rights may be estimated in the analogy of the estimation of the price of licensing agreements with adjustments to the risks of transferring digital rights in the information system.

CONCLUSION

From the research that was done, it is possible to draw the following conclusions:

1. Digital intellectual assets are digital rights to the results of intellectual activities that are recorded in the information system. They have an economic, legal and technological character and are valuable in the distributed register system.
2. Not all digital intellectual assets can be classified as objects of civil circulation because there are currently no legal grounds for regulating them (e.g. virtual gambling assets). Non-civil DIAs are not valuable.
3. As objects of valuation in accordance with applicable legal regulations may act: 1) intellectual property objects in digital form, which is NFT-token, which includes both DIA itself, and information about the owner and rights to the asset (Digital Art objects, NFT-domains, etc.); 2) rights to use of the intellective property object, recorded as NFT-tokens or digital utility rights in the information system.
4. The conceptual model of assessment of value of digital intellectual assets is a semantic (sensual) relationship of basic assessment categories (subjects, objectives, principles, factors, approaches and methods), as well as a functional description of the process of determining the value of DIA in accordance with the normative and legal framework of the assessment activity. Possible types of value of DIA, depending on the purposes of valuation are: balance, market and investment.
5. Further investigations on DIA could include methodological recommendations for the valuation and commercialization of specific types of digital intellectual assets, taking into account their specific characteristics and value factors.

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O.V. Loseva — the essence and classification of digital intellectual assets as objects of valuation, definition of principles, factors, approaches and methods of valuation, development of valuation models.
M.A. Fedotova — statement of the problem, development of the concept of the article.
N.M. Abdikeev — literature analysis, graphical representation of models and results.

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