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Comprehensive Classification of Virtual Assets

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Abstract

Background: One of the problems of the modern lawmakers in different countries is that they try to regulate an object before they study the nature of its origin, which, logically, entails many errors regarding its definition in the legal framework. The absence of unified definitions and clear classification of virtual assets as tools for implementing the methods of financial and management accounting of property according to their fundamental and unique features makes it nearly impossible to determine the features of virtual assets important for legal regulation and, therefore, to enshrine them in laws and establish a proper legal framework. The paper is dedicated to solving a relevant and cross-discipline scientific and applied task of developing a comprehensive multilevel classification of virtual assets. Unlike the few existing classifications that focus on parts of the virtual asset phenomenon and selective methods of its implementation, the paper proposes an all-encompassing comparison of all known types of virtual assets, which confirms the comprehensiveness of the classification proposed in this paper.

Purpose: To develop and substantiate a comprehensive and multilevel classification of known types of virtual assets, which allows solving the cross-discipline scientific and applied task of systematizing virtual assets for future development of a single approach to regulating relations, the objects of which are different types of virtual assets.

Materials and Methods: In order to study the nature of virtual assets and develop a comprehensive classification, a set of scientific research methods has been used: analysis, including cause and effect analysis, synthesis, comparison, generalization, systematization and interpretation of results and induction.

Results: The author describes a triune nature of virtual assets: technological, economic and legal, information and applied. This classification of virtual assets will allow determining promising tools for accounting of property and rights. Unlike other known approaches to differentiating virtual assets, where crypto-assets (or cryptocurrencies) were unjustified "leaders", the author has distinguished the group of tokenized assets for the first time. This particular group, due to its direct relation to property, allows performing accounting as well as reaccounting of property and rights in modern digital accounting systems – decentralized information platforms based on the distributed ledger technology (blockchain), whereas this accounting cannot be performed using crypto-assets due to absence of direct relation to property. Out of virtual assets, the author distinguishes a digital asset and analyzes the semantic features of the term "digital asset". The digital asset is based on a unique information resource as the original asset and on the property of derivativeness from the real asset, which greatly differentiates it from other types of virtual assets. All of

that allows considering it as an effective tool for implementing the methods of financial and management accounting of property. Thus, owners of digital assets can use the new way of accounting of their property and personal non-property rights. Based on the properties of a digital asset, the author distinguishes other types of virtual assets: polyasset and monoasset, with the relevant examples. The author provides the characteristics of their features and structural components while comparing them to the features of digital assets and giving clear and well-known financial and legal analogies regarding the implementation of mutual obligations between parties to a traditional deal. The paper also contains the first systematization of seven properties and parameters of a tokenized asset and, therefore, description of properties of three variations of a tokenized asset: monoasset, polyasset and digital asset. This allowed presenting the varieties of virtual assets as a three-level classification based on the complexity of the nature of virtual assets. The author's classification distinguishes seven types of virtual assets and contains their description.

Conclusions: Overall, the proposed approach to classification allows giving a scientific answer to the question of how to compare the multitude of known virtual assets and how to relate them to the legal framework of a state. These developments will be useful for legislators in basically every country, financial, tax and banking state bodies, as well as private companies when keeping books and performing accounting of virtual assets in their business activity.

Keywords: distributed ledger, blockchain, virtual asset, tokenized asset, digital asset, polyasset, monoasset, crypto-asset, decentralized information platform.

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Introduction

The absence of a single approach to regulating social relations, which distributed ledger tokens are objects of, is caused by the fact that governments and international organizations do not understand the mechanisms for practical implementation of distributed ledger tokens and, in particular, virtual assets as tools for implementing the methods of financial and management accounting of property.

Nowadays, national regulators have different points of view regarding classification of distributed ledger tokens. One of the most popular approaches is described in the Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs) developed by the Swiss Financial Market Supervisory Authority (hereinafter – FINMA). The Swiss regulator uses the economic function of tokens as the main criterion for classifying tokens. Thus, FINMA distinguishes three types of distributed ledger tokens:

- payment tokens are intended to be used, now or in the future, as a means of payment for acquiring goods or services or as a means of money or value transfer;
- utility tokens are intended to provide access digitally to an application or service by means of an infrastructure based on the distributed ledger;
- asset tokens represent assets such as debt or equity claim on the issuer. Asset tokens promise, for example, a share in future company earnings or future capital flows (Kud, Kucheriavenko, & Smychok, 2019; Swiss Financial Market Supervisory Authority, 2018).

The British Cryptoassets Taskforce distinguishes exchange tokens, security tokens and utility tokens (Braddick, Bailey, & Ramsden, 2018). In turn, the Financial Conduct Authority of Great Britain mentions e-money tokens along with these three types (Financial Conduct Authority, 2019).

On July 4, 2018, the Parliament of the Republic of Malta adopted the Virtual Financial Assets Act, which

introduced the concept of a DLT (Distributed Ledger Technology) asset that can be of the following types:

- virtual token is a record in a digital environment that has no value or application outside of the DLT platform on which it was issued and may only be redeemed for funds on such platform directly by the issuer of such DLT asset. This category does not include electronic money;

- virtual financial asset is any record in a digital environment that is used as a digital medium of exchange, unit of account or measure of value and is not electronic money, financial instrument or virtual token;

- electronic money where monetary claim to the issuer related to the transfer of funds to it is mandatory;

- financial instrument includes, aside from derivatives, any securities that can circulate in the capital market (shares, obligations), instruments of the currency market, participatory shares in investment funds and other financial products (Kud, Kucheriavenko, & Smychok, 2019; Parliament of Malta, 2018).

It is important to note that for the purposes of being used in economy and, as a result, of establishing a proper legal framework, objects that are more complex in nature and can also be based on distributed ledger tokens are of significant interest. They are virtual assets.

In October 2018, the Financial Action Task Force (hereinafter – FATF) amended their Recommendations and added the definitions, such as “virtual asset” and “virtual asset service provider” (Financial Action Task Force, 2012). FATF defines virtual asset as a “digital representation of value that can be digitally traded, or transferred, and can be used for payment or investment purposes”. It also notes that virtual assets do not include digital representations of fiat currencies, securities or other financial assets that are already

covered elsewhere in the FATF Recommendations (Financial Action Task Force, 2020).

Based on the definition of a “virtual asset” proposed by the FATF, virtual assets have the following key features:

- they are a digital representation of value;
- they can be digitally traded or transferred;
- they can be used for payment or investment purposes.

As you can see, the above definition is quite broad and can cover virtual assets that are based not only on the distributed ledger technology, but on other technologies as well (e.g. uncertificated securities or electronic money). This complicates developing an appropriate legal framework for this object greatly. Since the FATF Recommendations are a generally recognized international AML/CTF standard, financial experts and regulators around the globe focused on the term “virtual asset”.

The reason for defining virtual assets when creating the relevant regulatory framework is emphasized in the Proposal for a Regulation of the European Parliament and of the Council “On Markets in Crypto-Assets, and Amending Directive (EU) 2019/1937” (European Commission, 2020) along with the need to use the FATF Recommendations as the foundation. In addition, the FATF Recommendations regarding regulation of virtual assets were implemented into the norms of national legislation of a number of states and their dependent territories, which include Hong Kong (Securities and Futures Commission, 2019; Hong Kong’s Securities and Futures Commission, 2019), Ukraine (Verkhovna Rada of Ukraine, 2019), Pakistan (Financial Monitoring Unit Government of Pakistan, 2020), Virgin Islands (British Virgin Islands Financial Services Commission, 2020), Cayman Islands (Stuarts Walker Hersant Humphries, 2020), etc. The approach of FATF regarding virtual assets is also used by the World Federation of Exchanges (WFE) (World Federation of Exchanges, 2019).

Essentially, virtual assets can be derivative of property or property rights. Which is why only classification of virtual assets, including ones based on distributed ledger tokens, will allow creating a scientific substantiation for legal regulation of application of fundamentally new tools for implementing the methods of financial and management accounting of property in various sectors of economy.

It is also important to note that one of the problems of the modern lawmakers in different countries is that they try to regulate an object before they study the nature of its origin, which, logically, entails many errors regarding its definition in the legal framework (Kud, 2020a). Therefore, the issue of proper legal regulation and, in particular, of a scientifically substantiated determination of the main features of the regulation object, virtual assets, becomes more and more relevant with each passing day. Only scientifically substantiated classification of virtual assets as tools for implementing the methods of financial and management accounting of property will allow avoiding the situation where essentially different objects are regulated by legislation that creates a single

legal framework for them. In other words, the absence of unified definitions and clear classification of virtual assets as tools for implementing the methods of financial and management accounting of property according to their fundamental and unique features makes it nearly impossible to determine the features of virtual assets important for legal regulation and, therefore, to enshrine them in laws and establish a proper legal framework. What would help in establishing the legal framework for types of virtual assets is determination of specific properties that allow classifying them and determining the fields and subjects of regulating relations, which arise due to the use of certain types of virtual assets as tools for implementing the methods of financial and management accounting of property. The analysis of studying the issue allows determining the establishment of a legal framework for an object not controlled by the legal system yet, which is very important for the further practical use of its properties in economy and law (Kud, 2020a).

Materials and Methods

In order to study the mechanisms of potential use of virtual assets in various sectors of economy following a substantiated classification of virtual assets as tools for implementing the methods of financial and management accounting of property, the following scientific research methods have been used: analysis, including cause and effect analysis, synthesis, comparison, generalization, systematization and interpretation of results and induction.

Results and Discussion

It should be noted that classification is a general scientific research method, which constitutes organization of information when studying new objects (Kalambet, Ivanov, & Pivniak, 2015). The classification of objects envisions distinguishing combinations of objects, each of which has a common feature that manifests itself in a special way (Chmylenko & Zhuk, 2014).

One of the most important and frequently broken rules for correct classification is that each classification can only be based on one ground. A classification ground is a feature that allows dividing the general concept (the entire set of objects classified according to this classification) into types (specific terms – parts of this set) (A. Novikov & Novikov, 2010). In order to fundamentally study a certain phenomenon, it is necessary to consider its nature, which traditionally means essence, the main property of something (Kuznetsov, 1998).

Nature of Virtual Assets

In our opinion, in order to create a classification of virtual assets as tools for implementing the methods of financial and management accounting of property that would provide an objective picture regarding the classified object, we have to start with the complexity of the nature of virtual assets, which, in turn, has several components – technological, economic and legal, information and applied nature. Thus, the

classification ground for virtual assets as tools for implementing the methods of financial and management accounting of property is the complexity of their nature.

Technological Nature of Virtual Assets. One of the important properties of virtual assets is the technological aspect of their implementation, which indicates the creation of a virtual asset in the system based on a specific technology. The technological nature of virtual assets must be considered by dividing the technology a virtual asset is based on into distributed ledger technology and other technologies.

When talking about the distributed ledger technology, first we need to consider the relation between the categories “distributed ledger” and “blockchain”. Blockchain is one of the types of a distributed ledger where consensus (agreement) among network nodes is achieved by using a chain of blocks. Blocks are organized chronologically, connected to each other and protected using cryptography. Each block contains a hash code (a number of fixed length that is assigned to data of random length in a way that the probability of emergence of different data with the same hash would be close to zero, and recovering data using its hash would be as difficult as possible) calculated from the previous block and a payload. Information on transactions, concluded deals, entering into the ledger of data on an individual, a business entity, property, etc. may be a payload. In other words, almost any information can be a payload. Essentially, blockchain is a constantly growing ledger with records where one can only add data but cannot delete or modify data stored in previous blocks (Kud, Kucheriavenko, & Smychok, 2019).

It is important to note that blockchain is essentially one of the ways of implementing the distributed ledger technology based on the distributed ledger token as an accounting object.

Distributed ledger technology is a multifunctional and multi-level information technology designed for reliable storage, recording and transmission of diverse information (Kud, Kucheriavenko, & Smychok, 2019). Distributed ledger is a combination of hardware and software that operate together but in a decentralized way and independently of each other in order to record events with data of a distributed ledger token by means of transactions of a distributed ledger token synchronized using a certain consensus algorithm. In other words, the distributed ledger is a database that is distributed among several network nodes, each of which receives data from other nodes and stores a full copy of the ledger. These nodes are updated independently of each other. A key feature of a distributed ledger is its decentralization, i.e. the absence of a single data center. Moreover, the information in all nodes of the distributed ledger must be valid and up to date, which is only possible by reaching an agreement between all the nodes of the ledger. Each node compiles and records ledger updates independently of others. Then the nodes vote for updates to ensure that most nodes agree with the final version. Reaching an agreement on a copy of the ledger

is called consensus, and the process is performed automatically using a consensus algorithm. Once consensus has been reached, the distributed ledger is updated, and the latest agreed version of the ledger is stored in each node (Kud, Kucheriavenko, & Smychok, 2019).

Distributed ledger is a technological solution in digital space that provides a modern method of accounting of distributed ledger tokens. Essentially, the distributed ledger is an accounting system based on accounting objects in the form of distributed ledger tokens — objects of a distributed ledger token accounting system, which are identifiers of information structured in a certain way that can also be derivative of an original asset. In other words, the distributed ledger technology is the foundation for creating distributed ledger token accounting systems that expand the application possibilities for virtual assets and their integration into various fields. By their technological nature, virtual assets created in distributed ledger token accounting systems are distributed ledger tokens.

A distributed ledger token accounting system is an information system for registration, storage and exchange of the data of distributed ledger tokens based on the distributed ledger technology (Kud, 2020a). It is worth noting that a distributed ledger token is the main instrument of a distributed ledger (Kud, 2020a). Which means that the definition of a distributed ledger as a distributed ledger token accounting system allows considering distributed ledger tokens as objects, the accounting of which is performed using such a system. As noted above, a distributed ledger token is the main instrument of a distributed ledger. By their technological nature, virtual assets created in distributed ledger token accounting systems are distributed ledger tokens. It is also important to note that considering a distributed ledger token and its accounting units within the technological nature allows talking about “distributed ledger token data”, which is a combination of attributes and properties of a distributed ledger token:

- distributed ledger token hash;
- transaction hashes;
- number of distributed ledger token accounting units;
- address of storage of this distributed ledger token's accounting units, as well as of other attributes and properties that can be determined by the creator of this distributed ledger token.

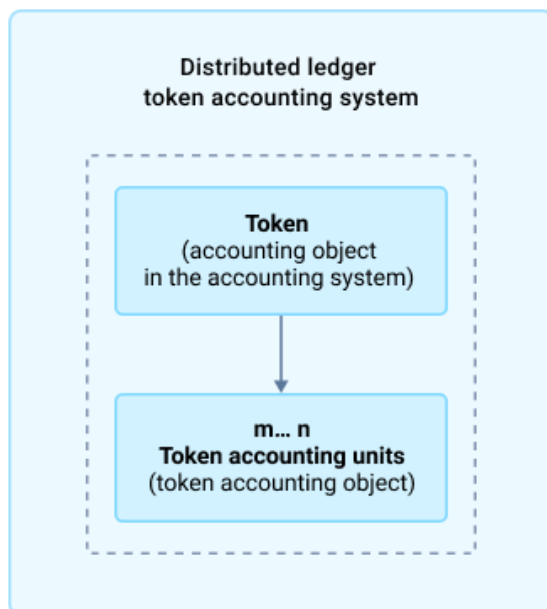
It should be noted that the attributes of a distributed ledger token are its necessary and constant features (Ozhegov & Shvedova, 2010), whereas the properties of a distributed ledger token are the features that comprise its uniqueness (Ozhegov & Shvedova, 2010), but are not mandatory.

A distributed ledger token is a record in a distributed ledger token accounting system. Any transaction of the distributed ledger token is accompanied by the creation of an identifier – a transaction ID (output of a one-way hash function), which is a type of an identifier assigned to a distributed ledger token transaction and is based on the distributed ledger token data. The identifier is generated based on the transaction date individually for

each transaction and is one of a kind. Such an identifier is publicly available. The transaction ID is connected to an unmodifiable and valid description of this transaction stored in a distributed ledger and includes date, identification of distributed ledger token accounting addresses and its volume when a transaction is executed. The unique identifier is used in information systems and can be used to identify a specific object in the network (Kud, Kucheriavenko, & Smychok, 2019). Therefore, the distributed ledger token creation stage begins once a request to transfer a specific number of accounting units of this distributed ledger token is received by the distributed ledger (Kud, Kucheriavenko, & Smychok, 2019). Circulation of the distributed ledger token means a transfer of a certain number of accounting units of this distributed ledger token from one user of the distributed ledger accounting system to another. In other words, the distributed ledger token means its accounting units circulating in the distributed ledger by means of a transaction with a unique identifier (Kud, 2019a). This means that a distributed ledger token has to be studied as an object, the accounting of which is performed using a distributed ledger token accounting system, where its accounting units are accounting units of a virtual asset of the distributed ledger as a whole. There are several features that allow considering a distributed ledger token (its accounting units) as an object (Figure 1):

Figure 1

Distributed Ledger Token Accounting System



Note: m is the minimal indivisible and/or divisible numeric value of distributed ledger token accounting units.

- accounting system (distributed ledger) users can create distributed ledger tokens by themselves;
- distributed ledger tokens exist in the form of identifiers and have their own accounting units in the accounting system;

- depending on his/her goal, when creating a distributed ledger token, a user of the accounting system may specify the number of accounting units of this token to be issued at his/her own discretion;

- not the distributed ledger token itself is transferred between accounting system users, but its accounting units;

- users of a distributed ledger as a distributed ledger token circulation environment keep records together, so none of them can alter or delete entirely any data of a distributed ledger token (Kud, 2020a).

Thus, a distributed ledger token has accounting units in a distributed ledger token accounting system, and users of this accounting system, based on their goals when creating a distributed ledger token, can specify the number of issued accounting units of this distributed ledger token by themselves. In turn, a distributed ledger token as an accounting object can be an independent object of property relations that has its own accounting units in a distributed ledger token accounting system. One of the properties of a distributed ledger token is its duality, which means that:

- a distributed ledger token may be an object, that can be used for accounting of any property existing outside the distributed ledger accounting system;

- this distributed ledger token's accounting unit may be a unit of measurement of the scope of rights to the property, the accounting of which is performed using the distributed ledger token.

This is why any property can be an accounting object in the distributed ledger token accounting system. It is important to note that not the distributed ledger token itself is transferred between users of this distributed ledger token accounting system, but its accounting units.

In other words, distributed ledger token accounting units that circulate in distributed ledger token accounting systems are virtual assets (hereinafter – virtual assets of the distributed ledger) that in distributed ledger token accounting systems are represented in the form of distributed ledger tokens with unique identifiers. The unique identifier is used in information systems and is intended to identify a specific object in the network, as well as allows excluding any probability of duplication of this object and confirms its authenticity (Kud, 2019b). Thus, an identifier is an attribute of an accounting object intended to identify it represented in the form of a unique set of alphabetical and/or numerical characters of a certain length and is assigned to an accounting object in its circulation environment. Thus, virtual assets of the distributed ledger are distributed ledger tokens.

Technologies other than the distributed ledger that allow implementing certain accounting systems can be used as the foundation to create virtual assets. Here are some examples of virtual assets created in accounting systems based on technologies other than the distributed ledger (hereinafter – virtual assets of the non-distributed ledger): coins in videogames, electronic money, uncertificated securities, digital

memberships, digital gift cards, etc. In addition, the nature of virtual assets of the non-distributed ledger is relatively well-studied, which is why their further classification is not relevant to this particular research.

Economic and Legal Nature of Virtual Assets. The economic nature of a virtual asset of the distributed ledger as one of the components of the economic and legal nature of the virtual asset of the distributed ledger allows moving to the classification level that follows the one based on the technological nature.

As mentioned before, the main functional purpose of the distributed ledger technology comes down to the ability to create modern information accounting systems of the new generation based on it. Therefore, as part of analysis of the economic component of the economic and legal nature of the virtual asset of the distributed ledger, the virtual asset of the distributed ledger must be considered from the point of its correspondence to the tool, using which the accounting of information on property is carried out in the distributed ledger token accounting system.

As stated above, technically, virtual assets of the distributed ledger are distributed ledger tokens. Accounting units of a distributed ledger token may be units of measuring the scope of rights to this distributed ledger token, while the distributed ledger token may be an object for accounting of any property existing outside the accounting system (outside the distributed ledger), such as:

- objects of civil rights (money, securities, results of work, services, results of intellectual activity, information and other tangible and intangible goods);
- assets as a type of property that represents a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity (Ministry of Finance of the Russian Federation, 1999);
- property rights (rights to use, dispose of and own an object of civil rights).

The described duality of the nature of the distributed ledger token is due to the fact that the distributed ledger token exists in the distributed ledger token accounting system in the form of an identifier and also has its own accounting units (Kud, 2020a). Therefore, virtual assets of the distributed ledger can be used for accounting of property, which may be an independent object of legal relations.

When talking about the purpose of accounting by means of virtual assets of the distributed ledger in the distributed ledger token accounting system, it has to be noted that it may be defined as one of the following:

Financial Accounting. Financial accounting by means of the distributed ledger token accounting system using virtual assets of the distributed ledger is possible because:

- virtual assets of the distributed ledger may be presented as an inventory number assigned to property for the purpose of accounting by means of a distributed ledger token accounting system;
- records of accounting units of virtual assets of the distributed ledger are defined as a product in civil

circulation and can correlate with units of financial accounting of property.

“Civil (property) circulation is a set of deals of all its participants and obligations that arise based on it, which legally establish economic relations of the exchange of goods” (Vitryanskii et al., 2010). In other words, the term “civil circulation” is intended primarily to define the actual transfer of civil rights from one person to another (Zakharkina, 2017). Civil circulation has a property and product nature (Em, 2006). Therefore, for clear understanding of the discussed matter, virtual assets of the distributed ledger shall be considered as products.

A product means specific economic goods produced for exchange. Karl Menger claimed that economic goods become products regardless of their ability to move, persons that offer them for sale, their tangibility, their nature as a product of labor, but are definitely intended for exchange. The ability of products to satisfy a certain need of a person makes up their consumer value (all products have it). Meanwhile, the ability of a product to be exchanged in certain proportions makes up its exchange value (Vidyapin et al., 2003).

Thus, in order to define a virtual asset of the distributed ledger as a product, the following conditions must be met:

1. This virtual asset of the distributed ledger must be based on the property deal.

The virtual asset of the distributed ledger as a tool for implementing the method of financial accounting of property that is in civil circulation can be created exclusively during preparation and conclusion of the agreement, which describes the right to use or dispose of the property.

2. Parties to the deal, the object of which is the virtual asset of the distributed ledger, must be identified.

This requirement establishes the functional aspects of operation of the distributed ledger token accounting system and consists of the need to ensure identification of the user that performed the transfer of accounting units of the virtual asset of the distributed ledger and the user who received these accounting units of the virtual asset of the distributed ledger as part of a certain deal.

3. There is an ability to confirm data about the property, the deal involving which may be the basis for the virtual asset of the distributed ledger, as well as about the creation of the virtual asset of the distributed ledger.

In order to ensure that a number of legal guarantees regarding the virtual asset of the distributed ledger are followed, there must be information about the owner of the property, the deal involving which this virtual asset of the distributed ledger is based on, confirmed in writing, as well as confirmed information on the scope of rights to this property that the creator of the virtual asset of the distributed ledger has.

Therefore, the above-mentioned conditions are mandatory and sufficient for defining virtual assets of the distributed ledger as products, which ensures its existence in civil circulation. In turn, in case the virtual

asset of the distributed ledger does not meet all the mentioned conditions, it will not be considered as an object of civil circulation (product) and will be intended for use for purposes other than exchange.

Going back to financial accounting in the distributed ledger token accounting system, it has to be mentioned that currently, the standardization of financial reporting on the international scale is done based on the requirements of the International Financial Reporting Standards (International Financial Reporting Standards Foundation, 2020) (hereinafter – IFRS), the development and publication of which is handled by an independent body of the International Financial Reporting Standards Foundation (IFRS Foundation), namely the International Financial Reporting Standards Advisory Council (IFRS Advisory Council). It should be noted that financial accounting that takes place in the distributed ledger token accounting system using a tool such as a virtual asset of the distributed ledger can be organized in accordance with the requirements laid down in the IFRS standards.

Management Accounting. In turn, if the tool that will be used for accounting of property is represented by a virtual asset of the distributed ledger that is not an object of civil circulation and is intended for use for purposes other than exchange, management accounting of property will have to be considered.

A virtual asset of the distributed ledger as a tool for implementing the method for management accounting of property that is not in civil circulation can be created only during preparation and conclusion of the agreement that describes this property intended for purposes other than exchange.

When talking about the purpose of management accounting, it has to be mentioned that unlike financial accounting, this type can be characterized as accounting for providing the relevant information, first and foremost, to users in order to manage production and business activity of the organization, to solve internal tasks of managing the organization, find and substantiate management decisions. The data of management accounting is a trade secret of the organization. In addition, the methodology and organization of management accounting are not regulated. Management accounting is performed in accordance with the rules established by the organization itself considering the specifics of its activity (Kulikova et al., 2014).

It is important to note that financial and management accounting of property by means of the distributed ledger token accounting system using the virtual asset of the distributed ledger will have a high level of authenticity because the distributed ledger technology, due to its properties, provides an entirely new way of storing and managing information in terms of reliability.

Based on everything stated above, the fundamental feature for considering a virtual asset of the distributed ledger as a tool used for accounting of property in the distributed ledger token accounting system is its legal connection to property, which, in turn, determines further consideration of the legal component of the

economic and legal nature of the virtual asset of the distributed ledger.

Legal nature is a legal feature of a certain phenomenon that represents its specifics, place and functions among other legal phenomena in accordance with its social nature (Alekseev, 2010). The legal nature of virtual assets of the distributed ledger should be considered based on its object and subject components. This allows determining the legal aspect of virtual assets of the distributed ledger, which, in turn, will become the foundation for creating a proper legal framework for virtual assets of the distributed ledger.

As noted when considering the technological nature of virtual assets of the distributed ledger, a distributed ledger is an accounting system based on accounting objects in the form of distributed ledger tokens – objects of the distributed ledger token accounting system that are identifiers of information structured in a certain way, which can be, but not exclusively, derivative of the original asset.

This leads us to two aspects important for considering the legal nature of virtual assets of the distributed ledger:

1. In case the virtual asset of the distributed ledger is not derivative of property, this virtual asset of the distributed ledger is considered as an object of property relations (property in digital form) (hereinafter – crypto-asset).

As noted above, a distributed ledger token is the main tool of the distributed ledger (Kud, 2020a). In other words, from the technological standpoint, virtual assets created in distributed ledger token accounting systems are distributed ledger tokens. Therefore, in order to consider the legal nature of virtual assets of the distributed ledger as crypto-assets, first and foremost, the attributes and properties of a distributed ledger token have to be considered.

Compared to objects of civil rights as a whole, the “object of property right” category is less expansive because objects of property right do not cover actions, results of services, etc. Objects of property right is property the contents of which is usually not detailed, which means any property can be owned (Borysova et al., 2011). The “property” category is a fundamental concept of civil law because it reflects the universal feature of the majority of social relations that comprise the subject of civil law (Lysenko, 2010). Property traditionally includes objects of civil rights (money, securities, results of works, services, results of intellectual activities, information, as well as other tangible and intangible goods), and separate attention must be paid to property rights (rights to use, dispose of and own an object of civil rights).

When talking about the issue of the object component, it is important to note that the analysis of the distributed ledger token accounting units conducted in terms of the technological nature allows stating that not the distributed ledger token but its accounting units can be the object of property legal relations. It must be noted that accounting units of the distributed ledger token may be the units of measuring the scope of rights to that distributed ledger token.

It is hard to imagine that a record in a traditional ledger, for example, in an accounting book or in a personal accounting file, which means a record not in the distributed ledger, could be a separate object of a deal. On the contrary, this record would more likely be considered a result of a legal fact that impacted the engagement in, changes to or termination of legal relations. In turn, a distributed ledger token as an object of accounting systems based on the distributed ledger technology may be an independent object of property relations that has its own accounting units in the system of distributed ledger token accounting system (Kud, 2020a) (Figure 1). Some of the best-known examples of crypto-assets include Bitcoin and Ethereum distributed ledger tokens because they are not related to any type of property rights. These virtual assets of the distributed ledger are crypto-assets due to the fact that when their accounting units are transferred, there is no deal involving property that exists outside the distributed ledger token accounting system.

2. If the virtual asset of the distributed ledger is derived from property, this virtual asset of the distributed ledger must be considered as property right in digital form derivative of property (hereinafter – tokenized asset).

Property rights usually mean subjective rights of subjects to civil legal relations that have to do with their legal rights to property objects (owning, using and disposing of property), as well as material (property) claims that arise during civil circulation and have monetary representation.

It is important to note that in the given case the tokenized asset will be a property right in digital form derivative of property. This property will be the original asset for the tokenized asset, i.e. property, the right to dispose of which is used by its owner to create the tokenized asset. Both property itself and the scope of rights to the property, among other things, can be an original asset.

The derivativeness of the tokenized asset from the original asset is determined by the connection to a specific deal, which is evident from mutual rights and obligations between the owner of the original asset and the owner of the tokenized asset. There is a condition that is mandatory for creation of a tokenized asset: it can be created and used only as a result of a deal involving the original asset. In other words, the tokenized asset cannot exist without a deal involving the original asset. The tokenized asset can be created only within the deal involving a specific property and only as a digital representation of the already existing property right, which is the object of that deal. These circumstances allow stating that these virtual assets of the distributed ledger are tokenized assets because when their accounting units are transferred, the deal will involve property that is outside the distributed ledger token accounting system, namely with the original asset of this tokenized asset.

It is important to note that precisely because the tokenized asset is based on the deal involving the original asset, the tokenized asset is a tool for implementing financial or management accounting of

this original asset in the distributed ledger token accounting system.

It is wrong to talk about relations that arise in the field of application of virtual assets of the distributed ledger without considering and distinguishing the legal status of subjects of such relations. This issue requires a comprehensive approach with establishing not only their objects, but the subjects as well.

The parties to relations in the field of application of virtual assets of the distributed ledger can be determined as users of a distributed ledger token accounting system. The distributed ledger token accounting system itself does not provide the ability to identify its users due to the absence of software architecture for creating accounts as user data stored to identify, authenticate and authorize them. This makes it impossible to use the distributed ledger token accounting system as an environment for concluding the deal, because the actions of users of distributed ledger token accounting systems are not subject to state guarantees, in particular protection of legal rights and interests of users that were not identified.

Thus, the consideration of the economic and legal nature of the virtual asset of the distributed ledger resulted in its division into:

- tokenized asset, which is a type of a virtual asset that exists in the distributed ledger accounting system in the form of a record with an identifier of information derivative of the original asset. If the tokenized asset is defined as an object of civil circulation, it allows conducting financial accounting of the original asset. Whereas the tokenized asset of the non-civil circulation can be used for management accounting of the original asset;

- crypto-asset, which is a type of a virtual asset that exists in the distributed ledger token accounting system as a record with an identifier of information not derivative of the original asset.

During this research, the subjects of relations in the field of application of virtual assets of the distributed ledger have also been studied. As a result of that, all parties to relations in the field of application of virtual assets of the distributed ledger can be defined as users of the distributed ledger token accounting system (hereinafter – users).

Thus, having determined the subjects and objects of relations in the field of application of virtual assets, the establishment of a legal framework for virtual assets of the distributed ledger and legal status of these subjects can be considered. It is very important for regulating relations that arise in the field of application of virtual assets of the distributed ledger (Kud, 2020a).

Information and Applied Nature of Tokenized Assets. The applied nature of a tokenized asset as a component of its information and applied nature allows moving to the classification level that follows the one based on the economic and legal nature.

The applied nature of a tokenized asset is characterized by properties of managing distributed ledger token accounting units, such as their divisibility or indivisibility, which must be considered together with the information nature.

The information nature of a tokenized asset is characterized by the information component of the tokenized asset that exists in its original asset.

If the original asset for the tokenized asset is an information resource derivative of the initial asset (hereinafter – digital asset information resource), it becomes a type of a tokenized asset called decentralized information platform digital asset (hereinafter – digital asset).

A decentralized information platform consists of a service infrastructure and a community of independent users having equal rights or pre-identified rights granted according to the levels of the decentralized governance model to make such a system stable (Kud, 2021). The decentralized information platform includes a distributed ledger token accounting system and can be used as an environment for concluding a deal, where counterparties identified by the decentralized information platform have accounts, and all actions are automatically recorded in this platform.

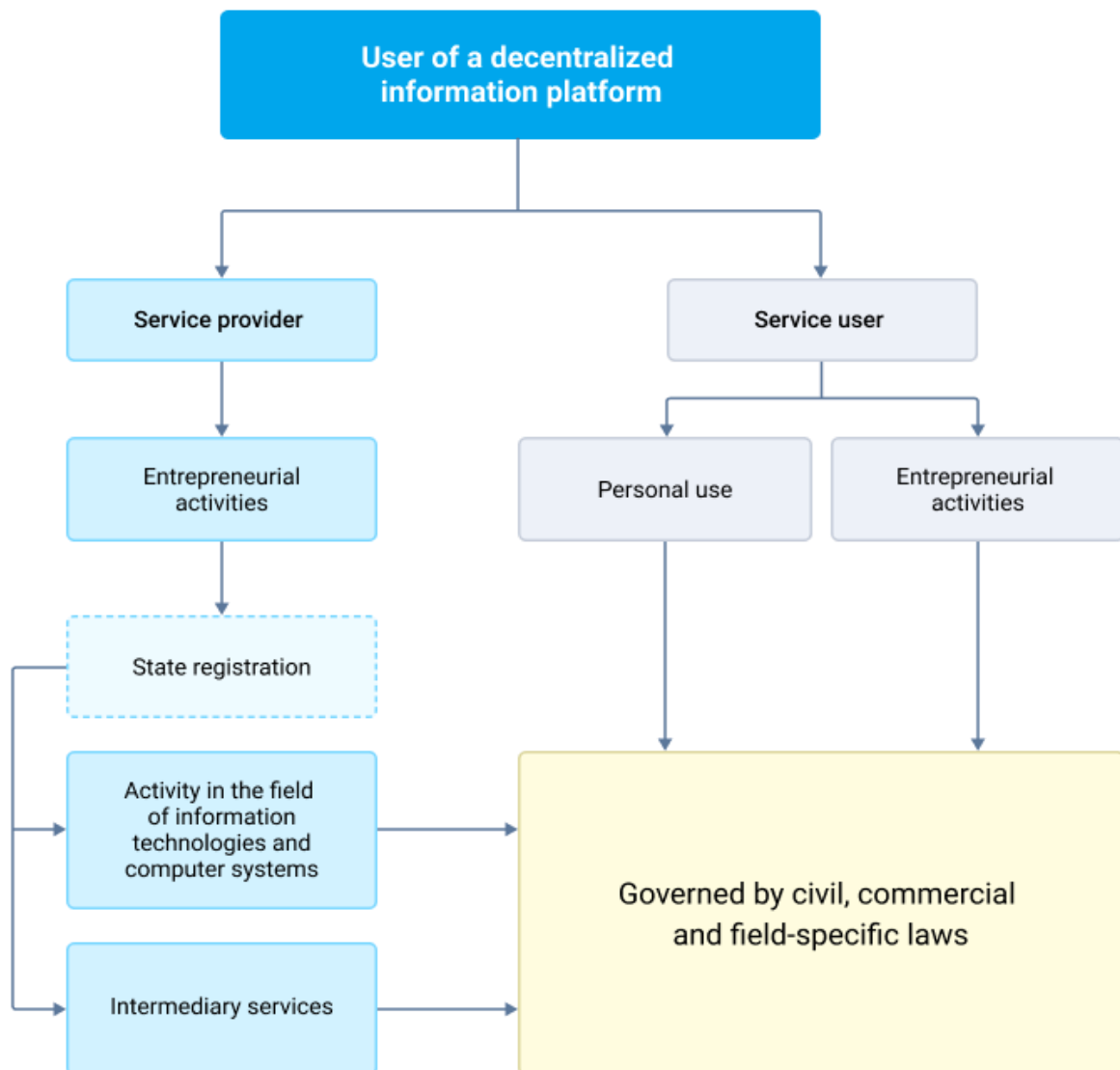
Since decentralized information platforms are a result of human activity, obviously, there are users that

ensure the operation of such platforms, and there are some users, whose actions are aimed at benefiting from these platforms. Therefore, the users of the decentralized information platform can be classified as “service providers” and “service users” (Figure 2).

The activity of service providers may be aimed at providing services to other users, which, in essence, causes the implementation of social relations in decentralized information platforms with digital assets as tools for implementing the methods of financial and management accounting of property. Digital assets and decentralized information platforms can be used to implement any kind of relations, including commercial, meanwhile digital assets themselves can also be objects of such relations. It is noted that the activity of service providers is entrepreneurial and is defined as activity in the field of information technologies and computer systems or intermediary services. In turn, other users of decentralized information platforms (service users) employ such services for personal use as well as for entrepreneurial activity.

Figure 2

Subjects of Social Relations Based on the Decentralized Information Platform



Social relations based on the decentralized information platform must be considered contractual and be regulated by civil and/or commercial law. Identification of users of the decentralized information platform allows stating that such deals can be covered by state guarantees, which include protection of legal rights and interests of identified users of the decentralized information platform. As an infrastructure solution, the decentralized information platform consists of software complexes that can be implemented in the form of services and components. Therefore, the analysis conducted as part of this research allows talking about a decentralized information platform, which is a hardware and software complex, the infrastructure of which consists of components and services, includes a distributed ledger token accounting system and provides its users with an ability to implement property and personal non-property relations by performing financial and management accounting of their property and personal non-property rights by means of digital assets.

The ability to create user accounts in the decentralized information platform as a combination of data about users stored and necessary for their identification, authentication and authorization, as well as existence of a set of components and services confirm that the decentralized information platform is a circulation environment for digital assets. Only the decentralized information platform with its components and services (as infrastructure solutions) allows creating the information component of a digital asset represented in the form of a digital asset information resource.

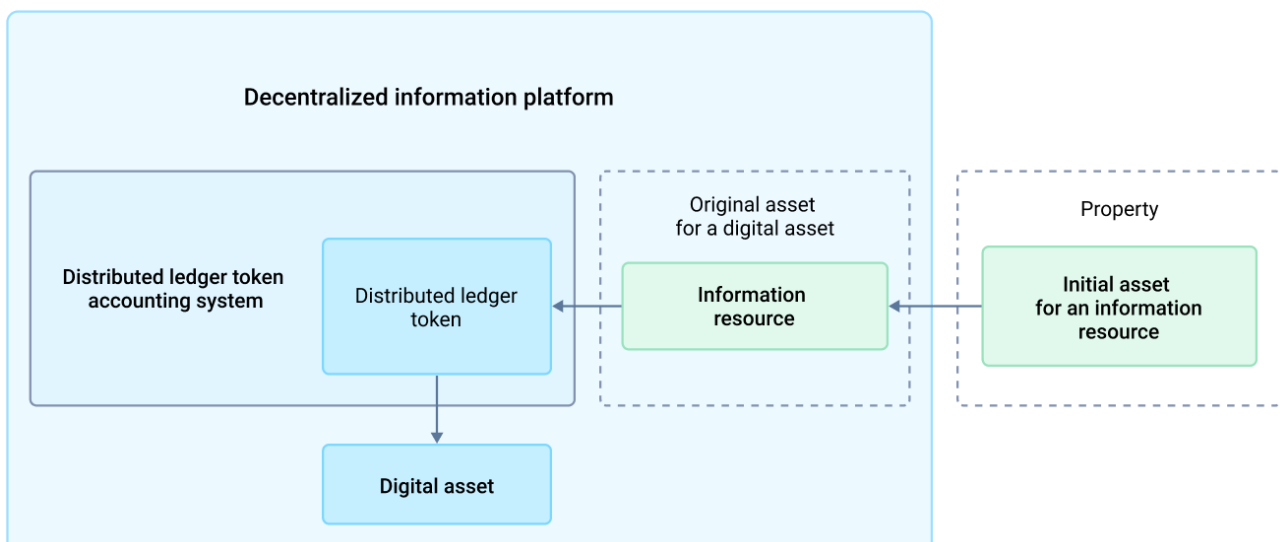
It is important to note that the digital asset information resource is the original asset for the digital asset in the decentralized information platform, which is a result of intellectual activity created by the owner of the initial asset in the amount proportional to the scope of rights to the initial asset he/she has.

The unique nature of the digital asset information resource that differentiates it from other original assets

deserves special attention. The derivativeness of the digital asset from the digital asset information resource is determined by legal connections with a specific deal in the decentralized information platform, the object of which is the digital asset information resource. In addition, unlike a lot of other original assets, the digital asset information resource is in the decentralized information platform, which provides it with additional properties, which include “authenticity”, “immutability”, “structuredness”, etc. In the context of the digital asset information resource, there is such a category as “initial asset” that the digital asset information resource is derivative of and that represents property that exists outside the decentralized information platform, the right to dispose of which is used by its owner when creating the digital asset information resource as an original asset for creating the digital asset. This means that in order to create the digital asset information resource derivative of the initial asset, it is very important that the decentralized information platform has a software infrastructure in the form of infrastructure of components and services that allows creating accounts of users of the decentralized information platform for their identification when disposing of property that is the initial asset.

Circling back to the initial asset, it is important to note that it represents the value, importance, usefulness of something, which can also be represented by various units of measurement depending on the field of practical application of this initial asset and the ecosystem that has this initial asset. Information on this property as an initial asset, as well as information on the set of rights and limitations on this property may be contained in the digital asset information resource in proportion to the scope of rights to the property owned by the creator of this digital asset information resource, which is the original asset for the digital asset (Figure 3).

Figure 3
Derivativeness of a Digital Asset



It should also be noted that the digital asset information resource as a way of recording information on the initial asset is created directly by the owner of the initial asset. In turn, this principle, as well as the definition of the digital asset information resource as an independent object of property legal relations, justify the definition of the digital asset information resource as an object of intellectual property rights of the owner of the initial asset. Therefore, the derivativeness of the digital asset information resource as an original asset for the digital asset and derivative of the initial asset is determined by a set of rights and obligations regarding the initial asset that the owner of the digital asset has.

The digital asset information resource as the original asset for the digital asset that is an object of intellectual property rights can be disposed of only in the decentralized information platform and only on the basis of the right to use. It should also be noted that, for the purposes of financial accounting, the digital asset information resource as the object of intellectual property rights will be defined in accordance with IAS 38 "Intangible Assets" dated January 1, 2012 (Joyce, 2017) as an intangible asset (IA).

Technically, digital asset accounting units are units for accounting of the scope of rights to access the digital asset information resource derivative of the right to the initial asset. In other words, the digital asset represents the right to use the intellectual property of the owner of the initial asset – information as an object of intellectual property rights, i.e. specific property. Thus, the object of legal relations of owners of digital assets is not the initial asset, but digital asset accounting units. When transferring digital asset accounting units, a certain scope of rights to access the digital asset information resource is transferred, which contains information that was provided by the owner of the initial asset regarding the set of rights to the initial assets and information on the obligations of the owner of the initial asset. It should be noted that when a digital asset circulates, i.e. when its accounting units are exchanged, a certain scope of rights to property expressed in the number of accounting units of such a digital asset is also exchanged.

Considering the main property of a digital asset and establishing connection between a digital asset as a unit of a scope of access (right of access) to the digital asset information resource and the property right to the initial asset allow considering a separate object of civil legal relations – digital asset information resource. This way, the digital asset represents a tool for implementing the method of using the information on the initial asset, which is presented in the decentralized information platform in the form of the digital asset information resource, which provides new opportunities for operating the set of rights to the initial asset (Kud, Kucheriavenko, & Smychok, 2019).

It is also necessary to consider the components of a digital asset:

- *economic component* in the financial field is represented by an identifier (Kud, 2019b). The identifier is an attributive feature of an accounting

object that is intended to identify it, is represented in the form of a unique set of alphabetical and/or numerical characters of a certain length and is assigned to the accounting object in its circulation environment. The identifier is used in information systems and is intended to identify a specific object in the network, as well as allows excluding any probability of duplication of this object and confirms its authenticity (Kud, 2019b). With the digital asset, the identifier is used to perform accounting of property (digital asset information resource as an original resource as well as any property as an initial asset). In the meanwhile, if the digital asset is the object of civil circulation, this accounting of property will be of financial nature. If the digital asset is determined as an object of non-civil circulation, it will be used for management accounting instead. It is important to note that the distributed ledger token as an accounting object in the distributed ledger token accounting system is used as an identifier of the digital asset information resource derivative of the initial asset;

- *legal component* in the legal field is represented by a derivative of the right (Kud, 2019b). The ability to implement the object that is derivative of the right is ensured by the fact that digital asset accounting units circulate only in the decentralized information platform, which is a hardware and software complex, the infrastructure of which consists of components and services, includes the distributed ledger token accounting system and allows its users to implement property and personal non-property relations by performing financial and management accounting of their property and personal non-property rights by means of digital assets;

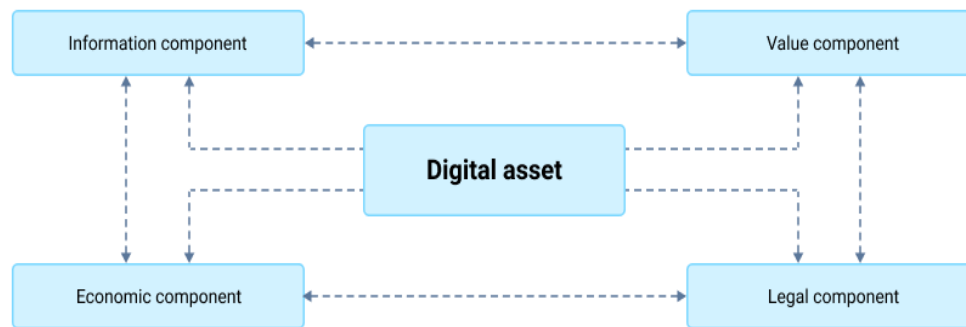
- *information component* in the field of information technologies is represented by the component "digital asset information resource", the rights to which circulate in the distributed ledger by means of distributed ledger token accounting units. For a digital asset, the digital asset information resource as an object used as an original asset, is the feature that distinguishes it from other tokenized assets;

- *value component* in the field of tangible and intangible goods is represented by value (Kud, 2019b). As noted before, the initial asset is defined as value because it is property that exists outside the decentralized information platform, the right to dispose of which is used by its owner when creating the digital asset information resource as an original asset for creating the digital asset. Therefore, the initial asset represents value, importance, usefulness of something, which can also be represented by various units of measurement depending on the field of practical application of this initial asset and the ecosystem that has this initial asset.

Based on the analysis provided above, a statement can be made that the concept of a "digital asset" has its own unique semantic features represented by the components (economic, legal, information and value), which are interconnected and interdependent. This connection is illustrated on Figure 4.

Figure 4

Semantic Features of the Concept of a “Digital Asset” in Economic and Legal Aspects



This way, a digital asset is an information resource derivative of the right to a value and circulating in the distributed ledger in the form of a unique identifier (Kud, 2019b). The Bitbon digital asset can be used as an example of a digital asset, which is derivative of the right to use the non-monetary asset (Kud, 2020b), as well as other digital assets that can be created in the Bitbon System (Bitbon System, 2020), a decentralized information platform, the infrastructure of which allows Bitbon System Users to implement property and personal non-property relations by performing financial and management accounting of their property and non-property rights by means of their digital assets.

If property that is not the digital asset information resource derivative of the initial asset is the original asset for the tokenized asset, the tokenized asset will be of the following types:

- polyasset of the distributed ledger token accounting system (hereinafter – polyasset) as the digital representation of property right that arises from the rights of the creditor and obligations of the debtor of the agreement regarding the disposition of the original asset, the accounting of which is performed using a lot of accounting units. In other words, the polyasset is an agreement (offer), which has one debtor and a number of creditors and recorded in the distributed ledger token accounting system;

- monoasset of the distributed ledger token accounting system (hereinafter – monoasset) as the digital representation of property right that arises from the rights of the creditor and obligations of the debtor of the agreement regarding the disposition of the original asset, the accounting of which is performed using an indivisible number of accounting units. In other words, the monoasset is an agreement (offer), which has one debtor and one creditor and recorded in the distributed ledger token accounting system.

When describing the essence of such a category as a “polyasset”, it is important to note that polyassets include well-known virtual assets of the distributed ledger, such as:

- stablecoins (if the polyasset is based on a deal involving money as the object of property legal relations). One of the well-known examples of this type of a polyasset is Tether (USDT), the value of which is backed by the U.S. dollars kept in accounts of Tether Limited that created it;

- various investment polyassets (that are based on a deal involving securities as the object of property legal relations);

- polyassets that are created for ICOs (Initial Coin (distributed ledger token) Offering) based on a deal involving information on property as the initial asset, etc.

One of the features of a monoasset is that it can be defined as a digital representation of property right that arises from the rights of the creditor and obligations of the debtor of the agreement regarding the disposition of the original asset the accounting of which is performed using an indivisible number of accounting units, which allows stating that a monoasset is an agreement (offer) with one debtor and one creditor, and the environment for recording it is the distributed ledger accounting system. This, in turn, determines the following unique features of a monoasset:

- a monoasset identifier can simultaneously be an agreement number;

- the indivisibility of the transferred monoasset accounting units due to indivisibility of the scope of rights to the original asset specified in the agreement.

In other words, as a result of one transaction in the distributed ledger token accounting system, a transfer of an indivisible number of monoasset accounting units from one user to another takes place, which is equal to 100% of rights to his/her original asset.

Examples of monoassets include virtual assets of the distributed ledger, which possess the property of indivisibility of their accounting units due to indivisibility of the scope of rights to the original asset, which are created by the authors of intellectual property objects in the distributed ledger accounting system called WIPO PROOF (World Intellectual Property Organization, 2020) in order to perform accounting of their copyright to such objects of intellectual property.

With regard to the components of polyassets and monoassets provided in Figure 5, it is important to note that both polyassets and monoassets have the same economic and legal properties as digital assets. Whereas the information component of polyassets and monoassets, unlike that of digital assets, is characterized by the existence of the original asset that is represented by any property (that is not an information resource derivative of the initial asset), the

right to dispose of which is used by its owner to create a tokenized asset. In turn, this characteristic of the original asset determines the absence of the value component of polyassets and monoassets, which is represented by the initial asset for the digital asset.

As part of researching the matter of information and applied nature, it is also important to note that the multitude of purposes of digital assets and polyassets determines the divisibility of their accounting units, as well as in the case of digital assets – indivisibility of their accounting units as well. Thus, a polyasset accounting unit corresponds to a certain scope of property right derivative of the original asset and must be greater than the minimum indivisible numeric value of a divisible scope of rights to dispose of the original

asset (indicated in Table 1 as “ $> m$ ”). Meanwhile, a digital asset accounting unit corresponds to a certain scope of rights of access to the digital asset information resource derivative of the initial asset and can be equal or greater than the minimum indivisible numeric value of the divisible scope of rights to use the original asset (indicated in Table 1 as “ $\geq m$ ”). A monoasset, which does not have a multitude of purposes, has a property of indivisibility of transferred accounting units due to indivisibility of the scope of rights to its original asset (indicated in Table 1 as “ m ”).

Thus, the comparison of categories “digital asset”, “polyasset” and “monoasset”, which is based on the research of information and applied nature of virtual assets of the distributed ledger, is provided in Table 1.

Figure 5

Derivateness of Polyassets and Monoassets

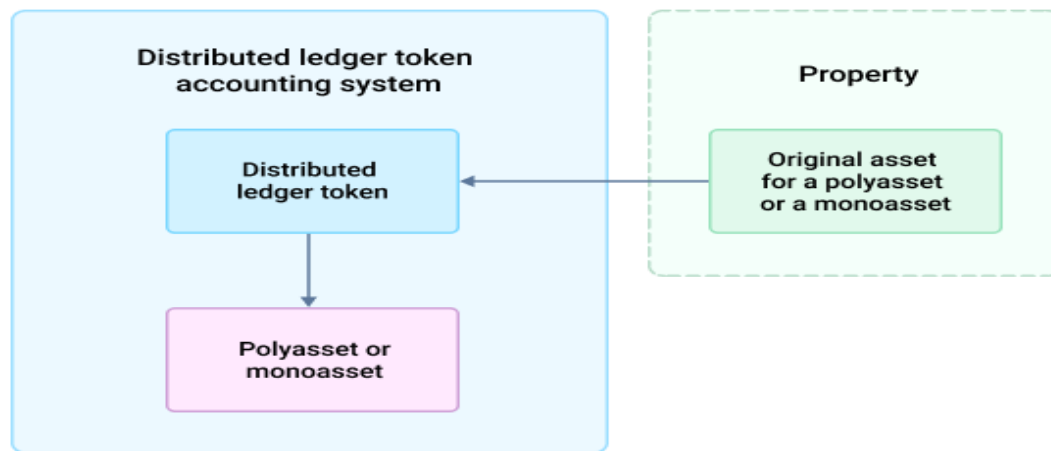


Table 1

Comparison of Properties of Various Types of Virtual Assets of the Distributed Ledger Derivative of the Original Asset

Type of the virtual asset of the distributed ledger	Distributed ledger token accounting units	Property of managing distributed ledger token accounting units	Derivative of the digital asset information resource
Digital asset	$\geq m \dots n$	Divisibility/indivisibility	+
Polyasset	$> m \dots n$	Divisibility	–
Monoasset	m	Indivisibility	–

Thus, the economic and legal nature of tokenized assets and information and applied nature of the types of tokenized assets (Figure 6) allow considering:

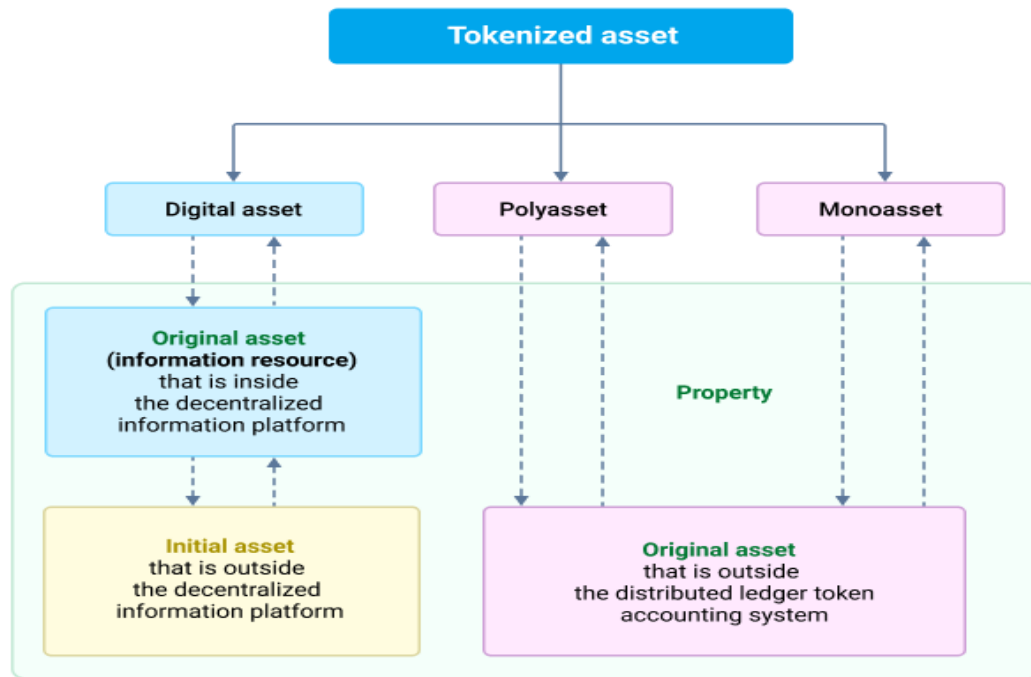
- *monoasset* as an agreement (offer), according to which mutual obligations of only one debtor (owner of the original asset) and one creditor (owner of mononasset accounting units) can be implemented;
- *polyasset* as an agreement (offer), according to which mutual obligations of only one debtor (owner of the original asset) and a number of creditors (owners of polyasset accounting units) can be implemented;
- *digital asset* as an agreement (offer), according to which mutual obligations of the debtor (owner of the original asset in the form of the digital asset information resource), as well as a number of debtors (owners of initial assets) and a number of creditors (owners of digital asset accounting units) can be implemented.

It is important to note that the main properties and parameters of tokenized assets include:

- existence of the distributed ledger token data, which is a combination of attributes and properties of the distributed ledger token: distributed ledger token hash, transaction hashes, number of distributed ledger token accounting units and address for storing this distributed ledger token's accounting units, as well as other attributes and properties that can be determined by the developer (creator) of the smart contract of this distributed ledger token. The existence of distributed ledger token data in the tokenized asset determines this parameter;
- circulation in the distributed ledger token accounting system, which represents an information system for recording, storing and exchanging distributed ledger token data based on the distributed ledger technology;

Figure 6

Types of Tokenized Assets Derived from Property



- existence of the original asset, specifically property, the right to dispose of which is used by its owner to create the tokenized asset;
- existence of the digital asset information resource, which is the original asset for the digital asset in the decentralized information platform that represents the result of intellectual activity and created by the owner of the initial asset in proportion to the scope of rights to the initial asset he/she has;
- existence of the initial asset, which the digital asset information resource is derivative of and which represents property that exists outside the decentralized information platform, the right to dispose of which is used by its owner when creating the digital asset information resource as the original asset for creating the digital asset;
- storage of the digital asset information resource in the decentralized information platform that is a hardware and software complex, the infrastructure of which

consists of components and services, includes the distributed ledger token accounting system and provides its users with the ability to implement property and personal non-property relations by performing financial and management accounting of their property and personal non-property rights by means of digital assets. A distinctive feature of the decentralized information platform is its infrastructure of components and services that allows, among other things, creating the digital asset information resource, as well as user accounts of this system for their identification in the process of disposing of property, thereby identifying the subjects for exercising property and personal non-property rights by means of digital assets.

Various combinations of the main properties and parameters of the tokenized asset allow distinguishing its types, such as “monoasset”, “polyasset” and “digital asset” (Table 2).

Table 2

Main Properties and Parameters of Types of Tokenized Assets

Properties and parameters	Tokenized assets		
	Monoasset	Polyasset	Monoasset
Distributed ledger token data	+	+	+
Circulation in the distributed ledger token accounting system	+	+	+
Original asset	+	+	+
Digital asset information resource	–	–	+
Initial asset	–	–	+
Storage of the digital asset information resource in the decentralized information platform	–	–	+
Divisibility of accounting units	–	+	+

Types of Virtual Assets

The multi-level classification of virtual assets as tools for implementing methods of financial and management accounting of property is based on the complex nature of a virtual asset. This principle is aimed at representing the complex nature of the virtual assets by considering its components: technological, economic, legal, information and applied nature.

The first classification level is based on the technological nature of virtual assets and allows distinguishing the following types:

1. *Virtual asset of the distributed ledger*, which essentially is the type of a virtual asset represented in the distributed ledger token accounting system in the form of a certain number of distributed ledger token accounting units, which in such systems are represented in the form of unique identifiers in such systems.

2. *Virtual asset of the non-distributed ledger* defined as a type of a virtual asset based on the technology other than the distributed ledger technology.

The examples of virtual assets of the non-distributed ledger include the following: coins in video games, electronic money, uncertificated securities, digital memberships, digital gift cards, etc. Each of these objects is relatively well-studied and has its own legal framework that takes all unique features of the object into account.

At the studied level, it is easy to notice that various types of virtual assets, in particular the considered “virtual asset of the distributed ledger” and “virtual asset of the non-distributed ledger”, have different environments and implementation principles and, therefore, the approaches to regulation of such objects should take these peculiarities into account, which means their regulation will be different (Kud, 2020a) depending on their application.

The second classification level is based on the economic and legal nature of virtual assets of the distributed ledger because virtual assets of the non-distributed ledger are a relatively well-studied complex object and are of no interest for the purpose of this particular research.

As part of the second classification level, the following types of virtual assets of the distributed ledger have been distinguished:

1. *Tokenized asset* defined as a type of a virtual asset that exists in the distributed ledger token accounting system in the form of a record with an identifier of information derivative of the original asset.

The tokenized asset is a property right in digital form derivative of property (original asset). There is a mandatory condition for creating the tokenized asset: it can be created and used exclusively as a result of a deal involving the original asset. In other words, the tokenized asset cannot exist without the deal involving the original asset. The tokenized asset can be created exclusively within the deal involving specific property and only as a digital representation of the already existing property right, which is the object of this deal. If the tokenized asset is defined as the object of civil circulation, it allows performing financial accounting

of the original asset. Whereas, if the tokenized asset is the object of non-civil circulation, it can be used to perform management accounting of the original asset.

Lexical and etymological analysis of the term “tokenized asset” indicates that it is property. The tokenized asset, being an object of property legal relations, exists only in the distributed ledger token accounting system as a record with an identifier of information derivative of the original asset.

The “tokenized” component indicates the key characteristic of the studied term, which is that the tokenized asset is not only property by itself. The tokenized asset is a type of a virtual asset, means of confirming obligations and other rights, including rights to access products and services, rights to a certain product or service, rights to receive fixed income or share of profit, management rights, rights to purchase a certain asset at a fixed price in the future (Eurasian Economic Commission, 2019).

Operations with tokenized assets are, essentially, contractual relations and must be governed by civil and commercial laws (depending on the subjects of relations) (Kud, 2020a).

2. *Crypto-asset* (crypto – cryptographic), which represents a type of a virtual asset that exists in the distributed ledger token accounting system in the form of a record with an identifier of information not derivative of the original asset.

Lexical and etymological analysis of the term “crypto-asset” indicates that it is property in cryptographic form, which is assigned an identifier in the distributed ledger token accounting system (Kud, 2019b). The term “crypto-asset” is generally used in the professional field and represents the technological side of this phenomenon: the result of combination of cryptographic technologies and the distributed ledger technology (Eurasian Economic Commission, 2019) and is the only correct one for using this concept at the statutory level.

A crypto-asset is an object of property legal relations (property in digital form). Due to objective absence of derivativeness and backing of crypto-assets by any property or property rights, it is suggested to classify transactions with them as “high-risk financial transactions” and, therefore, to classify them as such to be regulated and governed by state financial monitoring entities and field-specific laws accordingly (Kud, 2020a).

The third classification level prioritizes studying the features of the tokenized asset since this object is defined as the promising direction from the standpoint of its research potential and future application in economy and law.

The following types of tokenized assets have been distinguished as part of this classification level:

1. *Digital asset of the decentralized information platform*, which, essentially, is a type of the tokenized asset and is a digital representation of the right to use the digital asset information resource derivative of the initial asset.

The term “digital asset” consists of the following components:

- “asset”, which is a type of property that represents a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity (Ministry of Finance of the Russian Federation, 1999). Therefore, the meaning of the term “digital asset” indicates that it is property;
- “digital” indicates that a digital asset, being an object of property legal relations, exists only in digital space, specifically in the decentralized information platform in the form of a record with an identifier of information derivative of the digital asset information resource, which, in turn, is derivative of the initial asset.

In decentralized information platforms, the digital asset information resource, i.e. information as a single resource, is the property that can become the original asset for the tokenized asset of civil circulation. This means that the tokenized asset of civil circulation in digital space can be received as a tool for implementing the method of financial or management accounting of the initial asset – digital asset.

The definition of the tokenized asset as the digital asset of the decentralized information platform is based on establishing the digital asset information resource derivative of the initial asset as its original asset. The digital asset information resource is an independent object of legal relations and is a form of recording information on the initial asset created directly by the owner of the initial asset, which is why the digital asset information resource is an object of intellectual property rights of the owner of the initial asset. Thus, the derivativeness of the digital asset information resource as the original asset for the digital asset derivative of the initial asset is determined by the creator of the digital asset having a set of rights and obligations regarding the disposition of the initial asset. The digital asset information resource is a separate type of property, whereas the digital asset of the decentralized information platform is a representation of property right derivative of the digital asset information resource.

In accordance with their legal component, digital asset accounting units are the units for accounting of the scope of rights to access the digital asset information resource derivative of the initial asset. When transferring digital asset accounting units, a certain scope of rights of access to the digital asset information resource is transferred, which contains information laid down by the owner of the initial asset regarding the set of rights to the initial asset and data on obligations of the owner of the initial asset (Kud, Kucheriavenco, & Smychok, 2019).

Since digital asset accounting units correspond to a certain scope of rights to access the digital asset information resource as its original asset derivative of the initial asset, they possess the property of divisibility or indivisibility. Thus, digital asset accounting units are the tool for transferring the scope of rights to access the digital asset information resource from one user of the decentralized information platform to another.

If the digital asset is defined as the object of civil circulation, it allows performing financial accounting of the digital asset information resource as the original

asset and any property as the initial asset. If the digital asset is defined as the object of non-civil circulation, this digital asset can be used only to perform management accounting.

2. *Monoasset of the distributed ledger token accounting system*, which is defined as a type of a tokenized asset, the accounting units of which possess the property of indivisibility because they correspond to an indivisible scope of rights to the original asset.

A characteristic feature of the monoasset is that its original asset is any property that is not a digital asset information resource derivative of the initial asset.

The term “monoasset” consists of the following components:

- “asset”, which is a type of property that represents a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity (Ministry of Finance of the Russian Federation, 1999). Thus, the meaning of the term “monoasset” indicates that it is property;

- “mono” (from Greek monos – one) indicates that the monoasset does not have a multitude of purposes because this type of the tokenized asset is defined exclusively as the agreement (offer) with one debtor and one creditor, and such legal relations are recorded in the distributed ledger token accounting system.

The definition of the monoasset as the above-mentioned agreement (offer) determines the inability to divide the transferred monoasset accounting units due to indivisibility of the scope of rights to the original asset specified in the agreement. Thus, as a result of one transaction in the distributed ledger token accounting system, the transfer of an indivisible number of monoasset accounting units from one user to another takes place, which equals 100% of rights to the original asset of this monoasset.

3. *Polyasset of the distributed ledger token accounting system*, which is a type of a tokenized asset, the accounting units of which possess the property of divisibility, and their number corresponds to a specific scope of divisible property right derivative of the original asset.

A characteristic feature of the polyasset is that its original asset is any property that is not the digital asset information resource derivative of the initial asset.

The term “polyasset” consists of the following components:

- “asset”, which is a type of property that represents a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity (Ministry of Finance of the Russian Federation, 1999). Thus, the meaning of the term “polyasset” indicates that it is property;

- “poly” (from Ancient Greek πολὺς — numerous), which means “great quantity”, “multitude” indicates that the polyasset has a multitude of purposes because this type of a tokenized asset is defined as an agreement (offer) with one debtor and a number of creditors, and such legal relations are recorded in the distributed ledger token accounting system.

As for the other types of tokenized assets, there is a mandatory condition for creating a polyasset: it can be

created and used exclusively as a result of a deal involving the original asset. In other words, the polyasset does not exist without the deal involving the original asset. The polyasset can be created exclusively within the deal involving specific property and only as a digital representation of the already existing property right, which is the object of this deal. Since the number of polyasset accounting units corresponds to a certain scope of divisible property right derivative of its original asset, they possess the property of divisibility. Therefore, polyasset accounting units are the tool for transferring the scope of property rights to its original asset from one user of the distributed ledger token accounting system to another.

The approach chosen to classify virtual assets as tools for implementing the methods of financial and

management accounting of property takes into account the versatility of their technological, economic, legal, information and applied nature and, as a result, is based on the complexity of the nature of virtual assets (Table 3).

The approach to classification of virtual assets as tools for implementing the methods of financial and management accounting of property proposed in this paper is the foundation for creating a legal framework in order to objectively regulate relations in the field of application of virtual assets, as well as significantly lowers the requirements for subjects of legal relations in the field of application of virtual assets (users of distributed ledger token accounting systems, users of decentralized information platforms, as well as service providers and service users).

Table 3

Classification of Virtual Assets as Tools for Implementing the Methods of Financial and Management Accounting of Property

Nature	Type
Technological	Virtual asset of the distributed ledger
	Virtual asset of the non-distributed ledger
Economic and legal	Tokenized asset
	Crypto-asset
	Digital asset
Information and applied	Polyasset
	Monoasset

Conclusions

Over the course of more than ten years of its existence, the distributed ledger technology has significantly evolved and gone through several stages, so called generations (Kud, Kucheriavenko, & Smychok, 2019; Pypenko & Kud, 2019). However, establishing the legal framework for tools of the distributed ledger and enshrining the regulation of their application in legislation are still important and unsolved issues. Overall, with regard to the distributed ledger, legislators face a number of topical problems, solving of which would guarantee protection of rights of participants in legal relations implemented based on the distributed ledger technology (Kud, 2020a).

The Financial Action Task Force was the first to propose a generalizing name, “virtual asset”, for all types of tools based on the distributed ledger technology, which takes into account their versatile nature (Financial Action Task Force, 2012).

The research aimed at studying the tools of potential application of virtual assets in various field of economy proposes the classification of virtual assets as tools for implementing the methods of financial and management accounting of property, the division of which is based on their versatile technological,

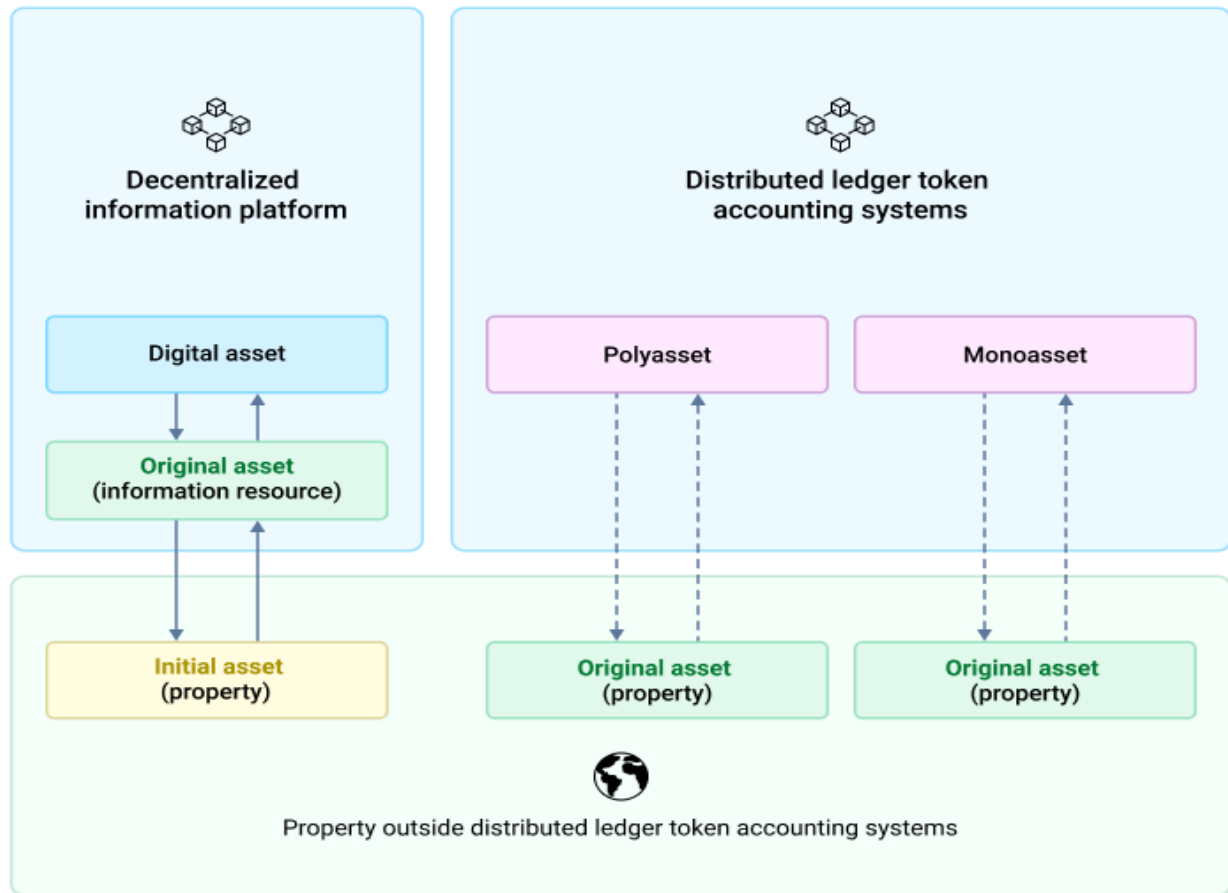
economic, legal, information and applied nature, i.e. on the complexity of their nature, and determines the following classification of virtual assets:

- first classification level (based on the technological nature) – division of virtual assets into virtual assets of the distributed ledger and virtual assets of the non-distributed ledger;
- second classification level (based on the economic and legal nature) – division of virtual assets of the distributed ledger into tokenized assets and crypto-assets;
- third classification level (based on the information and applied nature) – division of tokenized assets into digital assets, polyassets and monoassets.

It is important to note that the types of tokenized assets substantiated as part of the third level, “digital asset”, “polyasset”, and “monoasset”, can be applied as the base model for determining the following classification levels for implementing the methods of financial and management accounting (Figure 7) of property, which due to its nature can have different legal frameworks determined by state bodies based on the purpose of specific property.

Figure 7

Visual Representation of the Methods of Financial and Management Accounting of Property Using Various Types of Tokenized Assets



The principle of complexity of the nature of virtual assets as the principle for creating the classification of virtual assets as tools for implementing the methods of financial and management accounting of property based on considering the technological, economic, legal, information and applied nature can be illustrated using the visual representation of the classification of virtual assets (Figure 8).

As noted before, when considering the economic and legal nature, virtual assets of the distributed ledger were prioritized because virtual assets of the non-distributed ledger are relatively well-studied, which means that studying them in order to determine the main features for establishing the proper legal framework is not as important.

When considering the information and applied nature, the features of tokenized assets were prioritized because this object is promising in terms of its research potential and future application in economy and law.

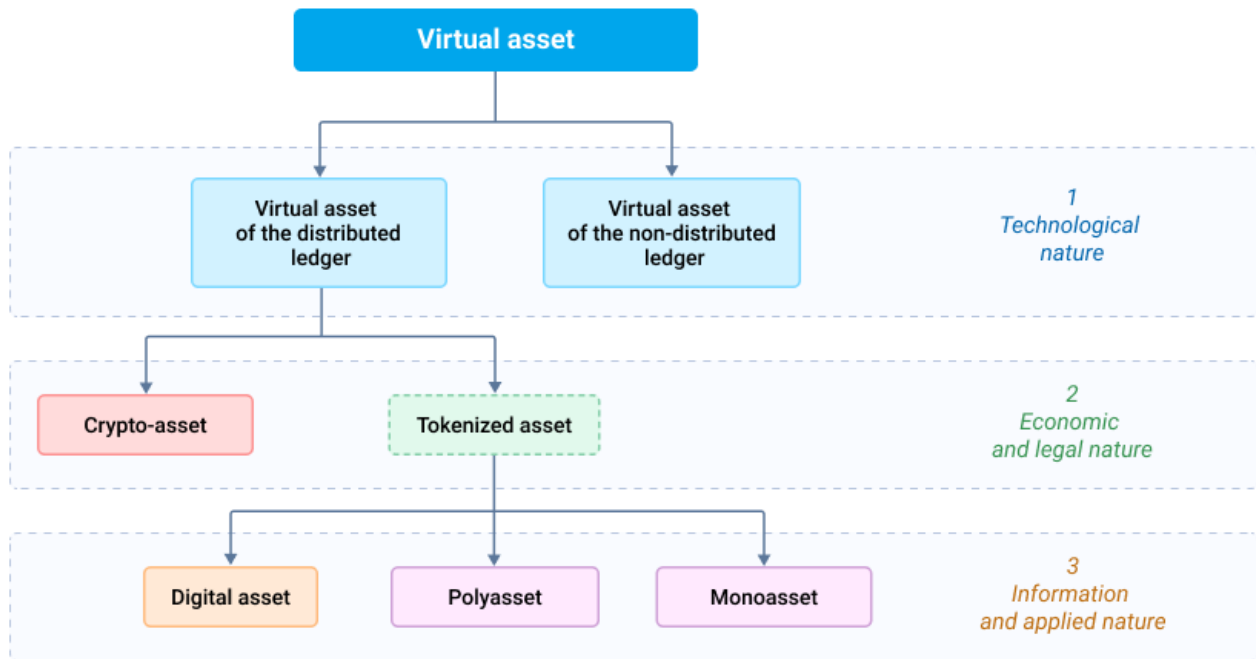
The classification of virtual assets as tools for implementing the methods of financial and management accounting of property proposed as part

of this research is scientifically substantiated, has classification grounds and can have practical significance for creating a proper legal framework for each mentioned type of virtual assets.

Tools of the distributed ledger, especially one of the most promising types of virtual assets of the distributed ledger, tokenized asset, can become the driving force for modernization of the global economy. This classification can definitely become the foundation for developing the methodology for determining the correspondence of a virtual asset of the distributed ledger to a crypto-asset, monoasset, polyasset or digital asset as the most promising type of virtual assets of the distributed ledger used as a tool for implementing the method of financial and management accounting of property. In addition, further research is required to study the nature of a digital asset information resource, the study of which, in turn, will become the foundation for the scientific substantiation of modifying the category “digital asset accounting unit” or “digital asset unit” broadly used in this research.

Figure 8

Visual Representation of the Classification of Virtual Assets Based on the Complexity of Their Nature



The creation of a comprehensive classification of virtual assets as tools for implementing the methods of financial and management accounting of property allowed studying the subjects and objects of relations in the field of application of virtual assets. This research significantly contributed to the terminology of the field of application of virtual assets proposed in the paper “The Phenomenon of Virtual Assets: Economic and Legal Aspects” (Kud, 2020a):

1. *Virtual asset* is a digital representation of value that can be traded in digital form or transferred, and can be used for payment or investment purposes (Financial Action Task Force, 2020).

2. *Distributed ledger* is a combination of hardware and software that operate together but in a decentralized way independently of each other in order to record events with the data of distributed ledger tokens by means of distributed ledger token transactions synchronized using a certain consensus algorithm. The distributed ledger technology ensures the operation of distributed ledger token accounting systems.

3. *Virtual asset of the distributed ledger* is a type of a virtual asset represented in the distributed ledger token accounting system in the form of a certain number of distributed ledger token accounting units, which in such accounting systems are represented in the form of unique identifiers.

4. *Virtual asset of the non-distributed ledger* is a type of a virtual asset based on a technology other than the distributed ledger technology.

5. *Distributed ledger token accounting system* is an information system for recording, storing and exchanging the data of distributed ledger tokens based on the distributed ledger technology.

6. *User of the distributed ledger token accounting system* is a natural person or a legal entity that uses the distributed ledger token accounting system to, but not exclusively, carry out deals with tokenized assets and/or crypto-assets.

7. *Identifier* is an attributive feature of an accounting object intended for its identification, represented in the form of a unique set of alphabetical and/or numeric characters of a certain length and assigned to the accounting object in its circulation environment.

8. *Hash in the distributed ledger token accounting system* is a type of an identifier assigned to events after they are recorded in the distributed ledger token accounting system.

9. *Smart contract* is an electronic algorithm containing a number of conditions that are executed in the distributed ledger token accounting system and fully exclude the human factor.

10. *Distributed ledger token* is an object of the distributed ledger token accounting system that is an identifier of information structured a certain way, which can be, but is not always, derivative of the original asset.

11. *Distributed ledger token accounting unit* is an object of accounting of distributed ledger token data in the distributed ledger token accounting system.

12. *Distributed ledger token transaction* is a process of recording (record in the distributed ledger in the form of a transaction hash) the change of the accounting address for a certain number of distributed ledger token accounting units.

13. *Transaction hash* is a type of an identifier assigned to the distributed ledger token transaction and based on the data of the distributed ledger token.

14. *Data of the distributed ledger token* is a set of attributes and properties of a distributed ledger token: distributed ledger token hash, transaction hashes, number of distributed ledger token accounting units and storage address of distributed ledger token accounting units, as well as other attributes and properties that can be determined by the developer (creator) of the smart contract of that distributed ledger token.

15. *Tokenized asset* is a type of a virtual asset that exists in the distributed ledger token accounting system in the form of a record with an identifier of information derivative of the original asset.

16. *Original asset* is property, the right to dispose of which is used by its owner to create a tokenized asset (Kud, 2020a).

17. *Decentralized information platform* is a hardware and software complex, the infrastructure of which consists of components and services, includes the distributed ledger token accounting system and provides its users with the ability to implement property and personal non-property relations by performing financial and management accounting of their property and personal non-property rights by means of digital assets.

18. *User of the decentralized information platform* is a natural person or a legal entity that uses the decentralized information platform to implement the methods of financial and management accounting of property and personal non-property relations by means of digital assets.

19. *Service provider* is a user of the decentralized information platform that provides services in the field of tokenized assets and crypto-assets including, but not limited to, those ensuring the performance of deals involving tokenized assets and/or crypto-assets.

20. *Service user* is a user of the decentralized information platform that receives services available in the decentralized information platform and/or uses tokenized assets and/or crypto-assets including, but not exclusively, to carry out business activity or for personal use.

21. *Digital asset of the decentralized information platform* is a type of a tokenized asset, the accounting units of which possess the property of divisibility or indivisibility, the number of which corresponds to a certain scope of rights of access to the digital asset information resource as its original asset derivative of the initial asset. It is an agreement (offer), in accordance with which mutual obligations of the debtor (owner of the original asset in the form of the digital asset information resource) and a multitude of creditors (owners of digital asset accounting units) can be implemented.

22. *Initial asset* is property that exists outside the decentralized information platform, the right to dispose of which is used by its owner when creating the digital asset information resource as the original asset for creating the digital asset.

23. *Digital asset information resource* is the original asset for the digital asset in the decentralized information platform that is a result of intellectual

activity created by the owner of the initial asset in proportion to the scope of rights to the initial asset he/she has.

24. *Polyasset of the distributed ledger token accounting system* is a type of a tokenized asset, the accounting units of which possess the property of divisibility, and the number of which corresponds to a certain scope of divisible property right derivative of the original asset. It is an agreement (offer), in accordance with which mutual obligations of only one debtor (owner of the original asset) and a multitude of creditors (owners of polyasset accounting units) can be implemented.

25. *Monoasset of the distributed ledger token accounting system* is a type of a tokenized asset, the accounting units of which possess the property of indivisibility because they correspond to an indivisible scope of rights to the original asset. It is an agreement (offer), in accordance with which mutual obligations of only one debtor (owner of the original asset) and one creditor (owner of monoasset accounting units) can be implemented.

26. *Crypto-asset* is a type of a virtual asset that exists in the distributed ledger token accounting system in the form of a record with an identifier of information not derivative of the original asset.

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Conflicts of Interests

The author declares that there is no conflict of interests.

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Анотація

Вступ: Однією з проблем сучасних законодавців у різних країнах є те, що вони намагаються регулювати об'єкт, не розібравшись у природі його походження, що, логічно, тягне й безліч помилок щодо його визначення в правовому полі. Відсутність уніфікованих визначень і чіткої класифікації віртуальних активів як інструментів для реалізації способів фінансового й управлінського обліку майна за їх фундаментальними, характерними ознаками робить практично неможливим визначення важливих для правового регулювання характеристик віртуальних активів, а отже, і їх закріплення в нормах права та встановлення належного правового режиму. Статтю присвячено вирішенню актуального та міждисциплінарного науково-прикладного завдання розроблення комплексної багаторівневої класифікації віртуальних активів. На відміну від нечисленних наявних класифікацій, які сконцентровані на фрагментах феномену віртуального активу та вибіркового застосування, у статті запропоновано всеосяжне бачення співвіднесення усіх відомих видів віртуальних активів, що дозволяє говорити про комплексність класифікації, поданої у цій статті.

Мета: Розробити та обґрунтувати комплексну багаторівневу класифікацію усіх відомих видів віртуальних активів, що дозволяє вирішити міждисциплінарне науково-прикладне завдання систематизації віртуальних

активів для подальшого вироблення єдиного підходу до регулювання відносин, об'єктами яких виступають віртуальні активи різних видів.

Матеріали та методи: Для дослідження природи віртуальних активів і розроблення комплексної класифікації було використано комплекс методів наукового дослідження: аналіз, зокрема аналіз причинно-наслідкових зв'язків, синтез, порівняльний метод, метод узагальнення, систематизації й інтерпретації результатів та індукція.

Результати: Окреслено триєдину природу віртуальних активів: технологічну, економіко-правову й інформаційно-прикладну. Ця класифікація віртуальних активів дозволить визначити перспективні інструменти для цілей обліку майна та прав. На відміну від інших відомих підходів до розрізнення віртуальних активів, у яких раніше необґрунтовану «першість» посідали криптоактиви (або криптовалюти), автор уперше виокремлює групу токенизованих активів. Саме ця група, завдяки наявності прямого зв'язку з майном, дозволяє вести облік, а також здійснювати переоблік майна та прав у сучасних цифрових системах обліку – децентралізованих інформаційних платформах на базі технології розподіленого реєстру (блокчейн), тоді як за допомогою криптоактивів, через відсутність прямого зв'язку з майном, неможливо вести цей облік. Автор серед віртуальних активів виокремлює цифровий актив й аналізує сутнісно-сміслові особливості поняття «цифровий актив». В основу цифрового активу покладено унікальний інформаційний ресурс як первинний актив і властивість похідності від реального активу, що радикально відрізняє цифровий актив від інших видів віртуальних активів. Усе це дозволяє його розглядати як ефективний інструмент для реалізації способів фінансового й управлінського обліку майна. Отже, власники цифрового активу можуть здійснювати у новий спосіб облік своїх майнових і особистих немайнових прав. Грунтуючись на властивостях цифрового активу, автор виокремлює інші види віртуальних активів: поліактив і моноактив, із відповідними прикладами. Наводить характеристику їх властивостей і структурованих елементів, співвідносячи їх із характеристиками цифрового активу, а також пропонує чіткі та добре відомі фінансово-правові аналогії із реалізації взаємних зобов'язань між сторонами у традиційному правочині. У статті вперше запропоновано систематизацію семи властивостей і параметрів токенизованого активу та, як наслідок, опис властивостей трьох різновидів токенизованого активу: моноактиву, поліактиву та цифрового активу. Це дозволило подати різновиди віртуальних активів у вигляді трирівневої класифікації, в основі якої знаходиться комплексність природи віртуальних активів. У авторській класифікації виокремлено сім різновидів віртуальних активів і наведено їхню характеристику.

Висновки: Загалом запропонований підхід до класифікації дозволяє дати наукову відповідь на питання про те, на якій підставі співвіднести між собою безліч відомих видів віртуальних активів і як віднести до них правовий режим держави. Ці розробки будуть корисні для законодавця практично будь-якої держави, державних органів фінансового, податкового та банківського контролю, а також для приватних компаній під час постановки на баланс та обліку віртуальних активів у своїй господарській діяльності.

Ключові слова: розподілений реєстр, блокчейн, віртуальний актив, токенизований актив, цифровий актив, поліактив, моноактив, криптоактив, децентралізована інформаційна платформа.

Аннотація

Введение: Одной из проблем современных законодателей в разных странах является то, что они пытаются регулировать объект, не разобравшись в природе его происхождения, что, логически, влечет и множество ошибок относительно его определения в правовом поле. Отсутствие унифицированных определений и четкой классификации виртуальных активов как инструментов для реализации способов финансового и управленческого учета имущества по их фундаментальным, отличительным признакам делает практически невозможным определение важных для правового регулирования характеристик виртуальных активов, а следовательно, и их закрепление в нормах права и установление надлежащего правового режима. Статья посвящена решению актуальной и междисциплинарной научно-прикладной задачи разработки комплексной многоуровневой классификации виртуальных активов. В отличие от немногочисленных имеющихся классификаций, которые сконцентрированы на фрагментах феномена виртуального актива и выборочных способах его применения, в статье предложено всеохватывающее видение соотношения всех известных видов виртуальных активов, что позволяет говорить о комплексности классификации, представленной в данной статье.

Цель: Разработать и обосновать комплексную многоуровневую классификацию всех известных видов виртуальных активов, что позволяет решить междисциплинарную научно-прикладную задачу систематизации виртуальных активов для дальнейшей выработки единого подхода к регулированию отношений, объектами которых выступают виртуальные активы различных видов.

Материалы и методы: Для исследования природы виртуальных активов и разработки комплексной классификации был использован комплекс методов научного исследования: анализ, в том числе анализ причинно-следственных связей, синтез, сравнительный метод, метод обобщения, систематизации и интерпретации результатов и индукция.

Результаты: Обозначена триединая природа виртуальных активов: технологическая, экономико-правовая и информационно-прикладная. Данная классификация виртуальных активов определяет перспективные инструменты для целей учета имущества и прав. В отличие от иных известных подходов к различению

виртуальных активов, в которых ранее необоснованное «первенство» занимали криптоактивы (или криптовалюты), автор впервые выделяет группу токенизированных активов. Именно данная группа, в силу наличия прямой связи с имуществом, позволяет вести учет, а также осуществлять переучет имущества и прав в современных цифровых системах учета – децентрализованных информационных платформах на базе технологии распределенного реестра (блокчейн), тогда как посредством криптоактивов, в силу отсутствия прямой связи с имуществом, невозможно вести данный учет. Автор среди виртуальных активов выделяет цифровой актив и анализирует сущностно-смысловые особенности понятия «цифровой актив». В основе цифрового актива лежит уникальный информационный ресурс как исходный актив и свойство производности от реального актива, что радикально отличает цифровой актив от других видов виртуальных активов. Все это позволяет его рассматривать как эффективный инструмент для реализации способов финансового и управленческого учета имущества. Таким образом, собственники цифрового актива могут осуществлять учет новым способом своих имущественных и личных неимущественных прав. Базируясь на свойствах цифрового актива, автор выделяет иные виды виртуальных активов: полиактив и моноактив, с соответствующими примерами. Приводит характеристику их свойств и структурных элементов, соотнося их с характеристиками цифрового актива, а также предлагая четкие и хорошо известные финансово-правовые аналогии по реализации взаимных обязательств между сторонами в традиционной сделке. В статье впервые предложено систематизацию семи свойств и параметров токенизированного актива и, как следствие, описание свойств трех разновидностей токенизированного актива: моноактива, полиактива и цифрового актива. Это позволило представить разновидности виртуальных активов в виде трехуровневой классификации, в основе которой лежит комплексность природы виртуальных активов. В авторской классификации выделены семь разновидностей виртуальных активов и дана их характеристика.

Выводы: В целом предложенный подход к классификации позволяет дать научный ответ на вопрос о том, на каком основании соотнести между собой множество известных видов виртуальных активов и как отнести к ним правовой режим государства. Данные разработки будут полезны для законодателя практически любой страны, государственных органов финансового, налогового и банковского контроля, а также для частных компаний при постановке на баланс и учете виртуальных активов в своей хозяйственной деятельности.

Ключевые слова: распределенный реестр, блокчейн, виртуальный актив, токенизированный актив, цифровой актив, полиактив, моноактив, криптоактив, децентрализованная информационная платформа.

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