BLOCKCHAIN TECHNOLOGY IN PROJECT FINANCE

A LEGAL AND PRACTICAL MODEL FOR FINANCING MEGA-INVESTMENTS

Witold Srokosz, Paweł Lenio and Grzegorz Sobiecki

Blockchain Technology in Project Finance

There is currently no comprehensive scientific study that addresses the problem of financing projects using Distributed Ledger (blockchain) Technology (DLT) that are not themselves embedded in the blockchain ecosystem, particularly in the context of long-term and capital-intensive investments. This book fills this gap. It poses a number of research questions such as "what financing model/mechanism is the most effective in the long term where very large financial resources are concerned?", "are there appropriate legal regulations in place?" and "can DLT (blockchain) technology provide usability and solutions that can be used in the process of financing capital-intensive investments?"

The book ultimately shows that it is possible to build a legal and economic model that would effectively enable the financing of long-term and capital-intensive investments, based on a specially prepared integrated platform operating on the basis of blockchain technology. As a result of the mechanisms of smart contracts, the platform would enable not only the issuance and service of tokens, including equity tokens, but also auxiliary and payment or utility tokens, and the automation of relationships between stakeholders. It would also allow the creation of a virtual decentralized autonomous organization that would control the implementation of the project, and a decentralized exchange that would enable token trading.

This book is intended for academics, scholars and researchers in the fields of economics, finance and law, particularly those focused on blockchain technology, distributed ledger systems and innovative financing mechanisms for large-scale investments. Policymakers and regulators involved in developing policies and legal frameworks for blockchain technology, cryptocurrencies and financial innovation would find it to be a practical reference.

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Introduction

In the world literature, there is currently no comprehensive scientific study that would address the problem of financing projects using DLT (blockchain) technology that are not themselves embedded in the blockchain ecosystem, in particular relating to long-term and capital-intensive investments. This monograph fills this gap and is thus important not only for economic and legal sciences but also because, as a result of basic research, it can be a starting point for planning the financing of mega-investments in business trading practice.

This monograph was written as part of a grant awarded by the Polish National Science Centre (decision number DEC-2020/39/B/HS5/00120). The scientific objective of the project was to develop a theoretical legal and financial model for financing long-term and capital-intensive investments using distributed ledger technology. This monograph is one of the results of research carried out under this grant.

The book poses a number of research questions that are consistent with the objectives of the grant, including what financing model/mechanism is the most effective in the long term with the involvement of very large financial resources? Can you find suitable analogies in the history of mankind? Are there appropriate legal regulations? Can DLT (blockchain) technology provide usability and solutions that can be used in the process of financing capital-intensive investments? A research hypothesis was put forward that it is possible to build a legal and economic model that would effectively enable the financing of long-term and capital-intensive investments based on a specially prepared integrated platform operating on the basis of blockchain technology. The platform would enable, thanks to the mechanisms of smart contracts, not only the issuance and service of tokens, including equity tokens, but also auxiliary and payment or utility tokens, and the automation of relations between stakeholders. It would also allow the creation of a virtual decentralized autonomous DAO that would control the implementation of the project, and a decentralized exchange that would enable token trading. In the course of economic and legal research, this hypothesis was positively verified, and the result of this research is the model of financing

long-term and capital-intensive investments constructed in Chapter 7 of the monograph.

The complex nature of the research required a multi-faceted, legal and economic approach. In the area of law, the research methods used included the dogmatic method and the comparative law method. In the area of economics, literature research, cause and effect analysis and descriptive modelling of processes were carried out.

The considerations presented in the monograph concern investments that have four features:

- Large-Scale (LS) – have a wide (international) range of impact;
- Capital-Intensive (CI) – require the accumulation of a large amount of capital and liquidity, unavailable to a single entity;
- Long-Term (LT) – involve a multi-year implementation period;
- Investment Project (IP) – are of a project nature (a defined goal and scope of work, an expected result in a specific time, an investor, a budget, stages and a schedule), not of a continuous development nature.

For the purposes of the conducted research and monograph, the terms "megaprojects" and "capital-intensive investments" were used to define these investments. It should be added here that the direct subject of consideration is the scheme, system and structure of investment financing and the support of this process using DLT, and not the consideration of support for the entire process of organization and coordination of the investment, although some suggestions do have an impact on the overall formal and legal shape of the project. The monograph does not refer in detail to the issues of profitability assessment, leverage security, liquidity management, revenue planning, advance payments, cost estimation or negotiations.

1 Capital-intensive and long-term investments

1.1 Historical examples of long-term and capital-intensive investments

The starting point for defining the research problem was the observation that there are many examples of investments in history that took many years to implement and consumed significant amounts of capital and that had a similar (project) nature and faced similar challenges. In order to better understand their specificity, we present several selected capital-intensive and long-term investments, as well as selected information relevant to the purpose of the work (for example, construction cost, construction time, method of financing).

Examples of attempts to finance a long-term and capital-intensive investment exclusively from private funds were the construction of the Suez Canal (1859–1869) and the construction of the Panama Canal (1879–1889 – the first approach, and 1904–1914 – the main construction period). In both cases, companies were founded (the Suez Canal Company founded in 1859 and Compagnie Universelle du Canal Interocéanique de Panama in 1880, respectively) that issued shares (and in the case of Compagnie Universelle du Canal Interocéanique de Panama, also bonds, including those linked to a lottery). The construction of the Suez Canal was financed by the share capital of private investors in approximately 55%, of which 52% was owned by French investors and approximately 45% by the Egyptian Government, later supplemented by bonds, mainly by the Egyptian Government (eventually >60% was government financing) (Hansen and Tourk, 1978, pp. 938–958). The funds obtained in this way were invested in the construction of canals. The cost of building the Suez Canal was approximately USD 10 billion at today's prices (approximately USD 470 million according to the 1870 estimate) (Alfred, 2012), and the Panama Canal was approximately USD 11.5 billion at today's prices (USD 375 million according to the 1913 estimate) (Onion et al., 2009). The Suez Canal Company brought large profits to investors (the rate of return for French shareholders and the British Government was approximately 8–9% at an opportunity cost of 3–4%, and for the Egyptian government 2–5% at an opportunity cost of 11%), while Compagnie Universelle du Canal Interocéanique de Panama went bankrupt

in 1889. Eventually, both canals were nationalized. In the case of the Suez Canal, this was in 1956, and in the case of the Panama Canal, the project started by Compagnie Universelle du Canal Interocéanique de Panama after its bankruptcy was bought by the US Government and completed in 1914. In 1977, the United States and Panama signed new agreements to replace the original 1903 agreement and agreed to transfer control of the canal in 1999, which became a fact. The Suez Canal is currently managed by the Egyptian state-owned Suez Canal Authority (SCA). It can, therefore, be said that in the case of the Panama Canal, the project was financed both by private investors (hundreds of thousands of French citizens who lost the invested funds) and by the government (the United States), which completed the investment project. The Suez Canal was expanded between 2014 and 2016 at a cost estimated at USD 9–15 billion in order to nearly double the capacity of the canal. The investment was financed through the issue of investment certificates issued to Egyptian and individual entities.[1]

Another example of a long-term and capital-intensive investment financed from private funds is the construction of the First Transcontinental Railroad in the United States in the 19th century (1863–1869). This project received support from the federal government. For the American bankers of that time, financing such construction was risky, raising the necessary capital (liquidity) to cover the investment costs was difficult, and the expected return was difficult to estimate. Also, politicians and the US federal government, especially in the face of Civil War expenses, did not want to incur such an outlay – the final cost of the transcontinental railroad was USD 100 million (approximately USD 2–3 billion at today's prices), which was one-third of the federal budget in mid-19th century in times of peace. Therefore, a financing mechanism was created in which it was entrepreneurs who bore most of the expenses, but with the support of the federal government. The mechanism was that for every mile of railroad track financed by private investors (enriched by gold mining and trading), the federal government was to transfer ownership of 10 miles of public land on either side of the line. The value of these lands, thanks to the railway line, was to increase in the future, which would increase investors' profits and reduce their risk. This opportunity was used by the founders of two companies – the Central Pacific Railroad Company and Union Pacific – which the government authorized to build sections of track in the central west and west of the country, respectively. Central Pacific issued USD 100 million of shares, of which it managed to sell USD 60 million (however, all of these shares were held by a small group of approximately seven investors). In addition, under the Pacific Railroad Act passed by Congress in 1862, the federal government could support the Central Pacific Railroad with funds obtained from the sale of 30-year government bonds. Thus, the company would receive USD 16,000 (approximately USD 480,000 at today's prices) for each mile of railroad built on flat land, USD 32,000 (approximately USD 960,000 at today's prices) in hilly country and USD 48,000 (approximately USD 1.5 million at today's prices) in mountainous miles. However,

the federal government expected these amounts to be repaid, meaning they were essentially loans secured by a mortgage on the railway line (McCurdy, 2019, pp. 14–20).

When writing about major infrastructure investments, it is difficult not to mention the Three Gorges Dam in the People's Republic of China. It was built over 10 years (1993–2003) and cost approximately USD 78 billion at today's prices. Due to the prevailing political regime, control of financing coordination was carried out by state institutions. The construction was financed by funds accumulated in the Three Gorges Project Construction Fund, mainly of public origin: loans from the China State Development Bank, income from the electricity of the Gezhouba Dam, income from the operational part of the project, national debt (government bonds), corporate bonds, as well as from the introduced electricity surcharge.[2] The construction of the dam system was associated with additional social costs related to displacement, destruction of cultural heritage and arable land in flooded areas and damage to the natural environment (Jackson and Sleigh, 2001, p. 57).

In turn, an example of using only public funds to finance a long-term and capital-intensive project is the construction of the International Thermonuclear Experimental Reactor – ITER, which is to be operated on the Tokamak principle. Construction began in 2013 and is scheduled to be completed in 2025. Full operation is scheduled for 2035 (Edwardes-Evans, 2021). This project is led by the international ITER Organization, which was established by an international agreement signed in 2006 by the People's Republic of China, the European Atomic Energy Community (Euratom), the Republic of India, Japan, the Republic of Korea, the Russian Federation and the United States of America. Although the agreement was signed in 2006, the idea of creating an international institution to build the Tokamak emerged at the Geneva Summit in November 1985. The following year, the European Union (Euratom), Japan, the Soviet Union and the United States agreed to jointly implement the project of the large ITER international fusion facility. Work on the conceptual design began in 1988, followed by increasingly detailed engineering design phases, until finally, in 2001, members approved the final ITER design. This project was joined in 2003 by the People's Republic of China and the Republic of Korea and in 2005 by India. The selection of the site for ITER was a lengthy procedure that was completed in 2005 when ITER members unanimously agreed to the European Union's proposed ITER installation near Aix-en-Provence in southern France.[3]

The original project budget was USD 5.6 billion (Geert De Clercq, 2016), and it is estimated that it may increase to USD 18–25 billion (Hutt and Breene, 2019). The European Union is responsible for approximately 45.5% of ITER's construction costs, with China, India, Japan, Korea, the Russian Federation and the United States contributing approximately 9.1% each. In the operational phase, the distribution of costs among members will be as follows: Europe – 34%, Japan and the United States – 13% and China, India, Korea and Russia – 10%. It was assumed that most of the contributions (i.e.,

90%) in the construction phase will be made by the countries participating in the project "in kind", i.e., instead of cash, they will bring components and buildings to the ITER Organization. The in-kind contributions of the members of the ITER Organization have been divided into approximately 140 public procurement agreements. These documents detail the technical specifications and management requirements for the procurement of systems, components and facility structures. However, what is particularly important from the perspective of the subject of this monograph is that the value of each procurement agreement is expressed in ITER Units of Account – IUAs. It is a currency designed to measure the value of in-kind contributions to ITER consistently over time. It is used as follows: procurement allocations have been distributed among Members on the basis of component valuations. Upon successful completion of a given component, the corresponding credit value is saved in the Member's account. The contribution of 9.1% of the project, therefore, amounts to summing up the IUA values of individual contributions.[4]

As in the case of the ITER project, there is also another research project in Europe – the Large Hadron Collider (LHC), controlled by CERN (European Organization for Nuclear Research). Its construction took 12 years (1995–2007) and cost approximately USD 4.7 billion (Roche, 2022). The project was financed from CERN's own funds (contributions of the governments of member countries, mainly Germany at over 70% of the annual budget, Great Britain, Italy, France and Spain), funds obtained from governments of observer states (including the United States), loans from the European Investment Bank (EIB) and European public funds (6th EU Research Framework Programme). It is difficult to determine the structure of this funding due to the lack of full availability of source information (Smit, 2002). Nevertheless, the list of funding sources indicates that the capital does not come from private entities.

The conquest of space provides examples of financing of capital-intensive and long-term investments. The first such programmes were fully financed from public funds by public entities (for example, the APOLLO programme and the space shuttle programme). The construction of the International Space Station, which commenced in 1985, also belongs to this group. In the period 1985–2015, it is estimated that the construction cost approximately USD 150 billion and was financed by own contributions of programme members: NASA (84%) and its partners: Russia (8%), Europe (3.3%), Japan (3.3%) and Canada (1.3%) (Lafleur, 2010).

In the 21st century, we can observe the phenomenon of moving away from financing the conquest of space exclusively from public funds, and either using public-private partnerships (PPPs) or even shifting the burden of financing exclusively to private entities, which means a gradual decentralization of funding for this research (Weinzierl, 2018, pp. 173–192; Heracleous et al., 2019, pp. 1–3; Pomeroy et al., 2019, pp. 44–50). The result is that in 2021, the global value of space activity amounted to USD 446.88 billion,

of which 79.8% was attributed to Commercial Space Products and Services and Commercial Infrastructure and Support Industries, while 11.6% was attributed to the US Government Space Budget and 8.6% to Non-US Government Space Budgets. In addition, in 2021, a record number of 145 orbital launch attempts were carried out from eight countries, with the number of commercial missions was growing faster than that of military and government missions. Some of these launches involved 14 private individuals who flew into space on Virgin Galactic, Blue Origin and SpaceX commercial vehicles.[5] The fact that commercial companies are more effective than government agencies is also evidenced by a comparison of costs incurred by a government agency and a private entity in connection with the construction of a space rocket. If NASA were to develop SpaceX's Falcon 9 rocket using its traditional development model, it would cost USD 4 billion, as estimated by NASA itself. Under a more commercial model with less government involvement and more commercial partner flexibility, the estimated costs would be USD 1.7 billion. In contrast, SpaceX announced that the development costs of the Falcon 9 rocket (and its earlier version, Falcon 1) amounted to USD 390 million, which is a quarter of the lowest NASA estimates (Heracleous et al., 2019, p. 1). In any case, in order to encourage private entities to explore space more widely, some countries have started to build an appropriate legal framework. This is primarily about the controversial American The Spurring Private Aerospace Competitiveness and Entrepreneur-ship Act of 2015 – "the SPACE Act of 2015" (McCarthy, 2015; DiMaria, 2016, pp. 415–440; Rostoff, 2016, pp. 373–400; Taylor, 2019, pp. 653–677).

Another example of a long-term and capital-intensive investment that has already been initiated in the 21st century is the programme to send a manned mission to the exoplanet – 100 Year Starship,[6] launched in the United States in 2011 on the initiative of NASA and DARPA (Defence Advanced Research Projects Agency). The programme is intended to last 100 years, but so far, the project is developing very poorly, and one of the reasons is insufficient funding. The project was initiated with one-time financial support from public funds consisting of DARPA awarding, after a competition, a grant in the amount of USD 500,000 to a private foundation, which is continuing the project based mainly on donations and contributions from members of the organization (Weinberger, 2014).

An example of a typical investment financed by private capital is the construction of the Burj Khalifa skyscraper in Dubai, United Arab Emirates. The skyscraper was built over five years (2004–2009). The project implementation costs were planned at approximately USD 876 million, and the final costs are estimated at approximately USD 1.5 billion due to the increase in the price of raw materials as a result of the global crisis in 2008 and the need to introduce significant changes to the project (Abraham, 2019, p. 694). The investor was a private real estate company (Emaar Properties), and the financing was carried out using own funds and bank loans.

An interesting example of a project development model that follows the trend of privatizing capital in large projects is Inmarsat (International Maritime Satellite) – an international non-profit organization created in 1979 by the International Maritime Organization, which is a specialized agency of the United Nations – was founded to establish and operate a satellite communication network for the maritime community. Eventually, Inmarsat was privatized and transformed into a private company that provides telephone and data services to users around the world. Currently, Inmarsat is a private British satellite telecommunications company offering global mobile services (Wolfe, 2022).

Other examples of megaprojects include:

- Construction of the Airbus A380 (USD 12.7 billion);
- Concorde aircraft construction (USD 15.9 billion);
- New safe shutdown of the Chernobyl plant (USD 2.1 billion);
- Deepwater Horizon oil spill (cleanup costs, fees and penalties: USD 65 billion);
- Cleanup after the Fukushima nuclear power plant disaster (USD 187 billion);
- COVID-19 vaccine development (USD 93 billion);
- Manhattan Project – development of a nuclear bomb ($24 billion);
- Deep Underground Neutrino Experiment (DUNE) ($6.5 billion);
- Thirty Meter Telescope (USD 1.5 billion);
- Global Positioning System (GPS) (USD 9 billion);
- Chūō Shinkansen – Japan's maglev railway line between Tokyo and Nagoya (USD 612 billion);
- Bharatmala Pariyojana – India's road ecosystem (USD 110 billion);
- Delhi Mumbai Industrial Corridor (USD 90 billion);
- Trans-European Transport Network (TEN-T) (USD 625 billion);
- Gotthard Base Tunnel (USD 10.3 billion);
- New Administrative Capital – Egypt's planned new capital (USD 250 billion);
- Masjid al-Haram – The Holy Mosque of Mecca (USD 10.6 billion);
- New World Trade Centre (USD 3.4 billion);
- South–North Water Transfer Project – diverting water from the south of China to the north (USD 79 billion);
- Nicaraguan Canal – an alternative to the Panama Canal (approximately USD 100 billion);
- Construction of the English Channel (Eurotunnel, English Channel) (USD 26.5 billion).

The aim of the work is not to analyse historical examples, but it is crucial to identify the existing mechanisms for financing long-term and capital-intensive investments in order to then be able to indicate their common distinguishing features and challenges, which will be used to determine the

features of a model capital-intensive investment. This, in turn, will enable the development of assumptions, general functionalities and mechanisms of the solution that could support the implementation of such investments. The list does not include projects that were not of a design nature, or in which it is difficult to distinguish design phases, such as the Great Wall of China, which was built in sections over several hundred years.

1.2 Organizational aspects

Analysing the examples of capital-intensive, long-term, large-scale investment projects, many specific features can be identified, distinguishing them from smaller projects (with a local range), shorter projects (with implementation within a few months) and ones that do not require large capital expenditures (implementation within the scope of one entity). These features have been grouped into four dimensions:

1 organizational;
2 social;
3 formal and legal;
4 economic and financial.

1.2.1 Specific features of projects – organizational dimension

In the organizational dimension, all the features of the projects that are important from the point of view of the purpose of this monograph (long project duration, capital requirement and geographical scope) result from the very significant expected result of the project. In such a case, the investor intends to create something that is often unique, and even one of a kind. A significant result generates a number of further features: a multi-stage project, multi-dimensional complexity of the project (including the technical, organizational, formal and legal aspects of the project), a large scope of project activities and a multiplicity of stakeholders, including investors. As a result, large investment projects are developed like an independent organization, and often take this form (a special purpose vehicle) for the purpose of project coordination, while also requiring a high level of formalization of project organization and facing resource constraints.

Capital-intensive projects are usually infrastructural in nature and are implemented in several areas, the largest ones (including those mentioned previously) are implemented in the following areas:

• research and development, innovation (knowledge acquisition);
• power engineering;
• transport;
• real estate;
• aviation;

- space industry;
- disaster recovery;
- communication;
- security;
- water and sewage installations;
- IT/ICT;
- environmental protection and resource efficiency;
- social inclusion;
- counteracting climate change;
- industry;
- military.

It is worth noting that the group of investments with a similar specificity also includes, in addition to the largest global projects, projects implemented on a slightly smaller regional or local scale, for example:

- transport projects: investments in the construction and modernization of transport systems, such as motorway networks, railways, airports, seaports and urban transport systems;
- energy projects: investments in the production and distribution of energy, such as the construction of wind, solar, hydro and nuclear power plants and the modernization of energy transmission and distribution systems;
- water and sewage projects: investments in water supply and sewage disposal systems, such as construction and modernization of water supply systems, sewage treatment plants and water distribution systems;
- projects in the real estate sector: investments in the construction and modernization of residential, office, commercial and industrial buildings and stadiums;
- telecommunications projects, such as building telephone, wireless data, Internet and television networks;
- projects in the field of education and health: investments in the construction and modernization of schools, universities and hospitals;
- projects in the field of security, such as the construction and modernization of civil defence, border protection and fire and police systems;
- cultural and tourist projects, such as construction and modernization of tourist attractions, museums and art galleries and the modernization of tourist attractions.

This suggests that solutions developed for the needs of capital-intensive and long-term investments can also be used on a smaller scale.

1.2.2 Implementation stages and phases

Long-term capital-intensive investments include many stages, which are often planned together as part of the project, and the documentation before starting

research and development work is often very complex, detailed, extensive and formalized, as megaprojects cannot be implemented using methods typical for startups. Each project is specific, and some phases within the stages may occur in a different order or overlap in time; however, several repeating stages and phases of the investment process can be identified.

As part of the pre-investment stage, the following phases can be identified: the initial (organizational) phase, the fundraising phase and the design phase.

Initial (organizational) phase – this phase lasts from the moment of the investment idea is formed and the initiation of activities, through its development, the gathering of stakeholders around a common project goal and defining the organizational assumptions of the group, organizational structure and corporate governance, to planning conceptual works; in this phase, cooperation agreements, letters of intent and memorandums are signed, a project development path (road map) is developed, a consortium may be created to coordinate activities and a management team is selected;

Fundraising phase – in this phase, assumptions regarding the organization of the investment financing mechanism are developed, talks are held with suppliers of basic or additional capital, and the first liquidity for current works may be obtained;

Concept phase – in this phase, the investment idea is developed and the initial design of the solution is prepared, and initial market analyses and initial business assumptions, including mechanisms and sources of financing for further activities, are carried out;

Design phase – in this phase, the investment idea is analysed in detail, market analyses are carried out, the final detailed design of the solution and business plan are prepared; design documents are prepared; cost calculation, technical plans and necessary permits and consents are obtained; and, depending on the project, research and development works may also be carried out, if the content of the project documents (functioning of the solution's mechanisms) is to depend on them.

Two phases should be indicated for the investment stage: construction and execution, as well as testing and implementation.

Construction and execution phase – this phase includes the actual implementation of the project; it covers the research work that enables the acquisition of practical knowledge, as well as the methodical solution of problems defined in the concept development and design phase, the results of which will be used in development work – while building the right solution (building of infrastructure, installation of equipment, construction, organization of all mechanisms and logistics).

Testing and implementation phase – after the construction of the solution is completed, tests and quality control are carried out, marketing activities are intensified, the works are accepted, compliance with standards is verified, work is also underway on introducing bug fixes and necessary updates, the formal and legal structure is being prepared (companies are set up to

handle the solution at the operational stage), staff are hired, and training is conducted.

In turn, the post-investment stage should be divided into the operation phase and the maintenance and modernization phase.

Exploitation (operational) phase – the project is put into use, launched at the target location for target customers; before the operation phase, the start-up phase (beta tests) may be carried out – after the tests are completed and the necessary permits are obtained, the infrastructure is transferred for the first market launch; the first feedback is collected and changes are made;

Maintenance and modernization phase – the infrastructure, which is most often the result of large investment projects, requires regular maintenance and modernization to maintain its functionality and usability for customers.

The total duration of the entire investment process in the case of long-term, capital-intensive infrastructure investments may range from several years to a dozen or so years, depending on the nature of the investment, with the pre-investment stage lasting one to three years, and the implementation of a large investment five to 15 years. Projects longer than this basically do not exist. Long-term projects require long-term forecasting of the state of the economy and economic parameters (interest rates), markets (demand for products), cost developments, potential changes in technology and labour availability. A longer forecasting period is associated with greater uncertainty (inability to assess risk) and an increase in the likelihood of black swan events – exceptional, irregular or surprising events, the effects of which are significant, but as unpredictable as their occurrence, which makes it impossible to protect against their occurrence. Paradoxically, it is not uncommon for an *ex post* analysis to indicate that there were indications of a possible occurrence, but they were omitted in the sea of information noise. Examples of such events are:

• the emergence of a completely new technology that undermines the economic sense of preparing the financed solution;
• international economic crises;
• military conflicts;
• natural disasters;
• pandemics;
• structural economic changes (for example, changes in the monetary regime).

1.2.3 Stakeholders

The complexity of the planned result and the significance of the project require the involvement of many parties at every stage of the investment implementation. In the case of megaprojects, several classes of stakeholders can be identified – each with its own interest, expectations, regulations, technical and organizational systems, culture and language:

- investors (core capital providers, owners);
- financial institutions (suppliers of supplementary capital, financial inter-mediation, additional services: leasing, insurance, guarantees, rating);
- organizers:
  - initiators;
  - coordinators (managers);
- operators of the target solution (employees);
- contractors and subcontractors:
  - designers, architects (development of concepts, project documentation);
  - consultants, advisors (taxes, law, PR/marketing agencies);
  - contractors providing services or goods for the target solution, including builders;
- recipients of the solution:
  - customers;
  - end users;
- social environment:
  - local communities;
  - media;
- public institutions:
  - central and local authorities (source of financing, concessions, permits, guarantees, grants, special regulations and interpretations), whereby the state or local government units may act through financial institutions they control;
  - supervisory institutions (monitoring, compliance verification).

Therefore, capital-intensive investments concern a wide range of stakeholders. It is worth noting that in large projects, a group of investors (owners and lenders), target clients, a broad social environment, authorities and media observers interpenetrate, i.e., a given entity (person) can often assume many roles at the same time from the point of view of the project: a target client, an investor, a member of the local community who is the recipient of external effects of the project, and an employee.

1.2.4 Resource constraints

The enormous scale of the project means that similar to monopsonies, projects become a significant recipient of various resources necessary from the point of view of the project, both locally and globally. The implementation of mega-investments requires a significant number of resources:

- natural environment (water, forests, mineral deposits, etc.);
- human resources (availability of required competences, professionals, management staff);
- semi-finished products (total availability and the ability to produce the required number);

- local infrastructure (accommodation for staff, transport networks, water and sewage networks, energy networks necessary to serve employees);
- technology (availability of licenses for specific solutions, availability of devices, existence of solutions to existing technical problems).

In the case of smaller projects, it is not necessary to verify the absolute feasibility of obtaining the required amounts of resources, as they are available in the market. In the case of megaprojects, it becomes necessary to plan, in separate processes, how to ensure their availability, which is sometimes formalized by special agreements.

This also means that, on the one hand, situating a project in spatial proximity to the necessary resources becomes more important than doing so in the vicinity of the target recipients, and at the same time it can cause a serious burden on the environment.

1.2.5　Coordination and management

Management methods in projects with high complexity and a long implementation time will be analogous to those in large international corporations. Specific management methods will usually be adapted to the qualifications and experience of the management staff, the scope of the project and its geographical and cultural location. The key aspect, however, is having a methodical and formalized approach in all processes, which results from the need to establish a common communication platform for plans, the division of responsibilities, tasks and their implementation status in a diverse group of the project team and investors, as well as specialization and clear division of tasks in accordance with competences and experience. Therefore, at the project management level, "agile" approaches, methodologies and tools typical of startups and smaller investment projects (including the popular Scrum, DSDM, Crystal, Kanban and Lean) will not work here, especially those in which the project management has a lot of discretion in making *ad hoc* decisions. The traditional "cascade" approach is closer to megaprojects with many stakeholders, investors and stages; it consists of the systematic implementation of successive, pre-planned steps that lead to the final solution. The planning of the entire project is aimed at helping reduce the risks associated with failure. For this reason, at the initial stage, it is crucial to carry out market research: of existing suppliers and of the demand for the target product, which are often overlooked by smaller projects.

Agile approaches require flexibility, which is limited by formalization, but necessary in large projects. We believe that the relationship is not permanent, and that specific formal, organizational and technological solutions can combine the requirements of large projects and the flexibility of smaller ones, without losing the quality of project coordination. This work, however, is limited to the analysis of the potential to support one of the project processes – financing – in this way. We claim that thanks to the appropriate

technological solution (based on blockchain technology), it is possible to make this process more flexible.

1.3 Social aspects

The distinguishing feature of investment megaprojects is their significant social role – both the need to obtain resources from the environment and its impact on the environment.

Capital-intensive investments are a source of jobs during project development, both directly and indirectly, for a large group of people with various qualifications at every stage of project preparation and implementation, and later also at the operational stage. At the same time, they directly provide public services for the project surrounding (bridges, dams and knowledge) or are a source of positive external effects related to them (connecting regions, accelerating and reducing transport costs, supporting tourism, sports and public health). Due to the need to conduct scientific research, they stimulate the development of science and civilizational progress.

Large infrastructure investments (public works) have been used as a strategic element of economic policy implementation to support global (total) domestic demand in many countries during economic crises. The export potential of services also increases the competitive potential of the region. They are systemically important. Therefore, they are not neutral for markets, industries or regions – their success may trigger a domino effect of benefits. However, their failure can achieve the opposite effect. Nevertheless, due to the effort put into their planning, preparation, the mass of capital invested and a kind of "inertia", they are basically always completed – although this does not always mean economic profitability for investors.

The examples cited previously show that the nature of the goods resulting from the projects, as well as their scope and socio-economic importance mean that in almost every megaproject a very important role is played by local, regional and central authorities or international organizations composed of the authorities of many countries. Originally, it was the authorities who initiated such projects, organized financing or provided their own financing, supervised and often directly coordinated their implementation. Over time, the burden of responsibility has shifted towards private capital; however, still the wide impact on the environment makes the authorities still an important stakeholder of these projects. Therefore, some project decisions may have a political aspect – also after the project has started, and some cannot be implemented without special regulations.

Due to the complexity and diverse structure of dependencies, large investment projects are characterized by a lack of transparency. This also applies to PPP models.[7] At the same time, the economic importance of megaprojects causes them to generate social interest and is, therefore, subject to constant media scrutiny. Media and community attention can generate pressure for certain design decisions or the abandonment of certain ideas. The

incompatibility of the interests of investors (who risk the most and have the greatest impact on the shape of the project) with the interests of the community may give rise to conflicts on a local or even international scale. The political influence of the environment can effectively block the implementation of the project. The community's opinion and will must, therefore, be taken into account, for example, through social consultations or standards of broadly understood corporate social responsibility (standard SA 8000,[8] AA 1000[9]), which cover areas such as:

• activities for the benefit of local communities affected by the effects of the project at every stage;
• applying occupational health and safety rules;
• respecting freedom of association (employees);
• ensuring the fairness of the management system and personnel changes;
• maintaining diversity, non-discrimination and equal opportunity (accessibility for people with disabilities, people of different genders, races, ethnic origins, religions, worldviews or sexual orientations);
• activities that meet the principle of sustainable development (respect for the principles of environmental protection, application of the 6R principles: Rethink, Refuse, Reduce, Reuse, Recycle and Recover).

In the era of the climate crisis, the principles of sustainable development formulated in the UN General Assembly's resolution "Transforming our World: the 2030 Agenda for Sustainable Development"[10] are particularly important. These principles (included in 17 goals) concern not only combating climate change but also other important social issues of a global scale, such as eradicating poverty, eradicating hunger and achieving food security, ensuring education, gender equality, access to water and sanitation, access to energy, promoting sustainable and balanced economic growth, building resilient infrastructure, developing innovation, reducing inequalities in and between countries, conservation and sustainable use of oceans, seas and marine resources, sustainable management of forests, combating desertification and land degradation and halting biodiversity loss. These goals should also be pursued through capital-intensive and long-term investments. Due to the long implementation period and significant capital involved, such investments will naturally and inherently be of importance (smaller or greater, direct or indirect – depending on the details of the investment) for the areas indicated in the Agenda for Sustainable Development.

The literature recognizes the importance of sustainable development principles for Project Finance, especially when such projects are implemented globally, and human rights are also mentioned in this context (Dufey and Grieg-Gran, 2011, p. 12 and next).

Therefore, capital-intensive investments are almost always important socially and terms of media. It is impossible to develop large and capital-intensive public projects "in the garage" or in a closed research and

development department of a private company without disclosing its existence. This does not mean, however, that all the capital of knowledge, know-how and intellectual goods generated during the project must be made fully public. This may be the case in publicly funded projects; however, privately funded projects still have the ability to keep information and data constituting a business secret, but it is necessary to properly manage the published information, taking into account the specificity of the community for which it is intended.

1.4 Legal aspects

1.4.1 Introduction

In the legal and regulatory dimension, the specificity of megaproject implementation lies in the fact that at each stage, it can be embedded in many jurisdictions (even if formally the main management centre is in a clearly defined jurisdiction), and in each jurisdiction it can be subject to many regulations at the same time. This complexity is all the more challenging if local regulations imply different activities that are mutually exclusive. In extreme cases, this may mean forsaking the idea of the product being available to customers from certain jurisdictions. Due to the multiplicity of parties, the formalization of arrangements usually requires a multilateral agreement or a network of agreements between stakeholders (primarily investors). Some mega-investments are part of the long-term plans of central authorities, or are established or regulated by special regulations (acts). It is also worth noting that the financing of large investments is not always directly regulated by law, despite its specificity and significance. In projects with an international scope, it is necessary to take into account at least four groups of legal provisions: (1) the law applicable to the entity conducting the project (for example, the law applicable to the registered office of the company) that applies to this entity and its activities in the territory of that country and extraterritorially; (2) the laws of foreign countries (for example, countries of the registered office of the contractors or investors, or the place of implementation of part or all of the project); (3) international public and private law; and (4) provisions containing conflict of law rules – specifying which courts or arbitral tribunals will apply to the dispute (Hoffman, 2008, p. 20).

Two main groups of regulations should be identified: those defining the organizational and legal framework for undertaking and implementing investments, and regulations concerning investment financing. The first group of regulations includes regulations on starting and running a business in all its organizational and legal forms (companies, cooperatives and even foundations and associations), as well as public law regulations on the implementation of public tasks by the state through appropriate organizational and legal forms (budgetary units, state agencies and state funds). The second group, on the other hand, includes provisions specifying a wide range of

methods of financing this economic activity, both in private law (for example, loans, leasing or the issue of bonds or shares) and public law (for example, regulations on public finances specifying the principles of public spending).

1.4.2 *Project Finance*

As a rule, there is no legislative practice for creating special legal provisions for capital-intensive and long-term investments. However, there are countries that create, in varying degrees of detail, regulations regarding Project Finance. These can be different approaches: the standardization of contracts by the state (The United Kingdom), General Project Finance Legislation (Italy) or a sector-specific Concern in General Project Finance Legislation (Turkey) (Pédamon, 2000, pp. 1278–1286). An approach that involves the creation of laws and other legal acts dedicated to a specific capital-intensive and long-term investment can also be identified (Poland).

As indicated in industry publications from 2023, generally, there is currently no specific legislation governing project finance in the United Kingdom. Laws relating to finance and insolvency are generally applicable. Certain project-finance specific provisions introduce exceptions to the general regulation, for example, about the insolvency of project finance companies (Wood et al., 2023, p. 227).

As mentioned previously, the United Kingdom is an example of standardization of contracts by the state; however, it is a historical example. The United Kingdom Treasury issued Standardization of PFI Contracts[11] and Standardization of PF2 Contracts[12] from 1999 to 2018. Private Finance Initiative (PFI) and Private Finance 2 (PF2) are forms of PPPs. PFI was the UK Government's preferred model of PPP until 2012. In 2012, PFI was replaced with PF2 in response to concerns about value for money. PF2 contracts provide greater transparency about the financial returns of project companies. PF2 was discontinued in 2018; however, existing PFI and PF2 contracts did not end.[13]

Italy is an example of a country with a single law that comprehensively regulates project finance – the Italian New Public Contracts Code of 28 March 2023, which entered into force on 1 April 2023.[14] Many rules of the new code will come into effect as of January 2024 (for example, most of the provisions on digitization of the contract lifecycle). On the effective date (1 July 2023), the provisions of the 2016 code will still apply to "ongoing proceedings". For strategic infrastructure governed by Legislative Decree No. 163/2006, some of the rules of the 2006 code will continue to apply. Title IV of Book IV of new Public Contracts Code is dedicated to project finance. The result is the introduction of some provisions dedicated only to project finance. For example, it is now mandatory to establish Special Purpose Vehicle (SPVs) – (but it is still optional outside project finance) – see Romitelli et al. (2023).

In accordance with Article 194 (1) of the Italian New Public Contracts Code for awards above the threshold referred to in Article 14, paragraph

1, letter (a), the tender notice for the awarding of a concession in the form of project finance requires that the successful tenderer constitutes a special purpose company in the form of a joint-stock company or limited liability company, including a consortium. The tender notice indicates the minimum amount of the company's share capital. In the case of a competitor consisting of more than one entity, the quota of participation in the share capital of each entity is indicated in the offer, under penalty of exclusion. The special purpose company, without this constituting a transfer of contract, takes over the concession relationship without the need for administrative approval or authorization. It replaces the successful tenderer in all relations with the granting body. In the case of payment of a price during construction by the granting body, the company members remain jointly and severally liable with the special purpose company towards the administration for any reimbursement of the contribution received. Alternatively, the special purpose company can provide the public administration with bank and insurance guarantees for the repayment of the sums paid as the price during construction, thus freeing the members (Article 194 (3) of the Italian New Public Contracts Code).

Title IV consists of three very extensive articles: 193 (*Procedura di affidamento* – assignment procedure), 194 (*Società di scopo* – purpose-built company) and 195 (Obbligazioni delle società di scopo – special purpose company obligations). From the perspective of the topic of this work, Article 195 is the most interesting. It determines the method of financing a project run by SPV. In accordance with this article, SPV may issue bonds and debt securities (although with certain restrictions). The bonds and debt securities referred to in the first period of investment can be dematerialized and cannot be transferred to parties that are not institutional investors or professional clients. In addition, the issuing of bonds is permitted exclusively to finance or refinance debt previously contracted for the construction of the infrastructure or works connected to the public utility service, and the offer documentation must clearly and evidently contain a warning regarding the degree of risk associated with the operation. It is also important that the bonds and debt securities, until the start of management of the infrastructure by the concessionaire or until the maturity of the bonds and securities themselves, can be guaranteed in accordance with methods regulated by decree of the Italian Minister of Economy and Finance, in agreement with the Minister of Infrastructure and Transport.

Turkey is an example of a country with neither a single PPP model nor a single framework law that would apply to all PPP projects implemented in specific industrial sectors. Several different PPP models are regulated in different acts for different industry sectors. These include PPP models such as Build-Operate-Transfer (BOT), Transfer of Operation Rights (TOR), Build-Operate (BO) and Build Lease-Transfer (BLT). In recent years, attempts have been made to prepare one comprehensive PPP act. The corresponding draft of such a law was first prepared in 2007 and submitted to Parliament. However,

this law was not adopted. Such a draft was again submitted in 2020, and again, it was unsuccessful (Bürosu, 2023, pp. 9–10).

The most popular PPP model in Turkey is the BOT model, which was introduced by Law No. 3096 on the Authorization of Enterprises other than Electricity Authority of the Republic of Türkiye for Electricity Generation, Transmission, Distribution and Trading. This model is also used in Law No. 3465 on the Authorization of Enterprises other than the General Directorate of Highways for Construction, Management and Operation of Access Controlled Highways. In addition, Law No. 3996 Certain Investments and Services with the Build Operate-Transfer Model was enacted in 1994 and has been used for several BOT projects. This act applies to sectors such as energy, transportation, communication, tourism investments and municipal services. In turn, the less popular TOR model is defined in Law No. 4046 on privatization procedures. Under this model, it is possible to transfer the right to operate (i) the entirety of the existing project company or (ii) only the production units of the existing company, in each case subject to certain conditions and for a specified period. However, the assets of the relevant project company are not transferred under the TOR model. The BO model is regulated under Law No. 4283 on Regulation of Establishment and Operation of Electrical Energy Generating Facilities and Regulation of Energy Sales under the Build-Operate Model, which applies to the construction and operation of power plants only. An entrepreneur builds and operates a power plant, and then sells the electricity produced to a state entity at a guaranteed price, under the BO model. This model differs from the BOT model in that the entrepreneur is the owner of the power plant and does not undertake to transfer it to a public entity after the end of the contract. The scope of the BO model is limited only to power plant projects, so it has been implemented in Turkey in a small amount. The healthcare sector in Turkey also has separate PPP regulations. Law No. 6428 on the Construction of Facility, Renewal and Service Provided by the Ministry of Health ("the MoH") with PPP model, and amendments in some laws and decrees introduce the BLT model. This act allows investors to construct and provide services, other than medical services, in healthcare projects with the BLT model. The BLT model regulated in Act No. 6428 is characterized by the fact that the investor builds the healthcare facilities and provides certain general support and medical support services on the hospital campus; however, the medical services are provided to the public by doctors and nurses of the MoH. The important thing is that at the end of the contract term, the investor must transfer the hospital facilities to the MoH (Bürosu, 2023, pp. 9–10).

Another example of a capital-intensive and long-term investment is the construction of the Central Communication Port in central Poland, which is to include the creation of a new airport that is to be a transfer hub in Central and Eastern Europe, and an extensive communication network, including a railway network. The main subject of the investment is the construction of a public use airport together with facilities, devices, equipment, networks and

installations used for its construction, in particular public roads and transmission networks.

In this case, the Polish legislator decided to introduce special legal regulations relating only to this investment. In Poland, there are no statutory provisions that fully determine the principles of implementation and financing of this type of investment.

The Polish Act on the Central Communication Port[15] came into force on 21 June 2018. The provisions of this act specify, inter alia, the principles and mode of management of the preparation and implementation of the Central Communication Port and related investments. Pursuant to the provisions of this act and in order to implement the investment, the State Treasury established a special purpose vehicle under the name "Centralny Port Komunikacyjny sp. z o.o". This company may be transformed into a joint-stock company in the future. The company's original share capital was PLN 10 million and was covered by a special-purpose subsidy from the state budget. Currently, the company's share capital exceeds PLN 11 billion, and the vast majority of this was covered by the State Treasury in the form of a contribution in kind. The entire capital group consists of over 20 commercial law companies operating mainly in the aviation industry.

From a legal and financial point of view, the investment is to be financed, inter alia, based on a multi-year programme specifying investment implementation deadlines and total expenditure from the state budget. The Government Plenipotentiary for the Central Communication Port is responsible for the preparation and supervision of this programme.

The investment may also be financed by the State Treasury transferring Treasury securities to increase the share capital. The Polish Minister of Finance may transfer Treasury securities to the special purpose vehicle on the dates and in the amounts specified in the multiannual programme to increase the company's share capital. The funds obtained by the company from the sale of contributed Treasury securities may be used to finance the implementation of its tasks. The conditions for the issuance of Treasury securities and the manner of realizing the resulting benefits are specified in "the letter of issue" issued by the Minister of Finance. This means that the implementation of this long-term investment may be based on the possibility of the state incurring debt.

The provisions of this act allow investments to be made by investors other than the company. Pursuant to Article 2 point 2 of the Polish Act on the Central Communication Port, these may be companies established by a special purpose vehicle, public finance sector units or other state-owned organizational units and entities dependent on these units. If there are investors other than the established company, the investment is managed by the investors in accordance with the management principles approved by the Government Plenipotentiary for the Central Communication Port. The issued rules state, inter alia, that the Central Communication Port Programme was established to ensure the effective and timely achievement of the objectives of this act on

the CPK and the Multiannual Programme based on the best global practices of projects of a similar scale. This programme is a tool for the strategic management, coordination and supervision of the management and implementation of groups of interrelated projects and activities aimed at achieving specific goals, benefits and results. The Management Principles constitute a set of regulations ensuring the coherence of the management activities of the Central Communication Port Programme. These are unified conditions, procedures and instructions for implementing the entire investment. The Management Principles define the principles of investment management, including the principles and mode of supervision of its implementation by investors, and the principles of cooperation and exchange of information between investors.[16]

The Polish Act on the Central Communication Port does not prohibit the sale of shares by the State Treasury to private entities. The possibility of a private investor joining the company and taking up new shares issued by the company has also not been excluded. With this in mind, it can be stated that the Polish special legal regulation regarding the construction of the Central Communication Port does not indicate a single source of its financing. It also does not stipulate that this investment will be financed only from public funds. Private capital participation is allowed. However, this act does not specify the rules for the participation of private capital. In October 2023, the company selected a consortium as a private strategic investor: Vinci Airports and IFM Global Infrastructure Fund (IFM).[17]

The creation of regulations in the field of Project Finance is to be facilitated by the Legislative Guide on Privately Finance Infrastructure Projects prepared by UNCITRAL in 2001.[18] The literature emphasizes that the recommendations formulated in this Legislative Guide are general and imprecise. Their usefulness is seen primarily in the fact that they should be reviewed for each Finance Project, and if any of these recommendations are not followed in the country where the project is to be implemented, stakeholders should consider whether the project is at risk (Hoffman, 2008, p. 21).

Undoubtedly, what distinguishes capital-intensive and long-term investments is the risk resulting from the involvement of large capital and extensive deadlines for investment implementation, which is greater than other investments. And these two issues should be particularly taken into account when drafting contracts and regulations, as well as when using performance bonds. For example, it is necessary to introduce into the contract (regulations) clauses securing the interests of the parties in the event of price changes, in particular inflation and interest rates. Agreements and regulations should also take into account natural changes in the composition of bodies of legal persons over time.

As a standard in the project contract (project agreement) concerning Project Finance, the issues related to the following are regulated (Yescombe, 2014, p. 129):

- Contract Term;
- Payment Mechanism;
- Contract monitoring by the Offtaker/Contracting Authority;
- Performance bonding and other guarantees;
- Compensation Events;
- Excusing Causes;
- Relief Events;
- Step-In by the Offtaker/Contracting Authority;
- Termination;
- Change of ownership;
- Dispute resolution.

If the contract period is relatively short, the investor's contribution must be repaid quickly. This may mean an increase in the cost of the product or service provided to a level that is unacceptable on the market. The reverse can also be observed. This means that extending the project implementation period may reduce the cost of the product or service (Yescombe, 2014, p. 130).

The debt period results from how long investors want to invest or borrow their funds. There may be difficulties in obtaining long-term loans in the market. Moreover, the period in which investors achieve the rate of return is also important. In the case of long-term investments, the flexibility of the investment should also be taken into account. For example, the investment may be influenced by future technological changes, which are difficult to predict at the stage of concluding the contract. In some cases, the duration of the contract may be determined by tax law provisions (Yescombe, 2014, pp. 130–132).

With regard to the payment mechanism, Yescombe points out that, in principle, investors are not entitled to any payments until the project is completed. There may be exceptions to this, namely, if the investment has specific stages, payments may be made upon completion of a given stage. Contract payments should be of a similar amount throughout the entire investment period. However, this amount may change due to objective reasons. Payments may be influenced by inflation (which has been observed in Europe in recent years due to the COVID-19 pandemic and the armed conflict in Ukraine), and the exchange rate of a specific currency (Yescombe, 2014, pp. 132–133). In this type of investment, there is a high probability of disputes. It is indicated that, in the first instance, such disputes should be resolved by arbitration conducted by an expert or a recognized court/arbitration tribunal (Yescombe, 2014, p. 161).

It is necessary to monitor the planned changes in the law on an ongoing basis so that appropriate, necessary changes in internal regulations can be made sufficiently in advance. In general, frequent changes in the law generate significant legal risk, which must be taken into account when creating a

legal framework for capital-intensive and long-term investments. Public law regulations, including tax law, are of particular importance here.

1.4.3 Capital companies

There are organizational and legal forms that in their legal essence have a "hidden" ability to function for long periods and carry out long-term and capital-intensive investments – in the sphere of civil law, these are capital companies, primarily joint-stock companies, and in the sphere of public law, they are state agencies.

The provisions on joint-stock companies create a legal framework for long-term investments, the purpose of which is to participate in the prosperity of an enterprise, which can take years. This legal framework protects the interests of shareholder investors, making investment safer (Charkham and Simpson, 1999, p. 44). Currently, this natural feature of the long-term operation of capital companies is also perceived in the context of sustainable development. Among other things, it is postulated to introduce a legal framework that aimed at inducing corporations and other economic actors to abandon the approach focused on quick profits in the short term in favour of thinking and acting in the long term, and in the case of striving to limit climate change, this can be a period of time counted in decades, even more than 50 years (Sjåfjell and Richardson, 2015, p. 323).

Shareholders entrust funds to a company that has legal personality in exchange for shares and, on the one hand, have an unlimited share in the company's profits, and on the other, limit their loss to the purchase price of the shares. Moreover, they are not legally responsible for the actions of the company. In addition, the shares are easily transferable, and thus there is the possibility of an easy exit from the investment at any time. These features are important in the case of long-term and capital-intensive investments, which by their nature carry a greater risk than short-term investments, and require less capital. The usefulness of a joint-stock company is evidenced by the practice (see Section 1.1).

At this point, mention can be made of the European company, the legal structure of which has been regulated in Council Regulation 2157/2001 of 8 October 2001 on the Statute for a European Company (SE).[19] A European company has legal personality. This company may be established within the territory of the European Union in the form of a European joint-stock company. The SE's registered office must be located within the Community, in the same Member State as its head office. Pursuant to Regulation 2157/2001, a European company also operates, among others on the basis of the laws adopted by the Member States to implement special Community measures specific to that company and the laws that would apply to public limited liability companies formed in accordance with the law of the Member State in which it has its registered office. Pursuant to point 7 of the recitals to Regulation 2157/2001, its provisions will permit the creation and management of

companies with a European dimension, free from the obstacles arising from the disparity and the limited territorial application of national company law.

1.4.5 European long-term investment funds

There are also no provisions specifically dedicated to financing long-term and capital-intensive investments, although legal regulations in the field of financial market law regulate various methods of financing investments in detail, for example, the law regulating the issue of shares or bonds, or regulations on granting loans and credits, which often by their very nature also take into account long financing periods (for example, mortgage loans). The exception is the law of the European Union, which has a legal regulation in the field of capital market law that directly concerns long-term financing, i.e., it refers to the long-term investment of significant capital. This is Regulation (EU) 2015/760 on European long-term investment funds.[20]

This regulation sets out rules for the creation and functioning of European long-term investment funds (ELTIFs), which are to provide finance of lasting duration to various infrastructure projects, unlisted companies or listed small and medium-sized enterprises (SMEs) that issue equity or debt instruments for which there is no readily identifiable buyer. Regulation (EU) 2015/760 is closely related to the provisions of Directive 2011/61/EU of the European Parliament and of the Council on Alternative Investment Fund Managers[21] – ELTIFs are EU AIFs that are managed by alternative investment fund managers (AIFMs) authorized in accordance with Directive 2011/61/EU. The objective scope of the Regulation is defined in Article 1(1), in which the Regulation lays down uniform rules on the authorization, investment policies and operating conditions of EU alternative investment funds (EU AIFs) or compartments of EU AIFs that are marketed in the Union as ELTIFs. In turn, Article 1(3) introduces a clear caveat that Member States shall not add any further requirements in the field covered by this Regulation.

Regulation (EU) 2015/760 imposes strict limits on the investment activities of ELTIFs to ensure that ELTIFs are genuinely oriented towards long-term investments and to ensure that they contribute to the financing of the sustainable growth of the EU economy. Therefore, an ELTIF should invest at least 70% of its capital in eligible investment assets (such as, for example, equity or quasi-equity instruments, debt instruments in qualifying portfolio undertakings, and loans provided to them. For more, see recital 17 of the Regulation). Moreover, according to recital 18 of the Regulation, eligible investment assets should include real assets with a value of more than EUR 10,000,000 that generate economic and social benefits. Such assets include infrastructure, intellectual property, vessels, equipment, machinery, aircraft or rolling stock and immovable property. Investments in commercial property or housing should be permitted to the extent that they serve the purpose of contributing to smart, sustainable and inclusive growth or to the

Union's energy, regional and cohesion policies. Therefore, ELTIFs finance investments that require very large capital, including capital-intensive ones.

From a legal perspective, it is interesting that the EU legislator spoke in the recitals of Regulation (EU) 2015/760 about the definition of the concept of long-term investment, stating that this definition is "broad". Therefore, no specific time period has been defined, for example, the number of years of the investment. However, in point 15 of the recitals, the EU legislator defines the following features of long-term investments, other than time:

1 eligible investment assets are generally illiquid;
2 eligible investment assets require commitments for a certain period of time;
3 eligible investment assets have an economic profile of a long-term nature.

In this way, the EU legislator sufficiently outlines the concept of long-term investment, and what is most important for the topic of this monograph, it gives a specific starting point for formal and legal considerations relating to long-term investments.

It should be emphasized here that under Article 1(2) of Regulation (EU) 2015/760, which defines the purpose of the Regulation as "to raise and channel capital towards European long-term investments in the real economy, in line with the Union objective of smart, sustainable and inclusive growth", ELTIFs should only finance long-term investments that are investments in the "real economy". The concept of the real economy is not defined by the EU legislator in the Regulation or explained in the recitals. Considering the content of recital 18 of the Regulation, which explicitly states that the Regulation is not seeking to promote speculative investments, it should be assumed that the reference to the real economy is to additionally emphasize the requirement that long-term investments made by ELTIFs should not be of a speculative nature.

In the light of the topic of this monograph, it is also interesting how the EU legislator understands the concept of infrastructure projects for the purposes of Regulation (EU) 2015/760. Recital 19 states that the scale of infrastructure projects means that they require large amounts of capital to remain invested for long periods of time. In this way, the EU legislator clearly classifies infrastructure projects as long-term and capital-intensive investments. The recitals also give examples of such infrastructure projects:

• public building infrastructure such as schools, hospitals or prisons;
• social infrastructure such as social housing, transport infrastructure such as roads, mass transit systems or airports;
• energy infrastructure such as energy grids, climate adaptation and mitigation projects, power plants or pipelines;
• water management infrastructure such as water supply systems, sewage or irrigation systems;
• communication infrastructure such as networks, and waste management infrastructure such as recycling or collection systems.

1.4.6 Public antitrust law

Public antitrust laws are also important. The implementation of a long-term and capital-intensive investment, and above all its effect, may have an impact on the global economy, or at least on the economy of the country where the investment will be implemented. There is a risk that such a large investment may distort competition in a given market of goods or services. Relations between investors and the investment project itself may also be important. In terms of competition rules, trade between investors and the company may be relevant. First and foremost, allowing investors who are separate entrepreneurs to preferentially use the effects of the investment may have specific effects under competition law.

Highly developed countries have quite restrictive legal solutions in the field of antitrust law. First of all, EU countries are bound by the provisions of treaties and the secondary law of the EU as an international organization in the field of competition protection and the internal market. The United States also has extensive antitrust legislation.

Under EU law, protection of competition is implemented on two levels, i.e., by primary and secondary law. According to Article 101 of the Treaty on the Functioning of the European Union,[22] all agreements between undertakings, all decisions by associations of undertakings and all concerted practices, which may affect trade between Member States and which have as their object or effect is to prevent, restrict or distort competition within the internal market shall be prohibited as incompatible with the internal market. The basic act of secondary law detailing the provisions of the Treaty is Council Regulation (EC) No 1/2003 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty,[23] which introduces, for example, a catalog of powers of state competition protection authorities, as well as the competences of the European Commission, including a catalog of penalties applied by the EU Commission.

Importantly, however, the Treaty allows certain prohibited activities if they contribute to improving the production or distribution of products or promoting technical or economic progress, while reserving a fair share of the resulting profit for users. Assuming that in addition to making a profit by investors, the implementation of a capital-intensive investment will also have the previously mentioned objectives, it is possible to apply to the investment and its investors restrictions less than those directly resulting from Article 101(1) of the Treaty.

The implementation of such a large investment may lead to it and its investors obtaining a dominant position on the market on which they operate. The provision of Article 102 of the Treaty on the Functioning of the European Union indicates that any abuse by one or more undertakings of a dominant position within the internal market or in a substantial part of it shall be prohibited as incompatible with the internal market in so far as it may affect trade between Member States.

It is important to note that the Treaty does not prohibit a company from holding a dominant position. It is only that an entity holding a dominant position on a given market may not abuse it. In addition, a specific action by an entity not holding a dominant position may be considered permitted under EU competition law. If a given entity achieves a dominant position, the same behaviour may constitute an abuse of that position. The dominant position is associated with special responsibility and a number of related restrictions to prevent the distortion of competition.[24]

The Court of Justice of the EU understands a dominant position as a position of economic power that makes it possible to hinder effective competition on the relevant market. A company can abuse its position because its situation allows it to act largely independently of competitors, contractors and ultimately consumers.[25]

The European Union considers the abuse of a dominant position to be primarily: directly or indirectly imposing unfair purchase or sale prices or other unfair transaction conditions, limiting production, markets or technical development to the prejudice of consumers, applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage, making the conclusion of contracts subject to acceptance by the partners of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts (Article 102(2) of the Treaty).

According to the Tribunal, the abuse of a dominant position requires three conditions to be met. First, the undertaking concerned must have a dominant position within the internal market or in a substantial part of it. Secondly, the dominant position must be abused. This occurs where the undertaking in a dominant position makes it more difficult for competitors, which are as efficient to enter or remain in the market in question by using means other than those which come within the scope of competition on the merits. Thirdly, the abuse of a dominant position must affect trade between Member States. This condition can be satisfied only if it is possible to foresee with a sufficient degree of probability, on the basis of a set of objective legal and factual elements, that the behaviour of the undertaking in a dominant position may have an influence, direct or indirect, actual or potential, on trade between Member States in such a way as might hinder the attainment of a single market between Member States. Purely hypothetical effects that the conduct of that undertaking may have do not satisfy that criterion.[26]

The Tribunal also ruled that Article 102 TFEU must be interpreted as meaning that a practice, which is lawful outside the context of competition law may, when implemented by an undertaking in a dominant position, be characterized as "abusive" for the purposes of that provision if it is capable of producing an exclusionary effect and if it is based on the use of means other than those which come within the scope of competition on the merits. Where those two conditions are fulfilled, the undertaking in a dominant position concerned can nevertheless escape the prohibition laid down in Article 102

TFEU if it shows that the practice at issue was either objectively justified and proportionate to that justification, or counterbalanced or even outweighed by advantages in terms of efficiency that also benefit consumers.[27]

The Treaty also prohibits Member States from applying to public undertakings any of the measures described previously that might infringe competition rules. Moreover, pursuant to Article 106 of the Treaty, undertakings entrusted with the operation of services of general economic interest or having the character of a revenue-producing monopoly shall be subject to the rules contained in the Treaties, in particular to the rules on competition, in so far as the application of such rules does not obstruct the performance, in law or in fact, of the particular tasks entrusted to them.

The above is important for considering the possibility of financing a long-term investment with the use of public enterprises or public funds. Any intervention by the state or public entities may result in an interference with the competition rules that is incompatible with the Treaty. Moreover, on the basis of EU competition law, an enterprise should be understood as any entity conducting economic activity, irrespective of its legal form and method of financing.[28]

In the context of a long-term investment financed from funds not provided by the state, the Treaty's ban on abusing a dominant position by applying dissimilar conditions to trade partners for equivalent services, and thus creating unfavourable conditions for competition may be of significant importance. If investors conducting business activity are entitled to any other benefits in addition to the payment of profit (for example, in the form of dividends), it may turn out that the company conducting the investment abuses its dominant position on the relevant market by favouring a specific category of contractors, whose only common feature is that they have made a prior investment of their funds.

EU competition law is not limited to the internal market and relations between companies operating within the Union. The European Commission works with third countries to prevent unfair competition. The Union concludes bilateral competition protection agreements, or competition protection law forms part of other agreements, such as free trade agreements or association agreements.[29]

To sum up, a long-term investment, due to its scope and economic importance, may significantly affect the functioning of the relevant market. It is very likely that the company conducting the investment will achieve a dominant position. Subsequently, each of its actions will have to be assessed in the context of abuse of its position, which may not lead to the detriment of contractors, customers or consumers.

Therefore, it is important to shape the relationship between investors and the company conducting the investment in such a way that, after achieving a dominant position, it is legally allowed for investors to derive profits (or more broadly – benefits) from the investment, not only in the form of dividends, and at the same time there is no distortion of competition on a given market.

The US antitrust law makes any agreement that restricts trade as well as any attempt to monopolize the market illegal. The literature on the subject also points to the similarities between the US competition law and Articles 101 and 102 of the Treaty on the Functioning of the European Union. Attention is also drawn to the institutionalized cooperation between the United States and the European Commission in respect of competition protection rules (Thomsen, Hoxie and Wright, 2016, pp. 534 and 545).

The scope of application of competition law and antitrust law depends on many factors. These include, first of all, the place of implementation and investment, as well as the seat of the entity whose legal personality the DAO is based on. These factors resulting from territorial aspects will have a significant impact on the obligation to apply specific competition protection legislation.

1.5 Economic and financial aspects

1.5.1 Specific features – economic dimension

In the economic dimension, the key feature is the scope of necessary financing – the total amount of capital needed to complete the investment and the related liquidity (large capital in a relatively short time). This requires a detailed determination of the scope of the project, necessary works, estimation of labour intensity and its costs, as well as material costs, taking into account trends in cost changes over time and economic conditions affecting future costs. In addition to the costs of investment implementation and operating costs specific to each project, the financing of the investment must also cover the following groups of costs common to most projects:

- real estate costs;
- depreciation costs of fixed assets and intangible assets;
- costs of a team of administrators and managers coordinating and monitoring work on the project;
- costs of key personnel – experts from individual areas who coordinate research and development work within these areas of knowledge;
- costs related to negotiations and the preparation of agreements between investment stakeholders;
- costs of preparing the project assumptions (the potential involvement of additional consultants);
- market research costs;
- forecasting costs;
- costs of PR, communication with the environment, including social consultations;
- international costs (translations, travels);
- costs of financing organization – specific for various mechanisms;
- costs related to the development and preparation of project documentation;
- administrative, accounting and legal costs related to the financing process.

Only after developing such a plan and budget can the scope of necessary financing be determined, a schedule of funds inflows be outlined, a financing mechanism selected, and investment talks with investors commence.

The long implementation time and the wide scope of the project generate many risks for the success of the investment (related to the creation of the product and the achievement of the expected returns). The lack of project transparency means that the information required by investors to assess these risk structures and the infrastructure market in general is either missing or widely dispersed, creating uncertainty. The absence of a clear reference point for measuring investment performance is also perceived by many investors as one of the main barriers to such investments, which increases the risks for investors and reduces the efficiency of project financing. In a long-term investment perspective, as mentioned previously, many factors affecting costs and revenues, as well as fundamental conditions (administrative decisions, regulations) may change, and events that are unlikely on a smaller scale, according to the law of large numbers, on a large scale must be considered as expected events. Classes of risks that should be taken into account when planning a project include:

- legal risks – interdependencies or contradictions of contracts, absence of regulation of new phenomena;
- financial risks – lack of profitability in the assumed horizon, withdrawal or insolvency of investors (loss of subsequent financing tranches), credit risks, exchange rate risks, interest rate risks, limited availability of skilled labour;
- (geo)political risks – design decisions made conditional on the political goals of the authorities;
- technological risks – emerging new technical challenges;
- general economic risks – economic crises, supply shocks, interventions of central authorities in the market;
- management, coordination and operational risk, conflict of interest risk;
- market risks – changes in consumer preferences; the emergence or intensification of competition;
- social and environmental risks.

The likelihood of the occurrence of some of them can be estimated; therefore, the risk can be determined and hedging against these risks can be planned. However, with the increase in the time perspective of the project, the high uncertainty of the project implementation also increases, caused either by the lack of sufficient data to estimate risks that are known but distant in time, or the probability of the occurrence of events referred to as "black swan", which cannot be estimated. This makes it impossible to protect oneself against their occurrence and effects, and at the same time strictly limits the time perspective of even the largest investment projects.

Due to the long-term perspective of the entire project, it is also more difficult to forecast its profitability – significant changes over time may affect both costs and revenues, alternative possibilities of investing capital, and discount rates. The scope and complexity of the project, the multitude of risks and the uncertainty mean that investors expect a high return on investment, and lenders may require a higher margin and additional collateral. The cost of raising capital is high in the case of mega-investments. Despite the considerable costs, investors are attracted by the fact that after reaching the operational stage, they can bring relatively high, stable income in the long term. At the same time, large investments require the accumulation of significant capital (liquidity) at one point in time, and the capital then being transferred to the investment.

The scale of the projects makes them unique either globally or in a specific geographical or functional range, which means that they basically constitute a natural monopoly. A monopoly, however, is private and uncontrolled by nature, and seeks profit (especially when marginal costs of production decrease with increasing production), which it achieves at higher prices and lower sales than a comparable good in a competitive market, then taking over the excess benefits of consumers. At the same time, the employment levels of a monopoly are usually *lower* than those of companies on the competitive market.

High expectations are also associated with social benefits (externalities). As the effects of the project flow far beyond the group of investors and the close environment of the project, they affect a wide – often international – community and natural environment. Therefore, high long-term external benefits are also expected, such as improvement of the quality of life, increase in efficiency, sustainable development, acquisition of new, widely available knowledge and support for local communities or specific ideas.

The default assumption for any new business is that it will continue as a going concern in the long term. It is not so with individual product lines. In the case of some (for example, computer games and computer equipment), the expected life cycle of the product is known, which after a period of growth faces a period of decline in interest, potential withdrawal of the product from the market, or being replaced with a new model. The life cycle of a megaproject resulting product is theoretically infinite. It does not cover the withdrawal of the product in the foreseeable future, but it does cover its expansion and modernization in the longer term. This is due to the fact that the benefits for investors are distant in time (even several years after the completion of the project and the launch of the product/service), and the moment of reaching the break-even point (BEP) may be further away during the implementation of the investment. Investors will, therefore, assume a long (unlimited) time horizon. Nevertheless, investors who take the risk can often count on high rates of return.

1.5.2 Investment financing mechanisms

The basic methods of financing investments can be attributed to different stages of the development of a business project.

[1] Pre-investment stage:

- financing from the investor's own funds (or the FFF principle: friends, family, fools) – at this stage, the investor usually bears the costs related to market research and project assumptions, feasibility analysis, preparation of the first technical documents and obtaining authorizations;
- financing from public funds – at this stage, one can apply for subsidies or grants from various public sources (for example, structural funds of the European Union) – costs related to detailing the concept, conducting in-depth research and development works; however, if the investment is initiated by a public entity (for example, a government agency), the financing may be carried out from the state budget;
- external financing from private funds – at this stage, one can apply for financial support from private investors (business angels), venture capital (VC) funds or high-risk funds, or use modern crowdfunding financing schemes to refine the project concept, develop prototypes and develop an MVP (Minimum Viable Product).

[2] Investment stage:

- financing from the investor's own resources – at this stage, the investor usually covers most of the investment costs;
- bank financing – the investor can take out a loan for investment purposes;
- financing from the issue of securities;
- financing from the state budget – in full (for example, by financing fully from the state budget of state agencies) or in part (for example, by granting a subsidy from the state budget to the entity implementing the investment).

[3] Operation stage – financing modernization and expansion:

- income generated from the conducted activity – the investor obtains income from operating in the area of the completed project, which allows them to achieve a return on investment and further development of the project;
- income from dividends and interest.

In practice, investment financing may take the form of programmes covering various forms at various stages of project development, and at each stage, the project may be supported by bank guarantees or mechanisms confirming creditworthiness or own liquidity.

Two groups of projects can be identified among capital-intensive long-term investments:

1 projects that are aimed at bringing economic benefits – after the investment is completed, revenues and returns for investors appear, and their result is solutions that provide private goods (Burj Khalifa) or "club" goods (highways), are financed largely by private capital;
2 projects that are aimed at providing non-economic benefits – they do not generate revenue as a rule, and their result is public goods (projects regarding the protection of the planet: a sky monitoring system, but also knowledge resulting from, for example, the use of the LHC or ISS), are financed in principle entirely by public capital.

Projects intended to provide public services, including knowledge and cultural values, rather than private goods sold on the market that generate revenue and achieve a return on investment for investors, were mostly publicly funded. Governments have been a major actor in this field given the inherent nature of public good infrastructure and the positive externalities often generated by such facilities. However, public deficits, increased public debt-to-GDP ratios, and sometimes the inability of the public sector to ensure effective investment spending have led to a reduction in the level of public spending on infrastructure in many economies. As a result, it needs to be highlighted that alternative sources of financing are required to support the development of large investment projects (especially infrastructural ones), emphasizing the potential participation of institutional investors due to the long-term nature of the liabilities of many types of institutional investors and the corresponding demand for appropriate long-term assets.[30]

There is also a large group of relatively large investment projects, especially infrastructural ones, such as motorways, water infrastructure and sewage systems, that provide universal services but generate income, thanks to which they are of interest to both private and public investors. Such projects often benefit from hybrid financing – PPPs.

Some authors point out that while private financing is a driving force for progress and innovation, it is not able to fully meet the financing needs of capital-intensive investments. It is not capable of replacing public funding, especially in poor regions or in the case of public goods with low (or no) profitability, where households lack the means to pay for services and equipment, but cannot be excluded from the consumption of these goods (Severino, 2020, pp. 84–87).

Participation in currently known investments required a very high investment entry threshold to avoid excessive fragmentation of financing sources, especially capital financing. The financing of mega-investments is not usually targeted at small or medium-sized investors or individual investors due to, inter alia, the costs of servicing a large number of small investors. At the same time, smaller investors are not interested in investments that require freezing

a large amount of capital for a long period of time, which means that they do not use the so-called long tail of investors (Kendall and Tsui, 2011). There are exceptions to this rule, which were discussed in Section 1.1.

There are a number of instruments that are traditionally used in the process of financing investments of different characteristics – those that bring investors a fixed income; a variable income (variable interest rate), dependent on revenues or profits, or not bringing income; instruments that are proprietary, debt or hybrid (mezzanine). These instruments enable risk sharing between investors, debt capital providers, the guarantor and financial intermediaries[31] (see too: Zhang et al., 2021, p. 4).

1.5.3 Financing mega-investments

The specificity of capital-intensive investments means that they also require a special approach to the organization of financing.

A specific feature of capital-intensive investments is that although they are usually "greenfield" investments involving the creation of solutions from scratch, the general expectation of investors is the final preparation of a complete and ready, implemented product that can start functioning at the end of the development phase and transition to the operational phase until the BEP and minimum return on investment are reached. Therefore, the financial perspective covers all stages of implementation – from the development of concepts and projects, through the period of investment implementation and the production of models and prototypes and the implementation and launch of the finished project result, to the period of operation. Moreover, capital providers are reluctant to take responsibility for the risk of investment implementation, which means that as a condition of financing, they require a performance guarantee, put penalties in the contracts or impose limits on incurring liabilities.

Due to the liquidity necessary for implementation and the need to disperse risks, it is often necessary to raise capital from many sources of financing (that are often geographically dispersed) from many investors (equity) or using various financial instruments and strategies (usually external financing). The most often used are issues of bonds or shares on the capital market, or investment loans granted by international banks or financial institutions. In some cases, capital-intensive long-term investments may be funded by governments or public bodies as part of infrastructure development programmes or other public initiatives. Investment projects themselves are very complex, so it is rare to find projects that use a large number of different financial instruments or very complex instruments for financing. Investment assets are often illiquid – even in the form of stocks. This increases some risks for investors (interest rate risk), forces the continuation of the investment even when the risk of its failure increases, and puts the project risk on the investor (because the investor has limited possibilities to exit the investment before its completion).

1.5.4 Organization of financing mega-investments

In the financing of megaprojects, the right financial and organizational model is crucial. It includes:

- identification of stakeholders and their roles: who is the investor, who is the sponsor, who supervises the project, who manages the project, who provides the capital, who is to be the owner of the product or who has the right of pre-emption, etc.;
- formal and legal structure of the project: special purpose vehicle (SPV/SPE, SPAC), consortium or implementation within one entity (Akbiyikli et al., 2011, pp. 209–210; Wolfe, 2022);
- level of independence, management sovereignty;
- source of capital: sponsor's own funds, share capital of private investors, debt capital from the issue of bonds, shares of investment funds or public funds;
- type of financial instruments: traditional stocks, bonds, shares with a special structure (for example, flow-through shares) to obtain sufficient financing for the planned scope of work and maintain a safe debt to equity ratio – otherwise referred to as leverage;
- form of capital contribution to the project: financial resources, in-kind contribution of movables, land, licenses, know-how, delegation of experts;
- participation of the public partner: funds in the form of a grant, subsidies, shares, tax reliefs, guarantees from public institutions, direct loans from public institutions or development banks, project security in the form of the creation of strategic reserves; special regulations (laws);
- the type of contracts that are concluded between stakeholders and the commitments are specified in them: cost-plus contracts for a specific purpose (as in the case of NASA), turnkey contracts, time and materials contracts, fixed price contracts, split contracts – the responsibility for the project is divided among several contractors ("split-package contracts");
- tools supporting the organization of financing are used.

A SPAC (special purpose acquisition company) is a shell corporation with no active business activity, whose main asset is funds to acquire existing companies. SPACs are used as a financial instrument to raise capital from investors through initial public offering (IPO) channels. The funds raised from the IPO are then used over a period of one to two years to finance ventures such as acquiring private companies and listing them on the stock exchange, or connecting with start-ups to provide them with access to long-term affordable capital to finance the development and expansion of infrastructure. "Flow-through shares" is a special issue of ordinary stocks where early losses from exploration, infrastructure development and initial operations are passed directly to shareholders as tax deductions and then become ordinary shares after the finalization of the tax deduction (Wolfe, 2022).

The organization of financing long and capital-intensive investments requires taking into account a number of organizational aspects, such as:

- risk management (including market, credit, regulatory and operational risk);
- cooperation with partners (government agencies, local authorities, private sector entities and local communities);
- project management – the choice of a project management methodology should take into account technical, budgetary, time-related and administrative issues, as well as international aspects;
- financing – the choice of the financing model (public-private/private partnership), financing mechanism (issue of shares/IPO, bonds, VC) must take into account the specificity of these projects;
- social and environmental aspects.

To implement such a large scope of design activities, standard approaches are not always enough. One of the methodologies focused on financing large investment projects is Project Finance (sometimes referred to as Structured Project Finance or SPF). Project Finance is a financial structure – a set of rules and a formal and organizational approach to obtaining long-term debt financing for projects requiring large capital expenditures.

It is based on a detailed assessment of the risks associated with construction, operation and project revenues and their allocation among investors, lenders and other parties under contractual arrangements. In the United States, the extraction of natural resources was organized in this way, starting with the extraction of crude oil, and then other raw materials, as well as for example, the construction of a railway in the United States, the Suez Canal, the Panama Canal, the subway in London or the airport in Athens. A similar approach is also used in the implementation of smaller private investments, including those carried out by individual sponsors (Yescombe, 2014, pp. 13–14).

It is proposed in the literature to use of a special purpose vehicle (SPV/SPE) and a securitization mechanism, which is a process by which the cash flows associated with one or more assets are pooled and transferred to an SPV, which in turn issues debt or equity securities representing claims to those underlying assets or cash flows. In most cases, the original assets are transferred by the originator (sponsor) of the SPV, which then issues securities to investors. The purpose of the SPV is to minimize the sponsor's exposure to risk and to help maintain its own creditworthiness and future access to financial markets. As a result, in noticeable contrast to parent company loans, SPVs are created to facilitate off-balance sheet financing and asset disposals. SPVs are usually owned and controlled by the parent companies that set them up (Yescombe, 2014, p. 40).

Due to the sponsor's liability, two basic types of project financing are highlighted in accordance with the SPF approach: limited and non-recourse

(Akbiyikli et al., 2011, p. 209). With limited project funding, lenders use the project's cash flow to repay debt servicing, but allow creditors and investors some recourse to sponsors for repayment in the event of failure. In *non-recourse* project financing, lenders use cash flow in the same way, but only have the project assets as collateral. The loan is, therefore, intended for an entity without a credit history, and is secured with cash flow generated on an ongoing basis and in the future by the project.

The specificity and conditions of Project Finance make it an approach intended for reputable, experienced and mature participants, including investors and sponsors.

Acknowledgement

Notes

 1 New Suez Canal project proposed by Egypt to boost trade, Cairo News.Net, 6 August 2014, www.caironews.net/news/224460353/new-suez-canal-project-proposed-by-egypt-to-boost-trade
 2 Three Gorges Dam Cost: How much did it cost to build such a huge project?, www.travelchinaguide.com/river/three-gorges-dam-cost.htm
 3 ITER Organization, www.iter.org
 4 100 Year Starship Organisation, www.iter.org/faq
 5 Space Foundation 2021 Annual Report, www.spacefoundation.org/wp-content/uploads/2022/04/SpaceFoundation_2021-Annual-Report_Final-1.pdf
 6 https://100yss.org/
 7 Infrastructure Financing Instruments and Incentives, OECD 2015, www.oecd.org/finance/private-pensions/Infrastructure-Financing-Instruments-and-Incentives.pdf
 8 Social Accountability 8000. Social Accountability International.
 9 AA1000 Account Ability Principles. Account Ability. www.accountability.org/standards/aa1000-accountability-principles/
10 https://sdgs.un.org/2030agenda
11 Standardisation of PFI Contracts, H. M. Treasury, Version 4, March 2007, https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/UK_Standardisation%20of%20PFI%20Contracts%20(ver4.2007).pdf
12 Standardisation of PF2 Contracts, draft, H. M. Treasury, December 2012, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/207383/infrastructure_standardisation_of_contracts_051212.PDF; see too: United Kingdom Treasury – Standardisation of PF2 Contracts (SoPC), https://ppp.worldbank.org/public-private-partnership/library/united-kingdom-treasury-standardisation-pf2-contracts-sopc-december-2012
13 PFI and PF2 projects: 2023 Summary Data, www.gov.uk/government/publications/pfi-and-pf2-projects-2023-summary-data; Policy paper, Private Finance

Initiative (PFI) and Private Finance 2 (PF2): Budget 2018 brief, www.gov.uk/gov ernment/publications/private-finance-initiative-pfi-and-private-finance-2-pf2-bud get-2018-brief

14 The Legislative Decree No. 36 of 31 March, 2023, published in the Italian Official Gazette No. 77 of 31 March, 2023.

15 Ustawa z dnia 10 maja 2018 r. o Centralnym Porcie Komunikacyjnym (Dz. U. z 2023 r. poz. 892).

16 Notice of the Minister of Infrastructure 1 of 24 September 2020 regarding the announcement of the Management Principles.

17 www.cpk.pl/pl/aktualnosci-2/vinci-z-francji-i-ifm-z-australii-spolka-cpk-wybrala-strategicznego-inwestora-lotniska (access online: 19.12.2023).

18 *Legislative Guide on Privately Financed Infrastructure Projects*. New York: United Nations Commission on International Trade Law, 2001.

19 Regulation 2157/2001 of the Council (EC) of 8 October 2001 on the Statute for a European Company (SE), OJ L 294, 10.11.2001, pp. 1–21, as amended.

20 Regulation (EU) 2015/760 of The European Parliament and of The Council of 29 April 2015 on European long-term investment funds, OJ L 123, 19.5.2015, pp. 98–121.

21 Directive 2011/61/EU of the European Parliament and of the Council of 8 June 2011 on Alternative Investment Fund Managers and amending Directives 2003/41/EC and 2009/65/EC and Regulations (EC) No 1060/2009 and (EU) No 1095/2010, OJ L 174, 1.7.2011, pp. 1–73, as amended.

22 Consolidated Version of The Treaty on European Union (OJ C 202 7.6.2016, p. 13, as amended).

23 Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty, OJ L 1, 4.1.2003, pp. 1–25.

24 EU Court of Justice (2003) Judgment of the Court of First Instance (Third Chamber) of 30 September 2003, Manufacture française des pneumatiques Michelin v Commission of the European Communities, Case T-203/01, ECLI:EU:T:2003:250.

25 EU Court of Justice (1978) Judgment of the Court of 14 February 1978, United Brands Company and United Brands Continentaal BV v Commission of the European Communities, Case 27/76, ECLI:EU:C:1978:22.

26 EU Court of Justice (2023) of 21 September 2023, Case C-510/22, ECLI:EU:C:2023:694.

27 EU Court of Justice (2022) of 12 May 2022, Case C-377/20, ECLI:EU:C:2022:379.

28 EU Court of Justice (1991) *Judgment of the Court (Sixth Chamber) of 23 April 1991, Klaus Höfner and Fritz Elser v Macrotron GmbH,* Case C-41/90., ECLI:EU:C:1991:161.

29 Bilateral relations on competition issues, Competition Policy. Available at: https://competition-policy.ec.europa.eu/bilateral-relations_en

30 Infrastructure Financing Instruments and Incentives, OECD 2015, s. 7.

31 Kendall and Tsui (2011, p. 15).

Bibliography

Abraham, O.A. (2019) 'Effective Project Management in Contemporary Developments: Case Study of Burj Khalifa Tower', *IRE Journals*, 3(2), 690–701.

Akbiyikli, R., Dikmen, S.U., Eaton, D. (2011) 'Financing Road Projects by Private Finance Initiative: Current Practice in the UK with a Case Study', *Transport*, 26(2), https://doi.org/10.3846/16484142.2011.589426

Alfred, R. (2012) 'April 25, 1859: Big Dig Starts for Suez Canal', Wired, 25 April, www.wired.com/2012/04/april-25-1859-big-dig-starts-for-suez-canal/

Bürosu, E.A. (2023) *The Legal 500 Country Comparative Guides Turkey PROJECT FINANCE*, www.cergun.av.tr/wp-content/uploads/Legal-500-PF-Guide-2023-Turkey-Chapter.pdf

Charkham, J., Simpson, A. (1999) *Fair Shares: The Future of Shareholder Power and Responsibility*. New York: Oxford University Press, https://doi.org/10.1093/acprof:oso/9780198292142.001.0001

DiMaria, S. (2016) 'Starships and Enterprise: Private Spaceflight Companies' Property Rights and the U.S. Commercial Space Launch Competitiveness Act', *St. John's Law Review*, 90(2), https://scholarship.law.stjohns.edu/lawreview/vol90/iss2/5

Dufey, A., Grieg-Gran, M. (2011) 'The Linkages Between Project Finance and Sustainable Development', in D. Ong, S. Leader (eds) *Global Project Finance, Human Rights and Sustainable Development*. Cambridge: Cambridge University Press, https://doi.org/10.1017/CBO9780511974311.003

Edwardes-Evans, H. (2021) European Council agrees Eur 5.61 billion funding for ITER fusion project, www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/022221-european-council-agrees-eur561-billion-funding-for-iter-fusion-project

Geert De Clercq (2016) Nuclear fusion reactor ITER's construction accelerates as cost estimate swells, Reuters, 7 October, www.reuters.com/article/us-france-nuclear-iter-idUSKCN1271BC

Hansen, B., Tourk, K. (1978) 'The Profitability of the Suez Canal as a Private Enterprise, 1859-1956', *The Journal of Economic History*, 38(4), 938–958.

Heracleous, L., Terrier, D., Gonzalez, S. (2019) 'NASA's Capability Evolution Toward Commercial Space', *Space Policy*, 50, https://doi.org/10.1016/j.spacepol.2019.07.004

Hoffman, S.L. (2008) *The Law and Business of International Project Finance*. Cambridge: Cambridge University Press.

Hutt, R., Breene, K. (2019) Scientists just got closer to making nuclear fusion work, World Economic Forum, www.weforum.org/agenda/2019/05/nuclear-fusion-could-solve-the-world-s-energy-problems-and-scientists-just-got-closer-to-making-it-work/

Jackson, S., Sleigh, A.C. (2001) 'The Political Economy and Socio-Economic Impact of China's Three Gorges Dam', *Asian Studies Review*, 25(1), https://doi.org/10.1080/10357820108713295

Kendall, T.D., Tsui, K. (2011) 'The Economics of the Long Tail', *The B.E. Journal of Economic Analysis & Policy*, 11(1), https://doi.org/10.2202/1935-1682.2845

Lafleur, C. (2010) Costs of US piloted programs, www.thespacereview.com/article/1579/1

McCarthy, K. (2015) *H.R.2262 – 114th Congress (2015-2016)*. U.S. Commercial Space Launch Competitiveness Act, www.congress.gov/

McCurdy, H.E. (2019) *Financing the New Space Industry: Breaking Free of Gravity and Government Support*. Cham: Springer International Publishing, https://doi.org/10.1007/978-3-030-32292-2

Onion, A., Sullivan, M., Mull M. (2009) Panama Canal Turned Over to Panama, www.history.com/this-day-in-history/panama-canal-turned-over-to-panama

Pédamon, C. (2000) 'How Is Convergence Best Achieved in International Project Finance?', *Fordham International Law Journal*, 24(4), 1272–1318, https://ir.law net.fordham.edu/ilj/vol24/iss4/8.

Pomeroy, C., Calzada-Diaz, A., Bielicki, D. (2019) 'Fund Me to the Moon: Crowdfunding and the New Space Economy', *Space Policy*, 47, https://doi.org/10.1016/j.spacepol.2018.05.005

Roche, C. (2022) How much money did CERN's Large Hadron Collider cost to build and who paid for it?, Diario AS, https://en.as.com/latest_news/how-much-money-did-cerns-large-hadron-collider-cost-to-build-and-who-paid-for-it-n/

Romitelli, G. et al. (2023) The New Italian Public Contracts Code, www.dlapiper.com/hu-hu/insights/publications/law-in-tech/the-new-italian-public-contracts-code

Rostoff, J. (2016) 'Asteroids for Sale: Private Property Rights in Outer Space, and the SPACE Act of 2015', *New England Law Review*, 51, 373–400.

Severino, J.M. (2020) 'New Models for Financing Essential Services', Field Actions Science Reports, *The Journal of Field Actions* (Special Issue 22), 84–87.

Sjåfjell, B., Richardson, B.J. (eds) (2015) *Company Law and Sustainability: Legal Barriers and Opportunities*. Cambridge: Cambridge University Press, https://doi.org/10.1017/CBO9781107337978

Smit, T. (2002) EUR 300 million for CERN's major Collider, www.eib.org/en/press/all/2002-127-eur-300-mio-for-cerns-major-collider

Taylor, K. (2019) 'Fictions of the Final Frontier: Why the United States SPACE Act of 2015 Is Illegal', *Emory International Law Review*, 33(4), 653–678, https://schol arlycommons.law.emory.edu/eilr/vol33/iss4/6

Thomsen, P., Hoxie T., Wright, G. (2016) 'Patents and Competition Law—United States', in Grubb, P. et al. (eds) *Patents for Chemicals, Pharmaceuticals, and Biotechnology, Fundamentals of Global Law, Practice, and Strategy*. Oxford: Oxford University Press.

Weinberger, S. (2014) 100-Year Starship: Mae Jemison reaches for the stars, www.bbc.com/future/article/20120518-reaching-for-the-stars

Weinzierl, M. (2018) 'Space, the Final Economic Frontier', *Journal of Economic Perspectives*, 32(2), https://doi.org/10.1257/jep.32.2.173

Wolfe, S. (2022) *Advanced Financing Options for Large Scale Space Infrastructure and Habitat Projects | SpaceRef – Your Space Reference*, http://spaceref.com/calen dar/calendar.html?pid=10268

Wood, M., et al. (2023) United Kingdom, in C.E. Ergün, B. Baltacıoğlu, P. Ecevit, T.A. Bozkurt, M. Kaim (eds), Global Project Finance Guide, Ergun Publication Series: Global Legal Guides, London 2023.

Yescombe, E.R. (2014) *Principles of Project Finance*. Amsterdam; Boston: Academic Press.

Zhang, Y. et al. (2021) 'Framework for a Blockchain-Based Infrastructure Project Financing System', *IEEE*, https://doi.org/10.1109/ACCESS.2021.3119589

2 The potential of financing projects using DLT

2.1 Blockchain/DLT

2.1.1 Data: type (ledger) and structure (chain)

Blockchain is a database technology that is designed to store data in a special way. Firstly, it is created to store data organized in a "ledger" – specific addresses of a given network are assigned a specific value (number of units), and often also additional values. Blockchain mechanisms also require saving additional technical data. Secondly, the ledger data are saved using the concept of a data chain, which was already described in 1991 by Haber and Stornetta (1991, p. 5). It consists of cryptographically combining data (data blocks) so that the record of the last one refers to the previous one. In this way, data entered later fixes entered earlier, as it is harder to change data written earlier, because you also have to make a change in all later blocks. Blockchain is designed to be used in a dynamic environment where there is a constant stream of data input requests. When used on a single machine, the blockchain facilitates primarily maintaining data consistency and unambiguous time stamping (the introduction of changes, i.e., the reorganization of blocks, is possible). When this mechanism is used as the basis for building a blockchain network, it makes the record durable and results in the database being write only and read only, without the possibility of editing or deleting data once they are entered. Queuing and data blocking is meant to save time in the recording process, enable data synchronization between nodes in a dynamic environment, and due to the nature of the data and the use of the system to transfer units between addresses, also enable the "netting" of balances (Kopeć, Sobiecki and Piech, 2022, pp. 23–29).

2.1.2 Decentralized p2p network

The second pillar of the broad understanding of the blockchain concept is the embedding of this particular data structure in a p2p network. A network in which each node can communicate directly with another node (peer-to-peer or p2p), which is the basis of the blockchain, is virtual (logical), irrespective

of how the nodes of this network connect physically. The key assumption for the existence of the blockchain network is its dispersion among nodes that have autonomy and are sovereign in their decisions – they are not controlled by a single decision-making centre (entity, company or person). At the same time, the nodes in the blockchain network have equal rights and none of them can assume a greater role and control the behaviour of other nodes, which endows the blockchain network with a politically decentralized (in terms of control) character. In some networks, the management mechanism is structured in such a way that there are groups of distinguished nodes (masternodes), but they are still groups of independent nodes. The possibility of direct communication with another network node (p2p) gives the network a decentralized character in terms of infrastructure (technical aspects). The network is constituted based on a *network protocol*. It arises between nodes acting according to common network rules, including, for example, methods of generating, processing and saving data in the network, and mechanisms of identification, authentication, incentives and communication between nodes in order to synchronize nodes (achieve a so-called consensus).

In the blockchain network, both infrastructural processes (the processing of new transactions, validation of transactions, writing of blocks, verification of the correctness of new blocks, storage of ledger data and relay) and usage processes (the reading of the ledger, ordering transactions and digital signing) can be carried out. The protocol can grant permissions to perform these processes within the network to all users, or to a limited, authorized group. Networks in which the implementation of infrastructural processes does not require prior permissions are referred to as "permissionless" networks. Networks requiring permissions are called "permissioned". The terms "public/private" or "open/closed" are also sometimes used, but they are used inconsistently. For the purposes of the monograph, it has been assumed in simplification that a private blockchain is a network in which prior permissions are required for the implementation of various processes (especially infrastructural ones), and a public or open blockchain is a network in which such permissions are not required (Kopeć, Sobiecki and Piech, 2022, pp. 23–29).

2.1.3 Synchronization mechanisms

In a blockchain network, a copy of the entire ledger is held by multiple network nodes. Originally, each "full node" stored a full copy of the database, but various solutions are now used to limit the amount of data stored and to reduce the amount of data sent over the network. In cloud systems, these nodes are centrally controlled and synchronized. In blockchain networks, the nodes are sovereign, so they require a specific state synchronization solution. Achievement of the so-called network consensus without a central coordinator is all the more difficult as requests to enter transaction data flow in continuously. The standard solution to this problem (also called a "Byzantine

fault") is to adopt two rules. Firstly, data are entered in blocks, and subsequent nodes are selected for validation and saving subsequent blocks. Secondly, one node is responsible for saving the data that have flowed in since the previous block was approved, and the others adapt to it, and after the correct verification of the record, they recognize it. One of the characteristic differences between blockchain networks is, therefore, the method of selecting the node that saves the transaction at a given moment. In networks that use the proof-of-work mechanism, for example, in the Bitcoin network, the node that will solve the latest cryptographic task the fastest is selected. Nodes or groups of nodes that use more computing power in this process have a greater chance of solving the task (the "block solution"). This task uses block transaction data and has a variable difficulty to keep to the average time to solve it (and add a new block), irrespective of how much total node computing power is devoted to this process. The main alternative to the proof-of-work mechanism is the proof-of-stake mechanism. In this mechanism, the chance of receiving the write permission is the greater the more units native for the network are blocked by a given node, and in the delegated proof-of-stake – the more units are blocked by nodes "voting" for a specific delegate (masternode). In other mechanisms, the chance to write may depend on the available disk space, reputation and many other factors, and in permissioned networks, it may be centrally controlled (random allocation) or based on the passage of time.

Adding a synchronization mechanism to the structure of data stored by the nodes of a decentralized network makes the data saved by this network become a permanent record – the more permanent it is, the more nodes are in the network, the more time has passed since the block was written (or, more precisely, the more data blocks were written after a certain block) and the more difficult it is to write a single data block. The difficulty of writing a single block may be related to the adopted consensus mechanism, or result from the costs associated with the writing (the costs of obtaining the appropriate number of crypto-assets, energy costs, etc.). The more permanent the record, the more difficult and costly it is to attack the network – i.e., the transaction data stored in it (not to be confused with an attack on a single node or a user's wallet) in order to change historical data blocks – i.e., reorganize blocks. For this reason, the Bitcoin network – which is the first and longest functioning network using the proof-of-work mechanism and having approximately 10,000 active nodes, is the strongest block fixer, throughout its history has not experienced a deliberate reorganization of blocks, and two cases of reorganization are known (Buterin, 2013; Kamat, 2020; Southurst, 2021) as a result of the need to cancel changes introduced by errors in the code of the application implementing the Bitcoin protocol (in 2010 and 2013).

2.1.4 Identification and authentication mechanisms

In blockchain networks, users of the solution are independent of the nodes maintaining the network. Users use the basic functionality of the blockchain network, i.e., maintaining and changing the balances of the units of a given network (native crypto-assets) in the ledger. As in any secure public system, the user must be identified in a certain way, and their digital identity must be linked to the state of ownership. At the same time, the user must be able to prove their authorization to dispose of these units (authenticate themselves). In blockchain networks, these processes are integrated with each other. In order to authenticate themselves, users will generate cryptographic keys – these make it possible to prove that they have the right to the balance. At the same time, on the basis of these keys, an address is generated by which the user is identified in the network and to which crypto-assets units are sent. A public network user can usually generate any number of keys and addresses (Kopeć, Sobiecki and Piech, 2022, pp. 23–29).

2.1.5 Incentivization mechanisms

Blockchain networks use a large amount of electricity in the process of validating transaction blocks and wear out computer equipment. This means that maintaining the infrastructure of the blockchain network is associated with non-negligible costs. The provision of computer resources for the implementation of infrastructural processes is, therefore, currently associated with the expectation of specific economic benefits. The blockchain network must, therefore, provide the nodes maintaining the network with a specific value. In closed networks, the utilities provided by the network and applications that can be monetized are often enough. In open, public networks, the blockchain protocol must include an incentive mechanism. In networks where units of native (own) cryptocurrency are generated and maintained, a node that validates the current block is rewarded with newly generated cryptocurrency. This is often the primary or only way for a new native cryptocurrency to appear in the system. The degree of satisfaction of the expected benefits depends on the one hand on the difficulty of approving blocks (resources used) and on the other hand on the market rate of the cryptocurrency in which the remuneration is denominated. Thanks to floating exchange rates, these factors keep blockchain networks in a dynamic balance. The fact that blockchain networks are still maintained, and some by thousands of nodes, proves that these expectations are met. However, this has not always been the case. The first generated units in the Bitcoin network had no exchange value, because there were no markets for their exchange for official currencies or goods of recognized utility. However, originally, the motivations resulted from natural curiosity or the desire to participate in an interesting project, or were ideologically based; therefore, despite miners receiving worthless rewards, the networks survived. Ideological issues may also be important

for the involvement of investors in a mega-investment, for example, the idea of fighting global warming or the idea of conquering space (Kopeć, Sobiecki and Piech, 2022, pp. 23–29).

2.1.6 Virtual machine and decentralized applications

The last pillar of the blockchain network is a solution that increases the flexibility of constructing and automatically implementing the rules of mutual relations between users – supplementing the usefulness of the network consisting of maintaining a basic ledger of crypto-assets with mechanisms for processing individual exchange rules, i.e., introducing a virtual decentralized machine. Thanks to it, users can specify and save in a formal programming language the rules of the flow of funds between different addresses by building so-called *smart contracts*. This gives the opportunity to construct advanced decentralized applications (dApps) covering a system of related smart contracts and complementary off-chain mechanisms (implemented outside the blockchain network), for example, user interfaces. DApps are the backbone of decentralized financial services (DeFi). Smart contracts are collections of computational functions and procedures stored in a decentralized ledger that are performed by machines in a decentralized network.

Smart contracts are written in a formalized programming language, converted to a form directly executable by the machine. They cannot auto-initiate – they must also be initiated (called) from the outside of the chain, through a properly set up transaction directed to the address of the smart contract (which in this case appears as a "virtual person" – the recipient of the transaction). Smart contracts cannot directly access off-chain data (data not embedded in the chain) and require the support of external entities (so-called oracles), which, by calling the appropriate functions of the smart contract as part of a transaction can provide or receive data from the outside from them. To function in open, public networks, smart contracts require a native token, which – as in the case of remuneration for saving transfer transaction blocks – allows one to generate revenues to cover the costs of executing smart contracts. At the same time, it means that almost every interaction with a smart contract requires incurring a certain cost. Some blockchain networks allow the implementation of complex algorithms as part of smart contracts (Ethereum network, Hyperledger Fabric, EOS, Corda and Tezos), and some have a limited set of features to implement selected processes (NEM, Stellar and Waves) (Suvitha and Subha, 2021). The former are referred to in some simplification as "Turing complete", and the latter as "Turing incomplete".

As part of decentralized applications, it is possible to build solutions that generate and support various types of tokens, including NFT, solutions for decentralized crowdfunding, decentralized, autonomous token trading platforms, lending services, betting, investment services, etc. (Kopeć, Sobiecki and Piech, 2022, pp. 23–29).

2.1.7 Applications of blockchain in the financing process

Blockchain provides completely new opportunities and utility potential that can bring efficiency in the financing process. This potential will result from several general utilities that result from the specificity of the technology (Sobiecki, 2021, pp. 14–16):

- Industrialization of trust – replacing the lack of trust in social and economic networks not with a trusted third party, but with an automated mechanism for enforcing a contract written in formal language that defines mutual obligations;
- Guarantee of recording records in a decentralized registry thanks to the block chain structure and redundancy of recording in a decentralized network, in which each node, being sovereign, is motivated to dedicate resources to maintain the network (store the registry, conduct calculations) and follow the protocol – it is very difficult to make changes to the historical records in the ledger or permanently take control over the recording of new data in the ledger – attacks on the network are very expensive and very difficult;
- The guarantee of non-repudiation of records and the ability to prove historical events, also thanks to the structure of recording sequentially entered and time-stamped data and thanks to the use of cryptography – a historically entered record almost unambiguously indicates a specific event, for example, in practice, it allows to prove that the document was created no later than at that time, and that the content of the document is exactly what one wants to prove;
- Continuity and transparency of history – thanks to blockchain technology, it is possible to trace and audit the full history of events recorded in a given ledger;
- Tokens – a new class of assets that are rare can be used to transfer value (payments), allowances and data, thanks to which it is possible to give them a market exchange value; this concerns both means of payment and tokens transferring rights, utilities and digital goods (including, potentially, securities);
- The ecosystem nature of solutions based on blockchain technology and tokens – a common standard of a digital good enables the penetration of various services and solutions, and the creation of network solutions (similar to a network company);
- The potential for real economic benefits – reduction of operating and transaction costs (for example, value transfer), offering new types of services, eliminating inefficiencies of existing business processes;
- Democratization of coordination and control – DAO mechanisms enable control using the principles of direct democracy, within a flat organizational structure, even in large and dynamic communities, as well as automatic implementation of community decisions;

- Openness and transparency of mechanisms – it is possible to verify the actual rules of functioning of services or organizations thanks to the availability of open network protocols and ledgers;
- Allows the maintenance of durable, elastically shaped relationship socio-economic even while maintaining a high degree of privacy;
- Minimization of delays in business relations – records in the blockchain ledger are almost immediate, and the change of asset owners does not require an additional settlement step;
- Atomicity of interactions with smart contracts – they either execute completely or fail; therefore, there is no risk of settlement and users do not have to entrust control of their digital assets to a third party;
- Privacy while maintaining user safety – zero-knowledge proof mechanisms, etc. enable control over publicly disclosed information about contractors and their transaction history;
- Full auditability of transactions – transaction ledger – both public and private, allows the auditing of transaction data, balances and identity, which can cover all events from the audited period;
- Strict access control – smart contracts enable flexible and transparent control of access to financing processes;
- Smart legal contracts – automation of contract processes.

In the process of raising funds for the implementation of an investment project, several solutions based on blockchain technology can be used:

1 crypto-assets, cryptocurrencies, tokenization;
2 crowdfunding process using tokens (ICO/STO/IEO);
3 automation of business logic and contract execution;
4 a coordination structure in the form of a DAO;
5 autonomous exchanges and liquidity pools;
6 loans (including unsecured ones);
7 anonymizing technologies;
8 a durable medium.

2.2 DLT processes and services to be used in the investment financing process

2.2.1 Crypto-assets, cryptocurrencies

There are many services that enable and support investing in the crypto-assets market using solutions based on blockchain technology (especially in the area of decentralized finance), such as staking (staking-as-a-service or SaaS), liquidity pools (liquidity-as-a-service), yield farming, automatic mutual funds (based on so-called oracles and wisdom of the crowds or based on automatic rules). Staking services are the cryptocurrency equivalent of a service similar to a joint venture and mutual fund mechanism, and

consist of the deliberate accumulation of crypto-assets in exchange for certain benefits. Such services are automated. In the case of SaaS, the collected funds are used in blockchain networks based on the proof-of-stake mechanism – they increase the chances of a given node to be granted the right to validate a block of transactions and receive a reward that is distributed among investors. Liquidity pools serve as a liquidity resource that is used by a particular decentralized service (lending, exchange or betting service). Liquidity-as-a-service is a fundraising service similar to SaaS, but for a different purpose – to enable decentralized services to function. Within the scope of this work, however, there is the potential for technology to support the financing process itself (which can apply to any investment projects – not only projects that are ultimately meant to function based on blockchain), and the instruments that can be used in this process.

Crypto-assets are assets whose balances are recorded in a ledger analogous to a bank account system. The main difference is that this ledger is operated by a decentralized, globally distributed network (DLT, for example, blockchain) that is usually publicly available. Without meeting formal requirements or having pre-assigned permissions, one can join the network of nodes providing infrastructure services, read the content of the ledger (transactions) or use the option of transferring units as a network client.

The transfer of value through the transfer of crypto-assets units is possible thanks to the existence of markets (also organized ones) for the direct exchange of cryptocurrencies into official national currencies, and sometimes other assets. Thanks to the flexible and unrestricted construction of blockchain ledgers, crypto-assets can be a carrier of various values, utility and permissions. In the ledger embedded in the blockchain network, crypto-asset units can be assigned a structured description of properties, which makes them a much more complex object than a unit of cash accumulated in a bank account. Thanks to this, crypto-assets can be a carrier of various asset classes (Cienfuegos, 2022):

- means of payment (cryptocurrencies, stablecoins, private currencies, CBDC, EMT);
- financial instruments (securities, fund participation units, bonds, promissory notes, etc.);
- other value carriers (loyalty points);
- carriers of rights (voices, rights to change service parameters, admission tickets);
- credentials carriers (certificates of graduation, courses, club membership, certificates of attendance (POAP), liquidity deposit certificates on the decentralized exchange – LP);
- data carriers (identification data, authentication data, digital signatures; instructions);
- digital, virtual goods (collectible goods, digital works of art, virtual clothes, profile pictures – PFP, badges, artefacts of computer games).

Crypto-assets can exist in two model forms:

- interchangeable – i.e., fungible tokens – it is possible to replace such a token with an identical one, both qualitatively and quantitatively (one bitcoin is always equal to another bitcoin);
- immutable – non fungible tokens or NFTs – these have an individual character and independent valuation, are not divisible or directly summable, and are in the latest release (NFT 2.0) – their features may change over time.

It is worth remembering that blockchain is a ledger system, not a classic database. It does not directly store digital goods (digital artwork or a profile picture), but digital receipts "linked" to a structured description that is "linked" to a specific visualization. However, these connections are ambiguous, which also causes legal problems, and additional legal solutions are used to clarify the rights resulting from the transfer of these virtual goods (including terms and conditions).

Cryptocurrencies are usually issued by public networks (such as the Bitcoin or Ethereum network), while tokens are created through issuance with the help of smart contracts. In doctrine and practice, such tokens are sometimes also referred to as cryptocurrencies. It is widely accepted that cryptocurrencies and tokens are crypto-assets.

Cryptocurrencies (also understood as tokens with a payment function) in the financing process can be used as a value transfer medium that has special characteristics. The payment potential of cryptocurrencies acting as a means of accumulating value allows them to compete with existing solutions in four main segments (payment systems and services):

- instant payments;
- international payments;
- micropayments;
- high-value payments (Sobiecki, 2022, pp. 395–400).

The potential in the instant payments segment results from the specific feature of cryptocurrencies, namely the absence of the payment settlement stage, which is characteristic of traditional card payments or bank transfers. In other words, clearing and settlement take place at the same time. At the same time, a very short time passes between the moment of the payment order and the moment of execution of the order (i.e., the recording of changes in balances or information about the transaction) – from a few minutes to even a few seconds. This is the time needed to record changes in the ledger resulting from the adopted solutions (in particular, the method of synchronizing node states – the so-called consensus protocol). In the case of Bitcoin, blocks are approved every 10 minutes, and the average transaction time is estimated at 40 minutes (Groves, 2023). In the case of the Terra cryptocurrency, the average transaction approval time is six seconds,

and similarly, it takes several seconds to approve a transaction for XRP (the Ripple project cryptocurrency). Therefore, cryptocurrencies can be defined as RTGS (real-time gross settlement) systems.

Cryptocurrencies using public, open blockchain networks are inherently global. To use them, all that is need is Internet access and the appropriate application (cryptocurrency wallet). International value transfer using cryptocurrencies can be much faster and cheaper than using traditional banking systems (and sometimes even compared with international transfer services).

Due to the potentially low transfer costs, when using some solutions, it is worth making micropayments, the value of which does not exceed a cent. In the case of the oldest cryptocurrency, Bitcoin, the average transaction fee in the last decade ranged from approximately several dozen cents to as much as USD 50; however, in the case of the cheapest networks in this respect, such as, for example, Stellar, the minimum cost of one transaction is 100 so-called stroops (equivalent to "cents"), i.e., XLM 0.00001 (the currency of the Stellar project), which at the rate of approximately USD 0.1 per XLM at the time of writing this paper, gives a cost of USD 0.000001 (0.0001 cents) per transaction.

The transaction cost for each cryptocurrency fluctuates mainly as a result of changes in exchange rates and transaction volume. Nevertheless, due to the fact that the cost of the transaction is not related to the value of the transaction, it enables low-cost, *high-value transfers*. A specific feature of cryptocurrencies as a means of payment is their payment "capacity" and linking them to the exchange rate, i.e., at a given moment, in a given network, a given number of tokens (supply) is available that have a specific market price that determines the total so-called capitalization of tokens (the product of the available supply by the current market rate), which limits to some extent the exchange of crypto-assets for official currencies (fiat) and thus limits the acquisition of cryptocurrency to some extent.

In addition, it is worth pointing out several additional distinguishing features:

- relative *anonymity* (privacy) of transactions, which is an additional utility in some applications (also illegal ones);
- *non-returnable* funds and irreversible transactions resulting from the impossibility of introducing changes to fixed ledger entries.

2.2.2 Token-based fundraising (ICO/STO/IEO/IDO)

The use of newly generated tokens as a means of accumulating value is a complement to the usefulness of cryptocurrencies (crypto-assets) as a means of accumulating value. The owners, developers or initiators of the project (usually a decentralized one) offer interested investors project tokens in order to raise funds to run their business. Tokens can be offered to closed groups

of investors (private placement) or publicly. The process of accumulating funds in the form of crypto-assets (usually recognized cryptocurrencies, including stablecoins) in exchange for newly generated tokens, which can be the carriers of various rights, is referred to as ICO (Initial Coin Offering).

ICO is usually carried out automatically and uses a smart contract in which the rules (algorithm) of collecting funds are strictly defined. When it receives funds, the contract generates or issues back a previously generated token. A fundraising smart contract can be part of a larger service system. The rules of the ICO process are very flexible. ICO can be implemented, for example, so that the generated tokens include a number of automatically enforced rights to receive benefits, defined as a percentage of the contribution or as a percentage of the profits generated by the platform, give the opportunity to use the services of the future solution, or give the right to discounts or bonuses, to manage the future service, to manage the service development process (division of collected funds), of pre-emption of new tokens or to transfer tokens to another address. These permissions may be granted individually or jointly. Traditionally, however, groups of permissions usually correspond to three groups of crypto-assets:

- utility tokens;
- tokens that meet the criteria for financial instruments, including securities (then the issue process is referred to as STO – Security Token Offering);
- payment tokens.

In order to avoid a wide range of obligations arising from the issue of financial instruments – strictly regulated assets – most issuers declare the issuance of utility tokens. Generated utility tokens are most often a carrier of the following rights:

- the right to receive services or goods in the future, the development and production of which is financed by the collection of funds – from the entity that conducted the collection;
- the right to vote:
  - in operational matters: for example, changes to the parameters of the target electronic service, or in selected matters also related to traditionally provided services (for example, loyalty tokens of a sports club with the right to vote);
  - in strategic matters: regarding, for example, the directions of project development (change of business logic in the application code or selection of investments in which the entity's funds are to be invested).

Voting results can be implemented automatically (such as changing the parameters of services in the Maker project as a result of voting by MKR token holders) or after additional approval (such as financing the implementation of proposed changes or specific projects selected in the voting of

Masternodes in the Dash network, or decisions regarding the selection of a template to be placed on a club's players' shirts in some clubs using the Socios service).

The issuance of tokens that are financial instruments (security tokens), i.e., the implementation of the STO process, can be a tokenized equivalent of the processes of the issue of various traditional financial instruments, including IPO (Initial Public Offering).

In the STO process, the generated tokens can be equivalent to shares in a limited liability company, bonds, participation units in an investment fund, etc. Just like each of the traditional financial instruments have a strictly defined organizational structure regarding the issue process, the issuer's obligations towards holders, rules of sale, organization of trading, supervision, entities participating in these processes, etc., in the case of tokens issued under the STO, a bundle of rights and features selected from several traditional instruments can be defined. The token can simultaneously give voting rights, fixed remuneration rights and the right to profits from the project and to use the target service free of charge.

Sometimes, the usefulness of generated tokens is limited to payments. Payment tokens are generated in the fundraising process when the financed project involves the construction of a payment system, as in the case of Ripple and the XRP token.

The ICO process can be carried out by the interested entity directly (where this entity prepares the appropriate contract or uses platforms that enable token generation). It can also be organized by a centralized crypto-asset exchange that has a specific legal personality. We then refer to it as an Initial Exchange Offering (IEO). IEO is an ICO where projects are carefully screened and analysed before the tokens are sold on the cryptocurrency exchange. The exchange is responsible for evaluating the credibility of the project; therefore, it will have to carefully vet the issuers of tokens to maintain the credibility of the exchange. As a result, cryptocurrency exchanges can prevent scammers and dubious projects from fundraising through IEOs. Moreover, because exchanges act as mediators, projects can gain much more exposure, interest and credibility. The ICO process can also be organized by a decentralized exchange (DEX). We then refer to it as an Initial Decentralized Exchange Offering (IDO). IDOs are the decentralized version of IEOs, and originated in 2019 when decentralized exchanges (DEXs) where transactions take place directly between cryptocurrency traders gained popularity. IDOs use DEXs to facilitate the sale of tokens through the IDO launchpad. Launchpads are fully automated and run on blockchains using smart contracts. To raise funds, a fundraising project is submitted to the IDO launchpad. If the project meets the launchpad's standards (as judged by the community, the launch team, or a third-party auditor), project owners can list their tokens on the DEX. These evaluation processes usually involve only the project code and whitepaper, and do not require the identity of the project owner to be disclosed, making the process much less rigorous than the IEO process (Tachachatwanich, 2022).

Project financing using ICO (STO/IEO/IDO) is a process that has the ability to support products in which network effects appear. Properly structured, it reflects the possibility of influencing the shape of the project not only by the owners (as in the case of shares) or initiators, but also by the users themselves, who become co-responsible for its development. Often, thanks to the ICO, the team developing the project achieves two streams of financing. On the one hand, these are funds raised in the direct sale of most of the generated tokens, and on the other hand, they are the remaining small part of the tokens that went to the main creators of the protocol in order to recognize their work to date, which may be liquidated in the future. ICO makes it possible to finance the riskiest projects or projects at an early stage of their development: at the startup stage, and even at the conceptual stage.

ICO can be treated as an alternative investment financing model to traditional forms. As a model, it includes several principles that have become common market practices and that can be generalized (Samieifar and Baur, 2021):

- a team of people is needed to prepare the target project;
- a team of people who can carry out the ICO process is also necessary;
- it targets a large number of venture capital providers;
- teams are preparing a whitepaper or similar document;
- the application code, if the project is of a programming nature, is made available in an open repository (for example, GitHub);
- extensive marketing is carried out to reach as many people as possible, also using a website dedicated to the project, which contains up-to-date information about the progress of the project, as well as social media;

The project whitepaper includes the following (Moxoto et al., 2021, p. 4181):

- the general assumptions of the project;
- the technologies and platforms used;
- the target shape of the project and the mechanisms of its operation;
- the project development plan (roadmap);
- the project team and cooperating persons, advisers;
- the KYC rules, i.e., investor identification (or lack thereof);
- the management principles;
- the formal, legal and tax aspects;
- the spending plan;
- a description of "tokenomics".

The tokenomics of a project include:

- the rules for generating and dividing tokens issued in exchange for collected funds;

- the schedule of investment rounds;
- the expected size of the collection (token sale): the minimum number (soft cap) and maximum number (hard cap), and the consequences of reaching or not reaching these values;
- a description of the obligations of the issuer (the rights of token holders), including the rules for the redemption of tokens, the issue of specific services in exchange for tokens or the remuneration of token holders;
- the token trading rules;
- the exchanges on which they will be available in organized trading.

It is surprisingly rare for marketing research of potential demand, feasibility studies and expected proceeds to be presented, as these are necessary in the preparation of investment prospectuses before the issue of shares, applications in competitions for public funds or in a business plan for the purpose of obtaining funds from loans.

ICOs can also be treated more as a financing support mechanism than a financing model. The broadly understood ICO process can be used to raise funds from various capital providers and in various organizational forms, depending on what mechanisms will be implemented and under which regulations this mechanism can be used. Tokens in the project financing process can also be used without using the automatic ICO mechanism.

2.2.3 Business logic automation of financial processes

Many of the in-project processes can be carried out automatically as part of a decentralized solution, and some of them relate to the fundraising stage. It is widely accepted that blockchain "replaces trust"; however, in an environment where trust exists, such technology as blockchain is not needed. Blockchain and smart contracts, as a technology that "replaces a lack of trust", enable the automation of the implementation of specific rules of cooperation between various stakeholders, including value flows between them and external entities (transfer transactions, exchange transactions and other more complex ones), coordination of these processes thanks to voting, the results of which can be automatically deployed (see DAO). Blockchain cannot replace the process of project planning, searching for investors, negotiations, signing contracts or project implementation, but it enables the automation of business and financial relations between project stakeholders, especially when they are geographically dispersed and sovereign in their decisions, and have similar rights in relation to the project. For this reason, it requires additional work devoted to the precise expression of the principles of the project's operation and the parties' obligations under the contracts in the form of IT documentation of the project, which can be implemented in the code of the smart contract. Both documentation and implementation should be audited by each stakeholder prior to launch.

Smart contracts, as originally defined by Nick Szabo in an online essay (Szabo, 1996), are an abstract concept referring to the automated execution of an already agreed-upon contract. The smart contract thus refers to the concept of the Ricardian contract (Grigg, 2004). The Ricardian contract, invented by Ian Grigg in 1996, is a method of saving an agreement or contract as a legal document so that it can be safely combined with other systems, such as accounting. The Ricardian contract puts the defining (key) elements of a legal contract (parameters) into a format that can be expressed and executed in software. The key is that the format should be both machine readable, so that its execution can be automated, and readable as a plain text document, so that lawyers and contracting parties can conveniently understand the essence of the contract. The so-called Ricardian contract does not contain an implementation mechanism, but is intended to capture strict and parameterized rules of the relationship between the parties. A smart contract is not directly readable for lawyers, and requires the intermediation of programming specialists, but it offers more possibilities – not only parameterization, but also algorithmization of entire processes and cooperation mechanisms. It is worth adding that from a legal point of view, both Ricardian contracts and smart contracts are not considered to be legally binding contracts or agreements.

It is debatable whether smart contracts have legal force in and of themselves, although the prevailing view is that they have no legal force on their own without additional contracts. In general, however, solutions prepared on the basis of previously concluded agreements may be a tool for their implementation, if this is clearly defined in the agreements. These issues are dealt with in Chapter 6.

2.2.4 Decentralized Autonomous Organization (DAO)

In addition to financial and business processes, project control can also be decentralized and largely automated thanks to a DAO (Decentralized Autonomous Organization). A DAO is a type of organizational mechanism bringing together a group of people (entities, also in a business network) with a fixed structure and working together to achieve common goals, distinguished by the use of decentralized technologies as a mechanism for coordinating group activities (voting mechanisms) and transferring group decisions. A DAO introduces a new institutional order (Berg et al., 2019, p. 3).

A DAO can be built using both smart contracts and mechanisms written in the blockchain network protocol. It is most often created to oversee and manage decentralized services (such as Maker) or networks (such as Dash).[1]

DAO members are independent and have common goals related to the organization, but a DAO differs from an association, company, foundation and other classical organizations by several specific features. DAO members:

- can be very geographically dispersed;
- communicate remotely and make decisions remotely;

- can exercise direct control over the service, even in a large group, but in some cases sub-groups specializing in specific areas (sub-DAO) are created;
- make decisions mostly democratically and in a decentralized way (there is no central entity that controls or steers the voting process), although the rules of cooperation, including voting, can be flexibly shaped;
- can interchangeably and simultaneously assume the roles of managers, developers, investors, project founders/initiators, external service providers, providers or consumers of a service provided within a platform they control, or solution promoters;
- are usually also DAO managers and are jointly and severally responsible for the effects of the activities of the group and their subordinates, but it is not difficult to imagine the organizational structure of a DAO in which there is a separate management board with different competences, other bodies, and division of members into different groups with different tasks;
- can be both investors in the project, developers, consultants, representatives of competing projects;
- can be identified only by the address of the blockchain network, which ensures high privacy but gives rise to additional management risks (for example, there is certainty whether someone has collected the majority of votes under different addresses).

All the rules of the organization's functioning, decision-making mechanisms, roles and competences of DAO members are written in the smart contract code (or network protocol), which gives the organization the feature of decentralization and limits the members' ability to influence both the organization's rules and operational processes (Ziolkowski, Miscione and Schwabe, 2020).

The term "autonomous" suggests that this organization is self-determining, although this is not always the case – not every group of DAO members has the ability to influence the mechanisms of the DAO's operation (i.e., the smart contract's algorithms). Everyone usually has the freedom to enter and leave the organization. A certain exception is membership in a DAO in a form that is fixed in the code; however, due to the lack of legal formalization, the use of rights is not forced in any way, and there are no specific consequences for not fulfilling the obligations (although due to the flexibility of the code, some effects can be introduced, for example, not awarding a reward for active supervision or refusing to return collateral in the form of a crypto-asset blocked in a smart contract for lack of action for the DAO).

In a broad sense, a DAO can function as a group of entities that:

- manages a decentralized service (DeFi) – the rules of its functioning are written in a smart contract;
- manages blockchain infrastructural services (rules of governance written in the protocol/code of the application, which is, de facto, an element of

the infrastructure and performs infrastructural tasks) – the rules of operation are written in the blockchain network protocol;
- uses a tool using blockchain to automate the organization of the decision-making process and consolidate decisions within a traditional organization (association, company or institution).

DAOs are usually associated with decentralized services, but the mechanism itself can be used to coordinate decision-making, as well as consolidate and verify decisions thanks to transparent processes in the case of groups of people operating within traditional organizations (associations, companies or institutions). The effects of DAO decisions (voting results) are usually recorded on the blockchain. They can also be automatically deployed if they are linked to appropriate mechanisms.

A group of entities controlling the nodes of the blockchain network itself should also be treated as a DAO, as it is difficult to dispute that they are a group of independent entities acting for a common purpose – miners and validators who directly provide services to the network or application. Some voting mechanisms are also encoded in the network protocol.

A DAO may make decisions regarding, for example:

- decentralized service parameters;
- changes in the rules of operation or processes of a related service;
- coordination of external service providers;
- electing delegates from among its members;
- selection of a project development proposal or a network protocol;
- allocating funds for projects;
- returning funds to investors;
- interest payments to investors;
- smart contract updates;
- deactivating a smart contract.

In the ecosystem of decentralized services, a DAO can decide to change the rules for accepting data from external data providers (including so-called oracles, which are the only way for a smart contract to obtain data from outside the blockchain, and keepers, who participate in creating and making markets).

In the financing process, DAO mechanisms may be used, for example, to coordinate operational decisions and manage the detailed decentralized processes mentioned earlier. If funds are to be collected using ICO mechanisms, a DAO can control the collection on an ongoing basis, decide to close the collection, exclude investors, or change the rights of issued tokens. A DAO may also be responsible for distributing the collected funds (Bizzer, 2018), optional return to investors (redemption and burning of the token), or interest payments, or coordinate the trading of generated tokens or decide on connecting additional external services to the system, such as

financial, information or security services (identification/DID, authentication or KYC).

The DAO concept can be used to organize a decentralized equivalent of special purpose acquisition vehicles/companies (or SPAV/SPAC) or special purpose acquisition DAOs (Ghavi et al., 2022).

DAO proponents seeking autonomy maintain that the self-executing nature of DAOs makes them exempt from regulatory oversight. This view is based on either an ideal (DAO is a technology beyond the reach of any regulator) or practice (DAOs are not entities and, therefore, cannot be served in a legal process or held liable). DAOs embedded in the public domain without incorporating an organizational and legal form and functioning without formal or legal agreements, generate significant legal risks for the users of these services. DAO organizers do so by exposing DAO stakeholders to uncertainty about their personal responsibility for a DAO's activities. Indeed, some DAOs may deliberately seek refuge in the uncertainty created by their lack of legal formalities in an attempt to avoid or delay regulatory responsibility and accountability for DAO operations. Without accountability defined by contracts or a legal form where individuals have known roles and expectations, DAO stakeholders are exposed to uncertainty: who owes whom what responsibilities? Who is responsible if something goes wrong – for example, the code works not as intended, or the funds accumulated, for example, in the liquidity pool, are embezzled? DAO founders, promoters, stakeholders and software developers may expose themselves (also unknowingly – by purchasing management tokens) to a large and uncertain liability, as it is left to the courts to determine to what extent they may have obligations to others in the context of the DAO, or whether any guarantees apply to the DAO service. This is also important for DAO clients – leaving it to the courts to determine whether a DAO stakeholder is liable to clients for damages suffered by the clients is risky.

Regulators around the world are beginning to see the problem of "excluding" DAOs, at least those created for maximum privacy, flexibility and reduction of formalities, embedded in the public domain – public, open blockchain networks – from the scope of existing legal regulations. It is worth noting that a DAO includes control mechanisms: coordination, control or parameterization of the automatic provision of a specific service by mechanisms also embedded in the blockchain network. The functioning of some services does not result in the ability to control them – to specify parameters, updates or any changes. In this case, it is difficult to talk about DAOs. Nevertheless, there are legal problems related to determining the persons responsible for the functioning of these mechanisms (the initiators who prepared and embedded the decentralized service on the blockchain). However, it is not the purpose of this monograph to analyse DAOs or resolve these doubts, as the assumption is to function in a clearly legally defined environment. The question asked was: how to implement a DAO formally and legally (Balthazor et al., 2023)?

A DAO defines the principles of the organization's functioning in the technological layer, but does not clearly indicate the rights and obligations of members, tax, information and reporting obligations, members' responsibility for the functioning and obligations of the DAO, members' rights to the property of the DAO, ways of representing the DAO, the legal personality, division into managing or supervisory bodies, separation of ownership rights to the DAO's assets, access to forms of capital, etc. Due to the flexibility of the technology, DAO mechanisms can theoretically be adapted to almost all existing formal and legal structures.[2]

Some authors argue that the interpretation and regulation of DAOs through the prism of traditional formal and legal structures for organizations may not be the right approach (Park et al., 2022). Nevertheless, several legal structures already exist, mainly in the form of limited liability companies, that currently allow the legal functioning of a decentralized organization (Mienert, 2021). These are discussed in Chapter 6, and examples include:

- Blockchain-Based Limited Liability Company (BBLLC) Vermont and Delaware LLC;
- Wyoming Decentralized Autonomous Organization Supplement DAO LLC;
- Tennessee DAO LLC;
- Marshall Islands LLC;
- Swiss Foundation;
- Cayman Island Foundation Company.

In addition to regulations that are prepared with DAOs in mind or include in their generality the possibility of imposing a legal structure on DAOs, there are also bottom-up initiatives to adjust the functioning DAOs and their mechanisms to existing regulations or their appropriate interpretation. One such attempt is an organization in the Dash ecosystem.

Dash is a blockchain network based on two levels of protocols: proof-of-work and proof-of-service. Ninety percent of tokens (with a market value) newly generated by miners go partly to miners and partly to the so-called masternodes responsible for infrastructure services, such as ensuring financial privacy (CoinJoin), instant transactions (InstantSend), supervision over miners and the network, and a decentralized management and budgeting system.[3] The structure of the block reward distribution is close to even distribution, but the share of masternodes increases slightly over time.[4] Ten percent of the tokens create a special fund. The decision to allocate the funds from this fund to the goals reported by the community[5] is made by a group of masternodes via voting.[6] Dash Core Group (DCG) is financed from this fund. This is a company (formerly a foundation) associating the founders and developers of the project.

Dash's blockchain protocol and the organization of its system ensure the financial independence and self-management of the project. The challenge,

however, was to develop a legal structure that would allow DCG to accept funds to finance its activities from an anonymous, dispersed group of entities, or controlled by such a group, in order to maintain the decentralization of the project (Figure 2.1).

For this reason, the so-called irrevocable trust – the Dash Trust – was established in New Zealand. The trustee (settlor) has no control over the trust.[7] The trust is managed by trust protectors. The first custodian was DCG and entities chosen by DCG. The trustees of the trust, who execute the will of the protectors, were two New Zealand companies specializing in trust and asset management. Protectors can change trustees. They also maintain other passive assets that belong to the network, such as patents or trademarks, and enforce related licensing requirements.

Control over the protectors is exercised by the masternodes, which annually select the protectors. The Dash DAO in the 2017 trust document is defined as an organization that exists but is not a tangible entity, but that has management powers. Its governing body is the masternodes, which have management powers to authorize the trust to contribute DAO assets to the trust, exchange protectors, or dissolve the trust. The trustee likely controls
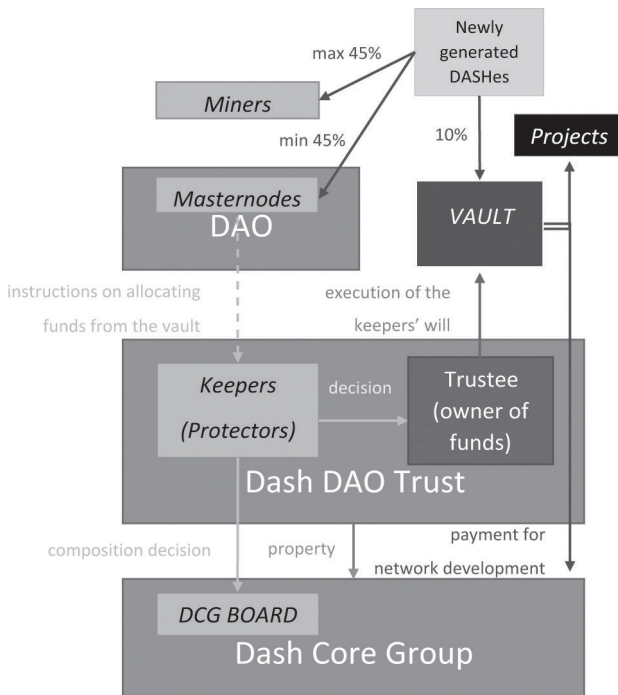

Figure 2.1 Legal structure of the Dash project.

Source: Own preparation, based on Taylor (2018).

the funds disposal keys at the vault address, and the funds in the vault appear automatically without the DAO's interference. To ensure the existence of the trust, even when the Dash network's masternodes cease to exist (for example, the network falls apart), there is an additional beneficiary – the International Red Cross (Valenzuela, 2018). Masternodes grant funds to both DCG and the Dash Trust to cover their operating costs. The Dash Trust is the majority shareholder of DCG, so masternodes, through voting and instructions issued in this way to protectors, de facto control the operation of the trust and DCG as owners, without actually being them (Taylor, 2018). It should be noted that Dash's case illustrates the use by the DAO of the legal structure of a trust in the common law system (it is more difficult or impossible in statutory law systems). The legal institution of a trust differs from the legal concept of a company, including the rights of the entrusting party (in the case of entrusting assets to the trustee on the basis of a trust) and the rights of partners (in the case of the acquisition of shares or stocks). The entrusting party does not have such influence over the manner of managing the assets (which are fully managed by the trustee in the interest of the entrusting party), unlike the partners, to whom the articles of association and the law grant a number of rights with regard to the assets of the company and the manner in which they are managed.

Usually, financial instruments used in the financing process are issued and serviced outside of the project by specialized entities. Similarly, their trading (including organized trading) takes place outside of the project, if they are admitted to trading. The potential of blockchain technology enables, as indicated, the internalization of many processes, including the generation (issuing) of various financial instruments in accordance with the initiator's assumptions. However, this potential can be (and is) also used in solutions enabling automatic handling of organized trading in such instruments. Platforms for automatic and decentralized trading in digital tokens, most often collectively referred to as "decentralized exchanges" (DEXs) are constructed in such a way that they connect the parties to the exchange transaction without the operational participation of other entities and at the same time without the possibility of influence by other entities. They can be divided into several types:

- order-book-based exchanges (OBBs), where automatic mechanisms collect sales and purchase orders on an ongoing basis, and execute exchange transactions in the DVP (delivery versus payment) model, at the exchange rate resulting from the collected orders; principals exchange directly with others according to matching by the system (an example is StellarX), and a by-product of such an exchange is the exchange rate reflecting the relationship between demand and supply in the market;
- decentralized exchange offices (automated market makers or AMMs) are algorithmic token exchange platforms based on a liquidity pool, i.e., liquidity reserves entered into the system by independent users instead

of on order tables; transaction principals trade with the pool, not with other principals (examples include the Bancor and Uniswap protocols); these types of exchanges do not have the ability to determine the exchange rate reflecting the market, but require a predetermined rate (information provided by oracles) or use special pricing formulas (pricing curves) based on changes in the available pool of assets;

- p2p market platforms are platforms similar to distributed exchanges based on order tables, but with more control over order conditions; the exchange takes place on the basis of individual direct p2p relations – the principal (the buyer or seller) implements the selected offer, exchanging according to the parameters specified in the individual offer (for example, LocalCryptos);
- trading platforms are extensive solutions that enable taking long and short positions, including leveraged positions, often combined with lending platforms that provide the missing capital for leverage or include such functionalities in their own protocol; they also include mechanisms such as escrow and margin call (a broker call to supplement capital) (Sobiecki, 2021).

In principle, DEXs, unlike centralized cryptocurrency exchanges, are not certified. There are no asset-listing requirements. The consequence of this is that some token pools are intentionally misleading. For example, many tokens on the Uniswap exchange have the same USDC ticker symbol. A user who does not verify the relevant smart contract addresses can purchase worthless tokens with the same ticker.

Stock exchanges organizing the trading of financial instruments in the generally understood financing process play a complementary role, but they contribute to increasing the usefulness and value of project financing through the issue of financial instruments (securities). They give access to diversified financial instruments, enable them to be used freely, provide technical facilities to make settlements between the parties, pay dividends, and calculate interest. They increase the liquidity of shares in the project, provide information on the current market valuation of assets (based on actual transactions), enable the implementation of specific investment strategies and flexibly achieve capital benefits thanks to relatively high control over funds invested in these instruments. At the same time, centralized exchanges ensure the safety of trading – they protect clients (investors) against fraud and manipulation, provide financial data and legal compliance.

Decentralized exchanges in the investment financing process can contribute to greater decentralization and democratization of the investment process, which can help provide better availability of liquidity for project financing, and facilitate and encourage the so-called long tail of investors to entrust funds. As DEXs are fully operationally automated and operate on tokens, they can be an automatic recipient of tokens generated during the fundraising process, and at the same time reduce transaction costs related

to handling the trading process and, like centralized exchanges, increase liquidity in the markets, while in the event of limited liquidity, the valuation mechanisms used by automatic market makers almost always enable the execution of transactions and, at the same time, a relatively real market valuation of securities.

2.2.5 Unsecured loans

Loans (credits) are one of the most important financial instruments that provide capital, even to the largest projects. However, not all lending services in the decentralized finance ecosystem are suited to this purpose.

The vast majority of loan services (or loan functionalities within other services, for example, MakerDAO) require collateral with liquid funds (in the form of cryptocurrencies), the market value of which often significantly exceeds the market value of the borrowed crypto-asset. So-called overcollateral can be from 150% to 200% of the value of the borrowed cryptocurrency. This is the case, for example, in projects such as Aave, Compound and MakerDAO.

However, these loans are of little use from the point of view of project financing. They are useful only to a small group of borrowers – mainly margin traders and cryptocurrency holders who do not want to sell their positions. The collateral requirement has been one of the factors holding back the development of the decentralized finance industry (Clear Chain Capital, 2021).

Secured loans will be cheaper due to lower risks, but it is difficult to then think of them as a way of raising capital. From the point of view of financing the project, the key motivation is to obtain liquid funds in the absence of any tangible collateral – apart from the promise of future revenues.

Unsecured loans, however, require an examination of the borrowing capacity in order to assess the risk associated with granting the loan and calculate the interest rate and then calculate the maximum amount that can be granted. In a decentralized, anonymized environment, where as a rule users are identified by a cryptocurrency address, this was a key challenge, just like debt collection or bailiff enforcement in the event of a loan default. However, there have been a number of attempts to solve this problem. Decentralized loans can be partially secured by other liquid means (crypto-assets) unsecured by any assets, but also collateral loans.

Decentralized credit scoring combines aspects of both traditional and decentralized credit systems, taking into account off-chain data to calculate creditworthiness. Off-chain integration covers a wide range of information sources, from traditional credit reports to social media information (Packin and Lev Aretz, 2023). In the case of the Third-party Risk Assessment model, risk assessment is carried out by entities specializing in risk assessment. Borrowers must make liquidity available, which becomes a reserve in case of default. The Crypto Native Credit Scores model involves creating an

on-chain user profile using information about the user's existing on-chain activities. In this case, the assessment can be carried out automatically using specific assessment algorithms based on, for example: data on transfers from various chains, own or integrated data from various services on repayments of historical loans, data on profits from investments under DeFi, and trading activity data from exchanges. In the Off-chain Credit Integration Model, the credit score is based on credit data imported from off-chain, thus linking on-chain user profiles to available off-chain data, such as financial transactions and other trust signals. In the Personal Network Bootstrap model, borrowers must be approved directly by members of the lender group. The Real World Asset Loans (RWA loans) model is a decentralized version of a secured loan/mortgage. Tokenized real world assets (RWAs) are a loan repayment guarantee. These assets are assessed in terms of risks and accepted as a loan guarantee by the so-called asset originator (AO) – an intermediary company in the process that certifies the existence and origin of assets. A similar solution is the Digital Asset Loans model, which is prepared for leveraged loans. Assets are placed in smart contract until the loan is repaid. If the user is found to be trading with performance that threatens the ability to repay the loan, the contract may liquidate your position. The last known model is flash loans, which consist of the fact that both the loan and the repayment must take place within the same transaction (during the execution of one submitted order). The use of the loan may involve, for example, buying a token on one exchange and selling it (with a profit) on another. Although it is an unsecured loan, it is of little importance for the possibility of financing projects (Sobiecki, 2022, p. 401).

2.2.6 Anonymizing technologies

Blockchain is a technology that enables secure transactions and interactions as well as the use of financial services while maintaining a high level of anonymity (privacy). Moreover, the level of anonymity can be flexibly adjusted, usually at the design stage of the solution. Existing technological solutions enable almost full disclosure of the identity of entities, for example, addresses in the Bitcoin network used by cryptocurrency exchanges – both centralized and decentralized – are widely known. Thanks to the transparency of the network registry, one can trace the full history of deposits and withdrawals to this address. Solutions exist that make it possible to replace, in practical use, the addresses of the blockchain network, which consist of relatively long strings of alphanumeric characters, with shorter names selected by the user, similarly to a DNS system that replaces domain names (such as www.sgh.waw.pl) to the IP addresses of the machine assigned to this address (194.145.100.219), as communication on the Internet takes place according to these numbers. An example of such a solution is ENS (Ethereum Name Service). This means that a company using the Ethereum network that wants to be uniquely identified can use this address domain system. However, this

does not guarantee an unambiguous connection, as choosing a domain name does not require proving that the address holder is actually the company (or person) associated with the given name. This can be the source of many misunderstandings and deceptions. Therefore, projects are currently being developed that enable unambiguous identification in a decentralized environment – DIDs (decentralized identities), including ones that allow the user to independently create and control decentralized identifiers without the intermediation of trusted certification centres – SSIs/SSIDs (self-sovereign identities). Examples include DICE ID (Wipro), ION (Microsoft), AID:Tech and EDIW (EU) (Boyle, 2023, p. 3). These solutions will provide users of decentralized services with greater security, and will enable the identification of an entity they can turn to in the event of non-standard circumstances that go beyond smart contract operations. DIDs/SSIDs can also be used outside the ecosystem of decentralized services.

Most public solutions are pseudonymous, which means that they use pseudonyms (for example, addresses) that, after using appropriate tools with various data sources, make it possible (in many cases) to connect them to a real controlling entity. However, decentralized solutions exist that are focused on maximum possible anonymity and hiding all possible information about interactions while still guaranteeing the ability to prove that they took place. The most frequently mentioned of these are Beam, Monero (XMR), Horizen (ZEN), Dash, Verge and ZCash. They use technologies such as MimbleWimble, ring signatures, RingCT addresses and stealth addresses, and so-called zero-knowledge proofs, for example, zk-SNARKs. These solutions make it possible to hide sender addresses in transaction data recorded in the blockchain ledger, hide sensitive transaction information (the value, sender and recipient addresses), hide public and private keys used to sign transactions, mix funds from multiple transactions so that it is impossible to unambiguously identify the source of the funds, abandon the use of network addresses, and redirect traffic between blockchain network nodes and users to a Tor network, which hides the identity (IP) of users.

Ensuring privacy in the financing process – understood as not disclosing either investor data or data on the ownership of shares or transactions – may be an argument attracting some investors (although to date, it has been largely motivated by speculative reasons or the desire to manipulate the uncontrolled market). There is a condition, however, that the ensuring of privacy does not take place at the expense of eliminating the protection of the participants of this process. Civil law allows for the existence of "silent partners" in companies and the existence of OTC markets in which information about changes in owners is not publicly disclosed, and high privacy is also provided by the cash-based money system itself. At the same time, however, there are regulations to prevent the use of anonymity for money laundering and terrorist financing, or for tax avoidance. Full anonymity (completely preventing access to any information regarding activities in the financing and user identification processes) is not possible (for economic or legal reasons)

even on the free market, and is rarely expected by investors or clients. It is also not applicable for legal reasons that require the implementation of KYC processes in order to secure systems and markets against money laundering and terrorist financing. Blockchain, however, enables the construction of solutions that give control over privacy and the ability to control who has access to information.

2.2.7 Durable carrier

Due to high data redundancy, blockchain is not a solution designed to store large amounts of data. Data storage costs rule it out as a generalized database. It is adapted to applications that use records in the ledger – units that can represent carriers of values, rights and digital goods. The usefulness of the blockchain network consisting of the practical impossibility of modifying once-entered data works well as a method of recording various types of documents, while the document itself is not saved in the blockchain network, but only its representation, for example, in the form of a cryptographic abbreviation or an unambiguous reference to another system that stores the document. Thus, it provides a "notary" service that consists of confirming the content of the document and the time of its creation (recording). This property is used to ensure the transparency of public and private documents in closed business networks, and reduces the costs associated with printing and sending these documents to customers or contractors.

The technical potential of blockchain technology enables the implementation of regulatory obligations imposed by regulators on companies providing certain services (banking or insurance companies) to use a "durable medium". The requirement of immutability of information stored on a durable medium is emphasized in the judgments of the Court of Justice of the EU (CJEU). In the judgment of 5 July 2012, *Content Services Ltd v. Bundesarbeitskammer*,[8] the Court stated that a carrier can be considered durable if it guarantees the absence of changes in the content of the information that has been provided to the consumer (paragraph 43). A durable medium can, therefore, be used in the financing process to increase the transparency of document flow, which is all the more important the more independent stakeholders are associated with the project.

2.3 Examples of the concept of using DLT in investment projects

Many authors have already taken up the possibility of using blockchain technology to implement various financial processes (not necessarily with project financing in mind), emphasizing the potential of eliminating intermediaries in these processes, automating processes, reducing costs and time of their implementation and the implementation of side processes, consolidating accounting records, increasing privacy and data confidentiality with simultaneous transparency of processes, processes triggered by events

(immediately) instead of by orders (which are saved and awaiting execution), and direct access of investors to the market. Application was considered in such processes as value transfer, creation (generation), allocation (distribution), transfer and management, withdrawal (redemption), trading in financial instruments, clearing, settlements and audits. An analysis of the literature on blockchain applications in finance is cited, inter alia, by Pombo-Romero and Rúas-Barrosa (2022, pp. 5–6).

Some authors have also analysed the possibility of using blockchain technology in connection with the implementation of various investment project processes. Apart from the support of purely technical processes specific to production, construction and logistics activities, which are complementary from the point of view of the investment project, the proposed applications and analyses of their implementation include:

- crowdfunding based on utility tokens – ICO (Barsan, 2017, p. 55; Strausz, 2017, pp. 23–26; Chanson, Risiu and Wortmann, 2018, pp. 2–4; Lipusch, 2018, pp. 9–10; Panin et al., 2019, p. 250; Fisch et al., 2020, p. 86; Boreiko and Risteski, 2021, pp. 1063–1066; Chod and Lyandres, 2021, p. 5984; Hsieh and Oppermann, 2021, pp. 8–9);
- decentralized securitization[9] (Cohen et al., 2017; Sindle et al., 2017; Wandmacher and Wegmann, 2020; Pombo-Romero and Rúas-Barrosa, 2022);
- finance management (mainly automation of payments) (Ahmadisheykhsarmast and Sonmez, 2020; Chong and Diamantopoulos, 2020; Das et al., 2020; Hamledari and Fischer, 2021; Sigalov et al., 2021);
- resource tokenization (digital representation of assets on the blockchain)[10] (Wandmacher and Wegmann, 2020; Meinzer, 2022);
- co-creation of a project roadmap (Piccirillo et al., 2022);
- management of construction contracts (Msawil et al., 2022; Zhang et al., 2023);
- documentation management, design information flow, BIM (Ciotta et al., 2021; Erri Pradeep et al., 2021; Lee et al., 2021; Sigalov et al., 2021; Tao et al., 2021; Das et al., 2022); building information modelling is an integrated process of sharing project (construction project) data, supported by appropriate software;
- quality management (Barbon and Ranaldo, 2022);
- supporting the dispute resolution process (Saygili et al., 2022).

From the point of view of the process of financing capital-intensive investments, the following seem to be crucial: crowdfunding based on utility tokens and decentralized securitization.

The vast majority of projects that used ICOs were carried out in an unregulated environment, allowing funds to be raised (in the form of established cryptocurrencies or stablecoins) to build projects that themselves would use blockchain technology. In this form of crowdfunding, the innovative aspect

compared with existing crowdfunding is that the digital assets that are issued enable easy trading on the secondary market. The issued tokens are, as a rule, of a utility nature and give the holders voting rights or the right to participate in future profits, or are like a voucher to be exchanged for services provided by the project in the future. Projects that raise funds by issuing tokens may fall under the definition of regulated financial instruments in certain jurisdictions. Determining whether a given token is a security token is difficult, and often depends on a detailed description of the holders' rights in the issuance terms and conditions or functions performed by the token (see also Section 5.1). Many authors mention the benefits of using ICOs compared with other forms of financing – lower costs of raising funds (cost of capital), omission of intermediaries and direct access to investment benefits, shorter fundraising time and larger amounts that can be collected (Arnold et al., 2019, pp. 260–262).

As Lee and Parlour (2022, p. 1107) note, projects raising funds through ICOs are often financed by their future clients. Direct participation by small investors, while a key feature of crowdfunding, is limited in traditional indirect funding, as investors do not control banks' lending decisions, and regulations limit venture capital to accredited investors. In the standard corporate finance paradigm, capital providers, entrepreneurs and consumers are distinct groups. Intermediaries finance entrepreneurs who use the funds to produce and sell. Consumers are on the sidelines, passively generating revenue for the entrepreneur. Lee and Parlour (2022, p. 1114) show that even in the absence of typical frictions, such as moral hazard and asymmetry of information, indirect financing is not enough to finance all socially effective projects, and crowdfunding can significantly improve efficiency by financing projects that intermediaries give up. While brokers price projects based on the cash flow they generate, consumers also receive a consumption benefit. It is worth noting that according to Lee and Parlour, client investors do not own the project (the tokens do not reflect ownership of the project) and, therefore, the value (and valuation of tokens) for clients will be slightly lower than for investors who are owners. As a result, entrepreneurs implementing the project, retaining its ownership and striving mainly for profit compete with other projects for capital with similar characteristics. An innovative aspect of projects financed by ICOs (decentralized finance services) is also the fact that the creators and entrepreneurs developing the project after its launch can pay themselves remuneration not from profits or revenues generated by the service, but from the pool of capital collected, which results, firstly, from the desire to maintain the service as decentralized as possible, secondly, from the fact that entrepreneurs may not be able to extract the full cash surplus from consumers, for example, due to the competition between projects on the market and moderately high interest from the demand side, and thirdly, due to the fact that the potential return (BEP) on the project is distant in time. This also means that the indirect financing of such projects may not be effective or even possible, and at the same time, crowdfunding may improve

the productive efficiency of the economy by financing some projects that the intermediary abandons. Crowdfunding works as a consumer engagement tool: consumers choose to give up some of their future surplus so that a product can be produced. However, consumers, susceptible to liquidity shocks, strongly discount the value of production generated in the future. Therefore, crowdfunding is more likely to improve efficiency compared with indirect financing when the entrepreneur has little market power and the project is short term. The authors also note that crowdfunding presents a "free-riding" problem, but it can be overcome by offering discounts to initial investors or granting preferential access to the product market to investors and those who purchase claims from them on the secondary market. In the last conclusion, the authors also noted that despite the two types of benefits obtained by investors (flows resulting from the rights to the project, and consumption benefits), both types of benefits are correlated.

Chod and Lyandres (2021) developed a theory of financing entrepreneurial ventures with tokens that is not limited to ventures using blockchain technology. They compared token funding, which represents claims to venture outcomes, with traditional equity funding, focusing on agency issues and information asymmetry frictions associated with these two methods of funding, as well as on risk sharing between entrepreneurs and investors. Token funding introduces an agency problem that does not exist with equity funding (insufficient production), while reducing the agency problem often associated with equity funding (insufficient entrepreneurial effort). They showed that token funding can be more effective than traditional financing (equity) in the case of projects developing services that are associated with low marginal production costs, for which the entrepreneur's effort is crucial and the volatility of payments is low. At the same time, tokens may have an advantage over capital in signalling the quality of the venture to external investors. Risk-averse entrepreneurs can transfer the risks of a venture to diversified investors without having to relinquish control.

Catalini and Gans (2019, pp. 34–35) analysed the financing of projects using tokens, with the assumption that entrepreneurs raise funds by issuing tokens and undertake to accept these tokens only as payment for their products. The authors show that the ICO mechanism allows entrepreneurs to generate buyer competition for the token, which endows it with value. At the same time, they note that the returns from the venture are independent of the increase in token supply over time. The greatest value a trader can collect is when the supply of tokens does not increase to encourage early entrants to invest. This means that the supply of the token in this model significantly affects its valuation.

Garratt and van Oordt (2022, pp. 14–15) also analysed a model in which tokens are a means of payment for future products. They emphasize that the funds raised as part of an ICO do not mean "money for nothing". Although the entrepreneur does not, as a rule, sell ownership shares or promise investors to repay the debt, and undertakes to accept tokens as a means of

payment, this does not mean that the entrepreneur does not incur costs or that the issued token has no value. They also point out that the total amount that rational investors will pay for the tokens sold as part of an ICO is limited only to a fraction of the total expected sales revenue (depending on the price of the product sold in the future) over the entire duration of the project. The only time investors benefit is when they sell tokens to customers. Once the tokens are sold, the investors no longer benefit from the initial investment, even though the platform continues to operate, and equity ownership ensures investors share in dividends for the life of the project. The limit on the amount that can be raised through an ICO may undermine the benefits of ICO funding, as the amount may be less than the amount required for the initial investment, even if the project's net present value is positive. However, they also showed that for some projects and circumstances, an ICO may be the only form of financing that induces the entrepreneur's optimal effort.

Wang et al. (2022) analysed the ICO model assuming the existence of an additional phase of the ICO process (pre-ICO). Most often, in this closed phase, entrepreneurs give away (airdrop) or sell tokens to a limited, selected group of investors. The authors of the article analysed the participation of institutional investors in the pre-ICO phase, and came to the conclusion that the introduction of institutional investors increases the equilibrium price of tokens at the public offering stage (proper ICO phase), as well as the fluctuations of token prices over time.

Pombo-Romero and Rúas-Barrosa (2022, p. 21) explored the suitability of blockchain technology for creating more-efficient and less-expensive financial instruments adapted to photovoltaic irrigation (PVI) projects and various investors. In order to determine the benefits and risks associated with this concept, a solution was designed and implemented to carry out decentralized securitization (transformation of non-liquid assets – power purchase agreements (PPAs), into liquid ones – asset-backed securities (ABS) – receivables resulting from a PPA). Thanks to this solution, various SPV stakeholders interact with each other by exchanging cash and security tokens (ABS tokens) in accordance with the smart contract. The resulting application can perform the tasks and processes of traditional securitization without the need for financial intermediaries or trustees. Investors benefit from a higher level of transparency of relevant information, such as the performance of the underlying asset and the financial position of the SPV. The relative simplicity and high predictability of power purchase agreements (PPAs) make them particularly well-suited to be built into a smart contract and serve as collateral for security tokens. The authors show that blockchain can reduce securitization costs and counterparty risk, streamline transactions, enable real-time analytics that will increase transparency in ratings, allow more investors to participate, and reduce overall transaction costs as fewer intermediaries are needed. Moreover, it can create and operate a decentralized secondary market for such tokens, providing investors with liquidity at no significant cost.

Acknowledgement

Notes

1 Decentralized Autonomous Organization Toolkit, World Economic Forum, January 2023, www.weforum.org/reports/decentralized-autonomous-organizat ion-toolkit
2 DAO Entity Matrix, Paradigm, https://daos.paradigm.xyz
3 Dash documentation: Mining. Available at: https://docs.dash.org/en/stable/docs/ user/mining/index.html
4 Dash documentation: Features, https://docs.dash.org/en/stable/docs/user/introduct ion/features.html#block-reward-reallocation
5 Dash Budget Proposal Generator, https://proposal.dash.org/
6 Dash Central: Masternode monitoring and budget voting, www.dashcentral.org
7 Deed of Settlement constituting The DASH DAO Irrevocable Trust, https://assets. website-files.com/5713afec1b6331b577731396/6282520934c76c32925251ea_D ASH%20Deed%20of%20Settlement.pdf
8 Judgment of the Court (Third Chamber), 5 July 2012. *Content Services Ltd v Bundesarbeitskammer*, Case C-49/11, ECLI:EU:C:2012:419.
9 See too: Building A Mortgage Blockchain Ecosystem, Redwood Trust, Inc., www. redwoodtrust.com/about-redwood/primers-and-white-papers/detail/8267/build ing-a-mortgage-blockchain-ecosystem
10 The Tokenisation of Assets and Potential Implications for Financial Markets. OECD 2022.

Bibliography

Ahmadisheykhsarmast, S., Sonmez, R. (2020) 'A Smart Contract System for Security of Payment of Construction Contracts', *Automation in Construction*, 120, https:// doi.org/10.1016/j.autcon.2020.103401
Arnold, L., et al. (2019) 'Blockchain and Initial Coin Offerings: Blockchain's Implications for Crowdfunding', in H. Treiblmaier and R. Beck (eds) *Business Transformation through Blockchain* (Volume I). Cham: Springer International Publishing, https://doi.org/10.1007/978-3-319-98911-2_8
Balthazor, A.W. et al. (2023) Response to the Law Commission of England and Wales' DAOs Call for Evidence, Insights, Holland & Knight, www.hklaw.com/en/insights/ publications/2023/02/response-to-the-dao
Barbon, A., Ranaldo, A. (2022) 'On the Quality of Cryptocurrency Markets: Centralized Versus Decentralized Exchanges', *arXiv*. https://doi.org/10.48550/arXiv.2112.07386
Barsan, I.M. (2017) *Legal Challenges of Initial Coin Offerings (ICO)*. (November 2, 2017). Revue Trimestrielle de Droit Financier (RTDF), no 3 pp. 54–65, Available at SSRN: https://ssrn.com/abstract=3064397
Berg, C., Davidson, S., Potts, J. (2019) *Understanding the Blockchain Economy: An Introduction to Institutional Cryptoeconomics*. Cheltenham, UK: Edward Elgar Publishing.

Bizzer (2018) Why Fundraising DAOs will Revolutionize the Investment Industry?, Medium, 5 September, https://medium.com/@bizzer/why-fundraising-daos-will-revolutionize-the-investment-industry-460b20645461

Boreiko, D., Risteski, D. (2021) 'Serial and Large Investors in Initial Coin Offerings', *Small Business Economics*, 57(2), https://doi.org/10.1007/s11187-020-00338-8.

Boyle, K. (2023) Money, Tokens, and Games: Blockchain's Next Billion Users and Trillions in Value, www.citifirst.com.hk/home/upload/citi_research/rsch_pdf_30143792.pdf

Buterin, V. (2013) 'Bitcoin Network Shaken by Blockchain Fork', *Bitcoin Magazine – Bitcoin News, Articles and Expert Insights*, https://bitcoinmagazine.com/technical/bitcoin-network-shaken-by-blockchain-fork-1363144448

Catalini, C., Gans, J.S. (2019) *Initial Coin Offerings and the Value of Crypto Tokens*, Rochester: SSRN, https://doi.org/10.2139/ssrn.3137213

Chanson, M., Risius, M., Wortmann, F. (2018) 'Initial Coin Offerings (ICOs): An Introduction to the Novel Funding Mechanism Based on Blockchain Technology: Emergent Research Forum (ERF)', in *Proceedings of the 24th Americas Conference on Information Systems (AMCIS) [Preprint]*, www.alexandria.unisg.ch/259822/

Chod, J., Lyandres, E. (2021) 'A Theory of ICOs: Diversification, Agency, and Information Asymmetry', *Management Science*, 67(10), https://doi.org/10.1287/mnsc.2020.3754

Chong, H.-Y., Diamantopoulos, A. (2020) 'Integrating Advanced Technologies to Uphold Security of Payment: Data Flow Diagram', *Automation in Construction*, 114, https://doi.org/10.1016/j.autcon.2020.103158.

Cienfuegos, M. (2022) NFT Utility Classification—Current and Prospective Trends, Blockchain Biz, 5 November. https://medium.com/blockchain-biz/nft-utility-classification-current-and-prospective-trends-3fe0b0c5b43a

Ciotta, V., et al. (2021) 'Integration of Blockchains and Smart Contracts into Construction Information Flows: Proof-of-Concept', *Automation in Construction*, 132, https://doi.org/10.1016/j.autcon.2021.103925

Clear Chain Capital (2021) The Current State of Undercollateralized DeFi Lending — 2021, Coinmonks, 4 July, https://medium.com/coinmonks/the-current-state-of-undercollateralized-defi-lending-2021-1f84e14527b5

Cohen, L.R., Samuelson, L., Katz, H. (2017) 'How Securitization Can Benefit from Blockchain Technology', *The Journal of Structured Finance*, 23(2), https://doi.org/10.3905/jsf.2017.23.2.051

Das, M., Luo, H., Cheng, J.C.P. (2020) 'Securing Interim Payments in Construction Projects through a Blockchain-based Framework', *Automation in Construction*, 118, https://doi.org/10.1016/j.autcon.2020.103284

Erri Pradeep, A.S., et al. (2021) 'Blockchain-Aided Information Exchange Records for Design Liability Control and Improved Security', *Automation in Construction*, 126, https://doi.org/10.1016/j.autcon.2021.103667

Fisch, C., Meoli, M., Vismara, S. (2020) 'Does Blockchain Technology Democratize Entrepreneurial Finance? An Empirical Comparison of ICOs, Venture Capital, and REITs', *Economics of Innovation and New Technology*, 31(1–2), https://doi.org/10.1080/10438599.2020.1843991

Garratt, R.J., van Oordt, M.R.C. (2022) 'Entrepreneurial Incentives and the Role of Initial Coin Offerings', *Journal of Economic Dynamics and Control*, 142, https://doi.org/10.1016/j.jedc.2021.104171

Ghavi, A., et al. (2022) A Primer on DAOs, The Harvard Law School Forum on Corporate Governance, 17 September. https://corpgov.law.harvard.edu/2022/09/17/a-primer-on-daos/

Grigg, I. (2004) 'The Ricardian Contract', in *Proceedings of the First IEEE International Workshop on Electronic Contracting*. San Diego, CA: IEEE Computer Society (WEC '04).

Groves, K. (2023) *10 Cryptocurrencies that Are Faster to Send than Bitcoin in 2023*. HedgewithCrypto. www.hedgewithcrypto.com/fastest-crypto-to-transfer/

Haber, S., Stornetta, W.S. (1991) 'How to Time-Stamp a Digital Document', *Journal of Cryptology*, 3(2), 99–111.

Hamledari, H., Fischer, M. (2021) 'Construction Payment Automation Using Blockchain-Enabled Smart Contracts and Robotic Reality Capture Technologies', *Automation in Construction*, 132, https://doi.org/10.1016/j.autcon.2021.103926

Hsieh, H.-C., Oppermann, J. (2021) 'Initial Coin Offerings and Their Initial Returns', *Asia Pacific Management Review*, 26(1), https://doi.org/10.1016/j.apmrv.2020.05.003

Kamat, U. (2020) *Answer to "What is the length of largest known reorganization in bitcoin?"*. Bitcoin Stack Exchange, https://bitcoin.stackexchange.com/a/92981

Kopeć, A., Sobiecki, G., Piech, K. (2022) 'The Meaning of Decentralised Finance', in R. Aneja and R. Dygas (eds) *Digital Currencies and the New Global Financial System*. London: Routledge, https://doi.org/10.4324/9781003310365

Lee, D., et al. (2021) 'Integrated Digital Twin and Blockchain Framework to Support Accountable Information Sharing in Construction Projects', *Automation in Construction*, 127, https://doi.org/10.1016/j.autcon.2021.103688

Lee, J., Parlour, C.A. (2022) 'Consumers as Financiers: Consumer Surplus, Crowdfunding, and Initial Coin Offerings', *The Review of Financial Studies*, 35(3), https://doi.org/10.1093/rfs/hhab058

Lipusch, N. (2018) *Initial Coin Offerings – A Paradigm Shift in Funding Disruptive Innovation*. Rochester, NY: Elsevier, https://doi.org/10.2139/ssrn.3148181

Meinzer, K.F. (2022) *Tokenization – From Illiquid to Liquid Real Estate Ownership*, www.ey.com/en_ch/real-estate-hospitality-construction/tokenization-from-illiquid-to-liquid-real-estate-ownership

Mienert, B. (2021) 'How Can a Decentralized Autonomous Organization (DAO) Be Legally Structured?', *Legal Revolutionary Journal LRZ*, https://doi.org/10.2139/ssrn.3992329.

Moxoto, A.C.D., Melo, P., Soukiazes, E. (2021) 'Initial Coin Offering (ICO): a systematic review of the literature', in *Proceedings of the 54th Hawaii International Conference on System Sciences*, http://hdl.handle.net/10125/71124

Msawil, M., Greenwood, D., Kassem, M. (2022) 'A Systematic Evaluation of Blockchain-Enabled Contract Administration in Construction Projects', *Automation in Construction*, 143, https://doi.org/10.1016/j.autcon.2022.104553

Packin, N.G., Lev Aretz, Y. (2023) *Decentralized Credit Scoring: Black Box 3.0*. Rochester, NY: Elsevier, https://doi.org/10.2139/ssrn.4375920.

Panin, A., Kemell, K.-K., Hara, V. (2019) 'Initial Coin Offering (ICO) as a Fundraising Strategy: A Multiple Case Study on Success Factors', in S. Hyrynsalmi et al. (eds) *Software Business*. Cham: Springer International Publishing, https://doi.org/10.1007/978-3-030-33742-1_19.

Park, S.Y., Chun, K., Kim, M.-S. (2022) 'Understanding Decentralized Autonomous Organizations (DAOs) as a Reaction to Corporate Governance Problems', *Digital*

Strategy Review [Preprint], https://smatoos.org/article/33717-understanding-decentralized-autonomous-organizations-daos-as-a-reaction-to-corporate-governance-problems

Piccirillo, I.N., Amaral, D.C., De Oliveira, M.G. (2022) 'A Research Agenda for Collaborative Roadmapping Supported by Blockchain Technology', *Sustainability*, 14(20), https://doi.org/10.3390/su142013093

Pombo-Romero, J., Rúas-Barrosa, O. (2022) 'A Blockchain-Based Financial Instrument for the Decarbonization of Irrigated Agriculture', *Sustainability*, 14(14), https://doi.org/10.3390/su14148848

Samieifar, S., Baur, D.G. (2021) 'Read Me If You Can! An Analysis of ICO White Papers', *Finance Research Letters*, 38, https://doi.org/10.1016/j.frl.2020.101427

Saygili, M., Mert, I.E., Tokdemir, O.B. (2022) 'A Decentralized Structure to Reduce and Resolve Construction Disputes in a Hybrid Blockchain Network', *Automation in Construction*, 134, https://doi.org/10.1016/j.autcon.2021.104056

Sigalov, K., et al. (2021) 'Automated Payment and Contract Management in the Construction Industry by Integrating Building Information Modeling and Blockchain-Based Smart Contracts', *Applied Sciences*, 11(16), https://doi.org/10.3390/app11167653

Sindle, G., et al. (2017) *Applying Blockchain in Securitization: Opportunities for Reinvention*. London, UK: Deloitte, www2.deloitte.com/content/dam/Deloitte/us/Documents/regulatory/us-sfig-report-applying-blockchain-in-securitization-opportunities-for-reinvention.pdf

Sobiecki, G. (2021) 'Zdecentralizowane finanse (DeFi)', in Związek Banków Polskich (ed) *Blockchain w sektorze bankowym*. Warszawa, Polska: Centrum Prawa Bankowego i Informacji, https://bank.pl/wp-content/uploads/2021/12/Raport_Blockchain-w-sektorze-bankowym.pdf

Sobiecki, G. (2022) 'Zdecentralizowane finanse osobiste', in K. Waliszewski (ed) *Finanse osobiste*. Warszawa: Polska Akademia Nauk, https://publikacje.pan.pl/chapter/124238/waliszewski-red-krzysztof-finanse-osobiste-2022?language=pl

Southurst, J. (2021) *Blockchain Attacks and Reorgs: Experiences from the Past*, CoinGeek, https://coingeek.com/blockchain-attacks-and-reorgs-experiences-from-the-past/

Strausz, R. (2017) 'A Theory of Crowdfunding: A Mechanism Design Approach with Demand Uncertainty and Moral Hazard', *American Economic Review*, 107(6), https://doi.org/10.1257/aer.20151700.

Suvitha, M., Subha, R. (2021) 'A Survey on Smart Contract Platforms and Features', in *2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS)*, https://doi.org/10.1109/ICACCS51430.2021.9441970

Szabo, N. (1996) *Building Blocks for Digital Markets*, www.truevaluemetrics.org/DBpdfs/BlockChain/Nick-Szabo-Smart-Contracts-Building-Blocks-for-Digital-Markets-1996-14591.pdf

Tachachatwanich, P. (2022) *Cryptocurrency Fundraising for Dummies and Why It Matters to Startups and Investors*, Beacon Venture Capital, 22 March, www.beaconvc.fund/knowledge/cryptocurrency-fundraising-for-dummies-and-why-it-matters-to-startups-and-investors

Tao, X., et al. (2021) 'Distributed Common Data Environment Using Blockchain and Interplanetary File System for Secure BIM-based Collaborative Design', *Automation in Construction*, 130, https://doi.org/10.1016/j.autcon.2021.103851

Taylor, K. (2019) 'Fictions of the Final Frontier: Why the United States SPACE Act of 2015 Is Illegal', *Emory International Law Review*, 33(4),

Taylor, R. (2018) *Dash Core Group Legal Structure Details*, Dash Forum. www.dash. org/forum/threads/dash-core-group-legal-structure-details.39848/

Valenzuela, J. (2018) *Dash Core Releases Details of Legal Trust Structure Allowing Masternode Network to Own Property*, Dash News, 1 August, https://dashnews. org/dash-core-releases-details-of-legal-trust-structure-allowing-masternode-netw ork-to-own-property/

Wandmacher, R., Wegmann, N. (2020) 'Tokenization and Securitization – A Comparison with Reference to Distributed Ledger Technology', in Y. Thorhauer and C.A. Kexel (eds) *Facetten der Digitalisierung: Chancen und Herausforderungen für Mensch und Management*. Wiesbaden: Springer Fachmedien, https://doi.org/ 10.1007/978-3-658-29870-8_8

Wang, S. et al. (2022) 'What do institutional investors bring to initial coin offerings (ICOs)?', *Transportation Research Part E: Logistics and Transportation Review*, 167, https://doi.org/10.1016/j.tre.2022.102876.

Zhang, X., et al. (2023) 'Blockchain Applications for Construction Contract Management: A Systematic Literature Review', *Journal of Construction Engineering and Management*, 149(1), https://doi.org/10.1061/(asce)co.1943-7862.0002428

Ziolkowski, R., Miscione, G., Schwabe, G. (2020) 'Exploring Decentralized Autonomous Organizations: Towards Shared Interests and "Code is Constitution"', in *Forty-First International Conference on Information Systems (ICIS), Virtual (India)*, 13 December 2020–16 December 2020, https://doi.org/10.5167/UZH-193663

3 Legal consequences of the global nature of financing long-term and capital-intensive investments using DLT

Distributed ledger technology by its very nature has a global reach. Hence, the financing of investments using this technology can have such a reach, especially in relation to investments requiring very large capital and long implementation periods. However, it should be emphasized that such financing can also be carried out in a way limited to the territory of one country or even part of it, for example, using so-called local money. It seems that the biggest problems related to the globalization of financing do not lie in the technological or business sphere, but in the legal sphere (although at the beginning of the 2020s, phenomena appeared that limited the progress of globalization, such as a pandemic, a climate crisis and wars – primarily aggression of the Russian Federation against Ukraine, and thus tendencies to strengthen the self-sufficiency of individual economies and to shorten and simplify the supply chain intensified). The basic problem is created by the principle of territorial application of law, which is a consequence of the sovereignty of individual states. The law is created and applied by individual states, and the natural borders of the creation and application of law are the territorial borders of states. For example, to purchase a token, it is normally enough to visit a specific platform (website), which is available to anyone from any corner of the world.

As a rule, the criterion for applying a given law to a company is its registered office. This is particularly true of public law, as civil law (including private international law) offers more freedom here, giving the parties the opportunity to choose the applicable law and even non-state law (Takahashi, 2022, p. 354). Work on UNIDROIT Digital Assets and Private Law Principles, which is a system of non-state private law dedicated specifically to crypto-assets, is well advanced.[1] It should also be highlighted here that the legal systems of some countries are particularly predisposed to being chosen by the parties in the area of capital markets (for example, for the issue of financial instruments); such a legal system is, for example, the UK law (Jordan, 2021, pp. 30–31). Nevertheless, in order to safeguard the public interest and protect service recipients (including consumers), the countries where the service recipients (investors/stakeholders) have their registered office or residence

may prohibit the provision of certain services, limit the provision of such services and, above all, subject the provision of services to the regime of national law. This, in turn, may increase the costs of providing such services, and offset economies of scale (Lehmann, 2019, p. 120).

In the case of high-capital investments, state coercion and national justice systems will certainly be decisive for many years to come, and self-enforcing arbitral systems based on smart contracts are and will be used in the future to resolve a multitude of unrelated small claims that could not realistically be brought before country courts (Ortolani, 2019, p. 303).

Government agencies are governed by the law of the country that created and manages the given agency (in the case of EU agencies, this is EU law). However, for international organizations, the applicable law is indicated by the international agreement establishing the organization (see, for example, Articles 5 and 12 of the Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project).[2] If blockchain technology is controlled by a company, state agency or international organization, it is relatively simple to determine the law applicable to this technology. Currently, the most popular distributed ledger technology is blockchain technology. A company, state agency or international organization controls this technology when the blockchain is private (private blockchain). The problem with determining the relevant law arises when the blockchain is public – all or most of the nodes are controlled by various unrelated entities, and at the same time, there is no single entity controlling the software (as is the case of, for example, Bitcoin or, more important for the subject of this monograph, Ethereum). If the structure of the DAO has not been "imposed" on the structure of the company (a cooperative, a foundation or another legal person), there is a significant problem with determining the law applicable to such a decentralized organization.

The importance of the global nature of financing capital-intensive and long-term investments using DLT varies depending on the scope and method of using DLT in the solution supporting this process. For example, one can give the following examples (this is just one possible approach):

a The legal person issues tokens for "global" buyers;
b The legal person issues tokens for "global" buyers and at the same time operates a trading platform for "global" users;
c The issue of tokens for "global" buyers is carried out by a DAO (this is a fully decentralized issue based on the DeFi idea);
d The issue of tokens for "global" buyers is carried out by a DAO (fully decentralized issuance) and at the same time, the DAO runs a trading platform for "global" users.

Of course, various intermediate variants are possible, for example, the issuance of tokens can be decentralized only partially. In addition, a variant is

also possible in which one entity issues tokens while another entity conducts their public offering.

The issue of tokens (ICO, STO and IEO) should always be based on the relevant terms and conditions, which define the rights and obligations of the issuer and the buyer of the token. It is the provisions of these terms and conditions that are crucial for indicating the type of token and the appropriate legal regulation both for the issue of the token and then for trading this token. This is about indicating both the relevant regulation (for example, for securities or regulated electronic money) and the country whose law should apply to the issue or trading of a given token. It is common practice to use a whitepaper; however, this is usually not a document that meets the terms and conditions from a legal perspective (for more, see Section 5.1).

The regulations of large, global token issues contain provisions that are often convenient for the issuer, i.e., specifying as the applicable law the country of the issuer's registered office or a law convenient for the issuer. The court having jurisdiction over the issuer's registered office is also indicated. Such reservations are usually effective against entrepreneurs, but may be ineffective against consumers. This note also applies to operators of platforms that trade tokens (crypto-assets) globally. If the token issuer or platform operator is based on the EU, it must take into account Regulation (EC) No 593/2008 of the European Parliament and of the Council of 17 June 2008 on the law applicable to contractual obligations (Rome I)[3] and Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters.[4] Article 6(1) and (2) of the Rome I Regulation states that if the purchaser of tokens or the user of a token trading platform is a consumer residing in an EU country, the law of the consumer's country of residence shall apply to a dispute between him and the issuer or platform operator, irrespective of the provisions of the regulations. Moreover, under Article 18 of Regulation No 1215/2012, the consumer has the right to bring an action against the issuer or platform operator before the court competent for the place of residence of the consumer. It should be emphasized here that this consumer right cannot be excluded by the issuance regulations or the regulations of the operation of the crypto-asset trading platform.

Acknowledgement

Notes

1 Digital Assets and Private Law – 'UNIDROIT', 3 June 2021, www.unidroit. org/work-in-progress/digital-assets-and-private-law/; 'Issues Paper – Study LXXXII – W.G.7 – Doc. 3', in. UNIDOIT – Digital Assets and Private Law Working

Group 2022, www.unidroit.org/wp-content/uploads/2022/12/W.G.7-Doc.-3-Iss
ues-Paper.pdf
2 International Atomic Energy Agency, www.iaea.org/sites/default/files/publications/
documents/infcircs/2007/infcirc702.pdf
3 OJ L 177, 4.7.2008, p. 6 as amended.
4 OJ L 351 20.12.2012, p. 1 as amended.

Bibliography

Jordan, C. (2021) *International Capital Markets: Law and Institutions*. Oxford,
New York: Oxford University Press.
Lehmann, M. (2019) *Global Rules for a Global Market Place? – The Regulation and
Supervision of FinTech Providers.*, https://doi.org/10.2139/ssrn.3421963.
Ortolani, P. (2019) 'The Judicialization of the Blockchain', in P. Hacker et al. (eds)
Regulating Blockchain: Techno-Social and Legal Challenges. New York: Oxford
University Press, https://doi.org/10.1093/oso/9780198842187.003.0017.
Takahashi, K. (2022) 'Law Applicable to Proprietary Issues of Crypto-Assets',
Journal of Private International Law, 18(3), https://doi.org/10.1080/17441
048.2022.2138102.

4 Existing legal regulations of cryptocurrencies and crypto-assets in the context of financing long-term and capital-intensive investments using DLT

Together with the dissemination of blockchain technology and the increasingly wider use of cryptocurrencies – and recently also crypto-assets – in trading, the involvement of states in the area of legal regulation of this technology has gradually increased. Four approaches can be identified here: (a) a ban, which may be total or partial; (b) supervisory authorities conducting regulatory sandboxes, innovation hubs and public-private partnerships; (c) including cryptocurrencies (virtual currencies) in the existing legal regulations, primarily in the anti-money laundering and anti-terrorist financing regulations and tax regulations; and (d) creating legal acts dedicated to blockchain technology, whereby these regulations may only apply to virtual currencies (cryptocurrencies) or to the issue more broadly, i.e., regarding cryptocurrencies (virtual currencies) and crypto-assets (Srokosz, 2021, pp. 154–158). The latter trend, in particular, is currently the most popular.

In 2021, countries where cryptocurrencies were completely banned (an absolute ban) were China, Nepal, Egypt, Tunisia, Algeria, Mali, Iraq and Oman. On the other hand, countries with an implicit ban were Bahrain, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Ecuador, Gabon, Georgia, Guyana, Indonesia, Jordan, Kazakhstan, Kuwait, Lebanon, Lesotho, Libya, Macao, Maldives, Moldova, Morocco, Namibia, Niger, Nigeria, Pakistan, Palau, Qatar, Saudi Arabia, Senegal, Tajikistan, Tanzania, Togo, Turkey, Turkmenistan, United Arab Emirates, Vietnam and Zimbabwe.[1] An "implicit ban" is used in the following meaning: "prohibiting banks and other financial institutions from dealing in cryptocurrencies or offering services to individuals/businesses dealing in cryptocurrencies or banning cryptocurrency exchanges are examples of implicit bans". These prohibitions are important from the perspective of the subject of this monograph, because they exclude the indicated countries as countries of residence for companies or other legal persons managing a long-term or capital-intensive investment using DLT technology. These bans also exclude legal and natural persons from the group of potential investors

in long-term and capital-intensive investments using DLT, but only those having their registered office or place of residence in countries with a complete (absolute) ban. It is important to make it clear that these bans are highly variable over time – the best example being China, which in recent years has gone from full freedom for cryptocurrencies to a partial ban and then a complete ban (Haynes and Yeoh, 2020, pp. 206–211). Long-term investments using DLT should be planned taking into account the high volatility of countries' approaches to cryptocurrencies (and crypto-assets) in terms of their full legality.

Of lesser importance for the financing of long-term and capital-intensive investments is the conduct of regulatory sandboxes and innovation hubs by supervisory authorities in individual countries. Regulatory sandboxes "offer a controlled environment for testing financial innovations that meet certain criteria. Sandboxes tend to lower the barriers to testing within the existing regulatory framework while ensuring adequate protection for the parties involved".[2] In turn, innovation hubs mean that "financial regulators offer individual assistance to companies that usually do not apply financial regulations and/or have doubts as to whether certain regulations apply to their activities". Regulatory sandboxes and innovation hubs are important for start-ups, but they are particularly suitable for projects that are assumed to be capital intensive, which of course does not mean that entities conducting capital-intensive investments cannot use regulatory sandboxes or innovation hubs. From the perspective of the considerations in this monograph, it is important that by their very nature, regulatory sandboxes are poorly suited to supporting innovations that are cross-border, and therefore also global, in nature (Allen, 2022, pp. 143–144). However, there are actions being taken to overcome this weakness. In the literature, attention is drawn to, for example, an initiative of the supervisory authorities – "GFIN Cross-Border Testing" – which is used to develop regulatory sandboxes with a cross-border scope.[3] On the other hand, state initiatives in the public-private partnership area are of great importance for capital-intensive investments.

In the European Union in 2021, the aggregate value of public-private partnership transactions that reached financial close in the European market totalled EUR 8 billion (in 2020, it was EUR 9.2 billion), and the average transaction size decreased to EUR 201 million (EUR 215 million in 2020). Three large transactions were closed in 2021, compared with seven in 2020. Their aggregate value amounted to EUR 3.8 billion, representing 47% of the total market value. All three transactions concerned construction projects – road construction, i.e., the Pedemontana Lombarda Motorway (Italy) EUR 2.1 billion, the Aydin-Denizli-Burdur Motorway (Turkey) – EUR 1.1 billion, and the D4 Expressway (Haje-Mirotice) (Czech Republic) – EUR 530 million.[4]

In EU law, public-private partnership is regulated by Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014 on the award of concession contracts.[5] In the case of hybrid projects implemented in the 2021–2027 financial perspective, Regulation 2021/1060 applies.[6] The

above-mentioned EU legal acts on public-private partnership do not directly refer to the possibility of financing using DLT technology, nor do they contain separate, detailed regulations regarding capital-intensive and long-term investments (projects), but they could undoubtedly be applied to such investments, also in the case of DLT technology. It is true that Directives 2014/23/EU, 2014/24/EU and 2014/25/EU contain a legal definition of innovation, and Directive 2014/24/EU regulates innovation partnerships, but what we are discussing here is an innovative product, service or process, not an innovative way of financing investments, especially capital-intensive and long-term ones.

The introduction of regulatory sandboxes and innovation hubs was supposed to be an alternative to full supervision (Kohen, 2021), but it seems that the global cryptocurrency market, and above all the crypto-asset market, has already reached a stage of development where appropriate legal regulations are necessary, including state supervision performed by competent authorities. A relevant legal regulation was prepared by the EU – work on the draft Markets in Crypto-Assets Regulation (MiCA) Regulation[7] ended on 31 May 2023 (the final version of the MiCA[8] regulation was published on 9 June 2023 enters into force on 29 June 2023 and will apply from 30 December 2024 with some exceptions – see Article 149 of this regulation). The United States has been trying to regulate crypto-assets at the federal level for some time, and an important step in this direction is the issuance by President Joe Biden of the Executive Order on Ensuring Responsible Development of Digital Assets.[9] Prior to this, a federal attempt at cryptocurrency regulation failed – in December 2019 a bill entitled the "Crypto-Currency Act of 2020"[10] was submitted to Congress; it was supposed to be primarily aimed at clarifying which federal agencies regulate digital assets, obliging those agencies to notify the public of any federal licenses, certifications or registrations required to create or trade in such assets, and other purposes (Brett, 2019). The next legislative initiative at the federal level was presented in the Senate in June 2022 – a bill to provide for responsible financial innovation and to bring digital assets within the regulatory perimeter, entitled "Lummis-Gillibrand Responsible Financial Innovation Act" ("RFIA")[11] (Arciniegas and Conner, 2022, p. 9 and next; Dewey and Patel, 2023).

It is worth noting here the position of UNCTAD (United Nations Conference on Trade and Development), which calls on authorities "to regulate crypto exchanges, digital wallets and decentralized finance to ensure the comprehensive financial regulation of cryptocurrencies". Moreover, UNCTAD considers that "regulated financial institutions should be banned from holding cryptocurrencies, including stablecoins, or offering related products to their clients".[12]

As regards existing regulations, they should be divided into two types: those that apply narrowly to cryptocurrencies (virtual currencies), primarily in the context of exchanging cryptocurrencies (virtual currencies) for legal means of payment (restriction of the operation of cryptocurrency exchanges and

cryptocurrency exchange offices), possibly additionally in their payment aspect, and those that deal with the subject in its entirety regarding crypto-assets, thus also tokenization.

An example of the first, narrow regulation relating mainly to the regulation of the operation of cryptocurrency exchanges (and cryptocurrency exchange offices) is the provisions contained in the Estonian Act on Counteracting Money Laundering and Terrorist Financing of 2017,[13] in the Polish Act of 1 March 2018 on Counteracting Money Laundering and Terrorist Financing,[14] and in the UK's The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017.[15] In this narrow regulation, in EU countries, the definition of virtual currencies from the Anti-Money Laundering (AML) V Directive[16] applies, according to which virtual currencies mean a digital representation of value that is not issued or guaranteed by a central bank or a public authority, is not necessarily attached to a legally established currency and does not possess a legal status of currency or money, but is accepted by natural or legal persons as a means of exchange and which can be transferred, stored and traded electronically. This approach will change in 2025 with the application of the MiCA Regulation and the amendments to the AML V Directive, and later, from July 2027, with the application of Regulation 2024/1624 of the European Parliament and of the Council of 31 May 2024 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing[17] and directive 2024/1640 of the European Parliament and of the Council of 31 May 2024 on the mechanisms to be put in place by Member States for the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, amending Directive 2019/1937, and amending and repealing Directive 2015/849[18] (more see Section 5.3).

An example of a country transitioning from such narrow regulation to comprehensive regulation of crypto-assets is Japan and, characteristically, such regulation in Japan was included in the framework of the regulations on payment services – the Payment Services Act,[19] amended in 2022. In turn, for example, in the state of New York, the so-called BitLicense,[20] i.e., a legal act that, admittedly, only applies to virtual currency business activity, covering primarily the activities of cryptocurrency exchanges and exchange offices and the activities of virtual wallet providers. However, in addition to the licensing rules, this act also defines the operating conditions, elements of capital requirements, obligations in the field of counteracting money laundering and financing terrorism, consumer protection as well as requirements regarding cybersecurity of licensed entities. These regulations are, however, too narrow in scope to be of significant importance for long-term and capital-intensive investments using DLT. For such investments, only legal acts that apply to crypto-assets, and thus tokenization, are relevant. There are increasingly more such legal acts from year to year, with the aforementioned EU MiCA Regulation being of key importance on a global scale (it will apply without the need for implementation throughout the EU). Still, some – to date only

a few – EU Member States and European Economic Area countries already have their own legal regulation regarding crypto-assets. These are Malta (Virtual Financial Assets Act),[21] Gibraltar (Distributed Ledger Technology Providers Regulations 2017)[22] and Liechtenstein (Token and TT Service Provider Act; TVTG).[23] In the United States, regulations exist in the State of Illinois – the Blockchain Technology Act,[24] the State of Wyoming – the Wyoming Utility Token Act[25] and Wyoming Money Transmitter Act,[26] the State of Nebraska – the Nebraska Financial Innovation Act,[27] the State of California – the Digital Financial Assets Law, which was ultimately vetoed in 2022 (Bishop, 2023; Dye and Lipana, 2022) and the State of Colorado – the Colorado Digital Token Act.[28]

These provisions introduce the regulation of activities related to crypto-assets, but the indicated regulations do not use the same terminology, and none of them use the term "crypto-assets" directly, which makes it difficult to implement cross-border projects (investments), not to mention global ones. They use such terms such as "DLT asset" (Malta Virtual Financial Assets Act), "value" (Gibraltar Distributed Ledger Technology Providers Regulations 2017), "token" (Liechtenstein TVTG), "open blockchain token" (Wyoming Utility Token Act), "digital asset" (Nebraska Financial Innovation Act) "digital financial asset" (California Digital Financial Assets Law) and "digital token" (Colorado Digital Token Act). This is generally about crypto-assets that are not classified as securities (or more broadly as financial instruments). Crypto-assets that are financial instruments, including securities, are subject to the relevant regulations for financial instruments, including securities (for more, see Section 3.3). Regulation usually consists of the requirement to obtain an authorization (license), or at least an entry in the relevant register.

In particular, it should be emphasized and highlighted from the perspective of the subject of this monograph that the above-mentioned regulations relating to crypto-assets, as a rule, do not apply to decentralized autonomous organizations (DAOs) that are not subject to the legal and organizational form of the company (i.e., they may apply to companies whose functioning has been supported by a DAO).

The MiCA Regulation stands out from the above-mentioned regulations in Europe and the United States. Its material scope is very broad, particularly against the background of the above-mentioned already existing regulations. The scope of the regulation will cover the issuance of crypto-assets in the EU, the offering of crypto-assets in the EU, and the provision of services related to cryptocurrency trading in the EU (but also under the MiCA Regulation, the principle will be maintained that relevant regulations on financial instruments, including securities, will be applicable to crypto-assets classified as securities, and more broadly financial instruments). Legal persons conducting a capital-intensive and long-term cross-border (global) investment involving the issuance of crypto-assets in the EU, the offering of crypto-assets in the EU, and the provision of services related to cryptocurrency trading in the EU

will be obliged to obtain the appropriate authorization even if they are based outside the EU. It is difficult to assume that such an investment, since it is to be global in nature, will be able to be carried out without the participation of EU clients. Undoubtedly, the provisions of the MiCA Regulation will set the direction of EU regulation for at least the next decade. Importantly, they will also have a strong impact on the regulations of non-EU countries. Observing the direction of legislation in the EU and in the United States, one can get the impression that the EU focuses on comprehensive regulation.

For the subject scope of the MiCA Regulation, of crucial importance are the concept of crypto-assets, definitions of individual types of tokens, the concept of issuing crypto-assets and offering crypto-assets, and the concept of crypto-asset services. The definition of crypto-assets changed significantly during the work being done on the MiCA Regulation (Tomczak, 2022, p. 367 and next). In the final version of the regulation MiCA, " 'crypto-asset' means a digital representation of a value or a right that is able to be transferred and stored electronically, using distributed ledger technology or similar technology". This definition is related to the definition of crypto-assets preferred by the FSB (Financial Stability Board) and IOSCO (International Organization of Securities Commissions), which accept that "crypto-assets are a type of private asset that depends primarily on cryptography and DLT or similar technology, as part of its perceived, or inherent value".[29] However, the definition contained in the MiCA Regulation seems broader, as it emphasizes that crypto-assets are a digital representation, while the IOSCO and FSB definitions explicitly treat crypto-assets as "private assets". Unification of terminology, including the introduction of a single definition of crypto-assets, and more broadly, the unification of the regulation on crypto-assets in all EU countries, which will happen after the entry into force of the MiCA Regulation, will favour and facilitate the implementation of global projects, including the financing of capital-intensive and long-term investments.

It is worth adding here as a side note that the definition of crypto-assets from the MiCA Regulation will apply primarily to public law regulations. For civil law relationships, for example, the definition of a digital asset from may apply UNIDROIT Digital Assets and Private Law Principles (December 2022),[30] which seems broader and even more technologically neutral: "Digital asset means an electronic record which is capable of being subject to control", while "electronic record means information which is (i) stored in an electronic medium and (ii) capable of being retrieved".

The MiCA Regulation distinguishes the following types of crypto-assets: asset-referenced token (ART), e-money token (EMT) and utility token (UT), which does not fully correspond to the current division of tokens made in practice and by supervisory authorities, where there are also payment tokens (see more in Section 3.4), but is justified by the main goal of the MiCA Regulation, which is the legal regulation of stablecoins, in particular the so-called global stablecoins. It should be emphasized that the reason for

undertaking legislative work on the MiCA Regulation, apart from the general need to regulate the dynamically developing crypto-asset market, is first and foremost the fear of EU countries and central banks against the so-called stablecoins, mainly the so-called global stablecoins.[31]

The British FCA distinguishes between exchange tokens, security tokens and utility tokens.[32] Similarly, Swiss supervisory authorities (FINMA – the Swiss Financial Market Supervisory Authority) distinguish payment tokens, utility tokens, asset tokens and hybrid tokens.[33] The MiCA Regulation does not use the term and concept of a payment token (payment tokens are mentioned only in point 2 of the recitals); however, the MiCA Regulation will obviously apply to payment tokens – in particular ART and EMT tokens are payment tokens.

The definition of "crypto-asset service" proposed in the MiCA Regulation is relevant for the practice of the functioning of a platform aimed at financing long-term and capital-intensive investments. This means any of the services and activities listed below relating to any crypto-asset:

a   providing custody and administration of crypto-assets on behalf of clients;
b   operation of a trading platform for crypto-assets;
c   exchange of crypto-assets for funds;
d   exchange of crypto-assets for other crypto-assets;
e   execution of orders for crypto-assets on behalf of clients;
f   placing of crypto-assets;
g   reception and transmission of orders for crypto-assets on behalf of clients;
h   providing advice on crypto-assets;
i   providing portfolio management on crypto-assets;
j   providing transfer services for crypto-assets on behalf of clients.

The entry into force of the MiCA Regulation will fill a gap consisting of a lack of regulation of the intensively developing crypto-asset market in those areas that are not covered by the provisions of the Regulation of the Single Financial Market existing in the EU, i.e., capital market regulations (mainly issues, offers and trading in financial instruments) and the payment services market, including regulated electronic money (for more on these provisions, see Sections 3.3 and 3.4). Thus, there will be a fully regulated process of issuing and offering tokens – in practice usually called an ICO – although other names are also used, depending on the legal classification of the issued token. Depending on the type of tokens issued and offered, this process could either be governed by the existing regulations (for example, regarding the issue and offering of financial instruments or the issue of electronic money), or the process was not regulated and, as a rule, MiCA will apply in this unregulated scope. In particular, the lack of ICO regulations leads to a number of irregularities, distortions or even fraud, which primarily affects small investors (consumers).

A solid, scientific study of over 1,000 ICOs showed that:

- in 31% of cases, whitepapers did not contain information about initiators or backers;
- in 57.68% of cases, whitepapers do not provide the name of the initiator or any background information on them, such as the address;
- in over 96% of cases, whitepapers are silent on whether the funding to be provided by participants will be pooled or remain segregated (Zetzsche et al., 2018, pp. 279–289).

It is worth noting here that in 2017, only 48% of ICOs were successful, but startups still managed to raise $5.6 billion (Williams-Grut, 2018). These data show the scale of risk to which consumers (including small investors) are exposed, and at the same time, they justify the need for full regulation of the ICO phenomenon.

The April 2022 version of the draft MiCA Regulation developed by the European Parliament[34] defines DAO: "'a decentralised autonomous organization' means a rule-based organizational system that is not controlled by any central authority and whose rules are entirely routed in its algorithm". The October 2022[35] and final versions no longer include this definition. The recitals of the October 2022 version of the draft state, however, that if crypto-asset services are provided in a fully decentralized manner, without an intermediary, they will not fall within the scope of the MiCA Regulation (see point 12a of the draft MiCA Regulation recitals of October 2022; same: recital 22 of the final version of MiCA Regulation). The MiCA Regulation will, therefore, apply to the provision of services in the field of crypto-assets, which will be provided at least in part in a centralized manner. Undoubtedly, it will be a significant challenge in practice and for jurisprudence to determine when it is possible to agree on full decentralization. Moreover, as underlined in recital 22 final version of MiCA Regulation,

> where crypto-assets have no identifiable issuer, they should not fall within the scope of Title II [crypto-Assets, other than asset-referenced tokens or e-money tokens], III [asset-referenced tokens] or IV [electronic money tokens] of this Regulation. Crypto-asset service providers providing services in respect of such crypto-assets should, however, be covered by this Regulation.

Therefore, the DAO in the field of token issuance will, in principle, not be covered by the provisions of the MiCA Regulation contained in Title II, III or IV. Platforms operated by a legal or natural person providing services in the field of crypto-assets may be fully subject to the MiCA Regulation (e.g., cryptocurrency exchanges). For now, the question remains whether in the light of the legislative process and the removal of the DAO definition from the MiCA Regulation (in the early 2022 version), platforms based solely on

the DAO structure should be considered fully decentralized. For such a distinction, it may prove important, for example, who provides the software for the platform – whether it is a legal person (company, foundation), or whether the platform operates on open-source software prepared by the so-called community. In practice, however, there is no doubt that Article 62 of the MiCA Regulation (concerning the authorization to operate as a crypto-assets service provider) cannot apply to DAOs.

In 2022, there was no legal regulation in any country in the world directly concerning DeFi, and there was also no single, established understanding of the concept of DeFi, including on the basis of the application of law.[36] If the financing of long-term and capital-intensive investments is based on the DeFi structure, in whole or in part, it should rather be expected that the crypto-asset regulations will apply only to some DeFi elements, for example, token issuance or token trading on the platform. In the event of further intensive development of DeFi, however, a separate legal regulation dedicated solely to DeFi cannot be ruled out in the future, which should be taken into account due to the long-term nature of the investment.

Acknowledgement

Notes

1 Regulation of Cryptocurrency Around the World: November 2021 Update. The Law Library of Congress.
2 EIOPA InsurTech Roundtable. How technology and data are reshaping the insurance landscape. Summary from the roundtable organised by EIOPA on 28 April 2017, https://register.eiopa.europa.eu/Publications/Reports/08.0_EIOPA-BoS17-165_EIOPA_InsurTech_Roundtable_summary.pdf
3 Cross-Border Testing, GFIN. Available at: www.thegfin.com/crossborder-testing
4 Market Update. Review of the European public-private partnership market in 2021. European Investment Bank, p. 1, www.eib.org/en/publications/epec-market-update-2021
5 OJ L 94, 28.3.2014, pp. 1–64.
6 Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy, OJ L 231, 30.6.2021, pp. 159–706.
7 Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937 (COM/2020/593 final).

8 Regulation 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No. 1093/2010 and (EU) No. 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937 (OJ L 150, 9.6.2023, pp. 40–205).

 9 Executive Order on Ensuring Responsible Development of Digital Assets, The White House 2022, www.whitehouse.gov/briefing-room/presidential-actions/2022/03/09/executive-order-on-ensuring-responsible-development-of-digital-assets/

10 The Library of Congress, www.congress.gov/bill/116th-congress/house-bill/6154/all-info?s=1&r=1

11 The Library of Congress, www.congress.gov/bill/117th-congress/senate-bill/4356/all-info

12 UN trade body calls for halting cryptocurrency rise in developing countries | UN News 2022, https://news.un.org/en/story/2022/08/112436

13 Rahapesu ja terrorismi rahastamise tõkestamise seadus Vastu võetud 26.10.2017, RT I, 17.11.2017, www.riigiteataja.ee/akt/121112020013; www.riigiteataja.ee/en/eli/517112017003/consolide

14 *Journal of Laws* 2022, item 593 as amended.

15 The Money Laundering, Terrorist Financing and Transfer of Funds (Information on the Payer) Regulations 2017, No. 692. www.legislation.gov.uk/uksi/2017/692/contents/made#pageTitle

16 Directive 2015/849 of the European Parliament and of the Council of 20 May 2015 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, amending Regulation (EU) No. 648/2012 of the European Parliament and of the Council, and repealing Directive 2005/60/EC of the European Parliament and of the Council and Commission Directive 2006/70/EC, OJ L 141, 5.6.2015, pp. 73–117, as amended.

17 OJ L, 2024/1624, 19.6.2024.

18 OJ L, 2024/1640, 19.6.2024.

19 Payment Services Act (No. 59 of 2009), www.japaneselawtranslation.go.jp/en/laws/view/3965/enhttps://www.loc.gov/law/help/cryptocurrency/japan.php

20 N.Y. Comp. Codes R. & Regs. Tit. 23, § 200 (2015), Official Compilation of Codes, Rules and Regulations of the State of New York Title 23. Financial Services Chapter I. Regulations of the Superintendent of Financial Services Part 200. Virtual Currencies.

21 Virtual Financial Assets Act (CAP. 590), L.N. of 2018; https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=NIM:202103962; https://legislation.mt/eli/cap/590/eng/pdf

22 Financial Services (Distributed Ledger Technology Providers) Regulations 2017, Legal Notice No. 204/2017, Gibraltar Gazette No. 4401 (12 October 2017), https://perma.cc/QG2W-8TQ6

23 Token and TT Service Provider Act: Gesetz vom 3. Oktober 2019 über Token und VT-Dienstleister (Law of 3 October 2019 on Tokens and TT Service Providers (Token and TT Service Provider Act; TVTG)) Serial number (LR-Nr 950.6.), www.lcx.com/wp-content/uploads/2020_Liechtenstein_Blockcchain_Laws_Translation_English.pdf

24 Financial Regulation (205 ILCS 730/) Blockchain Technology Act; www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=4030&ChapterID=20 (Accessed: 12 April 2023, access only from US territory).

25 Wyo. Stat. Ann. § 34-29-101 to 34-29-105, https://wyoleg.gov/statutes/compress/title34.pdf
26 Wyo. Stat. Ann. § 40-22-101 to 40-22-129, https://wyoleg.gov/statutes/compress/title40.pdf
27 2021 NE L 649, https://custom.statenet.com/public/resources.cgi?id=ID:bill:NE2021000L649&ciq=urn:user:PA6792530&client_md=641676d8d62dcc3f6ddf370c2d7d2733&mode=current_text
28 Colo. Rev. Stat. Ann. § 11-51-308.7, https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_023_01.pdf
29 Issues, Risks and Regulatory Considerations Relating to Crypto-Asset Trading Platforms. Final Report. Board of the International Organization of Securities Commissions, February 2020, p. 3, www.iosco.org/library/pubdocs/pdf/IOSCOPD649.pdf; Crypto-asset markets Potential channels for future financial stability implications, Financial Stability Board, October 2018, p. 3, www.fsb.org/wp-content/uploads/P101018.pdf
30 The International Institute for the Unification of Private Law, www.unidroit.org/wp-content/uploads/2022/12/W.G.7-Doc.-3-Issues-Paper.pdf
31 Joint statement by the Council and the Commission on "stablecoins", 5.12.2019.
32 Financial Conduct Authority, Guidance on Cryptoassets. Consultation Paper CP19/3, January 2019, p. 8.
33 FINMA Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs), Published 16 February 2018, p. 3.
34 MiCA: Proposal for a regulation on Markets in crypto-assets – Three-column table to commence trilogues, ST 7694 2022 INIT, 1.04.2022, https://data.consilium.europa.eu/doc/document/ST-7694-2022-INIT/en/pdf
35 Letter to the Chair of the European Parliament Committee on Economic and Monetary Affairs, Brussels 5 October 2022, ECOFIN 965, 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_13198_2022_INIT&from=En
36 IOSCO Decentralized Finance Report, the Board of IOSCO, March 2020, p. 1, www.iosco.org/library/pubdocs/pdf/IOSCOPD699.pdf

Bibliography

Allen, H.J. (2022) *Driverless Finance: Fintech's Impact on Financial Stability*. Oxford, New York: Oxford University Press.

Arciniegas, J., Conner, W.T. (2022) 'The Digital Asset Regulatory Landscape Begins to Take Shape: The Responsible Financial Innovation Act', *The Investment Lawyer. Covering Legal and Regulatory Issues of Asset Management*, 29(10), https://intelliconnect.cch.com/docmedia/attach/WKUS-TAL-DOCS-PHC/46/IIVL_IL_1022.pdf

Bishop, K.P. (2023) 'Assembly Member Takes Another Run at Digital Financial Asset Law', The National Law Review, 6 February, www.natlawreview.com/article/assembly-member-takes-another-run-digital-financial-asset-law

Brett, J. (2019) 'Congress Considers Federal Crypto Regulators In New Cryptocurrency Act Of 2020', *Forbes*, 19 December, www.forbes.com/sites/jasonbrett/2019/12/19/congress-considers-federal-crypto-regulators-in-new-cryptocurrency-act-of-2020/

Dewey J., Patel S. (2023) 'Blockchain & Cryptocurrency Laws and Regulations 2023', USA.

Dhanani, A., Hausman, B.J. (2022) 'Decentralized Autonomous Organizations', *Intellectual Property Technology Law Journal*, 34(5), www.bakerbotts.com/thought-leadership/publications/2022/may/decentralized-autonomous-organizations

Dye, B., Lipana, L.S. (2022) 'What the Veto of California's Digital Financial Assets Law Means for the Future of Cryptocurrency Regulation', JD Supra, www.jdsupra.com/legalnews/what-the-veto-of-california-s-digital-7546857/

Haynes, A., Yeoh, P. (2020) *Cryptocurrencies and Cryptoassets: Regulatory and Legal Issues*. Routledge, www.routledge.com/Cryptocurrencies-and-Cryptoassets-Regulatory-and-Legal-Issues/Haynes-Yeoh/p/book/9780367486365

Kohen, M.E. (2021) 'State Regulations on Virtual Currency and Blockchain Technologies (Updated March 2021)', www.carltonfields.com/insights/publications/2021/state-regulations-virtual-currency-blockchain-tech

Srokosz, W. (2021) 'Supervisory Issues Over Blockchain-based Activities', in L. Gąsiorkiewicz, J. Monkiewicz (eds) *Innovation in Financial Services: Balancing Public and Private Interests*. Londyn: Routledge.

Tomczak T. (2022), 'Crypto-Assets and Crypto-Assets' Subcategories Under MiCA Regulation', *Capital Markets Law Journal*, 17(3), https://doi.org/10.1093/cmlj/kmac008

Williams-Grut, O. (2018) 'Only 48% of ICOs were successful last year — but startups still managed to raise $5.6 billion', Business Insider, www.businessinsider.com/how-much-raised-icos-2017-tokendata-2017-2018-1

Zetzsche, D.A., et al. (2018) *The ICO Gold Rush: It's a Scam, It's a Bubble, It's a Super Challenge for Regulators*. University of Luxembourg Law Working Paper No. 11/2017, UNSW Law Research Paper No. 17-83. https://doi.org/10.2139/ssrn.3072298

5 Selected aspects of the application of public law to capital-intensive and long-term investments using DLT

5.1 Capital market law in the context of financing long-term and capital-intensive investments using DLT

The development of blockchain technology has led to the phenomenon of so-called tokenization. According to IOSCO (the International Organization of Securities Commissions), this is "the process of digitally representing an asset, or ownership of an asset. A token represents an asset or ownership of an asset. Such assets can be currencies, commodities or securities or properties".[1] If distributed ledger technology (DLT) is to be used to finance capital-intensive and long-term investments, undoubtedly one of the greatest benefits provided by this technology is the possibility of issuing investment or share tokens either by legal entities, or – which seems to be the most beneficial – via DAO. However, the question arises whether investment or equity tokens issued to finance a long-term and capital-intensive investment are transferable securities within the meaning of the law. Alternatively, more broadly, are they a financial instrument other than a security within the meaning of the law, for example, bonds, options, futures, swaps, forward rate agreements or any others derivatives? The classification of such a token as a security (and more broadly, a financial instrument) is also important from the perspective of trading in such a token. Currently, it is standard that the issue of securities and a number of other financial instruments and then trading in them is subject to advanced legal regulation. For example, in the EU, such regulation is contained primarily in the MiFID 2 Directive[2] and the MiFIR Regulation,[3] as well as in the UCITS IV[4] and V directives,[5] and in Directive 2011/61/EU. In the United States, on the other hand, this issue is regulated by a number of federal and state legal acts, while at the level of federal law, such legal acts as the Securities Exchange Act and Trust Indenture Act, but in the United States, due to the common law system, court decisions are of key importance here. In the United Kingdom, where common law also applies, such a basic regulation is the Financial Services and Markets Act 2000 (FSMA 2000), which was substantially amended by the Financial Services Act 2012 (FSA 2012).

When analysing the financing of long-term investments, one cannot lose sight of the capital markets of China and Islamic countries (which are

regulated by Islamic law). The importance of these markets will most likely only increase in the coming decades (Jordan, 2021, p. 392).

From the perspective of qualifying tokens as securities or, more broadly, as financial instruments, two approaches to the definition of securities and the definition of financial instruments may be useful: narrow and broad. In the narrow sense, the relevant legal act (which regulates financial instruments) contains a closed catalog of securities or applies the civil law notion of securities. An example is MiFID2. According to Article 4(1)(44) MiFID2, "transferable securities" means those classes of securities which are negotiable on the capital market, with the exception of instruments of payment, such as:

a   shares in companies and other securities equivalent to shares in companies, partnerships or other entities and depositary receipts in respect of shares;
b   bonds or other forms of securitized debt, including depositary receipts in respect of such securities;
c   any other securities giving the right to acquire or sell any such transferable securities or giving rise to a cash settlement determined by reference to transferable securities, currencies, interest rates or yields, commodities or other indices or measures.

However, it should be emphasized here that the terms used in this definition, such as "shares in companies", "other securities equivalent to shares in companies" and "bonds" should be understood (and defined) in accordance with the law of the given Member State.

As indicated in the literature, the concept of financial instruments has been defined by reference to catalog of financial instruments includes Annex I Section C MiFID 2 (Lieverse, 2017, p. 43). There is no need to quote the entire content of Section C here, but it is worth pointing out the most important items of this catalog of financial instruments, i.e.:

-   transferable securities;
-   money-market instruments;
-   units in collective investment undertakings;
-   options, futures, swaps.

The concept of financial instruments (defined by a reference to Section C) determines range the scope of application of MiFID 2 in the sense that MiFID 2 regulates investment services and activities to the extent only that these relate to financial instruments (Lieverse, 2017, p. 43).

In the broad sense, a legal act contains an open catalog of securities or indicates only some features of securities, and the decision whether a security (financial instrument) exists in a given factual situation may be taken by a supervisory authority or a court. Such an open catalog of securities is contained in the American Securities Act. Under Section 2(a)(1) of the Securities Act and Section 3(a)(10) of the Exchange Act, a security includes

"an investment contract". An investment contract is an investment of money in a common enterprise with a reasonable expectation of profits to be derived from the entrepreneurial or managerial efforts of others. The "touchstone" of an investment contract "is the presence of an investment in a common venture premised on a reasonable expectation of profits to be derived from the entrepreneurial or managerial efforts of others".

In the United States, it is assumed that whether a token is an "investment contract" and, therefore, whether it is also a security, is determined using the "Howey test" (Rohr and Wright, 2017, p. 40; Azgad-Tromer, 2018, p. 112; Shadab, 2019, p. 255; Pan, 2019, p. 458). Such a position is also taken by the Securities and Exchange Commission (SEC), according to which "in determining whether an investment contract exists, the investment of 'money' need not take the form of cash". The Commission paid attention that "investors in The DAO used ETH to make their investments, and DAO Tokens were received in exchange for ETH. Such investment is the type of contribution of value that can create an investment contract under Howey".[6]

The Howey test is a tripartite test: (1) the investment of money, (2) in a common enterprise and (3) with an expectation of profits to be derived solely from the efforts of others (a promoter or other third party). In compliance with the spirit of US securities laws, the Howey test must be applied in the light of the economic reality of the transaction (Rechtschaffen, 2014, p. 256). In the literature, attention is commonly drawn to the difficulty of distinguishing the non-financial, utility aspects of tokens from their investment nature and the resulting regulatory uncertainty in the area of US law. It is, therefore, proposed that appropriate legislative action be taken by the SEC or by US Congress in cooperation with the SEC (Rohr and Wright, 2017, pp. 90–91; Shadab, 2019, p. 255). Without adequate provisions, there remains significant uncertainty as to when the federal securities laws apply to crypto-assets (Goforth, 2023, p. 606 and the literature cited therein). The case of SEC v. Wahi is cited as an example.[7] According to the SEC, any cryptocurrency exchange that trades crypto-assets that qualify as securities must register as a securities exchange. From the perspective of the topic of this monograph, it is important to note that this registration requirement has recently been expanded by the SEC to include "platforms that do not function as traditional exchanges" (Goforth, 2023, p. 607).

Thus, depending on the provisions of the terms and conditions (the so-called whitepaper is not sufficient here from a legal point of view, but in practice, the whitepaper often replaces the terms and conditions) on the basis of which the token was issued, and taking into account the circumstances of its issue, as well as its features and functions (this is also pointed out by Gurrea-Martínez and Remolina Leon, 2019, p. 121), which have been assigned to it and which are implemented in practice (both from a legal perspective and technological possibilities), supervisory authorities must decide whether a given token is subject to the legal regulation of securities (more broadly: financial instruments) or is not covered by such regulation. For

example, MiCA introduces the requirement to publish a whitepaper in the case of the public offering of crypto-assets, inter alia, to facilitate the competent supervisory authorities in assessing and classifying the given crypto-asset. If the token is not classified as a financial instrument (including as a transferable security) – depending on the legal order of a given country, it is either not regulated at all, or is subject to the regulation of crypto-assets – such as the MiCA Regulation. Individual supervisory authorities are already developing a practical approach to this issue.[8]

The classification of a given crypto-asset as a financial instrument within the meaning of MiFID 2 is decisive for the scope of the MiCA Regulation. The MiCA Regulation does not apply if the crypto-asset in question is a financial instrument. This issue is so important in practice that on 29 January 2014, ESMA published the Consultation Paper on Draft Guidelines on the conditions and criteria for the qualification of crypto-assets as financial instruments[9] (hereinafter referred to as "the draft ESMA Guidelines"). In Draft Guideline 21, ESMA states that

> Crypto-assets that are to be qualified as financial instruments should be treated as such from a regulatory standpoint regardless of the technology applied to such tokens. The application of financial markets legislation does not depend on the actual use of any technology or on its kind.

However, in Draft Guideline 27, ESMA further details its position, pointing out that

> when evaluating whether crypto-assets qualify as financial instruments, national competent authorities and market participants should not view the technological structure of these assets as a key factor. Consequently, financial instruments issued by means of DLT (tokenised financial instruments) should not alter the fundamental nature of these assets.

According to ESMA, for a crypto-asset to be recognized as a transferable security under MiFID 2, it must be negotiable, transferable and encapsulate rights attached to securities. These key conditions and criteria should be assessed on a case-by-case basis by national competent authorities (Draft Guideline 35). As ESMA rightly points out,

> when a hybrid token displays features of a financial instrument, this characteristic should take precedence in its classification. Thus, the classification process for hybrid tokens should not only consider their multifaceted nature but also prioritize their identification as financial instruments where applicable.
> (Draft ESMA Guideline 79)

There are also legal regulations that explicitly apply to the issue of shares using blockchain technology, such as, for example, French Ordonnance

Regulation n° 2017-1674 du 8 décembre 2017 relative à l'utilisation d'un dispositif d'enregistrement electronic partagé pour la représentation et la transmission de titres financiers (Seretakis, 2019, pp. 224–225), and above all, Regulation 2022/858 of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on DLT.[10] This Regulation does not directly apply to an entity conducting a long-term and capital-intensive investment, but it is of such importance that it enables trading in tokens under EU law that are financial instruments on a DLT multilateral trading facility (which can be the currently functioning "traditional" stock exchange). Thus, a framework was created for the dissemination of financial instruments based on DLT in the EU, which is important for the possible functioning, in practice, of financing long-term and capital-intensive investments using DLT. Regulation 2022/858 creates a practical possibility, for example, to finance a long-term and capital-intensive investment by issuing securities using DLT, and creates a specific possibility to trade in securities issued in this way, which from the perspective of the currently existing DLT, would be in the form of tokens.

Regulation 2022/858 is also important for the MiCA Regulation, as it contains legal definitions of terms that will be used in the MiCA Regulation, i.e., a definition of DLT, distributed ledger, consensus mechanism and DLT network node (although MiCA Regulation repeats these definitions in the "glossary" in Article 3). Besides, these concepts are generally important for the legal regulation of the crypto-asset market and, therefore, also for financing long-term and capital-intensive investments using DLT.

A separate issue is the qualification of a token issue as crowdfunding. In many countries, crowdfunding has been regulated, and it may then turn out that from a legal perspective, the issue of a given token is in fact a form of crowdfunding. For example, in the EU, crowdfunding has been regulated by Regulation 2020/1503 of the European Parliament and of the Council of 7 October 2020 on European crowdfunding service providers for business.[11] The scope of application of this regulation has been precisely outlined in Article 1, results from the definitions specified in Article 2, and is so narrow that it will cover the issue of tokens only exceptionally. This is primarily due to the definition of crowdfunding contained in Article 2(1)(a) of Regulation 2017/1129. Moreover, as follows from point 1 of the recitals to this regulation, crowdfunding is a form of alternative finance for start-ups and small and medium-sized enterprises (SMEs), typically relying on small investments. Therefore, it seems that Regulation 2017/1129 will not have a significant impact on the financing of capital-intensive and long-term investments.

5.2 Payment services law and financing long-term and capital-intensive investments using DLT

On the platform related to the financing of long-term and capital-intensive investments, not only investment (equity) tokens, but also payment tokens

can be issued. There are historical examples of the use of internal units of account for long-term and capital-intensive investments (for example, ITER Units of Account – IUAs – see Section 1.1). A payment token can be used for settlements made by platform users with the entity running the platform (or the issuer, also when it is a DAO), but it can also be used for settlements between platform users within the platform only (a closed ecosystem), or such a token can even be used on other platforms or stock exchanges – in other *ecosystems*. Assigning a payment function to a token does not definitively determine the applicable legal provisions. Investment or share tokens can also be used in this way, even when they are classified as securities. Thus, in the first place, it should be decided whether the payment function is the main (basic) function of the token or the exclusive (only) function, or whether the token also performs other functions, and the payment function is only an additional function. In addition, for the legal classification of a payment token, it is important whether it is used in a limited ecosystem (on one platform) by a limited number of users, or whether it can be used by an unlimited number of users on different platforms (different ecosystems). Also important for the selection of the applicable law is the registered office of the company that issues the payment token and runs the platform on which this token is used. Above all, however, for the assessment of the relevant provisions, it is crucial to analyse the provisions of the terms and conditions on the basis of which the given token was issued. If the token is issued by the DAO and the DAO runs the platform on which the token is used, the situation becomes more complicated, because the existing legal regulations do not generally apply to the DAO.

Payment tokens remain outside of the scope of Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market (PSD 2).[12] A significant exception are those tokens that can stay qualified as adjustable electronic money, i.e., tokens that are electronic money within meaning of the definition of Article 2(1) of Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions (EMD 2).[13] Since they are electronic money within the meaning of the EMD 2, both the EMD 2 and the PSD 2 will apply to such tokens (in accordance with Article 4(25) PSD 2, "funds" means banknotes and coins, scriptural money or electronic money as defined in point (2) of Article 2 of EMD 2). Thus, the classification of a given token issued as electronic money within the meaning of EMD 2, for example, by a platform used to finance a capital-intensive and long-term investment, has far-reaching (major) legal consequences. The entity issuing such a token must obtain an authorization provided for electronic money institutions, and transactions on the platform using such a token will be qualified as payment transactions within the meaning of the PSD 2, with all the resulting consequences for the platform operator. It should be emphasized here that, as an exception, electronic money may also be issued by payment

institutions (but within certain annual turnover limits). In addition, if a token that qualifies as electronic money meets the exemption conditions provided for in Article 3(k) PSD 2 (see Article 2(4) AMD 2) regarding the limited scope of use, the provisions of AMD 2 and PSD 2 may not apply, which excludes the need to obtain authorizations under these directives and to comply with the requirements (obligations) provided for in these directives, which are quite burdensome for the entrepreneur.

If the payment token does not meet all the conditions of electronic money within the meaning of the AMD 2, but will be linked to the state currency, i.e., it will meet the definition of *asset-referenced token* (ART) within the meaning of the MiCA Regulation although its issue and trading will not be regulated under AMD 2, and PSD 2 will not apply to payments using it, the provisions of the MiCA Regulation will apply to its issue and trading. According to Article 3(1) (6) of this MiCA Regulation,

> an 'asset-referenced token' means a type of crypto-asset that is not an electronic money token and that purports to maintain a stable value by referring to any other value or right or combination thereof, including one or more official currencies.

In turn, pursuant to Article 3(1)(7) of the MiCA Regulation, "an 'electronic money token' (EMT) or 'e-money token' means a type of crypto-asset that purports to maintain a stable value by referencing to the value of one official currency". During the work on the MiCA Regulation, one of the significant problems was to establish a relationship between an e-money token (EMT) and electronic money within the meaning of Directive 2009/110/EC. This problem was resolved in that, in accordance with Article 48(2) of the MiCA Regulation, EMTs shall be deemed to be electronic money. This article is found in Title IV of the MiCA Regulation entitled "E-MONEY TOKENS", which is effective from 30 June 2024 (and not from 30 December 2024 as the vast majority of the provisions of the MiCA Regulation are). In 2023, tokens that meet the conditions of electronic money should be considered electronic money, which consequently means that their issuance is subject to regulation by AMD 2 and PSD 2. However, such a qualification may sometimes be controversial, or the issuance of tokens may be legally structured to avoid their qualification as electronic money. After 30 June 2024, the EMT will be considered electronic money, and AMD 2 and PSD 2 will apply to it, subject to Article 48(4)–(7) of the MICA Regulation. The main point here is that the exemptions provided for in Article 1(4)–(5) and Article 9(1) AMD 2 apply to the EMT.

This approach has been maintained in the draft PSD 3 Directive[14] and the draft PSR regulation,[15] with the reservation that it is planned to repeal EMD 2 and regulate all issues related to electronic money in the PSD 3 Directive and the PSR Regulation (including the classification of existing electronic money institutions as a type of payment institutions). According to Articles

1(3) of the draft PSD 3 and 1(2) of the draft PSR Regulation, unless specified otherwise, any reference to payment service providers shall be understood in these acts as meaning payment service providers and electronic money service providers. Additionally, it is indicated in the draft PSD 3 Directive and in the draft PSR that EMTs should be included – as electronic money – in the definition of funds.

Consequently, under the PSD 3 Directive and the PSR Regulation, the system of granting authorizations for payment institutions that will replace electronic money institutions should also apply to issuers of electronic money tokens (see point 6 of the preamble to the draft PSD 3 Directive). This also applies to exclusions, i.e., if an exclusion from the scope of the PSD 3 Directive applies to payment services, it will also apply to an electronic money token. It should be emphasized, however, that certain provisions of the MiCA Regulation will still apply to tokens constituting electronic money after the entry into force of the PSD 3 Directive and the PSR Regulation and after the repealing of Directive 2009/110/EC, as currently regulated, i.e., all the provisions of Title IV. For example, despite the exemptions from the application of the PSD 3 Directive to certain electronic money tokens, issuers of such tokens under Article 48(7) of the MiCA Regulation, will be required to prepare an information document regarding the crypto-asset, and to report it to the competent authority under Article 51 of this regulation.

The introduction of the definition of ART and the regulation of the issue and trading of this token into the MiCA Regulation is primarily aimed at achieving the main goal of this regulation, i.e., the regulation of so-called stablecoins.[16] Pursuant to the ECB,

> stablecoins can be generally defined as digital units of value that are not a form of any specific currency, or basket thereof, and that rely on a set of stabilisation tools to minimise fluctuations of their price against such currency, or currencies.[17]

This is primarily about so-called global stablecoins (GSCs) which are available as part of initiatives based on an existing, large and/or cross-border customer base, which may have the potential to quickly scale and achieve global or other significant reach.[18]

In the United States, regulations on stablecoins were introduced by, for example, the states of Nebraska and California (Clark, 2022). The regulation of stablecoins (mainly so-called GSCs) is extremely important for a platform used to finance long-term and capital-intensive investments, as it seems that the use of stablecoins as an internal settlement unit brings many benefits, especially if the functioning of stablecoins is officially regulated. The current trend indicates that such regulation will be made on the occasion of regulating crypto-assets (see, for example, the MICA regulation); however, a specific GSC may be subject to securities market regulatory frameworks,

provided that it bears the features to qualify it in such a way (this is how the MiCA Regulation puts it, and this is how IOSCO approaches it).[19] From the perspective of security and certainty of trading on such a platform, an even better solution would be to use a central bank digital currency (CBDC) on it, especially since CBDCs also use DLT. The Bank for International Settlements notes that

> CBDC is not a well-defined term. It is used to refer to a number of concepts. However, it is envisioned by most to be a new form of central bank money. That is, a central bank liability, denominated in an existing unit of account, which serves both as a medium of exchange and a store of value.[20]

In particular, a CBDC issued digitally by a central bank is to serve as a legal tender (for more, see Griffoli et al., 2018, p. 309). Work on the CBDC is being carried out by the European Central Bank (a digital euro)[21] – for more, see European Central Bank (2022), and the Federal Reserve.[22] According to the ECB,

> The digital euro would be like euro banknotes, but digital. It would be an electronic form of money, issued by the Eurosystem (the ECB and the national central banks of the euro area), and would be accessible to all citizens and firms.[23]

However, the most advanced in the introduction of CBDC is the People's Bank of China, which is already completing the pilot tests of China's CBDC, also known as the e-CNY or the digital yuan, the e-renminbi (e-RMB), the Digital Currency/Electronic Payment (DC/EP) project (for more, see Fullerton and Morgan, 2022, p. 11; Laskai, 2022). It should be emphasized, however, that in 2022, the e-CNY has not yet achieved all of its assumed functionalities, which is why it is used in China to a very modest extent, and so far, it is not gaining popularity either in China or even more so in the international arena (Laskai, 2022). Undoubtedly, however, any project involving long-term and capital-intensive financing using DLT must take into account the possibility of using a CBDC.

5.3 Countering money laundering and financing of terrorism versus financing long-term and capital-intensive investments using DLT

In the EU, the European model of regulating the obligations of obliged institutions (including banks) related to counteracting money laundering and terrorist financing has three levels. The first is non-prescriptive and consists of the recommendations of the Financial Action Task Force (FATF). The second covers acts of European Union law, and the third covers national legislation. This model is dynamic in the sense that it constantly adapts to the changing

reality shaped by criminal and terrorist activity, and the driving force behind changes in the legal sphere are the FATF recommendations.

Similarly, regulations in the United States and many other countries regarding AML are based on FATF recommendations, and this applies not only to FATF members, but also to other countries (Huang, 2015, p. 529; Jakobi, 2018, p. 184). United Nations conventions are important for AML regulations, but to date, none of them refer directly to crypto-assets, or even cryptocurrencies.

Cryptocurrencies and, more broadly, crypto-assets are significantly used for money laundering and terrorism financing (for example, see Colins, 2022, p. 15 and next; Durrant and Natarajan 2019, p. 73 and next; report of Europol[24] and Chainalysis[25]). The FATF recommends that countries thoroughly understand money laundering and terrorist financing risks, as understanding such risks is an essential part of developing and implementing a national AML/CFT regime.[26] The risk of the use of cryptocurrencies (and currently crypto-assets) in this way is assessed by the competent authorities of individual countries as very high.[27] This is not only about the exchange of crypto-assets (including cryptocurrencies) for legal tender and other crypto-assets (cryptocurrencies) via cryptocurrency exchanges, cryptocurrency exchange offices and in private trading, but also about the issue of tokens (Gurrea-Martínez and Leon, 2019, p. 146 and next).

The phenomenon of using cryptocurrencies for money laundering has been noticed by the FATF since the beginning of the development of cryptocurrencies,[28] and the FATF is constantly monitoring this phenomenon, also taking into account the ongoing evolution. The latest FATF recommendations already refer to crypto-assets – Virtual Assets.[29] FATF defines virtual assets as

> a digital representation of value that can be digitally traded or transferred and can be used for payment or investment purposes. Virtual assets do not include digital representations of fiat currencies, securities, and other financial assets that are already covered elsewhere in the FATF Recommendations.[30]

Directive AML V does not yet apply to crypto-assets, but still to virtual currencies (see Article 3(18) and (19) AML V). Among other things, the Directive applies to obliged entities such as providers engaged in exchange services between virtual currencies and fiat currencies and custodian purse providers (Article 2(1)(g) and Article 2(1)(h) AML V).

The US legal regulation regarding AML is more advanced in this respect, i.e., it applies not only to virtual currencies (cryptocurrencies), but also to crypto-assets, and more broadly, to DLT – see the Anti-Money Laundering Act of 2020 (the AML Act) contained in the FY2021 National Defense Authorization Act (NDAA)[31]. As emphasized by the US Department of the Treasury, virtual asset service providers (VASPs) doing business wholly or in

substantial part in the United States qualify as money transmitters, and by this are subject to AML/CFT regulations. From the perspective of the theme of this monograph, however, much more interesting is the position of the Department of Treasury regarding DeFi, which notes that

> While some DeFi services purport to run autonomously without the support of a central company, group, or person, many have a controlling organization—through a decentralized autonomous organization, concentrated ownership or governance rights, or otherwise—which provides a measure of centralized administration or governance.[32]

The EU recognizes the need to clearly extend the AML Regulation to include crypto-assets. The MiCA version of April 2022 proposed by the EU Parliament contained a legal regulation relating to AML, for example, in point 8 of the recitals and in Article 1. In the subsequent versions of the MiCA Regulation however, references to AML/CFT have been removed from Article 1 and the explicit declaration that the definition of crypto-assets should correspond to the definitions of virtual assets was withdrawn from the FATF recommendations in favour of a more general statement that, "the Union should continue to support international efforts to promote convergence in the treatment of crypto-assets and crypto-asset services through international organizations or bodies such as the Financial Stability Board, the Basel Committee and the Financial Action Task Force" (point 5I of the recitals to MiCA and point 8 of the recitals to the MiCA Regulation).

On 29 June 2023, Regulation (EU) 2023/1113 of the European Parliament and of the Council of 31 May 2023 on information accompanying transfers of funds and certain crypto-assets[33] entered into force. However, like most of the provisions of the MiCA Regulation, the provisions of this regulation will apply only from 30 December 2024. On that date, the changes introduced by Regulation 2023/1113 in Directive (EU) 2015/849 of the European Parliament and of the Council of 20 May 2015 on preventing the use of the financial system for money laundering or terrorist financing (5th AML Directive) will come into force. These changes aim to impose AML obligations on crypto-asset service providers (CASPs), within the meaning of the MiCA Regulation. This approach is continued in the new Directive[34] and the brand-new AML Regulation in the EU.[35]

Legal acts concerning AML, including those implementing the FATF recommendations, always define the obligations of the obliged entity – a legal person or possibly a natural person. FATF also defines a "virtual asset service provider" as "any natural or legal person". Either way, FATF provides a very detailed definition of a "virtual asset service provider".[36] As a rule, the legal regulations regarding AML cannot therefore be applied to DAOs (or more broadly, to fully decentralized finance), unless the DAO coincides with the legal structure of the company or other legal entity (however, this does not

exclude criminal liability for money laundering or financing terrorism for people who have an impact on the functioning of the DAO by interfering with the programming code, or those who created a given smart contract and implemented it). Here, it should be emphasized that although the FATF does not consider the DeFi application (i.e., a software program) to be a VASP in the light of standards it has issued, it believes that

> creators, owners and operators or some other persons who maintain control or sufficient influence in the DeFi arrangements, even if those arrangements seem decentralized, may fall under the FATF definition of a VASP where they are providing or actively facilitating VASP services. This is the case, even if other parties play a role in the service or portions of the process are automated.[37]

This FATF approach has been unfairly criticized (Lipton and Cohen, 2021, pp. 14–15). Undoubtedly, the intensive development of DeFi in recent years (2017–2022) is a consequence of escaping from AML/CFT procedures, the use of which on VASPs (including, primarily, on cryptocurrency exchanges) is increasingly enforced by individual countries. An important element of this growing pressure to comply with AML/CFT procedures is the pressure exerted by supervisory authorities on banks and other supervised financial institutions to pay special attention to transactions performed by centralized cryptocurrency exchanges and their clients. The development of DeFi (and, to some extent, stablecoins) is a consequence of cryptocurrency users seeking to escape this pressure and, as can only be suspected and cannot be ruled out, the conscious activities of organized criminal groups.

If a platform used to finance a long-term and capital-intensive investment is run by a legal person (for example, a company), it will be obliged to apply the AML regulations primarily in force in the country of its registered office. However, the obligation to apply the AML provisions in force in the countries where the company operates through the platform, and therefore in the countries of the "investors" – persons who purchase crypto-assets through the platform – cannot be ruled out. This is a consequence of the fact that if such a platform directs its services to persons residing or established in the territory of a given country, it should be assumed that it operates in the territory of that country. It should be highlighted that in the light of the definition of a "virtual asset service provider" used by the FATF, an entity (a legal person or natural person) intending to finance a long-term and capital-intensive investment using DLT will meet the conditions of this definition. An exception will be a situation in which the issued token or token traded on the platform is qualified as a security or other financial instrument, but in such a situation, the AML provisions that apply to securities (more broadly, financial instruments) will apply.

The importance of counteracting money laundering and terrorist financing increases as the amounts involved in a given project increase. In addition,

the specificity of cryptocurrencies and crypto-assets, as has already been emphasized, favours a high risk of money laundering and terrorist financing. Thus, financing a capital-intensive project using cryptocurrencies and crypto-assets should take into account AML/CFT requirements. It should be emphasized here that in the long-term perspective, only an increase in the detail of AML/CFT regulations and tightening of the financial system should be expected – this is indicated by the developmental trend of these regulations. Moreover, even if the platform (or more broadly, the entire process) for financing a capital-intensive and long-term investment were to be based entirely on decentralized finance, the functioning of such a platform (the course of the entire process) should, in the light of the position taken by the FATF, take into account at least the recommendations and guidelines formulated by this organization.

5.4 Tax and budget law versus financing long-term and capital-intensive investments using DLT

The first thing that should be considered here is the tax consequences of the functioning of the DAO structure on the basis of income taxes. In this aspect, an internal division should be made. The first aspect that requires analysis is the taxation of the entity itself (the organizational and legal form) on which the DAO structure is based or, depending on the adopted concept of the DAO structure itself, if based on the legislation of a given country, it can be treated as an income tax payer. The second aspect concerns the taxation of investors' income (revenue) in connection with the purchase and sale of tokens constituting crypto-assets. Due to the multiplicity and dispersion of investors and the global nature of investments, it is not possible to determine uniform tax consequences for each transaction of purchase and sale of tokens. Investors may come from many countries, and the legal tax burden may be determined by their tax residence. It is, therefore, necessary to analyse the tax systems of different countries.

Secondly, the financing of long-term and capital-intensive investments using DLT may cause certain legal and tax consequences in terms of turnover taxes. It should be assumed that under most legislation, organizing and conducting this type of investment using crypto-assets will constitute economic activity due to its durability, as well as its organized and professional nature. Therefore, in this regard, it is necessary to analyse the effects of the investment in terms of taxation with value added tax or taxes of a similar nature burdening the trade in commodities, goods, services and above all, property rights such as tokens and other crypto-assets. This aspect not only applies to the activities of an organization itself using DLT as a method of financing, although it may be significant for it. The issue of turnover taxes will also arise in the case of potential investors purchasing and then selling on the secondary market crypto-assets purchased to finance a long-term and capital-intensive investment.

It is also possible that the investors will be private individuals who are not interested in running a professional business and want to invest their assets by purchasing crypto-assets in the form of tokens issued as part of the DLT structure that manages and finances the investment. In such a situation, trade between private investors may be taxed with taxes on non-professional trade in goods (including property rights).

For the purpose of analysis in this part of the work, the authors chose tax systems of highly developed countries with stable legislation and universal access to information technology, as well as well-established freedom of doing business. Therefore, these will be selected European Union countries, taking into account EU legislation in the field of income taxes (to a limited extent), turnover taxes, tax avoidance and tax havens, as well as the United States of America and the United Kingdom.

The American tax system has a two-tier nature. At the federal level, there are primarily classic income taxes (personal income tax and corporate income tax) as well as excise tax.

The federal personal income tax is based on the criterion of citizenship, in contrast to the taxation of income occurring in the European Union countries, where the actual centre of vital (economic) interests is of fundamental importance. An additional criterion (that is independent of citizenship) is the so-called residency test. Tax residents are primarily natural persons with American citizenship, as well as individuals who stay in the territory of the United States for at least 31 days in a year, and a minimum of 183 calendar days in a given year and the two preceding years. Non-US taxpayers have limited tax liability (Miller and Oats, 2016, p. 35).

Most personal income is taxed with federal income tax. Pursuant to § 61 of the US Internal Revenue Code, the open catalog of sources of income includes, above all, remuneration from employment, pensions and income from real estate. From the point of view of determining the taxation rules for crypto-assets, the issue of which is to be a source of financing long-term and capital-intensive investments, the most important sources should include income from property rights other than rights to real estate, and income from business activity.

The federal personal income tax is based on a progressive tax scale. For example, in 2022, the lowest rate was 10% of the tax base and the highest did not exceed 40% (Hybka, 2016, p. 12). For self-employed persons, the tax rate in 2022 was generally 12.4% of the tax base (§ 1401 of the Internal Revenue code).

For the purposes of federal income taxes, crypto-assets, including virtual currencies, are treated as property (Dhanani and Hausman, 2022, p. 6). They are not legal tender. Therefore, the provisions of the federal tax law applicable to currencies as legal tender cannot be applied to them.[38] Therefore, the provisions of US property (ownership) tax law apply to transactions involving cryptocurrencies.[39]

In the event of a sale of cryptocurrency to which property tax laws apply, the taxpayer is liable for any gain or loss associated with the transaction.[40] Thus, it can also be concluded that trading in crypto-assets that have a specific financial value may cause legal and tax consequences similar to those caused by trading in virtual currencies, including cryptocurrencies.

The US tax authorities are of the opinion that from the point of view of federal income taxes, in the case of remuneration for a service provided in the form of virtual currencies, the taxpayer is obliged to recognize revenue equal to the value of the virtual currency as at the date of payment expressed in US dollars.[41] Importantly, taxpayers also obtain tax income when exchanging virtual currency for another type of property right, if they make a profit from the given transaction.

Importantly, the DAO itself may, under certain conditions, be treated as a taxpayer under federal income taxes (Arciniegas and Conner, 2022, pp. 15–16). This is a specific way of recognizing the DAO as a taxpayer, because it is not any organizational unit.

At the state level, individual states have far-reaching autonomy in shaping tax burdens. In most cases, there is an indirect tax charged to natural and legal persons conducting business activity, which is a kind of alternative to value added tax, which functions in European Union countries. Due to tax autonomy, individual states may shape the legal structure of this tax in different ways, or abandon it altogether.

As shown above, in the US income tax system at the federal level, trading in crypto-assets has legal and tax consequences. Income obtained from crypto-assets received as remuneration for services provided is subject to taxation, expressed in US dollars.

Income from the purchase or sale of crypto-assets with property value is also subject to income tax. This is important from the point of view of this monograph.

Firstly, in the case of issuing crypto-assets under a DAO managed by a private entity with the status of an income tax payer, tax income is generated equal to the value of issued and sold tokens. This means that income earmarked for financing long-term and capital-intensive investments must be reduced by the income tax due. An institution managing a DAO platform with a tax residence in the United States would, therefore, be required to tax its income from the issuance of tokens or other types of crypto-assets by such a platform, provided that they represent financial value.

Secondly, also subject to taxation is the secondary trade in crypto-assets that give the right to participate in the DAO platform, manage the project and derive potential future profits from the capital-intensive investment – this may be important for potential investors. It should be noted that an investment in crypto-assets entitling one to, among others, manage the DAO platform does not have to be permanent. In other words, the possibility of exiting from investments by selling the tokens to third parties or other investors is

meant to be an essential feature of financing long-term and capital-intensive investments managed by investors using the DAO platform. The sale of tokens constituting crypto-assets will be subject to US income tax, as it is assumed that the tokens will have a specific market-determined financial value. Of course, a situation may arise in which a given transaction will not bring the investor any income, because the token will be sold for a price lower than the purchase price. There will, therefore, be a tax loss referred to in the general property income tax rules that should be applied to crypto-assets.

Depending on the legal status of the investor and their individual situation, there may also be other tax liabilities and other liabilities resulting from the remaining burdens functioning in the US public levy system.

Turning to the British tax system, it should be pointed out that it is based primarily on income taxes (personal income tax and corporate income tax) and value added tax. Other taxes include the capital gains tax, excise duty and local taxes. The most significant of these are personal income tax and value added tax, followed by corporate income tax (Ghodsi and Webster, 2018, pp. 84–85).

In the case of personal income tax, there is a classic tax progression regarding the taxation of income. Depending on the tax base, tax rates ranged from 20% to 45% in 2022, with the United Kingdom having a relatively high tax-free allowance. The tax year, which begins on April 6 and lasts until April 5 of the following year, should be highlighted as a characteristic feature.[42]

UK income tax is charged, inter alia, from employment income (remuneration), social insurance benefits, property, savings and investments.[43] First of all, income tax will be levied on the receipt of crypto-assets in exchange for work provided.[44]

In the case of the incidental purchase and sale of crypto-assets by entities subject to UK personal income tax, in most cases, the transaction will be taxed with capital gains tax, which is regulated in the Taxation of Chargeable Gains Act 1992. In such a situation, it takes precedence over personal income tax. In other words, if the actions of the taxpayer do not bear the hallmarks of a professional business, they will be subject to capital gains tax.[45] Capital gains tax will be charged provided that two conditions are met: the crypto-assets (tokens) must have the ability to be the subject of ownership rights, and they must have a certain value.[46] In the case of crypto-assets, the profit from a given transaction is taxed, and the achievement of a loss does not cause tax implications. This means that this tax has the nature of an income tax. Taxation primarily applies to the sale of tokens for a price expressed in money, their exchange for others and the use of tokens to pay for goods or remuneration for a service.[47]

Capital gains tax rates depend on the taxpayer's total income, and ranged from 10% to 28% in 2022.[48]

The trade and issue of crypto-assets are also subject to corporate income tax, which is determined, inter alia, by the Corporation Tax Act 2009. All profits made by legal persons from the sale, exchange or use of crypto-assets

as payment for acquired goods or compensation for provided services are subject to taxation.[49] Gains from the sale of crypto-assets are taxed under the same conditions as for individuals, i.e., crypto-assets must be capable of being owned and must have a certain value.[50] Importantly, the pure profit earned from trading in crypto-assets is taxed, which means that the income earned can be reduced by the costs of obtaining it, for example, the cost of purchasing crypto-assets.[51]

Summarizing the tax consequences of the functioning of DAOs and the issue of tokens, and subsequent trade in them by investors, it is necessary to highlight the need to tax the profits of the entity (legal person) under which the DAO operates. These profits will result from the obtained price/remuneration paid by the investor purchasing the token that entitles the investor to participate in the DAO, co-decide on the investment being implemented, and derive income from it in the future.

Secondary trading in crypto-assets will also be subject to UK income tax, provided that the investor selling the token makes a profit.

The legal effects under other taxes and levies in the United Kingdom cannot be ruled out, and this will depend on the specific facts and the tax residence of the investors.

In the German tax system, tokens are understood as digital units of value that may contain specific rights or claims with various functions. The issue of tokens is treated as a type of alternative method of financing, including the financing of start-ups. Importantly, tokens also include utility tokens, the essence of which is to provide their holder with specific rights, access and voting opportunities. Additionally, there are tokens that incorporate capital-related rights, which are likened to financial instruments. The existence of mixed tokens that may contain utility- and investment-related elements can also be observed.[52]

The legal and tax consequences of the purchase and sale of utility and capital tokens as well as hybrid tokens containing elements of utility and capital tokens are regulated by the German Act of 16 October 1934 on Personal Income Tax (Einkommensteuergesetz – EstG) – in the version published on 8 October 2009.[53] The Tax Act applies primarily to natural persons with unlimited tax liability in Germany (tax residence). In the light of § 2 sec. 2 of the German Personal Income Tax Act, income tax applies to, inter alia, income from trading activities, self-employment and capital income. Other income listed in § 22 of the Act is also taxed. Pursuant to § 22 sec. 2 of this Act, other income includes income from private sales transactions, if the period between purchase and sale did not exceed one year. This income category includes income from the sale of utility tokens.[54]

Running a business based on a DAO may cause specific tax consequences in terms of value added tax, which is of particular importance in the European Union. This tax is a harmonized tax, and its legal structure is determined by Council Directive 2006/112/EC of the Council on the common system of value added tax (VAT Directive).[55]

Pursuant to Article 9 of the VAT Directive, a "taxable person" is understood as any person who, independently, carries out in any place any economic activity, whatever the purpose or results of that activity. The EU legislator, therefore, adopts a very broad definition of a taxable person. In the tax literature, it is claimed that the subjective scope of VAT covers not only natural and legal persons, but also all organizational units without legal personality (Terra, 2003, p. 315).

This means that irrespective of the legal form adopted for the purposes of implementing a long-term and capital-intensive investment, the managing entity of the DAO, and even the DAO itself – if we assume that it is an organizational unit under any tax legislation – may be considered to be value added taxpayers. In the current legal situation, it is more likely that the national tax authorities will recognize that the DAO itself does not bear the attributes of a payer of this tax, because it will only be an instrument for servicing and managing investments. Most importantly, it will not have an organizational structure or its own assets.

In the context of VAT taxation of solely activity within the DAO, i.e., the issue of crypto-assets allowing for the management of a project involving a long-term investment, as well as secondary trading in crypto-assets by potential investors, the jurisprudence of the Court of Justice of the European Union is of great importance.

In the best-known judgment of the CJEU of 22 October 2015,[56] it was assumed that under the provisions of the VAT Directive, transactions involving the exchange of traditional currency (FIAT) for units of the virtual currency Bitcoin, and vice versa, made against the payment of an amount corresponding to the margin resulting from the difference between the price at which a given entrepreneur purchases currencies and the price at which the entrepreneur sells them to customers constitute the provision of services for a fee – this is about the operation of cryptocurrency exchanges and cryptocurrency exchange offices. The exchange of cryptocurrency for FIAT currency (and vice versa) cannot, therefore, in the light of the case-law of the CJEU, constitute a supply of goods referred to in Article 2(1)(a) of the VAT Directive. Pursuant to this provision, the supply of goods for consideration within the territory of a Member State by a taxable person acting in that capacity is subject to European value added tax. The CJEU, therefore, qualified cryptocurrency as a currency constituting a contractual tender and not a commodity.

In the cited judgment, the CJEU also recognized that the exchange of cryptocurrency for FIAT currency (and vice versa) constitutes a financial transaction. As a result, it was also assumed that Article 135(1)(d) of the VAT Directive applies to this type of activity. Under this provision, EU Member States are required to exempt transactions – including brokerage – related to deposit accounts, current accounts, payments, transfers, debts, checks and other negotiable financial instruments, excluding debt collection.

The cited ruling of the CJEU should be considered important from the point of view of interpreting the provisions of EU tax law in the context of the taxation of crypto-assets. However, it does not prejudge the tax consequences of the issue of these tokens and their secondary trading, which do not have the full character of a virtual currency. In the light of the said CJEU judgment that cryptocurrencies are currencies, it proves that their only purpose is the function of a means of payment.

The main criterion for recognizing tokens issued within a DAO platform is to determine the scope of rights that they can incorporate. The essence of the platform is to be the ability to manage the investment by the holders of crypto-assets, which are to be issued for a fee (in exchange for state currencies or any other currencies, including cryptocurrencies). The fact that in certain circumstances they may constitute a contractual means of payment between the parties is of secondary importance. Their main feature is to implement the investor's rights and use them to have a real impact on the direction of long-term investment. Therefore, it cannot be said that in this case we will be dealing with financial transactions exempt from European value added tax. In other words, only payment tokens can benefit from a VAT exemption. Utility and investment tokens – and only such tokens are important from the point of view of the concept of the functioning of a DAO – cannot be exempted from taxation.

In the context of the taxation of crypto-assets, it should be emphasized that the above considerations relate primarily to the issue of crypto-assets by a DAO platform, and more specifically by the entity (unit) managing it. This is because taxation applies to activities carried out as part of the taxpayer's business activity. Secondary trading in crypto-assets among potential investors does not have to generate tax consequences on the basis of VAT. Taxation depends on whether the investor sells or purchases crypto-assets as part of their business activity within the meaning of Article 9 of the VAT Directive.

In the case of the purchase or sale of tokens as part of the management of one's private assets, there will be no value added tax. Depending on the tax system of the given country, a different turnover tax applicable to non-professional transactions may arise.

Considering the above analysis of selected tax systems in terms of the taxation of DAO platform activity and the taxation of the issue and trading of tokens, it is impossible to find legal regulations that are dedicated to long-term and capital-intensive investments. In individual legislation, however, there are legal and tax mechanisms that the entity managing a DAO platform, or the platform itself, can use on terms provided for all taxpayers who meet the statutory conditions. However, this applies only to certain countries, and is usually limited to specific taxes.

An example of this may be the legal structure of the corporate income tax that currently functions in Estonia. It is an income tax model based on the

distribution of profits at the time of their transfer (payment) to shareholders or stockholders. In Estonia, therefore, the moment when a tax obligation arises has been shifted from the moment that income is generated to the moment of distribution of profits or benefits of a similar nature to shareholders or stockholders, and the tax rate is 20%. It should also be highlighted here that the Estonian tax system is the most competitive of all OECD countries.[57] It aims to support investments (not only long-term ones). A similar method of corporate income taxation based on the Estonian model was introduced in Georgia in 2017[58] (Wądołek, 2022).

The idea of taxing the income of legal persons (mainly companies) with this type of income tax boils down to the statement that the accumulation of profits generated in the company makes it possible to avoid taxation. These profits can be earmarked for any purposes, including the implementation of investments, including those of a long-term nature. In terms of the taxation of income obtained under a DAO platform implementing a long-term and capital-intensive project, it can be highlighted that any income obtained by it (or by a legal person appointed to manage it) will not be taxed as long as it is not made available to investors holding tokens entitling them to participate in and manage the platform.

It is a system of income taxation that is very favourable for this type of undertaking, which is assumed to last much more than one tax year. It allows one to legally avoid taxation of the income generated, and allocate it for further development of the investment. The adoption of the classic rules of income taxation will mean that any income earned from the issue of crypto-assets will have to be spent in the same tax year only to avoid being taxed with income tax. Due to the specificity of long-term and capital-intensive investments, it is possible and very likely that it will be necessary to accumulate profits in the first few years of a DAO platform's operation, which may result in significant tax burdens on the basis of income taxes, significantly limiting the financial possibilities of the investment process. In order to limit the tax consequences of the implementation of the activities of a DAO platform, it is also possible to use tax havens or other territories of a similar nature. However, this involves a huge risk of tax avoidance, and even evasion (also see Srokosz, 2015, pp. 257–261). Countries that the European Union currently lists as tax havens include, for example, American Samoa, The Bahamas, Costa Rica, as well as the Marshall Islands and Trinidad and Tobago (EU Council Conclusions on the revised EU list of non-cooperative jurisdictions for tax purposes[59]).

Therefore, the use of tax havens or other territories of a similar nature cannot be a solution to the problem of taxation of the activities of a DAO platform. It should be noted that the taxation of income from any legally conducted activity is a natural phenomenon in highly developed and developing countries. Since an economic entity makes profits in connection with a specific economic activity, taking into account the needs of society – including the goals of sustainable development introduced by the United Nations – it is

obliged to share its profits in a certain way in the form of paying public levies due in a given country, including taxes.

The activities of a DAO platform and its investors should be tax transparent, and the platform itself should not be used for tax optimization or tax avoidance purposes. This would be inconsistent with its primary objective, which is to implement a long-term and capital-intensive investment.

It should be noted, however, that anonymized DeFi activity causes fairly significant problems in terms of tax collection and determination of taxable entities (Makarov and Schoar, 2022, p. 176). Significant problems may arise in determining the identity of the parties to the transaction, and as a consequence, it will be very difficult to properly identify the taxpayer. There may also be a problem with determining the appropriate tax jurisdiction and assigning the tax due a specific country. In this respect, the literature on the subject postulates the need to change KYC and AML regulations. However, the authors point out that this may be too expensive and impractical (Makarov and Schoar, 2022, p. 177).

The development of domestic and public international law, including EU legislation in the field of tax cooperation, aims to limit tax evasion and aggressive tax optimization, which should be viewed positively. This is crucial from the point of view of effective enforcement of tax obligations for taxpayers conducting business based on developing new technologies.

An example of such activities in the field of crypto-assets is primarily the draft Directive DAC8.[60] The European Commission proposes to amend Council Directive 2011/16/EU of 15 February 2011 on administrative cooperation in the field of taxation.[61] The Commission assumes that crypto-assets as alternative means of payment and investment may undermine the tax transparency developed in recent years and increase tax avoidance. The essence of the draft Directive boils down to the introduction of the obligation to report income obtained through investments in crypto-assets and the exchange of such information. In the light of the draft Directive, CASPs will be required to collect and verify information in accordance with the due diligence procedures set out in the Directive. Subsequently, crypto-asset obliged entities are required to provide the relevant competent authority with information on crypto-asset users, meaning those who use the provider's services to trade and exchange crypto-assets. Finally, the information received is to be transferred by the competent authority of the Member State to the competent authority of the relevant Member State of which the user of the reported crypto-assets is a resident.

The European Commission's draft is intended to significantly reduce the anonymity of crypto-assets by requiring taxpayer identification. Cryptocurrency market providers and operators are to be required to collect data on their customers. This will undoubtedly facilitate the possibility of assessing due liabilities of a public law nature (Matras, 2022, p. 29). The Commission assumes that the amending Directive will enter into force on 1 January 2026.

The European Commission also points out that due diligence rules, reporting obligations and other rules applicable to reporting CASPs are based on the OECD Crypto-Asset Reporting Framework.[62]

In addition, in 2022, the OECD prepared a crypto-asset reporting framework.[63] This document covers the principles of the crypto-asset reporting framework. It provides for the obligation to report tax information on transactions involving crypto-assets. In the light of the aforementioned document, the reporting obligation is to cover entities that, as part of their business activity, provide services in the field of crypto-asset exchange for or on behalf of their clients. These are to be not only cryptocurrency exchanges, but also all kinds of other intermediaries and service providers, including brokers.

In the light of the documents referred to above, the reporting obligation applies in particular to the exchange of crypto-assets into FIAT currencies and into other crypto-assets.

Summarizing the analysis of the tax burden in connection with the implementation of a long-term and capital-intensive investment, it should first be pointed out that from the perspective of applying tax law, two basic situations should be considered: the first is when the financing of the long-term and capital-intensive investment is carried out by a legal person, and the second is when a DAO smart contract is used for financing a long-term and capital-intensive investment. In the first case, a legal person may be established on the basis of commercial law (a company), cooperative law (a cooperative) or association law (an association or foundation), or it can be a state legal person (for example, a government agency) or a local government legal person (for example, a commune). In the second case, the DAO structure may be "imposed" on one of the organizational forms specified in the first case, but more likely those in the field of private law (for legal persons operating in the sphere of public law, a separate, explicit legal regulation would be needed in this case – such an approach is not taken into account by the legislators at all), or the DAO may remain unconnected to the organizational and legal forms giving the status of a legal person, primarily in connection with the organizational and legal form of the company. Undoubtedly, taxing a DAO makes it easier to "wrap" it in a specially dedicated limited liability company, such as, for example, Wyoming Limited Liability Company (more on this in Chapter 6). These findings are important from the perspective of the application of the tax law that applies to taxpayers – usually legal persons or natural persons.

The tax systems of developed countries are aware of the concept of an organizational unit without legal personality, but a DAO that, according to the assumptions of this study, is to be used to finance long-term and capital-intensive investments, will not meet the conditions of an organizational unit, because it will only be an instrument for handling an investment and a tool for managing it. First and foremost, it will not have an organizational structure or its own assets. In order to maintain the security of economic transactions,

such a platform is to operate based on the legal capacity of the legal person established to carry out the investment. From a formal point of view, the status of a taxpayer will likely be held by this person. Ultimately, it will be possible to determine the legal and tax subjectivity only after selecting the place of commencement of business and obtaining a tax residency. However, depending on the tax residency, one may find that a DAO may be a stand-alone taxpayer; however, this is rare. As has already been established above, such a situation may occur on the basis of federal income taxes in the United States.

While it is reasonable to question the taxation of a DAO itself due to its lack of legal capacity, there is no doubt as to the taxation of revenues (income) obtained by natural or legal persons who are participants in a DAO and obtain income (revenues) on this account.

Most often, such income (revenue) arises on the day of exchanging tokens obtained by persons participating in the DAO for legal tender or any other property right, for example, cryptocurrency. At the beginning of the second decade of the 21st century, countries rarely decided to tax income from the exchange of one cryptocurrency for another. In general, fairly large differences still exist in the details of taxation of the income (revenue) of natural and legal persons from the sale of tokens, and more broadly – cryptocurrencies. There is no uniform approach on a global scale to, for example, the definition of a token in the legal regulation of income taxes. The laws of individual countries use the terms "cryptocurrencies", "virtual currencies" and "crypto-assets". However, it should be assumed that all these terms, for tax purposes, will refer to tokens issued by a DAO unless, under the given legal regulation, a token is classified as a security or, more broadly, as a financial instrument (in this situation, the established rules for taxation of financial instruments, including securities, apply).

In the legal regulations of individual countries regarding income (revenue) taxes, a distinction is usually made – by taxing them differently – between entities conducting business activity consisting of exchanging cryptocurrencies (crypto-assets) for legal tender and cryptocurrencies (crypto-assets) for other cryptocurrencies (crypto-assets), i.e., activities characteristic of cryptocurrency exchanges and cryptocurrency exchange offices and other entities that obtain income (revenue) from the exchange of cryptocurrency (crypto-assets) for legal tender or from the exchange of cryptocurrency (crypto-assets) for another cryptocurrency (crypto-assets), or for goods or a service.

The assumptions made in this monograph show that an entity operating a platform for financing long-term and capital-intensive projects using DLT may organize exchange, on the platform, of a token issued by it. Such an activity may be qualified under the provisions of the tax law as economic activity consisting of the exchange of cryptocurrency (crypto-assets) for legal tender or consisting of the exchange of cryptocurrencies (crypto-assets) for other cryptocurrencies (crypto-assets). For example, under the tax legislation

of the European Union, this may result in the creation of a value added tax obligation.

When summarizing the analysis of the tax rules concerning DAO activities and buyers of tokens issued by it, it must be clearly stated that the scope of the tax burden may not in any way determine the choice of the organizational concept for the implementation of a long-term and capital-intensive investment, and may not determine the choice of the tax jurisdiction.

First of all, the registered office of the entity on the basis of which the legal personality of a DAO is to operate should be in a stable country with a well-established tax system that respects ownership rights and freedom of economic activity. In the case of long-term investments, when choosing a country from the tax point of view, one cannot be guided only by the amount of the tax burden.

In addition, from the point of view of the tax burden, it is impossible to predict the directions of the evolution of individual tax systems, including the rules of taxation for crypto-asset trading and income earned on this account.

This part of the work presents only the current legal and tax regulations in the field of the crypto-asset market that the DAO financing is to be based on. These regulations are subject to dynamic changes introduced by individual jurisdictions and international organizations in order to limit money laundering and tighten the tax system. In the case of choosing a financing model for a long-term and capital-intensive investment, the scope of public levies is important, but it cannot be one of the main criteria determining the shape of the organizational structure of the investment or its location.

Moving on to the analysis of financing a long-term and capital-intensive investment in the context of budgetary law and broader public finance law, the first thing to determine is the possibility of implementing such an investment within public entities financed from public funds. In addition, it also needs to be determined whether the provisions of public finance law in individual countries and international organizations (for example, the European Union) feature specific mechanisms to ensure the stable implementation of an investment, and above all, to guarantee financial resources for its implementation.

From the point of view of financing this type of investment based on DLT using public funds, either directly by states or by an international organization dedicated to the project, the actions of the state or international organization are burdened with a specific risk. In democratic countries, this type of project can be used for the purposes of intra-state political disputes and to achieve current political goals.

It should be remembered that in the case of countries and international organizations, the implementation of long-term and capital-intensive investments is based mainly on public funds. Irrespective of the legal systems, in developing and highly developed countries, administrators of public funds – especially those coming directly from given budgets – bear a certain type of responsibility.

It is primarily about a kind of separate disciplinary liability that is common in European countries that protects only the financial interests of states and is basically independent of other types of sanctions. In this regard, in relation to European Union countries, it is important to note the two-level supervision over the spending of public funds. Firstly, at the national level, internal law imposes specific sanctions for broadly understood irregularities in collecting and spending public funds. Secondly, at the EU level, additional control over the spending of funds is exercised by the EU Court of Auditors. However, it should be pointed out that the main task of the Court is to exercise a general audit of the EU's accounts, which *expressis verbis* results from Article 285 of the Treaty on the Functioning of the Union.

Irrespective of the financial and legal liability, most countries have further-reaching sanctions related to the disposal of public funds. It is primarily about criminal liability for embezzlement of public funds and their use for purposes other than the performance of tasks of a public nature.

One should also not forget about non-legal responsibility, which holds much greater significance for most societies and individuals. Namely, it is about political responsibility related to decision-making by politicians (holders of public authority) regarding the manner, goals and scope of spending public funds coming, in the vast majority, from tax-paying citizens.

The above types of responsibility are of far-reaching importance for the implementation of long-term and capital-intensive investments with the participation of a public entity, and above all, with the use of public funds. It must be remembered that when making certain decisions, public authorities are not guided only by socio-economic aspects. Most importantly, they consider the consequences of these decisions that directly affect them. Therefore, they make a risk assessment.

Risk assessment is also performed at the non-legal level. Without evaluating such activities, some decisions related to the use of public funds are determined by the election cycle and the goals of individual political parties in power at a specific time and place.

Bearing in mind the above analysis of liability and the risk related to the involvement of public funds in financing long-term projects based on DLT, the following thesis can be put forward. Public authorities may approach the implementation of such projects with a great deal of caution. Firstly, due to the fear of incurring responsibility, irrespective of its nature, because of the DLT, which is not widely known by all citizens and the lack of sufficient knowledge about it, including issues related to risk. Secondly, bearing in mind the principles of exercising power and the functioning of the political scene in democratic countries, it should be pointed out that organizing or joining a long-term investment may turn out to be unprofitable from the point of view of the short-term goals of individual political parties exercising power on the basis of an electoral mandate from the general public. The potential benefits of financing and organizing a long-term investment due to its specificity are postponed in time.

The above considerations only point to the potential attractiveness of the public financing of long-term investments based on DLT. It should also be examined whether legal mechanisms currently exist allowing the planning of public expenditures of individual states or international organizations in a perspective of more than one year.

In public finance, the generally accepted principle of planning revenues and expenditures is the annual nature of budgets. Most EU countries adopt their budgets for one financial year, which in most cases equates to the calendar year.

In the United States, the fiscal year is also 12 months long. Exceptionally, however, the US fiscal year begins on October 1 and ends on September 30 of the following calendar year. A similar situation also exists in Great Britain.

Individual countries and international organizations, recognizing the problem of planning income and expenses in the perspective of a year understood as a period of 12 consecutive months are introducing solutions allowing for financial planning in the long term. Here, legal mechanisms for long-term financial planning will be analysed based on the example of the EU as an international organization with an extensive structure and finances, and of fundamental importance for the functioning of European countries.

On the basis of the EU budget, the requirement to include the EU's expenditure in periods longer than the traditional financial year results from the Treaty on the Functioning of the European Union. In addition to the annual budget of the EU as an international organization, there also exist multiannual financial frameworks. Pursuant to Article 312 of the Treaty, the multiannual financial framework shall ensure that Union expenditure develops in an orderly manner and within the limits of its own resources. It shall be fixed for a period of at least five years. Importantly, the Treaty does not indicate the maximum period of operation of the multiannual framework.

The financial framework sets out the amounts of the annual ceilings for commitment appropriations by category of expenditure and the annual ceiling for payment appropriations. Pursuant to Article 312(2) of the Treaty, they are adopted in the form of a regulation of the Council of the European Union, in accordance with a special legislative procedure, after obtaining the consent of the European Parliament.

Currently, the legal framework for the years 2021–2027 is in force based on the Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027.[64] It should be noted that the multiannual financial framework is not rigid. During its validity, it can be adapted to the current legal and economic situation.

Therefore, international organizations have the ability to determine their income and expenses, including commitments for multiannual periods, a clear example of which is the EU. Therefore, there is a legal possibility to organize and subsequently finance a long-term and capital-intensive investment based on distributed ledgers by such entities that bring together certain

countries. However, it should be emphasized that the European Union is one of the most developed international organizations in terms of structure and, above all, from the point of view of the competences granted to it by the Member States, including the powers to create law.

The European Union's multiannual financial framework is very general. It is undoubtedly a good legal and financial instrument for long-term planning in an international organization. Its specification is the budget as an annual plan of income and expenses. It is difficult to implement such a multiannual financial framework into the method of financing a long-term and capital-intensive investments. Undoubtedly, the aspect of long-term financial planning and, above all, obtaining funds in a long-term perspective is crucial for this type of investment. The 5-year period of validity of the financial framework seems too short in relation to the deadline for implementing the investment covered by this monograph.

The method of establishing a multiannual financial framework in a long-term and capital-intensive investment may be taken from the provisions of primary European Union law. Given the multitude of investors and very dispersed capital, it is essential to define the rules for accepting multiannual planning documents.

An organization created solely for the purpose of implementing a specific project is the International Fusion Energy Organization (described in more detail in Section 1.1). The Organization was established under the agreement on the establishment of the International Fusion Energy Organization of 21 November 2006 concluded in Paris.[65] Pursuant to Article 5 of the Agreement, ITER has international legal personality, including the legal capacity to enter into agreements with states or international organizations.

The ITER Agreement was concluded for a period of 35 years, which undoubtedly speaks to the long-term nature of the investment. Under Article 24(3) of the ITER Agreement, this period may be extended. It should also be pointed out that the ITER Agreement may be terminated by mutual agreement, taking into account the time needed to complete operations and providing the necessary funds for decommissioning. Importantly, Article 25 of the ITER Agreement also regulates how to resolve any disputes.

The method of managing the organization has been clearly regulated in Article 6 of the ITER Agreement. The main body of ITER is the Council, which is composed of representatives of the members of the organization (a maximum of four representatives appointed by one member of the organization). The Council is responsible for the promotion, overall management and supervision of the activities of the ITER Organization in pursuit of its objective.

In the case of the ITER Council, there is a dual mode of decision-making. In the most-important matters, the Council takes decisions unanimously. This concerns, in particular, the appointment and extension of the term of office of the Director-General, the total budget for the various phases of the ITER project, the approval of changes in the overall cost allocation and

the accession of states to the ITER Organization (Article 6(8) of the ITER Agreement). In matters that do not require unanimity, the Council makes decisions by weighting votes. The weighing of the votes of ITER members reflects their contribution to the ITER Organization (Article 6(10) of the ITER Agreement).

Also of significant importance is that any of the entities may withdraw from the concluded agreement, excluding the first 10 years of its validity. Importantly, withdrawal from the project by one of the entities does not have a major impact on the financial situation of the organization, because pursuant to Article 26 of the ITER Agreement, withdrawal from the Agreement shall not affect the contribution of the withdrawing Party to the construction costs of the ITER facilities.

A positive argument for the leading participation of an international organization in the analysed investment is primarily the diversification of funds. This is because they come from at least several countries. In addition, states may – in various ways and on their own – obtain funds necessary for the implementation of investments by the Organization. The resources of individual countries can be equated with a kind of membership fee.

In addition, the financing of investments by an international organization with using crypto-assets purchased by individual Member States allows them to use the tokens purchased under the DAO. They can use tokens for settlements between themselves not only on the basis of a given investment. Tokens may, therefore, constitute units of account between contracting states. A similar situation occurs primarily under ITER, where the value of each procurement agreement is expressed in ITER units of account (see more extensively Section 1.1), although of course without using blockchain technology.

Another advantage of financing investments based on an international organization is the dispersion of decision-making among individual countries. This is important, because the concentration of powers to decide the shape and future of investments (a kind of ownership rights) by one entity may lead to the use of investments for particular purposes and may constitute an instrument used in international politics. However, historical examples, and above all the ITER Agreement, show that long-term investments require the members of the organization to be unanimous on the most-important issues. This unanimity makes it possible to protect the interests of minorities, but on the other hand, it can lead to the inability to take important decisions.

Bearing in mind the aspect of international politics and geopolitical issues, it is also necessary to highlight the threats to investments arising from their financing by international organizations. Firstly, at the stage of investment implementation, individual countries – fighting for their international position – may try to influence the directions of the investment's development at all costs. In other words, the particular interests of individual countries may determine the scope of the investment, and above all, the scope of its

financing. There may be a situation in which one of the states does anything it can to discontinue the implementation of the investment only to force other states to take a specific action in another sphere of activity.

In addition, the conflicts that have arisen between states in recent years, including armed conflicts, show the instability of international relations. Therefore, at the stage of investment implementation, a conflict may arise between members of international organizations. This conflict may lead to the suspension of funding and stalled development.

In the opinion of the authors of the monograph, the above threats may not support financing a long-term and capital-intensive investment using an international organization. This type of concept undoubtedly has positive aspects; however, it also carries certain risks. When considering the concept of creating an international organization, it is crucial to ensure the proper establishment of relations between the contracting states to mitigate the risk of conflicts and to prevent the possibility of the organization being exploited to pursue the interests of individual states. For example, the above-mentioned ITER Agreement introduces, to some extent, mechanisms limiting the above risks.

Moving on to the issue of long-term planning of revenues and expenditures, it can be pointed out that mechanisms of this kind occur, inter alia, in France, Russia, Poland, Great Britain and the Czech Republic.

The Constitution of the French Republic in the wording in force since 2008 allows for the introduction of laws on the programming of public finances.[66] According to Article 34, "The multiannual guidelines for public finances shall be established by Programming Acts. They shall contribute to achieving the objective of balanced accounts for public administrations".

French acts on financial programming primarily define the evolution of state revenues and expenditures in the period covered by the given act, as well as management principles (Zawadzka-Pąk, 2014a, p. 77). Individual acts on financial programming from recent years have been introduced for periods of several years, i.e., from four to six years.

In turn, in Great Britain, multiannual financial planning is based on a review of expenditures, which is adopted in four-year periods (originally, these were three-year periods). Its essence is to set spending limits for individual ministries (Zawadzka-Pąk, 2014b, pp. 178–182). However, there have been times when a spending review was in effect for less than four years (Smith, 2020). The current spending review was introduced in 2021 and is meant to apply to the 2024–2025 budget.[67]

It is also worth mentioning that the UK spending review does not cover all of the state's public spending (Smith, 2020).

In the Czech Republic, multiannual financial planning is a medium-term perspective. It should primarily encompass the revenues and expenses of the state budget and state funds covering individual years within the perspective. Importantly, the perspective also covers the liabilities incurred by the state. The medium-term nature of the perspective means that it is valid for two

years, although, in fact, it covers a given financial year and the following two years (Ruśkowski, 2014, pp. 62–63).

Poland, however, has a long-term state financial plan. The Act of 27 August 2009 on Public Finances[68] clearly highlights that it is adopted for the period of the financial year and the following three years.

For countries that are members of the European Union, Council Directive 2011/85/EU of 8 November 2011 on requirements for budgetary frameworks of the Member States[69] is binding. Pursuant to Article 4 of the Directive, Member States shall ensure that fiscal planning is based on realistic macro-economic and budgetary forecasts using the most up-to-date information. These forecasts shall be subject to regular, unbiased and comprehensive evaluation based on objective criteria, including ex post evaluation.

Importantly, Article 9 of the Directive imposes the obligation of multiannual financial planning on all Member States. Namely, Member States shall establish a credible, effective medium-term budgetary framework providing for the adoption of a fiscal planning horizon of at least three years, to ensure that national fiscal planning follows a multiannual fiscal planning perspective. It is also clear from the Directive that legal acts related to long-term financial planning may be subject to significant changes during their period of validity.

This allows for the free shaping of the content of multiannual financial plans of individual countries during their period of validity. It leads to the conclusion that such legal acts cannot guarantee stable sources of financing for a long-term and capital-intensive investment. First and foremost, forecasts of public revenues and expenditures may change in accordance with the electoral cycle in a given country. The above thesis is not a criticism of the content of the Directive, which in its assumption enables the dynamic shaping of the state's expenditure policy bearing in mind the will of its citizens expressed in democratic elections. It only shows that provisions on long-term financial planning are not able to fully guarantee stable financing of a long-term investment.

In the context of the implementation period of a long-term investment, the above-mentioned directive introduces a relatively short minimum period for forecasting public revenues and expenditures. This period is not really significantly extended by individual Member States.

Summing up the above analysis, it can be concluded that long-term financial planning is a legally and economically significant institution of public finance in individual countries. However, it is limited to a relatively short period compared with the assumed duration of a long-term and capital-intensive investment. Nevertheless, legal solutions sometimes exist that allow one to plan income and expenses for a very long period. This applies in particular to the EU's multiannual financial framework, where the Treaty on the Functioning of the European Union does not impose a cut-off date, with the current framework being adopted for a period of eight financial years.

Importantly, no common restrictions exist on the incurring of long-term liabilities. Developing and highly developed countries have the capacity to

incur such liabilities and organize long-term investments – public finance law allows this. However, a problem may arise with the feasibility of the amounts planned to be spent, which due to a number of external factors, may change and simultaneously are impossible to plan. At the same time, it is difficult to find mechanisms to protect investments against errors in financial planning based on public funds.

When synthesizing the above considerations, it is necessary to highlight at least two advantages of the investment financing model based on public funds utilizing public finance law. First of all, for potential investors purchasing crypto-assets, the security of the transaction is important. Such security, by definition, is provided by the state. It guarantees solvency. In addition, the state is obliged to transparently manage the funds (irrespective of the source of their acquisition). There is public control and supervision within the state authority, which further strengthens the investor's situation.

Secondly, the state has no bankruptcy capacity compared with most private sector entities. Therefore, it bears full and, as a rule, unlimited liability for its obligations. Apart from extreme cases (mostly resulting from armed conflicts), the state cannot lose its legal existence.

Assuming that the investment may be based on the activity of an entity other than the state itself as the subject of rights and obligations, such as state-owned companies and government agencies, guarantees and sureties play an important role. From the point of view of investors' safety, a state guarantee (surety) for the obligations of the entity responsible for the implementation of the investment and the structure of the DAO itself may be of great importance. This solution increases the stability and credibility of investments, as well as the safety of investors entrusting their funds.

The role of the state in investments is closely associated with the broad concept of state aid and the limitations in this regard. It should be noted that a long-term investment will be related to a greater or lesser extent to economic activity, since it is supposed to be profit oriented. This observation is of great importance, especially for Member States of the EU. In accordance with Article 107 of the Treaty on the Functioning of the European Union, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the internal market. State aid can take various forms. First of all, direct subsidies, credits, loans and the acquisition of shares in commercial law companies are classified as aid measures. Importantly, state aid can also be in the form of sureties and guarantees (EU Commission Notice on the concept of state aid within the meaning of Article 107(1) of the Treaty on the Functioning of the European Union).

Within the meaning of the Treaty, inter alia, aid of a social nature granted to individual consumers or aid to remedy the damage caused by natural disasters or exceptional occurrences is compatible with the internal market.

The main problem with the role of the state in long-term and capital-intensive investments is the possibility of distortion of competition. The Court of First Instance of the EU in its judgment of 22 February 2006 in the case of Le Levant 015 EURL and Others vs European Commission[70] in the context of the essential features of prohibited state aid pointed out that the provision of the Treaty

> contains the following premises. First, there must be an intervention by the State or through State resources. Second, the intervention must be likely to affect trade between Member States. Third, it must confer an advantage on the recipient by favouring certain undertakings or the production of certain goods. Fourth, it must distort or threaten to distort competition.

Importantly, in EU law, the very purpose of the activity of a given entity does not exclude the application of the provisions on state aid. Non-profit entities may be covered by state aid rules (EU Court of Justice, 2008, sections 27–28). For example, prohibited state aid may also apply to non-profit or social activities.[71]

Under EU aid law, a situation in which state-owned enterprises provide public aid has not been clearly regulated. In the case of the analysed investment, they co-finance it. The CJEU highlights that the mere possibility of assigning an aid measure to a public enterprise does not determine the existence of unlawful state aid. Therefore, when an aid measure may be assigned to the state, all circumstances should be taken into account, for example, that in granting aid, a public enterprise had to take into account the guidelines of government authorities, the nature of the enterprise's operations, as well as its legal status and whether it is governed by public law or the general rules applicable to commercial entities and the extent to which public authorities oversee business activities.[72]

To sum up, in order to recognize whether a given measure bearing the features of an aid measure constitutes unlawful state aid within the meaning of Article 107 of the Treaty on the Functioning of the European Union, a private investor test should be carried out. It involves carrying out an assessment of whether the State, when granting any form of aid, acted as a private investor. The behaviour of the state must, therefore, be compared with that of similar private investors operating under normal market conditions. The European Commission highlights that this is an appropriate measure to assess whether the state's activity takes place under normal market conditions (Sections 75–77 Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union).[73] If the state (a public entity or public enterprise) behaves like a private investor, no state aid is being granted.

The result of the private investor test depends on the detailed rules for the implementation and financing of a long-term and capital-intensive investment. It is possible to carry out, and is reliable on an *ad casum* basis, i.e.,

only after determining the scope and type of the implemented investment, and above all its subject (assumed effect).

However, the concept of financing a long-term investment with the use of public entities and public funds has a number of disadvantages. Financing a long-term investment with the need for significant cash outlays requires a flexible approach by investors. In the case of countries whose essence of functioning boils down to financing expenditure with public funds, a fairly significant legal barrier arises. Public finance law provisions set out a very rigid framework for the management of public funds, including their disposal. This is fully justified by the specificity of the sphere of state activity they regulate, but it may significantly hinder the financing of investments, especially those based on DLT. Moreover, the financing of investments requires the stability of the policy being pursued. The essence of democratic systems is the ability to change the political party in power in accordance with the election cycle or by means of a referendum. There are no legal guarantees that would allow successive governments to be ordered to continue the investment, as it may be inconsistent with their assumptions and voters' expectations.

Conducting economic activity is not the main purpose of the state. Its essence is mainly to provide its citizens, who are linked by specific ties, with public goods and services. These include security, education, higher education, defence and healthcare, which has been of great social importance in recent years. Therefore, the activities of the state cannot be profit-oriented. Profit is not excluded, but it cannot be the main reason for the activity of public authorities. In other words, the role of the state is to perform public tasks, not private ones the crux of which boils down to the goal, which is a specific profit. Importantly, the essence of a long-term and capital-intensive investment financed using DLT is to make a profit. Otherwise, investors might not be interested in purchasing crypto-assets to finance it.

Therefore, in the opinion of the authors of the monograph, the implementation of investments based on public funds at the disposal of the state is unrealistic. This investment is to be profit-oriented and, in principle, pursue the broadly understood private interest of investors, not the public interest.

5.5 Legal aspects of the implementation of sustainable development goals through long-term and capital-intensive investments financed using distributed ledger technology

On 25 September 2015, the UN General Assembly adopted the resolution Transforming our World: the 2030 Agenda for Sustainable Development. It contains 17 sustainable development goals and 169 related tasks. From the perspective of these goals, DLT (in particular blockchain technology) has one significant disadvantage and a number of advantages that may contribute to their implementation. Undeniably, a significant disadvantage of blockchain technology, which was noticed at the very beginning of its development, is the energy consumption of the *proof of work* process, which is

not necessarily rationally justified (Bala, Kopyściański and Srokosz, 2016, p. 152). This problem is only growing, and is now closely related to the issue of sustainable development (Fadeyi et al., 2020, p. 6; Jiang et al., 2021, p. 4; Náñez Alonso et al., 2021, p. 3). This is a significant drawback in the context of the energy crisis and the drive to reduce carbon dioxide emissions. Hence, in order to be consistent with diversified development goals, the financing of a capital-intensive and long-term investment, particularly one of a global nature, must be based on DLT that minimizes energy consumption to the maximum extent. This is technologically definitely possible.

Currently, the less-energy-intensive proof-of-authority (PoA) mechanism is being used (such a mechanism is used, for example, by the blockchain Hyperledger Fabric), although the proof-of-stake (PoS) mechanism and its three main variants seem unrivalled in terms of energy consumption: pure proof-of-stake (PPoS, used for example, by Algorand), delegated proof-of-stake (DpoS, used for example, by EOS and TRON) and bonded proof-of-stake (BPoS, used for example, by Ethereum 2.0),[74] see also Section 2.1.3 "Synchronization Mechanisms". It is considered that blockchains based on PoS and PoA mechanisms consume even orders of magnitude less than those based on the PoW mechanism, because they do not use the mining mechanism (mining process) – this is energy reduction of 99.95% or 99.98% or even higher.[75]

The adverse impact of blockchain technology on the natural environment can also change the appropriate use of this technology – namely, it can be used to more effectively manage the distribution of energy, in particular "green energy", and thus positively contribute to the achievement of goals 7 and 13 of sustainable development goals (Khezami et al., 2022, p. 12, 19; Barceló et al., 2023, p. 1 *et seq*). From the perspective of the subject of this monograph, this may be, for example, long-term and capital-intensive investments in the production and distribution of "green energy" and energy obtained from sources that do not contribute to global warming, such as nuclear power plants or tomatoes.

In MiCA (April 2022), in the proposal for the content of the recitals, a legislative proposal was drawn up by the European Parliament that was supposed to legally limit the energy intensity of the blockchain system (it was also pointed out that, in addition to the carbon footprint, the proof of work mechanism leads to significant generation of electronic waste due to the frequent replacement of mining hardware). Namely, it was proposed that the crypto-asset whitepaper operating based on the proof of work method contained an independent assessment of the crypto-asset's likely energy consumption. In addition, the European Parliament intended to directly refer in the recitals to the MiCA Regulation to the EU regulation implementing the idea of sustainable development on the EU single financial market, i.e., Regulation (EU) 2019/2088 (Sustainable Finance Disclosure Regulation – SFDR[76]). The Regulation lays down harmonized rules for financial market participants and financial advisers on transparency with regard to the integration of sustainability risks

and the consideration of adverse sustainability impacts in their processes and the provision of sustainability-related information with respect to financial products (see Article 1 SFDR). Point 5c of the recitals to MiCA proposed by the European Parliament (April 2022) stated that in line with the objectives of the Sustainable Finance Agenda, requirements regarding sustainability-related disclosures as defined in the SFDR and the EU Taxonomy for sustainable activities should also apply to crypto-assets as well as to CASPs and issuers. These proposals were not included in the content of the MiCA (October 2022), but the European Parliament revisited the idea of consensus mechanisms and its energy intensity in point 7 of the recitals to the final version of the MiCA Regulation. In addition, final version of the regulation also returned to the concept of including in the whitepaper information about the adverse climate impacts and other adverse environmental impacts resulting from the consensus mechanism used to issue crypto-assets. It is also expected that ESMA and EBA will be authorized to develop draft regulatory technical standards to further specify the content, methodologies and presentation of information in relation to sustainability indicators with regard to adverse impacts on climate and other environment-related adverse impacts, and to outline key energy indicators.

It seems that after the entry into force of MiCA, the SDFR will have to be amended to also include issuers of crypto-assets, offerors of crypto-assets and CASPs. The SDFR will, therefore, undoubtedly also be important for capital-intensive and long-term projects financed based on DLT. Hence, capital-intensive and long-term investments financed with the use of blockchain technology must all the more so be planned and implemented taking into account the goals of sustainable development. It should be pointed out that they may be used to achieve sustainable development goals 8.1, 8.3, 8.10, 9.1, 9.5 in particular.

The literature indicates a number of other sustainable development goals the achievement of can use blockchain technology, for example, support peer-to-peer trading of water rights (goal 6); develop smart contract for transport and logistics (goal 9); creating more liveable cities implementing platforms to monitor energy consumption, waste and so on (goal 11); enables tracking and tracing of supply chains and natural resource usage (goal 12); implementation mechanisms to monitor water pollution and preserve marine resources (goal 14); offer small cash payments in exchange for conserving nature (goal 15) (Parmentola et al., 2022, p. 210).

5.6 Protection of personal data and EU digital identity

The financing of long-term and capital-intensive investments may also be negatively affected by legal regulations that do not directly relate to crypto-assets, or more broadly – DLT. One can mention here, for example, provisions on the protection of personal data (especially in the EU, which attaches great importance to this issue, see, first and foremost, the GDPR), or provisions

on the protection of consumers and non-professional investors (the EU is also a leader in regulating this issue). Also noteworthy are the provisions of commercial law, including company law and securities law, which at different levels – depending on the country and legal culture (for example, different possibilities are created by Anglo-Saxon law and continental European law) – enable the tokenization of shares and stocks in companies (also see Section 3.3).

First of all, the development of personal data protection law, which is noticeable and undoubtedly needed in the era of the digital economy, may partially hinder the implementation of a capital-intensive investment based on DLT. Abuse by some entities of the trust of other people by using their personal data for their own activities, as well as unlawful data selling, resulted in an increase in the interest of individual legislators. In the European Union, this is primarily about Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data[77] (General Data Protection Regulation – GDPR).

The preamble to the GDPR states that the protection of natural persons in relation to the processing of personal data is a fundamental right. The principles of, and rules on the protection of natural persons with regard to the processing of their personal data should, whatever their nationality or residence, respect their fundamental rights and freedoms, in particular their right to the protection of personal data. This Regulation is intended to contribute to the accomplishment of an area of freedom, security and justice and of an economic union, to economic and social progress, to the strengthening and the convergence of the economies within the internal market, and the well-being of natural persons. The processing of personal data should be designed to serve mankind. The right to the protection of personal data is not absolute; it must be considered in relation to its function in society and be balanced against other fundamental rights, in accordance with the principle of proportionality. The preamble also states that the economic and social integration resulting from the functioning of the internal market has led to a substantial increase in cross-border flows of personal data. The exchange of personal data between public and private actors, including natural persons, associations and undertakings across the Union has increased. Rapid technological developments and globalization have brought new challenges for the protection of personal data. The scale of the collection and sharing of personal data has increased significantly. Technology allows both private companies and public authorities to make use of personal data on an unprecedented scale to pursue their activities. Natural persons increasingly make personal information available publicly and globally. Technology has transformed both the economy and social life, and should further facilitate the free flow of personal data within the Union and the transfer to third countries and international organizations, while ensuring a high level of protection of personal data, and those developments require a strong and more

coherent data protection framework in the Union, backed by strong enforcement, given the importance of creating the trust that will allow the digital economy to develop across the internal market.

The preamble also stated that any processing of personal data in the context of the activities of an establishment of a controller or a processor in the Union should be carried out in accordance with this Regulation, regardless of whether the processing itself takes place within the Union. Establishment implies the effective and real exercise of activity through stable arrangements. The legal form of such arrangements, whether through a branch or a subsidiary with a legal personality, is not the determining factor in that respect. In order to ensure that natural persons are not deprived of the protection to which they are entitled under this Regulation, the processing of personal data of data subjects who are in the Union by a controller or a processor not established in the Union should be subject to this Regulation where the processing activities are related to offering goods or services to such data subjects irrespective of whether connected to a payment. In order to determine whether such a controller or processor is offering goods or services to data subjects who are in the Union, it should be ascertained whether it is apparent that the controller or processor envisages offering services to data subjects in one or more Member States in the Union. Whereas the mere accessibility of the controller's, processor's or an intermediary's website in the Union, of an email address or of other contact details, or the use of a language generally used in the third country where the controller is established, is insufficient to ascertain such intention, factors such as the use of a language or a currency generally used in one or more Member States with the possibility of ordering goods and services in that other language, or the mentioning of customers or users who are in the Union, may make it apparent that the controller envisages offering goods or services to data subjects in the Union.

In the context of the problem of financing investments based on DLT, attention should be paid to Article 3 of the GDPR (constituting a partial reiteration of the preamble), which determines the territorial scope of its application. This regulation applies to the processing of personal data in the context of the activities of an establishment of a controller or a processor in the Union, regardless of whether the processing takes place in the Union or not. Importantly, it should also apply to the processing of personal data of data subjects residing in the Union by a controller or processor not established in the Union, where the processing activities involve the offering of goods or services to such data subjects. It follows from this provision that, irrespective of the location of the investment and the adoption of the law applicable to it, it can be stated with a high degree of probability that the investment will have to comply with the EU provisions on the protection of personal data. The problem of GDPR territoriality in the context of blockchain technology is very often raised in the literature on the subject (Berberich and Steiner, 2016, p. 423).

Responsibility for data processing rests with the controller, which within the meaning of Article 4(7) GDPR is a natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data. In the case of the analysed investment, this will be the company (legal person) on whose personality the DAO is based. Due to the fact that data of a personal data nature can be stored in the blockchain, controversies arise as to the extent of the responsibility provided for by the GDPR falls on the persons controlling the network nodes as well as on the members of a DAO that does not have legal personality.

The provisions of the GDPR introduce a very broad concept of personal data, which should be understood as any information about an identified or identifiable natural person ("the data subject"); an identifiable natural person is one who can be identified, directly or indirectly, in particular reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. Financing investments through the use of DAOs and issuing tokens requires the processing of investors' personal data, irrespective of whether they are consumers or business entities. The literature indicates that two types of data can be stored within the blockchain network. Firstly, there are metadata related to specific transactions (for example, the addresses of the sender and recipient, as they determine the identity of a natural person). Secondly, there are data about the subject of the transaction. Public keys are also considered personal data within the meaning of the GDPR. Even if the data is pseudonymized, it will still be personal data subject to pseudonymization (Flick, 2018, p. 22).

Therefore, it is necessary for the legal person on the basis of which the DAO operates to meet all the requirements set by the European legislator for data controllers. This primarily involves limiting the purpose of processing (data collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes), the principle of adequacy of processing, and ensuring data integrity (data processed in a manner that ensures adequate security of the personal data, including protection against unauthorized or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organizational measures). Importantly, the legal person with which a DAO is affiliated is responsible for the processing of the personal data, and must at the same time demonstrate that it complies with the principles of data processing (accountability principle).

Article 35 GDPR introduces an obligation to assess the impacts of data processing. In this regard, the GDPR places great emphasis on data processing using new technologies and, therefore, also using DLT. At the stage of planning and starting the investment it will, therefore, be necessary to carry out a thorough assessment of the impacts of the planned processing

operations for the protection of personal data, and to determine the threats to data security related to the financing of investments based on DLT. Pursuant to Article 24 of the GDPR, taking into account the nature, scope, context and purposes of processing as well as the risks of varying likelihood and severity for the rights and freedoms of natural persons, the controller shall implement appropriate technical and organizational measures to ensure and to be able to demonstrate that processing is performed in accordance with this Regulation. Those measures shall be reviewed and updated where necessary. Where proportionate in relation to processing activities, the measures shall include the implementation of appropriate data protection policies by the controller. Taking into account the state of the art, the costs of implementation and the nature, scope, context and purposes of processing as well as the risk of varying likelihood and severity for the rights and freedoms of natural persons, the controller and the processor shall implement appropriate technical and organizational measures to ensure a level of security appropriate to the risk (article 32 GDPR).

Irrespective of this, in accordance with the provisions of GDPR, the personal data controller has a number of obligations regarding their collection and processing. Firstly, the controller shall take appropriate measures to provide any information relating to processing to the data subject in a concise, transparent, intelligible and easily accessible form, using clear and plain language. The data subject shall have the right to obtain from the controller without undue delay the rectification of inaccurate personal data concerning him or her. Taking into account the purposes of the processing, the data subject shall have the right to have incomplete personal data completed, including by means of providing a supplementary statement (Article 16 GDPR). Furthermore, the data subject has the right to obtain from the controller the erasure of personal data (right to be forgotten), right to restriction of processing, right to data portability and right to object.

The planned investment will have to fulfil all these obligations if its activities are in any way related to the territory of the European Union. In the context of the use of blockchain technology, it is indicated that the objectives of the GDPR are not inconsistent with the objectives of this type of technology. However, the GDPR does not provide clear answers to problems occurring in the functioning of the blockchain. First of all, attention is drawn to the problem of the identity of the personal data controller. It is difficult to determine who the controller of personal data processed in the blockchain network is. It is assumed that users of the blockchain network who transfer data to this network as part of their business activities may be considered data controllers. For example, there may be a problem with the exercise of the rights of persons whose data are processed if it is impossible to determine who is obliged to exercise these rights. This may include the right to access data or the right to object. If data processing is based on consent, it is not known to whom it was granted. It is also emphasized that despite the significant problems reported under European personal data protection rules, the

GDPR does not exclude the possibility of economic use of blockchain technology (Van Ecke and Haie, 2018, pp. 532–533).

The global nature of the investment is related to the issue of transferring personal data outside the European Union. Pursuant to Article 45(3) GDPR, the transfer of personal data to a third country may take place when the European Commission finds that this third country, territory or specific sector or sectors in this third country ensure an adequate level of protection. Such transfer does not require any special authorization. The absence of a decision of the European Commission does not completely exclude the possibility of data transfer, because in such a case, the controller may transfer personal data to a third country only if it provides appropriate safeguards, and provided that enforceable rights of data subjects and effective legal protection measures are in place. However, this is at the discretion of the controller, for which it is responsible. Pursuant to Article 49 GDPR, it is possible to transfer personal data outside the EU without the need to obtain a decision from the European Commission and establish appropriate safeguards. Namely, a transfer or set of transfers of personal data to a third country without meeting the above requirements may take place, inter alia, if the data subject has explicitly consented to the proposed transfer, after having been informed of the possible risks of such transfers for the data subject due to the absence of an adequacy decision and appropriate safeguards; the transfer is necessary for the performance of a contract between the data subject and the controller or the implementation of pre-contractual measures taken at the data subject's request; and the transfer is necessary for the conclusion or performance of a contract concluded in the interest of the data subject between the controller and another natural or legal person. It seems that it is these legal mechanisms that will be used to finance mega-investments, since they are to be global in nature and access to them for investors is to be subjectively unlimited.

From the point of view of the global nature of the investment, legal regulations on the protection of personal data functioning in countries outside the European Union are also important. For example, in the United Kingdom, the Data Protection Act 23 May 2018 applies.[78] Although the United Kingdom formally withdrew from the European Union, British legislation is additionally based on the EU's GDPR.

Currently, however, work is underway on a new legal regulation in the field of personal data protection. On 8 March 2023, the Data Protection and Digital Information (No. 2) Bill was introduced into the House of Commons.[79] It is aimed at reducing burdens and stimulating the economy over the next decade, and significantly changing the current rules of personal data protection based on the GDPR (Clark et al., 2023, p. 5).

It should be highlighted that on 28 June 2021, Commission Implementing Decision (EU) 2021/1772 of 28 June 2021 was issued on the basis of Regulation (EU) 2016/679 of the European Parliament and of the Council on the adequate protection of personal data by the United Kingdom.[80] The

decision was issued on the basis of the above-mentioned Article 45(3) GDPR. The Commission indicated that UK data protection law provides a level of protection for personal data transferred from the European Union that is broadly equivalent to the level of protection guaranteed by the GDPR. The Commission's decision, therefore, allows for the free transfer of personal data to the United Kingdom.

In terms of personal data protection, the relationship between the European Union and the United States is somewhat different. Due to the problems related to the Privacy Shield – Commission Implementing Decision (EU) 2016/1250 of 12 July 2016 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the EU-US Privacy Shield[81] – EU authorities have started work on new mechanisms allowing for the free flow of data between Member States and the United States. The CJEU, in its judgment of 6 July 2020 in case C-311/18, stated that the above-mentioned decision of the Commission is invalid.

Currently, work is underway on a draft decision of the European Commission, which is to be issued pursuant to Article 45 GDPR in relation to the transfer of personal data to the United States. The decision is intended to enable – as in the case of Great Britain – the free flow of personal data. On 28 February 2023, the European Data Protection Board adopted its opinion on the draft adequacy decision with regard to the EU-US data protection framework.[82] The draft decision awaits further legislative steps.

The protection of personal data is closely related to the issue of digital identity. Very advanced work is being carried out in the European Union on a European digital identity. This work is progressing in two ways – the EU is on the one hand developing technological solutions, and on the other, legal regulations.

The EU Digital Identity will be available to EU citizens, residents and businesses that want to identify themselves or provide confirmation of certain personal information. It can be used for online and offline public and private services across the EU. Every EU citizen and resident in the Union will be able to use a personal digital wallet.[83] Following is a list of the key principles of the European Digital Identity[84]:

- available to any EU citizen, resident or business in the EU that wants to use it;
- widely useable as a way of identification or to confirm certain personal attributes for the purpose of access to public and private digital services across the EU;
- giving full control to users to choose which aspects of their identity, data and certificates they share with third parties, and keep track of such sharing.

Legal work on European electronic identification involves the development of a proposal for a Regulation of the European Parliament and of the

Council amending Regulation (EU) No. 910/2014 as regards establishing a framework for a European Digital Identity (COM/2021/281 final). The preamble to the draft of this regulation (last available version of 6 December 2022)[85] states that

> use cases that involve crypto assets should be compatible with all applicable financial rules including, for example, the Markets in Financial Instruments Directive, the Payment Services Directive, the E-Money Directive, as well as with possible future legislation on Markets in Crypto Assets and with anti-money laundering rules which could be included in the Transfer of Funds Regulation, and could require crypto asset service providers to verify the identity of users of electronic ledgers in order to comply with international anti-money laundering standards.

Changes to Regulation No. 910/2014 enabling the use of a European digital identity and a personal digital wallet are important for all projects financed using crypto-assets, including long-term and capital-intensive ones. It will be easier and cheaper to conclude online contracts with consumers (small investors) after the implementation of digital identity, because the service of establishing their identity provided by the EU will be simple and free of charge. The European Digital Identity will also make it easier for the entity conducting the investment to meet its tax and anti-money laundering and counter-terrorism financing obligations. Moreover, the European Digital Identity seems to make the functioning of DAOs easier from a legal perspective, as it will make it easier to establish the identity of entities participating in the DAO. This, in turn, may be important for the greater usefulness of DAOs in financing long-term and capital-intensive investments.

Acknowledgement

Notes

1 IOSCO Research Report on Financial Technologies (Fintech), February 2017, p. 51, www.iosco.org/library/pubdocs/pdf/IOSCOPD554.pdf; Issues, Risks and Regulatory Considerations Relating to Crypto-Asset Trading Platforms. Final Report. Board of IOSCO 2020, p. 1.
2 Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU, OJ L 173, 12.6.2014, pp. 349–496, as amended.
3 Regulation (EU) No. 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No. 648/2012, OJ L 173, 12.6.2014, pp. 84–148, and Directive 2011/61/EU, OJ L 173, 12.6.2014, pp. 349–496, as amended.

 4 Consolidated text: Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS), OJ L 302, 17.11.2009, pp. 32–96, and Directive 2011/61/EU, OJ L 173, 12.6.2014, pp. 349–496, as amended.

 5 Directive 2014/91/EU of the European Parliament and of the Council of 23 July 2014 amending Directive 2009/65/EC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) as regards depositary functions, remuneration policies and sanctions, OJ L 257, 28.8.2014, pp. 186–213.

 6 Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934, Securities and Exchange Commission, Release No. 81207/25 July 2017.

 7 No. 2:22-cv-01009, W.D. Wash., 21 July 2022, https://perma.cc/C2TK-HVSA

 8 Regulators' Statements on Initial Coin Offerings. www.iosco.org/publications/?

 9 European Securities and Markets Authority, www.esma.europa.eu/sites/default/files/2024-01/ESMA75-453128700-52_MiCA_Consultation_Paper_-_Guidelines_on_the_qualification_of_crypto-assets_as_financial_instruments.pdf

10 Regulation 2022/858 of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology, and amending Regulations (EU) No. 600/2014 and (EU) No. 909/2014 and Directive 2014/65/EU, OJ L 151, 2.06.2022.

11 Regulation 2020/1503 of the European Parliament and of The Council of 7 October 2020 on European crowdfunding service providers for business, and amending Regulation (EU) 2017/1129 and Directive (EU) 2019/1937 (OJ L 347, 20.10.2020).

12 Directive 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No. 1093/2010, and repealing Directive 2007/64/EC, OJ L 337, 23.12.2015, pp. 35–127, as amended.

13 Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions amending Directives 2005/60/EC and 2006/48/EC and repealing Directive 2000/46/EC, OJ L 267, 10.10.2009, pp. 7–17, as amended.

14 Proposal from 28.06.2023 for a Directive of the European Parliament and of The Council on payment services and electronic money services in the Internal Market amending Directive 98/26/EC and repealing Directives 2015/2366/EU and 2009/110/EC (COM(2023) 366 final).

15 Proposal from 28.06.2023 for a Regulation of the European Parliament and of the Council on payment services in the internal market and amending Regulation (EU) No. 1093/2010 (COM(2023) 367 final).

16 See recital 9 of the MiCA Regulation; Opinion of the European Central Bank of 19 February 2021 on a proposal for a regulation on Markets in Crypto-assets, and amending Directive (EU) 2019/1937, (CON/2021/4), p. 10.

17 European Central Bank, Stablecoins: Implications for monetary policy, financial stability, market infrastructure and payments, and banking supervision in the euro area, Occasional Paper Series, No. 247/September 2020, p. 7 and next.

18 For more see: Working Group on Stablecoins, Investigating the impact of global stablecoins, Bank of International Settlements, October 2019, p. iii.

19 IOSCO Global Stablecoin Initiatives. OR01/2020, March 2020, www.iosco.org/library/pubdocs/pdf/IOSCOPD650.pdf

20 Committee on Payments and Market Infrastructures Markets Committee, Central bank digital currencies, Bank for International Settlements, March 2018, p. 3.

21 For more, see European Central Bank, Report on digital euro, October 2020, www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf#page=37

22 Money and Payments: The US Dollar in the Age of Digital Transformation. Research & Analysis. Federal Reserve, 2022.

23 European Central Bank, www.ecb.europa.eu/paym/digital_euro/html/index.en.html

24 Europol Spotlight – Cryptocurrencies: Tracing The Evolution Of Criminal Finances, Luxembourg: Publications Office of the European Union, 2021, https://doi.org/10.2813/75468

25 The 2020 State of crypto crime. Everything you need to know about darknet markets, exchange hacks, money laundering and more, CHAINALYSIS, January 2020; The 2022 Crypto Crime Report, Original data and research into cryptocurrency-based crime, Chainalysis, February 2022.

26 National anti-money laundering / countering the financing of terrorism (AML/CFT) regime – FATF Guidance, National Money Laundering and Terrorist Financing Risk Assessment, February 2013 www.fatf-gafi.org/media/fatf/content/images/National_ML_TF_Risk_Assessment.pdf

27 Department of the Treasury, National Money Laundering Risk Assessment, February 2022, p. 40 and next, https://home.treasury.gov/system/files/136/2022-National-Money-Laundering-Risk-Assessment.pdf; Department of the Treasury, National Terrorist Financing Risk Assessment, February 2022, pp. 25–27, https://home.treasury.gov/system/files/136/2022-National-Terrorist-Financing-Risk-Assessment.pdf, Krajowa Ocena Ryzyka Prania Pieniędzy oraz Finansowania Terroryzmu, Warszawa 2019, www.gov.pl/attachment/717264b0-2867-4e41-98da-2e64cf158ac8

28 FATF report Virtual Currencies: Key Definitions and Potential AML/CFT Risks, 2014; Guidance for a Risk-Based Approach to Virtual Currencies, 2015.

29 Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers, October 2021; FATF report Virtual Assets Red Flag Indicators of Money Laundering and Terrorist Financing, September 2020.

30 Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers, October 2021, pp. 21–22.

31 Public Law 116–283, 16th Congress (www.govinfo.gov/content/pkg/PLAW-116publ283/pdf/PLAW-116publ283.pdf, for more about digital assets from the perspective of US authorities, see Leaders of CFTC, FinCEN and SEC Issue Joint Statement on Activities Involving Digital Assets, October 2019, www.fincen.gov/sites/default/files/2019-10/CVC%20Joint%20Policy%20Statement_508%20FINAL_0.pdf

32 Department of the Treasury, National Money Laundering Risk Assessment, February 2022, pp. 40–42, https://home.treasury.gov/system/files/136/2022-National-Money-Laundering-Risk-Assessment.pdf

33 Regulation (EU) 2023/1113 of the European Parliament and of the Council of 31 May 2023 on information accompanying transfers of funds and certain crypto-assets and amending Directive (EU) 2015/849, OJ L 150, 9.6.2023, pp. 1–39.

34 Directive (EU) 2024/1640 of the European Parliament and of the Council of 31 May 2024 on the mechanisms to be put in place by Member States for the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, amending Directive (EU) 2019/1937, and amending and repealing Directive (EU) 2015/849 (Text with EEA relevance) OJ L, 2024/1640, 19.6.2024. The Directive should be transposed by 10 July 2027.

35 Regulation (EU) 2024/1624 of the European Parliament and of the Council of 31 May 2024 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing (Text with EEA relevance) OJ L, 2024/1624, 19.6.2024.

36 Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers, October 2021, pp. 21–22.

37 Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers, October 2021, p. 27.

38 'Internal Revenue Bulletin: 2014-16', Internal Revenue Bulletin, 2014, 14 April. www.irs.gov/irb/2014-16_IRB (Accessed: 13 April 2023).

39 Frequently Asked Questions on Virtual Currency Transactions, Internal Revenue Service 2023, www.irs.gov/individuals/international-taxpayers/frequently-asked-questions-on-virtual-currency-transactions

40 Frequently Asked Questions on Virtual Currency Transactions, Internal Revenue Service 2023, www.irs.gov/individuals/international-taxpayers/frequently-asked-questions-on-virtual-currency-transactions

41 IRS Virtual Currency Guidance (Internal Revenue Bulletin: 2014–2016 | Internal Revenue Service)', Internal Revenue Bulletin: 2014–2016, 9 February 2023, www.irs.gov/irb/2014-16_IRB

42 Income Tax Act 2007, 2007 c. 3. Statute Law Database, www.legislation.gov.uk/ukpga/2007/3/contents

43 Income Tax Act 2007, 2007 c. 3. Statute Law Database, www.legislation.gov.uk/ukpga/2007/3/contents

44 'CRYPTO20050 – Cryptoassets for individuals: which taxes apply', HMRC internal manual: Cryptoassets Manual, 30 March.2021, www.gov.uk/hmrc-internal-manuals/cryptoassets-manual/crypto20050

45 'CRYPTO20250 – Cryptoassets for individuals: what is trading', HMRC internal manual: Cryptoassets Manual, 30 March. 2021, www.gov.uk/hmrc-internal-manuals/cryptoassets-manual/crypto20250

46 'CRYPTO22050 – Cryptoassets for individuals: Capital Gains Tax: what is an asset', HMRC internal manual: Cryptoassets Manual, 30 March 2021, www.gov.uk/hmrc-internal-manuals/cryptoassets-manual/crypto22050

47 'CRYPTO22100 – Cryptoassets for individuals: Capital Gains Tax: what is a disposal', HMRC internal manual: Cryptoassets Manual, 30 March 2021, www.gov.uk/hmrc-internal-manuals/cryptoassets-manual/crypto22100

48 Capital Gains Tax: what you pay it on, rates and allowances, GOV.UK, www.gov.uk/capital-gains-tax/what-you-pay-it-on

49 'CRYPTO41250 – Cryptoassets for businesses: Corporation Tax: Corporation Tax on chargeable gains – what constitutes a disposal', HMRC internal

manual: Cryptoassets Manual, 30 March 2021, www.gov.uk/hmrc-internal-manu als/cryptoassets-manual/crypto41250

50 'CRYPTO41200 – Cryptoassets for businesses: Corporation Tax: Corporation Tax on chargeable gains – introduction', HMRC internal manual: Cryptoassets Manual, 30 March 2021. www.gov.uk/hmrc-internal-manuals/cryptoassets-man ual/crypto41200

51 'CRYPTO41300 – Cryptoassets for businesses: Corporation Tax: allowable costs', HMRC internal manual: Cryptoassets Manual, 30 March 2021, www.gov.uk/ hmrc-internal-manuals/cryptoassets-manual/crypto41300

52 Einzelfragen zur ertragsteuerrechtlichen Behandlung von virtuellen Währungen und von Token (Entwurf), 2021, pp. 4–5.

53 Personal Income Tax Act of 16 October 1934 (BGBI I S. 3366, 3862).

54 Einzelfragen zur ertragsteuerrechtlichen Behandlung von virtuellen Währungen und von Token (Entwurf), 2021, pp. 19–20.

55 Directive 2006/112/EC of Council of 28 November 2006 on the common system of value added tax, OJ L 347, 11.12.2006, pp. 1–118.

56 EU Court of Justice Judgment of the Court (Fifth Chamber) of 22 October 2015 Skatteverket v David Hedqvist. Request for a preliminary ruling from the Högsta förvaltningsdomstolen, ECLI:EU:C:2015:718.

57 Experiences with cash-flow taxation and prospects: specific contract No. 13 TAXUD/2014/DE/310 based on framework contract No. TAXUD/2012/CC/117; final report 12 May 2015. Luxembourg: Office for Official Publications of the European Communities (Taxation papers, 55). https://doi.org/10.2778/575942

58 Guide to Taxation and Investment in Georgia 2021. Deloitte 2021, www2.deloi tte.com/ge/en/pages/tax/articles/guide-to-taxation-and-investment-in-georgia-2021.html

59 European Council, https://data.consilium.europa.eu/doc/document/ST-6375-2023-INIT/pl/pdf

60 Proposal for a COUNCIL DIRECTIVE amending Directive 2011/16/EU on administrative cooperation in the field of taxation, COM/2020/314 final.

61 Directive 2011/16/EU of Council of 15 February 2011 on administrative cooper-ation in the field of taxation and repealing Directive 77/799/EEC, OJ L 64, 11.3.2011, pp. 1–12.

62 Proposal for a COUNCIL DIRECTIVE amending Directive 2011/16/EU on administrative cooperation in the field of taxation, COM/2020/314 final.

63 OECD (2022) Crypto-Asset Reporting Framework and Amendments to the Common Reporting Standard. Paris.

64 Regulation 2020/2093 of Council of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027, OJ L 433I, 22.12.2020, pp. 11–22.

65 Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project, OJ L 358, 16.12.2006, pp. 62–80.

66 Texte intégral de la Constitution du 4 octobre 1958 en vigueur | Conseil constitutionnel, www.conseil-constitutionnel.fr/le-bloc-de-constitutionnalite/texte-integral-de-la-constitution-du-4-octobre-1958-en-vigueur

67 Autumn Budget and Spending Review 2021: A Stronger Economy for the British People, 2021.

68 Act of 27 August 2009 on Public Finance (*Journal of Laws* 2022, item 1634, as amended).

69 Directive 2011/85/EU of Council of 8 November 2011 on requirements for budgetary frameworks of the Member States, OJ L 306, 23.11.2011, pp. 41–47.

70 Judgment of the Court of First Instance (First Chamber, extended composition) of 22 February 2006. EURL Le Levant 001 and Others v Commission of the European Communities. Case T-34/02., ECLI:EU:T:2006:59.

71 Judgment of the Court of 21 September 1999. Albany International BV v Stichting Bedrijfspensioenfonds Textielindustrie, ECLI:EU:C:1999:430.

72 Judgment of the Court of 16 May 2002. French Republic v Commission of the European Communities, ECLI:EU:C:2002:294.

73 OJ C 262, 19.7.2016, pp. 1–50.

74 New Thematic Report: Energy Efficiency of Blockchain Technologies, EU Blockchain Observatory and Forum, 2021, pp. 11–15, www.eublockchainforum. eu/sites/default/files/reports/Energy%20Efficiency%20of%20Blockchain%20Tec hnologies_1.pdf

75 New Thematic Report: Energy Efficiency of Blockchain Technologies, EU Blockchain Observatory and Forum, 2021, p. 15, www.eublockchainforum.eu/ sites/default/files/reports/Energy%20Efficiency%20of%20Blockchain%20Tec hnologies_1.pdf

76 Regulation 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector, OJ L 317, 9.12.2019, pp. 1–16.

77 Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC, OJ L 119, 4.5.2016, pp. 1–88, as amended.

78 The National Archives, www.legislation.gov.uk/ukpga/2018/12/contents/enacted

79 UK Parliament, https://bills.parliament.uk/bills/3430https://bills.parliament.uk/ bills/3430

80 Implementing Decision 2021/1772 of the Commission (EU) of 28 June 2021 pursuant to Regulation (EU) 2016/679 of the European Parliament and of the Council on the adequate protection of personal data by the United Kingdom (notified under document C(2021)4800), OJ L 360, 11.10.2021, pp. 1–68.

81 Implementing Decision 2016/1250 of the Commission (EU) of 12 July 2016 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the EU-US Privacy Shield (notified under document C(2016) 4176) OJ L 207, 1.8.2016, pp. 1–112.

82 Urząd Ochrony Danych Osobowych, https://uodo.gov.pl/pl/138/2644

83 European Commission, https://commission.europa.eu/strategy-and-policy/priorit ies-2019-2024/europe-fit-digital-age/european-digital-identity_en

84 European Commission, https://commission.europa.eu/strategy-and-policy/priorit ies-2019-2024/europe-fit-digital-age/european-digital-identity_en

85 Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No. 910/2014 as regards establishing a framework for a European Digital Identity – General approach (6 December 2022), Interinstitutional File: 2021/0136(COD), https://data.consilium.europa.eu/doc/ document/ST-15706-2022-INIT/EN/pdf

Bibliography

Arciniegas, J., Conner, W.T. (2022) 'The Digital Asset Regulatory Landscape Begins to Take Shape: The Responsible Financial Innovation Act', *The Investment Lawyer. Covering Legal and Regulatory Issues of Asset Management*, 29(10), 9–18.

Azgad-Tromer, S. (2018) 'Crypto Securities: On the Risks of Investments in Blockchain-Based Assets and the Dilemmas of Securities Regulation', *American University Law Review*, 68(1), 69–137.

Bala, S., Kopyściański, T., Srokosz, W. (2016) *Cryptocurrencies as Electronic Means of Payment without the Issuer: Computer Science, Economic, and Legal Aspects*, Wrocław Wydawnictwo Uniwersytetu Wrocławskiego, https://depot.ceon.pl/handle/123456789/12406

Barceló, E., et al. (2023). 'Regulatory Paradigm and Challenge for Blockchain Integration of Decentralized Systems: Example—Renewable Energy Grids', *Sustainability*, 15(3), 2571, https://doi.org/10.3390/su15032571

Berberich, M., Steiner, M. (2016) 'Blockchain Technology and the GDPR – How to Reconcile Privacy and Distributed Ledgers?', *European Data Protection Law Review*, 2(3), https://doi.org/10.21552/EDPL/2016/3/21

Clark, K. (2022) *Will States Lead Way in Regulating DeFi?*, September 15, 2022, LexisNexis, www.lexisnexis.com/community/insights/legal/capitol-journal/b/statenet/posts/will-states-lead-way-in-regulating-defi

Collins, J. (2022) *Crypto, Crime and Control. Cryptocurrencies as an Enabler of Organized Crime*. Geneva, Switzerland: Global Initiative Against Transnational Organized Crime.

Dhanani, A., Hausman, B.J. (2022) 'Decentralized Autonomous Organizations', *Intellectual Property Technology Law Journal*, 34(5), www.bakerbotts.com/thought-leadership/publications/2022/may/decentralized-autonomous-organizations

Durrant, S., Natarajan, M. (2019) 'Cryptocurrencies and Money Laundering Opportunities', in M. Natarajan (ed) *International and Transnational Crime and Justice*. 2nd edn. Cambridge: Cambridge University Press, https://doi.org/10.1017/9781108597296.012

Fadeyi, O., et al. (2020) 'Opinions on Sustainability of Smart Cities in the Context of Energy Challenges Posed by Cryptocurrency Mining', *Sustainability*, 12(1), https://doi.org/10.3390/su12010169

Fullerton, E., Morgan, P.J. (2022) 'The People's Republic of China's Digital Yuan: Its Environment, Design, and Implications', *SSRN Electronic Journal [Preprint]*, https://doi.org/10.2139/ssrn.4204153

Ghodsi, Z., Webster, A. (2018) 'UK Taxes and Tax Revenues: Composition and Trends', in J. Iwin-Garzyńska (ed) *Taxes and Taxation Trends*. London: InTech, https://doi.org/10.5772/intechopen.74380

Goforth, C.R. (2023) 'Political Reality and Crypto Regulation', *Chapman Law Review*, 26(2), 599–643, https://digitalcommons.chapman.edu/chapman-law-review/vol26/iss2/6/

Griffoli, T.M., et al. (2018) 'Casting Light on Central Bank Digital Currencies', *IMF [Preprint]* (2018/008), www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/11/13/Casting-Light-on-Central-Bank-Digital-Currencies-46233

Gurrea-Martínez, A., Leon, N.R. (2019) 'The Law and Finance of Initial Coin Offerings', in C. Brummer (ed) *Cryptoassets: Legal, Regulatory, and Monetary*

Perspectives. New York, Oxford: Oxford University Press, https://doi.org/10.1093/oso/9780190077310.003.0006

Huang, J.Y. (2015) 'Effectiveness of US Anti-Money Laundering Regulations and HSBC Case Study', *Journal of Money Laundering Control*, 18(4), https://doi.org/10.1108/JMLC-05-2015-0018

Hybka, M.M. (2016) 'Federalne podatki dochodowe w Stanach Zjednoczonych Ameryki – konstrukcja prawna i znaczenie fiskalne', *Studia Oeconomica Posnaniensia*, Nr 4, https://doi.org/10.18559/SOEP.2016.4.1

Jakobi, A.P. (2018) 'Governing Illicit Finance in Transnational Security Spaces: The FATF and Anti-Money Laundering', *Crime, Law and Social Change*, 69(2), https://doi.org/10.1007/s10611-017-9750-y

Jiang, S., et al. (2021) 'Policy Assessments for the Carbon Emission Flows and Sustainability of Bitcoin Blockchain Operation in China', *Nature Communications*, 12(1), https://doi.org/10.1038/s41467-021-22256-3

Jordan, C. (2021) *International Capital Markets: Law and Institutions*. Oxford, New York: Oxford University Press.

Khezami, N., et al. (2022) 'Blockchain Technology Implementation in the Energy Sector: Comprehensive Literature Review and Mapping', *Sustainability*, 14(23), 15826, https://doi.org/10.3390/su142315826

Laskai, L. (2022) 'Let's Start with What China's Digital Currency Is Not', *DigiChina*, 8 March, https://digichina.stanford.edu/work/lets-start-with-what-chinas-digital-currency-is-not/

Lieverse, K. (2017) 'The Scope of MiFID II', in D. Busch, et al. (eds) *Regulation of the EU Financial Markets: MiFID II and MiFIR*. Oxford, New York: Oxford University Press.

Lipton, A., Cohen, L. (2021) 'DeFi: A Pathway Forward', *International Financial Law Review* [Preprint], www.iflr.com/article/2a646xn930ua9tjvpqnsw/defi-a-pathway-forward

Makarov, I., Schoar, A. (2022) 'Cryptocurrencies and Decentralized Finance (DeFi)', *Brookings Papers on Economic Activity* [Preprint] (Spring), www.brookings.edu/wp-content/uploads/2022/03/16265-BPEA-Sp22_MakarovSchoar_WEB-Appendix.pdf

Matras, T. (2022) 'DAC 8 – w kierunku rozszerzenia administracyjnej współpracy podatkowej o aktywa kryptograficzne', *Doradztwo Podatkowe – Biuletyn Instytutu Studiów Podatkowych*, 9(313), https://doi.org/10.5604/01.3001.0016.0186

Miller, A., Oats, L. (2016) *Principles of International Taxation*. 5 edn. Haywards Heath, West Sussex: Bloomsbury Professional.

Náñez Alonso, S.L., et al. (2021) 'Cryptocurrency Mining from an Economic and Environmental Perspective. Analysis of the Most and Least Sustainable Countries', *Energies*, 14(14), https://doi.org/10.3390/en14144254

Pan, R. (2019) 'Blockchains, Securities, and Sections 11 and 12 of the Securities Act', *NYU Journal of Law & Business*, 15(2), www.nyujlb.org/_files/ugd/716e9c_41bbea0752df4d6d810c3709a534f068.pdf

Parmentola, A., et al. (2022) 'Is Blockchain able to Enhance Environmental Sustainability? A Systematic Review and Research Agenda from the Perspective of Sustainable Development Goals (SDGs)', *Business Strategy and the Environment*, 31(1), https://doi.org/10.1002/bse.2882

Rechtschaffen, A.N. (2014) *Capital Markets, Derivatives and the Law. Evolution After Crisis*. New York: Oxford University Press.

Rohr, J., Wright, A. (2017) 'Blockchain-Based Token Sales, Initial Coin Offerings, and the Democratization of Public Capital Markets', *SSRN Electronic Journal* [Preprint], https://doi.org/10.2139/ssrn.3048104

Ruśkowski, E. (2014) 'Republika Czeska', in U.K. Zawadzka-Pąk et al. (eds) *Roczność i wieloletniość w finansach publicznych*. Warszawa: Wolters Kluwer Polska.

Seretakis, A.L. (2019) 'Blockchain, Securities Markets, and Central Banking', in P. Hacker, I. Lianos, G. Dimitropoulos, S. Eich (eds) *Regulating Blockchain. Techno-Social and Legal Challenges*. New York, Oxford: Oxford University Press.

Shadab, H.B. (2019) 'Regulating Blockchain', in P. Hacker, et al. (eds) *Techno-Social and Legal Challenges*. New York, Oxford: Oxford University Press.

Smith, C. (2020) 'Budget and the Spending Review', in *Focus*, 10 March, https://lords library.parliament.uk/budget-and-the-spending-review/

Srokosz, W. (2015) 'The Use of Cryptocurrencies for Tax Evasion and Tax Fraud' in: *Tax Law vs Tax Frauds and Tax Evasion: Non-Conference Proceedings of Scientific Papers*. Vol. 2. Košice: Univerzita Pavla Jozefa Šafárika v Košicach. Pravnicka Fakulta, www.upjs.sk/public/media/1084/Zbornik_46_2.pdf

Terra, B.J.M. (2003) *European Indirect Tax Law: VAT and Other Indirect Taxes*. Amsterdam: Ben J.M. Terra.

Van Ecke P., Haie A.G. (2018) 'Blockchain and the GDPR: The EU Blockchain Observatory Report', *European Data Protection Law Review*, 4(4), https://doi.org/10.21552/edpl/2018/4/18

Wądołek, M. (2022) 'Wzorce zagraniczne: Estonia, Gruzja – krótkie omówienie', in M. Guzek et al. (eds) *Estoński CIT w praktyce*. Warszawa: Wolters Kluwer Polska.

Zawadzka-Pąk, U.K. (2014a) 'Republika Francuska', in U.K. Zawadzka-Pąk et al. (eds) *Roczność i wieloletniość w finansach publicznych*. Warszawa: Wolters Kluwer Polska.

Zawadzka-Pąk, U.K. (2014b) 'Wielka Brytania', in U.K. Zawadzka-Pąk et al. (eds) *Roczność i wieloletniość w finansach publicznych*. Warszawa: Wolters Kluwer Polska.

6 Specific legal problems of DAOs in the context of financing long-term and capital-intensive investments

A smart contract is a computer program (programming code) and runs on a blockchain specially adapted to support such programs – in IT terms, such a blockchain is a "virtual machine". Already in 1996, Nick Szabo, the creator of the smart contract concept, pointed out that such a program has nothing to do with "intelligence" (Szabo, 1996). It should also be noted that Nick Szabo used the word "contract" (agreement) quite specifically – to mean a set of promises. To him, a smart contract "is a set of promises, specified in digital form, including protocols within which the parties perform on these promises" (Szabo, 1996). On the other hand, in civil law, a contract is understood as a joint declaration of the will of the parties, whereby the parties must be able to conclude contracts. And as it usually happens, the strictly linguistic issue is the first level of misunderstanding as to the meaning of a "smart contract" – while people who do not deal with the law often seem to understand this term literally as a "contract" in the legal sense, for lawyers it is definitely not so obvious (the misunderstanding of the legal and technical aspects of smart contracts by the authors of scientific publications is quite common), as Mik (2019, p. 4) rightly points out. Some authors rightly emphasize that smart contracts are computer programs that can be used for various purposes, which is not noticed by lawyers who focus too much on the problem of the legal enforceability of smart contracts (Reyes, 2021a, p. 1000). As indicated in the literature, of course, smart contracts can be used to "digitally represent a legally enforceable contract", but they can be used "to perform part of their obligations under a traditionally documented contract" or to create decentralized software that has no connection with legally enforceable contracts (Reyes, 2021a, pp. 1000–1001). It is, therefore, possible to distinguish between smart legal contracts (SLC) and other types of smart contracts. For example, SLCs can be defined as "a written and legally enforceable contract where certain obligations may be represented by or written in code".[1]

The doctrine points to a number of problems with the classification of such computer programs as contracts within the meaning of the law (for

example, the issue of the ability to conclude contracts in the context of pseudo-anonymity, decentralization and automation provided by blockchain technology; see Dutta, 2020, pp. 75–77). The issue of the capacity to conclude contracts is also noted by Mik (2019, p. 9). A smart contract is usually written by IT specialists and entered into a given blockchain operating as a virtual machine already in a ready form. The user, who currently is usually the buyer of a token issued by a computer program called a smart contract, has no influence on the content of this program. What is more – as a rule, they do not know or understand this program, because understanding the program requires fairly advanced technical knowledge. The argument that the user (token buyer) knows and understands the program called a "smart contract" could have been made at the beginning of the development of this technology; however, at present, at a time when DLT technology has become widely available, the vast majority of users do not check or "read" the programming code of the smart contract (which is usually publicly available). In fact, users (token buyers) make a decision to purchase a token based on a so-called whitepaper and terms and conditions. It is the terms and conditions that should define the rights and obligations, so their acceptance by the user (token buyers) means concluding a contract with the issuer of the token (i.e., with the natural or legal person that controls the smart contract). The key and most-controversial issue is to define in practice what "controlling a smart contract" means – this should always be assessed in the context of a specific factual state. A considerable portion of token issues (ICO/STO/ICE) is carried out using a smart contract, and there is no doubt that these contracts are controlled by a specific legal person (such as a capital company or foundation). It is the legal person who prepares the smart contract, introduces it to the blockchain, and organizes the sale of tokens, and it is with this legal person that the buyers of the token conclude the contract, usually by accepting the terms and conditions (sometimes, incorrectly, by accepting the whitepaper). It is on the basis of such market practice that the MiCA regulations are being created to fully regulate the issue of individual types of tokens, and this market practice is the basis for applying the regulations on the issue of financial instruments (securities), if the issued tokens are classified in this way.

It seems that the concept that the programming code itself can serve as content of the contract and that in actual fact, standard regulations (or whitepapers) are not needed to conclude the contract has not withstood the test of time and the mass use of smart contracts and tokens. Such an assumption – which is undoubtedly innovative and noteworthy – completely fails in mass consumer transactions involving which people with little or no IT knowledge. The fact of being aware of the risk and informing the other party to the agreement, especially when if that party is a consumer (or non-professional investor) is currently an extremely important criterion for assessing the agreement, including its validity. EU legislation, led by the case

law of the CJEU, is at the forefront in this regard (this issue seems to have not been sufficiently noticed in the wave of excessive enthusiasm for blockchain technology and the development of the so-called Lex Cryptographia, see: Wright and De Filippi, 2015, p. 48; Szczerbowski, 2018; Dimitropoulos, 2020, p. 1141).

A DAO is the most advanced form of the smart contract, and in the case of DAO, the controversies over who "controls" the smart contract are the biggest and, it seems, the most important from a legal point of view. The simplest case is when a legal person (usually a capital company) prepares and places the DAO programming code on the blockchain, and then distributes the tokens. The terms and conditions may specify the rights and obligations of the company and the buyers of the tokens – including, above all, the buyers' right to the company's profits and the rules for the token holders influence over the company's affairs. The classification of such a token (and even the legal effectiveness of issuing such a token) may vary depending on the detailed regulations of the law of the country that will be chosen to regulate the issuance, and the law of the country where the company has its registered office.

A more complex legal classification situation arises when a capital company controls a smart contract qualified as a DAO and the purpose of issuing tokens is to give them the character of shares (or stakes). In such a scenario, one can speak about "overlaying" ("wrapping") the DAO structure on the capital company (or vice versa: "overlaying" the capital company on the DAO structure), but in the sense that the existing capital company (as a legal person) issues shares (stakes) in the form of tokens, and the token buyers – who are also shareholders – utilize the technical and organizational capabilities provided by the DAO for managing the company. Therefore, it is a "hybrid" solution and does not seem to fully meet the theoretical, postulated conditions that a DAO should meet (see Section 2.2.4). This solution assumes the use of capital companies regulated in individual countries by national regulations, which usually do not take into account such a composition of a capital company and DAO. Hence, practical implications may arise that make it difficult (and sometimes even impossible) to implement such a solution in a number of countries. For example, in practice, Delaware LLC is presented as a very promising legal solution allowing a DAO to adopt the organizational and legal form of an LLC, or possibly the form of a Delaware corporation. Delaware Limited Liability Company Act[2] gives a great deal of freedom and flexibility to shareholders in the formation of LLCs, particularly in their structure and management. This is advantageous for the formation of DAOs, but as is pointed out, even with such flexible provisions, it is necessary to adapt the DAO to the legal regime through appropriate modifications to the DAO model (Nielsen, 2020, p. 1117). In other words, even in the case of very flexible corporate regulation, it is the DAO that needs to be adapted to the legal regulation, and not the legal regulation to the DAO. The following

features of Delaware LLC law are favourable to the application of the DAO (Nielsen, 2020, p. 1117):

– an LLC agreement will almost always control in any dispute (this is §§ 18–1101 of the Delaware Limited Liability Company Act, for example, in accordance with §§ 18–1101 (a), "the rule that statutes in derogation of the common law are to be strictly constructed shall have no application to this chapter", and in accordance with §§ 18–1101(a)(i), "a limited liability company agreement that provides for the application of Delaware law shall be governed by and constructed under the laws of the State of Delaware in accordance with its terms";
– an LLC agreement allows the partners to specify, in detail, the management, ownership structure, legal duties and more;
– provisions can be made to allow free transfer of ownership and voting rights;
– an LLC agreement can specify whether or not members are bound by fiduciary duties;
– partners can also choose a tax structure that works best for its members, allowing them to avoid double taxation;
– a characteristic feature of an LLC is, of course, limited liability (this allows DAO token buyers not to be liable for the activities of the company).

However, a more detailed legal analysis reveals a number of legal controversies showing the significant disadvantages of this solution, for example, the legal requirement of the state of Delaware that an LLC should store the names and addresses of all members of the LLC or shareholders of the Delaware corporation, and that this personal information must also be made available to LLC members upon request (Nielsen, 2020, p. 1116). Under §§ 18–305(a)(3),

> each member of a limited liability company, in person or by attorney or other agent, has the right, subject to such reasonable standards (including standards governing what information (including books, records and other documents) is to be furnished at what time and location and at whose expense) as may be set forth in a limited liability company agreement or otherwise established by the manager or, if there is no manager, then by the members, to obtain from the limited liability company from time to time upon reasonable demand for any purpose reasonably related to the member's interest as a member of the limited liability company: […] a current list of the name and last known business, residence or mailing address of each member and manager.

This means that any holder of a DAO token, which is a share in a Delaware LLC, will be able to request the disclosure of the personal information of any other holder of such a token.

An example of a DAO "wrapped" in a Delaware LLC is Tribut Labs (the LAO). It is a global group of Ethereum enthusiasts and experts who support the work of Ethereum builders. According to the founders, the LAO is organized as a member-directed venture capital fund, incorporated in the United States to comply with US law. The LAO allows members to pool capital, invest in projects, and share in any proceeds from the investment.[3] However, there is some regulatory uncertainty surrounding the LAO. Namely, there is a possibility that the US Securities and Exchange Commission (SEC) would consider the members' common interests in a member-managed DAO LLC, such as the LAO, to be securities. To mitigate this regulatory risk, the LAO limits membership to 99 investors, all of whom must be accredited investors.[4]

Wyoming state law also expressly provides for this possibility of applying company law to a DAO. The Wyoming Decentralized Autonomous Organization Supplement[5] (Wyoming DAO Supplement) not only allows the DAO to adopt the organizational form of a limited liability company (the Wyoming Limited Liability Company Act[6] applies to DAOs to the extent not inconsistent with the provisions of the Wyoming DAO Supplement), but even allows such a company to be managed solely by an algorithm (sole algorithmic manager). Under § 17-31-104(e) Wyoming DAO Supplement, "a statement in the articles of organization shall establish how the decentralized autonomous organization shall be managed by the members, including to what extent the management will be conducted algorithmically". Paragraph 17-31-109 specifies that management of a DAO shall be vested in its members or the members and any applicable smart contracts. All smart contracts utilized by a DAO shall be capable of being updated, modified or otherwise upgraded. A relevant provision from the perspective of US law is contained in § 17-31-110 of the Wyoming DAO Supplement, according to which

> unless otherwise provided for in the articles of organization or operating agreement, no member of a decentralized autonomous organization shall have any fiduciary duty to the organization or any member except that the members shall be subject to the implied contractual covenant of good faith and fair dealing.

The Tennessee DAO Statutes,[7] like the Wyoming DAO Supplement, recognize the DAO as a limited liability company to which Tennessee's Revised Limited Liability Company Act[8] applies. This regulation is very similar to the Wyoming DAO Supplement. For example, pursuant to Section 48-250-108 of the Tennessee DAO Statutes, "unless otherwise provided in the articles of organization or operating agreement, management of a decentralized organization is vested in:

(1) The organization's members, if member-managed; or
(2) The smart contract, if smart contract-managed".

In turn, Section 48-250-109, like § 17-31-110 of the Wyoming DAO Supplement, states that unless otherwise provided for in the articles of organization or operating agreement, a member of a decentralized organization does not have a fiduciary duty to the organization or another member, except that the member is subject to the implied contractual covenant of good faith and fair dealing.

The indicated laws of the states of Delaware, Wyoming and Tennessee are relevant not only for US residents. DAO companies under these laws are quite easily accessible to residents from other countries – for their registration; however, it is generally required to act through an appropriate agent – a registered agent.[9] The importance of these provisions is also that they provide inspiration for lawyers in other countries (see, for example, Fleischer, 2023, p. 618).

On the other hand, an increasing number of legislative initiatives can be observed aimed at creating the possibility of trading tokens – shares. In particular, Regulation (EU) 2022/858, creates the possibility for European stock exchanges to trade tokens qualified as financial instruments, including company shares (for more, see Section 5.1). The most legally controversial scenario is when there is no capital company or, more broadly, legal person (for example, a foundation or even an association) behind the placement of the DAO programming code on the blockchain and the issue of tokens. For example, in the practice of DAO functioning, Switzerland is a popular choice – compared with other European countries, it offers more-flexible regulations regarding foundations, and fairly moderate taxation (Mienert, 2021, pp. 10–11). Foundations in Switzerland are subject to Articles 80–89 of the Swiss Civil Code. It should also be noted that the four principles and 28 commented recommendations of the Swiss Foundation Code are applicable in practice.

Practitioners point out many advantages of DAOs using the Swiss foundation regulations. First of all, it is possible to specify in the foundation statutes the principles of operation of the foundation bodies and the method of management of the foundation, including the use of intelligent contact for voting. This allows DAO members to vote according to the rules set out in the smart contract and statutes. After the vote, the foundation's governing body (typically the foundation's board of directors) implements the appropriate decision made by the members using a smart contract (Zharun, 2024). Access to the extensive Swiss banking infrastructure is also important. In addition, Switzerland may be attractive by the example of other investors who run the largest projects in the crypto world in the form of a Swiss foundation (for example, Ethereum or dxdao). Particularly popular is the canton of Zug, Switzerland "Crypto Valley", where are registered: Ethereum, Cardano, Polkadot, Aave, Cosmos, Solana, Tezos, Dfinity, Near, Nexo and Diem. At the same time, a significant disadvantage is mentioned: the cost of setting up and running a foundation in Switzerland (for example, the cost of a local director on the board of directors and an initial capital of 50,000 Swiss francs,

as well as the cost of an audit, which depends on the size of the foundation's assets; it is possible to exempt foundations whose balance sheet total for the last two years was less than 200,000 Swiss francs from the obligation to have an audit – for more, see Zharun, 2024).

An alternative solution to a DAO is to set up an association in Switzerland. The association is regulated by Articles 60–79 of the Swiss Civil Code. Pursuant to Article 60(1) of the Swiss Civil Code, associations with a political, religious, scientific, cultural, charitable, social or other non-commercial purpose acquire legal personality as soon as their intention to exist as a corporate body is apparent from their articles of association. However, the association must be registered if it conducts a commercial operation in pursuit of its objects (Article 61(1) point 1 of the Swiss Civil Code). This is important in the case of DAO that the articles of association must be prepared in writing and indicate the objects of the association, its resources and its organization (Article 60(2) of the Swiss Civil Code). However, the association must be registered if: (1) it pursues a commercial activity in pursuit of its objects; (2) is subject to an audit requirement (Article 61(1) of the Swiss Civil Code).

In practice, it is suggested to use the Swiss Association for DAO (Decentralized Autonomous Association – DAA) in such a way that centralization is reduced as much as possible. The general assembly of the DAA has only basic powers (for example, amendment of the statutes and dissolution of the association). The Board (DAA Delegates) has only those powers required by the activities of a natural person, for example, representation and keeping accounts. However, the essence of the DAA is a decentralized member community (DDA Member Community) using a smart contract. Using smart contract voting, the community can decide on proposals and support for new projects and on the allocation of funds to projects.[10]

An example of a DAA was The Aragon Association – a non-profit entity based in Zug, Switzerland, and governed by Aragon Network Token (ANT) holders. This is a historic example, as the general assembly of members voted to dissolve the Aragon Association in November 2023. One of the important reasons for dissolving the association was bureaucratic complexity and unsuccessful attempts to modify management – in general, the form of the association turned out to be inappropriate for further management of this project. The Aragon Association used several DAOs, i.e., master DAO, executive sub-DAO and compliance sub-DAO. The Main DAO was an Aragon Govern DAO that acted as the executor for community votes on Aragon Voice, enabling ANT holders to exercise a direct token-weighted democracy over the network. The Executive Sub-DAO (ESD) acted as strategy facilitator and finance director for the AN DAO. The ESD was responsible for scheduling payments and deciding which initiatives to fund. Committee members of the Compliance Sub-DAO reviewed all proposals to the AN DAO and any sub-DAO for compliance within the Charter and overall legal compliance, providing feedback to proposal creators where appropriate. There was also

the Tech Committee, which is responsible for overseeing the quality of the Aragon Network's code and smart contracts.[11]

It should be noted here that, for now, smart contracts as computer programs are not created spontaneously. They are still written by people, and it is people who then deploy them on the blockchain and conduct appropriate marketing in order to disseminate knowledge about the smart contract and the token it issues (although, admittedly, it cannot be ruled out that in the near future people will be replaced by artificial intelligence). Such activity of smart contract creators seems sufficient to establish criminal liability and even tort liability under civil law. However, it appears insufficient to argue that such individuals form a partnership (particularly a general partnership). However, if they clearly express their will to enter into a partnership, it seems to be possible. In this particular case, regarding natural persons who jointly develop the programming code of a DAO smart contract, deploy it on the blockchain and subsequently exercise the rights derived from it, the concept of equating the programming code with an agreement in the legal sense may be applicable, because these natural persons undeniably possess the necessary IT knowledge. Here, doubts also arise as to whether such DAOs can be qualified as a partnership, let alone a capital company, when applying the assumption of recognizing a computer program – a smart contract – as equivalent to an agreement. Undoubtedly, there are also problems with the application of relevant company law (for example, in connection with pseudo-anonymity, automation or the cross-border nature of DAOs). It is also possible to completely reject the idea of applying company law to such a DAO and adhere solely to the principle of freedom of contract; however, in reality, such an approach leads to the creation of a new type of company based on freedom of contract, and such a possibility depends on the general principles of civil law applied in a given country (i.e., allowing or not allowing the creation of new types of companies on the basis of freedom of contract). Moreover, the role of the state is significant in this regard. The state can choose to remain passive in relation to this phenomenon (which currently applies to most countries in the world), or it can take action to adapt the regulations of existing types of companies so that they are better suited to the assumptions and nature of DAOs. As of now, this mainly achieved indirectly through statutory regulation, to a greater or lesser extent, of smart contracts – individual states in the US lead the way in such legislation (for example: Section 44-761 of The Arizona Revised Statutes[12]; North Dakota Century Code[13]; Tennessee legislation recognizing smart contracts 2018[14]). After all, the most radical approach is the creation by the legislator of a new type of company dedicated to DAOs, which in doctrine is referred to as crypto corporation. An example of this is the approach taken by the legislator the state of Vermont in the United States, which regulated a new type of blockchain-based limited liability companies (BBLLCs) in the 2018 act entitled "An act relating to blockchain business development".[15] This act added "Subchapter 012: Blockchain-Based

Limited Liability Companies" to "Title 11: Corporations, Partnerships and Associations" and "Chapter 025: Limited Liability Companies" of Vermont Statutes Annotated (V.S.A.). Pursuant to 11 V.S.A. § 4172 (Election), a BBLLC means a limited liability company organized pursuant to title 11 "Corporations, Partnerships and Associations" for the purpose of operating a business that utilizes blockchain technology for a material portion of its business activities by:

1 specifying in its articles of organization that it elects to be a BBLLC and
2 meeting the requirements of subdivision 4173(2) and subsection 4174(a) of this title.

Under 11 V.S.A. § 4173 "(Authority; requirements), notwithstanding any provision of this chapter to the contrary:

1 A BBLLC may provide for its governance, in whole or in part, through blockchain technology.
2 The operating agreement for a BBLLC shall:
   A provide a summary description of the mission or purpose of the BBLLC;
   B specify whether the decentralized consensus ledger or database utilized or enabled by the BBLLC will be fully decentralized or partially decentralized and whether such ledger or database will be fully or partially public or private, including the extent of participants' access to information and read and write permissions with respect to protocols;
   C adopt voting procedures, which may include smart contracts carried out on the blockchain technology, to address:
      i proposals from managers, members or other groups of participants in the BBLLC for upgrades or modifications to software systems or protocols, or both;
      ii other proposed changes to the BBLLC operating agreement; or
      iii any other matter of governance or activities within the purpose of the BBLLC;
   D adopt protocols to respond to system security breaches or other unauthorized actions that affect the integrity of the blockchain technology utilized by the BBLLC;
   E provide how a person becomes a member of the BBLLC with an interest, which may be denominated in the form of units, shares of capital stock or other forms of ownership or profit interests; and
   F specify the rights and obligations of each group of participants within the BBLLC, including which participants shall be entitled to the rights and obligations of members and managers".

A member or manager of a BBLLC may interact with the BBLLC in multiple roles, including as a member, manager, developer, node, miner or other participant in the BBLLC, or as a trader and holder of the currency in its own

account and for the account of others, provided such member or manager complies with any applicable fiduciary duties (11 V.S.A. § 4174).

These regulations are certainly not "technology neutral". Some authors point out that the separation and special treatment of BBLLCs does not make sense, because there is no political reason to privilege blockchains over other technologies (Bayern, 2023, p. 980). Therefore, there is no certainty that the legislative approach of such separation and special treatment will become widespread.

As indicated in the literature, the primary difference between Wyoming's and Tennessee's DAO regulations and those in Vermont is that Wyoming DAO Supplement and the Tennessee DAO Statutes expressly exclude DAO members from the fiduciary duties that exist within a "normal" LLC, while Vermont's "Subchapter 012: Blockchain-Based Limited Liability Companies" does not exempt a BBLLC from any other judicial, statutory or regulatory provision of Vermont law (Lafarre and Van der Elst, 2023, p. 11; Conway, 2022, p. 136).

The most famous and first Vermont BBLLC is dOrg LLC, which was established in May 2019. It is an autonomous collective of 100 or so Web3 developers. Membership in dOrg is represented as a non-transferable ERC20 token, which is called a "REP". Members earn REPs automatically by working on client projects or internally. Rep gives members a proportional share of voting weight and token bonuses, as well as other benefits. The DAO can vote to remove any member who is found to have infringed the Member Covenant or dropped below the dOrg's quality standards.[16]

DOrg LLC is organized in such a way that blockchain technology only supports business activities. The company still needs people to operate – it is not a completely "autonomous business" (Conway, 2022, p. 136; Reyes, 2021b, p. 442).

It should also be noted that in practice, the legal structure of a trust (which has no legal personality) is being used to formalize the DAO structure, associated with companies (see the example of Dash – Section 2.2.4). Also noteworthy is the use of exotic destinations and the legal system of the Cayman Islands, which provides for the legal structure of a so-called foundation company, which acts as an incorporated trust, i.e., it exhibits the characteristics of a trust under common law, while also possessing legal personality, the limited liability of a company and tax neutrality (Mienert, 2021).

Capital-intensive and long-term investments already generate enough risks, and it is not advisable to another risk arising from legal uncertainties related with "overlaying" DAO onto existing legal company structures. Therefore, it is recommended to use a capital company for such investments, which will serve as the issuer of tokens and will be legally responsible to the token holders, while the token buyers will have influence on the management of the investment based on an agreement between them and the company (concluded, for example, by accepting the terms and conditions). This influence over investment management can be implemented using DAO, which

will be treated as a tool for performing a traditional agreement concluded by acceptance of the terms and conditions, and not as an agreement in the legal sense.

There currently also exists an option that is rather impractical for the time being. It involves utilizing a new type of company specifically designed by the legislator for DAOs. For now, however, there are too few such legislative solutions on a global scale.

As a side note, on the other hand, it is worth considering a legislative initiative that involves creating a legal entity specifically dedicated to a particular capital-intensive and long-term project, combining the characteristics of a capital company and, at the same time, a DAO.

Acknowledgement

Notes

1 Blockchain: Legal & Regulatory Guidance, The Law Society of England and Wales, Third Edition 2023, p. 121, www.lawsociety.org.uk/topics/research/blockchain-legal-and-regulatory-guidance-report
2 Delaware Limited Liability Company Act, DEL. CODE ANN. tit. 6 (2018), https://delcode.delaware.gov/title6/c018/
3 The Lao, https://thelao.io/about
4 Decentralized Autonomous Organization Toolkit, World Economic Forum 2023, p. 19, www.weforum.org/reports/decentralized-autonomous-organization-toolkit
5 Wyo. Stat. Ann. § 17-31-101, https://sos.wyo.gov/Forms/WyoBiz/DAO_Supplement.pdf
6 Wyoming Secretary of State, https://sos.wyo.gov/Forms/WyoBiz/Wyoming_Limited_Liability_Company_Act_and_Close_LLC_Supplement.pdf
7 Tenn. Code Ann. § 48-250, https://casetext.com/statute/tennessee-code/title-48-corporations-and-associations/limited-liability-companies/chapter-250-blockchains/section-48-250-103-decentralized-organization-status
8 Tenn. Code Ann. § 48-250-102.
9 Wyoming Decentralized Autonomous Organization (DAO): Frequently Asked Questions, https://sos.wyo.gov/Business/Docs/DAOs_FAQs.pdf
10 Decentralized Autonomous Association, www.mme.ch/en/magazine/articles/decentralized-autonomous-association-daa
11 Aragon X AG, https://aragon.org/aragon-association; https://blog.aragon.org/a-new-chapter-for-the-aragon-project/; https://legacy-docs.aragon.org/aragon/readme-1/legal-and-technical-infrastructure
12 Section 44-7061 "Signatures and records secured through blockchain technology; smart contracts; ownership of information; definitions" of The Arizona Revised Statutes www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/44/07061.htm; https://law.justia.com/codes/arizona/2017/title-44/section-44-7061/

13 North Dakota Century Code Amended by House Bill 1045 (Eff. 1 August 2019; Section 17 ONLY Eff. 1 July 2020), www.ndlegis.gov/assembly/66-2019/docume nts/19-0127-06000.pdf

14 Tenn. Pub. Ch. 591 (2018), https://legiscan.com/TN/text/SB1662/2017

15 An act relating to blockchain business development 2018 – VT S0269, https:// legislature.vermont.gov/bill/status/2018/S.269 (access from within the United States only).

16 dOrg LLC, www.dorg.tech/#/faqs; https://docs.dorg.tech/

Bibliography

Bayern, S. (2023) 'Implied Organizations and Technological Governance', *William & Mary Law Review*, 64(969), https://scholarship.law.wm.edu/wmlr/vol64/iss4/3

Conway, K.A. (2022), 'Blockchain Technology: Limited Liability Companies and the Need for North Carolina Legislation', *Cambell Law Review*, 45(1), https://scholars hip.law.campbell.edu/clr/vol45/iss1/5/

Dimitropoulos, G. (2020) 'The Law of Blockchain', *SSRN Electronic Journal [Preprint]*, https://doi.org/10.2139/ssrn.3559970

Dutta, S.K. (2020) *The Definitive Guide to Blockchain for Accounting and Business: Understanding the Revolutionary Technology*. Bingley, UK: Emerald Publishing Limited, https://doi.org/10.1108/9781789738650

Fleischer, H. (2023) 'The Menagerie of Organizational Forms in German Company Law', *European Company & Financial Law Review*, 4, 593–622.

Lafarre, A., Van der Elst, C. (2023) The Viability of Blockchain in Corporate Governance, European Corporate Governance Institute – Law Working Paper No. 712/2023, http://ssrn.com/abstract_id=4483621

Mienert, B. (2021) 'How Can a Decentralized Autonomous Organization (DAO) Be Legally Structured?', *Legal Revolutionary Journal LRZ*, 2021, https://doi.org/ 10.2139/ssrn.3992329

Mik, E. (2019) 'Smart Contracts: A Requiem', *Journal of Contract Law, Forthcoming*, https://doi.org/10.2139/ssrn.3499998

Nielsen, T. (2020) 'Cryptocorporations: A Proposal for Legitimizing Decentralized Autonomous Organizations', *Utah Law Review*, 2019(5), 1105–1129, https:// dc.law.utah.edu/ulr/vol2019/iss5/5/.

Reyes, C.L. (2021a) 'A Unified Theory of Code-Connected Contract', *The Journal of Corporation Law*, 46(4), https://ssrn.com/abstract=3910766

Reyes, C.L. (2021b) 'Autonomous Business Reality', *Nevada Law Journal*, 21(2), https://scholars.law.unlv.edu/nlj/vol21/iss2/2

Szabo, N. (1996) Building Blocks for Digital Markets, www.truevaluemetrics.org/ DBpdfs/BlockChain/Nick-Szabo-Smart-Contracts-Building-Blocks-for-Digital-Markets-1996-14591.pdf

Szczerbowski, J.J. (2018) *Lex cryptographia. Znaczenie prawne umów i jednostek rozliczeniowych opartych na TECHNOLOGII BLOCKCHAIN*. Warszawa: Wydawnictwo Naukowe PWN.

Wright, A., De Filippi, P. (2015) *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, https://doi.org/10.2139/ssrn.2580664

Zharun, T., (2024) *Swiss Foundation as a DAO Legal Wrapper: What You Need to Know*, https://legalnodes.com/article/swiss-foundation-dao-legal-wrapper

7 Economic and legal model of financing capital-intensive investments

7.1 Assumptions of the model

7.1.1 Purpose and fields

The aim of the work was to find a systemic solution that utilizes the potential of blockchain technology, enabling the financing of large, capital-intensive investment projects. It was crucial to propose an approach that would potentially integrate functionalities in several areas:

- formal and legal (assumptions regarding agreements/contracts, formal and organizational structures, regulations);
- organizational (coordination system for implementation and management, services used);
- economic and financial (structure of financial instruments);
- technical (technologies, applications, Information and Communication Systems (ICT) and networks).

This will streamline the financing process by limiting the stage of searching for financial solutions that can be legally implemented and the stage of selection of tools that match the planned financial instruments, etc. The proposed approach is special in that it takes into account the specific features of capital-intensive projects, in particular their social aspect.

A conceptual framework has been proposed for a model that needs to be detailed in order to be implemented in practice. Although potential efficiencies resulting from technologies and specific mechanisms have been highlighted, it has not been verified in detail whether the approach will be cost effective, as it will depend on individual applications, and a detailed assessment of effectiveness (profitability) will require a separate analysis.

The condition for developing a new solution is the "compliance-by-design" approach, which is designing and building a solution adapted to existing regulations. A condition for implementation is, therefore, the existence of regulations under which it can be implemented now or in the foreseeable future, or a realistic possibility of implementing dedicated *ad hoc* regulation.

The organizational and technical problems are much easier to solve than the problem of the lack of regulations that allow for a solution – the preparation of a new law is a time-consuming and uncertain process (Lohmann, 2013).

7.1.2 Criteria

When looking for a solution to the problems existing in the mechanisms of organizing and financing capital-intensive investments identified above and wanting to take advantage of the effectiveness of blockchain technology, several general criteria that such a solution should meet have been defined. The solution should:

- increase the effectiveness of investment financing: reduce costs or increase the potential raised capital, or reduce risks;
- generate other tangible benefits and utilities, in particular for the community;
- deliver benefits to all stakeholders;
- be adapted to the specifics of capital-intensive investment projects;
- support the principles of sustainable development;
- generate minimal legal risks, in particular those resulting from the lack of legal regulations and in the area of financial market law and tax law, as well as anti-money laundering and terrorist financing regulations.

7.1.3 Assumptions

In order for the solution to meet the listed criteria, several assumptions regarding its features were made:

1 the solution is at least partially decentralized and uses the "standard" of the token as widely as possible;
2 the solution should activate stakeholders and democratize management;
3 a DAO (decentralized autonomous organization) is "overlaid" on an existing legal person;
4 the solution enables automatic execution of some processes.

7.1.4 Decentralization and tokenization

As the previous analysis of the literature showed (see Sections 2.2 and 2.3), financing investment projects, including long-term and capital-intensive investments, using distributed ledger technology (DLT) has the potential to bring new efficiencies and measurable benefits. This technology makes it possible to create a dynamic ("living") structure, and the financing of such a long-term investment does not have to be controlled by one entity. The basic features of the mechanism of financing long-term and capital-intensive investments based on DLT result from the properties of this technology.

The main advantages are dispersion and decentralization, which may be expressed primarily by the absence of a legal entity that would control the implementation of the programme (investment), but also the utilization of the potential of flexible tokenization and token trading. The use of a "standard" token is aimed at facilitating value flows, enabling flexible programming of additional utilities and transaction processing, as well as introducing liquidity in markets that have not been liquid so far. At the same time, the use of a tokenized official medium of exchange (for example, a CBDC) or a private medium (for example, EMT, regulated electronic money or a stablecoin other than EMT) is supposed to increase the flexibility and consistency of the solution so that all transferred values are tokenized. The authors do not assume the use of cryptocurrencies for payments due to fluctuations in their exchange value, valuation difficulties and a number of risks associated with their use.

It is possible to create a mechanism that is based on a distributed ledger and is fully controlled by a legal person (for example, a joint-stock company that controls network nodes or provides non-open-source software). However, this is a solution that does not take full advantage of the potential of DLT. In addition, a consequence of the use of this technology is the high availability of the project – its universality, which is generally expressed by the absence of restrictions on people intending to invest. For example, tokens issued to fund a project may be available globally and, in principle, can be acquired by anyone. For these reasons, a solution that eliminates central control in certain areas using DLT is the basic assumption of the model proposed by the authors. Possible limitations in this regard result not so much from technology as from legal regulations (see more in Chapters 3–6).

The utilization of the potential of decentralization in the solution is an important element that can potentially reduce the costs of obtaining financing, reach a wide audience (investors and customers) and provide additional utilities. The absence of a legal person to control the implementation of the programme may limit the negative economic effects of the centralization of control. Decentralization also enables wider access to investments (fewer restrictions for people intending to invest in the project), democratization of project management (including control of the project coordinator), maintenance of the continuity of competences and knowledge accumulated under the programme, and the creation of opportunities to bring values to the project other than just cash, such as objects (including real estate), know-how, patents and unique competences at the disposal of a dispersed group of stakeholders.

7.1.5 Activation of stakeholders as well as democratization and dispersion of management

DLT creates an opportunity to activate stakeholders as well as democratize and disperse management through the use of a DAO. This is another assumption of the model of financing long-term and capital-intensive investments we

propose. It can be achieved by utilizing a decentralized application based on smart contracts, thanks to which a DAO is created. A platform combining support for such a virtual organization and other functionalities (handling and trading tokens) would enable investors to vote, manage the investment and supervise its implementation.

7.1.6 A DAO overlaid on the existing legal form

Legal constraints (mentioned in Section 2.3 and discussed in detail in Chapter 6), particularly in the sphere of company law and public law (regulation of the crypto-asset market and, more broadly, financial services; tax law; and Anti-Money Laundering and Combating the Financing of Terrorism regulations) may be significant enough to hinder, at least in the near future, the practical implementation of long-term and capital-intensive investments using blockchain technology (more broadly: DLT), in particular tokenized shares and stocks, as well as DAO, which functions as a separate entity with legal personality. It is necessary to utilize existing organizational and legal forms for conducting business activities (or more broadly, financing investments). Therefore, a solution should be proposed that involves "overlaying" an existing, legally regulated, organizational and legal form of the DAO structure and at the same time using a blockchain network controlled to a certain extent by this DAO, i.e., a more private blockchain network than a fully public one. Among the available forms, the most suitable one appears to be a capital company, in particular a joint-stock company.

7.1.7 Automation of some processes

The proposed solution includes the automation of selected processes related to financing. Processes that are most easily automated using DLT involve relationships between different, independent, sovereign entities, rather than within a single entity, where centralized process automation seems more efficient. Therefore, the financing processes covered by the solution can include:

- collecting funds in tokenized form;
- issuing tokens and handling their transfer;
- payment of dividends, interest due on loans, conditional payments, automatic payments;
- providing information on flows to authorized entities;
- verification and certification of authorizations;
- submitting proposals, applications and initiatives related to the project;
- voting on proposals;
- generating transfer credentials;
- payments to external entities for a project with imposed conditions;
- KYC processes;
- signing of documents;

- notarization of documents on the blockchain (guaranteeing the content and dating), including financial ones, related to the implementation of the project;
- organization of the token-trading market related to the project.

Partly as part of the technical solution, the following can also be implemented: communication (information portal, forum), investor analytics, project monitoring, financial audits, conversion of funds into tokenized means of payment, verification of the payment capacity of contractors and investors, and identity confirmation. However, these processes may require a centralized approach or the need to refer to external systems. Potentially, as indicated earlier, it is possible for the solution to cover additional processes related to the project, for example, roadmapping. The model should not include internal processes related to a single entity or closely associated with the implementation of the project, including:

- budgeting;
- coordination and implementation of project activities;
- accounting, controlling;
- liquidity management;
- invoicing;
- factoring, debt collection;
- transfer of ownership (issue and trading in shares) – if it is not possible to issue tokenized financial instruments.

Potentially, a solution may be developed in the future with elements that are currently not regulated by law and are not yet used in practice, for example, the use of smart legal contracts (SLCs) or the tokenization of stocks and shares.

The analysis will omit many obvious practical implications and implementation challenges related to, for example, the need to limit unrestricted trade, speculation, market manipulation (pump and dump and insider trading), financing of criminal activities, pyramid schemes or fraud specific to decentralized markets such as "ICO exit-scam" or "bounty scam", plagiarism of documentation and code, problems of users with lost keys, implementation of the right to forget and other circumstances detrimental to the project. However, the analysis cannot overlook the AML/CFT regulation, because money laundering and terrorist financing are too strongly associated with crypto-assets, and are perceived as the greatest threat related to the use of crypto-assets (see also Section 5.3).

7.2 Description of the model

This chapter presents a conceptual framework and structure of the model that can be used to finance some capital-intensive and long-term projects.

7.2.1 Organizational chart

In the model-based approach to capital-intensive and long-term investment projects, the owner of the capital and the investor (sponsor) – a single company, a consortium or a public-private partnership – centrally organizes and supervises the entire process related to project initiation, financing and implementation. It provides capital, arranges supplementary financing, achieves dividends and oversees the project – all without any operational influence on management decisions. The project communicates with the social environment and public institutions, and pays for loans. After its creation, the project delivers a product (service) to the recipients, for which they pay. Ongoing costs are financed from revenues, loans are repaid and dividends are paid out from profits. The role of the investor is relatively passive, and investors are often few in number. Investors in smaller projects after the initial stages of project development or just after its launch can exit them with a relatively quick capital gain, even before the project becomes profitable. In large projects, identifying the increase of a project's value is more difficult during its development, and the market is less liquid. Investors are forced to sacrifice liquidity for a long time, and are associated with the project from the moment of initiation and for a large part of the product life cycle – their role does not end with the project being put into use (Figures 7.1 and 7.2).
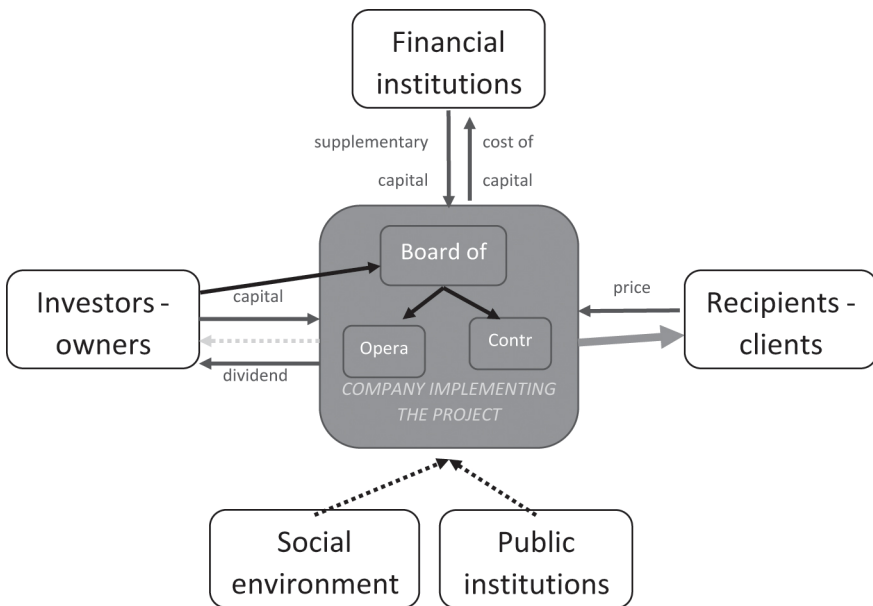
Figure 7.1 Traditional investment financing scheme.
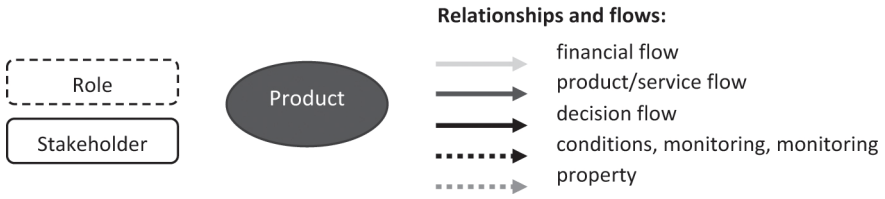
Figure 7.2 Explanations for Figure 7.1.
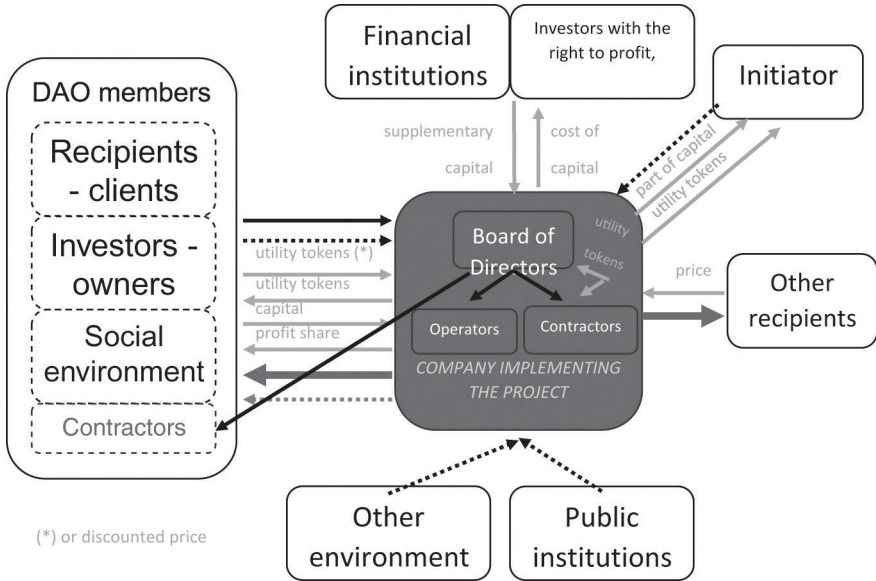
Figure 7.3 Investment financing scheme using the potential of DLT.

The new approach proposes several principles and solutions that combine those found in the markets of decentralized services (DeFi) and traditional ones. In the proposed model, an initiator was introduced – an entity, assumed to be private, with a specific business model, specialized in the preparation of the project concept, whose basic role ends with the raising of capital and the commencement of project implementation. It then hands control of the project over to a dispersed group of investors – owners, who are also future customers. The investors exercise "traditional" ownership supervision over the project and management board, but being part of the DAO, they can also influence the implementation of the project more directly (Figure 7.3).

7.2.2 DAO or investor-clients

A key feature of the proposed solution is the combination of the role of the client and the investor (owner) by addressing the project directly and mainly to future clients. Taking into account the large scale of projects and the extensive group of potential clients, this means a potential integration of the social environment of the project, and its members assuming simultaneous roles – clients, owners, investors, observers and sometimes also contractors.

In order to increase the value of the project for investors utilizing technology, the authors envision not only enabling them to have easier access to traditional oversight resulting from the exercise of ownership rights (for example, from shares), but also them to have direct influence on the project. For many dispersed, non-professional investors, making operational decisions can result in additional costs. In addition, direct democracy is not feasible as the primary means of making detailed project-related decisions that coordinate its implementation. Operational work must be coordinated centrally due to the complexity of the processes involved in the project.

On traditional stock markets, dispersed investors, despite having the right to do so, often do not have the opportunity to participate in the supervision over the company's work by participating in general meetings and voting. One of the reasons is the need to monitor information about such gatherings and to physically appear at a designated location. The tokenization of shares or remote supervision significantly facilitate this process and – especially for new issues – can increase the unit value of issued securities and thus increase the efficiency of the issue. Furthermore, to equip (using the technical potential) investor-clients with the possibility of remote, more-direct and individual influence over the project and thus reduce the risk of the principal-agent problem (insufficient effort of the board) arising and potentially increase the assessment of the value of the security for the investor even more, the introduction of real-time progress monitoring in the project has been proposed, which would enable investors to observe the incurred expenses. At the same time, the group of investor-clients is to constitute a DAO. In addition to monitoring, its members also have the right to vote in some project-related matters. These rights do not result from proprietary rights, but should result from the platform's terms and conditions or a separate agreement. Under this agreement, the project's (company's) management board agrees to accept decision-making instructions from the DAO (resulting from results of voting), formally retaining the right to make the final decision. If the management board makes decisions contrary to the instructions, it may be punished by, for example, a bonus not being awarded (under the agreement) or a formal decision to dismiss it (under ownership rights).

A key area of a DAO's influence on the project is the ability to monitor and control expenses implemented by the management board. The management board, while executing expenses beyond the fixed ones arising from agreements and contracts, groups them and submits them to the DAO for

voting. In order to take into account the limitations and problems resulting from the fact that not all investors have the opportunity and time to directly participate in project supervision, the DAO does not vote on approval, but on vetoing subsequent tranches of expenditures. By analogy, the voting may also concern the conclusion of agreements with contractors or employees. A veto can be valid when, for example, at least 80% of all the investors vote for it. A vetoed decision of the management board has no formal force; however, the management board, taking into account the consequences of the agreements, should refrain from implementation and take steps to eliminate irregularities and dispel the DAO's doubts. Vetoing instead of approval and a high threshold of required votes should eliminate attempts at sabotage, obstruction of the project and control of the project by a small number of investors.

By compiling potential voting items, the DAO may, among others:

- veto (approve) expenses and agreements with contractors;
- approve bonus payments for the management board (for example, in the form of product tokens);
- submit and vote on any proposals, thus suggesting the introduction of certain changes to the management board of the company (to the extent specified in the token issuance terms and conditions);
- regulate the functioning parameters of the token trading exchange (DEX);
- exercise formal rights attached to stocks (shares), for example, approve the composition of the management board (if the DAO members are also shareholders).

Unlike traditional capital markets and typical democratic processes, the DAO's supervision over the project may, through wisdom-of-the-crowd effects, constitute an effective supervisory mechanism capable of detecting potential irregularities in the project. This is due to the fact that diverse members of a large group of investors are more activated thanks to the multidimensional relationship with the project and their personal, individual motivations. They are meant to be the target customers themselves, while at the same time achieving a return on investment – they also have a direct impact on the project. Such a scheme brings investors closer to the project of which they are to be the main recipients. In a large community, there are people with diverse competences and levels of commitment, as well as those with knowledge and information, including those who enable substantive control of the project implementation even despite the lack of formal employment.

7.2.3 The entity implementing the project

The project is to be implemented using a central entity owned by investor-clients. In this entity, the central management board will provide a much

more effective form of operational coordination than a large, dispersed group of investors, even supported by tools facilitating decision-making (voting). At the same time, currently most jurisdictions have no legal framework for DAOs under which decisions made by the organization would be effective by operation of law. The entity implementing the project cannot be a non-profit organization due to the need for investors to have ownership rights to the service and the ability to achieve a return on investment. On the basis of currently applicable regulations, it should be assumed that the investment should be carried out by a commercial law company. Here, one can propose a joint-stock company, the structure of which allows for the issue of shares and the dispersion of capital, and depending on the registered office of the company or changes in the provisions of generally applicable law, it may allow for the tokenization of shares. Due to the fact that the investment is to be global in nature, a European company with a legal structure regulated in Council Regulation 2157/2001 is also an option.

The company implementing the project should be the issuer of the tokens and be legally liable to the token holders for the payment of profit and other benefits under the conditions set out in the token issuance terms and conditions. In turn, the token holders will have influence over the management of the investment based on an agreement between them and the company, which will be concluded by accepting the terms and conditions, which is most convenient option if there are many investors/stakeholders. The tool supporting the financing of the investment will be an application that utilizes smart contracts. The most convenient solution is to endow such tokens with the character of shares in the company conducting the investment, but this possibility is strictly dependent on the legislation of the country of the company's registered office, and is currently still controversial. In the near future, given current legislative trends, the following assumptions regarding the formal and legal structure of long-term and capital-intensive investments using DLT cannot be ruled out:

- basing financing on the issue of tokens using DLT technology, representing the right of their holders to participate in investment profits and investment management, which at the same time have the nature of a security – shares;
- buyers of tokens issued in this way will also be shareholders of a joint-stock company;
- the impact on the company's affairs and, thus, the investment being implemented by the company will be exercised by token holders via a smart contract (DAO or SLC), utilizing which the token issuance will take place (this is referring to the legally effective overlaying of the structure of a joint-stock company on the DAO);
- issued tokens can be traded in a secondary manner on a decentralized platform controlled by the DAO.

Here, a certain formal and legal option worth considering can be highlighted, in which investors make investments by purchasing participation

units or shares in the European Long-Term Investment Fund (ELTIF). These units or shares take the form of tokens issued using DLT technology. This variant of the target model requires not only appropriate legal regulation (including practical application) concerning the tokenization of company shares (or potentially units of participation), but also the approval of supervisory authorities, which, in accordance with Article 3 of Regulation (EU) 2015/760 allow an EU alternative investment fund (AIF) to operate as an ELTIF. On the other hand, EU AIFs are managed by alternative investment fund managers (AIFMs) who have obtained the appropriate authorization in accordance with Directive 2011/61/EU and the relevant national regulations implementing this directive. This solution has the advantage that it uses the legal framework created by the provisions of Regulation (EU) 2015/760 and Regulation 2011/61/EU, and thus minimizes legal risk and provides far-reaching investment security. However, a significant disadvantage of this solution is that is deprives investors of any influence on the course of the investment.

If due to legal regulations in the country of the company's registered office, there is no legal possibility to endow tokens with the character of shares or other form of participation, or if this solution would generate too high a legal risk, token buyers may affect the management of the investment based on an agreement between them and the company implementing the project concluded by, for example, acceptance of the terms and conditions. In this case, the terms and conditions must specify the content of the rights of token buyers, the manner of issuing instructions by token buyers (i.e., the rules of functioning of the DAO) and the legal consequences of the company's failure to comply with the instructions of the token buyers (for example, consent to the possibility of not being awarded a bonus based on DAO voting, or other consequences).

Therefore, it was proposed that the company implementing (leading) the investment should be a capital company. This solution gives the opportunity to collect almost unlimited funds for the implementation of projects, and builds the foundation for investment stability. Right from the outset of the investment, it enables the involvement of key investors and significant capital, and also creates the potential to engage public capital in special cases (through public-private partnership, and even by the state or local government taking over complete control of company). Similarly to the legal basis of DAOs, the tokenization of shares or stocks is not yet universally regulated; therefore, in the basic model, the authors assume that the executing company issues traditional shares. Under additional agreements (the platform's terms and conditions), tokenized rights can be associated with shares – to a part of the profits, to voting or to a part of future products. It cannot be ruled out that legal tokenization of financial instruments will become popular; in such a case, the implementation of financing in the proposed model may be facilitated.

7.2.4 Project initiator

Usually, each decentralized project (a service functioning automatically, based on decentralized networks, managed by a DAO), irrespective of whether it is ultimately put into operation in the public domain (on a public blockchain network) and control (operational or strategic) over it is given to a dispersed group, or ultimately controlled operationally in a centralized manner, it usually has a clearly identified (by company name, personal name or address) initiating entity. This entity acts as the entrepreneur preparing the project from the concept to a working product. It organizes financing for construction (for example, fundraising through an ICO), develops and monitors the project and carries out marketing activities; however, it does not incur operating costs if the project functions autonomously. Similarly, private investments in centralized structures providing services and products are initiated mostly by the ultimate owner, who is the recipient of the revenues generated by the project. Investments that provide public goods are usually initiated by a central institution at the local government, national or international level, as it inherently has a social mandate to act in the general interest. In the case of social projects that create or impact inter-personal relationships and are financed in a decentralized model, there may arise an issue of the initiator-founder – the originator who would assume responsibility for developing the initial concept, analysing the potential, conducting marketing to inform about the project's benefits and preparing the funding process. A situation may arise in which each member of a large group of entities (whether individuals or companies) sees a real benefit for all members that would result from the implementation of a solution, but none decide to make the effort to initiate it. Effects related to the diffusion of responsibility or opportunism ("why should I start something that will benefit others?") will come into play. Some individuals may not feel competent to make the proposal, or may not have the resources or time to initiate it. At the same time, the entity that makes the effort and incurs the costs of preparing the project expects to retain the greatest possible share and control over the project and to achieve the greatest benefits in the future, which is not always beneficial for the community and is the reason for the application of regulations – for example, regulations on antitrust or customer protection, or simply the provision of similar services by the state (which is not always effective), which reduces the incentive for private entities to initiate projects.

One possible solution is to utilize existing solutions, for example, crowdfunding platforms, which could help finance this initial "zero" stage of projects. Since the preparation of a product proposal involves minimal costs (although still not zero), often the idea itself is enough, without the need for a fully formed team, a ready prototype, or a PoC or MVP. Another solution is to utilize a platform, a specialized investor (business angel) or an investment fund, which enables the implementation of such initial activities and provides

organizational and legal know-how. Another option is to leave the initiation of capital-intensive projects to public institutions that monitor social needs on an ongoing basis and have a range of data and experience in implementing large investments.

In the proposed solution, capital-intensive projects are initiated by specialized private entities. Such entities, similar to some extent in their role to business angels and consulting companies, would specialize in professionally starting projects in which a large number of clients use the solution they jointly financed. Therefore, projects are initiated which, by definition, make sense only when they are ultimately dedicated to the community in which they function. For the solution to make systemic sense, the capital should also come mainly from this community, not from the initiator, and the community should be the main beneficiary of the project's benefits.

Therefore, the initiator would implement a new type of service, combining several types of competences (consulting, management, law, finance, programming). The role of such initiators is to prepare the project so that it raises the necessary capital for the implementation of the project, which they do not become the owner, manager, contractor or supervisor. The initiation of large projects in accordance with the proposed model means the emergence of a new business model, which involves the implementation of the first, fundamental stages of project preparation, including:

- selection of ideas in the form of an investment funnel;
- preparation of the initial concept of the selected idea, in accordance with the proposed model;
- carrying out an initial feasibility and efficiency analysis;
- organizing a working group of stakeholders (target customers) to explore the needs and investment potential and encourage investment, joining more customers;
- verification of the possibility of raising capital for the project, including from supplementary sources;
- organizing a group of people who can act as a management board, selecting them according to their competence (for this purpose, they can run their own base of professional managers or use headhunting companies);
- roadmapping – preparation of detailed assumptions for the project, collection and whitepaper;
- preparation of a tool (using blockchain technology) or use of an existing one for collection and future trading;
- obtaining public guarantees;
- advertising in the group of target customers;
- appointment of the organization implementing the project and its management board, supervision, making own contribution, with a simultaneous agreement on the transfer of part of the proceeds and tokens;
- assignment of documentation, know-how and intengible assets to the company;
- overseeing fundraising by the company.

In order for the initiator to have an economic sense of existence, incurring the costs for the implementation of these steps and the risk, his effort must be rewarded relatively early and generously, e.g., shortly after raising funds to finance the implementation of the project. Ultimately, it may be the case that the initiator, instead of providing capital to the project, is remunerated with a specific part of the funds from the capital raising process. The remuneration for the initiators, depending on the formal and legal possibilities, may be paid: from the collected capital, as part of shares in the company, or as part of a pool of utility tokens reflecting future services. The initiators take the risk and bear the costs, but they can get a relatively high and quick return in cash, and additionally with the prospect of replenishing the benefits in the future. Their effectiveness and efficiency determine how quickly and in what amount they will achieve the reward. However, they do not have to wait many years, unlike traditional investors, for a return on the project they initiate.

The role of the initiator is therefore important and specific – the investor is neither an investor nor a manager, but in a sense a service provider for the future project (the future company implementing the project). He is a professional initiator of large projects who initially connects the community, makes them aware of the need, organizes a social working group of potential investors-clients, takes on the role of mediator and first coordinator. The role of the initiator ends after successfully raising the necessary capital and appointing the management board of the company coordinating the preparation of the project. Further, the project is controlled by a distributed and to some extent autonomous organization (DAO) composed of investor-clients, which oversees the management board, monitors the project and influences certain project decisions.

It is worth noting that with the initiator's specialization defined in this way, he may also assume the role of a supplier of a ready-made *technical platform* (an application based on smart contracts) that enables the implementation of all financing processes. This platform can be made available on the basis of a separate agreement (or the initiator brings access to the platform as an own contribution to the established company) for subsequent projects initiated by the initiator.

7.2.5 Sources and forms of financing

In various economic systems, there is a phenomenon of concentration of market forces, sales, production effort and sources of capital on a small number of entities respectively supplying the product, narrow, most-popular product lines. As a result, the potential of other entities that can provide value to the system is not utilized. In the case of products, small suppliers lose out due to the lack of interest, which is instead directed at large suppliers, the production of less-popular products is not profitable, and in the case of investments, the costs of obtaining and servicing small suppliers of capital are too high. However, the development of ICT technology has introduced the

possibility of using the value potential provided by companies, products or investors from the "long tail" (Anderson, 2008; Kendall and Tsui, 2011). For many decades, small investors have been able to invest in capital markets, but this is often associated with costs – mainly transaction costs resulting from intermediation. The development of decentralized systems in which it became possible to use a new form of good – a token – to transfer various rights made it possible to achieve further efficiencies in utilizing the value of the "long tail" of products and services, but also investors (Swan, 2017, p. 6; Fitriningrum et al., 2018, pp. 154–164).

Large projects, the usefulness of which is spread out over a long time in the future, require capital to finance development, which, when converted into a single investor-client, can be a real barrier to entry – very high liquidity, which is often difficult to collect individually and even more difficult to "sacrifice". For example, in simple terms, financing the construction of an SNR (small nuclear reactor) for the needs of a small-town community means a cost of approximately EUR 1 billion spread out over approximately three years of construction. Assuming delivered power of 300 MW and energy consumption per household at approximately 0.23 MW (2 MWh per year), the power plant can supply 1,300 households. EUR 1 billion spread over 1,300 households results in an investment of EUR 770,000 per household. This amount, even divided into quarterly tranches, means that each household would have to provide quarterly capital in the amount of about EUR 65,000. Even assuming that it is an effective investment and will generate returns to investor-clients over the next several years, by offering customers energy at cost (even below market rates, especially if they take advantage of investor discounts), this is still a high amount.

In the proposed model, the "long tail" of investors based solely on customers, may turn out to be too short, even if one takes into account the systematic raising of capital as the project develops. This means that the potential of financing the project cannot be fully exploited, as it eliminates a group of investors who are interested in investing in the project but who are not potential customers. Therefore, the sources of financing must be supplemented and diversified and not exclude investors from outside the group of clients. In order to maintain the key role of investors, they should remain the sole owners, and other investors can participate in financing through other instruments (for example, debt instruments), corporate bonds or traditional loans. Other investors should not be owners also because of the increased expectations of future returns on investment, which will increase the cost of capital and reduce the value of the project for investor-clients.

An important feature of the model should be the high availability of financing: tokens, both in primary issue and in trade, should be available for purchase by any natural or legal person, both through professional intermediaries (for example, brokerage houses) and directly without intermediaries if this is technically and legally possible. Certain exclusions for certain categories of persons may be considered here, resulting from legal restrictions, whether

due to prohibitions applied in the country of residence or registered office of a given person, or as a consequence of the introduction of sanctions. High availability of funding means the implementation of mechanisms for counteracting money laundering and terrorist financing provided for by law – primarily, the issuer executing KYC. Buyers of tokens will not be able to be anonymous, and due to the AML and tax regulations (and in the case of overlaying a DAO on a capital company, also due to company law), will have to provide a number of personal data – not only their name and surname, but also place of residence, country of birth, and sources and amount of income. First and foremost, they will have to be identified (in the light of EU AML regulations, it will be necessary to use a qualified electronic signature or hold a video conference with an authorized employee of the issuer). The main mechanism to ensure that the ownership of the project remains in the hands of entities that are the main stakeholders of the project (customers and the social environment) involves specially designed incentives (for example, a right to future products, or the ability to shape the project through voting), and it being directed to target customer groups from the beginning.

7.2.6 *Opportunity to trade and market valuation*

Crowdfunding, in the broad economic sense, allows one to take advantage of the long tail of investors (Swan, 2017, p. 6; Fitriningrum et al., 2018, pp. 154–164). Investors on many crowdfunding platforms that collect funds to finance projects from clients have not been able to exit their investments for many years. The existence of a secondary market for crowdfunding can bring additional benefits, allowing them to exit the market and thus increasing the value of such solutions for investors; however, it is conditional on ensuring the liquidity of this market (Lukkarinen and Schwienbacher, 2023). To enable investors to flexibly exit the market, it has been proposed to implement a (technically) decentralized exchange platform (DEX) utilizing the mechanisms of automatic market makers. In the event of limited market liquidity, the pricing mechanisms used by automatic market makers almost always allow for the execution of transactions and, at the same time, a relatively real market valuation of securities (Angeris and Chitra, 2020, p. 1; Lehar and Parlour, 2021, pp. 28–29)

Issued tokens can be traded in a secondary manner on a platform operated by the initiator or on an external decentralized platform. Due to the fact that such tokens may, from a legal point of view, have the nature of securities (or at least financial instruments), it is also possible to trade such tokens on stock exchanges that will implement solutions enabling token trading. In the EU, this possibility was created by Regulation (EU) 2022/858.

7.2.7 *Technical aspects*

Blockchain technology is not the starting point; nevertheless, the use of this technology can meet all the required criteria for the target solution, in

particular, it will enable investors to directly access the financing and project supervision processes. It should be emphasized, however, that it is not necessary to build your own blockchain network (developing a network protocol, preparing an application compliant with the protocol and organizing a network of entities maintaining nodes) in order to take advantage of the full utilities provided by this technology. It is enough to base the technical solution supporting the financing process on smart contracts supported by existing networks – either private ones (such as Hyperledger Fabric or Cardano) or public, open platforms (such as Ethereum, Solana or EOS), and on applications that allow communication with them and with user wallets that store keys necessary for network and application authentication.

In the proposed solution, a key role is played by applications using smart contract mechanisms that enable the automation of many key processes, enabling the implementation of complex functionalities, ensuring greater utility of the solution for all stakeholders and reducing operating costs. In long-term investments, the blockchain network or applications based on smart contracts could be used for the following:

- to create a DAO, which allows investors to make certain design decisions;
- between investors to confirm (certify) shares in the project (a certificate that is not a transferable security), and if there is a jurisdiction that allows the implementation of STO (security token offering), to carry out a regular financing process by issuing share tokens (securities, corresponding to shares or stocks);
- issuing project tokens (equity tokens, if possible, and management tokens, product tokens, loyalty tokens, etc.);
- to organize token trading;
- to process payments within the project;
- between entities implementing the investment to exchange and certify documentation in supply chains (for example, subassemblies);
- between many investors and many contractors – for confirming, guaranteeing and tracking the progress of the project.

In the proposed solution, the most optimal option seems to be the use of the platforms of a private blockchain, i.e., one in which access control mechanisms are already implemented – to carry out specific processes within the network (create smart contracts, read the history of events recorded in the ledger, or use as a user) a given entity (identifying itself in the network by its address) must have appropriate permissions assigned to it. Private blockchain usually gives more control over the flow of information, and above all, over allowing users to access the service. In public networks, it is also possible to implement access restrictions, but this requires additional actions. However, there is often no control over access to the ledger itself and to the transactions (although to some extent, anonymized ones may be visible to the public). The software that maintains the entire network is provided by a blockchain-as-a-service provider or dedicated at the request of a project

initiator. The standard solution in this case is the development of applications that include the functionality of a digital wallet to maintain access keys to crypto-assets (tokens). Dedicated wallets make it possible to programme solutions that counteract certain difficulties specific to the blockchain network, for example, loss of access keys.

As part of the proposed model, we assume the use of several types of tokens. On the one hand, there are foundational tokens reflect official currencies. These can be both electronic money tokens (referred to by the EU as e-money tokens (EMTs)), central bank digital currencies (CBDCs), or other recognized nominal representations of money in the blockchain ecosystem. They will enable quick settlements within the platform. The actual process of obtaining these tokens belongs to the users of the platform, but the authors assume that it will be supported, for example, by the initiator of the project. The use of payment tokens in the solution may require the development or use of bridges connecting the application to systems that support these tokens. Payments under the project should be made smoothly, and the change of the form of payment (tokenized form or funds on the account) should be carried out automatically using the aforementioned bridges.

The second type of tokens are tokens giving the right to participate in the company's profits – for example, reflecting the ownership of the company that implements the project and is to ultimately deliver the product. Proprietary tokens may have a technically implemented integrated functionality enabling participation in voting, creating a DAO between their holders, as well as authorizations to receive product tokens (see below). These tokens may be transferable. Alternatively, if it would be impossible to use tokenized ownership instruments, tokens transferring voting rights (management tokens) may be separated from official instruments confirming or transferring ownership (stocks or shares), but they should be unambiguously and inseparably linked to ownership rights, which would also in this case require the development of technical bridges or the use of interfaces (APIs) to reflect the proof of ownership of these instruments in the proposed solution. This is aimed at granting the actual investors voting rights, i.e., the exercise of ownership rights. Investor tokens (management tokens, integrated tokens or ownership and management tokens) should also enable the monitoring of financial flows within the project.

In order to encourage the participation of future customers, investors have the right to receive a systematic discount on products in the form of issued utility tokens with payment utilities (essentially tokenized vouchers). These product tokens reflect the right to receive a part of the goods produced free of charge, for example, in proportion to one's contribution to the project. They are issued periodically (for example, monthly) and are valid for a predetermined period, for example, until the tokens for the next period are issued. These tokens are transferable. At the time of payment, they are redeemed (technically, they are "burned"). In a given tranche, tokens corresponding to, for example, 50% of production in the near future (which

corresponds to a discount of 50%) may be issued and distributed among investors in proportion to their contributions. The investors (holders of ownership or voting tokens) and holders of originator tokens (see below) are entitled to receive them free of charge. Thanks to this, their holders can use the platform's services partly free of charge. Technically, both token payments and the disposal of surplus tokens can be carried out automatically, taking into account the individual preferences of the holder set in the application. Initiator tokens grant the initiator the right to systematically receive product tokens, which the initiator can sell on the market and thus earn income also after the end of participation in the project. Another type of tokens that can be used are ones that certify the debt of the lender – they can reflect the rights arising from corporate bonds or other liquid debt securities. Thanks to the integrated trading market for all types of tokens (DEX), they can be liquified. This means that surplus tokens can bring an additional return to investors who have invested more capital.

To ensure the existence of a strong relationship and motivation to finance with capital from future users, a token should be a carrier not only of the rights to future profits or revenues, but also the right to make decisions on important project-related issues and additional bonuses (rebates) for service users. Thanks to this, the investing community will benefit from both the existence and availability of a product tailored to their needs (because it is developed thanks to their decisions), lower product prices resulting from lower product development costs (including the costs of raising capital), and limiting the impact of product monopolization on the price. There will also be additional benefits for users of the future service – discounts reducing the price (limited – up to the level of marginal costs). Such a structure may increase the propensity of future customers to invest, and limit the investing willingness of investors who seek capital gains. Such a solution prefers members of the community, especially those who invest, while not excluding definitely other investors. Therefore, the basic assumptions of the initial legal and economic model of financing long-term and capital-intensive investments include basing the financing on the issue of tokens using DLT technology, representing the right of their holders to participate in profits from the investment (and, if possible, also ownership rights), the rights to future products and the right to participate in the management of the investment.

To implement the token exchange functionality, a (technically) decentralized exchange platform (DEX) was proposed that uses the mechanisms of automatic market makers. Decentralization consists of basing this service, similarly to tokens, on the mechanisms of smart contracts. This gives token holders the opportunity to liquidate their shares or utility tokens, which transfer rights other than shares.

Automatic mechanisms and functionalities embedded in the smart contract and the project's applications should enable the use of all the utilities of the solution without the need to have in-depth knowledge of the functioning of blockchain technology, financial instrument markets or their valuation,
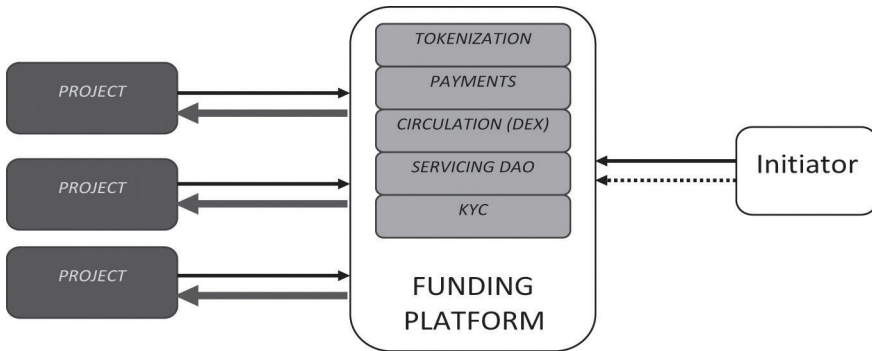
Figure 7.4 Scheme of the integrated funding platform.

adopted strategies, etc. They should automate as many of the processes as possible, enabling the setting of selected, intuitive parameters.

All technical processes can be implemented as part of dedicated applications or using a technical solution provided by the initiator. Such an integrated platform may enable the standardization of functionalities (services) made available to various projects (Figure 7.4):

- payments (including dividend payments, interest payments, payment with product tokens);
- issuing tokens;
- creating a DAO:
  - using rights from tokens;
  - submitting initiatives;
  - voting;
- operation of a decentralized exchange (DEX);
- monitoring;
- KYC processes;
- identification services, digital signatures;
- audits, information services, reporting to institutions;
- analytics for users.

Thanks to the integration of these functionalities in one solution, the initiator has the opportunity to achieve additional economies of scale, and the users of the platform (stakeholders of various projects) can flexibly switch to investments in other projects. In practice, in order to simultaneously maintain control and integration of the entire platform, and to limit the risks of the functioning of separate services, they can be separated as subsidiaries. As part of the platform, the DEX organization allows enables the compliance-by-design approach, and there is no need to use external platforms, where trading may include tokens or digital goods that do not generate legal risks.

After expansion, the platform could also be used by entities implementing an investment to exchange and certify documentation in supply chains (for example, subassemblies) or be utilized by investors and contractors to confirm and track progress in the implementation of investments – not only in relation to finance (expenses), but also the status of construction processes.

A separate issue that arises is determination of the entity that has the authority to manage the application itself. Depending on whether the application is dedicated to the project, is prepared by the initiator, or is the initiator's platform that enables support for financing and DAO organization for many projects, the right to change the code of the application and smart contracts (or change the network protocol, if an independent blockchain network was being built) may belong to different entities – the initiator, the company implementing the project (its management board) or the investors (DAO members). Traditionally, while DAO members have the ability to vote or adjust the parameters of the smart contract, the right to change the code of the application, which contains the implemented rules for the functioning of the platform connecting various stakeholders, are limited to a narrower group. The application supporting projects plays a strategic role in their success, because it contains system mechanisms that indicate the number of issued tokens, as well as their distribution and transfer. Its code should be known and auditable by representatives of each project at any time to prevent abuse, and so that the rules of its functioning are transparent. It seems that neither investors nor the management of the executing company should have full control over the application that handles the tokens they hold – this would create a conflict of interest. In the authors' opinion, the most effective solution is an application prepared and operated by the initiator who provides a ready-made management platform. In this case, control over the code should be shared between the representatives of all projects and the initiator. Project representatives may be delegated board members or project investors. Thanks to this, they can create a separate group of authorized persons who have the ability to influence the functioning of the platform.

The contract should have the capacity to be updated to fix potential errors or security gaps, as well as introduce new functionalities. Due to the significant impact of the application on the functioning of the entire ecosystem, updating such a contract should be limited to a minimum and require the consensus of all or almost all stakeholders. Modification rights can be assigned to addresses stored in code of the contract(s), making them harder to change. However, this may limit the flexibility of the functioning of a heterogeneous and variable group, as each project functions separately, so it seems that a more effective solution would be to introduce one more type of management token that transfers the rights to manage the entire platform (creates a "master DAO"), and that requires the consent of, for example, 80-90% of entities to modify the functioning of the platform. There are a number of special situations to consider when defining the terms of use or the content of agreements related to the functioning of the authorization system,

such as loss of access keys, sale of ownership/management tokens, project completion, etc.

7.3 Legitimacy and effectiveness of the solution

Communities of globally dispersed investors have already proven that decentralized financing is possible by financing many projects, including decentralized ones (apart from compliance aspects and pending lawsuits related to the suspicion of unauthorized issue of securities). Individual projects have been able to accumulate a market-valued value of tokens exceeding USD 1 billion under ICOs. This is more than the largest venture funding rounds for projects aimed at building digital service platforms. For example, the EOS project raised USD 4.2 billion and the Tezos project raised USD 1.7 billion (Allen, Fatas and Weder di Mauro, 2022, p. 2).

ICO fundraisers competed with venture capitalists and business angels, but often used funding from smaller private investors. ICOs can be an alternative way to raise funds from a wider audience at a stage when the project is just an idea. Decentralized funding enables high liquidity already at this early moment. This contrasts with traditional venture capital, where investment is typically illiquid for several years until the initial public offering (IPO) or sale of the company (Allen, Fatas and Weder di Mauro, 2022, p. 2).

To date, capital-intensive and long-term projects have been identified in two groups:

- providing public goods – financed publicly or partly privately;
- providing private goods – financed mainly privately, sometimes through crowdfunding.

The second case involves projects that are ultimately to be privately owned and allow the owners of the project's equity capital to generate income. The expected return is relatively high due to the high cost of raising capital and a number of project-related risks. To date, such projects were the subject of interest of initiators (founders) who themselves had extensive capital and were able to finance a large part of the activities, including initiating activities and then activities to organize further financing.

The use of technologies and decentralized solutions can generate a new class of public projects, but ones that are financed fully privately. Blockchain enables both the dispersion of ownership and the initiation of large projects by smaller entities. It disperses responsibilities and risks, reduces the required minimum own capital and enables smaller investors to profit from investments in large projects without increasing the costs of servicing small investors. Integrated solutions make it possible to automate many processes and contractual relations between stakeholders, provided that a formal and legal solution is found within which it will be possible for the project to function during development and in the operational phase. The original idea

of an ICO was to organize financing using the utility (technological) and ideological foundation of cryptocurrencies – enabling anyone with an Internet connection to anonymously participate in the venture market, even with a small amount of capital. Since the "ICO bubble" burst in 2018, regulations are constantly being developed to organize, but also to some extent limit the possibility of implementing such an idealistic model. Nevertheless, the potential of decentralized finance still exists.

The venture capital and private equity sectors tend to be restricted to qualified investors, and access is controlled by a number of intermediaries, partly because volatile and illiquid assets require investors to be able to tolerate a higher degree of risk. Crowdfunding of a large project enables the implementation of projects whose investors are the target recipients and clients of this project, and sometimes also other direct stakeholders, which resembles the functioning of a cooperative, but one that in this case is expanded by not only cooperative management of the finished service, but also cooperative (community) financing. Necessary social consultations are eliminated or limited in this case, as the community affected by the project is both the recipient and the decision maker, and at the same time may also be the beneficiary of potential profits generated by the project. As a result, the project can be planned in such a way as to best suit the entire community, and at the same time it can be effective in the sense that it is not focused on such high profitability for investors, but on achieving multidimensional benefits: economic benefits resulting from receivables (debt) or ownership (interest, dividends or capital appreciation), as well as social benefits – utility benefits common to all stakeholders of the project, resulting from access to the good and its lower price (rebates for investors) compared with a monopolistic supply. Therefore, investors benefit in several ways: investment and consumption benefits, and partly also reputational (psychological) benefits, while having a real, direct impact on the project. Rebates and the availability of a product tailored to the needs of a specific group of clients further reduce the profitability of equity investments for other groups of investors, encourage all members of the community to invest and reduce the benefits of so-called free-riders (clients who gain access to the good, despite the fact that they did not jointly invest in its development). At the same time, the availability of the target good, which is still offered cheaper than if it were provided by a profit-oriented private investor, is not absolutely limited. Thanks to this, the link between the project and the investor is stronger than in other methods of financing (shares or crowdfunding) due to the investor's direct, multi-faceted interest in the success of the project and the benefits of which the investor is the beneficiary that are not limited to profit.

As indicated earlier, the need for high concentration of capital with simultaneous directing of the project to investor-future clients will likely require a significant contribution of supplementary debt capital, which will increase the leverage of the project. The leverage mechanism often allows an increase in the scale of the business and achievement of higher profits. However, this

is not always beneficial. As shown by for example Brusov (2012) NPV tends to decrease with leverage when the equity value remains constant. However, where ownership is distributed primarily to prospective customers, there is less of a constraint on raising the additional necessary (debt) capital to finance an investment that exceeds the capabilities of the target customer group, as the value of the project for owners also largely stems from consumer benefits.

The link between the investor-owner and the client also reduces inefficiencies resulting from the monopolization or monopsonization of the solution, which negatively affect the price and availability of the target product for consumers. The pursuit of profit is no longer the sole objective. It remains a goal, as it is the profit that reflects the efficiency of the project and is the basis for achieving returns for investors. However, it is not the only objective, because investors also gain consumer benefits. Although a large project that does not maximize economic profit will not give such returns to investors as other investments would, the investors – who are future customers – will be able to benefit from the availability of the service and the potential employment, and will be co-owners of the services they will use. Limiting the importance of profit means that the project, while maintaining a high scale and a "technical" monopoly (one company on the market), will not behave on the market like a monopoly, which means that the price of goods sold on the market should be close to a comparable competitive market, and potentially lower, taking into account the potentially lower cost curve, and production should be larger and still available to anyone who expresses demand for the product (service).

In a project with the proposed conceptual framework, the costs of raising capital should be lower, which results from the reduction of risks and the elimination or reduction of certain cost categories – financial intermediation costs (during the generation and servicing of tokens), transaction and token trading costs, depreciation in project profitability, etc. A project in which the target customer is known from the beginning, as they are financing the implementation of the project, reduces the risk that the product will not be created and the costs associated with informational marketing and of market research. At the same time, reducing the risk of failure may reduce the cost of obtaining supplementary capital. The risks of failure, although they seem lower, are directly borne by investor-clients; therefore, they have a collective interest to actively participate in the development of the project as an active investor-decision maker, and sometimes as an employee, more than in traditional democracy and more than in the traditional capital market.

An additional benefit of decentralizing the financing of large projects may be the systematic use of the so-called the wisdom of the crowd, which socially supervises and monitors all stages of development and the subsequent functioning of the project, using a structure that is more transparent

than that of traditional investment projects. At the same time, the group participates in voting and in the market of tokens related to the project, which, through signalling effects, reflect the state of the project. Research shows that the dispersed knowledge of even a small group of non-specialized units can predict, for example, changes in stock prices on the capital market just like experts (Wagner et al., 2010; Chen et al., 2014). In decentralized networks, social influence can generate a learning dynamic that increases the wisdom of crowds and, as a result, the effectiveness of monitoring (Budescu and Chen, 2015; Becker, Brackbill and Centola, 2017).

As Lee and Parlour (2022, p. 1131) noticed, crowdfunding makes more sense when the project is short term due to customers' tendency to strongly discount the value of goods. In other words, customers are impatient. In wanting to meet needs, they are not willing to postpone consumption far into the future. Giving investor-clients some direct control over the project (but not so much as to paralyse the work) is intended to increase their patience. In addition, marketing and PR play an important role in the project, although it is slightly different than in traditional projects. The marketing department makes future clients feel that they are part of the project, and the project was part of their everyday life. An individual, personal approach to specific investors can additionally strengthen their bond with the project and reduce the level of discounting of the value of future consumption. At the same time, advertising investment in the project as a kind of pension fund can influence long-term thinking about the project and its benefits.

An important efficiency challenge is the traditional raising of sufficient capital in a short period of time (once off) to cover almost all expenses related to the implementation of the project until its launch. Therefore, it was proposed that funds should be collected systematically, and that instrument-tokens reflecting ownership be generated once, but sold systematically – for example, in annual, quarterly or even weekly public offerings, automatically, in accordance with the provisions of the smart contract, and the amount of ownership tokens sold in a given tranche should reflect the costs that will need to be incurred in the coming periods. All public offers in total should be distributed over the duration of the project (several years) in order to finance slightly more than 100% (120–150%) of the project's estimated costs and end with the estimated duration of the project. Thanks to this, capital for the implementation of the entire project can be collected as demand for it arises, which will reduce the required amount of capital needed to be provided by a single client-investor, solving to some extent the problem of one-time concentration of savings. At the same time, the investors know in advance the proportion of ownership in the target project they are investing in. An additional benefit of the first investors is the fact that they will have the greatest initial influence on the project. However, directing the project to investor-clients allows them to systematically invest in the project without burdening the individual budget like a single public offering would. The offer should

be designed in such a way as to enable the purchase of tokens by any future customer, without abandoning market mechanisms that ensure the efficiency of the fundraising process.

Support for financing through distributed technologies can significantly facilitate the creation of projects providing public or club goods, i.e., those whose beneficiaries are a *large group of people*, defined as to type (for example, housing estate or commune) – and in extreme cases, even the entire society, as the problems of the scalability of the approach are less than in the case of the scalability of centralized funding. With the increase in the scope and capital intensity of a project in which the decision maker and main beneficiary is a single entity, an increase in the scale of the project reduces its funding potential and increases potential difficulties through greater social responsibility and a disproportionate increase in fixed costs. The increase in the scope of a socially funded project makes it necessary to adapt to more clients, accept more stakeholders and raise more capital. These aspects are facilitated by the fact that a larger scope means more willing investors directly affected by the project. It can be expected that the overall efficiency of a socially financed project may increase with the size of the project in a decentralized way – at least up to a point. Projects that are too small may reach and benefit too few customers and, therefore, not be able to secure sufficient funding.

An apparent limitation of the effectiveness of the use of decentralized financing in the form of a collection of transferable tokens representing shares may be investors' motivations to purchase tokens not because they believe in the project and ultimately want to use its services, but because of the potential capital gain (they may gain from the increase in the token price). This is an apparent limitation, as this mechanism has been operating on the stock market for a long time, and what is more, changes in the share price are a market signal also observed by project decision makers.

Centralized platforms in general (including both those providing utility services, such as Uber or eBay, and marketplaces for securities) base their financing of development mainly on sales commissions (fees for services), while projects building decentralized platforms and financing themselves in decentralized way by issuing tokens (ICO), forego commissions (although they can technically programme them into the target service) in favour of token retention. This is also referred to as revenue sharing. Among the total pool of tokens generated, only a fraction is sold to investor-future customers (who are not owners), thereby financing the initial development of the service, while the remaining tokens are retained. The entire pool of generated utility tokens, which are the carrier of entitlements to future services, in the absence of other fees for services (specified, for example, in other tokens or official currency), reflects the value of the total revenue of the project development team (although this value at the time of generation of the pool may not be directly expressible in the official currency). Alternatively, instead of selling *a fraction* of the entire pool of tokens, they can liquidate a specific *number*

of the target product (service), as in crowdfunding – referred to as "output presale". The retained tokens motivate the development of the project to increase their market value and enable additional financing in the future. As Allen and Fatas show (Allen, Fatas and Weder di Mauro, 2022), both development levers help overcome moral hazard and encourage platform building. However, they are not perfect substitutes, and require strategic trade-offs. The commission approach leads to higher long-term returns for platform founders, while token retention can lead to higher levels (quality) of the service, benefiting service providers and users (Gan, Tsoukalas and Netessine, 2022, p. 30). Malinova and Park (2018, p. 36) add that all profitable projects that can be financed by own capital (equity) can also be financed by tokens; however, some profitable ventures that can be financed solely by tokens cannot be financed using own capital. This suggests that the retention of tokens and the foregoing of service fees or margins are complementary to the concept of social financing the construction and development of projects used by this community. It is worth noting, however, that funds collected through the issue of utility tokens that give the right to exchange for a service must be sufficient to cover not only the development costs of the project, but also the production costs of all services in the future. In the case of projects launched as part of decentralized finance, the marginal costs of services are basically close to zero, and the users cover the transaction costs that enable the use of DeFi services themselves.

In the case of the proposed concept, the clients financing the project are also its owners, and the role of the initiator is limited to launching the project and "getting it started". The production costs of the target services will not necessarily be close to zero, especially if the project being developed is infrastructural. Therefore, the described retention is impossible to implement. Retention makes sense when the initiator issues tokens reflecting the value of future revenues while retaining some of the tokens. In the case of the proposed model, this would mean that an entity that is not related to the project has control over the sale of the good. On the other hand, controlling the supply of tokens by the project owner (investors) will also not be justified, because the owner would not be able to sell such tokens on the market, obtaining additional funds for development, as the owner itself is, in principle, the recipient (client) of the project's products. Moreover, it would mean that the owner in this case finances the development of the project in two ways: by buying instruments reflecting ownership and by selling tokens reflecting the right to products. However, it would deprive itself of the possibility of consumption.

Therefore, it was proposed that the investor, together with the ownership instrument, would receive systematic (for example, monthly) utility tokens entitling it to receive, free of charge, a proportionate share of products estimated for production in the near future (for example, 30–50% of all products from a given period transferred in this way in exchange for redemption – the "burning" of a utility token). The token would expire at the end of

the period. Thanks to this, in the event of inability to consume, it will be able to sell the tokens on the market. This means that larger investors (which the project still needs) will be able to resell surplus entitlements at a certain discount to those who benefit from the discount (similar to a rebate), and generate additional income. The tokens could be liquidated automatically, according to the investor's preferences set in the application. To take advantage of the opportunity to encourage long-term thinking by initiators, management and employees, they could receive tokens analogous to property instruments, but devoid of ownership itself, yet entitling them to receive similar utility tokens. Both the utility tokens and initiator tokens could be traded on the market. From the investor's point of view, the amount it provides to the project reflects not only the value of potential profits, but also the value of products that can be obtained free of charge. The market valuation of both shares and stocks on one hand and utility (product) tokens on the other hand will reflect the current valuation of the product. Product tokens paid as bonuses to the management board can be under the control of the DAO. Failure to grant a bonus means no additional benefit for the management board, and this benefit is not taken over by any other group. Additional remuneration, as well as the fact of having tokens, the value of which depends on the quality of the work of the management board motivates the management board to act diligently and efficiently. The same is true for project initiators. Although in accordance with the assumptions, their role ends when the project is handed over to the investors (the DAO) and the management board, they receive remuneration in the form of a portion of the funds raised in subsequent rounds of public offerings for their contribution. To incentivize initiators to prepare a project that can be developed efficiently and benefit users and other stakeholders in the long run, they also receive a portion of the entitlement to product tokens that can be liquidated on the market. It is worth noting that the payment of a bonus to the initiators in the form of profit-sharing rights is not justified in this case if the project is not aimed at maximum profit.

Additional efficiencies can be achieved through the use of smart contracts, especially if they have legal force (this is an alternative proposal that can be implemented in the future when the legislative conditions are favourable). The use of smart contracts not only as a tool supplementing business relations (smart contracts can already be used to define and perform obligations arising from a legally binding contract), but also as a carrier of formalized contractual provisions can bring additional measurable benefits by implementing so-called SLCs. SLCs are designed (in form and structure) to create legally binding contracts that comply with the legal and regulatory requirements of the jurisdiction to which they are intended to apply. They constitute a legally binding agreement in which some or all of the contractual obligations are defined or performed automatically by a computer program. Such an application code requires additional agreements between the parties and additional terms of use. SLCs involve an arrangement regarding both

the intention of the parties and how automation will be used to achieve that intention. This allows the involvement of the court system in the event of a dispute, incorrect execution or computer code malfunction. Smart contracts and SLCs can connect to external data sources (oracles)[1] (Boyle, 2023, p. 3).

A solution makes sense systemically if all stakeholders benefit. Investor-clients have investor-consumer benefits. Efficiency can also be achieved by companies providing ideas (initiators) – not thanks to the independent implementation of ideas, but thanks to specialization in finding and structuring ideas for pro-social projects, economies of scale and additional cash flows (a share in the collected amount) paid once or systematically, thanks to which their income can be assured. This can encourage the creation of such firms, the transformation of existing consulting firms, or the expansion of activities by business angels. The activity of such companies is not as capital-intensive as, for example, that of infrastructural projects. Initiators have to cover costs mainly of a personal nature. The proposed separation of the initiator from the project implementation process makes it possible to limit the risk associated with project implementation for the initiator, while at the same time enabling the achievement of benefits already at the moment of launching its implementation, and then in the event of its success.

Not all projects can be effectively financed using the proposed solution. The model is expected to be more effective for projects that:

- provide a uniform product which brings a similar benefit to everyone (for example, energy);
- are embedded in a relatively homogeneous community of customers who share a common need, are relatively unanimous as to the final shape of the product, and can reach an internal compromise in the event of inconsistencies;
- are embedded in a community of customers who have above-average savings and possibly an above-average appetite for risk;
- involve a relatively long lead time to spread the collection of liquid capital over time;
- involve incurring the lowest possible total costs per investor-client.

It is worth noting that the proposed model is not the only possibility of utilizing DLT technology in the processes of financing capital-intensive investments. However, the proposed solution coherently combines economic, technical, formal and legal aspects, providing an integrated approach that can generate a number of new large, socially effective investments.

Acknowledgement

Note

1 Smart legal contracts. Advice to Government'. UK Law Commission, 2021, https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2021/11/Smart-legal-contracts-accessible.pdf

Bibliography

Allen, F., Fatas, A., Weder di Mauro, B. (2022) 'Was the ICO Boom Just a Sideshow of the Bitcoin and Ether Momentum?', *Journal of International Financial Markets, Institutions and Money*, 80, https://doi.org/10.1016/j.intfin.2022.101637

Anderson, C. (2008), *The Long Tail: Why the Future of Business Is Selling Less of More*. New York: Hyperion-Acquired Assets.

Angeris, G., Chitra, T. (2020) 'Improved Price Oracles: Constant Function Market Makers', in *Proceedings of the 2nd ACM Conference on Advances in Financial Technologies*, https://doi.org/10.1145/3419614.3423251

Becker, J., Brackbill, D., Centola, D. (2017) 'Network Dynamics of Social Influence in the Wisdom of Crowds', *Proceedings of the National Academy of Sciences*, 114(26), https://doi.org/10.1073/pnas.1615978114

Boyle, K. (2023) *Money, Tokens, and Games: Blockchain's Next Billion Users and Trillions in Value*, www.citifirst.com.hk/home/upload/citi_research/rsch_pdf_30143792.pdf

Brusov, P., et al. (2012) 'Influence of Debt Financing on the Effectiveness of the Finite Duration Investment Project', *Applied Financial Economics*, 22(13), https://doi.org/10.1080/09603107.2011.637893

Budescu, D.V., Chen, E. (2015) 'Identifying Expertise to Extract the Wisdom of Crowds', *Management Science*, 61(2), https://doi.org/10.1287/mnsc.2014.1909

Chen, H., et al. (2014) 'Wisdom of Crowds: The Value of Stock Opinions Transmitted Through Social Media', *The Review of Financial Studies*, 27(5), https://doi.org/10.1093/rfs/hhu001

Fitriningrum, A., et al. (2018) 'Blockchain Technology: Revenue Streams of Long Tail Business Model', in *SU-AFBE 2018: Proceedings of the 1st Sampoerna University—AFBE International Conference, SU-AFBE 2018, 6–7 December 2018, Jakarta Indonesia*. Jakarta, Indonesia: European Alliance for Innovation.

Gan, R., Tsoukalas, G., Netessine, S. (2023) 'Decentralized Platforms: Governance, Tokenomics, and ICO Design', *Management Science, INFORMS*, 69(11), 6667–6683, November.

Kendall, T.D., Tsui, K. (2011) 'The Economics of the Long Tail', *The B.E. Journal of Economic Analysis & Policy*, 11(1), https://doi.org/10.2202/1935-1682.2845

Lee, J., Parlour, C.A. (2022) 'Consumers as Financiers: Consumer Surplus, Crowdfunding, and Initial Coin Offerings', *The Review of Financial Studies*, 35(3), https://doi.org/10.1093/rfs/hhab058

Lehar, A., Parlour, C.A. (2021) Decentralized Exchange: The Uniswap Automated Market Maker (August 14, 2021). *Journal of Finance* (forthcoming), Available at SSRN: https://ssrn.com/abstract=3905316 or http://dx.doi.org/10.2139/ssrn.3905316

Lohmann, N. (2013) 'Compliance by Design for Artifact-Centric Business Processes', *Information Systems*, 38(4), https://doi.org/10.1016/j.is.2012.07.003

Lukkarinen, A., Schwienbacher, A. (2023) 'Secondary Market Listings in Equity Crowdfunding: The Missing Link?', *Research Policy*, 52(1), https://doi.org/10.1016/j.respol.2022.104648

Malinova, K., Park, A. (2018) 'Tokenomics: When Tokens Beat Equity', *Management Science*, 69(11), 6568–-6583, ttps://doi.org/10.1287/mnsc.2023.4882

Swan, M. (2017) 'Anticipating the Economic Benefits of Blockchain', *Technology Innovation Management Review*, 7(10), https://doi.org/10.22215/timreview/1109

Wagner, C., et al. (2010) 'The Wisdom of Reluctant Crowds', in *2010 43rd Hawaii International Conference on System Sciences*. Honolulu, HI: IEEE, https://doi.org/10.1109/HICSS.2010.483

8 Conclusions

The main goal set in this monograph was to create an economic and legal model for financing long-term and capital-intensive investment projects utilizing the potential of DLT (Distributed Ledger Technology) so that the new solution is an effective alternative and is adapted to existing legal possibilities (compliance-by-design approach). The monograph is the most important result of the work carried out as part of a grant financed by the Polish National Science Centre, and contains a proposal for such a model (see Chapter 7).

The starting point for developing the model was the analysis of the specificity of long-term and capital-intensive investment projects and their financing mechanisms, which was carried out in Chapter 1. A number of historical examples and specific organizational, social, legal, economic and financial features of long-term and capital-intensive investments have been highlighted. As a consequence of this analysis, it was determined, inter alia, that large investment projects usually:

- are infrastructural;
- are planned to be implemented for several to a dozen or so years, and there are basically no projects whose implementation is planned for more than 15 years;
- concern a wide range of stakeholders – both investors (owners and lenders) and a wide social environment, including the target group of customers;
- affect the economy systemically and, therefore, must take into account the important role of the authorities;
- involve many risks and uncertainties higher than in the case of shorter and less-capital-intensive projects;
- due to the scope and risks, require incurring a high cost of obtaining capital;
- may ultimately provide private goods – then, they are financed with a significant share of private funds or public goods (limited possibilities to reduce consumption); in such a case, public funds are the main source of financing;

- utilize the mechanism of issuing bonds or shares on the capital market for financing, but these assets are of low liquidity (difficult to sell on the market);
- require the accumulation of high capital, which limits access to such investments only to large investors and usually requires many sources of financing;
- often take the form of a special purpose vehicle for the purpose of project coordination;
- require a high level of formalization of the organization of project preparation and implementation;
- may be associated with significant resource constraints.

Individual phases and stages of the investment have been outlined, and have been linked to the basic methods of financing. Stakeholders and resource constraints were identified. It was found that among the known approaches, the "cascade" approach in management and coordination is appropriate for megaprojects. It requires a long planning process or a one-time collection of all capital for the implementation of objectives. Chapter 1 also highlights the social and media importance of capital-intensive and long-term investments, in particular the achievement of sustainable development goals.

It has been established that among the available organizational and legal forms, the best one for conducting long-term and capital-intensive investments is a joint-stock company. However, as a rule – with some exceptions for the functioning of Project Finance – there is no legal regulation specifically dedicated to long-term and capital-intensive investments. In this context, what stands out is the detailed and comprehensive legal regulation concerning European long-term investment funds (ELTIFs) as addressed in Regulation (EU) 2015/760. Due to the limited legal regulation, agreements concluded with investors are therefore, as a rule, of decisive importance for capital-intensive and long-term investments. However, relations between investors and the company conducting the investment should be shaped in such a way as to avoid the distortion of competition on a given market (especially since, due to the scale of the investments analysed in the monograph, they usually constitute a natural monopoly).

In the course of the research, the types of costs and types of risks associated with capital-intensive and long-term investments were identified. It needs to be emphasized that although investors may wait many years to reap the benefits, those who do take the risk can count on high rates of return. Financing of mega-investments is not usually addressed to small, medium-sized or individual investors; smaller investors are not interested in investments that require a large amount of capital to be frozen for a long period. Therefore, in order to attract smaller investors, it was proposed in the model to address the solution to the community of potential customers who would constitute the only or basic base of investors, thanks to which the investors would be

able to benefit from the project's results both through profit participation, the right to discounts or free products, or the availability product itself.

As a result of the analysis carried out in Chapter 1, the scope of the monograph has been limited to capital-intensive and long-term investments that are intended to bring at least minimal economic benefits (after the investment is completed, revenues and returns for investors appear, and their result is solutions that provide private goods). Thus, the scope of the research did not include projects aimed at providing non-economic benefits (as a rule, do not generate revenues, and their result is public goods) that are financed to a large extent with public capital and are controlled by public entities. However, it is possible to adapt the solutions proposed in the model described in Chapter 4 to projects in which the investors are the governments of many countries (or many local government units) that do not expect direct financial returns on investment.

Another important step towards the model developed in Chapter 4 is a detailed analysis of the potential of DLT technology, which can be utilized in investment projects, in particular in capital-intensive investments, carried out in Chapter 2. The essential properties of the technology and the resulting utilities were analysed. Blockchain technology in particular has the potential to, inter alia:

- enable the automation of relationships between entities that do not have much trust in each other thanks to smart contracts, while reducing the costs of some processes, and maintaining user privacy and programmability of access;
- capture records, thanks to which it can guarantee the non-repudiation of the content and the moment of their creation;
- enable the use of a new class of goods (a new form of goods) – tokens that can be a carrier of various powers and utilities, and that can be flexibly programmed.

Potential processes and services that can be used in the process of financing investment projects were also analysed, as were the concepts of using DLT in such projects described in the literature. Also discussed was the legal framework for the mechanism of financing capital-intensive investments using DLT, which was developed in Chapter 3. This analysis provided the basis for the construction of the model described in Chapter 4.

It was determined that the anonymization solutions offered by the DLT technology seem to be the least useful for financing capital-intensive and long-term investments, not only due to AML/CFT (Anti-Money Laundering and Combating the Financing of Terrorism) regulations, but above all, the requirements of tax law and company law (in the case of adopting a variant of the model that provides for the tokenization shares of the company running the project). In addition, the use of cryptocurrencies is less useful for financing such investments due to fluctuations in their exchange

rates and the mechanisms of unsecured loans (as part of the DLT ecosystem), which are not yet sufficiently developed. On the other hand, the most valuable processes and services for capital-intensive and long-term investments were identified as the concept of issuing and servicing tokens, the ability to create a decentralized autonomous organization (DAO), the automation of business logic and the use of a durable medium, with the concept of an autonomous exchange (DEX) and a durable medium as a possibility of notarizing documentation.

A multifaceted legal analysis of the potential for financing capital-intensive investments using DLT is conducted in Chapters 3–6. It takes into account the legal regulations of the European Union, US state and federal law, as well as regulations of selected countries from around the world. However, the analysis also assesses the practical applicability of certain seemingly promising business and technological solutions offered by DLT for financing capital-intensive and long-term investments, assuming a global and cross-border character. This primarily refers to the possibility, under the law in force on the date of time of submitting the monograph for publication, of applying company law provisions to the DAO without creating a legal risk that is significant for the success of the project. On the other hand, the global trend is clear and shows that in the coming years, the legal risk related to the tokenization of shares and the "overlaying" of the DAO structure and functionality on a joint-stock company will decrease, and eventually such a solution will become fully attractive for running capital-intensive and long-term investments. Additionally, a *de lege ferenda proposal* can be submitted regarding the elimination of barriers to the tokenization of shares in the legislation of individual countries.

However, already at present, thanks to the rising regulatory wave, primarily in Europe (where the EU is leading the way with the MiCA Regulation) and in the United States (where the regulatory burden is borne by individual states), there is a possibility of a fully legal and safe issue of utility and payment tokens, including stablecoins, that can be used to implement the functionalities provided for in the model proposed in Chapter 7. There is also a usable regulatory framework for regulated electronic money that can be used in investments, and in the near future there will be a possibility of extensive use of central bank digital currency (CBDC).

From the perspective of the model developed in Chapter 7, it is important that the currently applicable laws and the positions of regulatory authorities create a safe and low-legal risk opportunity to issue tokens that allow investors to participate in profits from a capital-intensive and long-term investment. Generally, however, such tokens are treated as financial instruments and, therefore, are subject to different regulation than utility and payment tokens – the best example of such an approach is the MiCA Regulation, but this is also present in the US law.

The model developed in Chapter 4 does not directly imply that the company conducting the investment is an obvious obligated institution within the

meaning of the AML/CFT regulations; however, such a possibility cannot be ruled out, as the obligation to apply these regulations depends primarily on the registered office of the entity (capital company) implementing the project, as well as the regulations of the countries where it operates (implements the investment). Due to the fact that, in addition to the provisions dedicated to AML/CFT, most civilized countries have a criminal law regulation providing for criminal sanctions for the crime of money laundering, it seems necessary for the entity conducting a capital-intensive and long-term investment financed using DLT technology to perform in relation to buyers (and holders) of tokens at least a full KYC ("Know Your Customer") procedure, and preferably to fully apply the relevant AML/CFT regulations. This is also dictated by the very high risk of using crypto-assets for money laundering and terrorism financing.

In the light of OECD recommendations, the implementation of the KYC procedure for buyers and holders of tokens is also necessary due to the provisions of tax law. In general, as noted in Section 5.4, tax law is a significant barrier to the use and development of DLT technology, including when it is used to finance long-term and capital-intensive investments. The research identified a number of such barriers, especially when such an investment is of a cross-border nature. This refers to the lack of legal regulations dedicated directly to the rules of taxation of crypto-assets. For example, on the basis of European Union law, the principles of VAT taxation of trading in crypto-assets have not been regulated to date. In judicial practice, there have been only attempts to determine the legal status of token transactions under the current legal framework. Moreover, there are basically no legal and tax solutions dedicated to long-term and capital-intensive investments, in particular those based on DLT. It should be noted that the tax regulation regarding the use of blockchain technology, especially the use of crypto-assets, has developed significantly in recent years; therefore, the legal risk in this area has significantly decreased and will continue to do so in the coming years. This applies mainly to income taxes, and to a lesser extent to VAT.

Some legal barriers and challenges related to capital-intensive and long-term investments using DLT technology may have their own specificity. This applies not only to the already mentioned AML/CFT regulations, but also to, for example, regulations on the protection of personal data (here mainly the EU's GDPR). Other barriers and legal challenges result from the distinctive features of such investments, such as antitrust regulations.

Due to the scale and social importance of capital-intensive and long-term investments, they must be consistent with the goals of sustainable development. If DLT technology is chosen to finance such an investment, it is best to base the solution on a network in which a consensus mechanism is used, which consumes as little electricity and hardware resources as possible and thus does not contribute to carbon dioxide emissions, which in turn translates into mitigating climate change. Deployment of the traditional proof-of-work mechanism is certainly out of the question.

The main objective of the monograph – finding a systemic solution that uses the potential of blockchain technology enabling the financing of large, capital-intensive investment projects – has been implemented in Chapter 7. It was crucial to propose an approach that would potentially integrate functionalities in several areas: formal and legal, systemic and organizational, economic and financial, as well as technical.

Looking for a solution to the problems found in the previously identified mechanisms of organization and financing of capital-intensive investments, and wanting to take advantage of the effectiveness of blockchain technology, the authors identified several general criteria that such a solution should meet, and several assumptions were made in line with the conclusions from previous chapters. On this basis, the conceptual framework of the model is presented in Section 7.1. The most important features of the model include:

- a specialized entity – the initiator – begins the process of developing the project, brings it to the point of raising equity capital and withdraws from the project, receiving remuneration and/or retaining some right to future profits or production;
- the project is aimed at a community of potential clients who are to be the main investors;
- despite the need to use additional sources of financing, the project is available to a large number of small investors, who control the project;
- investors, using the potential of technology and having a common vital interest to monitor the implementation of the project on an ongoing basis and have the opportunity to influence its shape, become members of the DAO and can vote on project-related matters;
- due to the currently widespread non-regulation of DAOs, it remains a virtual informal organization, operational management of the project remains centralized and the implementing entity is a traditional capital company, while additional supervision and the capacity of the DAO's members to influence the project is carried out under additional agreements;
- several types of tokens are to be used, including management (or integrated management and share) tokens giving rights to profits and active control of the project, product (utility) tokens giving rights to future products, and payment tokens.

Next, the authors identified sources of effectiveness of the proposed solution:

- investor-clients receive at least two streams of benefits: profit sharing and consumer benefits (access to the product, free products or products at a discount);
- thanks to systemic efficiencies, the project can generate lower risks and a lower cost of capital;
- the possibility of trading and the use of automatic market makers allows the introduction of the option of token liquidation, even in a relatively illiquid market;

- the inefficiencies of a monopoly are potentially limited;
- the so-called wisdom of the crowd is utilized in project supervision;
- the social (community) nature of the project generates fewer requirements for full planning of the entire project, and allows for more flexible forms of management and spreading the financing process over time, which is less burdensome for investor-clients;
- adaptation of the project to legally permissible possibilities, thus reducing the legal risks of the project, which is constructed solely on the basis of business potential;
- reducing transaction costs and eliminating intermediaries in business and potentially legal processes, utilizing process automation based on blockchain technology.

It has also been emphasized that the proposed model will be more effective for certain types of investment projects, and that the model is scalable, i.e., it can be applied not only to mega-investments, but also to investments on a smaller scale.

Acknowledgement

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