Dominik Mateusz Mizerski
University of Silesia, Poland
dominik.mizerski@us.edu.pl
ORCID ID: https://orcid.org/0000-0002-8253-5o38

Piotr Pinior
University of Silesia, Poland
piotr.pinior@us.edu.pl
ORCID ID: https://orcid.org/0000-0003-2084-0325

Dušan Rostáš
Pavol Jozef Šafárik University in Košice, Slovakia
dusan.rostas@upjs.sk
ORCID ID: https://orcid.org/0000-0003-1973-9203

The Admissibility of Blockchain-Based Solutions for Share Trading and Maintaining Shareholders' Register in the Context of the Dematerialisation of Shares[1]

Abstract: The mandatory dematerialisation of shares, which involves converting physical share certificates to electronic records, has unified the trading framework for registered and bearer shares. This paper examines the impact of mandatory dematerialisation on the regulations governing the trading and registration of shares in non-listed joint-stock companies, where shares are registered in the shareholders' register. The analysis is conducted in the context of modern technologies, such as smart contracts, distributed ledger technology and tokenisation, and their role in these processes. The authors refer to the possibility of concluding a share transfer agreement using smart contract technology and argue that, although maintaining a shareholders' register in the form of a distributed and decentralised database

---

is permitted, the provisions currently in force do not allow or fully enable the exploitation of the benefits available through blockchain technology, particularly the tokenisation of shares.

Keywords: shares, dematerialisation, shareholders' register, blockchain, smart contracts, tokenisation

Introduction

The mandatory dematerialisation of shares in joint-stock companies entered into force in Polish law on 1 March 2021 as a result of the Act Amending the Commercial Companies Code and Certain Other Acts of 30 August 2019 (Dematerialised Shares Act). As a result, neither registered nor bearer shares are in physical form, and the regulations on transferring all classes of shares have been unified.[2] All shares, which were securities incorporated in physical documents, have been replaced by demateralised shares subject to registration either in the shareholders' register (Article 328(1) Commercial Companies Code (CCC)) or in the National Securities Depository (Article 328(11) CCC); it is not possible to register shares in both (Article 328(12) CCC).

The mandatory dematerialisation of shares led to significant changes in the regulations governing the trading and registering of shares in non-listed limited joint-stock companies. The legislature's declared aims included enhancing market transparency, investor security and trading efficiency (Sejm of Poland, 2019). However, a closer analysis suggests that the amendment, though technically a modernisation, only partially addresses the practical and normative conditions necessary for integrating innovative technologies into the legal framework governing the trading and registration of shares of non-listed joint-stock companies. In particular, the reform appears to have been driven more by the need to identify the owners of bearer shares than by a genuine intention to embrace transformative technological developments, such as blockchain-based systems. As a result, the dematerialisation process, while symbolically aligned with digitisation efforts, falls short of creating a legal environment conducive to the adoption of more advanced technological solutions, including the tokenisation of shares.

The purpose of this paper is to present the impact of the mandatory dematerialisation on the rules for the trading and registration of shares in non-listed joint-stock companies whose shares are registered in the company's shareholders' register, in light of the use of modern technology in these processes. First, the article demonstrates that the dematerialisation of shares has introduced a new manner of transferring shares, resulting in a significant alteration in the share-trading regime. Second, it argues that, despite its formal openness, the provisions of Polish law cur-

---

2   The provisions on shares in joint-stock companies also applies to limited joint-stock partnerships (Article 126 § 1 point 2 CCC). The provisions on shares apply accordingly to subscription warrants, utility certificates, promoters' certificates and other titles to participate in the income or distribution of a company's assets (Article 328 § 2 CCC).

rently in force actually impose significant limitations on the effective use of modern, blockchain-based technologies in the trading and registration of shares in non-listed joint-stock companies. These limitations arise not only from the rigidity of regulatory requirements, but also from the functional design of the shareholders' register. In this respect, we focus strictly on the admissibility of using smart contracts as the basis of transferring shares, maintaining shareholders' registers as a diffused and decentralised database, along with the tokenisation of shares. Despite the introduction of profound changes in the form of shares and trading of shares in light of the mandatory dematerialisation, the Polish legislature has failed to take full advantage of the opportunities offered by blockchain-based technologies to apply their functionality when transferring and registering shares in shareholders' registers.

The analysis is based primarily on a legal-dogmatic approach. In addition, selective references to foreign literature and European legislation highlight both the shortcomings and the potential of the Polish system with regard to the possibility of using blockchain-based solutions in share trading and share registration.

1. The transfer of shares or the establishment of limited rights in rem in light of mandatory dematerialisation

The dematerialisation of shares under the Dematerialised Shares Act unified the legal rules governing the transfer of both registered and bearer shares in non-listed joint-stock companies, leading to it being regulated autonomously by the provisions of the Commercial Companies Code. New provisions replaced the previous regime for the transfer of shares, which were essentially based on the Civil Code (CC). The dematerialisation of shares has resulted in the moment of the transferral of shares being linked with an entry in the shareholders' register. A share transfer becomes effective upon entry in the register, which is, in principle, constitutive (Article 328(9) § 1 CCC).[3] Consequently, the dispositive effect is excluded when concluding a contract obliging the parties to transfer shares, and the intention of the parties to create a dispositive effect is reflected in the request for entry into the register (Popiołek, 2024, p. 875). Only the entity entered into the register is legally recognised as a shareholder, and this also applies to the establishment of limited rights *in rem*. The entity operating the register makes entries at the request of the company or of an interested party, based on documents justifying the entry or a shareholder's statement on the

---

3 The constitutive nature of an entry in the shareholders' register does not apply to the subscription of shares (except as provided for in Article 452 § 1 CCC) or the transfer of shares by way of inheritance, legacy, contribution in kind to the company, merger, division or transformation of the company, or any other legal event whereby a share or a limited right *in rem* relating to it is transferred by operation of law to another entity.

obligation to transfer shares or to encumber shares with limited rights *in rem* (Article 328(4) § 4 CCC).

The provisions of the Dematerialised Shares Act do not define the form of the agreement on the transfer of shares, leaving this choice to the parties. While the format of this agreement is not defined by law, it is indicated in the literature that it must at least be in documentary form (Pabis, 2022, p. 1702; Popiołek, 2024, p. 876), though an entry in the register may also be made on the basis of the shareholder's declaration of an obligation to transfer the shares. Hence the form of the agreement or the shareholder's obligation is discretionary and minor regarding constitutive entry in the shareholders' register.

In some cases, such as the creation of a pledge on shares, specific forms, such as a written form with a certified date or entry in a separate register, are required due to *lex specialis* rules (Article 329 § 1 CC). In particular, registered pledges must be in a specific form under the provisions of the Act on Registered Pledges and the Pledge Register, which requires a pledge contract to be concluded in writing and then entered in the pledge register. We support the view that an entry in the pledge register is constitutive, because the act of the Act on Registered Pledges and the Pledge Register is a *lex specialis* towards the provisions of the Commercial Companies Code (Mizerski, 2022, p. 50; Sobociński, 2022, p. 36; for a contrary view, see Popiołek, 2020, p. 7).

Importantly, the entity maintaining the shareholders' register is only required to assess the formal correctness of the submitted documents but is not obliged to verify their legality or authenticity, unless there are justified doubts (Article 328(4) § 5 CCC). The assessment of whether the doubts are justified is the responsibility of the entity maintaining the register, which must exercise due diligence when considering applications to make entries. In the event of any doubts, it should take appropriate action, in particular to obtain the statements of interested parties (Popiołek, 2024, p. 868; Sójka, 2021, p. 31). Consequently, it should be emphasised that if the entity maintaining the shareholders' register fails to perform its duties properly, it may become liable for damage inflicted to the company or to anyone with a legal interest.

In this respect, the situation where a purchaser, acting in good faith, buys shares from an unauthorised entity has become rather controversial. Some representatives of the doctrine grant protection to the purchaser in good faith under Article 169 § 1 CC, due to the entry in the shareholders' register (Opalski, 2019, p. 6; Sójka, 2020, p. 9), even though protection under this article refers to a purchaser of property rights incorporated in bearer documents. This is the reason why opponents of this view argue that attempts to extend the protection under Article 169 §1 CC to dematerialised shares are unjustified (Dybiński & Weber, 2022, p. 229; Popiołek, 2024, p. 876). In our opinion, protection under Article 169 § 1 CC does not apply to dematerialised shares because the transfer of rights attached to bearer shares in documentary form cannot be equated with an entry in a shareholders' register. Consequently, in the case of purchasing dematerialised shares from an unauthorised seller, the purchaser does not

become a shareholder due to the lack of legal legitimacy. Regardless of the interpretative doubts, the provisions of the Commercial Companies Code do not resolve the issue of unlawful entries in a shareholders' register, so only legislative initiatives to provide for a proper protection system can be a remedy for such entries.

2. Smart contracts on the transfer of shares

The lack of specified forms of contract for the disposal of shares opens up the possibility of using modern technologies, particularly the institution of 'smart contracts'. These are defined as contractual provisions written in the form of a self-executing algorithm, a cryptographically secured computer code (Szabo, 1997); another definition describes them as agreements whose execution is automated (Raskin, 2017, p. 309). A common feature of all these definitions is the possibility of using blockchain technology to conclude these contracts (Maxwell et al., 2017, pp. 79-97). Since the terms and conditions are recorded in the blockchain and cannot be amended, any uncertainty surrounding the possibility that one party might wish to renegotiate the contract is removed (Van der Elst & Lafarre, 2018, p. 5).

Under civil law, smart contracts should not be qualified as a separate type of contract; they are simply a means of concluding and (self-)executing a contract, provided this aligns with the intended purpose and the specific content of the computer program (code) (Pecyna & Behan, 2020, p. 207; Verstappen, 2023, p. 85; Załucki, 2024, p. 25). Furthermore, smart contract technology can also be used as an enrolment tool to reflect a previous contract concluded in the traditional manner (Mmereole, 2023, p. 31; Szostek, 2018, p. 121). From this perspective, the smart contract functions as a letter of confirmation.

To support the view that a smart contract is a means of concluding and executing an agreement, it is useful to consider whether contracts employing such technology may be used for the transfer of shares. The blockchain is divided into blocks that store transaction data, and these blocks are linked to each other by the cryptographic hash of the preceding block being placed in each block (except for the block that starts the blockchain, which is called the genesis). Like a file system, the blockchain has an internal structure in which the data is stored. The smallest identifiable element of this structure is a single transaction, which at the same time is the most appropriate element for consideration as a document (Szczerbowski, 2018, p. 5).

In view of this, it should be stated that an agreement concluded using smart contract technology meets the requirement of a declaration of intent being recorded as a document within the meaning of Article 77(3) CC. The requirement to identify the entity making the declaration is also met, as when an agreement is concluded via intelligent software, an individual transaction is always identified by the user's account name and digitally signed by the user. Furthermore, agreements concluded

as smart contracts always arise as a result of human intention, and it is irrelevant whether the program expressed that intention (Mmereole, 2023, p. 31). In addition, within the smart contract framework the condition on which the performance of the contract depends should be qualified as a condition under civil law (Gołaczyński, 2024). As indicated in the literature, the construction of the smart contract is consistent with the general rules of civil law, with agreements concluded as smart contracts able to meet the requirements for documentary form as set out in the Civil Code (Hadrowicz, 2020, p. 38).

With this in mind, we argue that, in the absence of specific form requirements for share transfer agreements under the Commercial Companies Code, the conclusion of such an agreement using smart contract technology can be considered as a document justifying the entry of the share transfer into the shareholders' register in the meaning of Article 328(4) § 4 CCC. The same applies to a usufruct contract. By contrast, a pledge or registered pledge agreement cannot be concluded using smart contracts under the requirements on the contract form (as explained above).

The conclusion of an agreement using smart contract technology does not exempt an entity maintaining a shareholders' register from the obligation to examine the legality and veracity of the documents justifying the entry, if any justified doubts arise in this regard (Article 328(4) CCC). The literature rightly emphasises that this examination concerns in particular the analysis of circumstances outside the computer program governing the process of concluding contracts, such as defects in the declaration of the will of the parties to the agreement or limitations on the legal capacity of those parties (Sójka, 2021, p. 30). Furthermore, it seems that the entity maintaining the shareholders' register cannot refuse to consider an application for registration solely on the grounds that it is based on an agreement concluded using smart contract technology. In particular, a refusal to recognise such an agreement as a ground for registration cannot be justified by the fact that the entity maintaining the register does not have the technical ability to verify the agreement. An exception to this principle concerns a situation where an agreement with an entity maintaining a shareholders' register, or the bylaws of such an entity, provides for restrictions on the form of the agreement that may be the basis for making an entry into the register.

The issue of smart contracts can be studied from a perspective broader than the system of self-executing contracts. Once the assumption that smart contracts constitute computer programs is accepted (Szabo, 1997), their potential application becomes inherently tied to the regulation of the underlying technology, which enables not only their formation but also their execution. From both a technical and a legal standpoint, it is not merely the conclusion of an agreement that is of importance, but also the performance of the obligations it entails, which is essential to ensuring fulfilment. Therefore the development of legal regulations on smart contracts can, in essence, be a regulation of a wider ecosystem that enables their use and execution, which means the regulation of technology.

3. Shareholders' registers in the form of diffused and decentralised databases

The primary function of a shareholders' register is to identify entities entitled to shares, as it contains information on shares issued by a company as well as its shareholders (Article 328(3) CCC). The shareholders' register can only be maintained by entities authorised to keep securities accounts under the provisions of the Act on Trading in Financial Instruments. The entity operating the register performs three functions simultaneously: first, it is the custodian that registers a series of shares in the name of the issuer and monitors the conformity of the number of shares in circulation with the size of the issue; second, it keeps an account of dematerialised shares in the name of each entitled shareholder; and third, it is the settlement entity recording changes in the shareholdings of each entitled shareholder (Sójka, 2021, p. 28).

In principle, the Polish legislature has maintained technological neutrality regarding the rules governing the maintenance of a shareholders' register. The organisation of the register depends mainly on the technical possibilities of the entity maintaining it. The legislature merely requires that the shareholders' register be kept in electronic form, which may be a diffused and decentralised database (Article 328(1) § 3 CCC). Regardless of the form of the register, the entity operating the register must keep it in a manner that ensures the security and integrity of the data contained therein (Article 328(1) § 4 CCC), in particular shareholders' personal data.

Under the current legislation, shareholders' registers can be kept using distributed ledger technology (DLT), in particular a database based on blockchain technology (Bronowska & Matraszek, 2020, p. 23; Dybiński & Weber, 2022, p. 214; Sejm of Poland, 2019; conversely, Michalski, 2021, pp. 241–242, who highlights limitations on the use of blockchain technology in keeping shareholders' registers). The data of the transactions in a block are stored using 'Merkle trees', which are constructed bottom-up. Here, one can find individual transactions (i.e. the underlying data) and their hashes. New hashes are constructed from pairs of such hashes, and the action is repeated until there is only one hash left. The single hash situated at the top of the Merkle tree is also called the Merkle root. Since changing any transaction (including the order) will change the Merkle root, the transaction data can be verified and validated (making it immutable) (Van der Elst & Lafarre, 2019, p. 126). The use of blockchain technology brings several benefits, including reduced costs, simple access and the security of the stored data. However, there are risks associated with these benefits, including the threat of data being tampered with before it is stored, operational risks (including improper or incorrect coding) and risks from increased levels of transparency (Andhov, 2019, pp. 14–16; Panisi et al., 2019, p. 216).

Blockchains can be public (permissionless) or private (permissioned) (Armstrong et al., 2019, p. 12; Szostek, 2018, pp. 49–50; Van der Elst & Lafarre, 2019, p. 126). Anyone on the internet can access a public blockchain without permission;

therefore anyone can become a user, receive a copy of the ledger and can propose and validate new blocks. In the absence of an intermediary, the validation of a transaction relies on a consensus being reached between all the parties or nodes. Conversely, private blockchains require permission from administrators for any of the above (Stocker, 2023, p. 452). Both blockchain systems are decentralised, with each participant in the blockchain keeping a replica of the ledger. These replicas are synchronised via a consensus mechanism, like the proof-of-work concept (Governatori et al., 2018, p. 386).

Using DLT is prima facie appropriable for a shareholders' register, since blockchain can be described as an open, distributed ledger that can record transactions between (unknown) parties in a verifiable and immutable way (Iansiti & Lakhani, 2017). However, with regard to the use of such technology for the operation of a shareholders' register, the Justification to the Dematerialised Shares Act (Sejm of Poland, 2019) directly indicates the possibility of using blockchain technology in operating the register but is devoid of further reflection. It must be emphasised that the use of blockchain technology would have to involve an entity that approves individual transactions or the blockchain of such transactions, making entries of them in the register (Dąbrowska, 2022, pp. 24–25; Sójka, 2021, pp. 29–30). Thus, in our view, it opens up the possibility of the register being based solely on a private blockchain, with the assigned tasks of the entity being maintaining the register (as a trusted third party), approving individual transactions and entering them into the register. Third parties would be excluded from the private blockchain, because shareholders and the company would have exclusive access to the register (Article 328(5) CCC). For this reason, the use of blockchain technology and the benefits associated with its use are currently significantly limited, due to the fact that the current legal framework does not fully embrace the potential of blockchain, meaning that it remains a theoretical option rather than a practical solution.

4. The tokenisation of shares at the dawn of the European Union legislation and in light of mandatory dematerialisation under Polish law

The question of the possible tokenisation of shares is essentially one of transforming traditional securities into a digital representation (Jiménez-Gómez, 2023, p. 671). Tokenisation has emerged as a corollary of blockchain development; it is the phenomenon of using DLT to reflect the economic value itself in the form of a token, or to reflect a given existing good in the form of a token indicating the rights and obligations associated with that good (secondary tokenisation), or to create tokens that are inextricably linked to a newly created good (primary tokenisation) (Langer & Pinior, 2023, p. 11). Tokens represent a particular asset or utility that usually re-

sides on top of another blockchain, and can represent any fungible and tradeable asset, from commodities to loyalty points and even cryptocurrencies (Obrist & Pfister, 2019, p. 305).

One of the most important legal acts defining the principles of using DLT, including the consequences of the possibility of tokenising shares, is Regulation (EU) 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 (the DLT Regulation). This legal act has been effective since 23 March 2023 and is called a 'pilot regime'; it creates a regulatory landscape where existing market infrastructure operators can deploy and test new DLTs. This 'sandbox' is not primarily intended for new market entrants but rather for existing operators on the market (Priam, 2022, p. 379), with the aim of assessing the potential of new technologies. It is emphasised in the literature that the pilot regime of the DLT Regulation should be seen only as a temporary legal regulation of technology to make it possible to test DLT (Hrabčák & Štrkolec, 2024, p. 33).

The idea of the DLT pilot regime is to temporarily relieve the sandbox participants from obligations that might otherwise prevent them from developing DLT solutions for trading and settling transactions in cryptoassets that qualify as financial instruments (Recital 6 of the DLT Regulation). Exemptions are not generally permitted for the participants. The sandbox regulation only entitles already-licensed market infrastructure operators to request an individual exemption from certain obligations from the competition authority under their default regulation regime (i.e. 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 (MIFID II), or Regulation (EU) no. 909/2014 of the European Parliament and of the Council of 23 July 2014 on Improving Securities Settlement in the European Union and on Central Securities Depositories and Amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) no. 236/2012). The pilot regime is also accompanied by several restrictions regarding the nature of financial instruments and the market capitalisation of the issuer (Article 3 of the DLT Regulation). Exemptions can be granted only on an individual basis.

The DLT sandbox distinguishes between several types of market infrastructure, namely DLT multilateral trading facilities (MTF) and the DLT trade and settlement system (TSS), which can be operated by investment firms or a market operator under MIFID II, and the DLT transaction settlement system (SS), operated by a central securities depository under Regulation (EU) no. 909/2014. A significant advantage of DLT is that it is capable of combining a multilateral trading system and a settlement system into one, in a new TSS system (Priam, 2022, p. 377).

The possibilities of taking advantage of the tokenisation of shares are very limited in the case of non-listed companies. The DLT Regulation does not govern this

issue explicitly either: it offers a list of various exemptions, one of which is an exemption from the obligation to comply with the 'book-entry form' of shares (Article 5(2)(a)). This exemption could also be applied to the DLT SS, which can be operated by a central securities depository. Considering the scope of Regulation (EU) no. 909/2014 (which affects shares in non-listed companies) and Article 7(9) of the DLT Regulation (which applies to a central securities depository that only operates the settlement systems infrastructure), it seems that exemptions under the DLT pilot regime could also be awarded for settling transactions of shares in non-listed companies. The question arises whether it would be possible, under the DLT pilot regime (in the case of a granted exemption), to permit shareholders to self-execute transfers of tokenised shares in non-listed companies via DLT.

Under the rules for the DLT MTF infrastructure, it is clearly stated that this infrastructure can also be open for natural and legal persons (Article 4(2) of the DLT Regulation). For the DLT SS, at the request of a depository, the relevant authority can also admit as participants entities that would not be considered participants in the meaning of Directive 98/26/EC on Settlement Finality in Payment and Securities Settlement Systems (Article 5(5) of the DLT Regulation). This means that the DLT SS system can potentially also be open to third parties. Unlike the exemption for the DLT MTF, the wording of the DLT SS exemption does not distinguish between natural and legal persons. Given that an operator requesting exemptions must demonstrate that an exemption is justified and proportionate (Recital 37 of the DLT Regulation), and given the duty of the relevant authority to consider investor protection, market integrity and financial stability (Recital 17), it is not clear whether such an exemption should also be awarded for natural and legal persons acting as shareholders. The final answer depends on the relevant authority, an individual assessment of the particular market infrastructure and the limits of technology. Theoretically, the transfer of tokenised shares in a non-listed company can be exempted under the DLT Regulation.

The EU legislature is expected to take a legislative initiative on the use of DLT to maintain shareholders' registers. This seems all the more likely given that it has already acted to establish a legal framework for the use of blockchain technology under the DLT Regulation (Hrabčák & Štrkolec, 2024, p. 31). The current DLT sandbox is likely to be in force until at least 24 March 2026. After that date, the Commission is set to submit a report on the pilot regime, setting out cost–benefit analyses to the European Parliament and Council for further action.

From the perspective of the Polish legislation resulting from the mandatory dematerialisation of shares, the tokenisation of shares in joint-stock companies only partially meets the conditions for share tokenisation in the form of maintaining a distributed shareholders' register when such a register is in the form of a private blockchain. However, due to the closed nature of the access to such a register, which prevents access to third parties (i.e. anyone other than the company, the shareholders and the entity maintaining the register), there is no justification and few practical im-

plications for the tokenisation of shares in non-listed joint-stock companies (see also Dąbrowska, 2022, p. 23; Pinior & Langer, 2024, p. 5). Consequently, the admissibility of the tokenisation of shares requires further legislative initiative by the Polish legislature, for which the provision of the DLT pilot regime might be a significant complementary contribution.

Conclusions

The Dematerialised Shares Act unified the rules governing the transfer of shares in non-listed joint-stock companies. The amendment introduced significant alterations, notably removing the requirement of a specified form for a share transfer agreement, excluding the dispositive effect in agreements obliging the transfer of shares, and linking the transfer of shares with a constitutive entry in the shareholders' register. The dematerialisation of shares also prompted a reassessment of previous views in the doctrine concerning the traditional meaning of securities in the form of physical certificates. As explained above, the issue of unlawful entries in shareholders' registers requires further legislative steps.

At the same time, blockchain-based technology will almost certainly play a pivotal role in share trading. At present, however, this role seems to be quite limited in the Polish legal system. Under the provisions of the Commercial Companies Code, there are no requirements for the form of a share transfer agreement, so the conclusion of such an agreement using smart contract technology can be considered as a document justifying the entry of the share transfer into the shareholders' register. Consequently, as presented in the paper, the legislature's application of technological neutrality enables the use of modern technologies. In particular, it is admissible to use blockchain technology to maintain a shareholders' register; however, as outlined above, it would be based solely on a private blockchain, which limits the potential use of this technology.

Furthermore, the provisions introduced by the Dematerialised Shares Act do not provide sufficient basis under national law to permit the tokenisation of shares in non-listed joint-stock companies. Allowing this possibility would require a profound overhaul of the chief elements of a joint-stock company, particularly the possibility of maintaining a shareholders' register as a public (permissionless) blockchain. Given the importance of the issue and the significant harmonisation of securities trading in EU Member States, it would be advisable to regulate this issue at the European level. Overall, it seems that the application of DLT, particularly blockchain technology, in keeping a shareholders' register may require legislative intervention to regulate the technologies that may be used.

REFERENCES

Andhov, A. (2019). Corporations on blockchain: Opportunities and challenges. *Cornell International Law Journal*, *53*, 1–40.

Armstrong, K. C. D., Hyde, D., & Thomas, S. (2019). *Blockchain and cryptocurrency: International legal and regulatory challenges*. Bloomsbury.

Bronowska, M., & Matraszek. J. (2020). Blockchain a rejestr akcjonariuszy. *Przegląd Prawa Handlowego*, *4*, 23–29.

Dąbrowska, J. (2022). Cyfrowa rewolucja. Rozważania o ucyfrowieniu spółki akcyjnej w świetle koncepcji organizacji biurokratycznej Maxa Webera i założeń ekonomii instytucjonalnej. In A. Kidyba & A. Olejniczak (Eds.), *Nowoczesne technologie. Szansa czy zagrożenie dla funkcjonowania przedsiębiorców w obrocie prawnym i postępowaniach sądowych* (pp. 13–36). Wolters Kluwer Polska.

Dybiński, J., & Weber A.-M. (2022). Mandatory dematerialization of shares in Polish private companies: A missed opportunity to do things right. *European Company and Financial Law Review*, *19*(2), 203–238.

European Parliament. (1988, 19 May). Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on Settlement Finality in Payment and Securities Settlement Systems (O. J. L 166, 11.06.1998).

European Parliament. (2014, 15 May). 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 (O. J. L 173, 12.06.2014).

European Parliament. (2014, 23 July). Regulation (EU) no. 909/2014 of the European Parliament and of the Council of 23 July 2014 on Improving Securities Settlement in the European Union and on Central Securities Depositories and Amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) no. 236/2012 (O. J. L 257, 28.08.2014).

European Parliament. (2018, 30 May). Regulation (EU) 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 (O. J. L 151, 02.06.2022).

Gołaczyński, J. (2024). Pojęcie i rodzaje umów elektronicznych. In J. Gołaczyński (Ed.), *Prawo umów elektronicznych. Zarys systemu* (pp. 1–70). Wolters Kluwer.

Governatori, G., Idelberger, F., Milosevic, Z., Riveret, R., Sartor, G., & Xu, X. (2018). On legal contracts, imperative and declarative smart contracts, and blockchain systems. *Artificial Intelligence and Law*, *26*(4), 377–409.

Hadrowicz, S. (2020). Smart kontrakt jako umowa. *Międzynarodowe Prawo Handlowe*, *4*, 32–42.

Hrabčák, L., & Štrkolec, M. (2024). EU regulation of the crypto-assets market. *Białostockie Studia Prawnicze*, *29*(1), 27–42.

Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review*, *95*(1), 118–127.

Jiménez-Gómez, B. S. (2023). Distributed ledger technology in financial markets: The European Union experiment. *Cuadernos de Derecho Transnacional*, *15*(2), 665–678.

Langer, M., & Pinior, P. (2023). Tokenizacja praw udziałowych w spółkach osobowych. *Przegląd Ustawodawstwa Gospodarczego*, *10*, 9–17.

Maxwell, D., Speed, C., & Pschetz, L. (2017). Story blocks: Reimagining narrative through the blockchain. *Convergence: The International Journal of Research into New Media Technologies*, *23*(1), 79–97.

Michalski, M. (2021). Dematerializacja akcji a realizacja uprawnień akcyjnych przez akcjonariuszy. In M. Michalski (Ed.), *Powszechna dematerializacja akcji. Modernizacja konstrukcji spółki akcyjnej* (pp. 231–271). Wolters Kluwer Polska.

Mizerski, D. (2022). Ustanowienie zastawu zwykłego oraz rejestrowego na akcjach w świetle przepisów o przymusowej dematerializacji. *Przegląd Ustawodawstwa Gospodarczego*, *10*, 46–51.

Mmereole, J. (2023). Zawarcie umowy przez inteligentne oprogramowanie – smart kontrakty. *Prawo Nowoczesnych Technologii*, *1*, 30–35.

Obrist, T., & Pfister, R. A. (2019). Tax treatment of cryptocurrency holders and miners in the era of virtual currencies from a multijurisdictional and Swiss perspective. In D. Kraus, T. Obrist, & O. Hari (Eds.), *Blockchains, smart contracts, decentralised autonomous organisations and the law* (pp. 299–348). Edward Elgar.

Opalski, A. (2019). Prosta spółka akcyjna – nowy typ spółki handlowej (część I). *Przegląd Prawa Handlowego*, *11*, 5–15.

Pabis, R. (2022). Commentary to Article 328(4). In Z. Jara (Ed.), *Kodeks spółek handlowych. Komentarz* (pp. 1680–1750). C. H. Beck.

Panisi, F., Buckley, R. P., & Arner, D. (2019). Blockchain and public companies: A revolution in share ownership transparency, proxy-voting and corporate governance? *Stanford Journal of Blockchain Law & Policy*, *2*(2), 1–32.

Pecyna, M., & Behan, A. (2020). Smart contracts – Nowa technologia prawa umów? *Transformacje Prawa Prywatnego*, *3*, 187–216.

Pinior, P., & Langer, M. (2024). Tokenizacja akcji i innych praw udziałowych w spółkach kapitałowych. *Przegląd Ustawodawstwa Gospodarczego*, *10*, 2–9.

Popiołek, W. (2020). Rozporządzanie akcjami rejestrowymi spółek niepublicznych. *Przegląd Ustawodawstwa Gospodarczego*, *5*, 2–13.

Popiołek, W. (2024). Commentary to Article 328(4). In P. Pinior and J. A. Strzępka (Eds.), *Kodeks spółek handlowych. Komentarz* (pp. 867–869). C. H. Beck.

Priam, R. (2022). A European distributed ledger technology pilot regime for market infrastructures: Finding a balance between innovation, investor protection and financial stability. *Journal of Financial Regulation and Compliance*, *30*(3), 371–390.

Raskin, M. (2017). The law and legality of smart contracts. *Georgetown Law Technology Review*, *1*(2), 305–341.

Sejm of Poland. (1966). Civil Code of 23 April 1964 (consolidated text, Journal of Laws of 2024, item 1061, as amended).

Sejm of Poland. (1996). Act on Registered Pledges and Register of Pledges of 6 December 1996 (consolidated text, Journal of Laws of 2018, item 2017, as amended).

Sejm of Poland. (2000). Commercial Companies Code of 15 September 2000 (consolidated text, Journal of Laws of 2024, item 18, as amended).

Sejm of Poland. (2005). Act on Trading in Financial Instruments of 29 July 2005 (consolidated text, Journal of Laws of 2024, item 722, as amended).

Sejm of Poland. (2019). Act Amending the Commercial Companies Code Act and Certain Other Acts of 30 August 2019 (consolidated text, Journal of Laws of 2019, item 1798, as amended).

Sejm of Poland, 2019. (2019). Justification of the government's draft act amending the Commercial Companies Code and certain other acts, print no. 3541. Retrieved 18 November 2024, from URL: https://orka.sejm.gov.pl/Druki8ka.nsf/0/38BFA72164FE8069C125841D00436FE7/%-24File/3541.pdf

Sobociński, F. (2022). Zastaw rejestrowy na akcjach spółki niepublicznej – problem konfliktu wpisów konstytutywnych. *Przegląd Prawa Handlowego*, *8*, 30–36.

Sójka, T. (2020). Obrót akcjami prostej spółki akcyjnej. *Przegląd Prawa Handlowego*, *1*, 5–11.

Sójka, T. (2021). Rejestr akcjonariuszy w postaci rozproszonej i zdecentralizowanej bazy danych. *Przegląd Ustawodawstwa Gospodarczego*, *4*, 26–33.

Stocker, P. (2023). The potential of blockchain technology for share transfers in nonlisted companies in Switzerland and the United Kingdom. *European Business Organization Law Review*, *24*, 439–470.

Szabo. N. (1997). Formalizing and securing relationships on public networks. *First Monday*, *2*(9).

Szczerbowski, J. J. (2018). Sprytne kontrakty a prawo umów – wprowadzenie. *Edukacja Prawnicza*, *2*, 5–9.

Szostek, D. (2018). *Blockchain a prawo*, C. H. Beck.

Van der Elst, C., & Lafarre, A. (2018). *Blockchain technology for corporate governance and shareholder activism* [Law working paper 390]. European Corporate Government Institute.

Van der Elst, C., & Lafarre, A. (2019). Blockchain and smart contracting for the shareholder community. *European Business Organization Law Review*, *20*, 111–137.

Verstappen, J. (2023). *Legal agreements on smart contract platforms in European systems of private law*. Springer.

Załucki, M. (2024). Technologia blockchain i smart contracts a perspektywa prawa prywatnego międzynarodowego jako wyzwanie dla ustawodawcy. *Przegląd Prawa Publicznego*, *11*, 20–37.