

Radoslaw Ignatowicz



Alfred Taudes

Custody, Global Investor Services, Raiffeisen Bank International AG, Am Stadtpark 9, 1030 Vienna, Austria Tel: +43 171707 5620; E-mail: radoslaw.ignatowicz@ rbinternational.com

WU (Vienna University of Economics and Business), Department of Information Systems and Operations Management, Institute for Production Management, Building D2, Entrance C, 3rd Floor, Welthandelsplatz 1, 1020 Vienna, Austria Tel: +43-1-31336/5611; E-mail: alfred.taudes@ wu.ac.at

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Opportunities in digital assets and digital custody: Tracking the modernisation of standard custody offering

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Radoslaw Ignatowicz

Senior Director, Product Owner — Custody, Global Investor Services, Raiffeisen Bank International, Austria

Alfred Taudes

Professor, Wirtschaftsuniversität Wein (Vienna University of Economics and Business), Department of Information Systems and Operations Management, Austria

Radoslaw Ignatowicz was born in Warsaw, Poland, graduated in finance and banking at the High School of Economics in Warsaw and the EMBA programme of the Warsaw Institute of Technology, London School of Economics, HEC and University of Bergen. Radoslaw (Radek) Ignatowicz is a senior director and product owner of Custody in Raiffeisen Bank International Global Investor Services Division in Vienna, where he looks after custody product development, participating in digital assets and digital custody strategy design. He has over 30 years of experience in the custody business. Starting his professional career in the securities services industry soon after the recreation of the Polish capital market in the 1990s, he became a head of custody for leading custody providers in Poland, such as Bank Pekao, Bank Austria, Unicredit, Deutsche Bank and Raiffeisen Bank International. He also worked as a board member of the Polish Central Depository for Securities (KDPW), where he represented the institution in EACH, CCP12 and ECSDA working groups. For eight years he led the Polish Custodian Bank Council, participating in shaping the framework of the Polish capital market. He is actively engaged in creating and implementing the direct access model of Raiffeisen Bank International AG in the Central and Eastern European markets.

Alfred Taudes was born in Vienna, graduated in business administration and MIS at the Vienna

University of Economics and Business Administration (WU) and Vienna University, a professor in Augsburg, Essen and Münster, and a visiting professor at the Universities of Tsukuba and Kobe, Japan. Since 1993 he has been Professor at the Vienna University of Economics and Business Administration (WU). He was the coordinator of the FWF Special Research Area 10 Adaptive Models in Economics and Management Science, Head of the WWT project Integrated Demand and Supply Chain Management, awarded the Science Prize of the City of Vienna and the Best Paper Award of the Association of University Teachers of Business Administration. From 2008 to 2015, he was Head of the Department of Information Systems and Operations Management, in 2018, he founded the WU Research Institute for Cryptoeconomics, and, in 2019, the Austrian Blockchain Centre. He has more than 100 publications in international journals such as Management Science, Marketing Science, Management Information Systems, etc to his credit. He is the organiser of the workshop series on cryptoeconomics, founder of the working paper series on cryptoeconomics and coordinator of teaching on cryptoeconomics at WU in the undergraduate, graduate and MBA programmes. He has overseen blockchain projects with the City of Vienna, the Austrian National Bank and Raiffeisen Bank International. He is a reviewer for Cryptoeconomic Systems, and is the organiser of the International

Workshop on Distributed Ledgers and Related Technologies at DEXA 2022, Vienna.

ABSTRACT

Digital assets are a new asset class whose adoption necessitates a transformation of custody similar to the transition from paper-based securities to a fully dematerialised securities system. This paper explores how traditional custodians can manage this transition in a proper way and employ distributed ledger technology to increase the efficiency of their operations and to provide digital asset and traditional services in an integrated way. Starting by describing the status of custody, the paper then describes the opportunities and challenges of blockchain-based digital asset custody and elaborates on the proper ways of integrating the novel platforms and processes in the business model of a traditional custodian. On this basis, a framework is developed for a future integrated custody service.

Keywords: digital assets, digital custody, blockchain, key management, tokenisation

THE STATUS QUO

Although the topic of this paper focuses on digital assets and digital custody, and, as such, should be forward looking, setting the background is important to understanding where custody business came from and what it has become over the decades. It is not only needed to draft historical context, but most of all to demonstrate the complexity and challenges associated with its current state, which have a direct impact on the possibility of adopting digital assets and on taking advantage of the opportunities that new technology brings.

Custody services emerged from the investors' need to protect their assets from being stolen or lost. Although asset safekeeping was not a regulatory limited activity, banks were best suited for the role due to their trusted position in the financial industry, solid capital base, existing infrastructure (vaults), ability to offer settlement through bank accounts and other auxiliary services associated with securities administration. Throughout the years of financial market evolution these core principles have not fundamentally changed, even though the financial industry has changed substantially both in terms of its organisation and complexity.

One of the key developments was the transformation of the securities market, which was operating initially with paperbased securities, into an immobilised or fully dematerialised securities system based on the adoption of book entry records. An important milestone of this transformation was the emergence of central securities depositories (CSDs) as a cornerstone of the securities market, empowered to keep order in managing records of securities and providing consistency in the securities bookkeeping principles. Under immobilisation or dematerialisation, safekeeping is reduced to a reconciliation activity, whereby the custodian's task is to ensure that its holdings at the CSD are always equivalent to the number of securities owned by its customers. In theory, the immobilisation or dematerialisation of physical securities in CSDs should have eliminated the need for an investor to use custodians, or at least marginalise their role to the safekeeping of still existing physical securities. However, investors continue to use custodians.

The reason for bringing the argument for that into the context of digital assets refers to fears expressed within the industry regarding possible disintermediation of custodian banks due to the distributed ledger technology (DLT). As in the case of CSDs implementation and securities immobilisation or dematerialisation, it is almost certain that the way of providing custody services will change, but, at the same time, the impetus for investors to use custodians would largely remain intact, which supports the thesis that custody services will remain a valid part of the banks' offering in the future.

Moreover, it is necessary to consider the global expansion of custody services over the years, which has largely contributed to their complexity. Dematerialisation of securities fostered the development of global securities markets, increasing investors' demand for overseas assets in the quest for higher returns. Custody services had to follow. This resulted in the creation of complex business structures dependent on intermediary chains across geographical areas, multiple jurisdictions and various types of securities systems. Large global custodians have to deal with over 100 different markets via a not significantly fewer number of sub-custodian banks servicing them on the ground. Attempts to reduce the complexity of securities markets via infrastructure consolidation, such as stock exchanges or CSDs mergers and acquisitions, have not changed the picture dramatically. In Europe, the securities market scene is highly fragmented, and, despite the heavily promoted TARGET2-Securities initiative, is as close to the creation of a single European securities market as it is to the creation of a United States of Europe.

In a low margin environment, cost reduction is a very powerful impetus for changing the market players' behaviour. In a Deloitte report, the authors presented a harsh but largely true picture of the custody industry struggle:

Even though custodians and depositaries perform key functions as part of the investment management value chain, reality shows that many custodians and depositaries are trailing behind other players in the FSI (financial service industry) when it comes to technological innovation. Many focus on adapting their legacy systems to cater for requirements imposed by regulators. Most often, this means patching platforms, likely implemented in the 80s, adding custom-built End-User Computing, and change the organisation and operations to keep the business going. Today, depositaries and custodians face a set of further challenges, with shrinking margins due to high levels of manual processing, increased competition, and generally uncertain macroeconomic environments.¹

This statement can be further supported by analysing settlement efficiency and the discussion around reasons for the CSDR implementation, which was aimed at providing financial motivation to cope with inefficiencies in the existing settlement system in Europe.

Industry leader discussions seem to confirm that these problems are acknowledged and that the course is set for fostering automation and elimination of existing manual processes. It is not clear, however, how long this transformation may take and whether efforts are invested wisely in bringing new quality, or whether the existing infrastructure continues to be patched to keep the business going.

THE RELEVANCE OF DIGITAL ASSETS FOR TRADITIONAL CUSTODIANS

The traditional asset classes are fiat currencies, commodities, securities and derivatives. With the advent of Bitcoin, these are complemented by the new class of digital assets. Digital assets are assets that are digitally represented on a DLT network. They are either created on the network (cryptocurrencies) or they are a digital representation of a traditional asset (tokenised asset).^{2,3}

Digital assets emerged in opposition to the mainstream financial system, around the time of the financial crisis of 2008, as a response to the crisis of trust in respect of traditional banking setups and central bank policies. Bitcoin represented the desire for a common digital currency, immune from manipulation and independent of national policy, which could be transacted using a peer-to-peer trustless network. In practice, this has been achieved by applying the concept of distributed ledgers and by solving the consensus problem, bringing trust to decentralised data storage. The core innovation of digital assets is the seamless transition from execution to settlement and data transparency, which has the potential to eliminate the inefficiencies in data reconciliation and exception handling inherent in the servicing of traditional assets. The settlement process in DLT is executed in near real-time and all information related to a transaction can be accessed by the relevant parties on a single secured platform,⁴ which could bring T+0 settlement closer. Moreover, the use of smart contracts can potentially simplify the processing of corporate events.

Ownership of digital assets is exerted via cryptographic keys only. An individual knowing a private key can transfer digital assets without further control of intermediaries and the loss of a key without a backup means an irretrievable loss of assets. It is estimated that 20 per cent of all Bitcoin assets have been lost due to these reasons.⁵ This challenge of proper key handling has opened up the opportunity for cryptocurrency exchanges to offer not only the exchange of fiat currency against cryptocurrency, but also to offer custody of cryptocurrencies. While these services are suitable for private investors in cryptocurrencies' space, they cannot fulfil the requirements of institutional investors willing to hold digital assets in general, neglecting, for example, proper business processes for transaction authorisation or KYC (know your customer) of corporations. Having high-grade custodial processes implemented for traditional assets, traditional custodians are well positioned to expand their services to digital assets, which may go beyond keeping the private keys safe.

Currently, traditional custodians are just beginning to be active in this area, with the total value of outstanding digital assets being US\$1tn, less than 1 per cent of assets held by top banks,⁶ while there are more than 500 cryptocurrency exchanges worldwide (Figure 1).

The reasons for this low level of engagement of traditional custodians are the still relatively small market size of digital assets, regulatory uncertainty and lack of standards in core technology offerings for highquality institutional digital asset custody. These factors are mutually enforcing, as some institutional investors are obliged to



Figure 1 Total market cap of crypto-assets Source: Coinmetrics

employ an independent custodian. Nevertheless, it is to be expected that regulatory uncertainty will decrease, and technology standards will be set. With the growth of traditional assets being stagnant, digital assets promise the expanding of potential participants, retail engagements and revenue replacement.

The recent FTX collapse⁷ also supports the thesis that it might be beneficial for the digital market if traditional banks take on a larger role as trusted third-party custodians. Their history over the centuries grants them a level of trust and security that could help consumers to adopt and use services with far more ease, mitigating the risks and losses that affect millions of crypto users today.

Another big stimulus to the development of digital assets custody will come from the traditional assets' tokenisation. Although, as a concept, it is nothing new, since in the traditional securities world there are instruments reflecting other assets (fund shares, derivatives, certificates or DRs), the new technology makes the process technically more robust, enabling additional benefits for the user through the application of smart contracts. Additional to these benefits of the technology, tokenisation can create liquidity by enabling fractional ownership and smaller unit investment, which supports an expansion of the potential investor base and the creation of new investments in capitalraising models.8 Conditional upon a favourable regulatory framework, the promising new cases are: easier access to commodities or other investments, which currently are difficult to participate in directly, such as residential or commercial real estates and infrastructural projects connected to energy mix transformation. Although still in an experimentation phase, significant growth of tokenisation projects is expected during the next 12-24 months. The expectation is that tokenised assets will represent between 10 and 30 per cent of the total assets by 2030, which would significantly improve the business case for the custodial banks (Figure 2).

The number of pilot projects in the area of digital assets and the growing number of announcements by traditional custodians regarding the launching of digital assets custody offering suggests that the change in the approach of the banks is coming. Even though digital assets capitalisation is still



Figure 2 The potential for digital assets in private and public markets Sources: OECD, SIFMA, IIF, MSCI, Savills, Bain analysis



Which of the following investments do you have in your name? N=l,OOO for each generation

Figure 3 At least one in four Gen Z, Millennials and Gen X invest in crypto Source: 2022 Investopedia Financial Literacy Study (27th January to 7th February)

small, it has been recognised that most liquid digital assets, such as cryptocurrencies and stable coins, have gained traction and become a visible market, attracting a large number of clients. It is estimated that, as of 2022, there were over 300m crypto users across the globe. Figure 3 depicts a survey among 4,000 US adults showing percentage investments in various asset classes (Figure 3).

This development cannot go unnoticed by banks and traditional bank clients such as asset managers. Digital assets have undeniably become part of the asset pool, which bank clients are also keen to invest in. They may not be a part of mainstream investments yet, but the growing demand by investors and the need to provide infrastructure and safety for access to this new market segment stimulates banks to look into the topic more closely. Strategically, traditional custodians are also pushed to move in this direction due to a growing pressure from newcomers, such as banking disruptors, FinTech or crypto stock exchanges expanding into institutional services. Even if the official standing of many banks towards digital assets remains conservative, the feeling of missing out and fear of disintermediation in this market segment is a growing headache. As always, the timing of entering this market is key to success. While the importance of digital asset custody is probably overestimated in the short run, in the long run it seems to be underestimated, and traditional custodians should start their journey towards digital asset services to prepare for when DLT expansion increases its speed. The move from traditional electronic solutions to DLT based digital assets will not happen overnight, however. Therefore, DLTs will exist alongtraditional centralised side securities systems, so custodians should adapt their processes and platforms to offer a seamless combined service experience, with the whole life cycle and process in mind.⁹ In the following, how such a service could be designed is described.

ENTERPRISE GRADE KEY MANAGEMENT FOR DIGITAL ASSET CUSTODY

Given the importance of the private key, traditional custodians must develop high quality processes and systems for key management suitable for institutional customers. At the core, these must solve the problem of the conflicting goals of protecting the key and its ease of use for transactions. Typical risks include cyber-attacks on the custodian's infrastructure, physical attacks where an attacker breaks in and forces employees to hand over keys, attacks via online channels that allow access to the private key, or inside jobs by compromised employees.¹⁰

To accommodate these requirements, the key should be kept in secure storage when not needed. For instance, military bunkers are used to provide the highest security.¹¹ After a transaction has been requested, a secure approval process must be executed before a blockchain transaction is started and linked directly and securely with the creation of a signature for the transaction. Cryptographic techniques such as secure multi-party computation (MPC) are available for implementing such a process. MPC allows parties to cooperatively compute a function over their data without revealing it. Each employee involved possesses a personalised hardware wallet, and every hardware wallet contributes its code execution part to achieve the final signing of a transaction. Once this manual approval process is terminated through a quorum and the transaction is authorised, an automatic authorisation process is started that checks the transaction for compliance with AML (antimoney laundering) and KYC rules and other internally defined policies.

This internal process is separated from the infrastructure connected to the Internet via the air gap to ensure a secure direct link between an unsigned and signed transaction. The possibilities for the realisation of the air gap range from acoustic to optical data transmission methods. The connection to the blockchain networks is carried out with the help of a blockchain service, which communicates with the blockchain nodes, sends signed transactions, queries the holdings of the managed addresses, listens for relevant events and, if necessary, forwards them for further processing to the internal business logic.

REFERENCE ARCHITECTURE FOR COMBINED TRADITIONAL AND DIGITAL ASSET CUSTODY

This new component forms the core of a digitally enhanced custody infrastructure. In order to map the business logic of the custodian, certain service components must be implemented in the solution architecture. This can be done, for example, with the help of micro services, which are controlled via a message bus system. Figure 4 shows a high-level description of such an architecture (Figure 4).

End users access the services of the custody solution via a web application (user interface, UI), whereas users such as asset managers or stock exchanges integrate the services into their system landscape via an application interface (API).

KYC processes must be enhanced by crypto components. For instance, in order to be able to create unlimited custodial wallets from a single platform and achieve full account segregation, the crypto custody accounts must be mapped and linked with the bank's existing internal customer accounts.

The AML and other compliance processes must be extended with tools for tracing cryptocurrency payments to check whether certain tokens are involved in illegal transactions. Whitelisting and blacklisting of addresses should be considered to ensure assets can only be sent to previously approved addresses.

Third-party providers, such as stock exchanges and market data services, eg for exchange rates, are integrated via the component External Services. Exchange



rates are used in particular for the determination of limits for transaction restrictions. Imagine a user-specific maximum payout amount, for example per day, which is measured in Euros for risk management purposes.

Bookkeeping and tax reporting must be adapted to correctly report the digital assets holdings and transactions and implement digital asset specific tax rules. These functions can be outsourced or done by the bank on its own as part of the solution.

Being regulated financial services institutions, custodians of digital assets must have proper IT risk management in place. For all business processes and systems, appropriate monitoring and control processes must be set up for IT risks, comprising the identification of IT risks, the definition of the need for protection, the resulting protective measures for IT operations, and the definition of measures for risk handling and mitigation of risks.

To achieve the system described above, banks do not need to build digital assets solutions from scratch, since most of the technical components are already available on the market. Not being the first movers into the digital assets space, banks are engaging in close cooperation with specialised FinTech companies providing custody or tokenisation solutions. All announcements of banks launching digital custody offering made so far were accompanied by the name of a FinTech company that provides the digital custody solution. This cooperation will definitely extend to other fields such as, for example, digital wallets or digital assets taxation services. The real difficulty for the banks is to build the competencies necessary to assess those solutions from the operational and IT risk perspective, and to integrate them into their traditional custody systems. This means banks will have to invest significant amounts into building the know-how of digital assets solutions and into developing strict mechanisms to control this new, more risky, type of custody. Close cooperation with technical solution providers, or even direct investment in such companies, may be a feasible strategy for achieving these goals.

SUMMARY

Despite the implementation of first practical digital assets custody use cases, many aspects of such services by traditional custodians need to be defined or discovered, including the timeline of anticipated changes.

If possible, to evaluate the further course of custody development in connection with digital assets, the three most probable scenarios for banks to engage in the process could be identified:

- Initial experimentation phase, where banks will engage in providing custody solutions to already existing digital assets, in particular cryptocurrencies, gaining knowledge and getting acquainted with new technologies and service structures.
- 2. Expansion into asset tokenisation, leveraging commercial business cases for digital assets custody.
- 3. Application of DLT to address issues of traditional custody, aiming at remodelling of existing securities infrastructure, driven by the need to shorten the settlement cycle and decrease operational costs.

These items are not necessarily sequential and may develop in parallel. The scenarios are also not universal, as some banks may choose a different pattern for the experimentation phase, not willing to get exposure for cryptocurrencies, for example. Judging by the number of challenges on the way, it seems as though it will be a rather long and curvy road.

There are still many issues to be addressed before custodian banks become comfortable with the new digital assets' ecosystem. As mentioned before, one of the key points on the agenda is an adequate regulatory framework. This is gradually being implemented, separating, regulatory wise, crypto currencies from other digital assets, which would fall largely into traditional financial instruments categories, becoming yet another class of financial market assets. Certain regulatory arbitrage can be observed, with some markets adopting a framework quicker than others. As always, it will not be possible to avoid inconsistencies and different approaches to the regulatory topic by different countries, which may create differences that also affect custody provision. As a good example, the US SEC's guidance to include safekept crypto assets into the balance sheet of the custodians could be pointed out, justifying this by the risks involved in safeguarding crypto keys.¹² Although this approach is unlikely to be sustained due to its far-reaching prohibitive consequences, it clearly shows that the road to digital assets custody may not be straightforward.

The same is true for technological aspects, since what is being talked about here are competing blockchain platforms and DLT solutions, which offer different responses to the digital assets' 'trilemma'. Instead of having 'one blockchain to rule them all', as some anticipated might happen, it now looks as if there will be unique blockchains for specific purposes — each occupying a different position on the spectrum of security, scalability and decentralisation.¹³ Fragmentation of the market seems inevitable and, therefore, custodians will need to deal with interoperability between various blockchains and technologies. This may significantly affect the benefits incorporated in digital assets settlement and safekeeping. Digital assets' compatibility may be another headache requiring custodians to apply new measures to deal with.

Another interesting topic is risk consideration. Providing traditional custody is not a risk-free activity. The industry, however, has managed to implement measures to limit such risks. In particular, the risk of total loss of assets under custody, for which every custodian is liable, seems to be limited considering the available measures to deal with technical and operational mistakes. In the digital assets space, however, the key aspect refers to safeguarding a private key as an ultimate component of assets control. Loss or destruction of such information leads to a total loss of assets. Although digital custody solutions address risks associated with private key management and implement measures allowing for safeguarding such keys, the definitive character of potential mismanagement of the client's private keys would be a reason for looking into such a product by banks' compliance forces. Also, from business perspective, this issue should raise a question as to how to price the digital assets custody services. If the fee should generate a margin on top of operational and risk costs, should it be comparable with today's custody standards? Will the operational cost reduction offset the extra risk component? It is not the only aspect of the digital custody product, compliance and business side that banks may be concerned about. One of the features of digital assets recorded on the chain is onesided transfer initiation. In the standard securities processing, transaction settlement is based on mutual consensus of the parties, while blockchains operate on the one-sided delivery principle, similar to payment execution. It means that the recipient of the asset has no say about incoming flow. This may not be an insurmountable obstacle, but may create some issues for the clients and custody providers exposed to an unwanted 'air drop' of digital spam.

The costs of entering the digital assets custody coupled with the need to integrate new solutions with existing systems may be another burden that not all the custodian banks would be willing to accept, especially considering that the prospect of running the parallel infrastructure for an undefined period of time may not be encouraging. Despite all these reservations, it seems that the interest of banks in testing this is not getting weaker, despite the recent downturn in crypto assets.

One of the interesting aspects of future custody that is yet to be discovered is how and when DLT will disrupt traditional securities systems infrastructure. Regulations such as the pilot regime for market infrastructures based on DLT support a top-down approach, mandating traditional players such as stock exchanges and CSDs to lead the change. It is also quite likely that all such projects will be based on permissioned blockchains rather than following a decentralised path. It can only be hoped that, when creating such solutions, sufficient emphasis will be placed on addressing inefficiencies of the current securities system, so that a real automation of settlement and asset servicing processes and shortening of the settlement cycle can be achieved. Focusing solely on technology replacement may cost a lot of effort and money, without bringing visible benefits.

REFERENCES

- Deloitte (2019) 'The Evolution of a Core Financial Service, Custodian & Depositary Banks: An Outlook on the Current and Future Status of the Industry', available at https://www2.deloitte.com/content/ dam/Deloitte/lu/Documents/financialservices/lu-the-evolution-of-a-corefinancial-service.pdf (accessed 25th October, 2022).
- (2) Workie, H. and Jain, K. (2017) 'Distributed Ledger Technology: Implications of Blockchain for the Securities Industry', *Journal of Securities Operations & Custody*, Vol. 9, No. 4, pp. 347–55.
- (3) Cherecwich, P. (2001–2002) 'Custody Rebooted: How the Asset Servicing Industry Must Adapt for the Digital Future', *Journal of Securities Operations & Custody*, Vol. 14, No. 1, pp. 42–53.
- (4) Deloitte, ref 1 above.
- (5) Originstamp AG, 'How Many Bitcoins Have Been Lost?' available at https:// originstamp.com/blog/how-manybitcoins-have-been-lost/ (accessed 19th November, 2022).
- (6) Walker, R., Massey, R., Steele, A. et al.
 (2021) 'The Unique and Complex Considerations of Digital Asset Custody', *Journal of Securities Operations & Custody*, Vol. 1, No. 2, pp. 150–62.
- (7) Napolitano, E. and Cheung, B. (18th November, 2022) 'The FTX Collapse, Explained', NBC News, available at https:// www.nbcnews.com/tech/crypto/sambankman-fried-crypto-ftx-collapse-explainedrcna57582 (accessed 23rd November, 2022).

- (8) Harwood-Jones, M. (2019–2020) 'Digital and Crypto-assets: Tracking Global Adoption Rates and Impacts on Securities Services', *Journal of Securities Operations & Custody*, Vol. 12, No. 1, pp. 49–57.
- (9) Domingo, C. and Mathew, E. (2021)
 'Tokenisation: Assembling the Building Blocks of an Institutional Digital Assets Marketplace', *Journal of Securities Operations & Custody*, Vol. 13, No. 3, pp. 218–36.
- (10) Hirtschulz, M., Hennig, M., Valovich, F., Resas, D. and Ulrich, N. (2020) 'Neue Blockchain-Basierte Marktinfrastrukturen: Digital Asset Custody', Rethinking Finance, 19th December, 2019, pp. 35–43, available at https://www.d-fine.com/ news/neue-blockchain-basiertemarktinfrastrukturen-digital-asset-custody/ https://www.d-fine.com/fileadmin/ user_upload/Neue_Blockchain-basierte_ Marktinfrastrukturen_Digital_Asset_

Custody_Matthias_Hirtschulz.pdf (accessed 23rd November, 2022).

- (11) NewsBTC (n.d.) 'The Swiss Alps Holds the Key to Storing Crypto Assets for Investors', available at https://newsbtc. com/all/the-swiss-alps-holds-the-keyto-storing-crypto-assets-for-investors (accessed 23rd November, 2022).
- (12) Ledger Insights (16th September, 2022).
 'Some US Banks Pause Crypto Custody Because of SEC Approach to Custody Accounting', available at https://www. ledgerinsights.com/some-u-s-banks-pausecrypto-custody-because-of-sec-approachto-custody-accounting/ (accessed 23rd November, 2022).
- (13) Spector, B. (8th April, 2020) 'Solving the Scalability Trilemma', quredo.com, available at https://www.qredo.com/blog/solvingthe-scalability-trilemma (accessed 23rd November, 2022).