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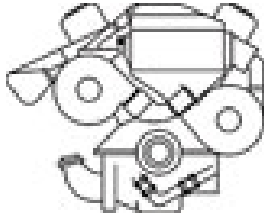
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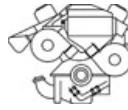
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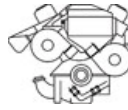
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Economics
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Management in ecology
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Business information system
Innovation and technology
Legal aspects of management
Economics and Law

These are basic, but not exclusive themed areas.

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Editorial on MEST Journal 2024Belgrade, July 15th, 2024

In the period between the January and July editions, the MEST Journal underwent a change in its Deputy Chief Editor position. It is with great pleasure to announce that Prof. PhD Daniela Todorova, the Rector of "Todor Kableshkov" University of Transport in Sofia (Bulgaria), has assumed this role. We extend our best wishes to her in her new position, and we are confident in her continued success both as an editor and a rector.

In addition to this, MEST Journal has also changed its graphic design. We hope it is now even more attractive and functional.

The world is currently experiencing a period of heightened tension and division, not only because of the Ukraine-Russia and Israeli-Hamas conflicts but also because of dramatic changes in the World Economy, disobeying the old- and the creation of new rules and relationships at the global level.

Divisions and conflicts appeared not only among nations but also within them, leading to disruptions in both international relations and interpersonal dynamics. Greed and fear took over. The increase in tensions is also influenced by uncertainty about whether the main actors know what they are striving for and whether they have a vision of how the events will unfold. The results of the parliamentary elections in several countries also speak of this.

The present era is marked by constraints on the flow of information, and the movement of people and goods, signaling a significant departure from previous decades' trends. This time of uncertainty, mass conflicts, and fear is tempered by an underlying hope that reason will ultimately prevail.

This global context has influenced the submissions to the MEST Journal, particularly on the theme of the Israeli-Hamas conflict. As a result, we have selected several articles that address these pressing issues for immediate publication in a Supplemental Edition alongside this July release.

In the MEST Journal July edition, we feature 16 articles from authors spanning Armenia, Belarus, Bosnia and Herzegovina, China, Croatia, Moldova, Russia, Serbia, Slovakia, Slovenia, the United Kingdom, and the United States. The countries have been arranged alphabetically. Some authors have made multiple contributions, reflecting their productivity and engagement with these critical topics. The articles necessitating urgent publication have been included in the Supplemental Edition, while others are still in the form of a preview, early birds. We will publish them in upcoming issues. Aligning with our commitment to extend accessibility and cost efficiency we offer MEST Journal Supplemental Edition online-only.

MEST Journal remains committed to fostering international collaboration and supporting authors in sharing their research findings. We encourage authors to publish their work with us, offering guidance, free publication, and adherence to Creative Commons 4.0 principles.

Thank you for joining us on this academic journey.

Warm regards,

Prof. Dr. Zoran Čekerevac





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#2	Position paper Walter E. Block EVICTIIONISM AND PRIVATE PROPERTY RIGHTS DOI: 10.12709/mest.12.12.02.01	7-12
#3	Original research paper Zdenek Dvorak, Lyudmila Prigoda, Zoran Cekerevac LAST-MILE DELIVERY - A CHALLENGING OPPORTUNITY FOR SMEs: MANAGERIAL AND ECONOMIC ASPECTS DOI: 10.12709/mest.12.12.02.03	13-25
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ROLE OF CRYPTOCURRENCIES REGULATION IN CHINA-CEEC COOPERATION

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Abstract

This paper explores the impact of cryptocurrencies on international trade, focusing on the regulatory challenges in China, the European Union, and Serbia. Cryptocurrencies offer promising opportunities for cost efficiency and transparency, yet their adoption in global trade encounters legal complexities, particularly in anti-money laundering efforts. This study aims to underscore the importance of a shared regulatory framework to strengthen trust and facilitate seamless cross-border transactions between China and Central and Eastern European Countries (CEEC) for win-win cooperation. Through a comparative analysis of the regulatory landscapes, this study offers insights into aligning legal frameworks to navigate the intricacies of cryptocurrency adoption in global commerce. It argues that a unified approach to cryptocurrency regulation can significantly streamline trade, promote transparency, and strengthen economic relationships. By proposing harmonized regulatory measures, this research emphasizes the potential of cryptocurrencies to reshape international trade dynamics, while also stressing the importance of comprehensive legal structures to address the challenges posed by the digital financial landscape.

Keywords: China-CEEC, Cryptocurrencies, Regulation, International Trade, Regulatory Framework, Regulatory Landscapes, Global Commerce.

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1 INTRODUCTION

Cryptocurrency, a form of digital or virtual currency utilizing cryptographic techniques for security, has emerged as a compelling alternative to conventional currency systems. Its decentralized nature, operating independently of government-controlled monetary policies, has sparked widespread interest among individuals and businesses seeking financial autonomy. The appeal of cryptocurrency is underscored by its potential benefits in international trade. With reduced transaction costs, accelerated settlement times, and enhanced transaction transparency, cryptocurrencies present a promising avenue for facilitating global commerce. Traditional payment systems, characterized by comparatively high transaction fees ranging from 2% to 5%, stand in stark contrast to the cost-efficiency offered by cryptocurrency transactions, which can be processed for mere cents. Despite the evident advantages, the adoption of cryptocurrency in international trade faces formidable challenges. Regulatory and legal hurdles loom large as one of the primary obstacles demanding urgent attention. The decentralized nature of cryptocurrency poses a unique challenge for governments attempting to regulate and monitor its usage, resulting in a landscape marked by confusion and uncertainty for businesses and investors alike (Anuyahong & Ek-udom, 2023).

The rise of cryptocurrencies presents new legal challenges, focusing on economic, tax, and financial regulations. Governments are explicitly regulating cryptocurrencies, particularly addressing anti-money laundering (AML) concerns, and reinforcing legal frameworks for prosecution. With an uptick in cryptocurrency-related crimes, there is a need for enhanced regulatory and proactive crime prevention measures, all while safeguarding citizens' fundamental rights. Current legal discourse lacks exploration of the intricate relationship between AML regulation, crime prevention, prosecution of cryptocurrency-related offenses, and the protection of fundamental rights. Future frameworks must reconcile regulatory imperatives with the fundamental rights of cryptocurrency owners, considering aspects like property rights and freedom to pursue a profession. In peer-to-peer cryptocurrency systems, the freedom of association must be acknowledged. In

prosecution, law enforcement actions may encroach on fundamental rights, requiring clear regulatory and investigative approaches meeting the criterion of necessity. The evolving cryptocurrency landscape demands interdisciplinary research for effective prevention, investigation, and prosecution strategies (Rueckert, 2019).

It is crucial to note that stringent regulatory policies can adversely impact the cryptocurrency market, leading to a sharp short-term drop in cryptocurrency prices. The extent of volatility varies among different cryptocurrencies and largely depends on the stability and maturity of the currency. However, this initial drop and uncertainty are likely to dissipate over the long run (Luo, 2022).

Building upon the legal challenges posed by the rise of cryptocurrencies and the need for robust regulatory frameworks, it is crucial to understand the foundational elements of blockchain technology. Characterized by key features such as decentralization, persistency, anonymity, and auditability, blockchain offers a distinctive and efficient alternative in various sectors, particularly within financial services like digital assets, remittances, and online payments. The decentralized nature of blockchain eliminates reliance on central authorities, providing a cost-effective and streamlined solution. Its persistent and tamper-resistant architecture ensures the immutability of recorded transactions, establishing a trustworthy record. The inherent anonymity in blockchain transactions, where users interact through generated addresses, contributes to enhanced privacy considerations. Moreover, the auditability feature, as seen in the Bitcoin blockchain's utilization of the Unspent Transaction Output (UTXO) model, facilitates straightforward verification and tracking of transactions. These objective characteristics collectively define blockchain's utility and reliability across a spectrum of applications (Zheng, Xie, Dai, Chen, & Wang, 2017).

Continuing our exploration of blockchain's impact, the distribution of cryptocurrency users globally reveals significant differences. Table 1 showcases that the Euro Area has the highest user base at 141 million, closely followed by the USA with 74.37 million users. In contrast, China and Serbia have

smaller user bases of 1.23 million and 0.54 million, respectively. These figures highlight the diverse landscape of cryptocurrency adoption worldwide, reflecting varying levels of acceptance and engagement within different regions.

On the other hand, Bitcoin mining distribution in 2022 illustrates notable shifts. Most Bitcoin mining took place in the United States, accounting for 37.84%, followed by China at 21.21%. It's noteworthy that China previously held the top position in 2019, commanding 75.53% of Bitcoin mining activities (FiatMarketCap, 2023). However, following a ban implemented in mid-2021, they relinquished this lead (Statista, 2024A).

Table 1. Number of cryptocurrency users of the selected market in millions for 2023
(Statista, Cryptocurrencies - Worldwide, 2024B)

Country	Users [millions]
China	1.23
Euro Area	141
USA	74.37
Serbia	0.54

2 CHINA

China: The People's Bank of China (PBOC) has been actively developing digital fiat currency since 2014, establishing a dedicated task force and the Digital Currency Institute to create the first-generation prototype. With the State Council's approval in 2017, pilot programs were launched for e-CNY, focusing on safe implementation while emphasizing mobile payments over cash transactions. Regulatory shifts in 2017 led to stringent measures to control cryptocurrency growth, banning Initial Coin Offerings (ICOs) and cracking down on mining and trading (People's Bank of China, 2021).

As China's digital economy advances, there's a clear shift away from cash transactions. According to a 2019 PBOC survey mobile payments constituted 66 percent of the total number and 59 percent of the total value, whereas cash transactions accounted for 23 percent of the total number and 16 percent of the total value. Card payments represented 7 percent of the total number and 23 percent of the total value (People's Bank of China, 2021).

China initially adopted a permissive regulatory stance toward cryptocurrencies. In 2013, the Central Bank, in collaboration with regulatory authorities, issued a notice addressing potential bitcoin-related risks. Subsequently, cryptocurrency transactions gained substantial traction in China, commanding 70% of the global market share. However, a regulatory shift occurred in 2017, marked by the implementation of stringent measures aimed at curbing the unchecked growth of cryptocurrencies and mitigating financial risks. The central bank, along with other regulatory bodies, explicitly prohibited Initial Coin Offerings (ICO). In 2019, the China Internet Finance Development Association issued cautions against ICOs and trading activities camouflaged by blockchain terminology. By May 2021, the State Council's financial commission underscored a crackdown on bitcoin mining and trading. These regulatory developments underscore China's assertive regulatory stance within the cryptocurrency domain, reflecting the government's commitment to oversight and control (Luo, 2022).

3 EUROPEAN UNION

European Union: The EU has taken steps to regulate crypto-assets with the Digital Finance Package (DFP) and the Markets in Crypto-Assets (MiCA) regulation effective from December 30, 2024. MiCA sets rules for crypto-assets, strengthens consumer protection, ensures financial stability, and promotes innovation in digital finance. The regulation addresses the evolving crypto-asset landscape and aims to create a secure and regulated digital finance ecosystem in the EU (European Parliament, 2023).

The European Parliament's self-initiated resolution on October 8, 2020, further underscores the importance of monitoring and regulating digital finance. In endorsing the DFP, the Parliament emphasizes the pivotal role of digital finance in the success of the Capital Markets Union (CMU), providing expanded financing options for companies and citizens. MiCA, at the core of this regulatory initiative, categorizes crypto-assets, governs their issuance and trading, and introduces transparency and disclosure requirements. This forward-looking

regulation responds to the evolving landscape of crypto-assets, aiming to create a robust legal framework that promotes innovation and addresses potential systemic impacts. The regulation, signed into effect on May 31, 2023, will become operational from December 30, 2024, marking a significant stride toward a secure and regulated digital finance ecosystem in the EU (European Parliament, 2023).

The MiCA regulation has jurisdiction over entities involved in certain crypto-assets that do not fall under the category of 'financial instruments' in existing EU legislation. This includes offerors requiring a license and enjoying an EU passport, such as cryptocurrency exchanges offering cryptocurrencies and tokens. Additionally, Crypto Asset Service Providers (CASPs) are covered, necessitating authorization, such as by the Central Bank of Ireland, irrespective of whether the crypto-asset falls under MiCA regulation. Both entities, offerors and CASPs, benefit from an EU passport under the MiCA framework (pwc, 2023).

The MiCA regulation categorizes crypto-assets into three groups: Asset-referenced tokens (ART), Electronic money tokens (EMT), and other crypto-assets not covered by existing EU legislation, including utility tokens. Although the term 'stablecoin' is not explicitly used, both ARTs and EMTs, considered variants of stablecoins, may be deemed 'significant' by the European Banking Authority (EBA) based on specified criteria. Significant ARTs and EMTs face additional regulatory scrutiny, such as stringent capital requirements. The regulation excludes cryptoassets that are unique and non-fungible to others (pwc, 2023).

Businesses falling under the MiCA regulation, or crypto-asset service providers (CASPs), encompass custodial wallets, exchanges facilitating crypto-to-crypto or crypto-to-fiat transactions, crypto-trading platforms, crypto-asset advising firms, and crypto-portfolio managers. Regarding asset applicability, MiCA covers Asset-referenced tokens (including stablecoins backed by commodities or multiple currencies), E-money tokens (stablecoins backed by a single fiat currency), and other tokens, including utility tokens. The regulation also

outlines that MiCA will only apply to non-fungible tokens (NFTs) if they share characteristics with assets explicitly covered by MiCA. For instance, if an NFT resembles a utility token or a financial instrument, MiCA rules may apply. It's crucial to note that merely assigning a unique identifier to a token doesn't guarantee non-fungibility under MiCA, and NFTs issued in large series could be considered fungible, necessitating authorization. This has implications for projects involved in fractionalizing NFTs (Legal Nodes, 2023).

4 REPUBLIC OF SERBIA

The Serbian Parliament enacted the Law on Digital Assets on October 28, 2020, defining digital assets as electronic value or rights that can be transferred, stored, and traded. The National Bank of Serbia (NBS) is designated as the supervisory authority responsible for overseeing the law's enforcement and ensuring investor protection and market development. The law covers all individuals and entities involved in digital asset issuance, trading, or investment, including cryptocurrency-related activities. The regulatory landscape in different regions, such as China, the European Union, and Serbia, reflects varying approaches to cryptocurrency regulation. Collaboration between China and Central and Eastern European Countries (CEEC) can enhance trust and streamline cross-border transactions, contributing to a conducive environment for trade and investment. Regulatory alignment and joint initiatives for education on cryptocurrency technologies are crucial for fostering resilience and efficiency in the financial ecosystem. (NBS, 2020).

The Law on Digital Assets in Serbia extends its regulatory scope to encompass all individuals and entities involved in the issuance, trading, or investment of digital assets. This includes individuals engaged in cryptocurrency mining or trading, companies operating cryptocurrency exchanges or Over-the-Counter (OTC) markets, and service providers offering various cryptocurrency-related services such as wallets, custodians, and exchanges. The comprehensive application of the law reflects its intent to regulate a broad spectrum of digital asset activities within the Serbian market (NBS, 2020).

5 CONCLUSIONS

In summary, the rise of cryptocurrencies introduces both opportunities and challenges in international trade. As we've explored, the benefits of reduced transaction costs and increased transparency coexist with regulatory complexities and security concerns.

In considering the regulatory landscapes of China, the European Union, and Serbia, it's evident that each region navigates cryptocurrency regulation differently. However, the collaboration between China and Central and Eastern European Countries (CEEC) holds special importance.

Aligning regulatory approaches between China and CEEC can not only enhance trust but also streamline cross-border transactions.

Emphasizing a shared regulatory framework in China-CEEC cooperation becomes crucial. Such alignment could foster resilience and efficiency in the financial ecosystem, contributing to a conducive environment for trade and investment. Additionally, ongoing collaboration should extend beyond regulatory measures to include joint initiatives for education and awareness about cryptocurrency technologies.

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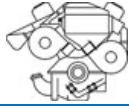
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EVICITIONISM AND PRIVATE PROPERTY RIGHTS

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Abstract

Evictionism is a compromise position between the pro-life and pro-choice positions on abortion. The former prohibits killing or removing the fetus from the womb apart from the mother's health considerations at any time during the pregnancy; the latter allows for both. Evictionism splits this particular "baby in half" by legally permitting the ejection of the pre-born baby at the mother's discretion, but not killing this very young person. Given present medical technology, the fetus is viable in the third trimester, very rarely before that. Thus, evictionism resembles to the pro-life result at this stage of development of the fetus, in that the mother has the reject to eject or evict the fetus from her body, and the latter is viable outside of the womb. However, in the first two trimesters, the results of evictionism and the pro-choice position overlap: when evicted, the fetus will not survive. However, as medical technology improves, and the pre-born baby is viable outside of the womb earlier and earlier, evictionism will more and more come to resemble the pro-life position. However, evictionism will always, at any level of technology, remain separate from these two other more extremist positions. Evictionism is thus the moderate position between these two extreme perspectives. Block in a series of publications supports evictionism; Wisniewski rejects this theory. Grisillo castigates both for elements of their debate concerning improvement and the use of analogies. The present paper is a critique of this latter paper.

Keywords: Abortion; evictionism; pro-life; pro-choice; analogies; improvement.

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EVICITIONISM AND PRIVATE PROPERTY RIGHTS

I had an ongoing debate with Wisniewski concerning whether my theory of evictionism was both correct and compatible with libertarianism.¹ I attempted to apply the non-aggression principle (NAP) of libertarianism plus its emphasis on

¹ See on this Block, 2020, 2011A, 2011B, 2014, 2021; Wisniewski, 2010A, 2010B, 2011; see also Cesario, 2021



private property rights to the controversy concerning abortion. My thought was that the unwanted fetus is in effect a trespasser.² Therefore, the ordinary rules concerning such an eventuality should be applied. The property owner in question, the mother in this case, should be able to remove the law breaker from her premises. Should she also be entitled to kill the rights violator? Of course not, that would be murder!

Allow me, please, to quote Grisillo's³ summary of my side of this debate, since he does so far more succinctly than I have ever succeeded in doing. He states as follows:

"Block's theory of evictionism distinguishes the act of ejecting a fetus from a mother's womb from the act of ejecting a fetus from a mother's womb and then killing it. The former is evictionism, the latter is abortion."

What is Wisniewski's objection to this clearly correct⁴ analysis? To put this into my words in his behalf, he argues by analogy: Suppose that A drugs B, and then surreptitiously hides him on C's private airplane. The latter discovers this trespass only when he is 30,000 feet in the air. As in the case of the preborn baby occupying the mother's womb, B is entirely innocent. To "evict" him from the airplane at this time would send him to certain death. There are no parachutes available we may assume, and, in any case, the plane is now over the ocean and B cannot swim. Wisniewski maintains this analogy of his is an apt one. Further, that it would be totally and completely unjust for C to eject B from his plane. Given that, the pro-life viewpoint in the abortion controversy is sound: just as C may not legally jettison B from his aircraft, neither may the mother perpetrate the analogous act upon her progeny. C should be required by law to land B safely; ditto for the mother after a normal nine month's pregnancy.

In my view Wisniewski's perspective is flawed. The analogy is weak. If the mother kills her baby when she could have, only, evicted him⁵ she is a murderer.⁶ Thus, she has only the right to eject,

not kill. Whereas, in sharp contrast, if we take seriously private property rights and the right of property owners to separate themselves from trespassers, C had every legal right to send B to his death via expulsion.⁷ Of course, there is a murderer in this scenario, too. But it is not C. Rather, it is A.

I also rejected Wisniewski's critique based upon a second disanalogy: A was a kidnapper. He worsened B's condition. One, by drug-raping him. That is a crime. Two, by placing him in an extremely dangerous environment. That is a second rights violation. In sharp contrast, the mother did no such thing. She merely became pregnant; that is of course not criminal behavior. Nor did she, assuming no abortion, place the baby in any danger. If anything, she improved the baby's position, vis a vis becoming pregnant, compared to what it otherwise would have been: non-existence.

Here is where Grisillo steps into this controversy. He objects to the latter claim:

"Block attacks Wisniewski's analogy by suggesting that a pregnant mother 'improves' the position of the fetus by giving it life, as opposed to a man (A) who does not improve his friend's (B) position by kidnapping him and placing him in an environment (C) without his consent. Block's main criticism of this analogy, on which much of his discourse with Wisniewski is predicated, is flawed, however."⁸

Grisillo continues:

"Block does not explain how a mother can improve the welfare of a fetus simply by getting pregnant... Certainly, a mother helps to create the fetus in the first place. This may be an improvement to her life, but cannot be one to the fetus's, because the acts of creation and improvement are necessarily mutually exclusive... An improvement can only be made to something (or that something's welfare) after it has already been created... Block's

² An innocent one, to be sure, lacking any element of mens rea.

³ Unless otherwise indicated, all my references to Grisillo will be to this one article of his.

⁴ If I say so myself

⁵ This is possible given present medical technology in the third trimester.

⁶ The doctor who enabled her to do so would have aided and abetted her in this crime, and thus is also guilty of criminality.

⁷ We say nothing about the morality of such an action, since it would take us, unduly, away from the issue addressed in this paper.

⁸ I have inserted the (A), (B) and (C) into this quote.

position implies that a fetus somehow exists prior to its creation in the womb. How else can its creation within the womb be an improvement to its welfare? In fact, it cannot. It has no welfare before its creation. Rather, its welfare is established and perhaps apparent when it is created, but only after that moment can it then be improved.”

I claim that I am herein having at least a verbal debate with Grisillo; many would characterize it as a mere verbal dispute, unworthy, perhaps, of taking place. We are only arguing about definitions after all, it might be contended. Perhaps an exception can be made to this general rule, given the importance of the abortion issue, both as a practical and a philosophical matter. Maybe it is of graver moment than that. My present debating partner also maintains that my position is even worse: “Unfortunately for Block, his error this time is not just one of semantics, but one of logic.”

To wit, it is logically impossible, and a semantic mistake as well, if I may put words into his mouth, for something presently non-existent, to be “improved” by coming into existence or being made to come into existence.

Perhaps there are counter examples. He who has Aladdin’s lamp at his beck and call can call into existence all sorts of things that heretofore did not exist. But can they be “improved” if they did not exist beforehand? This all depends upon the meaning of “improve.”

Synonyms for this word include: “make better, better, ameliorate, upgrade, refine, enhance, boost, build on, help, raise, revamp, brush up, polish up, perk up, tweak.”

Certainly, if something already exists, and flaws in it are reduced it has been “improved.” But it is difficult to see why the thing, the object, the person, necessarily had to exist beforehand. Grisillo’s understanding of language, I contend, is rather rigid. Mine contemplates more grey areas. If his interpretation were correct, the following statement would not merely be false, they would be, literally, meaningless:

The Big Bang, which occurred billions of years ago, was an improvement.⁹

It is also an improvement if all potential people started out as disembodied souls, and only some of us became “embodied” thanks to our mothers getting pregnant with us. Is Grisillo prepared to deny this possibility? I, of course, cannot offer any evidence in favor of this hypothesis, but I think that the burden of proof rests with him to demonstrate not that it is not true, but that it is literally incoherent, silly, nonsense, meaningless, gibberish. There must be millions of religious people, all speakers of language, who would disagree.¹⁰

Moreover, language is continually changing. Sensitive people¹¹ no longer use the “N word” to describe black people, the “C word” for women, the “K word” describing Jews, the “O word” to indicate Asians. Not too many years ago if you told people to “google that” they would not have had the slightest idea of what you were talking about. Ditto for “mouse,” “Facebook,” “tweet,” “motherboard” and hundreds of others related to the “Internet.” It appears it is no longer appropriate, at least in certain quarters, to use the phrase “colored people”; instead, “people of color” is accepted by the cognoscenti; and this despite the continued existence of the National Association of Colored People. Ditto for “Negro,” even given the continued thriving of the United Negro College Fund.

This being the case with language flexibility, is it really such a stretch to contemplate the meaningfulness of people improving their lot by being conceived? I go further. This is not really a stretch of language at all. Ordinary language speakers can certainly understand the concept of an entity’s being improved by being called into existence. For religious people, God created human beings. Where were the latter before this miraculous event took place? Nowhere, that is where. Then, thanks to God’s act, Adam and then Eve were created. If this is not an “improvement” in their situation, then nothing is. Surely all religious people would acquiesce in that contention. Thus, this claim could hardly be

⁹ My knowledge of physics is woefully inadequate. I am assuming, arguendo, that before this event literally nothing existed.

¹⁰ See for example Wood 2020.

¹¹ That is, politically correct wokesters.



meaningless, as Grisillo is contending. As to whether or not it is false, that is an entirely different question, whose truth is beyond the ken of the present essay.

Consider, now a not unrelated issue brought up by Rothbard (1982, pp. 100, 103):

"We must therefore state that, even from birth, the parental ownership is not absolute but of a 'trustee' or guardianship kind. In short, every baby, as soon as he is born and is therefore no longer contained within his mother's body, possesses the right of self-ownership by virtue of being a separate entity and a potential adult. It must therefore be illegal and a violation of the child's rights for a parent to aggress against his person by mutilating, torturing, murdering him, etc....But when are we to say that this parental trustee jurisdiction over children shall come to an end? Surely, any particular age (21, 18, or whatever) can only be completely arbitrary. The clue to the solution of this thorny question lies in the parental property rights in their home. For the child has his full rights of self-ownership when he demonstrates that he has them in nature—in short, when he leaves or 'runs away' from home."

Not so fast. I fear that only a person who has never had children of his own, particularly sons, could write this. My own son, at around age three, was continually "running away from home."¹² He was not, God forbid, abused in any way. He was

just adventurous. As soon as his little baby legs could carry him, he was off. He was "away" as the British would say. Presumably, there were greener pastures out there, somewhere, anywhere, and he was intent upon experiencing them. My wife and I should have allowed him to launch himself forth upon an unsuspecting world? Of course not. He was a baby. He didn't know what was in his best interest: staying right at home under our loving care, trusteeship, guardianship.

Yet it cannot be denied, there is core of truth in Rothbard's claim. Children, particularly those at least a little bit older who are not abused still have the right to leave the parental home and take up with other parents who are willing to do so, or, to set up housekeeping on their own. Child athletes, actors, performers, can earn enough wherewithal so as to become financially independent. Any legal age of departure can be nothing but arbitrary. However, in a civilized order, there would be some, well, order, placed upon children leaving the homes of their parents; again, we are assuming not even a scintilla of abuse; not even any moderate well-deserved spankings. How, then, should this work? The courts must step in.¹³ If and only when a legitimate judge gives his approval of a child's departure from the parental home, then and only then would the right of the child to "run away" be allowed. Presumably, no such authorization would have been granted to my son, certainly not when he was three years old and totally helpless.

Declaration

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¹² My daughter never did anything of the sort.

¹³ In the free society, they would all be private; see on this: Benson, 1990, 2002; Friedman, 1979, 1989; Hoppe, 2001; Osterfeld, 1989; Peden, 1977; Richman,

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LAST-MILE DELIVERY - A CHALLENGING OPPORTUNITY FOR SMES: MANAGERIAL AND ECONOMIC ASPECTS

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Abstract

Cities are expanding and becoming more populated. Citizens are becoming increasingly demanding in meeting their needs. Retail must constantly adapt to new client requirements. As a result, last-mile delivery is becoming more complex and requires new methods and innovative solutions. SMEs are becoming increasingly significant participants in the logistics chain. Transformation of last-mile delivery provides them with new development opportunities. After a short consideration of the current situation and forecasting future needs in logistics, the article detailly analyzes the importance of SMEs and the importance of modern last-mile delivery. In the second chapter, the authors analyzed modern e-commerce through the opportunities for SMEs participating in the global market and logistics chains and the challenges SMEs face. Specific attention the authors paid to the analysis of security and financing, which can be considered the most critical factors in the participation of SMEs in last-mile delivery. Some of the most common innovative logistics solutions and the need for legal regulations are analyzed below. Based on the analyses carried out in the work, in the Conclusions chapter, the conclusions reached by the authors are systematized and presented with suggestions for the continuation of the research.

Keywords: last-mile delivery, SME, logistics, innovative solutions, regulatory support, security, funding.

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1 INTRODUCTION

The world is increasingly changing. An enormous rise in e-commerce took place during the COVID-19 pandemic. The physical stores faced many



restrictions. E-commerce got a chance and became a solution for lockdowns. At first, due to the overload of suppliers, customers were satisfied if they managed to receive the ordered goods at all but soon, with the development of delivery, customers became more demanding and began to expect same-day delivery. In today's conditions, customers have increasingly diverse requirements that are becoming challenges for all small and large companies. The daily growth of e-commerce and restrictions caused by legal regulations contribute to that. In the desire to preserve the environment, governments and city administrations impose restrictions primarily on CO₂ emissions. That is not a whim but a struggle for survival. According to predictions, the total emission of greenhouse gases in cities will reach 70% by 2050. (Safonov, Kirsanov, & Čekerevac, 2022, p. VIII)

Various means of transport have different effects on the environment. Emphasizing the ecological aspect of transport types should be a significant aspect of the transport policy of an advanced society. The European Commission regularly issues recommendations and directives that deal with some areas of traffic development. States define the priorities of traffic development in their traffic policy, both for the provision of transport services and for the expected impacts on the environment. The authors of the article come from Central and Eastern Europe, and the experiences presented in the paper mostly show that these countries have very similar transport policies, where the aspect of environmental protection still plays a less significant role. (Dvorak, Rehak, David, & Cekerevac, 2020)

Last-mile delivery, the final part of a logistic chain, has many specifics. Its goal is goods' delivery from the last distribution logistics hub to customers' doors accurately, quickly, and at a reasonable price. The crucial specifics are the consequences of the environment where the activities take place and the size and number of shipments. According to the estimates, goods in the city exceed 20 to 30% on average of the total distance traveled from the producer to the customer (Rodrigue & Dablanc, 2021)¹.

Electric vehicles are suitable for last-mile delivery, as the delivery takes place in cities where solving the problem of air pollution is crucial. If thermal power plants generate electricity using fossil fuels, using electric transport vehicles outside populated areas is still not advantageous. The fuel utilization degree in internal combustion engines is often higher than in thermal power plants. (Čekerevac, Dvorak, & Prigoda, 2021)

Modern last-mile delivery has introduced significant changes in the supply chains' operation. These changes are not the result of the carrier's work alone. A characteristic of last-mile delivery is that there appear to be many participants who are less visible in other parts of the supply chain. The most important here are public actors such as branches of government, advocacy groups, residents, and retail activities. Because of their specific viewpoints, these groups are often in conflict. (Cekerevac & Bogavac, 2023)

1.1 The significance of SMEs

Nowadays, there is a consensus that micro, small, and medium-sized enterprises² are drivers of economic growth. The SME sector contributes prominently to the economy by creating employment opportunities, generating production, and introducing innovation and entrepreneurship skills. The dynamic role of SMEs is especially significant in developing countries. The successes of SMEs are often apostrophized, giving hope to other potential business entities. Due to the small size of SMEs, their failures go unnoticed, but the failure does not necessarily prevent owners from creating new SMEs in the hope of achieving success.

99.8% of European non-financial businesses are SMEs (Eurostat, 2020) and they employ about 100 million people. In March 2020, about 25 million European SMEs provided two of three jobs and 50% of Europe's GDP. 50% of SMEs undertake innovation activities. (EC, 2020)

In Europe, the Transport and Storage sector is one of the most significant and fastest-growing sectors. For example, in Latvia and Lithuania, this sector accounts for 9.5 and 12.3% respectively. (Aricha, 2018)

¹ Mileage traveled by ship or plane is not considered here.

² In this article, we have labeled micro, small, and medium-sized enterprises as SMEs.

The transportation and storage services employed ~8% of employed persons in the EU in 2020 and covered 5.5% of all enterprises. Figure 1 presents

the sectoral analysis of employment by enterprise size class in transportation and storage in the EU in 2020.

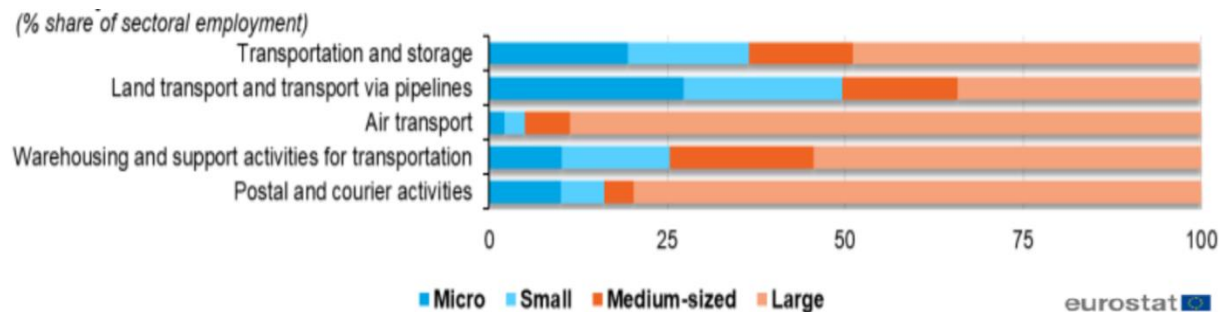


Fig. 1 Sectoral analysis of employment by enterprise size class

Source: (Eurostat, 2023)

Analysis of Figure 1 allows us to conclude that the largest share of SMEs working in the transport and warehousing services sector is in ground transport. It makes up approximately 70% of the total number of workers in this area, while large businesses account for about 30%. This fact is due, first, to the fact that in recent years, many individual entrepreneurs have appeared on the transport services market, carrying out labor activities without forming a legal entity. Starting a business here does not require relatively large expenditures of financial resources and time. In contrast, aviation transport accounts for the smallest number of SMEs employed (approximately 15%).

In our opinion, there are several reasons why there are few SMEs in the air transport sector:

1. *High competition in the market.* Many large companies in this industry have extensive

experience and resources for business development. Small businesses may find it difficult to compete with such large companies.

2. *High costs of starting and maintaining a business.* For launching a business in the air transport sector, one must invest heavily in equipment, staff training, aircraft purchases, etc. That can be overwhelming for smaller companies.
3. *Limited expansion opportunities.* Unlike other industries where small companies can expand by acquiring other companies or opening new branches, this can be more difficult in the air transport industry due to high competition and strict regulations.
4. *Difficulty in accessing financing.* Launching an air transport business requires heavy investments. That makes this type of activity less accessible for small companies.

Table 1 SDBS Structural Business Statistics (ISIC Rev. 4): Value added of SMEs and large firms

Variable	Labor productivity (in 1000 Euro)														
ISIC4	49_53: Transportation and storage														
Source	BSC: Business Statistics by Employment Size Class														
Time	2016			2017			2018			2019			2020		
Size Class	Total	Total SMEs	Large	Total	Total SMEs	Large	Total	Total SMEs	Large	Total	Total SMEs	Large	Total	Total SMEs	Large
Country															
Greece	31.00	24.00	51.00	36.00	29.00	53.00	29.00	20.00	58.00	34.00	23.00	65.00	25.00	19.00	44.00
Hungary	19.65	19.60	19.70	20.35	20.90	19.85	20.80	22.59	19.27	21.91	..	..	17.20	23.26	11.54
Slovenia	42.00	32.00	65.00	43.00	33.00	71.00	43.00	33.00	70.00	43.00	34.00	67.00	42.00	34.00	60.00
Bulgaria	12.82	11.28	15.90	13.33	11.28	16.92	14.36	12.31	18.46	15.90	13.33	20.00	15.38	13.85	18.46
Croatia	24.04	24.57	23.64	23.37	23.90	22.97	27.09	26.43	27.76	3.45	2.92	3.98	2.79	2.66	2.92
North Macedonia	10.95	10.75	11.71	11.13	10.80	12.35	11.55	..	..	12.09	..	..	..	..	..
Romania	12.10	10.48	14.52	13.31	11.69	15.73	13.91	12.50	15.93	15.73	14.11	17.94	14.92	15.12	14.72
Serbia	13.48	13.62	13.38	13.69	13.51	13.83	13.79	13.77	13.81	14.69	15.73	13.67	13.79	15.52	11.97

Data was extracted on 08 Sep 2023 at 08:47 UTC (GMT) from OECD.Stat

Source: Authors compilation based on (OECD, 2023)

Let us look at the dynamics of the added value of SMEs and large companies by country (Tables 1 and 2).

The dynamics of value added by SMEs and large companies depend on many factors, such as company size, industry, geographical location, innovation and technology, and the competitive environment.

In general, we can say that large firms usually have higher added value than SMEs. That is because large companies have significantly richer resources (human, financial, material), which allows them to develop new products and services, introduce advanced technologies, and

improve the quality of their products and services. In addition, large companies often have access to the best specialists and experts, which helps them grow their businesses faster and more efficiently.

However, it is worth noting that in some industries, for example, in the IT sector or the production of high-tech goods, small companies may have higher added value than large firms. It is also significant to consider that added value is not the only factor in business success. Success depends on the company's management strategy and ability to adapt to changing market conditions and customer needs.

Table 2 SDBS Structural Business Statistics (ISIC Rev. 4): Value added of SMEs

Size Class		1-249 persons employed (SMEs)				
ISIC4		49_53: Transportation and storage				
Source		BSC: Business Statistics by Employment Size Class				
Time		2016	2017	2018	2019	2020
Country	Unit					
Greece	Euro, Millions	3,270.3	3,751.1	2,760.0	3,193.3	2,584.3
Hungary	Euro, Millions	2,270.6	2,465.8	2,655.5	...	2,838.5
Slovenia	Euro, Millions	1,095.8	1,178.6	1,248.4	1,354.3	1,335.3
Bulgaria	Euro, Millions	1,180.7	1,260.6	1,350.8	1,461.6	1,502.2
Croatia	Euro, Millions	985.5	1,001.0	1,119.6	146.8	130.5
North Macedonia	Euro, Millions	268.3	270.1	..	..	..
Romania	Euro, Millions	2,386.7	2,783.6	3,090.7	3,543.8	3,688.0
Serbia	Euro, Millions	587.5	632.9	686.6	810.2	838.4

Data was extracted on 07 Sep 2023 at 17:08 UTC (GMT) from OECD.Stat

Source: Authors compilation based on (OECD, 2023)

Data in Tables 1 and 2 showed that the most interesting from the point of view of further analysis is 2020. In four out of eight analyzed countries, the added value of SMEs exceeds this indicator in large businesses. In our opinion, this trend is directly related to the COVID-19 pandemic, as it happened:

1. Increased demand for goods and services. During the pandemic, the need for many goods and services has increased significantly, which has led to increased production and sales. Many small and medium-sized enterprises had to increase their production and expand their assortment of production to satisfy the growing demand.
2. Improvement of technologies and innovations. During the pandemic, many small and medium-sized enterprises actively introduced new technologies and innovations to improve the quality of their production and services and increase their work efficiency. For example, they could use process automation, production robotization, artificial intelligence, and other modern technologies.
3. Flexibility and adaptivity. During the pandemic, many small and medium enterprises had to adapt quickly to changes in economics and consumer demand. They changed their production, pricing, and marketing strategies to remain competitive.

4. Availability of skilled employees. Many small and medium-sized enterprises have highly qualified personnel who can quickly learn about new technologies and products and effectively manage their processes. That allowed them to react to changes quickly and offer the best solutions to clients.

Table 3 SDBS Structural Business Statistics (ISIC Rev. 4): Employment of SMEs and large firms

ISIC449_53: Transportation and storage										
SourceBSC: Business Statistics by Employment Size Class										
Year	2016		2017		2018		2019		2020	
Units	persons employed		persons employed		persons employed		persons employed		persons employed	
Company size	1-249 SMEs	250+ Large	1-249 SMEs	250+ Large	1-249 SMEs	250+ Large	1-249 SMEs	250+ Large	1-249 SMEs	250+ Large
Country										
Greece	138,093	46,058	127,435	46,922	137,689	44,699	136,949	45,910	135,213	44,363
Hungary	115,873	131,230	118,007	131,082	117,543	137,532	..	..	122,045	130,691
Slovenia	33,745	13,112	36,237	13,307	38,092	14,315	39,980	15,056	38,795	15,036
Bulgaria	106,064	63,208	109,334	63,280	110,037	63,817	111,080	62,893	107,243	60,893
Croatia	39,977	43,176	41,810	42,674	42,145	38,894	49,325	43,258	48,624	41,541
North Macedonia	24,963	6,585	25,010	6,559	25,363	6,343	25,500	6,555	..	..
Romania	218,717	147,097	229,113	150,526	235,356	154,713	239,122	155,260	233,751	149,687
Serbia	43,156	58,036	46,860	55,590	49,866	54,008	51,516	52,291	53,996	51,626

Data was extracted on 07 Sep 2023 at 16:56 UTC (GMT) from OECD.Stat

Source: Authors compilation based on (OECD, 2023)

Thus, the added value of SMEs was higher during the COVID-19 pandemic due to increased demand for their products, improved technology and innovation, flexibility and adaptability, availability of highly skilled personnel, and other factors. Analysis of the Structural Business

Statistics for the study period shows that the share of SMEs in all countries presented in the table is growing steadily, except Hungary, where the employment share in small and medium-sized enterprises does not exceed the share of employment in large enterprises.

Table 4 SDBS Structural Business Statistics (ISIC Rev. 4): Turnover

Variable Turnover (Euro, Millions)										
ISIC4 49_53: Transportation and storage										
SourceBSC: Business Statistics by Employment Size Class										
Time	2016		2017		2018		2019		2020	
Size Class	1-249 persons (SMEs)	250+ persons (Large)	1-249 persons (SMEs)	250+ persons (Large)	1-249 persons (SMEs)	250+ persons (Large)	1-249 persons (SMEs)	250+ persons (Large)	1-249 persons (SMEs)	250+ persons (Large)
Country										
Greece	9,171	4,071	10,041	4,388	9,327	4,714	10,208	4,843	8,502	3,509
Hungary	8,497	7,506	9,041	8,014	9,384	8,857	..	..	10,164	7,040
Slovenia	3,889	1,393	4,292	1,536	4,693	1,674	4,953	1,646	4,711	1,317
Bulgaria	5,188	1,756	5,793	1,785	6,318	2,025	6,623	2,137	6,322	1,748
Croatia	2,769	1,798	3,091	1,706	3,234	1,766	440	273	400	181
North Macedonia	925	156	980	171	..	..	..	..	..	..
Romania	10,525	4,773	11,799	5,393	13,178	6,118	14,398	6,633	13,687	5,599
Serbia	2,496	1,765	3,106	1,475	3,398	1,609	3,635	1,753	3,292	1,100

Source: Authors compilation based on (OECD, 2023)

As noted earlier, SMEs generate 50% of Europe's GDP. The data in Table 4 shows that in all

analyzed countries, the turnover of small and medium-sized enterprises in transportation and

storage significantly exceeds that of large enterprises.

The study showed that small and medium-sized enterprises often occupy a large market share, which allows them to make significant profits. Large companies, on the other hand, are more limited in their ability to make a profit due to competition in the market.

In general, SMEs have advantages in flexibility, low market share, and innovation application, which allows them to offer customers better products and services at lower prices.

1.2 The significance of last-mile delivery

In 1950, of 2.5 billion people 30% lived in cities. Because of significant increases in the world population and the urban population, 7.66 billion in 2018, 4.2 billion or 54.8%, lived in cities. (Čekerevac, Prigoda, & Bogavac, 2022) We can expect an increase in the share of the urban population to 68% by 2050. Now there are more than 8 billion people on the planet Earth. This brings a series of challenges in providing conditions for the normal life of citizens. In addition to housing and streets, citizens should be provided with water, food, and clean air, as well as energy, consumer products, sewage, waste removal and processing, and more. In meeting most of these needs, last-mile delivery plays a significant role, and in most activities of last-mile delivery, SMEs are already engaged or can be engaged. The quality of last-mile delivery significantly affects the quality of life of the population. In the process of evaluating the quality of services, it is necessary to form a set of criteria and define appropriate indicators. Indicators must quantify individual criteria. With services, it is easier to quantify subjective factors, either through surveys or in some other way. Objective factors are more difficult to quantify fully. (Čekerevac, Davidović, & Čekerevac, 2010) For example, one factor that appears in last-mile delivery might be the delivery success rate. However, in addition, it is possible to measure fuel consumption, CO₂ emission, vehicle depreciation, the number of persons involved, and many other parameters, so the success of the delivery does not give a clear picture of the quality of the service. For this,

qualitative indicators are more useful, because they provide more information.

In the case of good organization and implementation, last-mile delivery services will be imperceptible and taken for granted by the population. Problems arise when something is not working properly. Then everyone feels the consequences. An obvious example is garbage collection. When it works, it's unnoticeable. When it doesn't work for some reason, the malfunction becomes more than obvious.

To meet the client's demands, transporters increasingly focus on just-in-time supply, but often customers want goods immediately. Therefore, the need for courier and express services is increasing. This is especially pronounced in food delivery.

2 E-COMMERCE - LAST-MILE DELIVERY AND SMES

SMEs can be significant participants in production and logistics chains. They can actively participate in e-commerce and last-mile delivery in many ways. In addition to providing a delivery service for their products, they can act as a last-mile warehousing and delivery service provider for other companies. Participating in global production and supply chains provides them with many benefits but also brings challenges to overcome.

2.1 Opportunities for SMEs when participating in global production and logistics chains

When small and medium-sized enterprises (SMEs) participate in global production chains, they can benefit from various opportunities. Some of them include:

1. Increased market access: Participation in global production chains allows SMEs to access expansive and varied marketplaces, expanding their customer base beyond domestic borders. That provides opportunities to tap into demand and reach international consumers.
2. Enhanced competitiveness: Collaborating with multinational companies can contribute to the competitiveness of SMEs as it allows them to learn from best practices, adopt advanced

technologies, and acquire valuable knowledge and skills to improve their business.

3. Technology transfer and innovation: Integration into global production chains often involves technology transfer and knowledge sharing. SMEs can benefit from exposure to advanced technologies, production techniques, and innovation processes, which enhance their productivity and capabilities.
4. Networking and collaboration: Engaging in global production chains gives SMEs contact with various partners and stakeholders. That networking opportunity opens doors for collaboration, partnerships, and access to resources, talent, and expertise.
5. Learning and capacity building: Participating in global production chains exposes SMEs to international standards, quality requirements, and best practices. This learning experience can enhance operational efficiency, product quality, and business performance.
6. Potential for growth and scalability: By integrating into global production chains, SMEs can scale up their operations, increase production volumes, and expand their business reach. This growth can lead to increased revenues and profitability.

Yuhua & Baihaki (2013) see the following benefits of SMEs participating in the global production chain (GPC):

- Participation of SMEs in GPCs improves their technical capacity. It allows them to adopt new production methods and the know-how of multinational corporations (MNCs). Through the training of workers in partner companies, SMEs can more quickly meet the conditions for meeting the set business standards. A successful business requires constant construction and improvement of technical capacities.
- It is a great advantage to be an MNC supplier and to participate in the GPC, as it means increased demand for MSP products and services, with all the accompanying benefits. Expanding to different markets enables small and medium-sized enterprises to reduce business risks, especially in crisis conditions.
- Cooperation with leading companies builds prestige and increases the credibility of SMEs. Such business enables easier access to

finance and attracts investors and human resources. This is advantageous because it allows SMEs to invest in new facilities and businesses with greater added value.

- GPCs provide SMEs with internationalization and indirect exports. In this way, they gain experience and more easily meet international standards. In case new market needs arise, SMEs can use their flexibility and quickly position themselves.

In addition to the mentioned advantages of involving SMEs in the last-mile delivery process, the location of SMEs can also be a significant advantage. Because of their size, SMEs are most often located in urban areas, which allows them to use their premises and warehouses as micro-hubs. That way, they can provide shorter distribution routes to the surrounding population than would be the case with large distribution logistics hubs.

SMEs need to assess their capabilities, identify suitable opportunities, and develop strategies to effectively participate in global production chains.

2.2 Challenges for SMEs when participating in global production chains

In addition to the advantages, small and medium-sized enterprises (SMEs) can face many challenges in last-mile delivery:

1. *Cost management*: Due to limited resources, balancing last-mile delivery costs (including transportation, personnel, and technology infrastructure) can be a challenge for SMEs.
2. *Efficient route planning*: Optimizing delivery routes to minimize distance, time, and fuel consumption can be complex, especially when dealing with multiple deliveries and unpredictable traffic conditions.
3. *Customer expectations*: Meeting customer expectations for fast, reliable, and on-time deliveries can be challenging for SMEs as customers increasingly expect expedited delivery and real-time tracking options.
4. *Infrastructure constraints*: Inadequate transport infrastructure, road conditions, or limited access to certain areas can hinder smooth and timely deliveries for SMEs.
5. *Labor availability*: SMEs may struggle to find and retain skilled delivery personnel,

especially during peak seasons, leading to potential delays or inefficiencies in last-mile delivery operations.

6. *Fleet management*: Fleet management, including maintenance, fuel management, and optimization of vehicle capacity, can be a significant challenge for SMEs with limited vehicle resources.
7. *Technology adoption*: Integrating and using advanced technology solutions like route optimization software, GPS tracking, or automated inventory management systems can be expensive and challenging for some SMEs.
8. *Reverse logistics*: Managing product returns, exchanges, or service requests can be complex and time-consuming, requiring efficient logistics and customer support processes.
9. *Sustainability and environmental impact*: Ensuring environmentally friendly last-mile delivery practices, such as reducing carbon emissions or using electric vehicles, can be challenging for SMEs due to higher costs and limited access to sustainable transport options.
10. *Regulatory Compliance*: Navigating complex local regulations and compliance requirements related to transportation, permits, customs, and labor laws can be challenging for last-mile delivery SMEs.
11. *Big data use*. SMEs can use the potentials of big data basic postulates (Cekerevac, Dvorak, Prigoda, & Cekerevac, 2016): more is always better; by their quantity, data create new knowledge and prediction possibilities; and using big data, one can answer all questions. Powerful software packages become available at very moderate prices. However, only a few SMEs can use big data in their businesses because of the lack of these kinds of skills. That is why it is difficult for SMEs to compete with large companies in a global market. They can achieve a competitive advantage in local markets because, due to constant contact with clients, they can understand client needs and habits and provide appropriate goods and services.

2.2.1 Security

Shipment insurance costs can have significant impacts on SMEs in last-mile delivery:

1. Financial burden: High insurance costs can financially burden SMEs. That can further strain their operating margin and affect overall profitability.
2. Competitive position: SMEs suffer comparatively higher insurance costs. That may reduce their competitive advantage and affect the SMEs' ability to attract and retain customers compared to other players in the market.
3. Shipping costs: High insurance costs can increase shipping costs. That can hurt the perception of SME's services value and make them less competitive.
4. Financial risk: Inadequate insurance or partial coverage can increase the SMEs' financial risk when shipment losses or damages. That can have far-reaching consequences for the financial stability of SMEs.
5. Business Planning: High insurance costs may require careful business planning and adjustments to maintain profitability. SMEs must incorporate these costs into their business models and financial projections.
6. The challenges related to the cost of insuring shipments in the last-mile delivery can be significant for SMEs. It is crucial that SMEs carefully assess their insurance needs, negotiate with insurers, and find a balance between adequate protection, financial viability, and competitiveness in the market.

2.2.2 Funding

The growth of the company undoubtedly depends on the managers and their knowledge. SME managers are mostly less trained than managers of large companies. Due to the inability to choose the most appropriate technology and software with their knowledge, they often do not have a clear picture of their company needs, so they often underestimate the necessary financial resources. That later creates difficulties in the work of SMEs. Due to low productivity, insufficient utilization of equipment, and lack of technology improvement, SMEs are often insufficiently competitive. Most SMEs are mainly users of technology, not creators of technology. One of the reasons for these events is insufficient financial resources. Empirical research by Baragwiha Frederick (2013) showed that surveyed companies agreed that financing constraints limited their ability to increase their business activities in many other areas, including

marketing, R&D, and technology. External financing is often an obstacle to growth.

For many SMEs and entrepreneurs, borrowing from banks is the most common source of external financing. To meet needs, they rely heavily on traditional bank financing. However, it is a big challenge for new, innovative, and fast-growing companies with a high risk/return profile (Cusmano, 2015). Most small businesses will never be able to raise enough funds from banks because they do not have good credit potential. Bank credit restrictions have become the "new normal" for SMEs and entrepreneurs, forcing them to look for ways to expand the range of available financial instruments.

Alternative forms of debt provide a distinct approach to SME financing, setting them apart from traditional lending methods and involving investors in the capital market stepping in to provide funds. That can be done through various means, both direct and indirect.

Direct tools refer to options that allow SMEs to raise funds directly from investors in the capital market. Examples of direct tools include corporate bonds, which involve issuing debt securities to investors seeking investment opportunities. By utilizing corporate bonds, SMEs can tap into the pool of available capital without relying solely on traditional bank loans.

In contrast, indirect tools encompass mechanisms like securitized debt and covered bonds. In these cases, SMEs still rely on bank loans. However, these loans are made possible by the activities of banking institutions in the capital market. Securitized debt involves bundling individual debts into a tradable financial instrument, allowing SMEs to have additional capital. Covered bonds involve securing the borrowed funds through a portfolio of assets, enhancing the creditworthiness of the SME.

The alternative to straight debt may be 'asset-based finance', 'alternative debt', 'hybrid instruments', and 'equity instruments'. Cusmano's analysis (2015) highlights the potential of SMEs to uptake these instruments. By utilizing alternative debt, SMEs can explore additional avenues for funding beyond traditional bank loans. Diversification brings greater flexibility and can

lower dependence on traditional banking institutions. However, SMEs need to understand the specific implications and requirements of each form of alternative debt and the regulatory frameworks that govern them.

Capital gaps are more pronounced in SMEs when they want to speed up the repayment of debts, but also in cases of change of ownership of the enterprise. The response of governments during the COVID-19 pandemic by focusing on mechanisms that allowed firms to increase their debt drove many SMEs into over-indebtedness.

2.3 Innovative logistics solutions

More than anyone else, the creators of smart cities have become aware of the necessity of introducing new solutions for last-mile delivery. SMEs can be effective agents in implementing such solutions. One of the innovative solutions is "smart" lockers. If SMEs are engaged in retail trade and have free space, they can offer deliverers to install smart lockers on their premises. When picking up the shipment, recipients of shipments will likely become customers and buy some of the products the store offers.

Also, they can offer their warehouses to deliverers to use as micro-hubs. Thus, the couriers could pick up the shipment closer to the delivery point.

One of the innovative solutions is the delivery of parcels by drones. In certain situations, SMEs can become bases from which drones will take off with shipments. With the introduction of robots in households, we can expect their mass application in delivery. SMEs can offer services in the form of micro hubs where robots will come to pick up goods.

We can expect innovative solutions also in the organization of delivery. When ordering goods electronically, sometimes the merchants do not need to deliver goods from a central warehouse. When SME stores are networked, merchants will be able to know if the ordered goods exist in a store near the place of the purchaser. If the requested goods are available in the MSP store, the store can deliver them from its warehouse with appropriate compensation. It can be a win-win combination when considering the rise of e-commerce.



Fig. 2 An example of smart cabinets in Portugal

These and other innovative solutions are discussed in more detail in (Čekerevac, Bogavac, & Radovanović, Some Solutions to Overcome Challenges Faced by Last-Mile Delivery in Smart Cities, 2023)

2.4 Regulatory support

As in other areas, the state can contribute significantly to last-mile delivery. In unregulated conditions, every SME must manage as they know how. Since the management usually does not have quality knowledge in this area, it is possible that there will be a lot of wandering and wrong solutions and that many SMEs will fail to the detriment of themselves and their clients. The state must provide regulatory support and, for the best solutions, provide incentives for SMEs to adopt green practices in last-mile delivery. The policy must be in a direction that promotes the growth of logistics startups and encourages innovation and cost-effective solutions for SMEs (Team Happen Recently, 2023).

Regulation bodies should remove from the regulation many ambiguities arising from the application of innovative solutions. Legislation should cover all aspects, starting from the basic definitions and ending with the issuance of work licenses and insurance. Drones and robots used in last-mile delivery and their participation in possible traffic accidents cause specific problems.

One of many possible situations is the robot being involved in an accident when the robot is new or still under warranty. Who will be responsible for the accident? The robot manufacturer, his owner, or the company that hired him to deliver the shipment? Or, maybe, someone hacked the robot because of inadequate protection? The same applies to the use of drones in delivery. Some experiences already exist with autonomous cars, but their street use is still an experiment. However, it is not possible to equate robots with autonomous vehicles. In the application of robots, we are talking about machines that move on sidewalks and in closed spaces, not on streets. Expanding the area covered by the Traffic Law cannot obtain the solution. In addition to the problem of possible traffic accidents, there is also a problem with delivery data protection. The question is how well SMEs are able to meet the GDPR criteria. Penalties in case of violation of GDPR requirements caused by delivery data collection and transmission are risks that SMEs, if decide to use delivery robots, must consider. Hoffmann and Prause (2018) discussed these problems and potential solutions in more detail in their paper.

Besides these requirements, with the mass use of robots, we can expect their mass appearance on the pavements. The question is how pedestrians will feel when robots appear in large numbers on pedestrian paths. Governments need to regulate that area. We should not lose sight of the fact that robots can become a target for criminals, not only high-tech criminals. Robots are easy targets. How will the theft of goods carried by robots, or even the theft of the entire robot, be treated?

The above indicates that it will be necessary to invest great efforts in drafting legislation to activate this type of last-mile delivery. Technical problems are much easier to solve.

The states can enact fundamental laws, but the cities must do most of the work. Last-mile delivery performs in cities, and they must take a specific interest in making it run smoothly. City administrations need to improve the quality of their services in a way that is characteristic of total quality management (TQM). Therefore, they must plan the implementation of TQM carefully. Due to the participation of many stakeholders, it is crucial to define the actors who will participate in the process and the success of the undertaken

activities' evaluation. Analyses based on the achieved numerical results are suitable for academic purposes, but to obtain a complete picture of the city authorities' work meaningful involvement of key stakeholders is necessary. The city management must respond promptly to the initiatives of citizens and groups of citizens, but also to the initiatives of SMEs and entrepreneurs. (Čekerevac, Davidović, & Čekerevac, 2010)

3 CONCLUSIONS

Last-mile delivery is a much-talked-about and studied problem. Since it is a complex problem involving many participants and influenced by many time-varying factors, it is impossible to find an ideal solution for all possible scenarios. That is why managers intend to find the optimal solutions in specific cases. When solving problems, managers often use artificial intelligence capabilities and techniques. However, many such solutions are not adequate in practice. Solutions based on the drivers' experiences are often more suitable. Drivers are on the streets daily and for a long time and know the conditions in which they move very well.

The competition in last-mile delivery is high. New deliveries appear every day. SMEs can be more significantly involved in global supply chains,

especially in last-mile delivery as goods deliverers, micro hubs, or traders who deliver goods from their warehouses to customers on behalf of larger companies. The potential is significant, but their ability to use it is questionable. Insufficient financing, ad hoc solutions in business, unclear legal regulations, poor knowledge about it, and the constant risk of failure in the case of irregular deliveries make it difficult for SMEs to operate and can threaten their survival.

Currently, last-mile delivery mainly takes care of the client and technological solutions. It cannot last indefinitely. Mass application of robots and drones in last-mile delivery cannot be expected soon due to several unresolved problems, primarily in legislation. Technology is currently ahead of legislation. Technological solutions are rapidly and unstoppably improving. More attention governments must pay to the people, the executors of the delivery service. Each last-mile delivery ends with human-to-human interaction. Deliverers often work to the limit of their endurance and in unfavorable conditions that can endanger their lives. They also have their lives and needs. To better protect deliverers, an appropriate legal framework creation requires additional efforts.

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REJOINDER TO GORDON AND NJOYA ON ISRAEL AND LIBERTARIANISM

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Abstract

*Block and Futerman (2021) maintain that the classical liberal political-economic philosophy, when properly understood, strongly supports Israel. Gordon and Njoya (2024) disagree and criticize the thesis of the two present authors. Gordon and Njoya (hence, GN) offer several arguments. For one thing, they maintain that we are mistaken in asserting a connection as we do between John Locke, libertarian theoretician of homesteading and private property rights, and Zionism. Our friendly critics aver that contrary to the title of our book, *The Classical Liberal Case for Israel*, we are simply making, instead, a typical or ordinary Zionist case to this end. GN also charge us with taking the position “that the legitimacy of the only Jewish state should not be questioned if the legitimacy of all other states is accepted.” Our learned colleagues hold the view that we “... consider that principles of property law are the only relevant benchmark by which a libertarian may ascertain war guilt. “All four of the present authors are staunch Rothbardians (we do not agree with him on this issue). Perhaps the widest divergence between the present authors and GN is the following: They opine that we “have misfired in (our) claim that Rothbard’s views of Zionism reflect a mistaken application of libertarian principles.” The present paper is our response to these criticisms of our book made by Gordon and Njoya.*

Keywords: Israel; Classical Liberalism; war; Hamas; Libertarianism

REJOINDER TO GORDON AND NJOYA ON ISRAEL AND LIBERTARIANISM

It is an honor and a pleasure to respond to Gordon and Njoya (2024). They are very careful commentators. They are fair-minded, polite,

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decent, accurate, and scholarly.¹ Nevertheless, we do disagree with their assessments of our major publication² on this subject with regard to several important substantive issues having to do with the imbroglio in the Middle East and here are our counterarguments.

First, it is of notice that GN do not necessarily oppose Israel. Quite the opposite, they claim that “It is true, as Ayn Rand argued in her own defense of Israel, that liberty is likely to be advanced more by Israel than by the Arab states...” But GN certainly oppose the way we construct our argument, as well as our focus, in defending Israel.

GN declare that “the main thrust” of divergence between the present authors and our mentor, Murray Rothbard, has to do with Zionism. We are not sure about the “main thrust,” but we certainly acknowledge that this is at least one of the important ways in which we depart from Mr. Libertarian.

In the view of GN: “It is fair to say that Jabotinsky is known less for championing Lockean principles of private property and free markets than for championing the right of Jewish people to a homeland and to defend that homeland by force if necessary.”

This is undoubtedly true. However, it is our contention that the two, Lockean principles of homesteading, and the right of Jews to the land they have homesteaded, lead in the same direction, ending up with the same conclusion. And Jabotinsky was indeed a classical liberal although he is far more well-known as a Zionist thinker and champion (Jabotinsky, 1923). The fact that the former is “less known” is irrelevant to its truth.

Let us demonstrate as an example of Jabotinsky’s regard for Classical Liberalism his letter to author Charles Vernon Bartlett, on December 9, 1938:³

“Dear Mr. Bartlett,”

“Mr. S. Jacobi introduced me to you in 1934, and I faintly hope that you have some recollection of the fact.”

“My colleagues and I shall probably soon have to approach you on matters concerning Palestine; but this letter is personal and has a different purpose.”

“Are you interested in the revival of Liberalism, the old-fashioned creed of the XIX-th century? I feel its time is coming; I think in about 5 years it will have enthusiastic crowds of youth to back it, and its catch-words will be repeated all the world over with the same hysteria as those of Communism used to be 5 years ago, those of Fascism to-day; only the effect will be deeper, as Liberalism has roots in human nature which all barrack-room religions lack.”

“If you are interested, and perhaps know of some budding initiative to act in this direction and to sponsor the launching of a militant or crusading Liberalism, I should like to help.”

“I understand some Jewish opponents of my brand of Zionism pretend to suspect me of being pro-Fascist. I am just the opposite: an instinctive hater of all kinds of Polizei-Staat, utterly skeptical of the value of discipline and power and punishment, etc. down to economic dirigée.”

“It is hardly necessary to add that, in speaking of Liberalism, I do not mean any British party but simply that philosophy which, shared by men of many parties in many countries, made the XIX-th century great.”

“I should be more than glad to hear from you on this subject.”

GN cite Simons quoting Jabotinsky as follows: “We do not have to account to anybody. We are not to sit for anybody’s examination and nobody is old enough to call on us to answer. We came before them and will leave after them. We are what we are, we are good for ourselves, we will not change, nor do we want to.”

¹ This is in sharp contrast to Hoppe (2024). We are thus very appreciative of the graciousness, and scholarly manner with which GN treat us. Our response to Hoppe’s “over the top” attack on us is Futerman and Block, Forthcoming.

² See on this Block and Futerman (2021)

³ Moreover, observe not only *what* he says but also at *what time* in history he says so.

But this hardly leads GN to where we presume they want to go: to drive a wedge between Lockean, e.g., libertarian homesteading, and Jabotinsky. This quote is merely a baring of the teeth.⁴ It is entirely compatible with an announcement that Jewish land claims are justified by the homesteading principles of classical liberalism and that Jewish Zionists will defend them to the utmost.

GN argue as follows: "Indeed as Block and Futerman observe, the case they make is essentially a Zionist case in this broader sense and not merely a case based on Lockean homesteading..."

But why cannot it be both? Why cannot it be both, on our part, equally? GN try to drive a wedge between Zionism and the homesteading theory of classical liberalism. To be sure, they are successful, insofar as the two are not at all identical. However, picture a Venn Diagram, where one element is labeled "red," and the other "round." Now, redness and roundness are entirely different concepts. Their overlap, in contrast, is something both red and round, such as a red-colored ball.

In a similar manner, now draw a Venn Diagram in which the two elements are, respectively, Jabotinsky-Zionism and Lockean-libertarian-homesteading. The two pairs here, have a bit more in common than red and round, even GN would presumably admit that. But their overlap is crucially important, and this is the point that GN miss, in our view. They triumphantly point to the admitted differences between the latter two pairs. We accept them, but look, also, at their overlap.

Briefly, Zionism is the national liberation movement of the Jewish People, *in their ancestral homeland*. The latter aspect is what links Zionism with the Lockean tradition. If only the first part were of relevance, a Jewish State could have been formed elsewhere. But Zionism's core is the idea that the Jewish people really developed and thrived in the land of Israel, as well as homesteaded much of it. The Jews were expelled two millennia ago but always wanted to get back to *their* land.

No, we do not say, as GN attribute to us, "that the legitimacy of the only Jewish state should not be questioned if the legitimacy of all other states is accepted." Rather, the legitimacy of all governments should be questioned, from the anarcho-capitalist perspective, and all should be found seriously wanting. However, the present authors have tried to take seriously the challenge put forth by Rothbard (1967). To question the Israeli government per se, and/or any other government for being a state totally ignores this scholar's challenge not to engage in "sectarianism." We want to compare the government of Israel with all other such entities, to determine which is worse than the others, and which is better. In other words, which one is closer to the NAP (non-aggression principle), and which one is further from it. This is a point of which GN are not fully cognizant as they should be, as it is so central to our analysis.

No truer words were ever said than these by GN: "... it is primarily on this point, on the concept of private property, that they (the present authors) clash with Rothbard. They do not simply wish to defend Zionism, but to argue that opposing Zionism amounts to opposing private property rights in general."

However, we cannot quite see our way clearly to agreeing with this assessment of GN's: "The authors consider that principles of property law are the only relevant benchmark by which a libertarian may ascertain war guilt."

Yes, they are indeed highly "relevant" to our deliberations, but they are only a (big, to be sure) part of the story. But they are far from being the "only" benchmark. Also of great (and greatest) applicability is the inveterate hate of Jews exhibited by Arabs in general and Palestinian Arabs in particular. The pogrom of 1929 in Hebron had nothing to do so with "property law."

Nor does this remarkable statement have anything to do so with "property law": "The Day of Judgement will not come about until Moslems fight the Jews (killing the Jews) when the Jew will hide behind stones and trees. The stones and trees will say O Moslems, O Abdulla, there is a Jew behind me, come and kill him..."⁵ There is also the issue

⁴ Would the "peaceniks" in the present Israeli Knesset show half as much spirit as this man?

⁵ A quote from Islamic sources in the Hamas Covenant (1988).

that Hamas uses its children as shields. None of this is at all irrelevant, as GN would have it.

State GN: "Block and Futerman argue that in War Guilt Rothbard is addressing the wrong issue. Their view is that rather than questioning whether Israel is more guilty than her Arab neighbors (to which their answer is no), Rothbard should instead ask who homesteaded the land of Israel 3,000 years ago. This would lead him to the correct conclusion: that Israel is the true owner and is thus justified in using force to seize back and defend her land."

We must give GN at least partial credit for accuracy. This is indeed one of our claims. However, these reviewers of our 2021 book only tell part of the story here. In addition to the Jews having a far better claim to having homesteaded land under dispute three millennia ago, there is also the issue that even within the last century or two Arab land claims are highly suspect on libertarian homesteading grounds, since a preponderance of them were given to them by governments (British, Ottoman) and were not at all homesteaded, since they consisted of non-cultivated, non-homesteaded swamps and desert (considered *uncultivable* at the time). In contrast, the Hebrews "made the desert bloom" in the land they could purchase (and subsequently more once the State of Israel was born). They, in sharp contrast, and for the most part did indeed engage in homesteading the land that was considered theirs. So, it is not only the case that most of the land was owned by the government (either Ottoman or British) and not by Arabs, but also much of the land that was considered Arab was not homesteaded by them (some, of course, did, *but not all*).

State GN: "The authors' charge against Rothbard is therefore that he does not delve deep enough into the annals of history to ascertain the first owner of the land of Israel." Yes, that is indeed one of our criticisms against Rothbard. But this certainly does not exhaust our charges, as GN imply.

GN claim that "the (present) authors have misfired in their claim that Rothbard's views of Zionism reflect a mistaken application of libertarian principles ... But the(se) authors fail to appreciate that the ... beliefs and goals of Zionism are, at best, only tangentially related to libertarian theories concerning just land titles."

We return the compliment. We maintain that it is GN who have "misfired." These book reviewers of ours are mistakenly trying to ascribe to us a position we do not hold. We do not at all maintain any sort of identity between Zionism and the Lockean homesteading theories of libertarianism. We only hold that there is an overlap between these two very different perspectives on this one issue: land titles in contested areas in the Middle East. In very much the same way there is an overlap between the theory of private property rights and the role of market prices. The latter cannot exist without the former, but neither is reducible, let alone identical, to the other. It is in this sense that opposing Zionism is to oppose private property rights in general, because Zionism is the idea that Jews return to *their land*. If it is theirs (and it is), that is a question to be treated by a different approach, because it is empirical rather than theoretical. But, *if* it is their land, then according to Classical Liberalism and libertarianism, it is just that they hold it. Of course, Zionism does not equal Classical Liberalism and libertarianism, they are different political philosophies.

GN assert, quite correctly, that "Neither of the protagonists fighting over disputed land in the Middle East can credibly claim to be fighting for libertarian principles." True enough. However, the position of one of these "protagonists," the Israelis, is far more *compatible* with "libertarian principles" than the other, the Palestinian Arabs. Also, one of the main charges of the latter against the former is that the former "expelled them and expropriated them", i.e. an argument ultimately dealing with property rights.⁶ That is all we set up to prove, and that is all we have succeeded in proving. In other words, GN are taxing us with failure to

⁶ This does not mean that they are essentially *motivated* by it, only that they rationalize their hatred in this way. In other words, anti-Zionists do not oppose Israel for property rights reasons but use alleged property rights violations ("massive expropriation and expulsion") to

build the narrative that they use to legitimize their attacks. These occurred throughout history, long before property rights became relevant with the birth of this country in 1948.

demonstrate something not totally unrelated, but not exactly on point. Yes, we agree with these critics, we have indeed failed to do that which we had no intention of accomplishing in the first place.

Moreover, if the main charge against Israel is on alleged property rights violations, that means that we can refute it by analyzing the property rights situation at the time. But that does not mean that we will convince anti-Zionists, who are motivated by something else, namely, opposition to Jewish presence in the area as such. No anti-Zionist in the West claims to be against Israel because it is full of Jews (in the Arab world they are far more honest) but say, instead, that they oppose the "Zionist entity" that "robbed and expelled Palestinians from their lands and olive gardens." We recognize that this is just an excuse, but we must nevertheless refute the "expropriation" argument. We must do so not only to show that it is a lie but also to show why there is a very powerful Classical Liberal case for Israel.

Our recognition of Arab aggression as the source of the conflict can be seen in several places in our book. As we claim in p. 367:

"Suppose Israel had started in 1948, with exactly 7% of the land that Rothbard, [...] concede was legitimately owned Jewish land. Let us now engage in a bit of contrary-to-fact history. What would the Arab reaction have been to this 'legitimate' state of Israel? It is not too great a leap into the dark to posit that they would have reacted under this science fiction-type assumption in the same manner they actually did at that time. That is, the nations of Syria, Egypt, Transjordan, Lebanon, Iraq, Saudi Arabia, and Yemen would have attacked this fledgling new nation. Perhaps, even more avidly, since this 'legitimate' nation would have been even weaker. The Arabs regarded the Jews as a viper in their bosom. Evidence for this contention lies in the numerous riots and pogroms staged by the former against the latter long before the creation of the Jewish state in 1948."

Next, GN assert: "Whatever that theory of justice is, property rights based on ethnicity, DNA, and

genetic entitlement to ancestral lands corroborated by religious texts and cultural inheritance is not a libertarian theory of private property rights."

We beg to differ. What these excellent libertarian theoreticians are in effect claiming is that only if there were an "individual Jew who can trace his ownership rights over any specific piece of land from 2000 years ago" would this assertion of ownership pass muster under "a libertarian theory of private property rights." They are asserting in effect that individualism is the be-all and end-all of land rights and that collectivism is not merely second in rank, but entirely invalid. How, then, do they deal with native Indian claims to own territory? Such tribes of people, collectives if you will, long predated the arrival of the Europeans. Based upon GN's theory of libertarian property rights, they would not have owned even one square inch of this territory, since they did not homestead even so much on an individualistic basis. Rather, they did so collectively. Where is it written in graven stone that only the homesteading acts of individuals can garner property rights, but that if it is done by collectives, such as Indian tribes, it plain just does not count at all? Nowhere, is our contention. On the other hand, if GN can now see their way clearly to validate Indian claims to property, it is difficult to see how they can avoid this conclusion in the case of the Jewish "tribe."⁷

Moreover, we never claimed that *every inch* of land belongs to the "Jews" as such because millennia ago they were there (only some of the land controlled by Jews can be justified in that way). That explains *why* they wanted to return, not why they have a right to be in the land of Israel now (which is *because* they created their own country by homesteading it and building it, in an area that was for the most part an uncultivated, un-homesteaded desert). The genetics and cultural connection explain the link between certain modern-day Jews (the *Kohanim*) and specific places such as the Temple Mount in Jerusalem, which is very important because it is a crucial site in the entire "conflict." We do not make that claim for *all* of the land, but the few places that do apply

⁷ GN are herein confusing methodological individualism with political individualism. The former is an aspect of Austrian economics and is apodictically true: only individuals, not groups, can act. Subtract all the

individuals from the group, and there is nothing left. The latter is simply false, as shown by the fact that, surely, the American native peoples owned some land. See on this Crepelle and Block (2017).

are still relevant. Moreover, despite that it is not a fully “libertarian theory of property rights” it is more compatible with it than the alternative: the Temple Mount to be owned by the Islamic Waqf.⁸ In other words, it is an innovative solution *based* on property rights theory for a complex issue such as the Temple Mount ownership. Moreover, how does supporting Jewish homesteading in the land of Israel (Judea) make us non-libertarians but implicitly defending Arab land ownership of an entire un-homesteaded area by fiat (as Rothbard, 1967, does) is libertarian?

In their next at-bat, our reviewers make this statement: “It is true, as Ayn Rand argued in her own defense of Israel, that liberty is likely to be advanced more by Israel than by the Arab states but that does not in itself mean that a defense of Israel is an application of libertarian principles. Rather, that point merely asserts that libertarian principles are more likely to flourish in Israel than in neighboring states.”

Yes, we the present authors strongly agree with this assessment. But we fail to see how this can be a proper criticism, or, even relevant, to our writings. We barely mention Miss Rand in our book (2021) and not at all in anything even approaching this context. However, given that GN raised this issue, we must also say at this point that the fact “that liberty is likely to be advanced more by Israel than by the Arab states” should certainly point in the direction or support a strong suspicion “that a defense of Israel is an application of libertarian principles.” That is so because the opposite idea, to defend the Arab states which would not advance liberty as much as Israel, is in effect to support a less free state of affairs for that area of the Middle East now comprised by Israel. So, in this respect, how could a libertarian *not* support Israel on these grounds alone⁹? If “liberty is likely

to be advanced more by Israel than by the Arab states” then there must be at least *something* in Israel that is in accordance with libertarian principles, and facing the only alternative of other regimes that would not advance liberty as much¹⁰ then a libertarian should support the former. Remember, following Rothbard (1967) we must reject sectarianism, and it is either Israel or the other Arab states (or Iran) that are in the running.

Try as we might, we cannot see our way clearly to agreeing with this statement of GN: “Deciding ... who is more or less to blame for a particular war and who is the true aggressor falls within the purview of historical analysis, foreign policy and the specific details of particular events rather than a theory of just acquisition of property.”

In our view, the “just acquisition of property” is not a necessary condition for determining war guilt, but upon occasion, it can be a sufficient one. As we are forever fond of saying, war guilt in the present Middle Eastern conflagration has other dimensions besides property titles. Greater hatred for Jews than love for their own children on the part of the Arabs plays an important role in this determination. However, titles to property must also be considered in this context, for the Palestinian Arabs claim they were booted off their legitimately owned property, and that when they use violence against the Israelis,¹¹ it is justified on the grounds of repossessing what they think is rightfully theirs.

Let us stipulate, *arguendo* only, that in not allowing the “right of return” for the Arabs who abandoned their property in 1948,¹² Israel did indeed steal their land. For the libertarian critics of Israel, matters are very simple: this stolen land must be returned. Period. But matters are not quite as simple as that. In leaving, many of these Arabs

⁸ Once again, we claimed that a specific group of Jews, the *Kohanim*, are entitled to that very specific piece of property because they are both genetically and culturally linked to the builders, *in the absence of any other group or individual with better claims to it*.

⁹ Emphasis on this last word, alone. That is, we are now operating under strict *ceteris paribus* assumptions. The only thing we now know about the two situations, Arab versus Israeli, is that the latter is more libertarian. Then, of course, we logically entitled to deduce that if Israel is in charge, the situation will be more libertarian than if the opposite occurs.

¹⁰ Rothbardiana is not an option in the area, or pretty much anywhere else either for that matter.

¹¹ Say what you will against these people, it cannot be denied that they are intent on using violence, mainly against women and children, *on both sides*, to attain their ends.

¹² As a summary, the most important of the “New Historians” himself, Benny Morris, explains what happened in 1948 in Morris (2008).

were following the orders of the half-dozen invading armies; they were thus aiding and abetting them. It is thus not at all as clear as supposed that this was a case of land theft.¹³ But we are assuming, for the sake of argument, that it is. However, what about the fact that at around this time and afterward, a similar number of Jews were expelled from the Arab countries busily invading Israel? Why do we not hear even a single peep from anti-Zionist libertarians (including Rothbard) about that particular land (and other property) theft?¹⁴ If there were a Solomon-like libertarian judge, he might well have ruled that the Arabs who left Palestine in 1948 instead of returning to their homes and olive gardens should take over the land of the exiled Jews, and, vice versa, those forced to leave the Arab countries would take over their properties. This massive land swap is an aspect of justice in the realm of the possible, but it completely eludes the (libertarian) critics of Israel. This is mainly because the latter do not even recognize nor mention that a million Jews were massively expelled and expropriated from the countries, they had been living in for millennia just because they were Jews.¹⁵

Here is a claim of GN which, we allow, makes a good point against us, but only because they do not quote the entire sentence we wrote. They offer the following: “The authors clearly disagree with Rothbard on how historical events unfolded but it does not follow that in a disagreement over who aggressed against whom, one party is defending private property while the other is ‘against the entire concept of private property.’ It is merely a debate over contested facts, or at any rate the significance of contested facts, rather than a debate over the concept of private property.”

But we did not write that the Arabs are “against the entire concept of private property,” plain and

simple. It is not true that all Arabs always oppose private property rights. For the most part, they rely upon this concept when it suits their purpose and ignore it when it does not.

Here is an entire paragraph from whence this phrase was lifted, out of context:¹⁶

“The roots of all the hatred against Israel are deeply embedded in anti-Zionism. We would challenge that to be anti-Zionist is to be against the entire concept of private property and inheritance *in a broad sense*. It is high time that the liberty movement, the real and true classical liberals of the world, stand up and take notice. Those who attack Israel are *almost always* enemies of private property and free markets generally” (emphasis added).

Yes, we still insist, GN to the contrary notwithstanding, that *in a broad sense*, the anti-Zionists are *almost always* enemies of private property. GN are excellent reviewers, but on this one occasion, they seriously err.

GN end on this note: “The question of whether Israel has committed acts of aggression is not reduceable to Lockean homesteading principles, nor can the Ethics of Liberty be construed as a manual capable of settling wars between nations. Ultimately, in claiming that the dispute in the Middle East can be resolved through libertarian principles of private property Block and Futerman have lost sight of the complexity of the philosophical issues. They devote attention to showing, for example, the hatred that has historically been shown towards Jews (p. 252-253) but they are wrong to suppose that this is in any way related to a theory of private property and naive to hope that inter-racial hatred can be resolved by reference to property rights.”

¹³ For an analysis of this subject, see Block and Futerman (2021), Chapter 3.

¹⁴ And here the land and property theft were clear. These Jews were not even thought to be dangerous to their countries’ populations in the way that the departing Arabs were in Israel.

¹⁵ And these Jews, unlike Palestinian Arabs condemned by the Arab countries to leave in refugee camps as eternal refugees, resettled (some in Israel, others in the US and other countries) and moved on with their lives (with no compensation whatsoever).

¹⁶ GN do quote us here (but the sense does not change): “The right of the Jewish People to inherit and develop the land of their ancestors is so deeply rooted in historical and cultural evidence that to dispute it is simply a farce. It is tantamount to denying the basic rights of private property in a broad sense. That is what the attack against Israel’s legitimacy essentially is—an attack against private property rights generally, for anybody at all.”

Here is our reaction: We never wrote that whether Israel has committed acts of aggression is reduceable to Lockean homesteading principles. Our position, instead, is that these Lockean homesteading principles are an important determinant of war guilt between Israel and its enemies and that the former's actions, not those of the latter, are far more consistent with them.

We further do not support the claim that "the Ethics of Liberty (cannot) be construed as a manual capable of settling wars between nations." Au contraire, it is a *splendid* manual capable of determining guilt or innocence in wars between nations. The only trouble, here, is that the Rothbard of 1967 did not fully adhere to these principles. If he had given due credit to property rights in certain areas emanating from thousands of years ago, as well as took cognizance of just how weak the Arab property titles of a century ago were,¹⁷ based upon Lockean homesteading grounds he would have taken a position 180 degrees removed from his actual view. This is because, for the most part, the Arabs did not cultivate the swamp and desert they claimed for their own. Had Rothbard incorporated all of this, plus the understanding of the deep hatred against Jews (with or without a state) in the area, he would have come to a very different conclusion about war guilt in the Middle East.

We deny we "have lost sight of the complexity of the philosophical issues." They are not all that complex in this respect. The question is not whether the Jews had a perfect claim on Lockean homesteading grounds to all property under dispute. The issue is, which side had a *better* such claim. When looked at through these eyeglasses, the result is simple, not complex.

GN credit us with devot(ing) attention to showing, for example, the hatred that has historically been shown towards Jews (p. 252-253) but (we) are wrong to suppose that this is in any way related to a theory of private property. But we never "suppose" any such thing, and challenge GN to specify wherein we made any such "supposition."

Rather, it was and still is our view that this is an entirely *separate* matter, totally apart from a theory of property rights, but highly relevant to an explanation as to why there is such turmoil in the Middle East. Property rights enter the picture when analyzing an important aspect of the justice of the cause of each side, especially inspecting the main charge that Palestinian Arabs make to Israel ("expulsion and expropriation"), but not on the origin of the dispute: the Arab rejection of any Jewish presence in the area, especially in the form of a state.¹⁸

As such, we claim over and over in the book, for instance, that:

"... in our view specific historical narratives are merely excuses for the Palestinian Arabs' chronic rejectionist positions against Israel. Their true motive is a rejection of any Jewish presence in the area whatsoever." (Block & Futerman, 70)

"It is first and foremost the Palestinian Arabs rejection of Jews that is the cause of war." (Block & Futerman, 162)

"As Rothbard points out, there were some minority groups that favored a bi-national Jewish-Arab state, but that idea was dismissed not only because the creation of a Jewish state was a vital need for Jews but also because it avoided the main problem, the real cause of conflict: Arab leadership opposition, shared by much of the Arab population, to any Jewish presence in the land, with or without a state." (Block & Futerman, 263)

Our learned reviewers claim we are "naive to hope that inter-racial hatred can be resolved by reference to property rights." But where oh where did we ever say, or even *think* such a preposterous thought? *Could* it be solved that way? Yes, and we can say so.¹⁹ But we do not for a moment believe it is likely. It is as if we were of the opinion that if the Arabs just read John Locke, all would be well. We have been accused of many things in our intellectual careers, but, to channel President Biden, this charge is surely "over the top."

¹⁷ And also considering that most of the land was owned by the government, not by Arabs, and that Palestinian Arabs never had sovereignty over the land either.

¹⁸ See also Pipes (2009).

¹⁹ It constitutes no logical contradiction to assert that pigs can fly and that there are pink-skinned elephants.

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EVOLUTION OF CRYPTOCURRENCIES AND THEIR UTILIZATION IN THE DIGITAL ECONOMY

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Abstract

Cryptocurrencies and blockchain technology have revolutionized finance and technology, presenting unparalleled opportunities for innovation. Emerging with Bitcoin in 2009, the crypto ecosystem has significantly evolved, encompassing a wide range of digital assets and decentralized applications. This paper delves into the origins of cryptocurrency, the dynamics of crypto transactions, and the transformative potential of blockchain technology. It examines various types of cryptocurrencies, including coins and tokens. Also, it explores the multiple layers of blockchain technology, from foundational infrastructure to advanced applications. Despite facing challenges, like market volatility and regulatory uncertainty, continuous collaboration and innovation drive the field forward. By adopting responsible development practices, stakeholders can harness the potential of cryptocurrencies and blockchain to foster a more inclusive, transparent, and efficient financial ecosystem. This evolution promises to redefine traditional financial systems and enable new forms of economic participation and digital interaction, ultimately contributing to a more equitable global digital economy worldwide.

Keywords: Coin, Cryptocurrencies, Token, Blockchain.

1 INTRODUCTION

The emergence of cryptocurrencies represents a groundbreaking evolution in the realm of finance

and technology, revolutionizing traditional modes of currency exchange and paving the way for innovative business transactions. Since the inception of Bitcoin in 2009 by an anonymous entity known as Satoshi Nakamoto, the landscape of financial transactions has experienced a paradigm shift, leading to the creation of a decentralized digital economy. This research

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paper embarks on a journey to explore the origins of cryptocurrencies and delve into the intricate dynamics of business transactions within the crypto realm.

The genesis of cryptocurrencies can be traced back to the global 2008 financial crisis, which eroded trust in traditional banking systems and highlighted the vulnerabilities of centralized financial institutions. Against this backdrop, Satoshi Nakamoto introduced Bitcoin, a peer-to-peer electronic cash system based on blockchain technology. The innovative concept of blockchain, a decentralized ledger that records all transactions across a network of computers, laid the foundation for a new era of digital currency and financial autonomy.

Bitcoin's inception marked the beginning of a proliferation of cryptocurrencies, each with unique features and functionalities. Ethereum, launched in 2015 by Vitalik Buterin, introduced smart contracts, enabling the execution of programmable agreements without the need for intermediaries. Subsequently, a myriad of alternative cryptocurrencies, commonly referred to as altcoins, emerged, further diversifying the crypto market and fostering technological innovation.

The advent of cryptocurrencies has catalyzed a paradigm shift in business transactions, offering unprecedented opportunities for individuals and enterprises to engage in a borderless and censorship-resistant digital economy. Cryptocurrencies facilitate instant and low-cost transactions, transcending geographical boundaries and eliminating the need for intermediaries such as banks or payment processors. This decentralized nature of cryptocurrencies empowers individuals to have control over their financial assets, enhancing privacy and security in transactions.

Moreover, blockchain technology integration into various sectors has paved the way for innovative business models and applications. From decentralized finance (DeFi) platforms enabling lending, borrowing, and yield farming to non-fungible tokens (NFTs) revolutionizing digital ownership and authentication, the crypto realm continues to push the boundaries of possibility. These developments underscore the transformative potential of cryptocurrencies

beyond mere monetary transactions, ushering in a new era of decentralized governance, supply chain management, and digital identity verification.

However, despite the promises of decentralization and financial inclusion, the crypto realm poses challenges and risks. The volatility of cryptocurrency prices, regulatory uncertainties, and security vulnerabilities underscore the need for robust risk management frameworks and regulatory oversight. Moreover, concerns regarding the environmental impact of cryptocurrency mining and the proliferation of illicit activities underscore the importance of addressing these issues to ensure long-term sustainability and cryptocurrency legitimacy.

2 BLOCKCHAIN TECHNOLOGY

Blockchain technology stands at the forefront of technological innovation, poised to revolutionize modern industries with its decentralized and transparent framework. Originally synonymous with cryptocurrencies and NFTs, blockchain has evolved into a versatile solution capable of reshaping the fundamental processes of various sectors worldwide.

At its essence, blockchain operates as a distributed ledger, recording transactions across a network of interconnected nodes. This decentralized structure ensures that no single entity has control over the data, enhancing security and mitigating the risk of fraud. Each transaction is cryptographically linked to the preceding one, forming an immutable chain of blocks, hence the name "blockchain."

The transformative potential of blockchain extends across numerous industries, offering unparalleled benefits in transparency, efficiency, and security. In finance, blockchain technology facilitates the establishment of decentralized financial systems, eliminating the necessity for intermediaries such as banks and transforming the landscape of financial transactions. Through smart contracts and self-executing agreements stored on the blockchain, parties can automate and enforce the terms of their agreements without the need for intermediaries, reducing transaction costs and delays.

Moreover, blockchain technology has vast implications for supply chain management, providing a transparent and immutable record of product movements from production to distribution. By tracing the origin and journey of goods, blockchain enhances supply chain efficiency, reduces counterfeit products, and ensures product authenticity.

In the healthcare sector, blockchain enhances data security and interoperability, allowing patients to maintain ownership of their medical records while securely sharing them with healthcare providers. That ensures the integrity and confidentiality of sensitive health information, enhancing patient privacy and trust.

Furthermore, blockchain technology facilitates the transition to renewable energy by optimizing energy trading and incentivizing sustainable practices. Through peer-to-peer energy trading platforms built on blockchain, individuals can directly buy and sell excess renewable energy, fostering a more efficient and sustainable energy ecosystem.

While blockchain technology holds immense promise, challenges like scalability, interoperability, and regulatory concerns remain significant barriers to widespread adoption. However, ongoing research and development efforts continue to address these challenges, driving innovation and expanding the potential applications of blockchain across industries. (Wamba, Wamba-Taguimdje, Lu, & Maciel M. Queiroz, 2024)

2.1 Cryptocurrency types

Based on blockchain technology, we recognize two types of cryptocurrencies: coins and tokens.

A coin is a digital asset that has blockchain technology. The most well-known example of a coin is Bitcoin. The main characteristic of coins is that they are designed to be a medium of exchange. That means they can be used to purchase goods and services, much like any other currency. In addition to being a means of payment, coins can also be used for speculation. That entails purchasing coins in the hope that their price will rise, allowing them to be sold at a profit.

On the other hand, a token is also a digital asset. However, it does not have blockchain technology.

Instead, tokens are created based on existing blockchain technology. Tokens and coins share many similarities in terms of operation and underlying technologies, but they differ in purpose. Tokens are created to raise funds for projects. They can be likened to companies selling their shares through stocks.

Essentially, although coins and tokens are digital assets, they fulfill distinct roles within the blockchain ecosystem. Coins are primarily used as a medium of exchange, akin to traditional currencies, whereas tokens are often created to represent ownership of assets, participation in a project, or access to a service within a specific ecosystem. Understanding these distinctions is crucial for investors and enthusiasts navigating the diverse landscape of cryptocurrencies and blockchain-based assets. (Charfeddine, Benlagha, & Khediri, 2022)

2.2 Layers

The layers in cryptocurrencies refer to different levels of the technological stack that constitute the cryptocurrency ecosystem. Each layer has its own functions and specific tasks, contributing to the overall operation of the cryptocurrency network. Generally, the cryptocurrency ecosystem is divided into four main layers known as Layer 0, Layer 1, Layer 2, and Layer 3.

Layer 0, also known as the "base layer," is the foundational level of the blockchain technology stack. It consists of the physical infrastructure, including hardware and network protocols required for the blockchain technology operation. This layer focuses on designing the network architecture, consensus mechanisms, and cryptography used to ensure network security. Layer 0 is crucial for the overall security and operation of blockchain technology, as it provides data processing and transmission integrity. Examples of protocols in layer 0 include the Internet Protocol (IP), Transmission Control Protocol (TCP), and User Datagram Protocol (UDP), which provide the necessary framework for data packet transmission across the network. In essence, Layer 0 serves as the backbone of the blockchain technology stack, providing the fundamental infrastructure needed for blockchain operation.

Layer 1 refers to the base blockchain layer that acts as the primary accounting system for cryptocurrencies. This layer includes cryptographic mechanisms, consensus mechanisms such as Proof of Work (PoW) and Proof of Stake (PoS), and other basic functionalities required for blockchain operation. Layer 1 enables the storage and processing of conducted users' transactions and ensures security and transparency throughout the cryptocurrency network. The mining process, necessary for verifying and confirming transactions in the blockchain, also takes place in this layer. Layer 1 is crucial for the operation of cryptocurrencies and serves as the foundation for further development of other layers in the cryptocurrency ecosystem. Technologies such as blockchain are used in this layer to ensure security, reliability, and decentralization across the entire cryptocurrency network. An example of a cryptocurrency acting as layer 1 is Bitcoin.

Layer 2 builds upon Layer 1 and addresses some of the challenges associated with the base blockchain layer. This layer utilizes various technologies such as off-chain transactions, sidechains, and other mechanisms to achieve greater scalability, speed, and efficiency in the cryptocurrency network. In Layer 2, transactions are conducted off the main blockchain, allowing for increased transaction throughput and reduced transaction costs. Layer 2 can also facilitate more complex transactions requiring larger amounts of data. Additionally, Layer 2 addresses the issue of high transaction fees, sometimes characteristic of base blockchain networks, by enabling lower transaction fees and greater accessibility for users. Examples of cryptocurrencies operating on layer 2 include Polygon, Optimism, GMX, etc.

Layer 3 in cryptocurrencies is an extension of Layer 2 and enables the execution of more complex applications such as decentralized applications (DApps), smart contracts, and other projects based on blockchain technology. Layer 3 employs various technologies that enable communication between different blockchains, integration of external data into blockchains, and other solutions that enhance functionality and user experience. Layer 3 is aimed at developers looking to build more complex applications based on blockchain technology. It is a significant step in the cryptocurrency ecosystem development

because it allows greater flexibility and efficiency in application development. Examples of cryptocurrencies operating on layer 3 include Ethereum (ETH), the EOS (EOS), Cardano (ADA), and others that support the execution of decentralized applications and smart contracts. (Zebpay, 2023)

2.3 Uses of cryptocurrencies

Cryptocurrencies have long captured the attention of people worldwide. While most individuals focus solely on their price and use as an investment vehicle, cryptocurrencies offer much more than that. Understanding these different purposes can help cryptocurrency users better leverage the potential of these digital assets. Below are detailed explanations of the purposes of crypto tokens and coins.

Utility tokens are a specific type of cryptocurrency that, unlike coins (e.g., Bitcoin), is not designed as a medium of exchange. Instead, a token has utility value for users, meaning users within the protocol can access various functions. These benefits examples include using applications, purchasing virtual items, voting for ideas, influencing project development, lowering transaction fees, etc. Any crypto project can issue utility tokens, which, unlike Bitcoin, are not mined but rather sold in an Initial Coin Offering (ICO). Projects may also choose to distribute some of their tokens to users as a reward for participating in the initial development phase, a process known as an "Airdrop." Utility tokens primarily serve for the growth and development of a project and use within its system. However, tokens also have a monetary value on the secondary market, making them usable as investments, protection against inflation, and long-term stores of value. (Vidal-Tomas, Briola, & Aste, 2023)

Security tokens are a form of cryptocurrency representing ownership stakes in real-world assets such as company equity, real estate, commodities, etc. Holders of these tokens can receive a share of profits as dividends on traditional markets. Companies seeking additional funding for their business or projects can issue specific ownership of their company through security tokens offered to investors on cryptocurrency exchanges facilitating the purchase of these tokens. Security tokens are also

subject to securities laws and regulations, similar to traditional securities. (Kreppmeier, Laschinger, Steininger, & Dorfleiter, 2023)

As their name suggests, payment tokens exist for the purpose, of payment for services or products, claims author Jei Young Lee in his article (2019). Typically, these tokens have no other function or connection to any project. Generally, these cryptocurrencies serve as value assets similar to cash or gold, facilitating purchases, sales, and various other transactions. They also provide the same functions as fiat currencies.

Exchange tokens are digital assets owned by the cryptocurrency exchange. Generally, there are more main uses of exchange tokens that directly benefit both traders and the exchange itself: Cryptocurrency exchanges are platforms for buying, selling, and exchanging cryptocurrencies and are a significant aspect of the ever-expanding cryptocurrency ecosystem. Exchanges offer users a user-friendly interface, similar to those expected from most traditional online financial exchanges or brokerage accounts but provide access to a spectrum of digital assets. As the cryptocurrency industry evolved, exchanges had to adapt to the evolving needs of their customers – both in terms of expanded trading options and platform functionalities. Exchange tokens are one such innovation. (Makridis, Frowis, Sridhar, & Bohme, 2023)

NFTs are digital tokens representing ownership rights to digital art, which can appear in the forms of images, music, in-game items, etc. Fundamentally programmed like most cryptocurrencies and operating on the same blockchain technology, they are classified as types of cryptocurrencies. They can also be bought and sold on most cryptocurrency exchanges. NFTs have existed for years but did not gain popularity until 2021, when the market was valued at a record \$41 billion, nearly surpassing the total sum of money in the entire world's physical art market. Like artworks, NFTs cannot be entirely counterfeited, as each NFT contains its identification number, and like any cryptocurrency transaction, each NFT transaction has its number. Purchasing an NFT also entails ownership of the selected item, as it comes with built-in authentication, which serves as proof, a

factor that can be highly significant for an individual collector of a particular collection. NFTs differ from traditional cryptocurrencies. One NFT cannot be exchanged for another NFT, as can be done with fiat currency, euros for euros, or with cryptocurrencies, bitcoin for bitcoin. (Anselmi & Petrella Giovani, 2023)

DEFI refers to a new financial industry within the development of the so-called Web3, which will be discussed in the next chapter. DEFI protocols offer users similar financial services one might expect from a traditional bank but without centralized authorities. These services include options for earning interest on assets, borrowing and lending assets, etc. Instead of intermediaries to verify transactions, these applications prefer to use smart contracts. Smart contracts are blockchain-based programs that automatically execute commands when certain criteria are met. DEFI also does not require user authentication; instead, protocols identify users by their unique wallet addresses. In addition to decentralized crypto lending services, DEFI includes decentralized exchanges, where users can exchange their cryptocurrency for any other, similar to banks where, i.e., we can change euros for US dollars. There are also decentralized staking pools, where users can lock their cryptocurrencies in a specific network for a certain period. By doing so, the user contributes to the security and progress of the entire network. In return, the network rewards the user with a percentage of the total value of locked cryptocurrencies. (Saengchote, Putninš, & Samphantharak, 2023)

DEFI tokens are cryptocurrencies associated with the DEFI projects and serve a specific purpose within the DEFI protocol's ecosystem. These tokens are typically designed on the blockchain on which the corresponding DEFI project is built. The use of tokens is intended for use in specific applications within the ecosystem and is usually designed as a "utility token."

Stablecoins are a specific type of cryptocurrency designed to maintain a stable value, thereby reducing the risk of value fluctuations. Unlike other cryptocurrencies known for their high volatility, the value of stablecoins remains relatively constant. Stablecoins have various use cases, including trading, converting cryptocurrencies into fiat currency to mitigate trading risks, and serving as

a store of value, among others. They have gained popularity in recent years due to their ability to provide users with a reliable means of preserving stability and security in the cryptocurrency world. While stablecoins have proven to be valuable in ensuring stability in cryptocurrency trading and maintaining value compared to other cryptocurrencies, caution is necessary as there have been instances of stablecoin failures in the past (Gubareva, Bossman, & Teplova, 2023)

3 CONCLUSION

In conclusion, the rise of cryptocurrencies and blockchain technology marks a monumental shift in the landscape of finance and technology. From the introduction of Bitcoin to the diverse ecosystem of digital assets and decentralized applications, this revolution has redefined how we perceive and engage in financial transactions.

Cryptocurrencies offer unprecedented opportunities for individuals and businesses to participate in a borderless, decentralized economy. With features such as instant transactions, enhanced privacy, and lower costs, they empower users to take control of their financial assets and engage in transactions without intermediaries. Meanwhile, blockchain technology provides a transparent, immutable ledger that enhances security, efficiency, and trust in various industries, from finance to supply chain management.

However, challenges and risks remain amid the promise of decentralization and financial autonomy. Volatility in cryptocurrency markets, regulatory uncertainties, security vulnerabilities, and environmental concerns associated with mining demand careful consideration and proactive mitigation strategies. Additionally, scalability and interoperability issues hinder the widespread adoption of blockchain technology, necessitating ongoing research and development efforts.

Despite these challenges, the transformative potential of cryptocurrencies and blockchain technology remains undeniable. They promise to drive innovation, facilitate financial inclusion, and transform traditional business models. By embracing innovation, addressing regulatory concerns, and promoting responsible development, we can harness the full potential of these technologies to build a more inclusive, transparent, and efficient financial ecosystem.

In this rapidly changing landscape, it is essential for stakeholders - including governments, businesses, and technology innovators - to collaborate. Together, we can overcome challenges, drive innovation, and unlock the transformative power of cryptocurrencies and blockchain technology to create a more equitable and sustainable future for all.

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ARMENIA'S ENVIRONMENTAL DIPLOMACY: UTILIZING INSTITUTIONAL PRECONDITIONS

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Abstract

Environmental security does not recognize political borders. Despite the will of the neighboring countries, common environmental threats exist and require careful assessment and joint efforts to reduce and eliminate them. During many natural and techno gene disasters, as well as pandemics and other trends, as indicated in the works of many international experts, countries face similar challenges. As can be noticed from recent developments, common environmental threats often compel us to deal even with parties involved in armed conflicts. The significance of discussing risks and ways of unofficially reducing them is emphasized, along with the need to invite impartial professionals in environmental security with a calm demeanor on both sides. It is also significant to count on issues of common interest in which technical cooperation is possible with the help of international structures and flexible approaches, as well as a technically well-structured agenda for the environment followed by monitoring political events to shape dialogue in a relevant and developmental context. In addition, financing cross-border cooperation needs external support.

Keywords: *Cross-border cooperation. Environmental diplomacy. Common threats. International organizations. Political interests.*

1 INTRODUCTION

From the point of view of security and sustainable development in the region, there is perhaps no more natural contributing factor than the "forced" cooperation between neighboring states aimed at reducing and neutralizing common environmental threats. This factor itself cannot contribute to any positive process if there is no awareness of it. Neighboring states often deliberately ignore the

general nature of environmental threats until the damage they suffer dominates conflicts motivated by economic and political interests (Libecap, 2014). Therefore, diplomacy, particularly environmental diplomacy, has a significant role in this issue. The pollution of the air basin, the violation of the ecological balance formed around rivers and them, the turbidity of drinking water sources, the fires of forests and mines, and other phenomena are not exceptions in the case of Armenia, Azerbaijan, and neighboring countries. It is not a secret that the drinking water is causing irreparable brain damage. Those threats continue

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even today when the necessary steps are not taken to ensure environmental security in the region in a bilateral and multilateral format.

2 METHODOLOGY AND INSTITUTIONAL FRAMEWORK

Although the practice of environmental diplomacy has existed for a long time, its place in the international arena has only recently been recognized. COVID-19 was another lesson for the nations to deal with each other to reduce common threats (Halabowski & Rzymiski, 2021). Already in the 14th century, European powers demonstrated international efforts to protect the environment when they agreed to conclude agreements on the fishing resources regulation. In the following centuries, environmental diplomacy acquired a multilateral dimension, culminating in the first multilateral Stockholm Summit organization in 1972 to address environmental issues (Ali & Vladich, 2016) (Orsini, 2020). As a result, the United Nations created the United Nations Environment Program (UNEP). Besides this, the summit defined the issue of the environment as an international issue. During this period, the term “environmental diplomacy” and its content were formalized and popularized (Ali & Vladich, 2016). In 1992, two decades after its establishment, the UNEP Earth Summit was held in Rio de Janeiro, Brazil. This summit included broader themes, issues, and actors in the further development of environmental diplomacy (Ali & Vladich, 2016). The Earth Summit also popularized multilateral agreements to address and manage regional and global environmental issues (Dorsey, 2014).

As for the concept of environmental diplomacy, it has changed over time.

Subject-wise, environmental diplomacy is theoretically exclusively concerned with environmental issues (O'Neill, 2017), but in practice, it addresses cross-cutting issues related to topics such as intellectual property, health, security, trade, and energy, among others (Orsini, 2020).

Environmental diplomacy usually leads to the signing of agreements at different levels (bilateral, multilateral, and global) to ensure the fulfillment of agreed obligations (Li, Zakari, & Tawiah, 2020). Considering UNEP data, Susskind and Ali (2014) and Li, Zakari, and Tawiah (2020) noted that there

are more than five hundred internationally recognized agreements related to the environment.

3 ANALYSIS

In the post-pandemic world, environmental diplomacy gained vital importance at the international level. In September 2020, world leaders identified environmental protection as a central theme for post-pandemic recovery (Gopinath, 2020). Moreover, environmental diplomacy has created opportunities to connect environmental protection and peacebuilding. In this regard, it should be Armenia's goal that UNEP uses its relatively apolitical and neutral position and scientific foundations to promote discussion and/or cooperation on environmental issues among conflicting or former conflicting groups in our region. That applies not only to Armenia and Azerbaijan, but also to Georgia, Russia, Turkey, and Iran. Environmental diplomacy can apply the concept of using natural resources and environmental issues as a platform for cooperation, dialogue, and trust building. On the other hand, Armenia's environmental diplomacy should aim to transform the conflict over resources into a basis for sustainable cooperation, with the goal that sustainable governance can create the basis for long-term stability and peace. At the same time, we must consider international learning experiences and lessons and encounter obstacles. The David Jensen and Denis Hamro-Drotz studies (2012) provide the basis for helpful conclusions that we can localize with examples from our region. In particular, lessons learned from environmental diplomacy between Israel and Palestine before the 2023 armed conflict may include the following:

- Common environmental threats can be a source of cooperation even between hostile parties.
- Diplomacy should be quiet, without advertising successes, to achieve success.
- Such negotiations require devoted, experienced individuals with strong environmental and political skills and diplomatic tact. Former parliamentarians and former ministers of the environment are the best, provided that their candidacies are seen as neutral and credible factors on both sides.

- Finding practical solutions requires ingenuity to find issues of common interest where technical cooperation is possible and where there is an understanding of the importance and implications of any minor problem.
- High-level politics can always prevent moving forward. New attempts are unavoidable when discussions fail due to other political factors. It takes a lot of time.
- There is a need and utility for UNDP to provide high-quality technical information that allows both sides to understand the nature of the problem.

Equally helpful has been environmental diplomacy between Iran and Afghanistan, the lessons of which may include the following:

- Environmental diplomacy is time-consuming, labor-intensive, and resource-intensive. It is a long-term investment that must be well planned and financed from the outset while maintaining the flexibility to adapt to demand-driven needs and changes in the negotiation trajectory.
- A strong technical understanding of the environmental problem and its history is vital; UNEP's independent expert report served as an excellent source of objective information that helped eliminate political arguments and could not be disputed on technical grounds, "level the playing field" and reduce information asymmetries.
- Monitoring political developments is necessary to shape the dialogue in a relevant and developing context. Identifying policy opportunities and correctly timing interventions is crucial.
- The availability of potential funding for a cross-border management project is a powerful incentive to maintain the interests of both parties.

Examples of environmental diplomacy of Armenia's neighboring country are not limited to this. The settlement of problems between Iran and Iraq is also instructive. Lessons learned from this example include:

- In our region, where tensions over resources are high, it is important to support dialogue and basic communication before touching on sensitive political issues. In the beginning stage, the objectives should be limited, and

the potential political outcomes kept open. It is not necessary to raise the expectations of political agreement. At the beginning of the Iraq-Iran dialogue, although the parties were not prepared to discuss specific issues in the marshes, they could discuss general water management principles. After an initial exchange of views on best practices, the process led to the exchange of technical information on wetlands. Both sides agreed on the importance of the meeting and requested additional assistance from UNEP.

- It is significant to ensure, as far as possible, that the parties present the same level of information at the initial stages of the dialogue. In the case of the marshes, the Iranian delegation presented its long-term vision, including plans to build a dam and reservoir.
- Water is a topic of great political interest. Water issues can be linked to agriculture and food security (International Panel, 2017) and other political topics like, i.e., energy. Other ministries may also be interested in technical dialogues. This Marshland's proposal attracted the attention of other ministries, including the Foreign Office. That gave the whole process a higher profile overall, more media coverage, and could lead to political issues that might not have existed had the technical and narrower focus been maintained.

Finally, a significant experience of environmental diplomacy has been gained in the relations between North and South Sudan. This intervention gives us several lessons:

- As in most other cases discussed in this paper, the main purpose of the initial meeting was to bring the two groups together without specifying specific technical goals and objectives. The agenda was essentially open to participants. Most of those involved had never met, and communication between the North and the South Sudan environmental ministries essentially was non-existent. The initial goal was to exchange information and build trust between the parties. At the second meeting, when the environment ministers presented themselves, the aim was to facilitate the process by allowing the participants to suggest the content.

- Using the PCEA as an entry point for initial engagement between the parties is a useful tool. This approach ensures the inclusion of local knowledge, facilitates local involvement and ownership, and helps identify any key political tensions. This can help the peace process to identify threats to peace over natural resources, as well as pave the way for inter-agency cooperation.
- Public ownership is essential to maintain and monitor the momentum of the process. However, when stakeholder consultations are held in the context of the PCEA, it is significant to consider that the final report must be an independent product of UNEP and that UNEP must verify all facts against objective sources of information. The report was disseminated to stakeholders immediately after the launch to ensure fast-tracking.

How important is all this for Armenia? After all, every country and region has its characteristics, and what makes it hard to evaluate these cases and reach general conclusions are their big differences. However, water and air pollution, reduction of forest area, soil salinization and degradation, landscape changes, threats to biodiversity, natural disasters, and the effects of climate change are still present in Armenia and the mentioned countries. Moreover, during the last 44-day war, huge damage was done to the nature, natural resources, and environment of both Artsakh and Armenia. It can be considered a part of the war of resources and natural resources worldwide. That proved the 44-day and other "one-day wars" provoked by neighboring Azerbaijan, which also had the goal of taking natural resources, water resources, hydropower plants, and mineral resources. The neighboring country has captured the very areas that are water catchment basins, mines, and forest areas, and by losing all that, the country loses its vitality. After the 44-day war, Artsakh's capital was water-deprived. The Shikahoghi reserve, with almost all of Stepanakret's water supply, was under the control of Azerbaijan. Even before the war ended, on October 26, 2020, when the Zangelan region was still under Armenia's control, and it was not clear how the war would end, the Ministry of Environment of Azerbaijan signed an agreement and announced a tender, and the winner of that tender was the Anglo-Asian corporation.

Azerbaijan signed an agreement with the same organization with several mines in the territory of Artsakh (including the Kasheni mine). Therefore, environmental diplomacy also aims to preserve and develop the existing natural resources to ensure the country's economic independence and security. As for the possible localization of the learning experience of different countries studied, in general, the following can be considered.

First, environmental diplomacy in our case is almost impossible to imagine without bona fide mediators, an international organization, or a neutral country. In addition, it is significant for such mediation negotiations to consider what already exists. All cultures, societies, or nations have mechanisms for creating dialogue between groups and mediating disputes. Where they have experienced conflict, local and traditional processes and institutions for consensus building and dispute resolution can create many opportunities for environmental diplomacy. At the same time, if these mechanisms lack political legitimacy, it may require a new alternative process. National ownership and acceptance of the process is vital. The level of political commitment among the parties involved in implementing the agreed measures and translating them into concrete results is a critical success factor. Capacity building for environmental diplomacy interventions is particularly necessary in situations where one party is weaker than the other, capacity building should be phased so that initial efforts focus on building the technical and institutional capacity of the weaker party. A neutral third party, whether a local stakeholder, NGO, business interest, international organization, or national government, can pressure or encourage conflicting parties to build peace, and is often necessary to advance the agenda. A third party can have multiple roles and use different strategies to advance the agenda. It can provide a neutral platform for discussion, unbiased information, or technical expertise in the form of environmental challenges cost estimations. Both parties can accept it. At the international level, the financial support promises and sanctions threats can be used to encourage the parties involved to continue cooperation. A third party may also be useful in providing international arbitration mechanisms or monitoring capacity. In

environmental diplomacy, long-term commitment, engagement, and funding are vital. There are few "quick wins" in environmental diplomacy and peacebuilding. Staying engaged over time is a significant challenge. The long-term nature of building trust and cooperation around natural resource management, addressing pollution hotspots, or collaborating to respond to natural disasters makes one- and two-year project timelines unrealistic. For environmental diplomacy to be effective in the long term, resources must also be allocated to support program implementation. Otherwise, lack of funding can be a limiting factor. When engaging in ongoing dialogues, Armenia should aim to hold at least 1-2 meetings per year to at least maintain continuity, especially when government changes are expected in negotiating countries. International experience shows that it is important to strike the right balance between technical and political cooperation. If the issues discussed are too narrow and too technical, they may have little impact on broader peacebuilding efforts. However, if environmental diplomacy is too quickly politicized, the process can stall due to political differences between the parties involved.

In the case of environmental diplomacy between Armenia, Artsakh, Azerbaijan, and Turkey, it is important to set realistic goals. Collaborative programs that may raise expectations but are unrealistic may be ineffective.

Issues of vital interest, on the contrary, can contribute to the achievement of common agreements between the parties (Susskind & Ali, 2014). For example, in recent years, the neighboring countries Turkey, Iran, Azerbaijan, and Georgia have turned their attention to using the opportunities of Lake Sevan, the only source of drinking water in the region. On the other hand,

the problems of Lake Sevan are increasing rather than decreasing. Due to the lowering of the lake level, the water quality has changed. It was caused by agricultural activities and domestic and industrial waste. The minerality of the inflowing water increased 1.5 times. A large amount of mineral phosphorus is replaced by nitrogen. The average annual water transparency has increased from 12 meters to 4.5 meters, which is a consequence of the development of mining activities in the Sevan basin. Therefore, the measures against the decline of the lake level and the degradation of the ecological system should be considered not in isolation, but in the context of cooperation on regional environmental issues, and security and peace should be made its first condition.

The necessity of traditional diplomacy cannot be underestimated in all of this. These functions also apply to scientists who may prepare documents or be logistical coordinators. Without tact and professionalism, both parties can make mistakes that may disrupt the process.

4 CONCLUSIONS

Common environmental threats can be good starting points. As a rule, the rationale for environmental cooperation and security becomes particularly clear when a common threat exists and requires the cooperation of the parties involved. In the case of a joint environmental crisis, a joint emergency response can be an opportunity for further cooperation and building trust between the parties. Examples of common threats or crises are aspects related to climate change, health problems, or pollution. Developing joint early warning systems before a disaster or joint recovery measures can provide an effective start.

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SILENT WARFARE: UNDERSTANDING THE IMPACT OF CYBER BLOCKADES AND SANCTIONS

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Abstract

Traditionally, experts considered several blockades, including sea and land, with the development of aircraft transportation - air, and with the advent of space technology and special satellites - space. Also, information blockades have been introduced with the rapid development of computer technology and communication tools. Each type of blockade had its historical characteristics; they differed in costs and, of course, efficiency. In the second half and at the end of the 20th century, scientists operated the term cyber blockade and restrictions in cyberspace. The paper sequentially considers physical environments (domains): air, land, sea, outer space, information space, and cyberspace. Multiple definitions of cyberspace have emerged as this concept evolves and becomes more nuanced in response to rapid developments in the technical, technological, economic, and social dimensions of modern life. Due to their potential, cyber-attacks and cyber warfare have garnered significant attention considering the ongoing development of society and business. Cyber-attacks are carried out regularly - against government agencies, military and civilian departments, and private businesses. The growing dependence of countries on cyberspace can play a negative role in the process of confrontation. The enemy can attack those areas where cyberspace is a decisive element. The authors discussed the questions of cyber-blockade efficiency.

Keywords: Cyber Domain, Cyberspace, Cyber Attacks, Cyber War, Cyber Blockade, Cyber Sanctions

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1 INTRODUCTION

The organization and operation of sanctions in cyberspace is a new area that needs research. Cyber sanctions appeared as the new political tool and weapon of influence. With the development of information technologies, under the influence of which the digital environment forms, the latter has become an arena of competition between the leading states in terms of information. In the digital environment, a system of challenges forms for the individual, society, and the state.

Consequently, cyber sanctions researchers defined as economic and financial measures aimed at changing the targets' behavior using malicious actions in cyberspace and/or intrusions.

On the other side, a cyber-blockade is a specially created situation caused by an attack on cyberinfrastructure or information systems, creating obstacles to a state's access to cyberspace and preventing the transfer of data beyond geographic boundaries.

The duration of a blockade is a secondary factor that matters only from the point of view of creating and achieving the desired effect. Information on many actors at different levels related to the role of anonymity, the speed of a cyber-attack, and the cost of cyber-blocking are required to analyze and evaluate the "cyber blockade" category. All this represents significant deviations from experience.

Ultimately, cyber blockades can be a tool of international relations and sanctions. They are an effective and inexpensive method of the counterparties' access control to modern critical infrastructure facilities and can be implemented in such a way as to increase the anonymity of the perpetrators of the attack or plausible deniability, thus reducing the risk of retaliation.

2 LITERATURE REVIEW

The main sources related to our research problems are the works of Alison Lawlor Russell (2014) and William D. Bryant (2016). Russell's book stands out in this series as it is the first to examine the phenomena of blockade operations

in cyberspace, which are large-scale attacks on infrastructure or systems that aim to prevent an entire state from sending or receiving electronic data. Cyber blockades can take place through digital, physical, and/or electromagnetic means, and their emergence in cyberspace has significant implications for international law and our understanding of cyber warfare.

In examining this topic, we analyzed a long list of sources and grouped them into several categories. The first group consists of works that aim to investigate sanctions as an economic and political leverage to pressure certain states. That includes publications by the United Nations, the Organization for Economic Co-operation and Development (OECD), the Organization for Security and Co-operation in Europe (OSCE), and others. Some notable examples include works by Golnoosh Hakimdavar (2014), Lee Jones (2015), and David Cortright and George A. Lopez (2018).

The second group includes papers that discuss the traditional and new domains of conflict, particularly cyberspace. The military researchers' approaches in defining the composition and structure of cyberspace we consolidated into a distinct sub-group. It includes articles by Y.I. Starodubtsev, P.V. Zakalkin, and S.A. Ivanov (2020), Kovalev, A. P., Sotnik, S. A., and Sotnik, D. S. (2023), which explores the main objectives of technosphere warfare and ways of achieving them. They formalize the notion of cyber weapons and formulate an approach to estimating their combat potential while also considering the main factors that condition the need to form specialized services of the Armed Forces intended for combat actions in cyberspace. The work of (Jones, 2015) is also noteworthy.

It is significant to note the use of developed models for each domain, such as the Model of Gaining and Utilizing Land Superiority, the Model of Gaining and Utilizing Maritime Superiority, the Model of Gaining and Utilizing Air Superiority, the Model of Gaining and Utilizing Cyberspace Superiority, Domain Superiority Model, Complete Model of Local Cyberspace Superiority, and

others. The model proposed by M. Libicki (2007) should also be analyzed and utilized separately.

Political and economic sanctions were being used long before our time. The chapter "The History and Effectiveness of Economic Coercion" by author Irina Bogdanova (2022) in the monograph is of interest, as it provides a historical overview of the sanctions used in international law and the protection of human rights. The temporal coverage of the history of economic coercion spans ancient Greece, the Roman and Byzantine empires, the Middle Ages, World War I, the period between World War I and II, the Cold War, and so on.

An additional source for researching historical aspects is the following book (Askari, 2003), which presents the history of economic sanctions.

3 RESEARCH METHODOLOGY

In the economic and political confrontation realm, a wide range of sanction mechanisms find application. Let us briefly consider the composition of economic sanctions. Economic sanctions include three directions: unilateral, multilateral by the UN or groups of countries, and new "smart" sanctions.

Unilateral sanctions include export sanctions (embargo); sanctions against import boycotts/tariffs and freezing diplomatic relations.

Multilateral sanctions by the UN or groups of countries include sanctions against arms trade (targeted/strategic sanctions), "comprehensive" sanctions (which are complemented by financial sanctions) and freezing of diplomatic relations.

"Smart" sanctions include financial sanctions and asset and investment freezes. Economic sanctions can have any objective combination (Alexander, 2009): modification of the target's behavior, retaliation, or punishment, or as a signal to the target or other third countries.

The "Global Sanctions Data Base (GSDB)" provided a classification of sanctions (Felbermayr, Kirilakha, Syropoulos, Yalcin, & Yotov, 2020). GSDB covers 729 publicly tracked, multilateral,

plurilateral, and purely bilateral sanctions from 1950 to 2022 (GSDB-R3, 2023). In addition, GSDB classifies these sanctions based on three significant aspects. Firstly, by the type of sanctions considered (e.g., trade, financial, travel sanctions, etc.). Secondly, the political objectives behind the observed sanctions. In particular, the GSDB system groups the sanctions objectives into separate categories (e.g., policy change, regime destabilization, prevention of war, human rights, etc.) of registered policy objectives. Thirdly, the perceived degree of success for each identified sanction is covered by five categories ranging from unsuccessful sanctions to the full agreement by the target with the sender's demands.

GSDB defines sanctions as mandatory restrictive measures applied by individual countries, groups of countries, the United Nations, and other international organizations to eliminate violations of international norms. The final objective is to encourage target countries to change their behavior or limit their actions. GSDB classified sanctions according to three crucial parameters: the type, objectives, and success.

GSDB classifies sanctions by type into five categories covering trade, financial activity, arms, military aid, travel, and another category called "other sanctions". The database also classifies sanctions based on their political objectives which include changing policies, destabilizing regimes, preventing wars, and promoting human rights, etc.

Lastly, the GSDB categorizes sanctions based on their perceived success degree, ranging from unsuccessful to fully achieving the sender's demands.

Overall, sanctions are a general tool used in economic and political conflict to modify the behavior of the target, seek revenge or punishment, or send a signal to the target or third-party countries. They can take various forms, including export sanctions, import boycotts/tariffs, asset freezes, investment freezes, etc. The GSDB provides a comprehensive classification of sanctions based on their type, political objectives, and perceived degree of success.

Table 1. Sanction types and impacted groups.

Type	Groups likely to be affected
Trade	- Export sanctions: producer groups and exporters harmed. Multiplier effects are likely in intermediate sectors. - Import sanctions: consumer groups (e.g. urban middle classes) and sectors reliant on imports harmed; import-competing industries may benefit. Embargoes on key commodities like oil may raise costs economy-wide. - Smugglers may receive windfall gains. - State agencies reliant on trade taxation may be harmed; revenues may also suffer if trade losses depress overall economic activity. - If sanctions cause exports to fall below imports, creating a balance of payments deficit, government intervention to depress import demand could slow economic activity, with further consequences.
Investment	- In the short term, local capitalists benefit because they may acquire departing foreign firms' assets cheaply, and since capital becomes scarcer, its returns increase. - In the longer term, lack of investment, technology transfer, and foreign expertise may depress productivity, profits, growth, and employment opportunities, particularly for skilled workers. Economy-wide multiplier effects are likely. - State apparatuses may be harmed directly if investment is an important source of foreign exchange, and indirectly if stunted growth damages tax revenues. - Disinvestment may depress demand for, and thus the value of, the local currency, depressing importers' purchasing power and increasing foreign debt repayment costs for both private and public borrowers
Aid and Finance	- Directly harms groups dependent on external aid/finance, e.g. for livelihoods or investment capital. Possible multiplier effects. - Directly harms state apparatuses dependent on overseas aid and loans; and indirectly the sectors upon which these resources would be spent.
Assets	Harms those with assets frozen and their dependents.
Monetary (currency manipulation)	- Importers, exporters, and consumers (private and public) suffer from price volatility and alterations in buying power. - Private and public borrowers with foreign-denominated loans face higher repayment costs. - The government may suffer an ideological blow if the national currency has ideological resonance. - Non-tradable or subsistence sectors will be less affected.
Arms	- May constrain the state's capacity for war or domestic coercion. - As with import embargoes more generally, potential windfall gains for domestic producers and smugglers.

Source: Lee Jones (2015, p. 44)

4 ANALYSIS

4.1 Domains/Types of Blockades

Not so long ago, humanity only had two physical domains - land and sea - each with different physical characteristics. People could only explore the sea with the help of specific technologies such as sailboats, steamships, and nuclear submarines. People used land only with the help of technical tools such as wheels, plows, and so on. Significant changes occurred a century ago

when a third physical domain appeared - aerospace. The launch of the first satellite in 1957 added a new domain - outer space. The development of the computer and communication technology industry and the creation of state and private information systems and networks served as the basis for another domain formation - the information domain. That created the prerequisites for the formation of cyberspace.

Figure 1 shows the interconnection of physical domains.

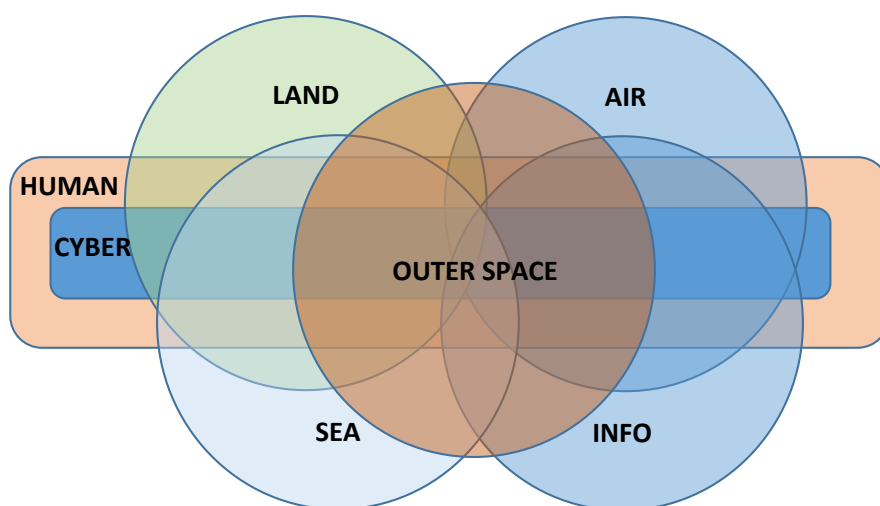


Figure 1 Domains Interconnections.

Source: Author's original work

Over time, a whole set of categories related to this domain appeared in common use - cybersecurity, cyber terrorism, cyber violence, cyber aggression, cybercrime, cyber victimization, cyber war, cyber defense, cyber-attack, cyber boycott, cyber blockade, cyber sanctions, computer zombie, cascade weapons, electronic bomb, and others.

It is to point out that the new domain is influential and has a very strong connection with all the others. Once technology is applied to every area of human life, these connections create significant dependencies between all domains. Moreover, this means that when affecting one domain, others will be affected also.

A very significant aspect in the domain and cross-domain confrontation is humans. Countries must use their people to overcome the challenges of being outnumbered, outdistanced, but mainly "outlearned" by adversaries. In the context of cyberspace management, agile and adaptive development through education and training is crucial to keep pace with the rapidly developing technical, technological, economic, and social aspects of life.

4.2 Cyberspace – a New Arena of Conflict

Recently, a sixth domain was added - cyberspace. Analysts propose numerous definitions for cyberspace, including one that describes it as a

virtual environment in which digital information transmits over computer networks. Another definition is that cyberspace is a global domain within the information environment, consisting of interdependent information network infrastructures with stored and circulating data, including the Internet, data transmission networks, computer systems, and the processors and controllers used (Joint Staff, 2018). A review of several definitions of cyberspace has been conducted by Kuehl (2017). However, the author notes that over time, this category will change and become more specific depending on the rapidly developing technical, technological, economic, and social aspects of our lives. Other definitions include:

1. Electronic (including photo-electronic, etc.) environment through which information is created, transmitted, received, stored, processed, and destroyed (Godwin III, Kulpin, Rauscher, & Yaschenko, 2014).
2. A global area of the information space that represents an interconnected network of information system infrastructures, including the Internet, telecommunications networks, computer systems, embedded processors, and controllers (JP 1-02, 2019).
3. A complex environment that enables interaction between people, software, and services using globally distributed devices and information and communication technology networks (Cybersecurity, 2012).

4. Software that operates in computer devices, information that is stored (and transmitted) in these devices, or information that is created by these devices. The equipment and buildings in which these devices are located are also part of cyberspace (ITU-T Recommendation X.1121, 2004).

A more precise definition of cyberspace is given in. Cyberspace is an artificial, heterogeneous technological system with a multitude of operational and technological management organs at various levels. The process of creating and operating this system is not predetermined by the requirements of a single management system but operates in the interests of various heterogeneous, including antagonistic, management systems. The properties depend both, on the characteristics of its elements and the volume and properties of the processes implemented in the interests of internal and external consumers.

Many experts consider this new domain from the perspective of a new sphere of armed conflict. Naturally, we are interested in actions related to the implementation of a blockade in this new domain - a cyber blockade. A cyber blockade is a specially created situation caused by an attack on

the cyberinfrastructure or information systems that prevents a state's access to cyberspace, thereby preventing the transmission of data beyond its geographical borders.

It should be noted that there is a significant difference between a cyber-blockade and censorship or other forms of internal control that exist in government management practice. In this case, the government does not allow certain information to be obtained or transmitted, usually for reasons of internal stability. The cyber blockade must be effective in preventing the transmission of information, and the duration of the blockade is a secondary factor that only matters in terms of creating and achieving the desired effect. For example, a blockade that lasts only a few fractions of a second will have relatively little significance, but a blockade during a critical time (such as election day) or one that lasts for several weeks or months can be considered highly effective depending on the goals. As with a naval blockade, maintaining a cyber-blockade for a predetermined period is not mandatory. The important thing is the ultimate effectiveness of the blockade in achieving the desired goals.

Table 2. Similarities among Blockade Operations in Six Different Domains

	Maritime	Aerial	Land	Space	Info	Cyber
Actions	Prevent ingress/egress of ships or craft to or from ports or harbors	Prevent aircraft from entering airspace or No Fly Zone (NFZ)	Prevent entry to or exit from a specific city or region	Prevent entry into outer space	Prevent the transmission of information beyond national borders	Prevent the transmission of data beyond borders
Actors	States, independent territories	States, independent territories	States	States	States	States, non-state actors, individuals
Capabilities	Superior maritime capabilities; knowledge of the domain and opponent's vulnerabilities	Superior aerial capabilities; knowledge of the domain and opponent's vulnerabilities	Superior land capabilities; knowledge of the domain and opponent's vulnerabilities	Superior technological or economic capabilities; knowledge of opponent vulnerabilities	Historically sea-based capabilities to interfere with cables, knowledge of the domain, and opponent's vulnerabilities	Technological capability; knowledge of the domain and opponent's vulnerabilities
Presence of conflict	War or extant conflict	War or extant conflict	War	War or extant conflict	War	War or extant conflict
Role of neutrals	Rights protected	Rights protected	Rights protected	Rights protected	Rights protected	Neutrals are not specifically targeted, but consequences are difficult to predict

Source: (Russell, 2014, pp. 81, 184)

The following table provides a comparison of blockade operations in all domains.

It is considered necessary to provide the main conclusions drawn from the analysis of the category of cyber blockade presented.

Cyberspace is a physical network that can be manipulated to punish a counterparty by obstructing their access to the data flow necessary for security and prosperity. At the same time, cyber-blocking is an effective means of denial or hurdle of access to cyberspace.

A cyber blockade is a situation caused by an attack on cyberinfrastructure or systems that prevent government structures from accessing cyberspace, thereby preventing data transfer (input-output) beyond geographical boundaries. Cyber blockade is a legitimate tool of international state management and, like other types of blockades, can be considered an act of war (although ultimately the target state decides whether it wants to consider it as an act of war and potentially escalate the situation). Cyber blockades target entire states and attempt to cause mass disruptions in the functioning of critical infrastructure elements. The goal of the cyber blockade is to prevent the transfer of data beyond geographical boundaries by manipulating, controlling, or dominating cyberspace and related technologies to cause political, economic, social, or psychological harm to the opponent.

Actors use cyber blockades as a tool for international relations and sanctions as they are an effective and inexpensive method of controlling the opponent's access to modern networks. Moreover, that tool can be deployed with increased anonymity or enabling plausible deniability, thus reducing the risk of retaliation. In addition, there are alternative options for achieving the same result, especially for non-state actors.

States, proxy groups, non-state actors, or individuals can conduct cyber blockades if they have the resources and opportunities. However, non-state groups can also introduce a cyber-blockade if they possess the necessary technical skills to plan and coordinate a large-scale cyber-attack, targeting entire states. Physical attacks on cyber infrastructure require limited resources and

expertise; at a minimum, perpetrators must be able to detect and destroy key cyberinfrastructure. Electromagnetic attacks are usually part of state warfare and require significantly more resources to achieve. Thus, depending on the cyber blockade scenario (through digital, physical, or electromagnetic attacks), the capabilities and resources to conduct a cyber-attack can vary from relatively low (physical destruction of cables or terminals) to high and very high (electromagnetic attacks).

Cyber blockades can affect all aspects of cyberspace technology, including power grids, power stations, landline phone services, mobile phone services, financial systems, and so on. Cyber blockades, like other blockades, are essentially non-violent, but they can result in damage, destruction, or death depending on their implementation scenarios and impact on targets. Targets classified as "limited" under international law, such as hospitals, will still be limited in cyberspace.

Cyber blockades can be efficient tools for achieving specific goals, but they are not always the preferred option for actors. Depending on the goals and circumstances, decision-makers may choose more specialized cyber-attacks that can achieve more precise and sophisticated results (e.g. espionage or the destruction of specific systems) while maintaining the integrity and security of other systems.

Cyber-blockades can be established relatively quickly and at a low cost, depending on the method of attack used.

Cyber-blockades are technically feasible against any country. However, they are easier to achieve against smaller countries. Developed countries usually have more connections to the cyber domain, creating a more resilient network of connections between that country and other countries.

Cyber blockades can be seen as a subset of information blockades because they are aimed at the transmission of information. However, information blockades have not received wide recognition, so this classification may not be the most useful for policymakers. In addition to being a subset of information blockades, cyber

blockades should also be considered separately as they may occur in a specific domain. Therefore, cyber blockades can affect both individual domains and/or a subset of information domains, affecting two or more domains.

Cyber-blockades may exist, but they should not always be considered acts of war. Depending on the circumstances and context, which is crucial, a cyber blockade may be considered a complete blockade. However, a peaceful blockade is a form of coercive diplomacy, in which the blocking state declares that it does not seek to provoke war but rather to compel the blockaded state to yield to its demands. It is highly likely that at some point soon, the international community will attempt to introduce cyber blockades as a form of sanction against states that violate international law.

The increase in the number and diversity of actors in cyberspace creates repudiation challenges and enables attacks from anonymous platforms. Instead of relying on a traditional deterrence model, which may be insufficiently effective in cyberspace, states must focus on creating reliable information protection and backup systems.

Public-private partnerships are particularly important for cyber-blocking because the cyber domain is not purely public - it is owned and mainly managed by private corporations or individuals. At the same time, governments are tasked with protecting it as part of critical national infrastructure. Other types of blockades have affected the private sector to varying degrees (such as commercial ships, commercial airplanes, or even telegraph cables), but cyber blocking represents the first case where public and private interests are much interconnected.

As the topology of cyberspace and its actors change, so do the capabilities and vulnerabilities associated with cyber blockades. Technological progress reduces vulnerabilities in some areas, while changes in cyberspace itself are likely to

uncover new vulnerabilities that cyber-threat actors will exploit.

5 CONCLUSIONS

Analysis of the impact of the sanctions (traditional and new "smart" ones) using institutional, economic, and cultural dimensions of processes that have been observed recently indicates the transformation of the "war-prevention tool" into a weapon of geo-economic warfare.

In other words, the mechanisms of sanctions and blockades can be followed through an assessment of the internal economic contradictions that have intensified, as well as between leading states. Sanctions reinforce and increase the contradiction between transnational capital and national labor; sanctions can disconnect the target state from global value chains, lowering its economic and fiscal capabilities; Sanctions can increase the contradiction between freedom and domination and push the population to government opposition, which inevitably takes repression measures to democratic tendencies in society and enforces its control over strategic sectors of the economy.

In conclusion, cyber blockades and cyber-restricted zones are serious problems in the modern world. They imply threats to national security, commercial interests, and freedom of expression. Therefore, states should develop reliable information protection and reservation systems, as well as establish public-private partnerships to effectively combat cyber threats.

However, as cyberspace topology and actors change, so do the opportunities and vulnerabilities associated with cyber blockades. Therefore, it is necessary to constantly improve and update protection systems and apply modern technologies for more effective counteraction against cyber threats.

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ANALYSIS OF CHINA-CEEC INNOVATION AND ENTREPRENEURSHIP COLLABORATION - CASE STUDY ON SLOVENIA

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Abstract

This paper presents a comprehensive exploration of the multifaceted collaboration between China and Eastern European Countries (China-CEEC), focusing on the China-CEEC Innovation Cooperation Research Center and the First Youth Innovation and Entrepreneurship Competition. Employing a case study approach with Slovenia as the focal point, the analysis integrates comparative metrics, including the Global Innovation Index, Expert Ratings of Entrepreneurial Framework Conditions, Intellectual Property Rankings, and the Global Talent Competitiveness Index. Furthermore, the comparative analyses presented in the paper underscore China's global leadership in various dimensions, particularly in intellectual property. This study contributes to a detailed understanding of the dynamic collaboration between China and Eastern European countries, showcasing a commitment to innovation and sustainable development by emphasizing the China-CEEC Innovation Cooperation initiative, the First China-CEEC Youth Innovation and Entrepreneurship Competition, and its role in fostering collaboration among young innovators and entrepreneurs. It examines participation criteria,

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project categories, and the comprehensive support provided to winners, including matchmaking services, policy assistance, and post-competition benefits. This collaborative initiative stands as a testament to the enduring friendship and commitment within China-CEEC Cooperation, fostering innovation and entrepreneurship.

Keywords: Innovation, Entrepreneurship, China-CEEC Collaboration, Slovenia, China

1 INTRODUCTION

The paper examines the cooperation between China and Eastern European Countries (China-CEEC) Cooperation initiated in 2012, focusing on its multifaceted collaborations, including the China-CEEC Innovation Cooperation Research Center and the Youth Innovation and Entrepreneurship Competition, while emphasizing comparative analyses between China and Slovenia. These analyses encompass expert ratings of entrepreneurial framework conditions, intellectual property rankings, and standings in the Global Innovation Index. The paper concludes by positioning the China-CEEC Cooperation as a platform for cross-regional collaboration, emphasizing innovation, engagement, and a commitment to sustainable development for win-win cooperation.

China-CEEC Cooperation, initiated on April 26, 2012, serves as a cross-regional collaboration platform. Based on long-standing friendships, this initiative is founded upon the collective dedication of all participants to achieve mutually beneficial collaboration and progress. As Chinese President Xi Jinping highlighted at the China-CEEC Summit: "...with a commitment to win-win cooperation and common development and a resolve to create a better future together..." (China-CEEC, 2022). Since its establishment, China-CEEC Cooperation has experienced notable growth, focused primarily on practical collaboration. President Xi further emphasized the significant progress, stating that "...trade between China and CEE countries is nearly 85 percent bigger than nine years ago, and growth in China's import from CEE countries is 22 percentage points higher than that of export." (China-CEEC, 2022).

Guided by the Leaders' Summit, this initiative has expanded its reach into various sectors, including economy and trade, culture, education, youth exchange, agriculture, tourism, science and technology, health, think-tank exchange, and sub-national cooperation. The outcomes of this

cooperation have proven fruitful across these diverse areas, playing a constructive role in strengthening bilateral ties between China and Central and Eastern European countries and contributing to the broader enrichment of China-Europe relations (China-CEEC, 2023a).

The China-CEEC cooperation operates through dual mechanisms: the central government and local administrations. The enthusiastic participation of numerous local governments has sparked unprecedented fervor, marking a dynamic phase in this collaborative endeavor. The central focus is to facilitate the global expansion of local enterprises, promoting heightened internationalization, and fortifying their global image and openness (Zuokui, 2021).

Building upon this commitment to innovation, the China-CEEC Cooperation initiated a significant follow-up through the hosting of the First China-CEEC Youth Innovation and Entrepreneurship Competition, conducted in May 2023, serving as a dedicated platform for the exchange of ideas, learning, and collaboration among young innovators and entrepreneurs from both China and Central and Eastern European countries. Organized by the Department of International Cooperation and the Department of Foreign Expert Services of the Ministry of Science and Technology of China, in collaboration with the Zhejiang Provincial Science and Technology Department, Ningbo Municipal People's Government, and co-organized by the Talent Office of the CPC Ningbo Municipal Committee, Ningbo Science and Technology Bureau, and China-CEEC Innovation Cooperation Research Center. Joint through the collaborative efforts of organizers and key academic and research entities partners: Ministry of Education and Science of North Macedonia, Technology Transfer and Innovation Center of Faculty of Electrical Engineering and Information Technologies, Ss Cyril and Methodius University in Skopje, STARTIT, Polish Academy of Sciences, Warsaw Society, Greek Research and Innovation

Secretariat, Hungarian R&D and Innovation Agency, Zagreb Innovation Center, Zilina University, "Todor Kableshkov" Higher School of Transport in Bulgaria, Novi Sad Science Park of Serbia, Steinbeis Technology Transfer Management Company in Romania and with Slovenian Innovation Hub (China-CEEC Innovation Cooperation Research Center, 2023a).

The competition was open to universities, research institutes, enterprises, and other social teams in China and Central and Eastern European countries. The eligibility criteria were stringent, requiring participating youth innovation teams to demonstrate innovative ability and high growth potential. The teams were primarily engaged in the research and development, manufacturing, and service of high-tech products, holding intellectual property rights and free of property disputes. Projects eligible for entry had to be in the pre-market stage, excluding large-scale consumer purchases and public sales in the local market. The competition accepted projects in the stage of limited product testing, discontinuous production, certification, or those ready to put products on the market. The projects submitted addressed major social, economic, development, or environmental challenges, providing innovative solutions aimed at improving social living conditions in both China and Central and Eastern European countries. The CEE countries encompassed Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Romania, Bulgaria, Albania, Northern Macedonia, and Greece. Participants showcased innovative projects in crucial areas including Digital Innovation, Biomedicine and Healthcare, and Advanced Materials. The competition unfolded in two key stages: the Preliminary Round, where expert evaluations determined finalists based on submitted documents, and the Final Round, held offline in Ningbo, China, on May 17 and 18, 2023, presented as a roadshow. Prizes were awarded to winners in each category, and during the final round, the committee provided comprehensive support, including accommodation, meals, and transportation. Moreover, winners benefited from post-competition support, encompassing matchmaking services and policy assistance, further exemplifying the holistic approach of the China-CEEC Innovation Cooperation initiative.

(China-CEEC Innovation Cooperation Research Center, 2023b).

The China-CEEC Youth Innovation and Entrepreneurship Competition stood as a testament to the collaborative efforts between China and Central and Eastern European countries in nurturing innovation, fostering cross-cultural exchanges, and addressing shared challenges for the betterment of societies. The event marked a milestone in the promotion of youth-led innovation and entrepreneurship in the region.

In addition to the China-CEEC Innovation Cooperation, another significant implementation is the pilot project Accelerator Program for start-ups in the field of agriculture between China and the countries of Central and Eastern Europe. The Accelerator Program aims to foster innovation in areas crucial for sustainable agriculture, including reducing the carbon footprint in the HoReCa industry, GIS in agriculture, food waste solutions, carbon neutrality, food technologies, irrigation systems, and the circular economy of food and beverage supply. The program signifies the commitment of the CEEC to collaborative and innovative solutions for sustainable agricultural development in partnership with China (APACCEEC, 2023).

2 COMPARATIVE ANALYSIS OF INNOVATION IN CHINA AND SLOVENIA

In the Global Innovation Index 2023, China and Slovenia showcase distinct standings across various metrics. China secures the 12th rank among the 132 economies considered, standing 1st among the 33 upper-middle-income group economies, and securing the 3rd position among the 16 economies in the Southeast Asia, East Asia, and Oceania region. On the other hand, Slovenia is positioned 33rd globally, achieving the 32nd rank within the high-income group of 50 economies and standing at 21st among the 39 European economies evaluated. This comparative analysis underscores China's notable lead in the overall index, particularly within its income group and the broader regional context, while Slovenia maintains a respectable global position but lags China in these key dimensions, signaling

divergent levels of innovation competitiveness (Soumitra et al., 2023).

Figure 1 represents the Expert Ratings of the Entrepreneurial Framework Conditions for China and Slovenia in 2022, assessed on a scale from 0 to 10 (0 = very inadequate insufficient status, 10 = very adequate sufficient status). The scores indicate a thorough evaluation of factors essential to entrepreneurial success, revealing that China outperforms Slovenia across various dimensions in entrepreneurial framework conditions. Specifically, China excels in crucial areas such as Entrepreneurial Finance, Ease of Access to Entrepreneurial Finance, Government Policy (Support and Relevance), Government Policy (Taxes and Bureaucracy), and Physical Infrastructure. Notably, China exhibits a higher rating in Market Dynamics, indicating a more dynamic market entry environment. Meanwhile, Slovenia demonstrates strengths in Commercial and Professional Infrastructure, and maintaining competitive scores in Entrepreneurial Education at School and Ease of Entry: Burdens and Regulation.

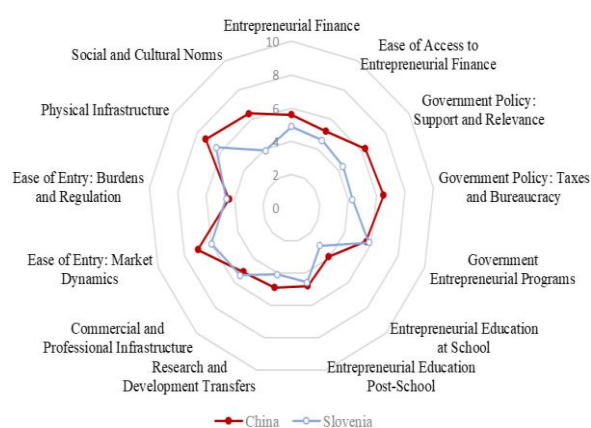


Fig. 1 Expert Ratings of the Entrepreneurial Framework Conditions for China and Slovenia in 2022

Source: (Hill et al., 2023)

Figure 2 represents the rankings for intellectual property in three categories: patent applications, trademark filings, and designs in applications, for both China and Slovenia. Rankings are depicted on a scale of 0 to 100, where first place is designated as 100, last place as 0, and 50 indicates the midpoint. As illustrated in Figure 2, China leads globally in all three categories of intellectual property: 1,586,339 patent applications, 8,561,984 trademark filings, and 1,408,921 designs in applications. In comparison,

Slovenia's rankings are as follows: 52nd in patent applications (811), 47th in trademark filings (53,579), and 33rd in designs in applications (7,638). China's substantial numbers underscore its dominance, while Slovenia maintains competitive rankings in the global landscape of intellectual property.

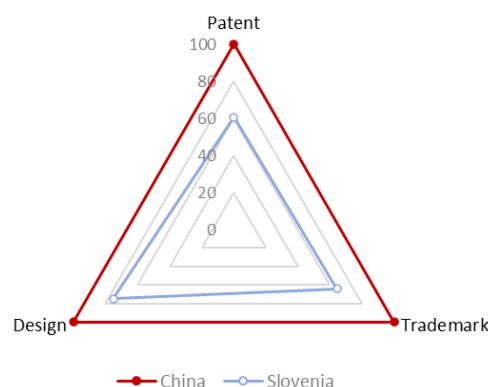


Fig. 2 Intellectual property ranking for China and Slovenia in 2022

Source: (WIPO, 2023)

Figure 3 presents The Global Talent Competitiveness Index for 2023, portraying scores across five pivotal pillars for China and Slovenia. China is ranked 40th out of 134, demonstrating notable strengths in the Enable and Grow pillars. In contrast, Slovenia secures the 28th rank, excelling in Attract, Retain, and Vocational and Technical Skills.

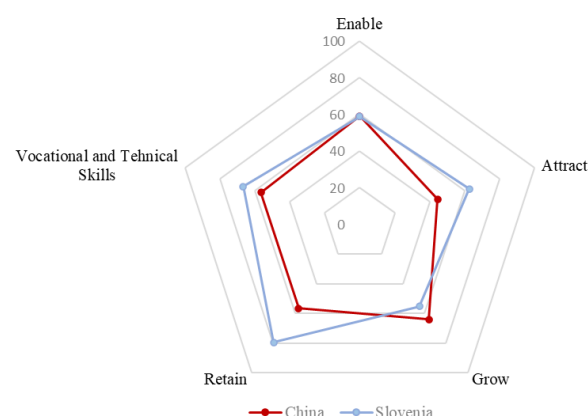


Fig. 3 The Global Talent Competitiveness Index by Pillar for China and Slovenia in 2023

Source: (Lanvin & Monteiro, 2023)

3 THE FIRST CHINA-CEEC YOUTH INNOVATION AND ENTREPRENEURSHIP COMPETITION – CASE STUDY

The China-CEEC Youth Innovation and Entrepreneurship Competition, alongside other

China-CEEC collaborations, promotes the exchange of ideas, learning, and collaboration among young innovators and entrepreneurs. By facilitating a collaborative spirit, China-CEEC accelerates innovation in both China and the CEEC, fostering win-win scenarios for the present and future.

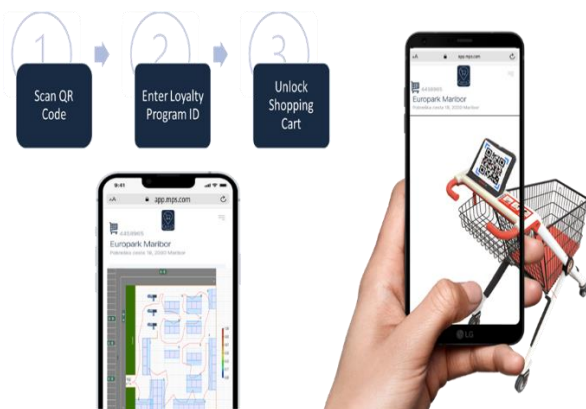


Fig. 4 Mall Positioning System

Source: Authors

As a participant in the finals of the China-CEEC Youth Innovation and Entrepreneurship Competition alongside Anej Grasic and Tine Dobnik, we had the opportunity to present and showcase an innovative idea, Mall Positioning System (MPS, Fig. 4), a smart shopping cart lock system which utilizes WiFi and NFC technologies to track the path of customers within the store, while simultaneously enhancing their shopping experience with a user-friendly web-based application that allows them to unlock their shopping carts in three simple steps. MPS can assist retailers in understanding customer preferences and purchasing behavior by monitoring customer store paths, collecting, and analyzing real-time data to develop informatics to identify their most profitable customer segments, and developing personalized promotions that

drive repeat purchases. MPS's unique value proposition is that it distinguishes itself by collecting identifying shopper data as it links the customer loyalty program ID to the shopping cart ID, locating customers in real-time, and offering a web-based application for non-loyalty app users, all while seamlessly integrating to the shopping carts.

Participating in the competition provided valuable mentorship, support, idea-sharing, and networking opportunities with young talents from China and CEEC. Additionally, we were offered follow-up support and policy assistance, enriching our overall experience.

4 CONCLUSIONS

China-CEEC Cooperation stands as a robust testament to the enduring friendship and commitment shared among its participants since its initiation in 2012. The multifaceted collaboration, spanning diverse sectors and operating through central and local mechanisms, has yielded notable successes in fostering practical cooperation. Initiatives like the China-CEEC Innovation Cooperation Research Center and the Youth Innovation and Entrepreneurship Competition reflect a commitment to innovation, youth empowerment, and sustainable development. The comparative analyses presented in the paper underscore China's global leadership in various dimensions, particularly in intellectual property. In essence, the China-CEEC Cooperation serves as a model for cross-regional collaboration, contributing not only to strengthening bilateral ties but also to the broader enrichment of global relations through innovation, engagement, and a commitment to sustainable development for win-win cooperation.

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ANALYSIS OF CHINA'S TRADE RELATIONS WITH CEEC

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Abstract

This paper provides an analysis of China's trade relations with Central and Eastern European Countries (CEEC), with a focus on Bosnia and Herzegovina (BIH), Bulgaria (BGR), Croatia (HRV), Romania (ROU), Serbia (SRB), and Slovenia (SVN). It underscores the fundamental principles of international trade and the reciprocal advantages arising from collaboration between China and these CEEC nations. The analysis explores economic indicators, including GDP, current account balance, merchandise exports and imports, and agricultural product trade. Additionally, the paper highlights the stable economic conditions in China, characterized by consistent interest rates and minimal consumer price index fluctuations. Building on the stable economic conditions in China, the paper emphasizes the potential for win-win collaboration without currency risk. It proposes a strategic partnership involving the supply of advanced financed machinery from China to CEEC nations in exchange for fixed quantities of crops. The objective is to cultivate mutual economic and technological growth within a dependable and predictable trade environment.

Keywords: International Trade, China-CEEC, Agriculture, Comparative advantage

1 INTRODUCTION

In exploring the dynamic landscape of China's trade relations with the Central and Eastern European Countries (CEEC), it is imperative to begin with a fundamental insight into international

economics — the recognition of the inherent advantages derived from trade. The exchange of goods and services between nations is, by and large, a mutually beneficial endeavor. Despite prevailing misconceptions, the belief that trade becomes detrimental, particularly in the presence of substantial disparities in productivity or wages, is not accurate (Krugman, Obstfeld, & Melitz, 2012, pp. 3-8). This realization is crucial as we delve into the multifaceted dimensions of China's

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trade engagements with the CEEC, where the benefits extend far beyond what many might perceive on the surface.

Countries partake in international trade for two fundamental reasons, both of which enhance the benefits they gain from participating in trade. In the first instance, nations engage in trade owing to their inherent differences. This enables countries to leverage their unique strengths by establishing agreements where each specializes in activities in which it excels. Furthermore, countries involve themselves in trade to achieve economies of scale in production. In practical terms, this means that if each country focuses on producing a limited range of goods, it can attain greater efficiency by producing each of these goods on a larger scale. This contrasts with the inefficiency that would arise if a country attempted to produce a diverse array of goods independently (Krugman, Obstfeld, & Melitz, 2012, pp. 23-50).

Building on the foundation of the importance of international trade, the collaboration between China and the Central and Eastern European Countries (CEEC) stands as a compelling example of leveraging unique strengths for mutual economic development. In a strategic move to promote economic growth, the "16+1 cooperation" mechanism was established, marking a significant milestone. The initiation of the China-CEEC economic and trade forum in 2011 further underscored the commitment to fostering economic ties. During the inaugural and subsequent forums held in Budapest and Warsaw, China actively engaged with 16 central and eastern European nations. These gatherings facilitated a shared understanding and consensus on the imperative to strengthen bilateral economic and trade cooperation, reflecting a harmonious convergence of interests and goals (Ruixia & Yuxin, 2009).

With Greece's participation, the platform evolved into 17+1, signifying improved China-EU relations. The 17+1 initiative aims to invigorate the Belt and Road Initiative (BRI) with CEE collaboration, holding enormous potential. Recent years have witnessed increased trade volumes and improved economic relations, supported by political and societal projects, emphasizing the platform's commitment to strengthening cooperation in economy and trade between China and the CEE

countries (Üncel & Güner, 2021). Serbia, a participant in the 17+1 community, has received notable investments from China in infrastructure, industry, and the energy sector. In acknowledgment of these investments, the Serbian government has implemented a visa-free agreement for Chinese citizens. Hungary, known for its longstanding friendship with China, has facilitated investments such as the Budapest-Belgrade railway and the Huawei European Supply Center. Along the Adriatic shore, Albania, Bosnia and Herzegovina, and Croatia have also witnessed significant Chinese investments, particularly in infrastructure projects. Noteworthy examples in Croatia include a spa resort in Krapinske Toplice and an investment in Rimac Automobili (Brinza, 2019)

Although the trade volume between China and the Central and Eastern European countries remains relatively modest, the trade dynamics exhibit a pronounced mutual complementarity. This is particularly evident in labor-intensive and capital-technology-intensive industries, presenting a notable advantage and considerable potential for future economic integration and trade expansion. Strengthening economic and trade collaboration between China and the CEEC holds the promise of fostering not only economic development but also enhancing social welfare for both parties involved. Addressing a persistent challenge is essential for advancing China's economic and trade relations with Central and Eastern European countries — namely, the prolonged issue of China's trade surplus with the region. Moreover, the current trade complementarity between China and the CEEC primarily involves mutual complementation between industries and lacks a closer cooperative relationship in terms of intra-industry complementation. Consequently, there is a shared imperative for China and the CEEC to actively encourage their respective enterprises to deepen economic cooperation and expand investments in other countries (Wang & Xu, 2019).

Building on the imperative for enhanced economic cooperation, one exemplary avenue lies in the sphere of agriculture fostering closer ties in the agricultural sector, both regions can capitalize on their unique strengths, leveraging technological advancements and sharing best practices. By cultivating stronger connections in the agricultural sector, both China and the Central and Eastern

European Countries (CEEC) can harness their distinct strengths, utilizing advancements in technology and exchanging best practices. This strategic alignment is reinforced by findings indicating that agricultural product trade between China and the CEE countries possesses characteristics such as high complementarity, substantial potential for products with comparative advantages, and a noticeable trend toward intra-industry trade. To fully unlock this potential, there is a shared imperative for China and the CEE countries to emphasize their comparative advantages and adjust the product structure of exports. This concerted effort is geared towards achieving mutual benefits and establishing a win-win outcome in bilateral trade, echoing the overarching call for heightened economic cooperation (Yu & Qi, 2015).

2 ECONOMIC OVERVIEW

China's economic overview in 2022 reveals a GDP of \$18,100,044 million and a per capita income of \$11,970. The country holds the top position in merchandise exports and the second position in imports, contributing to a trade surplus reflected in a current account balance of 2.3% of GDP, excluding intra-EU trade. Trade constitutes 18.5% of GDP, with a per capita trade figure of \$2,214. In the domain of commercial services, China ranks third in exports and second in imports. The country's merchandise exports total a substantial \$3,593,523 million, while merchandise imports are valued at \$2,716,151 million (WTO, 2023a).

China's agricultural product exports amounted to \$69,373 million, with top exports including 'Other food preparations' (HS2106) at \$3,269 million, Preparations of a kind used in animal feeding (HS2309) at \$2,987 million, Plants' parts otherwise preserved (HS2008) at \$2,944 million, Vegetable saps and extracts (HS1302) at \$2,753 million, and Onions, shallots, garlic, leeks (HS0703) at \$2,404 million. Contrarily, China's agricultural product imports significantly surpassed exports, reaching \$217,692 million. The major imports included Soya Beans (HS1201) at \$61,236 million, Meat of bovine animals, frozen (HS0202) at \$17,084 million, Maize (corn) (HS1005) at \$7,104 million, Other fruit, fresh (HS0810) at \$6,102 million, and Palm oil and its fractions (HS1511) at \$5,842 million (WTO, 2023a).

Table 1. Economic Indicators for Bosnia and Herzegovina (BIH), Bulgaria (BGR), Croatia (HRV), Romania (ROU), Serbia (SRB), and Slovenia (SVN)

	GDP	CAB	CHN-Imp
BIH	25.48	-3.9%	8.1%
BGR	89.12	-0.7%	5.8%
HRV	71.02	-1.2%	3.3%
ROU	301.85	-9.3%	5.1%
SRB	70.91	-6.9%	12.1%
SVN	62.17	-0.4%	11.9%

*GDP - Gross Domestic Product (2022, Current Prices, in Billion USD)

*CAB - Current Account Balance (2022, As % of GDP)

*CHN-Imp – China shares of country's total imports (2022, As % of Total Imports)

Table 2. International Trade Indicators for BIH, BGR, HRV, ROU, SRB, and SVN

	Exp-M	Imp-M	Exp-A	Imp-A
BIH	9.67	15.38	0.56	2.32
BGR	50.24	58.05	8.74	6.93
HRV	25.31	44.3	3.41	5.05
ROU	96.71	132.49	12.61	13.64
SRB	29.06	41.15	5.06	3.23
SVN	69.7	69.74	2.12	3.46

*Exp-M - Merchandise exports, f.o.b. (2022, Current Prices, in Billion USD)

*Imp-M - Merchandise imports, c.i.f. (2022, Current Prices, in Billion USD)

*Exp-A – Agricultural Products Exports, c.i.f. (2022, Current Prices, in Billion USD)

*Imp-A – Agricultural Products Imports, c.i.f. (2022, Current Prices, in Billion USD)

Table 1 and 2 provides a concise overview of the economic indicators for Bosnia and Herzegovina (BIH), Bulgaria (BGR), Croatia (HRV), Romania (ROU), Serbia (SRB), and Slovenia (SVN). This snapshot serves as a preliminary exploration, laying the groundwork to unravel the intricate dynamics of China's cooperative ventures with Central and Eastern European countries (CEEC). Through a closer examination, we aim to uncover the potential impact these collaborations may have on trade relations in the region.

Bosnia and Herzegovina's economic overview in 2022 showcases a GDP of \$25,484 million and a per capita income of \$6,643. The country ranks 102nd in merchandise exports and 94th in imports,

with a trade deficit indicated by a current account balance of -3.9% of GDP. Trade accounts for 47.5% of GDP, with a per capita trade figure of \$3,152. Commercial services are positioned 101st in exports and 153rd in imports. Economic ties are notably strong with the European Union, constituting 56.9% of imports. Serbia plays a significant role, contributing 10.8%, along with substantial shares from China (8.1%), Turkey (5.9%), and the United States (3.3%). Other regions contribute 15%. In terms of exports, the EU remains the dominant partner at 73.6%, followed by Serbia (13.9%), Montenegro (3.2%), Turkey (1.7%), and Switzerland (1.4%). The remaining 6.2% encompasses exports to other regions (WTO, 2023b).

Bulgaria's economic overview in 2022 showcases a GDP of \$89,115 million and a per capita income of \$11,851. Globally, it ranks 60th in both exports and imports for merchandise trade, with a trade per capita of \$7,304. Notably, the current account balance stands at -0.7% of GDP (excluding intra-EU trade), indicating a slight deficit. Importantly, 55.3% of Bulgaria's imports are from the European Union, demonstrating strong economic ties. The Russian Federation significantly contributes with 10.8%, followed by Turkey (8.4%), China (5.8%), and Ukraine (3.2%), with an additional 16.5% from other regions. Bulgaria's exports are primarily directed to the European Union (62.8%), emphasizing substantial economic ties, and include notable shares to Turkey (5.9%), Serbia (2.6%), Ukraine (2.4%), and the United States (2.2%), along with 24.1% to other regions (WTO, 2023c)

Croatia's economic overview in 2022 showcases a GDP of \$71,019 million and a per capita income of \$16,763. Globally, it stands 73rd in merchandise exports and 62nd in imports. The current account deficit is -1.2% of GDP (excluding intra-EU trade). Trade per capita is \$8,999, with commercial services at 48th in exports and 79th in imports, constituting 53.7% of GDP (excluding intra-EU trade). Imports heavily lean on the EU (70.6%), notably from the U.S. (7.6%), Serbia (3.5%), Bosnia and Herzegovina (3.4%), and China (3.3%). Diversification is evident, with 11.6% from other regions. Exports, primarily to the EU (68.7%), feature Bosnia and Herzegovina (10.4%)

and Serbia (6.2%). The U.S. takes 2.3%, while Turkey and other regions collectively make up 1.5% and 10.9% (WTO, 2023d).

Romania's economic overview in 2022 showcases a GDP of \$301,845 million and a per capita income of \$14,575. Globally, it secures the 43rd position in merchandise exports and the 37th in merchandise imports, but with a significant deficit reflected in the current account balance at -9.3% of GDP (excluding intra-EU trade). Trade per capita stands at \$6,284, with commercial services ranking 34th in exports and 41st in imports, contributing to 43.1% of GDP (excluding intra-EU trade). Notably, Romania maintains robust economic ties within the European Union, with 71.1% of imports and 71.9% of exports directed towards the EU. Key contributors to imports include Turkey (5.6%), China (5.1%), the Russian Federation (4.3%), and Ukraine (1.7%), with an additional 12.1% from other regions. Similarly, in exports, Turkey (3.1%), the United Kingdom (2.9%), the United States of America (2.5%), and Moldova (2.5%) play smaller roles, with an additional 17.2% attributed to other regions (WTO, 2023e).

Serbia's economic overview in 2022 showcases a GDP of \$70,909 million and a per capita income of \$9,088. Globally, Serbia holds the 71st position in merchandise exports and the 63rd in merchandise imports, with a trade per capita of \$5,244. The current account balance reflects a small deficit at -6.9% of GDP (excluding intra-EU trade). Notably, Serbia's imports are diverse, with the European Union as the primary contributor at 54.9%. China holds a significant share at 12.1%, followed by contributions from the Russian Federation (7.5%), Turkey (5.2%), and Bosnia and Herzegovina (3.1%). Other regions collectively make up 17.2% of Serbia's imports. On the export front, Serbia strategically directs the majority, 64.1%, to the European Union, highlighting strong economic ties. Bosnia and Herzegovina follow as a significant trading partner at 7.5%, with the Russian Federation and Montenegro contributing 4.1% each. China represents another noteworthy destination with a 4% share, while other regions collectively make up 16.3% of Serbia's exports (WTO, 2023f).

Slovenia's economic overview in 2022 showcases a GDP of \$62,167 million and an impressive per capita income of \$28,140. In global trade, it ranks 51st in merchandise exports and 53rd in imports, with a noteworthy trade per capita of \$22,909. The current account balance stands at -0.4% of GDP (excluding intra-EU trade), signaling a minor deficit. Trade constitutes a substantial 81.4% of GDP (excluding intra-EU trade), emphasizing Slovenia's strong international trade presence. Imports primarily flow from the European Union at 71.1%, with notable contributions from Turkey (5.6%), China (5.1%), the Russian Federation (4.3%), and Ukraine (1.7%), while another 12.1% originates from other regions. Slovenia strategically directs 61% of exports to the European Union, underlining robust economic ties, with Switzerland as a significant trading partner at 21%, and smaller contributions from Serbia (2.8%), the Russian Federation (2.2%), and Bosnia and Herzegovina (1.9%), while other regions collectively comprise 11.2% (WTO, 2023g).

3 TRADING CONDITIONS

In examining China's trade relations with the Central and Eastern European Countries (CEEC), it is crucial to consider ongoing factors that significantly impact the dynamics of international trade. Beyond the Law of One Price, Interest Parity, Purchasing Power Parity (PPP), and the International Fisher's Equation, other influential factors include geopolitical influences, trade agreements, global economic conditions, industry characteristics, and technological advancements (Krugman, Obstfeld, & Melitz, 2012). In examining China's trade relations with the Central and Eastern European Countries (CEEC), our focus will be specifically on the nominal bilateral exchange rate, Consumer Price Index (CPI), and interest rates.

The exchange rate significantly shapes global trade dynamics. How international trade factors affect exchange rates varies depending on a country's specifics and policies. For instance, exports, imports, and interest rates can impact exchange rates in certain cases, although the influence of interest rates may not be consistent across all situations (Kang, 2016).

Table 3. Nominal Bilateral Exchange Rates Against the Euro for China (CNY), Bosnia and Herzegovina (BAM), Bulgaria (BGN), Croatia (HRK), Romania (RON), and Serbia (RSD) - (As % for base year Q3 21)

	Q3 21	Q4 21	Q1 22
CNY	100.00	96.52	94.12
BAM	100.00	100.52	100.52
BGN	100.00	100.00	100.00
HRK	100.00	101.08	101.61
RON	100.00	100.20	100.00
RSD	100.00	100.36	99.86
	Q2 22	Q3 22	Q4 22
CNY	92.91	92.51	99.60
BAM	99.48	101.03	101.03
BGN	100.00	100.00	100.00
HRK	100.00	101.75	101.21
RON	99.80	99.60	100.00
RSD	99.42	99.36	100.17
	Q1 23	Q2 23	Q3 23
CNY	99.87	105.48	103.48
BAM	100.52	100.00	101.03
BGN	100.00	100.00	100.00
HRK	/	/	/
RON	100.00	100.61	100.40
RSD	99.73	99.88	100.03

In Table 3, the initial starting point for each currency is established by expressing its exchange rate as a percentage relative to its value against the Euro, using Q3 2021 as the base year with a standardized value set at 100%. This means that the exchange rates provided for various currencies, such as the Chinese Yuan (7.48), Bosnian Convertible Mark (1.94), Bulgarian Lev (1.96), Croatian Kuna (7.44), Romanian Leu (4.94), and Serbian Dinar (117.29), represent their respective percentages in comparison to their values against the Euro during the third quarter of 2021. The analytical focus will be directed specifically towards the Chinese Yuan (CNY) to Euro (EUR) exchange rates, as this currency pair demonstrates discernible variations over the given period, offering a more dynamic perspective for analysis compared to the other currencies which maintain a comparatively steady relationship with the Euro.

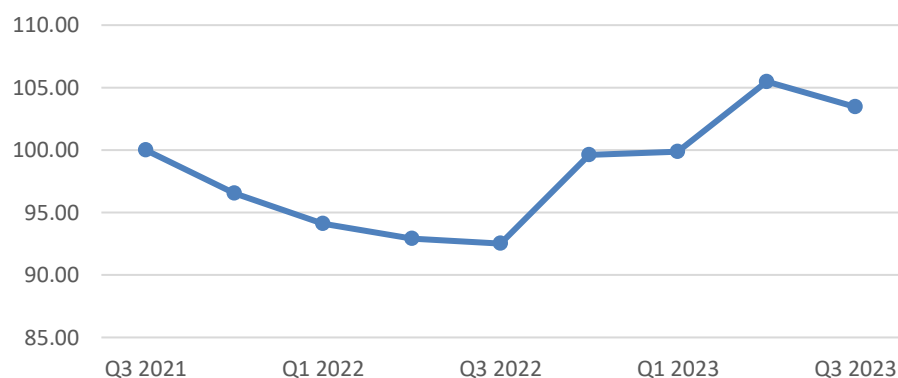


Fig. 1 Nominal Bilateral Exchange Rate CNY Against the EUR (As % for base year Q3 21)
(IMF Statistic, 2023)

The interest rate landscape across several countries is diverse. In Bosnia and Herzegovina, the Bank Lending Rate is reported at 4.694% (CBBH, n.d.), while Bulgaria's interest rate stands at 3.64% (BNB, 2023). China exhibits a one-year Lending Prime Rate (LPR) of 3.65% and an over-five-year LPR of 4.3%, notably maintaining stability over the past couple of years (PBC, 2023). Croatia maintains a Marginal Lending Facility at 4.75%, Main Refinancing Operations at 4.50%, and a Deposit Facility at 4.00% (HNB, 2023). Romania's interest rates as of January 11, 2023, include a Policy Rate of 7.00%, a Lending Facility of 8.00%, and a Deposit Facility of 6.00% (BNR, 2023). Serbia sets its Discount Rate at 100% of the key policy rate, which is 6.50% (NBS, 2023), while in Slovenia, as of September 20, 2023, the Deposit Facility is at 4.00%, Main Refinancing Operations at 4.50%, and Marginal Lending Facility at 4.75% (Banka Slovenije, 2023).

Table 3 presents the consumer price indices (CPI) as a percentage change from the previous period for various countries across the quarters from Q3 2021 to Q3 2023. The countries included in the analysis are Bosnia and Herzegovina (BIH), Bulgaria (BGR), China (CHN), Croatia (HRV), Romania (ROU), Serbia (SRB), and Slovenia (SVN). Notably, China stands out for its exceptional stability in consumer prices, showcasing minimal fluctuations ranging from 0.07% to 0.29% throughout the specified quarters. In contrast, other countries in the dataset, such as Bulgaria, Croatia, Romania, Serbia, and Slovenia, demonstrate more varied consumer price movements, signifying potential shifts in inflation rates during specific periods. It's worth noting that data for Bosnia and Herzegovina is unavailable. Overall, this analysis emphasizes China's

consistent and stable consumer price trends compared to the more fluctuating patterns observed in other countries over the examined quarters.

Table 3. Nominal Bilateral Exchange Rates Against the Euro for China (CNY), Bosnia and Herzegovina (BAM), Bulgaria (BGN), Croatia (HRK), Romania (RON), and Serbia (RSD) - (As % for base year Q3 21)

	Q3 21	Q4 21	Q1 22
BIH	/	/	/
BGR	1.33	3.59	4.28
CHN	0.07	0.89	0.82
HRV	0.7	2.15	1.83
ROU	1.78	2.67	2.99
SRB	1.46	2.52	2.43
SVN	1.15	1.36	1.17
	Q2 22	Q3 22	Q4 22
BIH	/	/	/
BGR	5.62	3.33	2.91
CHN	0.46	0.45	0.1
HRV	5.75	2.25	2.87
ROU	6.34	2.62	3.35
SRB	3.85	3.89	4.13
SVN	4.6	3.17	0.79
	Q1 23	Q2 23	Q3 23
BIH	/	/	/
BGR	2.83	0.75	0.84
CHN	0.23	-0.68	0.29
HRV	0.49	2.26	1.46
ROU	2.01	2.32	/
SRB	3.26	2.54	1.07
SVN	1.08	2.95	1.6

4 CONCLUSIONS

In summary, the exploration of China's trade relations with the Central and Eastern European Countries (CEEC) underscores a dynamic landscape marked by strategic collaborations and mutual economic benefits. Anchored in the foundational principles of international trade, the acknowledgment of inherent advantages derived from trade highlights the multifaceted dimensions of China's engagements with the CEEC. The "16+1 cooperation" mechanism and the China-CEEC economic and trade forum serve as significant milestones, reflecting a shared commitment to fostering economic ties. The paper emphasizes the potential benefits of enhanced economic cooperation, particularly in the agricultural sector. By leveraging technological advancements and sharing best practices, China and the CEEC can create synergies that benefit both regions (Carter, Zhong, & Zhu, 2012). The analysis of economic indicators for Bosnia and Herzegovina, Bulgaria, Croatia, Romania, Serbia, and Slovenia highlights the diverse economic landscapes and trade dynamics within the CEEC, providing a comprehensive backdrop for understanding the collaborative opportunities.

While nominal bilateral exchange rates exhibit fluctuations, the unwavering stability of China's interest rates, particularly the Lending Prime Rates, and consistently low Consumer Price Index, creates a reliable foundation for sustainable trade partnerships with the CEEC. As the CEEC nations seek to strengthen their trade ties with China, the stable economic conditions offered by China present a strategic opportunity for these countries to enhance their economic growth and stability through collaborative efforts. Looking ahead, leveraging these stable economic factors can facilitate deeper integration, increased investments, and expanded trade between China and the CEEC, contributing to shared prosperity and economic development.

Building upon our findings, we propose a symbiotic framework aimed at mitigating currency risk and fostering mutual benefit. The proposition involves China supplying advanced agricultural

machinery to CEEC nations, with a distinctive repayment structure based on trade agreements involving the exchange of agricultural produce. A strategic element can be introduced, to enhance the clarity and stability of the repayment process.

Quotas, equivalent to the monthly repayment due, could be established, providing a transparent framework that ensures a steady and predictable flow of agricultural commodities as repayment. This structured approach adds a layer of financial predictability and contributes to the sustainability and reliability of the proposed symbiotic framework.

For China, this approach opens avenues for market expansion, as it gains increased access to the diverse agricultural markets of CEEC nations, providing an opportunity to showcase and distribute its advanced machinery. Additionally, it establishes China as a key contributor to the modernization of agricultural practices in the CEEC region, fostering technological collaboration and creating a mutually beneficial economic partnership. Furthermore, amidst the backdrop of increasing urbanization in China, this initiative aligns with the rising demand for agricultural products, creating a strategic synergy between urbanization trends and agricultural trade. Meanwhile, for CEEC nations, the proposition offers technological advancement through access to cutting-edge agricultural machinery from China, allowing them to modernize their agricultural practices and enhance efficiency and productivity. The collaboration also facilitates the development of local expertise in handling and maintaining advanced agricultural technology, contributing to skill enhancement. Moreover, the structured trade agreements ensure repayment and diversify the agricultural trade portfolio of CEEC nations, reducing dependence on specific crops.

In essence, this innovative approach sets the stage for a collaborative venture where both China and the CEEC nations stand to gain not only economically but also technologically, paving the way for a resilient and mutually enriching win-win cooperation.

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DIGITAL ECONOMY AND CYBERSECURITY ANALYSIS WITH A FOCUS ON CHINA AND SLOVENIA

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Abstract

This paper explores the evolving landscape of digital economy cooperation between China and the Central and Eastern European Countries (CEECs), set against the backdrop of the China-CEEC Cooperation Initiative and the Belt and Road Initiative (BRI). It highlights the untapped potential for digital economy projects, despite the absence of major projects under the BRI framework, and underscores China's strategic shift towards exploring new areas of collaboration, including the digital economy, artificial intelligence, financial technology, life sciences, and environmental protection. The paper delves into the rapid development of the digital economy, accelerated by the COVID-19 pandemic, focusing on how both China and the CEECs are strengthening their digital economies to overcome current challenges and foster future growth. It examines China's commitment to digital economy expansion, digital governance, and international cooperation, including initiatives such as the "Global Initiative on Data Security" and the application to join the Digital Economy Partnership Agreement (DEPA). Additionally, the paper considers the digital economy in Slovenia, highlighting its strategic

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commitment to digitalization, cybersecurity efforts, and its role within the broader digital transformation landscape in Europe. Through this analysis, the paper aims to provide insights into the opportunities and challenges of China-CEEC digital economy cooperation, offering recommendations for fostering effective collaboration and advancing mutual benefits in the digital era.

Keywords: China-CEEC Cooperation Initiative. Belt and Road Initiative (BRI). Digital economy cooperation. Digital governance. Cybersecurity efforts.

1 INTRODUCTION

The China-Central and Eastern European Countries (CEEC) Cooperation, initiated on April 26, 2012, serves as a cross-regional platform fostering mutual benefit and development through pragmatic collaboration across diverse sectors such as economy, culture, education, and technology. Facilitated by regular Leaders' Summits, this cooperation has expanded substantially, contributing positively to bilateral relations between China and the CEECs and enhancing broader China-Europe relations. (China-CEEC Cooperation, 2021).

The integration of digital economy sectors into the Belt and Road Initiative started in 2015 to enhance international communications connectivity and establish an "Information Silk Road" with the cross-border optical cable networks and other communication trunk lines construction. Despite the Central and Eastern European countries' participation in Belt and Road Forums, no major digital economy projects were organized or implemented under the BRI framework. Nevertheless, there is significant untapped potential for further development (China-CEE Institute, 2021).

Moreover, during the summit in 2019 held in Ljubljana, Chinese State Councilor and Foreign Minister Wang Yi emphasized the cooperation's transition towards exploring new areas of collaboration. He highlighted the opportunity to deepen traditional collaboration while also expanding into new fields such as the digital economy, artificial intelligence, financial technology, life science, and environmental protection. This strategic shift underscores a proactive approach aimed at fostering even stronger win-win cooperation and exploring new avenues of mutual benefit, ultimately pushing for the advancement of China-Europe relations (China CEEC, 2019).

The rapid development of the digital economy, driven by technologies like the Internet, big data,

and artificial intelligence, is reshaping global economic structures and competitive dynamics. The COVID-19 pandemic has further accelerated this trend, with countries increasingly relying on digital means for pandemic control and economic recovery. China and Central and Eastern European countries (CEECs) are both actively strengthening their digital economies amidst the pandemic challenges. Despite facing new cooperation hurdles, digital economic collaboration has emerged as a key focus for advancing China-CEEC cooperation (CIIS & HIIA, 2022).

2 DIGITAL ECONOMY IN CHINA

China views the digital economy as pivotal amidst global transformations. The government is committed to promoting digital applications and services for the benefit of its citizens, while also enhancing domestic laws and regulations and integrating into global digital governance frameworks. China actively seeks to join high-level digital trade agreements, fosters global digital economic cooperation, and advocates for an open, inclusive, and balanced approach to digital governance. On the other hand, Economic growth in Central and Eastern European countries (CEECs) has traditionally relied on key industries, exports, foreign direct investments, and EU cohesion funds. However, these growth drivers are becoming exhausted, with labor shortages and overreliance on specific export markets and industries such as automotive. To overcome these challenges and move up in the global value chain, CEECs are increasingly focusing on digitization. Furthermore, China actively engages in global cooperation within the digital economy, collaborating with other nations to foster its healthy development and create new opportunities for global economic growth. President Xi Jinping called for a shared cyberspace community at the 3rd World Internet Conference in November 2016. In September 2020, China introduced the "Global Initiative on

Data Security," aimed at contributing insights to data security maintenance, digital development, cooperation, and global digital governance enhancement. Additionally, China's formal application to join the Digital Economy Partnership Agreement (DEPA) in November 2021 showcases China's commitment to participating in international digital economy exchanges and cooperation efforts (CIIS & HIIA, 2022).

Since then, China has engaged in several rounds of dialogues with DEPA members, providing insights into its laws, regulations, and regulatory practices concerning the digital economy. Additionally, China has actively demonstrated its willingness to cooperate under the DEPA framework (Xinhua, 2023a).

The recent developments in China's digital economy underscore a remarkable journey of digitalization and growth over the past decade. By 2022, the digital economy had surged to approximately 6.99 trillion U.S. dollars, a significant leap from its valuation in 2012. This expansion is mirrored in the country's internet user base, which nearly doubled, reaching 1.08 billion by June 2023, alongside a substantial increase in internet penetration from 42.1% to 76.4%. The thriving digital community has paved the way for the success of internet enterprises, with the number of Chinese internet companies listed on stock markets expanding from just over 50 in 2012 to nearly 160 in 2023, marking the rise of giants such as ByteDance and Pinduoduo. The advancement of AI technologies, particularly foundation models, is reshaping the digital landscape, enhancing productivity, and fostering industry innovation. The China Internet Development Report 2023 highlights China's commitment to amplifying the application of new technologies across critical sectors, including agriculture and education, while addressing the digital transformation hurdles faced by small and medium-sized enterprises due to financial and technological constraints. China's vision for international cooperation in digital applications and the promotion of global digital governance rules reflects its proactive stance on shaping a more inclusive digital future. The Digital Silk Road initiative exemplifies this approach, aiming to extend the benefits of internet development globally. The emphasis on fostering regional collaboration and creating an equitable digital

ecosystem was echoed at the Wuzhen Summit, signaling China's intent to integrate digital and real economies more deeply and support the digital transformation of small and medium-sized businesses. Despite these advancements, challenges such as data privacy and security remain, particularly in the application of AI foundation models. These concerns highlight the need for balanced development that not only boosts productivity but also safeguards user privacy and data integrity, underscoring the complexities of navigating the digital economy's future trajectory (Xinhua, 2023b).

Xu and Li (2022) analyzed the digital economy across 31 provinces in mainland China from 2010 to 2020, they revealed several critical findings that contribute to the understanding of digital economic growth and its disparities. Firstly, the digital economy in China has exhibited a steady expansion, yet this growth is accompanied by increasing regional disparities, with a pronounced development gradient from east to west. This disparity is partly due to the varying effectiveness in adopting advanced digital technologies, with a notable decline in 2020 likely caused by the disruptions of the COVID-19 pandemic, which affected demand and supply chains, especially in economically developed regions. Secondly, the study underscores the steady progress in the performance of digital platforms, despite fluctuations influenced by domain name issues and regulatory changes aimed at fraud reduction and network security enhancement. It highlights a regional imbalance in digital platform development, with higher scores predominantly in the eastern and central regions, though the disparity gap has shown a slight narrowing over time. The research also points out a consistent upward trend in the performance of digital users, driven by improvements in mobile phone penetration and telecommunication service volumes. This trend reflects an enhanced network environment, reduced internet transaction costs, and expanded internet access, with a decreasing distribution trend from east to west. Furthermore, digital innovation has demonstrated growth from 2010 to 2019, with more developed regions typically generating more innovations. The geographical distribution of digital innovation aligns with the socioeconomic landscape, but there are efforts underway to balance the digital

resource distribution to foster innovation in less developed areas. Lastly, the digital industries have shown steady development over the decade, with a pronounced provincial and east-to-west imbalance. Despite this, certain less developed regions have made significant progress in digital industrialization, supported by favorable policies, exemplifying Liaoning's advancements in digital industries.

China's latest digital development plan outlines a comprehensive strategy to foster a digital China. Aimed at supporting the country's modernization efforts in the digital era, the plan envisions significant advancements in digital infrastructure, the economy, and technology innovation by 2025. By 2035, the goal is for China to become a global leader in digital development, achieving harmonious progress across economic, political, cultural, social, and ecological domains. The strategy emphasizes the integration of digital technology with the real economy, applying digital innovations across diverse sectors such as agriculture, manufacturing, finance, education, medical services, transportation, and energy. Additionally, the plan seeks to establish a thriving digital government, a vibrant cyberspace culture, accessible digital public services, and digital technology-driven ecological governance. Central to this vision is fostering an ecosystem that encourages independent digital technology innovation, with businesses playing a pivotal role and a strong emphasis on improving intellectual property protection. (Xinhua, 2023c)

3 CYBERSECURITY IN CHINA

As highlighted in China's commitment to international digital economy exchanges and cooperation efforts, the importance of cybersecurity in the digital transformation underscores the critical necessity of safeguarding digital infrastructure. In today's interconnected world, where data is increasingly digitized and exchanged across borders, cybersecurity plays a crucial role in protecting sensitive information, maintaining trust, and ensuring the integrity of digital transactions. With cyber threats evolving in sophistication and frequency, businesses, governments, and individuals face unprecedented risks of data breaches, cyberattacks, and digital fraud. Therefore, investing in robust cybersecurity measures is not only necessary to mitigate these

risks but also essential for fostering confidence in digital technologies and enabling the continued growth and innovation of the digital economy. By prioritizing cybersecurity, organizations can proactively defend against cyber threats, safeguard critical assets, and uphold the privacy and security of digital infrastructure, thereby facilitating a safe and secure environment for digital commerce, communication, and collaboration.

The Data Security Law of the People's Republic of China, effective from September 1, 2021, aims to regulate data processing and ensure data security while promoting data utilization and protecting rights (The National People's Congress of the People's Republic of China, 2021). It encompasses:

- General Provisions: Establishes the law's purpose, scope, and fundamental principles, including the importance of safeguarding national security and individual rights in data activities.
- Data Security and Development: Outlines the state's role in promoting secure data development and utilization, emphasizing the balance between security and economic growth.
- Data Security Systems: Introduces systems for classifying, protecting, and managing data based on its importance and the potential impact of its compromise.
- Data Security Protection Obligations: Details obligations for data processors, including adherence to laws, implementing security measures, and conducting regular risk assessments.
- Security and Openness of Government Data: Focuses on enhancing e-government, protecting government data, and promoting transparency and accessibility.
- Legal Liability: Specifies penalties for violations of the law, including fines and other sanctions to enforce compliance.
- Supplementary Provisions: Addresses additional aspects like the application of the law to state secrets and military data security.

4 DIGITAL ECONOMY IN SLOVENIA

The digital economy in Slovenia is characterized by widespread internet and broadband access,

significant investments in ICT, and a growing ICT sector. Key elements include e-business, e-commerce, social media use, cloud computing, and the Internet of Things, underpinned by a skilled workforce with various levels of e-skills. The digital economy's growth is reflected in the increasing importance of online activities and ICT in economic, social, and cultural spheres, driving changes in business processes, work, production, and overall economic development (Zupan, 2016).

In the 2022 Digital Economy and Society Index (DESI), Slovenia showcases a strategic commitment to digitalization, ranking 11th among the EU countries. That reflects its consistent efforts towards enhancing digital skills, infrastructure, and public sector digitalization. Despite nearing the EU average in human capital, Slovenia identifies gaps in digital skills, emphasizing the need for ongoing reskilling and upskilling to adapt to technological advancements. Its enterprises outperform the EU average in providing ICT training, indicating a strong focus on workforce development. Slovenia's digital connectivity exhibits strengths in high-capacity network coverage but faces challenges in 5G deployment, highlighting areas for technological improvement. The country also demonstrates robust performance in integrating digital technologies among SMEs, particularly in cloud services and artificial intelligence, yet it sees potential for growth in big data utilization. The Digital Slovenia 2030 strategy outlines a comprehensive roadmap for digital transformation, focusing on digital skills, secure infrastructure, business digitization, and public service innovation. This initiative aims to foster an inclusive digital society, leveraging digital technologies for economic growth and social welfare. Moreover, Slovenia's proactive approach to cybersecurity and data governance, especially in response to global incidents, underscores the importance of resilience and trust in the digital era. Through strategic investments and policy initiatives, Slovenia aspires to a digitally enabled future, emphasizing inclusivity, innovation, and security as foundational pillars. The DESI 2022 report highlights Slovenia's journey towards realizing its digital ambitions, positioning it as a proactive participant in Europe's digital transformation landscape (European Commission, 2023).

5 CYBERSECURITY IN SLOVENIA

Cybersecurity in Slovenia has evolved significantly, marked by the adoption of the Cybersecurity Strategy in 2016 and the establishment of the Government Office for the Protection of Classified Information (UVTP) as the national cybersecurity authority in 2017. Slovenia's proactive approach to cybersecurity is further exemplified by the longstanding operation of SI-CERT, the national response center for cybersecurity incidents since 1995. Despite the comprehensive framework and efforts to safeguard digital assets, Slovenia has experienced minor cybersecurity incidents, with the most significant being the WannaCry ransomware attack in 2017, which underscored the persistent threat landscape and the need for continuous vigilance and enhancement of cybersecurity measures (Ministrstvo za javno upravo, 2018).

Slovenia's proactive approach to cybersecurity is underscored by the establishment of SI-CERT, the Slovenian Computer Emergency Response Team. This vital entity operates within the broader framework of ARNES (Academic and Research Network of Slovenia) and stands as a testament to the country's commitment to maintaining a secure and resilient digital environment. As the designated national authority for monitoring and responding to cybersecurity incidents, SI-CERT plays a critical role in Slovenia's cybersecurity strategy. It offers a comprehensive suite of services, including early warning systems, risk and incident analysis, methodological support in case of incidents, and the dissemination of crucial information on cybersecurity risks to relevant stakeholders. Furthermore, SI-CERT's involvement in international cooperation networks and its efforts to raise public awareness through initiatives like the Safe on the Internet program reflect Slovenia's integrated approach to addressing cybersecurity challenges. Funded by the Government Information Security Office, SI-CERT's operations are pivotal in safeguarding Slovenia's informational assets and enhancing the nation's cyber defense capabilities (SI-CERT, 2024).

In 2022, SI-CERT managed a total of 4,123 cybersecurity incidents. An estimated breakdown suggests that technical attacks and incidents

involving social engineering constituted roughly 30% of these occurrences each, with phishing attacks accounting for the remaining 40%. This figure indicates a marked escalation in incident numbers over the previous years, with 3,177 incidents recorded in 2021 and 2,775 incidents in 2020.

In the EU-27, the sectors that experienced the highest incidence of ICT security-related issues, leading to disruptions in ICT services, data destruction or corruption, or the disclosure of confidential information, were the ICT sector (29.6%), professional, scientific, and technical activities (30.8%), and the sectors of water supply, sewerage, waste management, and remediation activities (24.6%). The construction sector (17.6%) and the domain of wholesale and retail trade, including the repair of motor vehicles and motorcycles (23.7%), were comparatively less impacted. The higher vulnerability in the ICT sector can be linked to its extensive use of digital technologies, possession of vast amounts of sensitive information, and possibly more nascent security protocols relative to other sectors. In contrast, Slovenia's most impacted sectors were water supply, sewerage, waste management, and remediation activities (23.7%), along with professional, scientific, and technical activities (18.7%), reflecting a similar pattern of ICT security challenges (Gorišek, Pregarc, Dobnik, Ferjan, & Kralj, 2023)

Furthermore, Gorišek and others (2023) identified that organizations prioritize three primary components in their cybersecurity strategies: confidentiality, integrity, and availability, acknowledging the interconnectedness of these concepts. They observed that while some companies emphasize availability due to the operational necessity of continuous production, others, particularly in the financial sector prioritize confidentiality and integrity, highlighting industry-specific cybersecurity priorities. Their study identified five significant cybersecurity risks across various Slovenian sectors: environmental and human safety, production goals, product quality, and the protection of sensitive information, noting that the degree of cybersecurity threats often correlates with an organization's level of digitalization. Sensitive information was identified as the most pressing concern across all sectors. They reported that companies use standard risk

assessment methodologies and invest in employee training and data security software for protection. Despite these measures, challenges such as remote workforce security and skills shortages underline the complexity of maintaining robust cybersecurity defenses.

The study highlighted the increasing risk of human exploits and the role of AI in enabling attackers to generate widespread attacks. The study advocates for a proactive approach to cybersecurity, emphasizing the importance of continuous employee training, regular updates to security software, and the development of comprehensive business continuity plans to navigate the evolving threat landscape effectively.

6 CONCLUSIONS

In conclusion, this paper analyzed the complex and dynamic nature of digital economy cooperation between China and the Central and Eastern European Countries (CEECs), framed within the context of the China-CEEC Cooperation Initiative and the Belt and Road Initiative (BRI). Despite the initial absence of major digital economy projects under the BRI framework, the analysis pointed out an evident potential for engaging in untapped areas such as artificial intelligence, financial technology, life sciences, and environmental protection. The rapid advancement of the digital economy, expedited by the COVID-19 pandemic, revealed both opportunities and challenges, emphasizing the importance of strengthening digital infrastructures, enhancing digital governance, and fostering international collaboration.

China's significant strides in digital economy expansion, including efforts to join international digital agreements like the DEPA and initiatives such as the "Global Initiative on Data Security," showcased a commitment to playing a leading role in global digital governance. The paper also analyzed the digital economy landscape in Slovenia, which exemplified a strategic commitment to digitalization, underscored by substantial progress in cybersecurity measures, thereby contributing to the broader European digital transformation efforts.

The insights derived from this analysis underscored the importance of continued collaboration, innovation, and mutual benefit. It

called for both China and the CEECs to leverage the opportunities presented by the digital economy to foster economic growth, enhance digital governance, and address cybersecurity challenges. As these regions navigated the complexities of the digital era, their collaborative efforts served as a blueprint for other cross-regional partnerships aiming to harness the benefits of the digital economy for sustainable and inclusive development.

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THE TECHNOLOGICAL LEVELS OF PRODUCTION AND CONSUMPTION OF BELARUS, RUSSIA, AND KAZAKHSTAN

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JEL Category: **O39**

Abstract

Innovative economic growth is not only based on the development of technologies that ensure the growth of aggregate supply. This type of growth is impossible without constant innovation in consumer goods that drive growth in aggregate demand. At the same time, in modern economic theory, the attention of researchers focuses mainly on the development of engineering and technology and the role of innovation in the field of consumer goods has not been studied separately from technical and technological innovations. The article analyzes the special roles of production innovations and consumer innovations in economic growth. A methodology developed by the author is presented for measuring the technological level of consumption, as well as for comparing the production technological level and the consumption technological level in the national economy. Based on statistical data, technological levels of production and consumption were calculated for the Russian Federation, the Republic of Belarus, and Kazakhstan. The results of analysis of the dynamics of the production and consumption technological levels are presented. The level of correspondence between the technological capabilities of production and consumption within the national economies of the countries under consideration is evaluated. Such an analysis allows us to anticipate possible threats to the development of countries occupying a catching-up position in innovative development, as well as to anticipate the danger of a slowdown in economic growth for countries that are leaders in innovative development.

Keywords: Innovations. Technological level. Techno-economic paradigm. Consumer-economic paradigm. Economic growth. Quantitative assessment.

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1 INTRODUCTION

Innovative economic growth, characterized by a sustainable and continuous increase in living standards, is not only the development of technologies that ensure the growth of aggregate supply. This type of growth would not be possible



without constant innovation in consumer goods, which drives growth in aggregate demand. The mechanisms and results of the impact on economic growth of innovations in production and consuming goods are fundamentally different.

At the same time, in modern economic theory, the attention of researchers is focused mainly on the development of engineering and technology, and the role of innovation in the field of consumer goods has not been studied separately from technical and technological innovation. Known approaches to assessing the technological level of a national economic system are based mainly on assessing its production facilities.

The purpose of this study is to develop and test, using the example of the Russian Federation, the Republic of Belarus, and Kazakhstan, a methodology for measuring the technological level of consumption, as well as for comparing the technological levels of production and consumption in the national economy.

To achieve this purpose, it is necessary:

1. to determine indicators that allow an objective assessment and comparison of the technological levels of production and consumption in the national economy.
2. calculate the values of these indicators for the Republic of Belarus, the Russian Federation, and Kazakhstan.
3. analyze the calculation results obtained for the countries under study.

2 PRODUCTION AND CONSUMPTION INNOVATIONS AND ECONOMIC GROWTH

Innovative economic growth requires not only innovation in the field of production goods (in other words, in the field of engineering and technology) but also innovation in the field of consumer goods, i.e., goods and services designed to satisfy human needs directly.

It is known that innovations in the field of production goods (hereinafter referred to as production innovations) ensure an increase in labor productivity and, ultimately, an increase in the volume of production of consumer goods per capita. In addition, innovative equipment and technologies open opportunities for the creation of innovative consumer goods, the production of

which was impossible at the previous level of technological development.

Innovations in the field of consumer goods (hereinafter referred to as consumer innovations) consist of creating fundamentally new ones, expanding the range, and improving the quality of already-known goods. Consumer innovations stimulate the population to purchase these goods, even without waiting for the complete physical wear and tear of old, previously purchased items with similar functions. This increases per capita consumption.

If innovation occurs mainly in the direction of improving production processes, providing a sharp increase in the output of traditional consumer goods, and at the same time not enough attention is paid to improving the consumer goods themselves, then, sooner or later, markets will become oversaturated with traditional consumer goods. In such a situation, producers cannot sell the volumes of goods produced, which may be the beginning of a recession in the economy. Even if traditional goods that the population already possesses are offered to them at reduced prices, people still do not want to purchase what they already have in excess quantities (Malkevich, Tikhomirov, & Zenchuk, 2003).

We can say that the lack of production innovation limits economic growth on the aggregate supply side, and the lack of consumer innovation limits economic growth on the aggregate demand side.

Joseph Schumpeter emphasized that the development of innovation is discrete in time. The periods during which a surge of innovation occurs Schumpeter called "clusters" (Schumpeter, 1982), but the terms "waves of innovation" and "techno-economic paradigm" have become more established.

A techno-economic paradigm is understood as a set of related industries that have a unified technical level and develop synchronously. The change in the leading, dominant techno-economic paradigms in the economy of a country or of the world sets the unevenness of economic growth, which expresses itself in the form of economic cycles. Such scientists as N. Kondratiev (2002), J. Schumpeter (2008), T. Kuczynski, K. Freeman, and K. Perez contributed to the development of

the theory of techno-economic paradigms (waves of innovation). The theories of these researchers were continued by V.F. Bainev (2020), S. Yu. Glazyev (1993), (1990), D. S. Lvov (1986), (1990), Yu. V. Yakovets (1999), and others.

However, published research on this topic has not examined the role of consumer innovation separately from production innovation. Innovative consumer goods and the consumer-economic paradigms formed by them, as a rule, are considered inseparable from the corresponding techno-economic paradigms, as their inseparable part.

However, innovative consumer goods play an independent role in economic growth and can be sold and consumed outside the corresponding techno-economic paradigm to which they belong. Almost any consumer goods of earlier techno-economic paradigms can be produced using the equipment and technologies of later paradigms. For example, ordinary bread can be baked both in a village oven and at a bakery equipped with various types of industrial equipment (II-IV paradigm), in a home electronic bread machine (V paradigm), and perhaps soon with the participation of a home android robot or printed on a food 3D printer (VI paradigm). Cleaning the floor in a home can be done with a broom and a damp cloth, with an electric vacuum cleaner (IV paradigm), with a robotic vacuum cleaner (VI paradigm), and using an android robot (VI paradigm).

And vice versa, almost any consumer goods of higher consumer-economic paradigms can be imported into a country that does not have the corresponding techno-economic paradigm but is at earlier stages of technological development. For example, today one can see how the population of countries that do not have technologies for the production of computers and mobile phones (V paradigm) actively use these goods. In this case, there is a situation in which the consumer-economic paradigm in the country is ahead of the techno-economic paradigm by time, and there is also a discrepancy between the techno-economic and consumer-economic paradigms geographically, across countries.

Considering the above, we will understand the consumer-economic paradigms as a set of interrelated methods and processes of satisfying

the personal wants and needs of the population, for which the production of consumer goods is carried out using equipment and technologies of the corresponding techno-economic paradigm, and in which consumer goods predominate, which cannot be produced using technologies of lower techno-economic paradigms.

While each new techno-economic paradigm steadily brings with it an increase in labor productivity (based on mechanization, electrification, automation of production, the beginning of the intellectualization of the technosphere), in other words, an increase in production per capita, each new consumer-economic paradigm steadily brings with it an increase in consumption per capita.

In a national economic system, at any given time, there are simultaneously several techno-economic paradigms, among which one can distinguish the main, dominant paradigm, which characterizes the main directions of development of the economic system at a given time (Lvov, D.S.; Glazyev, S.Yu., 1986). In the same way, at any given time, several consumer-economic paradigms simultaneously exist in the national economy, and they may not coincide with the current techno-economic paradigms.

The problem of consumer-economic paradigms is discussed in more detail in (Zianchuk, 2023).

For countries that are leaders in innovative development, the lag in the development of a new consumer-economic paradigm from the developed new techno-economic paradigm is fraught with the oversaturation of domestic markets and a subsequent recession in the economy. The export of excess amounts of consumer goods to other countries, to new geographic markets, can postpone the problem of oversaturation and recession for some time.

As a result of the export of innovative consumer goods from countries that are leaders in innovative development to catching-up countries, in these catching-up countries, the opposite situation may occur - an advance of the consumer-economic paradigm compared to the techno-economic paradigm. In exchange for imported innovative consumer goods, catching up countries usually export their natural resources, reducing their reserves. At the same time, in a catching-up

country, the demand of the population is “diverted” from consumer goods produced within the country to imported goods. This situation is not conducive to the development of the manufacturing sector of the catching-up country. Instead of investing in developing the production sector, society's resources are directed to expanding consumption.

3 MEASURING PRODUCTION AND CONSUMPTION TECHNOLOGICAL LEVELS

Objective quantitative measurement of the technological level of an economic system and its subsystems is a complex scientific problem that has not yet been fully resolved.

One of the possible approaches to quantitative measuring the technological level of an economic system was proposed by V.F. Baynyov and Zhang Bin (Bainev & Zhang, 2021), (Baynev, V.F., Makarevich, S. V., 2023). The approach they developed is based on the system of periodization of technical and technological progress by D. Lvov and S. Glazyev, which involves the identification of 1–6 techno-economic paradigms (Glazyev, Theory of long-term technical and economic development, 1993), (Glazyev, 1990). High-tech production belongs to the sixth techno-economic paradigm, while the technologies of the second techno-economic paradigm today are not just low, but backward.

To calculate the specific value of the indicator of the technological level of the national economy TL (“technological level”) V.F. Bainev and Zhang Bin proposed a formula for the weighted arithmetic value (Bainev & Zhang, 2021), (Baynev, V.F., Makarevich, S. V., 2023):

$$TL = \frac{6 \cdot H + 5 \cdot MH + 4 \cdot ML + 3 \cdot L + 2 \cdot B + 6 \cdot HS + 3 \cdot S}{100\%} \quad (1)$$

where:

- TL – is an indicator of the technological level of the economic system (national economy).
- H – the share of economic activities related to high technology production, %.
- MH – the share of economic activities related to medium-high technology production, %.
- ML – the share of economic activities related to medium-low technology production, %.
- L – the share of economic activities related to low technology production, %.

- B – share of other economic activities related to the production of low backward technology, %.
- HS – share of economic activities related to the high-tech services sector, %.
- S – share of the sector of other (non-high-tech) services, %.

The bigger the share of economic activities related to higher techno-economic paradigms in the economic system, the greater the indicator of the technological level of the economic system.

It is necessary to clarify that the indicator proposed by V.F. Baynyov and Zhang Bin (formula 1), which the authors themselves called “the technological level of the national economy,” is essentially the technological level of production, but not of the national economy. As shown above, the role the sales markets of innovative goods play in the functioning of the national economy is no less than the role of available production facilities and technologies. Therefore, the technological level of consumption also needs quantitative measurement and analysis.

To measure the technological level of consumption, a similar approach can be used:

$$TL_c = \frac{6 \cdot H_c + 5 \cdot MH_c + 4 \cdot ML_c + 3 \cdot L_c + 2 \cdot B_c + 6 \cdot HS_c + 3 \cdot S_c}{100\%} \quad (2)$$

where TL_c – is an indicator of the technological level of personal non-productive consumption in the economic system (national economy).

- H_c – the share of consumed consumer goods created in high technology production, %.
- MH_c – the share of consumed consumer goods created in medium-high technology production, %.
- ML_c – the share of consumed consumer goods created in medium-low technology production, %.
- L_c – the share of consumed consumer goods created in low technology production, %.
- B_c – the share of consumed consumer goods created in the production of low backward technology, %.
- HS_c – the share of consumed consumer services created in the high-tech services sector, %.
- S_c – the share of consumed consumer services created in the sector of other (non-high-tech) services, %.

4 TECHNOLOGICAL LEVELS OF BELARUS, RUSSIA, AND KAZAKHSTAN

As an example of the application of the above methodology, a calculation of the technological levels of production and consumption for the Republic of Belarus, the Russian Federation, and Kazakhstan was carried out. The study examined a period of five years, from 2016 to 2021. The necessary data for later years has not yet been published in open access.

As the initial data for calculating the technological levels of production, official data on the production of goods and services in the countries under study by type of economic activity using the production method (by value-added) were taken (Statistics, 2023), (Economic statistics, 2023), (Official statistics, 2023).

Table 1 shows the structure of goods and services production in the Russian Federation, calculated based on official statistical data (Statistics, 2023).

Table 1 – Structure of production of goods and services in the Russian Federation by type of economic activity by production method (by value-added) for 2016 and 2021.

Code	Type of economic activity	Technological level identifier	2016		2021	
			GVA*, at current prices, million rubles	GVA %	GVA, at current prices, million rubles	GVA %
1	2	3	4	5	6	7
A	Agriculture, forestry, hunting, fishing, and fish farming	L	3 287 844.3	4.27	4 974 105.0	4.22
B	Mining	L	7 423 112.8	9.63	15 030 929.6	12.77
C	Manufacturing industries, including:	–	–	–	–	–
C10-C12	Production of food products, beverages, and tobacco products	L	1 583 149.1	2.05	2 439 928.7	2.07
C13-C15	Manufacture of textiles, clothing, leather, and related products	L	177 385.9	0.23	297 663.8	0.25
C 16	Wood processing and production of wood and cork products, except furniture, production of straw products and wicker materials	L	201 313.4	0.26	426 921.0	0.36
C 17	Production of paper and paper products	L	271 988.7	0.35	437 028.0	0.37
C 18	Printing activities and copying of information media	L	75 740.4	0.10	114 409.0	0.10
C 19	Production of coke and petroleum products	ML	1 475 262.1	1.91	3 083 973.4	2.62
C20	Production of chemicals and chemical products	MH	791 050.6	1.03	1 638 519.2	1.39
C21	Production of medicines and materials used for medical purposes	H	174 049.3	0.23	576 466.1	0.49
C22	Production of rubber and plastic products	ML	213 985.0	0.28	379 638.4	0.32
C23	Production of other non-metallic mineral products	ML	409 375.2	0.53	691 258.4	0.59
C24	Metallurgical production	ML	1 744 440.4	2.26	3 715 966.7	3.16
C 25	Production of finished metal products, except machinery and equipment	ML	711 023.2	0.92	988 996.7	0.84
C26	Production of computers, electronic and optical products	H	487 549.6	0.63	746 337.0	0.63
C27	Electrical Equipment Manufacturing	MH	192 017.9	0.25	321 467.8	0.27
C28	Production of machinery and equipment not included in other categories	MH	313 085.8	0.41	584 909.1	0.50
C29	Production of motor vehicles, trailers, and semi-trailers	MH	247 142.0	0.32	636 964.4	0.54
C30	Manufacture of other vehicles and equipment	MH	455 661.8	0.59	934 742.3	0.79
C31_C32	Production of furniture and other finished products	L	129 303.1	0.17	276 647.0	0.23
C33	Repair and installation of machinery and equipment	ML	363 799.3	0.47	634 244.2	0.54
D	Providing electricity, gas, and steam; air conditioning	ML	2 258 180.9	2.93	2 865 510.1	2.43
E	Water supply; water disposal, organization of waste collection and disposal, pollution control activities	S	379 347.9	0.49	656 924.6	0.56
F	Construction	S	4 899 595.6	6.36	5 963 811.1	5.07
G	Wholesale and retail trade; repair of vehicles and motorcycles	S	11 301 783.3	14.66	15 269 978.0	12.97
H	Transportation and storage	S	5 624 665.3	7.30	7 069 934.8	6.00

Code	Type of economic activity	Technological level identifier	2016		2021	
			GVA*, at current prices, million rubles	GVA %	GVA, at current prices, million rubles	GVA %
I	Activities of hotels and catering establishments	S	702 669.4	0.91	955 425.5	0.81
J	Activities in the field of information and communications	HS	1 953 446.3	2.53	3 235 412.9	2.75
K	Financial and insurance activities	S	3 398 322.0	4.41	5 383 927.1	4.57
L	Real estate activities	S	7 849 650.6	10.18	11 711 460.8	9.95
M	Professional, scientific, and technical activities	HS	3 431 789.1	4.45	5 255 975.4	4.46
N	Administrative activities and related additional services	S	1 865 711.6	2.42	2 214 231.1	1.88
O	Public administration and military security; social security	S	6 140 037.8	7.97	8 404 172.9	7.14
P	Education	S	2 442 864.9	3.17	3 723 555.7	3.16
Q	Activities in the field of health and social services	S	2 449 113.5	3.18	3 958 052.5	3.36
R	Activities in the fields of culture, sports, leisure, and entertainment	S	688 017.8	0.89	1 065 805.1	0.91
S	Provision of other types of services	S	457 379.0	0.59	626 549.3	0.53
T	Activities of households as employers; undifferentiated activities of private households in the production of goods and provision of services for their consumption	S	506 278.7	0.66	445 396.7	0.38
TOTAL			77 077 133.6	100	117 737 239.4	100

* – GVA is Gross Value Added.

Column 3 of Table 1 indicates the technological levels for each type of economic activity. To solve the problem of assigning each specific type of economic activity to a certain technological level, the statistical classification of economic activities in the European Community (NACE Rev. 2) was used. In NACE, by the recommendations of Eurostat and the OECD, industries related to high-tech, medium-high-tech, medium-low-tech, and low-tech types of economic activity are identified.

Based on the data in Table 1 types of economic activities are grouped by technological levels, and

columns 3 and 4 of Table 2 present the share of goods and services of each technological level in the volume of production of goods and services in the Russian Federation for 2016 and 2021.

Similar calculations of the structure of production by technological levels were carried out for the national economies of the Republic of Belarus based on statistical data (Economic statistics, 2023) (Table 2. columns 5 and 6) and Kazakhstan based on statistical data (Official statistics, 2023) (Table 2. columns 7 and 8).

Table 2. Structure of production by technological levels in the Russian Federation, the Republic of Belarus, and Kazakhstan for 2016 and 2021

The technological level of production (NACE Rev. 2)	Technological level identifier	Share in production volume, %					
		Russian Federation		Republic of Belarus		Kazakhstan	
		2016	2021	2016	2021	2016	2021
1	2	3	4	5	6	7	8
High technology production	H	0.86	1.12	1.31	1.43	0.26	0.45
High-tech services	HS	6.99	7.21	8.80	11.33	7.48	6.40
Medium-high technology production	MH	2.59	3.50	6.90	7.77	0.96	1.73
Medium-low technology production	ML	9.31	10.50	9.78	8.17	9.35	10.61
Low technology production	L	17.06	20.38	18.48	19.13	21.66	23.68
Other (non-tech) services	S	63.19	57.29	54.75	52.17	60.31	57.14
Production of low backward technology	B	0.00	0.00	0.00	00.00	0.00	0.00
TOTAL		100.00	100.00	100.00	100.00	100.00	100.00

For the initial data used in computing the technological levels of consumption, we referred to the official data (Statistics, 2023), (Economic statistics, 2023), (Official statistics, 2023) on the volumes of retail trade in goods, as well as the volumes of services consumed by the population in the countries under examination.

We also categorized various groups of consumer goods and services based on their technological levels and determined the proportion of each

group in the country's overall consumption. The technological level assigned to a consumer good was based on the technological level of the economic activity responsible for its production.

Table 3 displays the results of the calculations for the consumption structure classified according to technological levels in the national economies of the Russian Federation, the Republic of Belarus, and Kazakhstan.

Table 3. Structure of consumption by technological levels in the Russian Federation, the Republic of Belarus, and Kazakhstan for 2016 and 2021

The technological level of consumption (NACE Rev. 2)	Technological level identifier	Share in consumption volume, %					
		Russian Federation		Republic of Belarus		Kazakhstan	
		2016	2021	2016	2021	2016	2021
1	2	3	4	5	6	7	8
Consumption of goods created in high-technology production	H_c	4.21	5.26	4.30	5.11	7.65	7.92
Consumption of high-tech services	HS_c	0.00	0.00	0.01	0.00	0.05	0.02
Consumption of goods created in medium-high technology production	MH_c	6.10	10.05	10.25	10.74	15.16	17.38
Consumption of goods created in medium-low technology production	ML_c	7.10	8.66	10.28	10.49	18.41	16.88
Consumption of goods created in low-tech industries	L_c	58.25	55.20	52.38	47.61	45.57	46.68
Consumption of other (non-tech) services	S_c	23.78	20.33	22.35	25.70	11.82	10.15
Consumption of goods created in the production of backward technology	B_c	0.56	0.51	0.43	0.34	1.33	0.97
TOTAL		100.00	100.00	100.00	100.00	100.00	100.00

Further, utilizing the data provided in Table 3, indicators for the technological levels of production and consumption were computed

using formulas 1 and 2. Table 4 presents the outcomes of calculations for the three countries.

Table 4. Indicators of the technological level of production and technological level of consumption in the Russian Federation, the Republic of Belarus, and Kazakhstan for 2016 and 2021

National economy	The technological level of production			The technological level of consumption		
	2016	2021	Growth rate, % (2021)/(2016)	2016	2021	Growth rate, % (2021)/(2016)
1	2	3	4	5	6	7
Russian Federation	3.38	3.42	101.18	3.31	3.44	103.93
Republic of Belarus	3.54	3.62	102.26	3.43	3.47	101.17
Kazakhstan	3.34	3.35	100.30	3.71	3.74	100.81

5 ANALYSIS OF PRODUCTION AND CONSUMPTION TECHNOLOGICAL LEVELS

5.1 Dynamics of production technological levels.

The results obtained allow us to state that at the beginning of the period under review in 2016 production technological levels of the three countries were approximately the same (Table 3. column 2). After five years, in 2021 the countries in question also have almost the same production technological level (Table 3. column 3). The Republic of Belarus is in the first place, its production technological level was 3.62. The Russian Federation is in second place with 3.42, and Kazakhstan is third with 3.35.

In the five years under review, none of the countries under consideration experienced a significant change in the production technological level. The maximum growth rate of the indicator occurred in the Republic of Belarus – 102.26%, followed by the Russian Federation – 101.18%, and Kazakhstan – 100.30%.

At the same time, it is necessary to pay attention to the fact that in all three countries, there was an increase in real GDP: in the Republic of Belarus by 109.0%, in the Russian Federation by 108.5%, in Kazakhstan by 115.2%. That is, the real volume of production increased significantly, but its technological structure changed slightly. This suggests that the main source of economic growth in the countries under consideration is not innovation. GDP growth occurs mainly not due to the transition to new techno-economic paradigms, but due to other factors. GDP growth is predominantly quantitative, not qualitative.

For comparison, according to (Baineв & Zhang, 2021), the level of technology in China, calculated using a similar methodology, was 4.1 in 2010, and 4.6 in 2018.

In a separately considered national economy, the volume of goods produced using technologies of higher techno-economic paradigms can grow in absolute terms. However, if there is no increase in the share of higher techno-economic paradigms relative to lower ones, then this indicates that there is a replication (scaling) of existing technological achievements, and there is no introduction of

higher ones. At the same time, statistical reporting can create the illusion of innovative economic development.

5.2 Comparison of technological levels of production and consumption

As can be seen from column 6 of Table 4 in 2021 the countries under consideration have approximately the same technological level of consumption. Kazakhstan is in first place – 3.74, followed by the Republic of Belarus – 3.47 and the Russian Federation – 3.44.

Among the three countries under consideration, Kazakhstan has the most noticeable discrepancy between the technological level of consumption (3.74) and the technological level of production (3.45). The discrepancy is small, but it may indicate the emergence of a situation in the national economy of Kazakhstan in which the consumer-economic paradigm is ahead of the techno-economic paradigm.

This situation, with a certain degree of caution, can be explained by the fact that Kazakhstan, by world standards of innovative development, is a catching-up country, and at the same time has large reserves of raw materials and natural resources, which it exports in exchange for the import of high-tech consumer goods.

The development of this situation is dangerous for the national economy because the population's demand is "diverted" from consumer goods produced within the country to imported goods, which does not contribute to the development of production within Kazakhstan.

In the Republic of Belarus, the technological level of consumption is 3.47, while the technological level of production is 3.62, i.e., considering errors in the initial data and calculations, the levels are approximately equal.

This equality can be explained by the fact that the Republic of Belarus is a catching-up country in terms of the level of innovative development and, at the same time, does not have large reserves of raw materials and natural resources that could be exported in exchange for significant volumes of imports of high-tech consumer goods.

In the Russian Federation, the technological level of consumption is 3.44, while the technological level of production is 3.42, i.e., the levels are approximately equal.

In contrast to the Republic of Belarus, the Russian Federation has large reserves of raw materials and natural resources, which it exports and theoretically could purchase high-tech consumer goods in significant volumes in exchange for them. Why is it not observed that the technological level of consumption exceeds the technological level of production?

It can be assumed that the actual situation has developed partly under the influence of sanctions against the Russian Federation, because of which the import of high-tech goods into the country is limited. However, this issue requires more serious research, beyond the scope of this article.

6 CONCLUSIONS

The mechanism and results of the impact on economic growth of innovations in the field of production goods and innovations in the field of consumer goods are fundamentally different. A delay in the development of production innovation limits economic growth on the aggregate supply side, and a delay in the development of consumer innovation limits economic growth on the aggregate demand side.

In the modern theory of innovative development, the concept of techno-economic paradigms occupies a significant place. However, published research on this topic has not examined the role of consumer innovation separately from production innovation.

Nevertheless, innovative consumer goods play an independent role in economic growth and can be sold and consumed outside the corresponding techno-economic paradigm to which they belong.

One of the possible approaches to solving the problem of quantitative measurement of the production technological level and the consumption technological level is based on a system of periodization of technical and technological progress, which involves the identification of techno-economic paradigms.

Analysis of the dynamics of the technological levels of production and consumption, assessment of the degree of correspondence of the techno-economic and consumer-economic paradigms in the national economy, as well as analysis of the structure of production and consumption by technological levels allow to anticipate possible threats to the development of countries occupying a catching-up position in innovative development, as well as to anticipate the danger of a slowdown in economic growth for countries that are leaders in innovative development.

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FROM THEORY TO PRACTICE: THE ROLE OF CRYPTOGRAPHY IN SECURING BLOCKCHAIN NETWORKS

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Abstract

Blockchain technology has evolved from its origins in cryptocurrencies to become a fundamental component of secure digital interactions across diverse sectors, including healthcare, finance, and public administration. This article delves into the theoretical and practical applications of cryptography within blockchain networks, emphasizing key cryptographic functions, algorithms, and protocols such as RSA, elliptic curve cryptography (ECC), and SHA-256. It scrutinizes the use of digital signatures for transaction verification and the crucial role of hash functions in ensuring data integrity. Additionally, the article presents practical examples of symmetric and asymmetric encryption methods, underscoring their significance in maintaining privacy and security. The study also highlights the emerging challenges posed by quantum computing and explores ongoing research in post-quantum cryptography. Furthermore, it provides insights into the advancements in cryptographic techniques essential for the robustness of decentralized networks. By linking theoretical frameworks with practical implementations, this article aims to offer a comprehensive understanding of the cryptographic security measures pivotal for the future of blockchain technology.

Keywords: Elliptic curve cryptography (ECC), RSA algorithm, SHA-256, proof-of-work, digital signature, post-quantum cryptography, cryptographic protocol.

1 INTRODUCTION

In the ever-evolving digital landscape, blockchain technology has emerged as a transformative force with the potential to revolutionize industries far beyond its initial application in cryptocurrencies like Bitcoin (Nakamoto, 2009). As blockchain continues to gain traction across various sectors,

including healthcare, finance, and public administration, the need for robust security measures becomes increasingly critical. At the heart of blockchain security lies cryptography, a field that provides the essential tools and techniques to ensure the integrity, confidentiality, and authenticity of digital transactions (Stormhub, 2023).

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This article delves into the theoretical and practical aspects of cryptography within blockchain networks, highlighting how these techniques are



employed to secure decentralized systems. We will explore fundamental cryptographic functions, algorithms, and protocols such as RSA, elliptic curve cryptography (ECC), and SHA-256, which form the backbone of blockchain security (Koblitz, Menezes, & Vanstone, 2000). Additionally, we will examine the role of digital signatures in verifying transaction authenticity and the importance of hash functions in maintaining data integrity (Briggs, 1998).

Moving from theory to practice, this article will provide real-world examples of how cryptographic techniques are implemented in blockchain platforms like Bitcoin and Ethereum (Shor, 1999). We will also discuss the emerging challenges posed by quantum computing and the ongoing research in post-quantum cryptography aimed at safeguarding blockchain networks against future threats (n.d., 2008).

By bridging theoretical concepts with practical applications, this article aims to enhance understanding of the critical role cryptography plays in securing blockchain networks and to provide insights into the future directions of blockchain security (Wikipedia, 2024).

This article focuses on addressing three key research questions.

- R₁ - What key cryptographic functions and algorithms are used in blockchain networks?
- R₂ - How these cryptographic techniques are implemented on various blockchain platforms?
- R₃ - What are the main challenges and future directions in cryptography for blockchain development?

2 METHODS

To answer the first two research questions, I analyzed technical documentation and case studies from major blockchain platforms such as Bitcoin and Ethereum. To address the third question, I evaluated current research publications on the impact of quantum computing on cryptographic standards and conducted expert interviews with cryptography specialists.

Blockchain technology, initially developed as the underlying architecture for the cryptocurrency Bitcoin, has rapidly evolved into a subject of significant interest across various industries. Its

application now spans finance, healthcare, logistics, and beyond, providing decentralized solutions that enhance transparency and reduce the need for third-party verification in transactions. At the core of blockchain's secure and efficient operation lies cryptography (Buterin, 2024).

Cryptographic Functions, Algorithms, and Protocols: Cryptographic functions are essential for securing data and communications in blockchain networks. They ensure confidentiality, data integrity, and authentication, forming the backbone of secure transactions. Key cryptographic algorithms such as RSA (Rivest-Shamir-Adleman) and elliptic curve cryptography (ECC) leverage mathematical principles to provide robust security (Koblitz, Menezes, & Vanstone, 2000). RSA relies on the difficulty of factoring large numbers, while ECC uses the complexity of the elliptic curve discrete logarithm problem, offering higher security with smaller key sizes, which is crucial for devices with limited computational power (Briggs, 1998).

Cryptographic protocols like SSL/TLS (Secure Sockets Layer/Transport Layer Security) and IPsec (Internet Protocol Security) play a vital role in securing communications over networks (Shor, 1999). These protocols use cryptographic algorithms to encrypt data and ensure secure data transmission, preventing unauthorized access and tampering (n.d., 2008).

The importance of cryptography in blockchain technologies and decentralized networks is not just theoretical. Real-world examples of attacks and security incidents demonstrate how critical it is to implement cryptographic methods correctly. For instance, in 2014, Mt. Gox, at that time, the largest bitcoin exchange in the world, became a victim of a massive hacking attack. The attackers exploited a flaw in the Bitcoin protocol implementation known as "transaction malleability" and stole approximately 850,000 bitcoins, worth around \$450 million at that time (Decker & Wattenhofer, 2014). This incident highlighted the importance of cryptographic protocols' proper implementation in blockchain systems.

Hash Functions, Algorithms, and Protocols:

Hash functions are integral to blockchain technology, ensuring data integrity and

authenticity (Wikipedia, 2024). A hash function transforms input data of any size into a fixed-size string of characters, typically a hash value. The SHA-256 (Secure Hash Algorithm 256-bit) is widely used in blockchain for creating secure and unique digital fingerprints of data (Wikipedia, 2022B).

In blockchain, hash functions are used in consensus protocols like Proof-of-Work (PoW). In PoW, miners compete to solve complex mathematical puzzles based on hash functions, ensuring that each block added to the blockchain is valid and secure (Cormen, Leiserson, Rivest, & Stein, 2022). This mechanism not only maintains the integrity of the blockchain but also prevents double-spending and fraud (Rolland, 2015).

The importance of correct implementation of hashing functions and cryptographic protocols was dramatically illustrated by the Heartbleed bug in 2014. This critical flaw in the popular cryptographic software library OpenSSL allowed attackers to access sensitive information, including private keys (Durumeric, et al., 2014). The incident underscored the necessity of regular security audits of cryptographic libraries and the proper implementation of protocols.

Digital Signatures: Functions, Algorithms, and Protocols: Digital signatures are cryptographic techniques that provide authentication, integrity, and non-repudiation of digital messages and transactions. They ensure that a message or transaction has been created by a known sender and has not been altered in transit (Wiki, 2019).

Algorithms such as RSA and ECDSA (Elliptic Curve Digital Signature Algorithm) are commonly used for creating digital signatures (n.d., 2011). RSA, with its foundation in number theory, and ECDSA, leveraging the elliptic curve discrete logarithm problem, offer secure methods for verifying digital signatures (Camilamacedo86, 2018). These algorithms are essential in blockchain for signing transactions, ensuring they are authorized and legitimate (Aamir, 2019).

Protocols like PGP (Pretty Good Privacy) use digital signatures to secure email communications, highlighting the widespread application of these cryptographic techniques beyond blockchain (Boehme, Christin, Edelman, & Moore, 2015).

The importance of correctly implementing ECC was highlighted in the case of Blockchain.info in 2015. A flaw in the random number generator of this popular Bitcoin wallet led to the creation of weak private keys. The quick detection and resolution of the issue prevented a potentially massive loss of bitcoins (Courtois, Emirdag, & Valsorda, 2014). This incident underscores that even a small error in the cryptographic algorithms implementation can have serious consequences.

Quantum Computing and Cryptography: One of the emerging challenges in the field of cryptography is the advent of quantum computing. Quantum computers have the ability to solve complex mathematical problems exponentially faster than classical computers. Therefore, they pose a significant threat to current cryptographic standards (Narayanan, Bonneau, Felten, Miller, & Goldfeder, 2016). Algorithms like Shor's algorithm can efficiently factor large numbers and solve discrete logarithms, potentially breaking RSA and ECC-based cryptographic systems (Zohar, 2015).

To address this threat, researchers are developing post-quantum cryptographic algorithms resistant to quantum attacks (Antonopoulos, 2014). These new algorithms aim to provide security even in the presence of powerful quantum computers, ensuring the continued integrity and blockchain network security (Bonneau, et al., 2015).

2.1 Cryptographic Functions in Blockchain

RSA and ECC in Blockchain: RSA (Rivest-Shamir-Adleman) and elliptic curve cryptography (ECC) are essential cryptographic algorithms used to secure blockchain networks. RSA is based on the difficulty of factoring large numbers when ECC relies on the complexity of the elliptic curve discrete logarithm problem. Both algorithms provide robust security for key exchange and digital signatures.

Bitcoin utilizes ECC, specifically the Elliptic Curve Digital Signature Algorithm (ECDSA), to ensure the authenticity of transactions. When a user initiates a transaction, their private key generates a digital signature, which is then verified using the corresponding public key (Briggs, 1998; Shor, 1999). This process ensures that the transaction was initiated by the legitimate owner of the funds.

Protocols Utilizing Cryptographic Functions: Cryptographic protocols such as SSL/TLS (Secure Sockets Layer/Transport Layer Security) and IPsec (Internet Protocol Security) are crucial for securing communications over networks. These protocols use cryptographic algorithms to encrypt data and ensure their secure transmission, preventing unauthorized access and tampering (n.d., 2008).

In blockchain networks, SSL/TLS protocols can be used to secure communication between nodes, ensuring that data transmitted across the network remains confidential and unaltered (Wikipedia, 2024).

2.2 Hash Functions in Blockchain

SHA-256 in Bitcoin Proof-of-Work: Hash functions are essential for ensuring data integrity and authenticity in the blockchain. SHA-256 (Secure Hash Algorithm 256-bit) is widely used in blockchain for creating secure and unique digital fingerprints of data (Wikipedia, 2022B).

In Bitcoin, miners compete to solve complex mathematical puzzles based on SHA-256. Miners must find a hash value that meets a specific criterion, which requires substantial computational effort. Once a miner finds a valid hash, he can add a new block to the blockchain. This process secures the network by making it computationally infeasible for malicious actors to alter the blockchain (Cormen, Leiserson, Rivest, & Stein, 2022).

Data Integrity and Tamper-Proofing: Hash functions ensure that any changes to the input data result in a completely different hash value, making it easy to detect tampering (Rolland, 2015).

When a transaction is added to a blockchain, its details are hashed and included in a block. Any alteration in the transaction details would result in a different hash value, alerting the network to potential tampering (Wiki, 2019). This mechanism ensures the integrity and immutability of blockchain data (n.d., 2011).

2.3 Digital Signatures in Blockchain

ECDSA for Transaction Verification: Digital signatures provide authentication and integrity for

blockchain transactions. ECDSA is widely used in blockchain to ensure that transactions are authorized and legitimate (Camilamacedo86, 2018).

Both Bitcoin and Ethereum use ECDSA for transaction verification. When a user signs a transaction with their private key, it creates a digital signature. The network nodes then use the public key to verify the signature, ensuring the transaction is valid and has not been altered (Aamir, 2019).

Ensuring Transaction Authenticity: Digital signatures ensure that transactions are initiated by legitimate users and have not been altered during transmission (Boehme, Christin, Edelman, & Moore, 2015).

In blockchain-based voting systems, digital signatures can be used to verify voter identities and ensure that votes are cast legitimately. Each vote is digitally signed by the voter and verified by the network, preventing fraudulent voting and ensuring the integrity of the election process (Narayanan, Bonneau, Felten, Miller, & Goldfeder, 2016).

2.4 Cryptography and Encryption in Practice

Cryptography and encryption are fundamental components of blockchain technology, ensuring the confidentiality, integrity, and authenticity of data within decentralized networks (Zohar, 2015). This section explores the practical applications of symmetric and asymmetric encryption in blockchain, highlighting their roles in securing communications, protecting data, and enabling trustless transactions (Antonopoulos, 2014).

2.4.1 Symmetric Encryption in Blockchain

Symmetric Encryption (AES): Symmetric encryption, where the same key is used for both, encryption and decryption, is highly efficient for securing large amounts of data. The Advanced Encryption Standard (AES) is a widely adopted symmetric encryption algorithm known for its speed and security (Bonneau, et al., 2015).

In blockchain applications for healthcare, patient records can be encrypted using AES before being stored on the blockchain. This ensures that sensitive medical information remains confidential

and is only accessible to authorized parties with the decryption key (Nakamoto, 2009). By using AES, healthcare providers can protect patient privacy while leveraging the transparency and immutability of blockchain technology (Buterin, 2024).

Efficient Data Protection: Symmetric encryption is particularly useful for protecting data at rest and ensuring the confidentiality of large datasets (Stormhub, 2023).

Blockchain platforms can use AES to encrypt large volumes of data stored within the network. For example, a decentralized storage solution like IPFS (InterPlanetary File System) can encrypt files using AES, ensuring that even if data is distributed across multiple nodes, it remains secure and accessible only to those with the appropriate decryption keys (Koblitz, Menezes, & Vanstone, 2000).

2.4.2 Asymmetric Encryption in Blockchain

Asymmetric Encryption (RSA and ECC): Asymmetric encryption, which uses a pair of keys (public and private) for encryption and decryption, is essential for secure key exchange and digital signatures. RSA (Rivest-Shamir-Adleman) and elliptic curve cryptography (ECC) are two prominent asymmetric encryption algorithms (Briggs, 1998).

In blockchain networks, asymmetric encryption is used to secure exchange keys over public channels. For instance, when a user wants to share a symmetric encryption key with another user, they can encrypt it using the recipient's public key (RSA or ECC). Only the recipient, who possesses the corresponding private key, can decrypt and access the symmetric key, ensuring secure communication (Shor, 1999).

Digital Signatures: Asymmetric encryption also underpins digital signatures, which provide authentication and ensure the integrity of messages and transactions (n.d., 2008).

Bitcoin and Ethereum use the Elliptic Curve Digital Signature Algorithm (ECDSA) to verify transactions. When a user initiates a transaction, it is signed with their private key, creating a digital signature. Network nodes then use the public key to verify the signature, ensuring the transaction is authentic and has not been tampered with. This

mechanism prevents unauthorized transactions and maintains the integrity of the blockchain (Wikipedia, 2024).

2.4.3 Hybrid Encryption Approaches

Many blockchain applications use a hybrid approach, combining the efficiency of symmetric encryption with the security of asymmetric encryption (Wikipedia, 2022B).

In secure messaging applications built on blockchain, a hybrid approach is often used. Messages are encrypted using a symmetric key (e.g., AES), ensuring fast and efficient encryption. The symmetric key is then encrypted with the recipient's public key (RSA or ECC) and sent along with the message. This ensures that only the intended recipient can decrypt the symmetric key with their private key and subsequently decrypt the message. This method provides both efficiency and security in communication (Cormen, Leiserson, Rivest, & Stein, 2022).

2.4.4 Cryptographic Protocols and Practical Implementations

TLS/SSL for Secure Communications: Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that provide secure communication over a computer network (Rolland, 2015).

Blockchain nodes communicate with each other over the network, often using TLS/SSL to encrypt the data transmitted between nodes. This prevents eavesdropping and tampering by ensuring that all data exchanged between nodes remains confidential and authentic (Wiki, 2019).

IPsec for Network Security: Internet Protocol Security (IPsec) is a suite of protocols for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a communication session (n.d., 2011).

In private blockchain networks, IPsec can be used to secure communications between different nodes and data centers. By encrypting and authenticating IP packets, IPsec ensures that data transmitted over the network is protected from interception and tampering, providing a robust security layer for blockchain infrastructure (Camilamacedo86, 2018).

2.5 Case Studies

To illustrate the practical applications of cryptographic techniques in securing blockchain networks, this section examines specific case studies of prominent blockchain platforms (Aamir, 2019). We will explore how Bitcoin and Ethereum implement cryptographic functions, hash functions, digital signatures, and encryption to ensure the security and integrity of their networks. Additionally, we will look at other notable blockchain platforms such as Hyperledger Fabric and Ripple to understand their unique approaches to cryptographic security (Boehme, Christin, Edelman, & Moore, 2015).

2.5.1 Bitcoin

Cryptographic Techniques in Bitcoin: Bitcoin, the first and most well-known cryptocurrency, relies heavily on cryptographic techniques to secure its network. The primary cryptographic components used in Bitcoin include SHA-256, ECDSA, and Proof-of-Work (PoW) (Narayanan, Bonneau, Felten, Miller, & Goldfeder, 2016).

- **SHA-256 and Proof-of-Work:** Bitcoin employs the SHA-256 hash function in its Proof-of-Work consensus mechanism. Miners compete to solve a complex cryptographic puzzle by finding a hash value that meets a specific criterion. This process requires significant computational effort, ensuring that new block creation is resource-intensive and secure. The first miner to solve the puzzle adds the new block to the blockchain and is rewarded with newly minted bitcoins (Zohar, 2015).
- **ECDSA for Transaction Verification:** Bitcoin uses the Elliptic Curve Digital Signature Algorithm (ECDSA) to ensure the authenticity of transactions. Each transaction is signed with the sender's private key, generating a digital signature. Network nodes verify this signature using the sender's public key, ensuring that the transaction was indeed authorized by the legitimate owner of the funds (Antonopoulos, 2014).
- **Example - Bitcoin Transaction:** When a user initiates a Bitcoin transaction, they sign the transaction data with their private key, creating a digital signature. This signature is then broadcast to the network, where nodes

use the public key to verify the authenticity of the transaction. Once verified, the transaction is included in a block and added to the blockchain through the PoW process (Bonneau, et al., 2015).

2.5.2 Ethereum

Cryptographic Techniques in Ethereum: Ethereum, the second most well-known cryptocurrency after Bitcoin, employs various cryptographic techniques to secure its network and enable the functioning of smart contracts. The primary cryptographic components used in Ethereum include SHA-3, ECDSA, and the Proof-of-Stake (PoS) consensus mechanism (Narayanan, Bonneau, Felten, Miller, & Goldfeder, 2016).

- **SHA-3 and Proof-of-Work/Proof-of-Stake:** Ethereum uses the SHA-3 (also known as Keccak-256) hash function for its cryptographic operations. Initially, Ethereum employed a Proof-of-Work (PoW) mechanism similar to Bitcoin, but it is gradually transitioning to Proof-of-Stake (PoS). In the PoS mechanism, block validators are selected based on the amount of ether (ETH) they hold and are willing to "stake" as collateral (Zohar, 2015).
- **ECDSA for Transaction Verification:** Like Bitcoin, Ethereum uses the Elliptic Curve Digital Signature Algorithm (ECDSA) to ensure transaction authenticity. Digital signatures are generated using the sender's private keys and verified using their public keys, ensuring that transactions are authorized by the legitimate owners of the funds (Zohar, 2015).
- **Example - Ethereum Transaction:** When users initiate transactions in Ethereum, they sign the transaction data with their private keys, creating a digital signature. This signature is then broadcast to the network, where nodes use the public key to verify the transaction's authenticity. Once verified, the transaction is included in a block and added to the blockchain through either the PoW or PoS mechanism (Bonneau, et al., 2015).

2.5.3 Hyperledger Fabric

Cryptographic Techniques in Hyperledger Fabric: Hyperledger Fabric is a modular and

configurable platform for building blockchain applications, designed primarily for enterprise use. It employs various cryptographic techniques to secure its network and manage identities.

- **Modular Cryptography:** Hyperledger Fabric allows the use of different cryptographic algorithms depending on the application needs. The most commonly used are ECDSA for digital signatures and hash functions like SHA-256 for ensuring data integrity (Zohar, 2015).
- **X.509 Certificates for Identity Management:** Hyperledger Fabric utilizes X.509 certificates to authenticate network participants. These certificates are issued by a Certificate Authority (CA) and are used to authenticate users and nodes within the network (Zohar, 2015).
- **Example - Transaction in Hyperledger Fabric:** When initiating a transaction in Hyperledger Fabric, the user creates a transaction proposal, which is signed with their private key and verified by other network members using their X.509 certificates. Once verified, the transaction is endorsed and added to the blockchain (Bonneau, et al., 2015).

2.5.4 Ripple

Cryptographic Techniques in Ripple: Ripple is a distributed system focused on fast and low-cost transactions, often used by financial institutions for cross-border payments. It employs several cryptographic techniques to secure its operations.

- **SHA-512Half:** Ripple uses a variant of SHA-512 called SHA-512Half for hashing transactions and other critical operations within the network. This algorithm ensures data integrity and processing speed (Zohar, 2015).
- **ECDSA and Ed25519 for Digital Signatures:** Ripple supports two main types of digital signatures - ECDSA and Ed25519. ECDSA is similar to Bitcoin and Ethereum, while Ed25519 offers higher speed and security for signing transactions (Zohar, 2015).
- **Example - Ripple Transaction:** When a user initiates a transaction in Ripple, the transaction data is signed using the user's private key, and the resulting digital signature

is broadcast to the network. Validators in the network verify this signature, and once successfully verified, the transaction is added to the Ripple ledger (Bonneau, et al., 2015).

3 RESULTS

My analysis revealed that cryptographic functions like SHA-256 and algorithms such as RSA (Rivest-Shamir-Adleman) and ECC (Elliptic Curve Cryptography) are fundamental pillars in securing blockchain transactions. SHA-256, a hashing function, is widely used in the Bitcoin network, where it transforms transaction inputs into a compact, 256-bit output, ensuring data integrity and immutability. On the other hand, Ethereum, aiming for higher efficiency and security, utilizes SHA-3 as part of its Proof-of-Work protocol. SHA-3 provides better resistance against cryptanalytic attacks compared to previous versions of hashing algorithms.

RSA and ECC algorithms are used for securing digital signatures and encryption in blockchain applications. RSA employs two key numbers – a public key and a private key – for encrypting and decrypting information, allowing secure key exchange even over unsecured channels. ECC, known for its efficiency with smaller key sizes and faster operations, is preferred in modern blockchain platforms like Ethereum for faster and more secure transactions.

One of the main challenges identified in my analysis is the security risks associated with the gradual development of quantum computers. Quantum computers pose a potential threat to traditional cryptographic schemes like RSA and ECC due to their ability to quickly solve factorization and discrete logarithm problems, on which these schemes are based. The growing need to develop post-quantum cryptography is crucial to prevent possible attacks that could compromise current encryption techniques and the overall integrity of blockchain networks.

4 CONCLUSIONS

As blockchain technology continues to evolve, addressing these future challenges will be critical to maintaining the security, efficiency, and trustworthiness of decentralized networks. Cryptographic techniques have proven to be

fundamental in securing blockchain platforms, enabling trustless transactions, and ensuring data integrity and privacy. The practical implementations of cryptographic algorithms like RSA, ECC, and SHA-256, along with digital signatures, have solidified the foundation of current blockchain systems.

However, the advent of quantum computing poses a significant threat to existing cryptographic standards. Post-quantum cryptography research is essential to develop algorithms that can withstand quantum attacks, ensuring the long-term security of blockchain networks. Scalability remains another critical challenge, with ongoing research into Layer 2 solutions, sharding, and other innovative approaches aimed at enhancing transaction throughput and reducing energy consumption.

Privacy and confidentiality are paramount, especially as public blockchains expose transaction details. Technologies such as Zero-Knowledge Proofs and zk-SNARKs offer promising solutions to maintain privacy without compromising the transparency and immutability of the blockchain. Additionally, regulatory and compliance frameworks must evolve with technological advancements to foster innovation while ensuring legal adherence. Integrating KYC

and AML protocols into blockchain systems is a step towards achieving this balance.

Interoperability between diverse blockchain networks is also crucial for a connected ecosystem. Solutions like cross-chain protocols, atomic swaps, and blockchain bridges are being developed to facilitate seamless interactions across different platforms.

By staying ahead of these challenges through continuous research and development, the blockchain community can ensure that the technology remains robust and resilient in the face of emerging threats and opportunities. The ongoing advancements in cryptography, scalability, privacy, regulatory compliance, and interoperability will be instrumental in realizing the full potential of blockchain technology across various sectors, driving its sustained growth and adoption.

In conclusion, my findings highlight the critical role of advanced cryptography in the protection and sustainability of blockchain networks. It is essential to continue innovating and developing new cryptographic approaches to prevent security threats while simultaneously supporting the expansion and adoption of blockchain technologies across various sectors.

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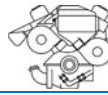
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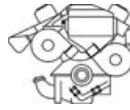


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Defending the Defendable on Libertarianism, Hamas, and Israel

Walter E. Block
Alan G. Futerman

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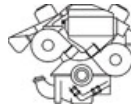
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FROM FRIEND AND CO-AUTHOR TO MAD CRITIC
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