Journal of Law, Market & Innovation

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Presentation of the Journal of Law, Market and Innovation

Ours is an era of great change and speed. The increasing convergence of the physical, digital, and biological worlds has paved the way for changes that have overturned every aspect of our lives. In 18th century's England, the introduction of the steam engine overturned production processes, making them faster and much more efficient (first industrial revolution). At the end of the 19th century, electricity and oil boosted the renewal of industry. This led to mass production (second industrial revolution). In the 1950s, the emergence of computers and digital technology laid the foundations for the global era and today's automation and technology-driven economy.

Today's scenario is based on a mix of technology, digitalisation, and automation. And it is within this hyper-connected framework that researchers in law are called upon to respond and meet new challenges as they arise. Our future is approaching rapidly. Mankind has experienced tremendous improvements in quality of life resulting from the progress of knowledge, economic growth, and stronger institutions, among other factors. Compared to the past, this new phase has unique characteristics. The processes of continuous technological change have been underway for some time, but the recent emergency linked to the Covid-19 pandemic has inevitably acted as an accelerator. 'Innovation' in all its different forms will dramatically affect the well-being of both present and future generations. In the context of the JLMI, the word 'innovation' covers both the digital transition, the green and circular transition, and the social and economic transition.

To offer the international community of academics and professionals a venue where the debate on these forms of innovation can thrive, a diverse group of researchers from different legal disciplines has decided to join forces to launch the Journal of Law, Market & Innovation (JLMI). The JLMI is an international academic, fully peer-reviewed law journal, to act as a cutting-edge forum to discuss all legal issues pertaining to 'innovation' and how it affects global and national markets. Both the advisory board and the editorial board are international, which reflects the vocation of this Journal to reach out globally in terms of both jurisdictions considered and targeted audience. The rooms where the editorial process is mostly handled are anyway the virtual and physical ones of the University of Turin and of the Turin Observatory on Economic Law and Innovation (TOELI), established at the glorious Istituto Universitario di Studi Europei (IUSE).

We are deeply grateful to all those who, thanks to their hard work and/or invaluable advice, made it possible to turn our idea into something real.

R.d.C., C.P.

Foreword to Issue 1/2022

This issue of the Journal of Law, Market & Innovation is a joint initiative with the Master of Laws in International Trade, within the Turin School of Development. The Master is jointly delivered by the University of Turin (Law Department) and the International Training Center of the International Labour Organisation in partnership with the University Institute of European Studies (IUSE), UNCITRAL and UNIDROIT.

Planned on an annual basis, such dedicated issue of the JLMI focuses on international and comparative approaches to trade law with the goal of offering challenging ideas, critical insights and new perspectives. The interdisciplinary approach adopted within the Master is also reflected in this issue's contributions. Each one addresses its topic from a specific area of law while considering the international, supranational or transnational legal dimension of it. Contributions from the Alumni of the Master programme are particularly welcome. However, each submission undergoes the same blind peer-review process. A Call for papers is published every year to collect proposals on a given trade-related question, but spontaneous submissions on relevant topics are accepted and processed as well.

The current issue deals with *The Interplay of Physical and Digital Trade Law*. It is intended to discuss to what extent technology and digital trust are changing global trade law, and what are the implications of the interplay of physical trade and the digitalisation of the economy for the regulation of global trade. The editors of the issue are the scientific coordinators of the 2020-2021 edition of the Master programme, University of Turin's dr Elena D'Alessandro, Professor of Civil Procedure, dr Lorenza Mola, Professor of International Law, and dr Cristina Poncibò, Professor of Comparative Private Law, together with dr Riccardo de Caria, Professor of Comparative Public Law as Co-Editor-in-Chief of the JLMI.

The issue also features the first Innovation Letter of the JLMI, dedicated to the new Foreign Investment Law in China.

<div align="right">E.D'A, L.M., C.P., R.d.C.</div>

Riccardo Ventura·[*]

INNOVATION LETTER

ONE YEAR OF NEW FOREIGN INVESTMENT LAW AND ONE CENTURY OF OLD COMMUNIST PARTY. NOTES FROM A WESTERN EXPATRIATE IN CHINA

SUMMARY

1 Introduction – 2 Background of the new law on foreign investments – 3 Equality of foreign invested enterprises, protection of intellectual property and access to public procurement – 4 A real change? – 5 The Chinese establishment – 6 Possible outcome

1 Introduction

According to the narrative illustrated in the Memorial of the First Meeting of the Chinese Communist Party, in the district of Xintiandi in Shanghai, the party was founded here in 1921. At that time, Xintiandi was a poor residential area, and later, after the war and thirty years of hard communist regime, it became poorer. Now, it is a sequence of elegant restaurants and luxury stores, embedded in renovated Shanghainese shikumen houses. This one-century anniversary has been celebrated with an exhibition of power and wealth, including light-shows on the financial towers of Lujiazui in Shanghai, a militaristic representation on Tiananmen Square in Beijing, and massive propaganda on all state TV channels, broadcasting interminable serials on the virtues of Mao Tze Dong and the heroism of the Chinese fighting against the Japanese, the Kuomintang, and the US army in Korea. With a notable silence on the three decades of mass murders and starvation between 1949 and 1978, as well as on the massacre of students in 1989.

This historic anniversary occurs one year and a half after the entering into force, on 1 January 2020, of the new Foreign Investment Law (Law) and the related Regulation for

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[*] The author is attorney at law; former general counsel of the Chinese operations of a US multinational corporation based in Shanghai. This article reflects his personal opinions, not the position of his employer. They are the result of studies of local law and history, observation of international and Chinese media, and interviews with Chinese nationals and other foreign expatriates with different backgrounds.

Implementing the Foreign Investment Law (Regulation). A more mundane anniversary, that of course nobody has celebrated.

There is a connection between the two occurrences, made by Chinese history, politics, and Western misperceptions.

2 Background of the new law on foreign investments

The Law and the Regulation have superseded three previous laws: the Law on Wholly Foreign-Owned Enterprises (1986), the Law on Chinese-Foreign Equity Joint Ventures (1990), and the Law on Chinese-Foreign Contractual Joint Ventures (2000).[1] Over the years, this legal framework made of multiple layers with many amendments and implementing regulations, became obsolete and difficult to coordinate. Besides, it was criticised as too protective for Chinese enterprises, and discriminatory against foreign enterprises, on the no-longer valid justification that foreigners were in a stronger economic and technological position.

International criticism against China's laws and policies on foreign investments focused on three main arguments: (a) inequal status of foreign invested companies towards Chinese-owned companies, (b) extorsion of foreign intellectual property rights, and (c) entry barriers to public procurement.[2] This criticism grew on the back of three broader political issues. The first, concerning the status of China as developing country in the WTO.[3] The second, concerning geopolitical interests around the control of Taiwan and the South China Sea. The third, concerning human rights, recently focusing on the Uyghur population in Xinjiang and the protests in Hong-Kong.[4]

The political conflict has driven a dramatic increase of import tariffs on Chinese products in the US and other Western countries, followed by countering tariffs in China on their products and, recently, to the suspension of the approval by the EU Parliament

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[1] For an overview of the three old laws see Flavio Picaro, 'Diritto Societario Cinese: gli investimenti stranieri in Cina' [2017] Cammino Diritto.

[2] A motivated defense of China's policy in international trade can be found however in Tingliang Wang, 'Western Misperceptions and China's Approach to International Investment Law' [2019] Santa Clara Journal of International Law 1.

[3] China has been a member of WTO since 11 December 2001. Since that time, China enjoys since then the status of developing country. This gives to China the right to restrict imports to protect specific industries and raise import tariffs without reciprocity. However, nowadays China is the second-largest economy in the world, with the GDP of an economic superpower: $14.14 trillion, and a recent Credit Suisse report highlights that the number of wealthy Chinese people overcame the number of wealthy Americans in 2019.

[4] See Margaret K. Lewis, 'Why China Should Unsign the International Covenant on Civil & Political Rights' [2020] Vanderbilt Journal of Transnational Law 131.

of an important trade treaty reached at the end of 2020 with China, frustrating years of lengthy negotiations.[5]

In such complex scenario, the issues of foreign investments appeared the easiest and quickest to resolve.[6] So, in 2019 the new unified foreign investment law, a project that was lagging since years, was resumed, revised, and passed in record time by the National Congress and the State Council.[7]

3 Equality of foreign invested enterprises, protection of intellectual property and access to public procurement

The Law and the Regulation address bluntly the three mentioned critics concerning inequality, intellectual property, and public procurement.

First and foremost, the Law affirms that foreign investors in China enjoy national treatment.[8] This means that the treatment of foreigners and their investments may not be less favorable than that accorded to domestic investors and their investments.[9] The national treatment principle, however, is limited by the Special Administrative Measures for the Access of Foreign Investment, commonly known as "negative list", which is a list of strategic businesses restricted to Chinese enterprises, or to joint ventures in which Chinese nationals have at least joint control. As a result, China grants national treatment to foreigners only outside the negative list,[10] which is updated from time to time by the State Council.[11] The fencing of foreign investors out of the negative list is a significant competitive advantage that China enjoys without incurring in trade sanctions, thanks to its status of developing country in the WTO.

Other main provisions of the Law set out that the state protects the investment of foreign investors, their income, and other lawful rights and interests within China,[12] and that foreign invested business may not be subject to obstructions or restrictions.[13] On

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[5] China-EU Comprehensive Agreement, available at <https://trade.ec.europa.eu/doclib> last accessed 31 March 2022. An original and critical analysis of the most contentious subjects negotiated in the China–EU Comprehensive Agreement on Investment is the one by Yuwen Li, Tong Qi and Cheng Bian (eds), *China, the EU and International Investment Law. Reforming Investor-State Dispute Settlement* (Routledge 2020).

[6] Interesting perspectives from lawyers and political scientists from Europe and Asia on the interactive dynamics between law and diplomacy in international trade and investment in Chien-Huei Wu and Frank Gaenssmantel, *Law and Diplomacy in the Management of EU–Asia Trade and Investment Relations* (Routledge 2019).

[7] Mo Zhang, 'Change of Regulatory Scheme: China's New Foreign Investment Law and Reshaped Legal Land' [2020] UCLA Pacific Basin Law Journal 179.

[8] Article 4 of the Law.

[9] This statement has been described as an evolution of the opening of the Chinese market to foreign investors started with the reforms of 1978 and, in particular, with article 18 of the Constitution approved in 1982, which sets forth simply that the state allows foreign investors to invest in China.

[10] The latest version of the negative list is Order No. 32 of the National Development and Reform Commission of the People's Republic of China and the Ministry of Commerce of the People's Republic of China of June 23, 2020.

[11] The state council is the government body immediately below the president and above the ministries.

[12] Art. 5 of the Law.

[13] Art. 15 §1 of the Law.

the contrary, foreign investment is encouraged through state aid on funding, land supply,[14] taxes, fees reductions, exemptions, and business licenses.[15] The Law establishes that foreign invested companies are subject to the same mandatory standards of nationals,[16] and that the process for license applications is the same for national and foreign invested companies.[17] Foreigners may also participate to the public comment of draft laws or regulations,[18] also through chambers of commerce and associations, symposiums, meetings, or hearings.[19] Two other reassuring statements of the Law are that foreign invested companies may not be subject to expropriation, except for reasons of public interest and subject to market-value indemnity,[20] and they enjoy free movement in and out of the People's Republic of their contributions, profits, capital gains, assets proceeds, and royalties.[21] Public officials that contravene rules and discriminate foreign investors are subject to punishment under criminal law rules.[22] Most of the said provisions simply reaffirm the content of pre-existing laws, although in a more bold and comprehensive fashion. A more innovative principle is that foreign invested companies are subject to the standard rules of company law, without derogations:[23] this is probably the most visible change for foreign investors, that by the end of 2024 must amend the articles of their Chinese subsidiaries and joint ventures to align them with standard company law. This should enable more freedom to adapt the articles of companies to the needs and intentions of their shareholders, among other things on profits distribution.

To confront the most acrimonious cause of mistrust against China, the Law sets out that the intellectual property rights of foreign investors are protected. In theory, they were protected also earlier. The difference is that now infringers are liable to heavier penalties than in the past and through more expedite disputes resolution.[24] The protection of intellectual property applies explicitly also to public administrations, who are the main agents accused of extorting technologies, by forcing foreign companies to disclose technical data in exchange for unrelated business licenses, or other necessary

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[14] All land belongs to the State. Privates may obtain long-term, transferable concessions to build on it and use it: a rule that is often pointed at to affirm that China is still communist in its roots, notwithstanding its market economy.

[15] Art. 12, 19, 20 of the Law. Art. 6 of the Regulation.

[16] Art. 14 of the Regulation.

[17] Art. 35 of the Regulation.

[18] Art. 10 of the Law.

[19] Art. 7 of the Regulation. The public consultation is a rather efficient system through which the legislative committees in charge of drafting new rules consult important stakeholders, including foreign investors on commercial matters. This process is not just a formality: the Chinese legislative authorities have a genuine interest to learn and consider the comments they receive in their revisions.

[20] Art. 21 of the Law, art. 20 of the Regulation.

[21] Art. 22 of the Law.

[22] Art. 17, 41 of the Law.

[23] Art. 31 of the Law.

[24] Art. 22 of the Law.

regulatory approvals.[25] The Law states that no public administration may force the transfer of technology by administrative means,[26] implicitly recognising that this is what has happened so far.[27] Disclosure of trade secrets must be limited to the extent required for legitimate purposes of law, and the access to it must be limited to officials in charge of their implementation.[28] Whenever the disclosure of intellectual property is necessary for compliance purposes, public administrations and their employees who receive it are obliged to keep it confidential.[29] In all cases, public officials that breach their duties are subject to disciplinary action, or punishment established by criminal law.[30]

When it comes to public procurement, the Law guarantees that foreign invested enterprises may participate in governmental bids through fair competition,[31] without obstructions or restrictions.[32] To this purpose, buyers and procurement agencies may not apply discriminatory treatment, or impose ownership structures, brands, or other conditions that would penalize foreign invested enterprises.[33] All products and services

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[25] See Julia Ya Qin, 'Forced Technology Transfer and the USA-China Trade War: Implications for International Economic Law' [2019] Journal of International Economic Law 743. This study is an analysis of the IP extortion practices and the possible legal means to counter them. In essence, foreign investors must share confidential information relevant to technology, like production processes, designs, or even source codes with government officials to obtain or maintain market access. See many examples in Jyh-An Lee, 'Forced Technology Transfer in the Case of China' [2020] B.U. J. SCI. & TECH. L. 324. This article observes that also the mandatory JVs forced in certain industries by the negative list have been an effective tool to acquire know-how from the West.

[26] Art. 23 of the Law, art. 24 of the Regulation.

[27] See many examples in the articles referenced in footnote 26. Foreign companies who have been subject to extortions of know-how by governmental agencies are reluctant to declare it in public, to avoid retaliations and obstacles to their business in China. However, many real-life cases have been summarised in the the Joint Submission of January 2019 on the draft Foreign Investment Law of the American Chamber of Commerce in China and the U.S. Chamber of Commerce: "[...] In practice, when foreign-invested enterprises apply for High and New-Technology Enterprises (HNTE) designation, some local governments require patents to be registered in China, otherwise the application is not approved. Moreover, although the article bans forced technology transfer through administrative means, our organisations remain concerned about pressure through non-administrative means to force technology transfer, such as informal means by administrative agencies or their staff. [...] there remains the possibility that provisions in other laws, regulations and practices will undermine it, for example: (a) Article 69 of the 3rd Draft of the 4th Amendment to the Patent Law would allow local administrative authorities to seize confidential information including trade secrets, which would in effect be forcibly transferred to competitors[...]. (b) Articles 24, 25 and 29 of the Regulations on Technology Import and Export Administration (TIERs) of the People's Republic of China place restrictions on how technology is imported into China that are not applicable to tech transfer or IP licensing between domestic entities in China. These constitute a form of forced technology transfer. (c) Environmental, pharmaceutical, medical device or other regulations that require disclosure of confidential information including trade secrets which are not necessary to accomplishing the purposes of the regulations, or sharing information obtained in such regulatory review with third parties such as competitors or experts affiliated with competitors. (d) We also understand that there are interpretations of the Supreme Court on Article 329 of the Contract Law as well as other regulatory requirements to register all intellectual property agreements involving foreign parties with the Ministry of Commerce as a precondition for Chinese parties to pay royalty and engineering service fees to foreign parties.

[28] Art. 25 of the Law.

[29] A new patent law was also approved in Oct 2020, effective June 2021, and has increased the protection of patents and the liability of infringers.

[30] See footnote 22.

[31] Art. 16 of the Law.

[32] Art. 15 of the Regulation

[33] Art. 15 of the Regulation.

provided within China shall be equally treated.[34] Finally, the Law promises a strengthening of the supervision and investigation of the fairness of procurement processes,[35] and again the punishment of violations.[36]

4 A real change?

Undoubtedly, the Law and the Regulation contain a sequence of broad-range, positive statements: equal treatment, protection of intellectual property, and fairness in public procurement are what the world's investors requests to China. However, according to many observers these rules show a *"general lack of detail and excessively vague language with respect to many key terms and provisions."*[37] Vagueness gives very broad margins of discretion on their application, which consequently depends on the intentions of the officials who will apply the new rules. As a result, one year after its implementation, the Law has not really impacted the reality of the business for foreigners in China. For example, nothing has changed with regard to the transfer of money out of China, even for commercial transactions and especially in foreign currencies, that in spite of the bold language of art. 22 of the Law, still requires the same cumbersome and narrow process.

Being aware that in China, probably more than anywhere else, practice matters much more than the wording of laws (and contracts), the international community has acknowledged the Law with skepticism and is still waiting for tangible developments. The Chinese establishment, however, is not signaling any urgency. The extent of the application of the Law is now, and will continue to be, a reaction to the atmosphere that they perceive around them. Due to the epidemic and the transition of power in the US, since 2020 not much has happened, other than an increase of hostilities through export control rules, expected to intensify in the future. Consequently, the application of the Law and the Regulation has stalled, and foreign enterprises are rather experiencing an increase of regulatory restrictions, mainly motivated by national security, making their business in China increasingly difficult.[38]

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[34] Art. 16 of the Law.

[35] Art. 17 of the Regulation.

[36] Art. 41 of the Regulation.

[37] Submission of the American Chamber of Commerce in China and the U.S. Chamber of Commerce on the draft Foreign Investment Law Implementing Regulations of December 2019.

38 Recent examples are the Anti-Foreign Sanctions Law and the Data Security Law, both enacted on June 10, 2021. For an overview of the economic theories behind national security, see Chieh Huang, 'China's Take on National Security and Its Implications for the Evolution of International Economic Law' [2021] Legal Issues of Economic Integration 119.

5 The Chinese establishment

Meanwhile, the one-century anniversary of the Communist Party has affirmed more than ever the strength of the Chinese establishment, the suffocation of any dissent, and the end of the Western myth that economic prosperity will bring democracy.[39] In reality, wealth has become the main tool of the party to strengthen its dictatorial power, because people regard the lack of freedom as the price to be paid for prosperity and stability. In the public messaging surrounding the one-century anniversary, most emphasis is on the millions of people brought out of poverty (omitting that they were brought and kept in poverty for decades by the same regime) and on the number of rich people in nowadays China. The rest is all about the unity and independence of the country, as opposed to the divisions and subordination of the "century of humiliation" ended in 1949.[40] Wealth, unity, and independence from foreigners are the three recognised achievements of the Communist Party and the reasons why Chinese people broadly support it, with only marginal, insulated and promptly eradicated exceptions. From this perspective, the Communist Party has done what imperial dynasties did in past centuries, when they took over from a previous dynasty, each time after years of political decline, invasions, and famines. As in the imperial history, unity and independence were achieved first, and the path to economic prosperity was found later (in the communist era, only after the death of Mao Tze Dong and the fall of the orthodox followers of his ideology). The communist dynasty is steadily in charge, it will stay for long, and it will not make compromises on the foundations of its power: not on Hong Kong, Taiwan, Xinjiang, Tibet, or any other territory that in the past was part of the Chinese empire; not on the blind obedience to the Communist Party's doctrine, dogmatically dictated in all schools to educate citizens to submission; not on any foreign influence on how the treatment of their citizens, perceived as interference on internal affairs reviving past humiliations. Whenever the regime will feel mistreated on any of those fronts, it will take action against the maltreaters.

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39 See Rana Mitter and Elsbeth Johnson, 'What the West gets wrong about China' [2021] Harvard Business Review, available at <hbr.org/2021/05/what-the-west-gets-wrong-about-china> (last accessed 31 March 2022). This interesting article quotes an eloquent part of a speech of former U.S. President Bill Clinton in 2000: "By joining the WTO, China is not simply agreeing to import more of our products, it is agreeing to import one of democracy's most cherished values: economic freedom. When individuals have the power [...] to realize their dreams, they will demand a greater say."

40 Term used in China to refer to the century following the Opium Wars of 1839-1842 and 1856-1860, during which the largest empire of the world was turned step by step, through unequal treaties, military expeditions and insurrections, into a fragmented and battered territory controlled by brutal invaders, foreign economic exploiters and war lords.

6 Possible outcome

With this background, unilateral trade sanctions cannot be expected to push China in any constructive direction. Let alone sanctions to allegedly defend religious minorities or street protests in ex-Western colonies: all complex political situations with substantial economic implications, where the freedoms of speech and religion voiced by Western commentators are only the surfaces of the problems. If the US, the EU and their allies will continue down a path of hostilities, based on allegations that they do not raise towards other powerful regimes (other than Russia and its satellites), the dynasty will feel disrespected and will react aggressively. The Law and the traditional benign diplomatic declarations of China on harmony in international relationship will remain empty words.[41]

To move out from the deadlock, Western countries should rethink the agenda towards China on many areas of confrontation.

China should be accepted for what it is: a nation ruled by an establishment that thanks to decades of mass executions, suffocation of dissent, threatens and massive propaganda enjoys the unconditional support of the large majority of a huge population, which is politically passive and does not want to be saved by the West. After all, Chinese people have suffered and worked hard to get where they are and deserve to be collectively respected.

The forced indoctrination that is currently taking place in reluctant autonomous provinces is the same, although much less bloody, that took place in the past seventy years in the rest of the People's Republic. Either we accept China with the legacy of its communist dictatorship and we do business here, or we do not: it is an hypocrisy to object to the hard regime in Xinjiang and Hong Kong, and to forget the hundreds of thousands of Chinese victims of the campaigns against the right, the great leap forward, the terror of the cultural revolution (celebrated during my youth by our left-winged intellectuals), as well as nowadays repression in Mainland China, while continuing to make billions in the Chinese market.

The possibility to push Western human rights in China was real in the 80s, until the massacre of Tiananmen Square of 1989, which was a turning point in Chinese history. It was let go for greed and ingenuity: for the profitable perspectives of a new, huge market, and the blind belief that, thanks to economic growth, China was anyway on the path to democracy. Western powers made only formal condemnations of the bloodshed of students who wanted political, and not only economic change. But Western companies continued seamlessly to bring massive investments and technologies into China, chasing the multiplied returns that they ultimately have cashed out. Thanks to that, and

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41 Cf. Chieh Huang, 'China's Take on National Security and Its Implications for the Evolution of International Economic Law' [2021] Legal Issues of Economic Integration 119.

to the hard work of Chinese dreaming western living standards, China has grown at record speed, acquiring a much stronger negotiating power and developing sophisticated trade and investment strategies.[42] Now, trying to influence China politics is a useless rhetorical exercise. Unless, perhaps, Western economies were able to make real pressure by completely retreating from China and embargoing it, through a joint action that would be very difficult to coordinate and would severely impact their GDP: something hard to imagine in times of high public debt.

Taiwan should be defended from a military aggression, if necessary also by deploying defense forces in the Pacific, but not by supplies of weapons to its local military, that could ignite a regional war with potential intercontinental impact. Taiwan should be rather persuaded through international diplomacy to open a negotiation for its adhesion to the People's Republic, maybe with a referendum and possibly as autonomous province, allowing the Communist Party to make offers to buy Taiwanese consensus, for instance on taxes, welfare, or committing investments in infrastructures. A peaceful unification would close a deep wound left by the civil war of the past century, without any serious geopolitical unbalance for the West (in particular for the US, whose influence in the South East lies on the ties with Japan, South Korea, Australia and India, not so much with little Taiwan island.)

China is an advanced and developed country. The exceptions of its scarcely populated rural and desertic areas do not change the fact that China has the second economy of the world, aiming at becoming the first. So, the paradox of its protected treatment in the WTO as developing country must end. To achieve this goal, the energies of Western nations in the international community should focus on it. The WTO is the only legitimate venue where the People's Republic can be confronted, respectfully, to level its playing field with other developed economies. Ending the distraction and disturbance of bilateral trade wars or other useless arguments and focusing on a joint effort at the WTO would force China to dialogue, because this is not a topic that they may elude claiming that it is an internal affair. They would have no alternatives than an equal dialogue, with the only possibility to gain a little more time and some graduality.[43]

In the context of a fair WTO negotiation, the unilateral sanctions and tariffs against China of the past few years should be unilaterally revoked, to de-escalate tensions and

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[42] See Julien Chaisse, *China's International Investment Strategy: Bilateral, Regional, and Global Law and Policy* (OUP 2019).

[43] See Bernard Hoekman and Robert Wolfe, 'Reforming the World Trade Organisation: Practitioner Perspectives from China, the EU, and the US' [2021] China & World Economy 1. See also Ronald Eberhard Tundang, 'US–China Trade War An Impetus for New Norms on Technology Transfer' [2020] Journal of World Trade 943; Vivienne Bath, 'China's Role in the Development of International Investment Law –From Bystander to Participant' [2020] Asian J. WTO & Int'l Health L & Pol'y 359.

prompt the same step by the Chinese government on countering measures, setting a suitable climate for negotiations.[44]

If one day China will accept the undeniable status of developed country, the unbalanced situation of its trade barriers can be resolved by the WTO agreements, with no need to amend them. At the same time, one must consider that China's production costs are continuing to increase thanks to the improvement of social conditions, and that Western industries have learned hard lessons from major global trade disruptions caused by epidemics, natural disasters and accidents: these facts should slowly revert the wild industrial delocalisation towards faraway cheap labor.[45] Pursuing these goals should slowly adjust the trade balance with China and relax today's tensions. At that point, the encouraging words of the Law may have a serious chance to evolve into the daily business practice of an open, competitive, and regulated market: undoubtedly and unfortunately, under a repressive political regime, but contained within the borders of a largely supportive and actually proud nation. Otherwise, we will have other unpromising Chinese anniversaries.

Shanghai, September 2021

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[44] See Henry Gao, 'WTO Reform and China: Defining or Defiling the Multilateral Trading System?' [2021] Harvard International Law Journal Special Issue 1. For a different perspective, see Angela Huyue Zhang, 'The U.S.-China Trade Negotiation: A Contract Theory Perspective' [2020] Georgetown Journal of International Law 809. This Article illustrates the circumstances when a trade agreement is difficult to write, unlikely to succeed and impossible to enforce. As an alternative to a trade agreement, this article advocates for a stronger economic integration as a commitment device. By allowing each country to hold the other's assets, economic integration can push cooperation between nations when trust is lacking.

[45] With the side effect of reducing the massive pollution caused by global trade transportation.

Mireia Artigot Golobardes[*]

ALGORITHMIC PERSONALISATION OF CONSUMER TRANSACTIONS AND THE LIMITS OF CONTRACT LAW

ABSTRACT

Firms increasingly use artificial intelligence (AI) and massive amounts of data to target consumers, influence consumers' choices and tailor the contracts consumers enter in online markets. Algorithmic transactions include personalised contracts driven by data extracted from consumers based on their acceptance of the terms of use of a specific application, but often simply based on their online behavior and without their consent or even their knowledge. Contract personalisation can conceivably improve consumers' surplus from transactions and hence their welfare, but it can also enable firms to exploit consumers' biases and appropriate most or all of the surplus generated by contracts. In this latter case consumer protection is in serious danger.

This article argues for a broad approach to consumer protection in this context. First, consumer protection in algorithmic market transactions cannot be disconnected from the analysis of terms of use contracts or from the dynamics of data markets. Second, consumer protection cannot be addressed only with contractual instruments. The complex structure of algorithmic contractual relationships and the spill over between them requires contract law instruments but also the adoption of public policy measures.

JEL CLASSIFICATION: K12, K22, K24, K33

1 Introduction

The Internet and web-based business networks have enabled new forms of economic interaction through social networks and multi-sided markets.[1] Many markets and new market segments now exist within digital environments and are heavily influenced by network effects,[2] creating new market dynamics resulting, in many cases, in imperfectly competitive structures. One type of market for which these effects are key are multisided markets. This type of market arises in websites, applications and online platforms where individuals exchange goods or services, and where network effects are present in the demand and the supply side and crossed network effects link the two sides.

Recent decades have seen enormous growth, both in Europe and globally, in the number of transactions and in the economic importance of each transaction in these new digital markets. For example, between 2014 and 2019 the proportion of internet users in the EU who entered into a transaction for goods or services in digital networks increased from 63% to 71% overall, rising above 80% in certain EU states.[3] This phenomenon has become increasingly important in our societies not only due to its growing economic significance but also due to the opportunities it brings to consumers through wider choices of goods and services, lower transaction costs and greater information for making decisions. At the same time, though, there is also an exponential increase in the data that businesses are collecting on consumers' characteristics, preferences and behaviour, and in the power of the hardware and algorithms used to analyse this data for personalising consumer choices and contract terms.

Digital markets enable a market environment with low transaction costs and negligible entry costs. Participants in these markets – individuals and businesses – often engage on both the demand side and the supply side. Digital markets offer

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[1] This research focuses on multi sided market platforms – including multi sided market applications– that show network effects, of particular importance for consumer welfare.
[2] S.J. Liebowitz and Stephen E. Margolis, «Network Externality: An Uncommon Tragedy» [1994] Journal of Economic Perspectives 133.
[3] European Commission, A European agenda for the collaborative economy, COM(2016) 356.

consumers contractual bundles, which combine data agreements[4], encapsulated in terms of service (ToS) and privacy agreements, with contracts governing the underlying consumer transaction.[5]

Leveraging machine learning[6] and other forms of artificial intelligence,[7] these networks use consumer data to personalize a range of consumer experiences, from market choices to contract terms. The asymmetric information structure and its impact on the potentially personalised design of market transactions is of especial importance when focusing on transactions involving business and consumers, which are already inherently asymmetric contractual structures.

The use of data in digital markets and online contracts for digital and non-digital products is neither new nor unique to multi-sided markets. However, the large-scale use of consumers' data enabled by artificial intelligence (AI) and machine learning results in processing massive amounts of data points that make it possible to obtain remarkably accurate information about market participants, including inferences of their preferences, choices, and interests. This makes it possible to design and structure the transactions they enter into in a personalised way.[8]

The multi-contractual and multidimensional structure of consumer transactions in digital markets challenges the adequacy and effectiveness of some of the legal mechanisms for consumer protection currently in place, particularly those mechanisms focused on commercial practices, pre-contractual information, and ex post control of standard contract terms. This makes it difficult for consumers to protect

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[4] Data agreements refer to the terms of service and privacy agreements that internet users (consumers) enter into when accessing a website, downloading an online application or participating in an online multi-sided market platform. These standard agreements establish the terms of use of the website or application and the personal data collected during the user's online activity. From this perspective they enable drawing an accurate picture of the consumer's personal, profesional, economic profile and of its market choices. See Sandra Wachter and Brent Mittelstadt, «A Right to Reasonable Inferences: Re-Thinking Data Protection Law» in the *Age of Big Data and AI* (2018). 10.31228/osf.io/mu2kf and Zuiderveen Borgesius, F. & Poort, J. (2017). Online Price Discrimination and EU Data Privacy Law. *J Consum Policy* 40, 347–366 noting the importance of consumer's data in personalising digital consumer contracts.

[5] Natali Helberger et al, EU Consumer Protection 2.0: Structural asymmetries in digital consumer markets, [2021] BEUC (<https://www.beuc.eu/publications/beuc-x-2021-018_eu_consumer_protection.0_0.pdf> accessed 31 March 2022) and Christopher Koopman et al, The Sharing Economy and Consumer Protection Regulation. The Case for Policy Change [2015] 8 Journal of Business, Entrepreneurship & the Law 529.

[6] Machine learning is the process through which computers are trained to learn and recognize patterns based on a model given to them and data fed to them. The dynamic learning process involved in machine learning has remarkable implicatins for consumers given that their data in a given moment in time may allow computers to learn about preferences and choices and infer about future decisions consumers may take. See Rory Macmillan, Big Data, Machine Learning, Consumer Protection and Privacy (July 26, 2019). TPRC47: The 47th Research Conference on Communication, Information and Internet Policy 2019, Available at SSRN <https://ssrn.com/abstract=3427206> accessed 31 March 2022

[7] Artificial intelligence involves computer techniques that aim to replicate some aspects of human and animal cognitive processes in computers. See Rory Macmillan, «Big Data, Machine Learning, Consumer Protection and Privacy» (July 26, 2019). TPRC47: The 47th Research Conference on Communication, Information and Internet Policy 2019, Available at SSRN: https://ssrn.com/abstract=3427206

[8] This paper will focus on the contract regulating the consumer transaction, not on the personalised information or targeted advertisement consumers may be exposed to.

their interests in transactions and their experiences in markets, endangering the effectiveness of the EU's legal framework for consumer protection, which is one of the Union's fundamental principles[9] and a mandate for public authorities at both the EU and member states levels.[10] Ensuring that consumers are capable of acting according to their market choices while being able to meet their expectations from the transactions they enter into is a core element of the internal market. Some steps have been adopted to counter this trend, but they are at risk of being outpaced by the rate at which consumers are participating in online digital markets and the speed of technological development.

This paper aims at presenting the ways these digital markets can threaten consumer protection and argues that contract law instruments fall short in ensuring a level of consumer protection at least equivalent to the one afforded in non-digital transactions.

2 Transaction personalisation: from street markets to Artificial Intelligence

The personalisation of transactions is not a new phenomenon nor is it an infrequent one. In fact, it occurs more frequently than is generally understood. Certain transaction contexts are particularly conducive to personalisation. For example, street market sellers may charge different prices depending on whether the customer is perceived to be a regular client, a tourist, someone with a high income, or someone who is informed about the product. At the same time, depending on the type of store and the type of demand the store has, transactions may also show different characteristics. For example, small fruit stores may reduce prices for produce that is close to spoiling, may give special deals to regular customers based on stock, or may give informal credit to customers who they think will pay later while not offering it to others. In other words, transaction terms in a range of traditional markets are uniform across consumers or across time, and this heterogeneity may be due to the characteristics of suppliers (e.g. small stores with regular long-term clients), the characteristics of consumers (e.g. repeated buyers versus tourists), and the relationship between them. Personalisation of transactions, in this context, often enhances the surplus generated by the transaction and has positive effects for both parties given that it enhances the characteristics of the contract object to the buyer's preferences, it generates trust between them and hence reputation on both that they will want to protect so that can ensure future transactions in favorable conditions for both. However, this context could also result in harmful effects for the consumer. For example, when consumers are perceived to be tourists

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[9] Article 38 of the Charter of Fundamental rights of the European Union (2000/C 364/01).
[10] Article 169 of the Treaty on the Functioning of the European Union [2012] OJ C/326, p. 47–390.

and the value of trust and reputation is low, contactual conditions may be worse than if consumers were local and likely to enter into future transactions with the seller. However, the variables, dynamics, and positions of both parties in digital contracts is remarkably different as compared to non-digital contracts. At the same time, the structure and dynamics of the transaction – and of its contractual personalised design – is also very different between digital and non-digital transactions.

Digital transactions involve a multi-contractual and multi-dimensional contractual structure: a first phase involves the unavoidable decision regarding the access and eventually processing of the consumer's personal data. In this first phase consumers must decide through accepting, rejecting or configuring the privacy policy, the personal data they are willing to share and eventually allow processing through machine learing and other forms of AI. A second phase involves entering into the transaction itself – for example, for the purchase of a good or a service.[11]

AI enables personalisation of online transactions. This personalisation reaches a new dimension of refinement from different perspectives. First, AI enables personalisation of all phases of market transactions: from personalisation of advertisement and hence of the choices consumers may have access to, to personalisation of transaction terms – contract personalisation – and eventually personalisation of remedies. AI, thus, allows for personalising all the market transaction cycle: from consumer's choices to transaction contract terms.

Second, AI allows for a more precise personalisation. AI allows for individual personalisation beyond the traditional segment-based personalisation. Non-AI personalisation tends to personalize consumers or targets often relying on objective discretional and static criteria such as age, gender, income level, education level. AI allows for personalisation in the broad sense not only on personal characteristics – in contrast with group characteristics that would allow for segmentation – but also on dynamic variables such as the information provided by the consumer, or extracted from the consumer's online activity, past purchases and personal or professional context. AI makes it possible to combine variables reflecting consumer characteristics in a dynamic way, personalising transactions based on these variables and adjusting the personalisation in real time as the data and variables change. Personalisation, thus, can be more tightly tuned to the consumer's characteristics at any given point in time, adjusting as those characteristics change.

Third, AI allows for the improvement and constant enhancement of personalisation of market transactions. AI, through machine learning, makes it possible to improve transaction personalisation based on data provided by the consumer regarding

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[11] See Frederik Zuiderveen Borgesius and Joost Poort , Online Price Discrimination and EU Data Privacy Law [2017] J Consum Policy 347 and Michèle Finck, The Limits of the GDPR in the Personalisation Context [2021] in U. Kohl, J. Eisler (eds), Data-driven Personalisation in Markets, Politics and Law, Cambridge University Press.

preferences, interests and ultimately choices. AI, in contrast with non-AI personalisation, has the capacity to modify choices and terms and to experiment with consumer preferences, adjusting choices and terms not only based on the interaction between the consumer and the platform, but also based on the stream of aggregate data that network markets have on consumers' preferences, profiles and choices. With more information collected and processed, AI can offer consumers better, or better tailored, terms.

The use of AI, *per se*, though, is neither positive nor negative for consumers. On one hand, AI may allow consumers to have a better experience in markets, to adjust choices to their preferences, and to receive standard contract terms that enable them to enter into transactions and enjoy greater contract surpluses.[12] On the other hand, AI may enable sellers to condition and limit consumers' choices by presenting information in a way incompatible with the Unfair Commercial practices directive,[13] enable professional sellers to use consumers' data without their knowledge or actual consent, exploit consumers' biases and cognitive limitations, and ultimately strip any contract surplus from consumers.[14] At the extreme, AI may also result in discrimination against consumers based on gender or race, for example, violating their fundamental economic rights of access and participation in online markets , in enjoying similar contract terms, and ultimately in enjoying economic advantage from market transactions.[15]

AI potentially enables the maximisation of the consumer's market experience. However, AI also allows for the inference and use of valuable information on consumers' characteristics regarding preferences, choices, habits and, most importantly, willingness to pay for a product or service. From this perspective, AI can expose consumers in digital markets while enabling sellers and online markets to assess, with remarkable accuracy, the contract terms the consumers are likely to accept while adjusting transaction terms to their (the sellers') best interests. From this perspective, online markets where sellers may personalize contracts to the consumers' characteristics may place consumers in a remarkably vulnerable position without their awareness, presenting a particular danger to consumer protection rights.

Neither contract personalisation nor contract uniformity is, by itself, necessarily harmful or problematic for consumers, but neither is inherently beneficial either.

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[12] Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

[13] Gerhard Wagner and Horst Eidenmueller, Down by Algorithms? Siphoning Rents, Exploiting Biases and Shaping Preferences –Regulating The Dark Side of Personalised Transactions [2019] University of Chicago Law Review 581.

[14] See Michael D. Grubb, Overconfident Consumers in the Marketplace [2015] J Econ Perspectives 1; Xavier Gabaix and David Laibson, Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets [2006] Q J Econ 505, 507–11; Stefano Della Vigna and Ulrike Malmendier, Contract Design and Self-Control: Theory and Evidence [2004] Q J Econ 353, 389.

[15] Jon Kleinberg, Jens Ludwig, Sendhil Mullainathan, and Cass R. Sunstein, Discrimination in the Age of Algorithms [2018] Journal of Legal Analysis 113.

Contract uniformity entails all consumers having a similar – if not the same – set of choices, contract terms, prices, and mandatory rules, regardless of their preferences and circumstances – including, of course, their willingness to pay.

Uniform contracts have the potential to generate a moral hazard problem because consumers face unformly designed transactions for uniform objects that they may value differently and this can generate cross-subsidies among consumers with distributional – regressive – effects.[16] Uniform consumer contracts have the same transaction design and allocation of transaction risk, and they pay the same for the contract object and for legal protection that they may value differently and may also exercise differently. When a contract provides a uniform set of rights across consumers who may value these rights differently, consumers with lower valuation subsidize the rights of the ones who value them most and who may exercise them most.[17] Given that the contract is uniform and its price is as well, those consumers who do not value some of the rights included in it will be paying a higher price for the contract than they otherwise would be paying if they could separate out the rights they do not value. This higher price they pay subsidizes those consumers who value these rights more.

In this uniform contract setting, consumers with lower income and lower willigness to pay – who tend to be less likely to exercise their consumer rights – subsidize the risk distribution and contract rights from the transaction to high income consumers, who pay the same but are more likely to exercise those rights under the contract and hence are not bearing the full cost of their rights under the contract.[18] This cross-subsidy generates extra contract costs for the low valuation group of consumers while lowering the cost of the contract for the high valuation group of consumers, who happily take the windfall.[19]

These cross-subsidies have distributive implicatons.[20] If the contract is uniform and its price is as well, consumers who value most the rights provided by the contract terms and hence expect to exercise them more are subsidised by those who value the rights

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[16] See Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

[17] Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255

[18] The higher willingness to pay is positively correlated to the higher level of education or awareness of his rights and a higher likelihood of exercising those rights. Lower income consumers who may be likely to exercise their rights are subsidising the level of legal protection of high-income consumers who have the same contract and pay the same for the object but are more likely to exercise those rights: cf Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

[19] At the extreme, consumers who would not be willing to pay the price of the uniform contract would leave the market. This would be true even if contract prices were different. Those consumers who would value contract rights less than their price would eventually decide not to enter into the contract so that only those who would value the uniform contract more than its cost would enter into the contract: cf Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

[20] Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019]University of Chicago Law Review 255.

less and expect to exercise them less. Poor consumers pay for rights they may not exercise or may not care about and the result is regressive.[21]

From this perspective, both contract structures, uniform and personalised, present advantages, dangers and challenges for consmer welfare that will be presented in the next sections of this paper.

3 Contractual bundles, data sources and the dynamics of algorithmic personalisation

Among the key characteristics and distinctive elements of consumer transactions in digital markets are their contracting structure and decision-making dynamics. Consumer contracts in digital markets are structured in two stages that are different and functionally autonomous but factually closely related. When a consumer visits a website, enters a platform or a double-sided marketplace or downloads an application, the first thing they find is a request to access and collect – and eventually process – their personal data. This data may include, for example, browsing history, contacts, phone details, and geolocation data. The decision regarding which personal data to share – if any – is a previous, unavoidable and mandatory element to the transaction regarding the object or service the consumer is looking for. It Is also of essential importance for the consumer's present and future welfare. The personal setting of the privacy policies – through accepting, rejecting or modifying the personal data the consumer is willing to share – is a first filter that determines the present and possibly future status of the consumer in the digital market in which he or she intends to participate.

Once the privacy policy has been accepted, rejected or configured in a personalised way, the second element of contracting with consumers in digital markets is the configuration of the transaction that has as its object the exchange of goods or services – digital or not. The regulation of consumer protection in the European Union applies to transactions that take place in traditional markets as well as digital markets. Although structurally similar to the regulation of consumer contracts in non-digital markets, the regulation of consumer transactions in digital markets presents distinctive elements from the point of view of the pre-contractual information the consumer should have before entering into the contract, the design of the consumer contract, the nature and object of the digital contract, and the instruments and remedies available to the consumer in the event of breach.

Although formally distinct, legally and functionally autonomous, the two stages that shape consumer transactions in digital markets – privacy policies and consumer contracts defining the terms of the underlying transactions – are closely related. The

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[21] *Ibidem.*

first, privacy policies, have a fundamental influence not only on the configuration of the design of the consumer transaction but also on the welfare the consumer may obtain from it.[22]

Personal data is the essential element for insights into the preferences of participants in digital markets, their purchases, their profiles and their expected future market decisions. This allows for the targeting of advertisement to consumers' preferences and suggesting them purchasing alternatives adjusted to their preferences, defining their choices, tailoring contract terms – including prices – to the consumer's ability to pay, personalising the object of the transaction to the consumer's preferences and ultimately adjusting contract remedies to the consumer's profile.

There are various different types and mechanisms of personalisation depending on the data used and the dynamic of the personalisation process. One type, called segmentation, involves contracts that are differentiated based on the set of static, stable descriptors or variables associated with a given consumer. The variables may be behavioral, as in the case of consumers' browsing histories, or their frequency of digital market participation and ways in which they use digital markets. They may also be demographic, including consumers' ages, genders and incomes; geographic, including consumers' geolocations, and psychological, including consumers' interests, values, and attitudes. All of these variables make it possible to segment consumers into groups that are expected to react differently to various values or to hold different market preferences.

Whereas the segmentation approach to personalisation leads to consumers being exposed to different market experiences based on the group in which they have been placed, other forms of personalisation go further and rely on personal and individual consumer profiles. Real-time personalisation, for example, uses AI to customize consumer experiences to individual characteristics and behavior at any given moment in time.

4 Beyond individuals' decision and control: multiple dimensions, different data sources and one single dataset

AI-driven digital platforms make it possible for firms to obtain, process and use massive amounts of data in ways that are extremely valuable for their market positions, targeting consumers, profiling them and designing transaction terms according to individual or group characteristics. This data is obtained through a variety of approaches. Some is obtained based on the consumer's consent given when visiting the

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[22] Frederik Zuiderveen Borgesius and Joost Poort, Online Price Discrimination and EU Data Privacy Law [2017] J. Consum Policy 347.

platform itself or when visiting other websites or downloading applications. Some is obtained through the consent of other individuals or institutions that have sufficient connections to or similarities with the target consumer to make it possible to infer things like place of residence, family structure, and socioeconomic. Some of the data is purchased in data markets[23] and some is inferred by combining the target consumer's data and with aggregate personal data from other market participants.[24] Thus, any given dataset about a consumer can have multiple different origins with very important legal implications.[25]

The first approach for obtaining data about target consumers is to collact their personal data from them with their consent. This approach is governed by the European model of data protection,[26] which is structured around the European Data Protection Regulation and based on self-deterministic and private law principles. Through information transparency, the regulation assumes that individuals control and manage their own personal data and, thus, are able to protect their rights by giving or withholding consent.

The Data Protection Regulation requires that the data subject be given transparent information regarding access to and collection and processing of their data. The private autonomy of the individual is placed at the center through the process of consent. Individuals are assumed to control and manage their personal data by giving or withholding consent or by modifying or revoking consent to change the scope of access and processing of their data or to even delete it completely.[27]

The second major approach to obtaining data on given target consumers is to collect it from individuals or institutions related to these consumers. Here the existing regulatory model starts to have serious problems. The extreme case is the one in which

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[23] For simplification, we will assume that this data available in data markets has been obtained legally and hence through the individual's consent regarding access and processing of this data.

[24] Inference data, as long as anonymous, falls outside the scope of application of the General Data Protection Regulation (GDPR), as established by Recital [26] that provides that "(...) *The principles of data protection should therefore not apply to anonymous information, namely information which does not relate to an identified or identifiable natural person or to personal data rendered anonymous in such a manner that the data subject is not or no longer identifiable. This Regulation does not therefore concern the processing of such anonymous information, including for statistical or research purposes.*" Anonymous data is not only that that does not allow identifying an individual but also that data that could not be used to single out or to identify a natural person directly or indirectly. So, as long as the data does not allow identifying or singling out –directly or indirectly – a data subject, such data falls outside the scope of application of the GDPR.

[25] Part of the data forming the consumer's dataset –the one allowing to identify the subject – is subject to the GDPR while anonymised data – such as inference data, for exemple – falls outside of the scope of application of the GDPR. See Jordan M. Blanke, «Protection for 'Inferences Drawn': A Comparison Between the General Data Protection Regulation and the California Consumer Privacy Act», (2020), 1, Global Privacy Law Review, Issue 2, pp. 81-92.

[26] The European model of data protection regulation is structured around the subject's consent. See Articles 4 and 6 of Regulation 2016/679 of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (hereinafter General Data Protection Regulation, GDPR), OJ L 119, 4.5.2015, p. 1-88.

[27] See Ryan Calo, Against Notice Skepticism in Privacy (and Elsewhere) [2013] Notre Dame L. Rev. 1027, 1047–59 arguing in favor of the model of data protection based on the subject's consent.

the target consumer has never surfed the internet but their spouse, children, friends and coworkers are on the internet and have shared information about themselves and about the target consumer. The data released on the internet by all of these people may include places of birth, countries of residence, ages, education levels, incomes, preferences, choices, tastes, and details about their professional lives, which, taken together, can enable firms to draw a remarkably accurate picture of the groups to which the target consumers belong. That is, the data companies use for targeting their consumers, influencing their choices as well as designing the terms of their transactions reach well beyond what these consumers themselves voluntarily release.

Having data on an individual's personal, professional, educational, social and financial context today is enough to draw an accurate profile of the individual or of a relevant group in which the individual may be placed. Note that such data and the potential group personalisation of the consumer it could be used for, would take place regardless of the individuals' own preferences about releasing their data or being characterised as part of a particular group of consumers. This dichotomy between the data that platforms and applications have regarding relevant individual traits and the individuals' decisions to release personal information have profound legal implications regarding the role of the individuals' consent and control of their personal data and the awareness of its use.

The possibility of individuals being profiled[28] as members of groups based on personal and contextual data challenges the basic element on which data protection rests in the European Union and the western world more generally: consent.[29] This data is obtained, processed and used without the target individuals' consent and yet the existing data protection framework does not appear to be triggered. Neither does it appear that contract law and private autonomy instruments commonly used for controlling private law relationships are sufficient to adequately regulate the access to this data, its use and its effects for the individual consumer. This problem will be developed in section 5.

The third approach to obtaining data on target consumers is to purchase it from data brokers.[30] These data brokers are companies in the business of obtaining and selling data -both primary and secondary data – in secondary markets.[31] Primary data is

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[28] Article 4(4) of the GDPR defines 'profiling' as
"(…) *any form of automated processing of personal data consisting of the use of personal data to evaluate certain personal aspects relating to a natural person, in particular to analyse or predict aspects concerning that natural person's performance at work, economic situation, health, personal preferences, interests, reliability, behaviour, location or moviments."*
[29] See articles 4 and 6 of the GDPR.
[30] Examples of databrokers are datacoup (https://datacoup.com) or acxiom (https://www.acxiom.com/).
[31] As an illustration, Joana Moll, an artist and researcher, was able to buy the online dating profiles of 1 million people for €136 from data broker USDate. The data she bought included the profiles of customed gathered from the online dating app Plenty of Fish, 5m photographs and details like their date of birth, zip code and gender as well as intimate

information collected specifically for the firms/platform/app purpose while secondary data is information – generally public – that has been collected by others such as for example, public administrations. This latter type is generally free or relatively cheap to obtain but the information obtained through its processing is remarkably valuable for market participants.

Ultimately, whatever approach is taken to obtaining consumers' data, this data is processed using machine learning and other forms of AI to make inferences.[32] The data obtained through the consumer's consent, the data collected through the consent of the individuals forming the consumer's personal, professional and institutional context and the personal data available in the market and obtained from data brokers all come together to form the dataset on which the AI operates to draw inferences about the consumer's personal characteristics, preferences, interests and market activity – all of which enhance the effectiveness of the consumer's personalisation of the market experience.

5 Types of personalisation; behavioral personalisation and "data-driven" personalisation

Machine learning and other forms of AI make it possible to tailor consumer's choices and to design and personalize transactions and the consumer contracts governing them. This personalisation is possible based on the collection of data from the sources described above and the inferrences about consumers' personal traits, preferences and characteristics that are drawn from this data.[33] Algorithmic personalisation reaches many different phases of consumers' participation in markets, including their choices, the standard terms included in their contracts, and the remedies they may be entitled to in case of a breach of contract.

There are two major types of personalisation mechanisms: behavioral personalisation and data-driven personalisation. Even though the data used to personalize may be based on the same dataset, the mechanisms – and legal implications – of the two types of algorithmic personalisation are remarkably different.

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information like sexuality, religion, marital status and whether they smoke, drink or have children. After GDPR, Moll did not detect any change in the number of profiles (<https://www.ft.com/content/f1590694-fe68-11e8-aebf-99e208d3e521>) (last accessed 20 December 2021).

[32] As explained above, inference data, as long as anonymous, is not considered personal data and falls outside the scope of application of the GDPR. See recital [26] of the GDPR.

[33] See Katarzyna Poludniak-Gierz, Consequences of the use of personalisation algorithms in shaping an offer – A private law perspective [2019] Masaryk Univerity Journal of Law and Technology, arguing that personalisation may also create the perception of a relationship with the seller and hence give a "personal" content to the commercial transaction.

Behavioral personalisation[34] is based on the prior behavior of the consumer in digital markets. Behavioral personalisation does not define the personalised terms of the transaction based on inherent characteristics of the consumer like race, sex, income, or education, but on the consumer's activity and behavior in digital markets.[35] The data used in behavioral personalisation is the data obtained from the subject's consent as well as the subject's data obtained from data brokers.

Data-driven personalisation, in contrast, is based on the complete dataset obtained through all of the approaches discussed above. That is, data-driven personalisation uses the data obtained through the consumer's consent, along with data from individuals and institutions in the consumer's social and personal context, and data from databrokers, and it uses AI to infer new data points about the consumer. Using the comprehensive dataset, data-driven personalisation allows for accurately targeting consumers according to their preferences, designing contract terms – including price terms – according to their willingness to pay, adjusting the contract object to the consumer's preferences and ultimately being able to provide contract remedies adjusted to the consumer's preferences.[36]

A fundamental difference between the two mechanisms is that with behavioral personalisation consumers have some possibility of behaving strategically and hence misleading the algorithms learning from their activity. With data-driven personalisation, in contrast, strategic behavior by both sides of the transaction is not possible.[37] Instead, all of the power lies with the firm that controls the digital platform and the consumer's scope for reacting against data-driven personalisation is much narrower.

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[34] Haggai Porat, Consumer Protection and Disclosure Rules in the Age of Algorithmic Behavior-Based Pricing [2020], available at <http://www.law.harvard.edu/programs/olin_center/Prizes/2020-1.pdf>, last accessed 31 March 2022.

[35] An example of the use – non-disclosed and not acknowledged – of behavioral personalisation is Amazon where the page display is customised to the visitor based on the personal data and metadata available about them to improve customer engagement trough personalising product and content recommendations as well as personalize marketing campaigns (amazon.com).

[36] See Katarzyna Południak-Gierz, Chapter 15 Personalisation of Consumer Contracts—Should We Personalize Interpretation Rules?, in Ana Mercedes Lopez Rodriguez, Michael D. Green, and Maria Lubomira Kubica (eds), *Legal Challenges in the New Digital Age* (Brill, 2021) noting that in light of consumer contract personalisation, rules of interpetation might have also to be personalised.

[37] On the dynamics and effects of strategic consumer behavior under behavioral personalisation – specifically price personalisation – see Haggai Porat, Consumer Protection and Disclosure Rules in the Age of Algorithmic Behavior-Based Pricing [2020], available at <http://www.law.harvard.edu/programs/olin_center/Prizes/2020-1.pdf> and Yuxin Chen and Zhong Zhang, Dynamic targeted pricing with strategic consumers [2009] International Journal of Industrial Organisation 43.

6 The legal anatomy of European consumer protection law in digital markets

As explained above, consumer transactions in digital markets involve a contractual bundle with two different dimensions: (1) data contracts – ToS and privacy agreements – and (2) consumer contracts governing the underlying transactions into which consumer enter. The second dimension may or may not be personalised.

The European regulation on consumer protection is structured around consumers and the contracts they enter in digital and non-digital markets. Its ultimate goal is ensuring consumers' sovereignty in markets so that consumers are in a position to take informed decisions based on their preferences. Consumer contracts and contractual remedies are the main instruments European consumer protection regulation provides to consumers in order to be able to seek redress either with respect to unfair contractual terms or with respect to a possible lack of conformity of the object of the consumer contract – through warranties or remedies for breach.

The literature has broadly discussed and shown that purely contractual remedies are highly ineffective in consumer contracts.[38] However, the vulnerability of consumers is even higher in algorithmic personalised contracts given that, in addition to the informational and bargaining imbalances inherent to consumer contracts, it is difficult – if not impossible – to assess the configuration, implications and effects of these personalised contracts for consumer welfare.

This section presents a general structure of European consumer protection regulation, the main characteristics of the European data protection regime and the main implications of the spillovers between privacy policies and personalised algorithmic contracts. Section 5 presents the inherent limitations of contractual instruments to ensure consumer protection in personalised algorithmic contracts.

7 Europen regulation of consumer protection

Consumers are at the core of European regulation on consumer protection. Consumer protection is closely linked to market regulation: both from the point of view of the general structure of the market – ensuring that it has the most competitive structure possible – and from the point of view of the obligations faced by the manufacturer prior to placing a product in the market or while it is on the market. From

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[38] Yanis Bakos, Florencia Marotta-Wurgler and David R Trossen, Does Anyone Read the Fine Print? Consumer Attention to Standard-Form Contracts [2014] The Journal of Legal Studies 1

this perpective, prior to the introduction of a product in the market, the manufacturer must comply with the product safety regulations.[39]

While the product is in the market and prior to the transaction with the consumer, the manufacturer/seller must inform consumers[40] and notify the authorities of any risks the product may present.[41] At the same time, while the product is on the market the manufacturer/seller – before and after a possible transaction with a consumer – must take action if the risks presented by the product make it unsafe, including withdrawing it from the market when necessary.[42] Finally, the manufacturer (and in some cases also the seller) will be held civilly liable for damages caused to consumers/users by defective products placed in the market.[43] Although relevant for consumer protection, the analysis of European regulations on competition regulation, product safety and liability for damage caused by defective products is excluded from the analysis in this research paper.

As noted above, the main goal of European consumer protection regulation is to ensure, as much as possible, that consumers are in the position to take informed decisions according to their preferences in the transactions they enter into. An essential element of the consumer protection regime in Europe is therefore information. Consumers should have the necessary information to, in their exercise of their private autonomy, take decisions according to their preferences and form accurate expectations about the contract surplus they stand to obtain from a given transaction. Without transparent and truthful information, consumers are not able to take informed decisions about the risks, characteristics and price of the product in question. The emphasis on consumer information is placed both in the pre-contractual phase – through the regulation of commercial practices – and in the contractual phase in which the contract that regulates the transaction with the consumer materializes – through the control of the standard contract terms included in the contract.

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[39] Directive 2005/95 of 3 December 2001 on General Product Safety, OJ L 11, 15.1.2—2, p. 4-17 provides for a general obligation on product safety but also includes an obligation to comply with the sectoral regulation applicable to the specific product. Before a product is introduced in the market suppliers must ensure that the products present a reasonable level of risk under the consumer's expectations and compatible with its use.

[40] Article 5.3 of Directive 2001/95.

[41] Article 5.3 of Directive 2001/95 establishes the obligation of monitoring and informing about the risks that eventually the products present. Product traceability is an essential element of the regulations, which through the European Union's Rapid Information Exchange System, "RAPEX", early warning system for dangerous – unsafe – non-food products, sellers must locate and eventually withdraw dangerous products from the market. Commission Implementing Decision (EU) 2019/417 of 8 November 2018 laying down guidelines for the management of the RAPEX, pursuant Article 12 of Directive 2001/95 / EC on general product safety and its notification system (notified under document number C (2018) 7334), OJ L 73, 15.3.2019, p. 121–187. Directive 2001/95 / EC of the European Parliament and of the Council of 3 December 2001 on general product safety (OJ L 11, 15.1.2002, pp. 4-17).

[42] Article 3.4 of Directive 2001/95.

[43] Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products OJ L 210, 7.8.1985, p. 29–33.

At the pre-contractual level, the consumer's right to truthful and transparent information is regulated in a significant amount of Community legislation ranging from the regulation of misleading advertisement[44] to the regulation of unfair commercial practices.[45] The Unfair Commercial Practices Directive aims at protecting the economic interests of consumers before, during and after a business transaction. It regulates the practices – both actions and omissions – related to the promotion, sale, or supply of a product by a seller. The ultimate goal of the regulation of business practices is to provide a level and quality of information so that the average consumer does not take decisions based on misleading information that would not have been taken without the misleading information.[46] That is, the directive prohibits commercial practices – misleading,[47] and aggressive[48] – that could cause an average consumer to take decisions regarding a transaction he or she would have otherwise taken.[49]

The fundamental idea, widely explained in the economic literature, is that markets work when the decisions of their agents reflect their preferences regarding the design and dynamics of the transactions, as well as the purpose of the transactions. Business practices and the information provided to consumers clearly influence consumer decisions in the market, and the law seeks to prevent practices that manipulate consumers into taking decisions that depart from their prefereces.[50]

At the contractual level, consumer protection is articulated through the control of unfair standard contract terms in consumer contracts. The goal is that informed consumers can obtain the contract surplus they expect to obtain from the contracts they enter.

Consumer contracts are the central element of the European consumer protection regime. The objective of the pre-contractual phase is to ensure that the consumer is in a sovereign position to make informed decisions that reflect their preferences and expectations about the transaction. The second phase of consumer protection in the

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[44] Directive 2006/114/EC of the European Parliament and of the Council of 12 December 2006 concerning misleading and comparative advertising *OJ L 376, 27.12.2006, p. 21–2.*

[45] Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending Council Directive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council ('Unfair Commercial Practices Directive') *OJ L 149, 11.6.2005, p. 22–39.*

[46] Fernando Gomez Pomar, The Unfair Commercial Practices Directive: a Law and Economics perspective, *Indret,* 1/2006.

[47] Article 6 on misleading commercial practices and article 7 on misleading omissions of the Unfair commercial practices directive.

[48] Article 7 of the Directive on Unfair Commercial Practices.

[49] Fernando Gomez Pomar, The Unfair Commercial Practices Directive: a Law and Economics perspective, *Indret,* 1/2006.

[50] Directive 2011/83/EU of 25 October 2011 on consumer rights, amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council Text with EEA relevance
OJ L 304, 22.11.2011, p. 64–88.

marketplace focuses on controlling the structure and distribution of the contractual surplus between the professional seller[51] and the consumer in order to ensure that consumer expectations regarding the expected surplus from the transaction materialize.

The position of the parties in the design, structure and contract terms that allocate the contractual surplus generated by the transaction is clearly asymmetric. The contract is designed and structured by the professional, in a uniform, abstract and general way for infinite consumers with whom they eventually carry out transactions – without thinking of a specific consumer. The consumer contract contains general contracting conditions that are clauses not individually negotiated and that assign obligations to the parties of the contract, assign the risks inherent to the transaction and distribute surplus between the contractual parties.

The asymmetry in information, bargaining power and influence over contractual design as well as influence over decisions about the distribution of the contract surplus are the basis of the complex structure of controls of unfair standard contract terms.[52] The Directive on abusive clauses provides for a multilevel control structure of non-negotiated clauses in contracts with consumers: one control of formal transparency[53] and another of material or substantive transparency[54] – in order to ensure that the consumer, prior to the conclusion of the contract, is in a position to know the content of the contract and to form an adjusted expectation of the expected surplus.

In 2018/2019 the European legislature undertook a major reform of consumer protection[55] regulation to modernize it with respect to two different dimensions. The first was the need to standardize consumer contractual protection regardless of the nature of the object of the contract – with or without digital elements – and the face-to-face or virtual environment of the contract. The second was to modernize the rights of consumers in sales contracts, essentially represented by Directive 2019/771 on certain aspects of contracts for the sale of goods,[56] and by Directive 2019/2161 on the sale of

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[51] See the judgment of the Court of Justice of the EU in *Kamenova* C-105/17, of October 4, 2018, where the CJEU established that the qualification of a contractual party as a profesional should be done on a case-by-case basis and in contrast to the position of consumers that have incomplete information and without capacity to negotiate the contract terms.

[52] Directive 93/13/EEC of 5 April 1993 on unfair terms in consumer contracts, *OJ L 95, 21.4.1993, p. 29–34* (hereinafter Unfair contract terms Directive).

[53] Article 3 of the Unfair contract terms Directive.

[54] Article 4.2 of the Unfair contract terms Directive. The Unfair Contract Terms Directive provides that the test of material transparency will be applicable to contract terms not defining the main subject matter of the contract. However, the Court of Justice of the European Union seems to have extended the scope of application of the material transarency test to all standard contract terms in consumer contracts, including those defining the main subject matter of the contract., See CJUE C-621/17, *Gyula Kiss, CIB Bank Zrt. v. Emil Kiss y Gyuláné Kiss*, of October 3, 2019. This idea was already present in CJUE C-348/14, *Maria Bucura v. SC Banpost SA*, of July 9, 2015.

[55] Most of the Directives adopted in the consumer protection reform of 2018-2019 will enter into force in 2022.

[56] Directive 2019/771 of 20 May 2019 on certain aspects concerning contracts for the sale of goods, amending Regulation (EU) 2017/2394 and Directive 2009/22/EC, and repealing Directive 1999/44/EC, *OJ L 136, 22.5.2019, p. 28–50.*

goods.[57] At the same time, the 2018/2019 reform on consumer protection also raised the focus of the role of the consumer in the market to go beyond the position of the consumer in the market and include a collective dimension of the consumer with a political agenda and social effects of preferences and decisions.[58] Consumers, as a group in the market, is the group in which the European legislator in some way trusts to successfully implement community policies on sustainability and the environment – the so-called New Deal.[59] Today it is still too early to anticipate the impact and possible success or failure of incorporating the collective dimension of the consumer into European regulations.

Directive 2019/771 does not overrule the regulation of the sale of goods established by Directive 1999/44 but regulates the aspects related to the conformity of goods sold,[60] the rights of consumers due to lack of conformity and the commercial warrantees on the objects of contracts. Directive 2019/771 fully harmonizes[61] some essential aspects of consumer sales while keeping the general regime in the hands of the member states.[62]

The modernisation of consumer protection regulation, the second objective of the 2018/2019 reform, has been articulated through the Directive 2019/2161, which has modified different directives on consumer protection[63] and pursues two major goals. First, the transformation and harmonisation of the sanctioning regime applicable to infringements of consumer protection regulations and, second, the strengthening of consumers' right of information, which translates into greater transparency duties for sellers or service providers before the transaction takes place. It also incorporates mechanisms to provide greater legal certainty, coherence and clarity in the consumer protection system.

With respect to the sanctioning regime established by Directive 2019/2161, the Directive requires Member States to guarantee dissuasive, effective and proportionate sanctioning frameworks.[64] To this end, the Directive establishes indicative and non-

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[57] Directive 2019/2161 of 27 November 2019 amending Council Directive 93/13/EEC and Directives 98/6/EC, 2005/29/EC and 2011/83/EU of the European Parliament and of the Council as regards the better enforcement and modernisation of Union consumer protection rules, *OJ L 328, 18.12.2019, p. 7–28.*

[58] Michal Grochowski, «European Consumer Law after the New Deal: A Tryptich», (2020), *Yearbook of European Law*, Volume 39, p 387–422.

[59] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee: A New Deal for Consumers (COM/2018/0183 final); hereinafter: 'New Deal'.

[60] Article 6 and 7 of Directive 2019/771 on ertain asepects concerning contracts for the sale of goods.

[61] Article 4 of Directive 2019/771 on ertain asepects concerning contracts for the sale of goods.

[62] Article 3.6 of Directive 2019/771 on ertain asepects concerning contracts for the sale of goods.

[63] Directive 2019/2161 modifies the following directives: Directive 93/13, of April 5, 1993, on unfair contract terms in consumer contracts, Directive 98/6, of February 16, 1998, on the protection of consumers in terms of indicating the prices of products offered to consumers, Directive 2005/29, of May 11, 2005, on unfair commercial practices of companies in their relationships with consumers and Directive 2011/83, of October 25, 2011, on consumer rights.

[64] The maximum saction should represent, at least, 4 % of the trader's annual turnover in the Member State or Member States concerned and in the event that it was not possible to determine said percentage, the maximum amount for the sanction should be equal to at least two million euros. Article 1 (4) and (5) of Directive 2019/2161 amending

exhaustive criteria to facilitate the uniform application of sanctions that may be imposed through administrative or judicial proceedings.

With respect to the right of transparency and information, Directive 2019/2161 updates and expands the obligations provided for in the Unfair Commercial Practices Directive, which considers deceptive those practices that substantially limit the information relevant to make an informed decision about a transaction for the average consumer.[65] Directive 2019/2161 broadens the scope of the concept of substantial information in relation to relevant elements of the transaction and requires that this information be provided by the seller and/or the digital platform; omission is considered a misleading practice.[66] Directive 2019/2161 imposes on digital platforms and sellers different information obligations, which it qualifies as substantive,[67] with respect to consumers in relation to different essential aspects of sales: (1) information regarding the legal status of sellers of products and services as well as of the distribution of obligations between the digital platform and the third party – whether the third party is a seller or not and the application or not of the rules on consumer protection,[68] (2) information regarding the criteria that determine the classification or positioning of the products or services in the results of online searches[69] and whether that search is provided by an external provider to the seller or it is a functionality that is provided directly by the seller,[70] (3) information regarding the eventually automated mechanisms of determination of the price[71] and (4) information regarding the mechanisms of valuation, review and creation of reputation on the digital platform. Failure to comply

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Directive 93/13. It should be noted that the sanctioning regime is introduced in the amendments of all Directive amended by Directive 2019/2161 but it is not included in the Directive 2019/2161 itself.

[65] Or when this information is provided in an unclear, ambiguous, intelligible or in an inadequate moment. Article 7 of Directive 2005/29.

[66] New Annex I of Directive 2005/29.

[67] Article 7 of Directive 2005/29 estabishes that any commercial practice that omits substantial information, understood as that information necessary for the consumer to make an informed decision about the transaction, will be considered misleading. Directive 2019/2161 has expanded the information considered substantial, the omission of which will be considered a misleading practice.

[68] This obligation is established in a new article 6a of Directive 2011/83 in its section (d) that provides that
(d) where applicable, how the obligations related to the contract are shared between the third party offering the goods, services or digital content and the provider of the online marketplace, such information being without prejudice to any responsibility that the provider of the online marketplace or the third-party trader has in relation to the contract under other Union or national law.
The legal qualification of third parties is of fundamental importance for consumers because the consumer protection regime is only applicable in those contracts between business/professionals/traders and consumers.

[69] Preamble 20 of Directive 2019/2161. This obligation requires the modification of Annex I of Directive 2005/29. Online platforms must dislose the parameters that determine the classification of the results of online searches without being obliged to disclose the code or the mechanics of the algorithm that provides for those results.

[70] Article 3 of Directive 2019/2161 modifying article 7 of Directive 2005/29 on Unfair commercial practices and introducing a 4th section in the article.

[71] This obligation is consistent with the provisions of Article 22 of the General Data Protection Regulation (GDPR) that requires informing data subjects if the terms of the contract have been fully automatised. The underlying idea of this information is allowing consumers to know whether the terms – including the price terms – they are being offered are higher or lower than the other offered to others so that they can decide whether the term they have been offered is acceptable to them – in absolute and relative terms.

with the information obligations towards consumers constitutes an unfair commercial practice.

In sum, the European consumer protection regime places consumers at the center and consumer contracts at the core of the regime that influences the pre-contractual phase, controling the contract itself and providing remedies in case of breach. Algorithmic personalisation of consumer digital contracts introduces a new dimension through the use of personal data to influence the consumer's market experience globally. It occurs before entering into the contract, through the design and personalisation of contract terms, and ultimately through the personalisation of the contract object and the possible contract remedies. This is the subject of the next section.

8 Consumers' personal data as the feeding element of personalised contracts

Algorithmic consumer contracts are built with personal data. This is an important element that does not modify the contractual nature of the contracts with consumers themselves and the legal regime applicable to them but does affect the consumer's position in the contract, the design of the standard contract terms and ultimately the distribution of the contractual surplus between the contracting parties. The role of data brings potential for gains for consumers, but it also presents risks for consumers and market dynamics that warrant concern.[72]

European data regulation rests on transparency and consent, as provided by Regulation 2016/679.[73] Consumers have the right to decide whether they consent – opt in – to their data being accessed, collected, used and sold, as well as the right to know which data is collected. The Data Protection Regulation applies to the fully or partially automated processing of personal data, as well as to the non-automated processing of personal data contained or intended to be included in a file.[74] The definition of personal data is found in article 4.1 of the regulation and is articulated through four elements: (a) all information, (b) relative to (about), (c) a natural person, (d) identified or identifiable.[75]

Access to the personal data of the interested parties is of special importance both for platforms and for owners and managers of digital markets because this data provides the profile of the individuals who visit and use these platforms and markets. From this perspective, establishing the terms of acceptance of the privacy policy is a necessary

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[72] Gerhard Wagner, Horst Eidenmueller, Down by Algorithms? Siphoning Rents, Exploiting Biases and Shaping Preferences – Regulating The Dark Side of Personalised Transactions [2019] University of Chicago Law Review 581.

[73] Regulation 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation, hereinafter GDPR) [2018] *OJ L 119/1.*

[74] Articule 2.1 of the GDPR.

[75] Article 4.1 of the GDPR.

condition in order to enter into the consumer contract establishing the terms of the underlying transaction.[76]

Personal data, in many cases, is essential to carry out the transaction, especially when it is digital. The platform, digital application or seller in a double-sided market will need, for example, the name and surname of the buyer, the address of the buyer to deliver the product that is the object of the transaction and the details of the credit card with which the payment is made. However, most digital platforms, applications and double-sided market managers do not limit themselves to the data strictly necessary to carry out the transaction. Privacy policies generally include a level of data that makes it possible to draw a profile of the users' characteristics, preferences and tastes.

The processing of the personal data of the data subject makes it possible to know very precisely their profile in their digital activity in the double-sided markets or in the platforms in which they participate. This knowledge has a very relevant economic value both for sellers and for market managers. Knowing the preferences, tastes and decisions of individuals through their digital activity allows them to personalize information, make purchase suggestions, display products in optimal ways, and ultimately tailor the contracts that digital consumers accept. In short, through artificial intelligence, the processing of personal data of individuals – interested parties – allows them to personalize the informational, commercial, advertising and contractual experience of the consumer in digital markets as well as to influence and anticipate their future informational and commercial activity in those markets.

The personalisation that the consumer's experience in digital markets – through personalised advertising, pre-contractual information adjusted to the characteristics of the consumer and the contract that regulates the terms of the transaction, among others – is in itself neither negative nor positive for the consumer. However, the informational asymmetry between the contractual parties in digital environments places, as will be explained later, the consumer in a position of special vulnerability to ensure a level of well-being in digital transactions at least equivalent to that which he or she would obtain in traditional transactions. In addition, consent, a fundamental element that allows access to and processing of personal data of consumers, is not the appropriate instrument to balance the position of consumers and react to a possible violation of their privacy.

Consumers' data rights, their exercise and their effectiveness have been broadly discussed in the literature.[77] EU law promotes transparency by mandating the disclosure of the consumer data being collected – through cookies, fingerprinting or

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[76] Article 6(1)(b) of the GDPR.

[77] Sandra Wachter, Brent Mittelstadt, A Right to Reasonable Inferences: Re-Thinking Data Protection Law in the Age of Big Data and AI [2019] Columbia Business Law Review 2 and Frederik Zuiderveen Borgesius, Joost Poort, Online Price Discrimination and EU Data Privacy Law [2017] J Consum Policy 347.

Internet Service Providers' monitoring – and of the use eventually given to this data.[78] However, evidence suggests that information transparency is not equivalent to knowledge or control, and this weakens the effectiveness of the data protection regime.

9 The relevance of contract spillovers in personalised algorithmic contracts

Algorithmic personalisation has an impact on two major contractual phases: before the transaction takes place and how the transaction is contractually designed. Before the consumer enters into the contract, personalisation allows traders and sellers to target individuals and offer them products and services that may better adjust to their preferences. In this sense traders and sellers are in a position to influence the consumer's welfare, which simultaneously increases the likelihood that the transaction takes place. The influence on consumers' preferences and choices results in narrowing market choices to best fit consumer preferences so that it is more likely that the transaction will take place to the benefit of both contracting parties. From this perspective personalisation would be socially beneficial given that it would allow for generating contract surpluses that might not take place without such personalisation.[79]

At the contractual level, algorithmic personalisation allows traders and sellers to offer contract terms that are specially tailored to individual consumers and hence are more acceptable to them at lower transaction costs. Sellers/traders may be able to adjust the consumers' choices to the data and information available about them in a way that transaction costs decrease. In this sense, personalisation would allow the consumer to obtain a higher surplus from the contract while enhancing the aggregate surplus created by the transaction at the market level.

The potential positive aspects of contract personalisation on consumer welfare are contingent on different variables such as whether consumers have pre-contractual information on personalisation, the market structure – whether the market is perfectly competitive or not – and whether it is possible to segment consumers.[80] Ultimately, if traders or sellers compete and are able to charge consumers a price reflecting the cost of the personalised legal protection they are afforded and consumers are aware of that, the outcome not only would be efficient but also optimal. Under these assumptions consumers would be charged a different price but this price would reflect the cost of the legal protection they are afforded. From this perspective, the transaction structure

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[78] See Ignacio Cofone, Adriana Z. Robertson, Consumer Privacy in a Behavioral World [2018] Hastings L.J. 1471, 1475, 1489–1490 and Ignacio Cofone, Beyond Data Ownership, [2021] Cardozo Law Review (in press).

[79] From a purely welfarist perspective, this would be socially positive.

[80] Omri Ben-Shahar, Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

enabled in this context would involve different costs according to their individual preferences and hence different prices reflecting the marginal costs of their legal protection.

Consequently, if contract personalisation was complete and perfect, transaction costs would be different and adjusted to the consumer's preferences and prices would reflect the heterogeneous structure of costs – from the seller and from the buyer. The contract surplus would be efficient and the outcome would be Pareto optimal given that each party in the contract – sellers/traders as well as consumers – would achieve its maximum contract surplus under the contract. Further, there would be no deadweight loss, no cross-subsidy between consumers would take place and the incentives to contract would be optimal.

Reality, however, does not function so efficiently. Algorithmic contract personalisation also throws important shadows.

Algorithmic contract personalisation raises concerns that are a mirror image of its potential welfare enhancing effects. Algorithmic personalisation is possible because of the enormous amounts of data sellers/traders collect, enabling them to adjust choices and contract terms to the consumer's preferences.

In general terms, personalisation can result in losses for those consumers who received a cross-subsidy from other consumers under uniform contracts. That is, those consumers that enjoy uniform contract terms and contract prices but are willing to pay higher prices for the protection afforded because they are more inclined to using them end up seeing their contract prices to go up because personalisation involves a correspondence between contract prices and the level of legal protection afforded. Other consumers see their contract prices reduced under personalised contracts because they now only pay for the level of legal protection they decide to purchase.

Despite the welfare enhancing potential of personalisation, it raises concerns regarding manipulation of consumer preferences, exploitation of consumer behavioral biases and eventual transfers of the consumer surplus to the seller/trader.[81] This may end up limiting consumers to a narrower set of choices, engaging in welfare-reducing transactions and ultimately accepting surplus losses in personalised transactions.

At the pre-contractual stage, the data available to sellers/traders enables them to target ads and recommendations in order to shape consumers' preferences so that ultimately they enter into transactions they would not have entered into had this targeted influence not taken place.

The data available to sellers/traders also positions them to exploit behavioral biases that prevent consumers from correctly assessing expected costs arising from

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[81] G Wagner, HGM Eidenmueller, Down by Algorithms? Siphoning Rents, Exploiting Biases and Shaping Preferences – Regulating The Dark Side of Personalised Transactions [2018] University of Chicago Law Review 581.

transactions and hence the surpluses they can expect to obtain from them.[82] This is particularly acute in complex transactions, but cognitive limitations and behavioral biases are present well beyond complex structures.

At the extreme, algorithmic personalisation can result in first degree price discrimination – or perfect discrimination – broadly studied in economics.[83] First degree price discrimination generates efficient outcomes from the perspective of the surplus generated by the contract and hence from the market. However, it raises equity concerns given that it can enable one of the contracting parties, in this case, the perfectly discriminatory seller, to keep the entire surplus generated by the contract and hence from the market. If sellers know or can infer consumers' reservation prices, personalisation can lead consumers to accept the terms of the transaction without obtaining any surplus from it. Under this structure, consumers end up happy with the contract terms of the perfectly personalised contract but poorer because they do not obtain any surplus from the transaction. In this case, despite of the optimally efficient outcome obtained, consumer protection would be under threat.

10 The inherent limitations of contract law in protecting consumers in algorithmic personalised contracts

AI presents two different but closely connected dimensions in consumer transactions: (1) an intrinsic dimension regarding algorithm design and its responses in consumers' choices and personalised transactions, and (2) a relational dimension regarding the impact on consumer welfare of personalised market choices, transaction design and remedies for breach. With respect to the intrinsic dimension, the EU approach to AI is based on the principles of transparency and explainability of algorithms.[84] With respect to the relational dimension, literature has focused on the economic effects of personalisation for consumers[85] and the legal implications of automatisation for consumers' sovereignty in market transactions, recommending protection because of their weaker informational, bargaining and contracting position in B2C transactions while ensuring they are able to take market choices and shape the

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[82] See Michael D. Grubb, Overconfident Consumers in the Marketplace [2015] J Econ Perspectives 9, 12–13; Xavier Gabaix, David Laibson, Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets [2006] Q J Econ 505, 507–11; Stefano Della Vigna and Ulrike Malmendier, Contract Design and Self-Control: Theory and Evidence [2004] Q J Econ 353, 389.

[83] Hal Varian, *Intermediate microeconomics: A modern approach* (W.W. Norton & Co, 2010) and Benjamin Shiller et al., First degree price discrimination using big data [2013] Brandeis Univ., Department of Economics.

[84] See Directive 2019/2161.

[85] Omri Ben-Shahar, Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255 and Townley Ch. et al., Big Data and Personalised Price Discrimination in EU Competition Law [2017] Yearb. Eur. Law 683.

transactions they enter into according to their preferences.[86] Literature has also focused on the limitations of the current EU instruments – pre-contractual information duties, contractual transparency control and ex post remedies for breach – for protecting consumers in automated, and ultimately personalised, transactions.[87]

The European model relies heavily on private law instruments to protect private autonomy in digital and non-digital markets. Consumer contracts are the main instrument that European law provides to consumers in order to ensure their rights are complied with and seek redress in case their rights are violated.

Contract law, though, when used in asymmetric contexts like contractual relationships between professionals and consumers, is not effective. Further, when personal data is involved as an element shaping and defining the terms of the contract between the professional and the consumer, the effectiveness of contract instruments is even lower. Contract law does not appear sufficient to ensure that the the expected welfare consumers obtain from non-digital non-personalised contracts is equivalent to that obtained in the digital personalised realm.

11 The limitations of contract law in consumer contracts

Consumer contracts are inherently asymmetric[88] from the perspective of the information between the contracting parties as well as from the perspective of their negotiation capacity. For that reason, different legal systems adopt different mechanisms to balance, as much as possible, the position of the contracting parties in the contract. Four of them, used in European consumer law, will be presented here: mandated disclosures, default rules, contract controls, and remedies for breach – warranties. However, all of these mechanisms appear clearly ineffective, for different reasons, in protecting consumers' private autonomy and placing them in a position symmetric to that of the professional.

Mandated disclosures aim at providing a minimum requirement of information that must be given to consumers on relevant characteristics/features of the contract content and the contract object so that they can accurately assess the expected contract surplus generated by the transation. Mandated disclosures, even if well intentioned, present major challenges. The first is the fact that consumers often do not understand or even read the contracts they are faced with.[89] The second is that horizontal mandated

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86 Oren Bar-Gill, Price Discrimination with consumer misperception [2020] Applied Economics Letters, Harvard Law School John M. Olin Center Discussion Paper No. 1033.

87 Oren Bar-Gil, Omri Ben-Shahar, Regulatory Techniques in Consumer Protection: A Critique of European Consumer Contract Law [2013] CMLR 109.

88 Katarzyna Poludniak-Gierz, Consequences of the use of personalisation algorithms in shaping an offer – A private law perspective [2019] Masaryk Univerity Journalof Law and Technology.

89 Yanis Bakos, Florencia Marotta-Wurgler, David R. Trossen, Does Anyone Read the Fine Print? Consumer Attention to Standard-Form Contracts [2014] The Journal of Legal Studies 1, showing that in a simple of 65000 consumers, one out

disclosures may result in misleading consumers instead of enhancing their information. If disclosures are not justified and do not accurately reflect the transaction risks, they can result in false inferences and hence a disruption on consumers' decisions.[90]

Default mandatory rules in contract law are meant to protect consumers from unfavorable contact terms that may be present to the contract. Because of the asymmetric position of the contracting parties, contract drafters – the professionals – are in a position to introduce contract terms that are most favorable to themselves. [91] Mandatory rules intend to balance the consumer's position through introducing non-waiveable rights. The idea is that consumers are afforded a minimum contract quality that cannot be diluted through negotiation. From this perspective, mandatory rules are positive for consumers. European consumer law uses extensively mandatory rules as a mechanism of consumer protection, such as withdrawal rights or remedies for lack of conformity – warranties. However, mandatory rules also present some risks because of their unintended effects, such as raising prices, shrinking markets,[92] or generating cross-subsidies between consumers with deep regressive effects.[93]

Contract controls and warranties are two instruments used in European consumer protection. As explained earlier, contract controls of standard contract terms – formal and substantive transparency controls – set up by the Directive 93/13 aim at ensuring that contract terms provide a minimum quality of contract terms. Transparency controls have been presented in section 4 above so will not be presented here. Warranties, on the other hand, regulated by Directive 2019/771,[94] aim at ensuring that the product object of the transaction complies with the general characteristics of the product type. These are two instruments, widely used in European consumer law, that aim at providing certainty to consumers regarding features and qualities of the contract object.

These mechanisms are necessary because consumers, for the most part, do not understand or read the contracts they are faced with. It is widely accepted that private autonomy and pure freedom of contract is not possible in the context of consumer

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of 1000 consumers actually read the terms of use in online software contracts. The fact that hardly anyone reads online contracts allows Bakos and Marotta to conclude that drafters – sellers are in a very powerful position when drafting consumer contracts.

[90] Oren Bar-Gill, David Schkade and Cass R. Sunstein, Drawing False Inferences from Mandated Disclosures [2017] Harvard Public Law Working Paper No. 17-06 (available at <https://ssrn.com/abstract=2914354>, last accessed 31 March 2022) claiming that mandated disclosures should be justified in real evidence because if not they would send distorted messages to consumers and hence disrupt their decisions in markets.

[91] Omri Ben-Shahar and Ariel Porat, Personalising Mandatory Rules in Contract Law [2019] University of Chicago Law Review 255.

[92] *Ibidem.*

[93] Antonio Karampatzos, *Private law, nudging and behavioral economic analysis: the mandated-choice model* (Routledge, 2020).

[94] See articles 5, 6 and 7 of Directive 2019/771.

contracts. When the role of personal data is introduced, these contract dynamics that generate important asymmetries are exacerbated.

The limitations resulting from contracts are also exacerbated by the role of data in algorithmic personalised contracts, which places consumers in an even more vulnerable position than the one they occupy in consumer contracts generally.

12 The statistic and dynamic elements of consent in privacy policies and consumer's vulnerability in algorithmic contracts

The European Data Protection Regulation aims at providing individuals with control and management of their personal data through consent. If this control actually existed, consumers – data subjects – would be able to assess the role and effects of their data in the design and content of the personalised contracts they are offered. That is, if the transparency and control model of personal data would allow consumers to control their data they would know which data they have agreed to share and process, which data has been used to design the contract they are offered and what are the effects of this data for the distribution of the contractual surplus between the seller and the consumer compared to an alternative – eventually a non-personalised contract.

None of this appears to be the case in digital markets. This weakens the position of consumers because they remain blind to the role of their personal data in the design and in the content of the personalised contracts they are offered.

Privacy policies have a very similar structure to contracts. However, the European Data Protection regime is not configured for contracts between an interested party – eventually a consumer – and a professional with the object of personal data. The understanding that privacy is a fundamental right makes it impossible for it to be the object or consideration of a contract. Consenting to share and process the subject's personal data, therefore, cannot, at least as of today, constitute a necessary and limiting consideration for accessing pages, platforms or digital double-sided markets. [95]

Data has a static and a dynamic dimension and consent, the basic element of the European data protection regulation, might be adequate for the static dimension but it is clearly inadequate for the dynamic one. The static – and individual – dimension is manifested through the consent given for access to personal data.

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[95] See Thomas B. Norton, The Non-Contractual Nature of Privacy Policies and a New Critique of the Notice and Choice Privacy Protection Model [2016] Fordham Intell. Prop. Media & Ent. L.J. 181). The consideration of privacy policies as contracts is now pending before the CJEU in the case C 446/21 Schrems v. Facebook Ireland Ltd. Filed by the Austrian Supreme Court on July 20, 2021. It should be noted, though, that article 6(1)(b) of the GDPR provides that acceptance of the mandatory terms of the privacy policy and the definition of the of the non-mandatory terms to be accepted or rejected is a necessary condition in order to enter into the subsequent consumer contract for the underlying transaction.

However, the processing of personal data is of an eminently dynamic and collective nature. The content of this consent and its effects are radically different for the individual. The nature of data processing or portability is dynamic. The dynamic element of the processing of personal data has to do with the temporal dichotomy between the time of consent to the processing of personal data and the time when the effects of such processing are experienced. At the moment when individuals consent to the processing of their personal data – in whole or in part – they consent to a treatment or portability of this data that, through AI, will result in future effects. Thus, at the time of consent, consumers are unaware of the possible uses and impacts that the processing of their data may have for their profile and position in transactions in digital markets, and particularly for their well-being in future transactions in digital markets.[96]

Data processing also has a collective dimension.[97] Personal data is combined with the data of other individuals to provide new information and inferences about the data subject. It is not possible for data subjects to know at the time of giving consent what are the probable results of such data combination and therefore what information may eventually be obtained about them through this combined processing with data from other individuals.[98]

Consequently, the nature of personal data and its different dimensions make it effectively impossible for individuals to assess, evaluate and determine the role and effects of the use of data in their algorithmic contracts. It is not possible for consumers to know what personal data is available from them, what role of this data plays in the personalised contract offered to them, and most importantly, what are the effects the use of this data has on the surplus they might obtain from the transaction compared to possible alternatives.

Contract law cannot provide remedies for this situation given that the lack of awareness, quantification, counter-factuals available to assess the harm eventually inflicted[99] to the consumer's interest make it impossible for consumers to seek redress. The black box generated by data in algorithmic personalised contracts generates risks for consumers that challenges the effectiveness of consumer protection regulation in digital markets.

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[96] See Elena Gil González, Paul de Hert, Understanding The Legal Provisions That Allow Processing and Profiling of Personal Data—An Analysis Of GDPR Provisions And Principles [2019] ERA F. 597, 600 claiming that consent of the data subject could be a valid instrument as long as it was provided freely, genuintly and in an informed way and considering that consent of privacy policies does not present these elements.

[97] See Ignacio Cofone, Adriana Z. Robertson, Consumer Privacy in a Behavioral World [2018] Hastings L.J. 1471, 1475, 1489–1490.

[98] Michèle Finck, The Limits of the GDPR in the Personalisation Context, in U. Kohl, J. Eisler (eds), *Data-driven Personalisation in Markets, Politics and Law* (Cambridge University Press, 2021).

[99] Sandra Wachter, Brent Mittelstadt, Chris Russell , Counterfactual explanations without opening the black box: automated decisions and the GDPR [2018] Harvard Journal of Law & Technology.

13 Conclusion

As of today, European regulation of consumer transactions in digital markets addresses in a segmented way the different phases of the consumer's contractual path and the different dimensions of digital consumer contracts. From the perspective of the contractual path of digital consumer contracts, the European regulation focuses on ensuring consumers' sovereignty by regulating ex ante contractual commercial practices and pre-contractual information duties, controlling standard contract terms in consumer contracts and providing ex post contractual remedies for lack of compliance with contract terms. Further, the regulation focuses in one specific dimension of the consumer transaction at a time: either privacy policies or consumer contracts regulating the transaction.

The interaction, effects, and impact of consumers' personal data and therefore their privacy is a disruptive element that distorts the positions of professionals and consumers in digital markets and especially in transactions. It is essential to observe, study and analyze the conditions in which contractual customisation can provide greater well-being for the consumer and, above all, analyze the conditions in which the consumer's expected contractual surplus may end up being reduced or even eliminated.

This segmented approach presents major limitations when addressing algorithmic transactions that are ultimately personalised using data previously obtained to drive machine learning and other AI approaches to tailoring choices and designing consumer contracts. In this setting, focusing on the consumer's opt-in consent largely misses the heart of the issue. Without considering consumers' previous choices – in particular in privacy policies – it is not possible to effectively apply ex post transparency controls over standard contract terms or determine whether terms should be treated as unfair.

In light of all of this, it is of utmost importance to adopt a global and comprehensive approach to the different contract phases and to reach beyond contract law to protect consumers' private autonomy and expectations in algorithmic personalised contracts. The approaches adopted to date do not protect consumer welfare and they call into question the overall effectiveness of the European consumer protection regime when it comes to algorithmic personalised consumer contracts.

David S. Bloch[*]

NON-FUNGIBLE TOKENS: A SOLUTION TO THE CHALLENGES OF USING BLOCKCHAIN BILLS OF LADING IN THE INTERNATIONAL SALES OF GOODS

ABSTRACT

The non-fungible token (NFT) has emerged as a way of authenticating unique digital assets. Thus artists have started selling digital artwork authenticated by NFTs, gaming companies can sell unique in-game products, and athletic leagues have started selling digital "cards" depicting key moments in sporting events.

Like cryptocurrencies, NFTs are applications of blockchain technology. A blockchain is a series of cryptographically linked records. The blockchain itself is "public" in the sense that every transaction is visible to all participants. But an encrypted block cannot be changed without altering all prior blocks – and alerting all other users in the blockchain.

Cryptocurrencies and NFTs differ in a critical respect. A unit of cryptocurrency is a fungible token, meaning it is identical to any other unit of cryptocurrency. In the same way that one Euro is equal to any other Euro, one Bitcoin has the same value and same characteristics as any other Bitcoin. An NFT, by contrast, is uniquely identified in the blockchain. So while one NFT may have the same market value as another NFT, no two NFTs are the same. This means NFTs are not useful as currency, but are valuable as incorruptible identifiers.

NFTs have other useful attributes. For example, they inherently include ownership information. This means that the NFT itself indicates who owns it—when it was created and by whom, who controls it now, and every transaction leading from the original to the current owner—at all times. Also, they are "extensible." This means that NFTs can be added together or merged in order to create a new NFT in a traceable way.

There are, of course, other digital representations of physical assets. Goods already are stamped with bar or QR codes, expensive products typically have serial numbers or other unique identifiers, and software often is accompanied by one-time-only passwords. But none of these are cryptographically secure in the way NFTs are, and none of them combine proof of authenticity and proof of ownership in a single instrument.

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The bill of lading is a venerable institution in international trade. Evolving over centuries and well developed by the time of the medieval lex mercatoria, the bill of lading is a paper form specifically contemplated and described in the key treaties enabling modern cross-border sales of goods—the Vienna Convention, the Hague-Visby Rules, and the U.S. Carriage of Goods by Sea Act. It indicates ownership of goods in transit, evidences the terms of the contract of carriage, and shows where, when, and to whom the goods were conveyed at every step between origin and ultimate destination. As a paper document, however, the bill of lading (often in multiple counterparts) is a critical bottleneck and source of risk.

Proposals to update paper bills of lading with an electronic equivalent have circulated for many years. And with the development of blockchain technology a decade ago, more recent proposals have discussed putting bills of lading on a blockchain. But these proposals are incomplete, because the blockchain is merely a ledger.

An NFT on a blockchain, however, is the ideal replacement for bills of lading and other documents reflecting passage of title. Each change of ownership of an NFT is publicly documented in the NFT's blockchain ledger. Done right, the NFT itself, in each block, contains both an incorruptible copy of the bill of lading and a complete chain of custody. And the fact that NFTs are extensible means a business can verify both components and finished goods.

This paper will discuss using NFTs as a substitute for traditional bills of lading.

SUMMARY
1 Introduction – 2 Blockchains and Tokens – 3 Existing Use Cases for Blockchain Technology – 4 A New Use Case: NFTs for Bills of Lading – 5 Conclusion

1 Introduction

The non-fungible token (NFT) has emerged as a 21st-century way of authenticating unique digital assets by way of blockchain technology.

Bills of lading are as old as NFTs are new.[1] The key treaties and domestic trade laws—the Vienna Convention,[2] the Hague-Visby Rules,[3] and the U.S. Carriage of Goods by Sea Act,[4] among many others—expressly contemplate the exchange of bills of lading to

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[1] G. Marcus Cole, 'The Long Convergence: "Smart Contracts" and the "Customisation" of Commercial Law' [2019] Southern California Law Review 851, 862-869 (tracing the history of contract law); David A. Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Maritime Law Journal 197 at 200 ("The bill of lading owes its universal recognition, under both the common law and the civil law, to the lex mercatoria, the body of commercial law shaped by merchant practice and custom during the medieval period").

[2] United Nations Commission on International Trade Law (UNCITRAL), 'Convention on the International Sale of Goods' (Vienna 1980) 1489 United Nations Treaty Series 25, 567.

[3] UNCITRAL, 'International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (The Hague Rules)' (Hague 1924, Visby 1968) 120 League of Nations Treaty Series 2764 and 1412 United Nations Treaty Series 23, 643.

[4] 46 United States Code §§ 30701 *et seq*.

effectuate the international transhipment of goods. Yet bill of lading remains a paper instrument. "A negotiable or order bill of lading is a fundamental and vital pillar of international trade and commerce, indispensable to the conduct and financing of business involving the sale and transportation of goods between parties located at a distance from one another."[5] But as a paper instrument that passes from hand to hand accompanying identified goods, it is inefficient and highly susceptible to mistake—to say nothing of outright fraud.[6]

Various commentators have proposed to use blockchain-based ledgers to replace bills of lading, but this solves only half the problem: a blockchain consists of a transparent and tamper-proof record of transactions but does not uniquely identify the goods being transacted. The development of non-fungible tokens, however, unlocks the other half: a blockchain tracing ownership of NFT-associated goods is transparent, tamper-proof, and allows sellers, shippers, and buyers, to precisely track and pass title to identified goods without sending laminated bits of paper back and forth across the ocean. Using the UNCITRAL model law on electronic transferrable records, open-source blockchain, and NFTs, shippers can finally adapt their historic practices to 21st-century technology.

2 Blockchains and tokens

2.1 Blockchain[7]

A *blockchain* is a *distributed-ledger*[8] (a ledger that all participants jointly record and maintain[9]) that lists cryptographically linked records. Each record (or "block") contains a unique identifier of a particular transaction, a timestamp showing when it was created, and a cryptographic "hash" (a mathematical transformation of the prior block's

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[5] United States Court of Appeals for the Second Circuit, *Berisford Metals Corp. v. S/S Salvador*, 779 F.2d 841, 845 (2d Cir. 1985).

[6] Naomi Chetrit, Mayrav Danor, Angelic Shavit, Boaz Yona & Dov Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [Fall 2018] 22 Virginia Journal of Law & Technology 56 at 69-74.

[7] See generally Jean Bacon, Johan David Michels, Christopher Millard & Jatinder Singh, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers' [2018] Richmond Journal of Law & Technology 1; Lawrence J. Trautman & Mason J. Molesky, 'A Primer for Blockchain' [2019] University of Missouri-Kansas City Law Review 239.

[8] A "ledger is a shared system of record among participants on a business network; each member of the network has access rights and consensus is required from all network members; and all validated transactions are permanently recorded." Joyce G. Mazero & Leonard MacPhee, 'Setting the Stage for a Best-in-Class Supply Chain: Part 2' [2021] Franchise Law Journal 403 at 404-05.

[9] Jung-Ho Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] Journal of Korea Trade 113 at 117 ("the blockchain can be defined as a distributed-ledger system in which all participants jointly record and manage transaction information by distributing the ledger that records transaction information over a peer-to-peer network rather than a central server of a particular agency").

unique identifier) that identifies the record it was created from (its "parent").[10] Because each block contains a cryptographically distinct hash value that identifies the previous block, one can trace the blockchain back to its original ("genesis") block. The below graphic, Figure 1, shows an extremely simplified blockchain:
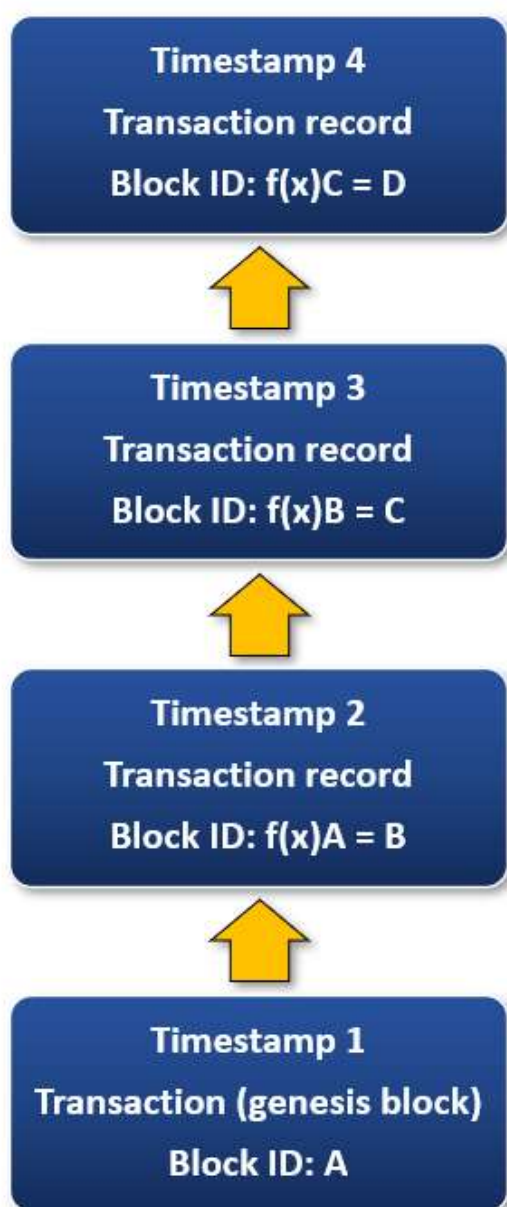

Figure 1: Simplified blockchain schematic

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[10] J Bacon, JD Michels, C Millard and J Singh, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers' [2018] Rich. J. L. & Tech. ¶¶ 4-8.

In Figure 1, a particular item or a digital representation of one (a token, a coin, etc.) is created at Time 1 in Block A. The token or coin in Block A is then transacted in some way (sold, exchanged for goods, etc.) at Time 2 using two-factor (public key/private key) encryption,[11] and a record of that transaction appears in Block B. The Block B ID is a mathematical transformation (designated here as *f(x)*) of the ID in Block A. So anyone on the blockchain can verify that Block B did indeed come from Block A. But only the owner of Block B (who holds the private key) can transact (and hence unlock) it. In Figure 1, the same item (coin, token, etc.) is then transacted to Block C and thence to Block D.

Identical copies of the blockchain are stored by all participating computers, so that every transaction is visible and verifiable by every other computer participating in the ledger.[12] To add an additional block to the blockchain, all of the computers in the peer-to-peer network must agree that the new transaction is valid. Any effort to change a block after the fact would require changing the blockchain at every node of the network—a daunting task. This can be done in various ways, but most commonly is achieved by way of a consensus algorithm.[13] That is to say, each participant in a particular blockchain keeps a copy of the blockchain in a peer-to-peer network.[14] So the blockchain is relatively impervious to fraud.

Changing the ledger requires cooperation between the consignor and consignee of a particular block:

Verification of each party's intent to change the state of the ledger is done through digital signatures attached to transactions. This is done through public key cryptography, a cryptographic technique whereby two sets of 'keys' … are generated. One of these keys, the private key, is kept secret by the user, as, together with the information in the transaction message, it constitutes an element in the function to generate the digital signature. This digital signature allows users to approve changes in the state of the address to which they have access by virtue of the secret key. A second function using the public key is used to verify the validity of the digital signature.[15]

In this fashion, the payload of a particular block can be transacted in a way that is verifiable by all even though only the owner can decrypt and use the block.

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[11] Ibid.

[12] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 118 ("blockchain operating on a distributed network is designed to be managed jointly by members with identical transaction records copied to their computers in the system without independent servers").

[13] Ibid. 118 ("The consensus algorithm is an algorithm that ensures the integrity of the system by cross verifying the mathematically calculated result values subject to a specifically defined procedure by nodes that are not mutually reliable in the distributed network. Computers on the network must reach an agreement on the validity of the transaction before new data blocks are added to the end of the blockchain").

[14] Ibid. 117.

[15] Niels-Philip Adbellatif, 'An Ethereum bill of lading under the UNCITRAL MLETR' [2020] Maastricht Journal of European & Comparative Law 250 at 257.

2.2   Tokens

In blockchains, a *token* is a digital representation of anything of interest or value.

Physical coins and paper money are "tokens" in the sense that they have no (or very little) inherent value but can be exchanged for valuable goods or services because both buyer and seller agree on the equivalency between the currency and the goods being purchased. Before the era of floating currencies, the value of coins and scrips were backed by a store of value (the British Pound Sterling could be converted to silver till 1717 and gold till 1931; gold backed the U.S. dollar till 1971). Now, such currencies are not pegged to precious metals but instead are "floating" and backed only by consumer confidence and the full faith and credit of the issuing central bank. Economists have been proposing forms of electronic fiat currency since the early 2000s.[16]

Moving to the digital space, tokenisation predates and is logically separate from both electronic currency and blockchain technology. Digital tokens in computing environments are used as a mechanism for managing access or use rights – hence, a click-through license or software download code work because a *token* (representing an authorisation right) is placed on a user's computer in exchange for money or simply the agreement to be bound. Web sites place "cookies" (tokens) on user devices for purposes of tracking (navigation, targeted advertising) or authorisation (age verification). A mobile phone-based electronic ticket for an airplane flight or a concert likewise uses a *token* to represent the requested access right (entering the airport, getting into the show). All of these tokens are issued by the provider of the goods or services the user seeks to access (the airline, the concert promoter), and in theory the provider is able to validate whether the token is authentic or counterfeit.[17]

A blockchain token likewise can represent a physical asset (a kitchen table, a tree), a digital asset (a license to use an app, a "skin" in a videogame, a downloadable music track), a security interest (a share in a company; fractional ownership of a sports franchise), or a permission of some kind (a ticket to a museum or a concert; access to a nightclub or airplane). The key difference is that there is no unique issuer, central authority, or guarantor. Rather, a blockchain token is governed by a smart contract and ownership of that token is confirmed by consensus on the blockchain itself. Thanks to public key-private key encryption, only the holder of an encrypted token's private key can unlock—and hence transact—the block on the blockchain containing that particular token.[18]

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[16] E.g., Robert J. Shiller, *The New Financial Order* (Princeton University Press 2003) 202-221.
[17] Shermin Voshmgir, *Token Economy* (2nd edn, Token Kitchen 2020) 39, 152-168.
[18] Ibid. 38-50, 68-80.

3 Existing use cases for blockchain technology

There are at least a half-dozen primary use cases for blockchain technology today.

3.1 Cryptocurrency

The most common use case for blockchain technology—indeed, the use case for which blockchain was developed—is cryptocurrency. A cryptocurrency is a fiat currency that is not backed by a government. The genesis block of a cryptocurrency is consists of a highly complex equation, puzzle, or challenge with a finite number of increasingly difficult solutions.[19] These solutions require significant computer processing power to find, and thus cryptocurrency "miners" attempt to acquire additional units of cryptocurrency by devoting computer processing power to uncovering additional solutions to the equation. Each new solution is added to the blockchain ledger, and the registered owner of that solution can then engage in economic transactions using his "mined" cryptocoin.

Importantly, while the blockchain keeps an indisputable record of transactions involving cryptocoins, the coins themselves are *fungible* tokens. This means that any particular unit of cryptocurrency is identical to any other unit of cryptocurrency. In the same way that one Euro is equal to any other Euro, one Bitcoin has the same value and same characteristics as any other Bitcoin. From the perspective of the underlying mathematical function, there is no difference between the first solution and the hundredth solution—each solution is equally correct and each yields a token with the same transactional value. They are uniquely *identified*, in much the same way that each U.S. dollar bill has a unique serial number, but cryptocoins are not meaningfully different from one another.

The blockchain also enables decentralised exchanges, which allow currency trading without the need for a clearing house.[20]

3.2 Identity Verification

Because blockchain operates via public-key/private-key encryption, a user can verify his identity or personal information by presenting proof of a verified attestation rather

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[19] For example, "[t]o mine a valid new Bitcoin block, the hash value of that block must achieve a particular pattern, namely it must start with a certain number of zeros. To create a valid block, a miner must add a random number, known as a *nonce*, to the header of the block such that the resulting hash value fits the pattern. Miners solve this puzzle by trial-and-error, iterating through different nonces until the hash value has the required number of leading zeros. The higher the number of zeros required, the harder the puzzle." J Bacon, JD Michels, C Millard and J Singh, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers' [2018] Rich. J. L. & Tech. ¶ 40 (emphasis original).

[20] S Voshmgir, *Token Economy* at 224.

than revealing the information itself.[21] "For example, when an identity owner presents a proof of their date-of-birth, rather than actually checking the truth of the date of birth itself, the verifying party will validate the government's signature who issued and attested to this credential to then decide whether he trusts the government's assessment about the accuracy of the data."[22] This the basis of products such as Tykn's Self-Sovereign Identity single-sign-on solution.[23]

3.3 Cross-Border Money Transfers

Blockchain also has the potential to revolutionize remittances, cross-border payments, and wire transfers. Today, most international transactions between banks use the SWIFT system, which functions as a secure central messaging service that financial institutions use to facilitate interbank transactions.[24] SWIFT is in effect a hub-and-spoke system, with all transactions routing through the central SWIFT node. If the same SWIFT transactions were instead performed on a blockchain, each financial institution would be connected directly to the others, speeding up the process of moving money between banks by removing SWIFT's intermediation. This decentralised peer-to-peer financial exchange system is at the heart of Ethereum.[25] But others also offer similar services. Abra, for example, operates by transferring money from the sender to a "teller" registered on Abra's network, who then transfers the money to a teller in the recipient's home location, with the second teller sending the money to the recipient—all validated on a blockchain accessible to all four participants (and many others).[26]

3.4 Accounting and Auditing

Public and private companies need to be able to reliably track their transactions—both for internal accounting purposes and (particularly for public companies) for external audits. Maintaining a register of transactions on a blockchain would significantly streamline the accounting and bookkeeping process. Major international

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[21] Ibid. 84-86.
[22] <https://tykn.tech/identity-management-blockchain/> accessed 15 February 2022.
[23] See <https://tykn.tech/> accessed 15 February 2022.
[24] The Society for Worldwide Interbank Financial Telecommunications. See <https://www.swift.com/about-us> accessed 15 February 2022, and <https://www.swift.com/about-us/history> accessed 15 February 2022.
[25] <https://ethereum.org/en/what-is-ethereum/> accessed 16 February 2022.
[26] David Hamilton, 'Blockchain Remittance: The Future of International Money' (20 August 2018) Coin Central, <https://coincentral.com/blockchain-remittance/> accessed 16 February 2022.

accounting firms such as Deloitte,[27] KPMG,[28] and Ernst & Young[29] offer specific guidance on (and products for) using blockchains to track and audit transactions.

3.5 Validation of Uniqueness

Most tokens on most blockchains are fungible, which is to say that they are interchangeable even if they are uniquely identified on the blockchain. Thus, in the case of a cryptocoin, each unit of currency is worth the same as any other, even though it is possible to trace the blockchain back and determine specifically when each new coin was mined. Likewise, a fractional ownership[30] in a work of art or a sports team is fungible (every fraction is equal to every other fraction) even when the item owned (The Last Supper, Juventus) is unique. Tokenised concert tickets may be fungible (for a general-admission show) or nonfungible (for a show where particular seats are at a premium).[31]

That is, indeed, the key difference between a cryptocoin and a *nonfungible* token or *NFT*. A nonfungible token is uniquely identified in the blockchain.[32] A unit of cryptocurrency is not. Cryptocurrencies and NFTs differ in that critical respect. Each unit of cryptocurrency is identical and hence *fungible*, in the same way that one Euro is equal to any other Euro. Not so for NFTs. While a particular NFT may have the same *market value* as another NFT (for example, two NFTs of Stephen Curry three-point shots may be valued at the same price), the NFTs themselves are not the same. This means NFTs are not useful as currency (except by way of barter), but are valuable as incorruptible identifiers.

Blockchains that support non-fungible tokens can be used to authenticate unique digital assets. Thus artists have started selling digital artwork authenticated by NFTs (*e.g.*, the digital artist Beeple sold a group of NFTs for over $69 million[33]), gaming

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[27]   Deloitte, 'An internal auditor's guide to auditing blockchain' (2019) <https://www2.deloitte.com/us/en/pages/risk/articles/internal-auditing-guide-to-blockchain.html> accessed 16 February 2022; Sandro Psalia, 'Blockchain: A game changer for audit processes' (22 September 2017), <https://www2.deloitte.com/mt/en/pages/audit/articles/mt-blockchain-a-game-changer-for-audit.html> accessed 16 February 2022.

[28]   KPMG, 'Auditing blockchain solutions' (October 2018), <https://assets.kpmg/content/dam/kpmg/in/pdf/2018/10/Auditing_Blockchain_Solutions.pdf> accessed 16 February 2022.

[29]   EY Americas, 'How blockchain will revolutionize finance and auditing' (29 April 2019), <https://www.ey.com/en_us/digital/blockchain-why-finance-and-auditing-will-never-be-the-same> accessed 16 February 2022.

[30]   S Voshmgir, *Token Economy* at 253-261.

[31]   Ibid. 169 (discussing asset tokens, credential tokens, and access tokens).

[32]   Ibid. 168-170.

[33]   Jacqui Palumbo, 'First NFT artwork at auction sells for staggering $69 million' (21 March 2021) CNN, <https://www.cnn.com/style/article/beeple-first-nft-artwork-at-auction-sale-result/index.html> accessed 28 November 2021.

companies can sell unique in-game products (from skins[34] to crypto-kitties[35]), and athletic leagues have started selling digital "cards" depicting players or key moments in sporting events (*e.g.*, the U.S. National Basketball Association's NBA Top Shots, digital renderings of particular "moments" in basketball history[36]; SoRare sells NFTs of professional soccer players for fantasy gaming[37]).

NFTs have two other attributes relevant to our discussion here. *First*, they inherently include ownership information. This means that the NFT itself indicates when it was created and by whom, who owns it now, and every transaction leading from the original to the current owner. *Second*, they are "extensible." This means that NFTs can be added together or merged in order to create a new NFT in a traceable way.

Thus, the NFT has the function, already, of representing ownership. But it is distinct from copyright. A copyright confers the right to copy, reproduce, translate, prepare derivative works, display, and perform a particular work.[38] Not so for NFTs. Owning an NFT does not confer the copyright in a particular digital work, meaning that the NFT-holder cannot (for example) copy or make derivative works of it. Owning the NFT associated with a particular digital performance does not prevent others from copying and redistributing that performance—it merely gives the NFT-holder the ability to say that he is the "true" owner of the "original" performance. Ownership of an original artwork has value in the real world—even the best reproduction is nowhere near as valuable as an original da Vinci, and it is of course possible for copyright owners to convey their rights to particular works of art—but digital copies of digitally recorded audio-visual performances are *exact*, meaning that the value of an NFT associated with a particular digital asset is mostly psychic, unless the copyright holder also has agreed to prevent the creation of additional copies—and is willing to police the market to prevent bootlegs.

3.6 Supply Chain Management

Manufacturers have started using NFTs to monitor supply chains and track components. Thus, Alfa Romeo plans to use NFTs to identify the sources of component parts (which will help with respect to possible recalls and manufacturing problems), track the car's performance and repair history, and even authenticate that—should the

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[34] Hafsa Lodi, 'NFT clothing and designer avatar skins: how fashion is being digitised' (25 September 2021) The National News, <https://www.thenationalnews.com/lifestyle/luxury/2021/09/25/nft-clothing-and-designer-avatar-skins-how-fashion-is-being-digitised/> accessed 28 November 2021.

[35] Available at <https://www.cryptokitties.co/> accessed 28 November 2021.

[36] Available at <https://nbatopshot.com/> accessed 28 November 2021.

[37] Available at <https://sorare.com/> accessed 28 November 2021.

[38] See 17 United States Code § 106.

car be resold—it is authentic and contains authorised parts.[39] This approach could easily be applied to other complex products containing multiple parts from different vendors.

3.7   Data-as-an-Asset

It has been proposed that NFTs can be used to "containerize" personal or corporate data (in the form, for example, of a "basic attention token"[40]), allowing to be used only with pre-set permissions and securely tracking those uses without inadvertently sharing more than is allowed. Because NFTs are digitally signed and time-stamped, data owners possess "a secure and verifiable audit trail" of the data the NFT represents.[41] Voshmgir discusses the alternative vehicle of "privacy tokens," which can facilitate compliance with know-your-customer laws without compromising personal privacy.[42]

4 A new use case: NFTs for bills of landing

4.1   Problems with Paper Bills of Lading

Bills of lading are critical instruments in international trade. A bill of lading describes the goods being ships, identifies the points of origin and destination, and generally contains all of the necessary information for shippers and carriers to properly transmit goods across national boundaries. Because it is critical to establishing the chain of custody and passing the risk of loss, the bill of lading is physically signed serially by the shipper, the carrier, and the receiver to confirm all points at which the shipped goods change hands. No matter what goods are being shipped or how they are shipped, the bill of lading itself has always been a paper document. The necessity of a bill of lading is called for in the core treaties and laws supporting international trade. Possession of a bill of lading conveys title to the described goods.

The bill of lading has three distinct functions. *First*, it is an indicator of ownership. To hold a bill of lading is to hold title to the identified goods. *Second*, it evidences the terms (payment, insurance, and so on) of the contract of carriage between the seller, the shipper, and the buyer (and others along the chain of custody). *Third*, it functions as a receipt, showing where, when, and to whom the goods were conveyed at every step

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[39] George Downs, 'This Car Comes With an NFT (And No, It Isn't a Bored Ape Picture)' (17 February 2022) *The Wall Street Journal* (New York, 17 February 2022).

[40] S Voshmgir (2020) 'Token Economy' at 298-302.

[41] Praphul Chandra & Arushi Goel, 'If data is the new oil, then enterprise NFTs are the tankers. Here's why' (29 September 2021) World Economic Forum, <https://www.weforum.org/agenda/2021/09/if-data-is-the-new-oil-then-enterprise-nfts-are-the-tankers/> accessed 16 February 2022.

[42] S Voshmgir, *Token Economy* at 202-203.

between origin and ultimate destination. This helps fix the risk of loss and allows interested parties to track the progress of a particular shipment.

Possession of a bill of lading conveys title to the goods the bill of lading describes.[43] Thus, there is often controversy when the description contained in the bill of lading does not exactly conform to the goods received by the consignee.[44]

Being paper documents, bills of lading are also susceptible to fraud.[45] Reported cases describe situations in which a Korean seller of ladders bribed a carrier's local agent to issue bills of lading for 44 containers of folding ladders when in fact only 9 containers were shipped,[46] goods were misdescribed in order to reduce freight rates,[47] and dates were fraudulently backdated to avoid breach of contract[48] or shift the risk of loss.[49] Indeed, in light of collusion and fraud, "a paper bill of lading may be subject to suspicion by all members of the supply chain."[50]

And to be sure, the authenticity of the goods described in a bill of lading can have real-world consequences. Counterfeiting remains a substantial problem worldwide. When high-technology goods are counterfeited, the risks are not borne just by buyers and sellers, but also by broader segments of the population (as, for example, if a counterfeit router causes a hospital's computer systems to crash[51]). In part for this reason, the international shipping community has developed detailed chain-of-custody processes to ensure that authentic goods are taken from the point of manufacture, to the point of shipment, to the point of receipt—and likewise insurance and related instruments to protect against the risk of counterfeits. The bill-of-lading system does not cure *all*

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[43] Marek Dubovec, 'The Problems and Possibilities for Using Electronic Bills of Lading as Collateral' [2006] Arizona Journal of International & Comparative Law 437 at 442; NP Adbellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 250.

[44] NP Abbellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 252-253.

[45] N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 69 ("The most prominent shortcoming of the traditional bill of lading is its physical nature").

[46] Supreme Court of the Netherlands, *Damco Maritime International BV v. Meister Werkzeuge Werkzeugfabrik GmbH*, 4 April 2003, NJ 2003, Nr. 122.

[47] United States Court of Appeals for the Second Circuit, *La Fortune v. S.S. Irish Larch*, 503 F.2d 952 (2d Cir. 1974).

[48] Queen's Bench Division of the High Court of the United Kingdom, *Kwei Tek Chao v. British Traders* (1954) 2 QB 459.

[49] United Kingdom Court of Appeal, *Motis Exports Ltd. v Dampskibsselskabet AF 1912 Aktieselskab and Aktieselskabet Dampskipsselskabet Svendborg* (2000) 1 Lloyd's Rep 211.

[50] Christian Albrecht, 'Blockchain Bills of Lading: The End of History? Overcoming Paper-Based Transport Documents in Sea Carriage Through New Technologies' [2019] Tulane Maritime Law Journal 252 at 258.

[51] See, *e.g.*, U.S. Department of Justice, 'Departments of Justice and Homeland Security Announce 30 Convictions, More Than $143 Million in Seizures from Initiative Targeting Traffickers in Counterfeit Network Hardware' (6 May 2010), <https://www.justice.gov/opa/pr/departments-justice-and-homeland-security-announce-30-convictions-more-143-million-seizures> accessed 3 December 2021 ("'These cases involve greedy businessmen hocking counterfeit and substandard hardware to any buyer—whether it could affect the health and safety of others in a hospital setting or the security of our troops on the battlefield,' said John Morton, Assistant Secretary of Homeland Security for ICE.").

risks—misdescription of goods can be catastrophic[52]—but they system has certainly stood the test of time.

It is, however, an anachronism. "Whatever benefits the current paper-based system still provides, it also results in a number of costly problems including delayed arrival, insufficient or inaccurate information, high cost of transport and fraudulent issuance of the bill of lading."[53] In short, "[t]he paper bill of lading system is not a failsafe means of protecting its holder's right to possess cargo."[54] So it is not surprising that theorists have for many years reached for alternatives to modernize bills of lading.

4.2   Blockchain-Based Bills of Lading

There have long been digital representations of physical assets. Goods already are stamped with unique bar or QR codes, expensive products typically have specific identifiers (*e.g.*, vehicle identification codes), and software often is accompanied by one-time-only password-protected authorisation codes. And earlier systems such as BOLERO (the Bill Of Lading Electronic Registry Organisation),[55] SeaDocs (the Seaborne Trade Documentation System),[56] CMI,[57] essDOCS,[58] and TradeCard[59] attempted to create electronic bills of lading without relying on blockchain. But none have been widely adopted.

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[52] For a discussion of multiple shipping disasters resulting from misdescribed goods, see Kyle Brennan, 'Up in Flames: The Explosive Risks of Misdeclared Hazardous Cargo in Shipping Containers Following the *Maersk Honam* Fire' [2019] Loyola Maritime Law Journal 259.

[53] N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 69.

[54] DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 210.

[55] For a discussion of why BOLERO has not been more widely adopted, see Paul Todd, 'Electronic bills of lading, block-chains and smart contracts' [2019] International Journal of Law & Information Technology 339; N Chetrit, M Danor, A Shavit, B Yona & D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 77-78; and DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 218-223 ("Bolero's largest obstacle is that no corporation or financing bank would ever make use of a system that precludes insurance").

[56] For a discussion of why SeaDocs has not been more widely adopted, see N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 76-77; and DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 213-215 ("The SEADOCS project collapsed after less than a year for myriad reasons").

[57] See DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 215-218 ("While the CMI model rules demonstrate one of the best efforts of "soft laws" meant to dematerialize the negotiable bill of lading, major flaws impeded its success").

[58] Ibid. 228-230 ("For a viable electronic bill of lading system to succeed, international conventions or national laws must recognize the legal effect of electronic negotiation. The essDOCS website is unable to cite to either in support of its claim to be a 'legal equivalent' to paper bills of lading").

[59] See N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 78 ("Unfortunately, Trade-Card was also prone to fraud from malicious users").

Characteristics of blockchain make it particularly promising for supporting electronic bills of lading. And so several academics have proposed adapting blockchain technology to bills of lading in international transactions.

There are barriers, of course. Professor Mark Shope concludes that a blockchain bill of lading is not supported by the combination of the UNCITRAL Model Law of Electronic Commerce,[60] the UNCITRAL Model Law on Electronic Signatures,[61] and the UN Convention on the Use of Electronic Communications in International Contracts,[62] because the UN Convention that seems to embody those UNCITRAL model laws expressly excludes bills of lading.[63] While the United States Federal Bills of Lading Act[64] does not plainly say that a bill of lading must be a physical document, various provisions (for example, the requirements surrounding delivery where a bill of lading has been lost, stolen, or destroyed[65]) make little sense in the context of electronic transactions. Similarly, the U.S. Electronic Signatures in Global and National Commerce Act,[66] like the UN Convention, approves electronic signatures on any "contract or other record created, generated, sent, communicated, received, or stored by electronic means,"[67] but does not speak to bills of lading.

But both Professor Shope and Professor Jung-Ho Yang propose using blockchain within the context of the UN Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea (the "Rotterdam Rules")[68] and the 2017 UNCITRAL Model Law on Electronic Transferrable Records[69] to replace paper bills of lading with a blockchain bill of lading.[70] Shope says that the Rotterdam Rules are structured to support a bill of lading in the form of a "negotiable electronic transport record"[71] and that "blockchain bills of lading (correctly configured) would be compatible with the Rotterdam Rules, but there is still work to be done to fully realize blockchain bills of lading within this legal framework."[72] In particular, he focuses on the problem of moving between electronic and paper bills of lading as part of the same transaction—something

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[60] UNCITRAL, 'Model Law on Electronic Commerce' (1999) U.N. Sales No. E.99.V.4.

[61] UNCITRAL, 'Model Law on Electronic Signatures' (2002) U.N. Sales No. E.02.V.8.

[62] UNCITRAL, Convention on the Use of Electronic Communications in International Contracts (2007) U.N. Sales No. E.07.V.2, 2898 United Nations Treaty Series 50,525.

[63] Mark L. Shope, 'The Bill of Lading on the Blockchain: An Analysis of its Compatibility with International Rules on Commercial Transactions' [2021] Minnesota Journal of Law, Science & Technology 163 at 173.

[64] 49 United States Code §§ 80101-80116 (the Pomerene Bills of Lading Act).

[65] 49 United States Code. § 80114.

[66] 15 United States Code §§ 7001-7006.

[67] 15 United States Code § 7006 (4)

[68] U.N. General Assembly, 'United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea' (2 February 2009) G.A. Res. U.N. Doc. A/Res/63/122.

[69] UNCITRAL 'Model Law on Electronic Transferable Records' (2017) U.S. Sales No. E.1.V.5, A/CN.9/834.

[70] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 130.

[71] ML Shope, 'The Bill of Lading on the Blockchain: An Analysis of its Compatibility with International Rules on Commercial Transactions' [2021] Minn. J. Law, Science & Tech at 174.

[72] Ibid. 188.

the Rotterdam Rules would seem to require but that would undermine the singularity and uniqueness inherent in transactions recorded by way of a blockchain system. Yang proposes that "the transfer of token between trading participants on a blockchain network can be performed in parallel with the movement of physical assets, and a clear chain of asset proof can be established, establishing a clear chain of asset provenance."[73] He goes on to demonstrate that a blockchain transaction can satisfy Article 9 of the Rotterdam Rules, which sets forth the minimum requirements for an electronic document to replace a paper one, as well as the UNCITRAL "functional equivalence" rule.[74] Professor Shope likewise concludes that the UNCITRAL Model Law on Electronic Transferrable Records would support blockchain bills of lading as "electronic records," depending on whether more jurisdictions adopt the model law.[75]

Professor Niels-Philip Abdellatif agrees, writing that the Model Law "would remain an exercise in futility (or, at the very least, of far decreased worth) where [bills of lading] are concerned were it not for the fact that an exciting new technology, blockchain, is capable of succeeding in the digitisation of [bills of lading] where others have failed."[76] Others have reached the same conclusion.[77] The newest iteration of the U.S. Uniform Commercial Code likewise embraces electronic documents of title,[78] and at least arguably would support a blockchain bill of lading.[79]

The virtues of blockchain are reasonably clear. "Blockchain is unique in that it does not require any central server or authority, which makes it extremely secure from hacking and allows for instantaneous transfer and usage of information. ... The transparency introduced by [b]lockchain would make it much easier for parties in the container supply chain to verify the accuracy of information, vet their customers, and detect shell companies and companies with deficient compliance histories."[80]

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[73] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 120.

[74] Ibid. 122.

[75] ML Shope, 'The Bill of Lading on the Blockchain: An Analysis of its Compatibility with International Rules on Commercial Transactions' [2021] Minn. J. Law, Science & Tech at 199-200.

[76] NP Abdellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 255.

[77] *E.g.*, Koji Takahashi, 'Blockchain Technology & Electronic Bills of Lading' [2016] Journal of International Maritime Law 202; C Albrecht, 'Blockchain Bills of Lading: The End of History? Overcoming Paper-Based Transport Documents in Sea Carriage Through New Technologies' [2019] Tulane Mar. L. J. at 272-74; N Chetrit, M Danor, A Shavit, B Yona & D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 92-97 (arguing that the Wave system is consistent with the Rotterdam Rules).

[78] Allison Skopec, 'PIN Chagrin: The Glencore Heist and EDI Through the Lens of Delivery Orders' [2017] Tulane Maritime Law Journal 221 at 228-229 and 238.

[79] Christopher M. McDermott, Jeffrey Nagle, Martin Horowitz and Stephen M. Johnson, 'Will Blockchain Render the Bill of Lading a Relic?' (21 August 2017) <https://www.cadwalader.com/resources/clients-friends-memos/will-blockchain-render-the-bill-of-lading-a-relic> accessed 6 December 2021.

[80] K Brennan, 'Up in Flames: The Explosive Risks of Misdeclared Hazardous Cargo in Shipping Containers Following the *Maersk Honam* Fire' [2019] Loyola Mar. L. J. at 283-84; see also N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with

Blockchain is a fundamental building block of all cryptocurrencies, and is widely used by "banks, insurance companies, and those in the diamond trade who need to establish chains of custody."[81]

Moreover, blockchain bills of lading would enhance shipping safety, because information on shipments could easily and cheaply be "provided all the way down the chain via the cargo's electronic bill of lading to the actual crew of the ship carrying that cargo, with no bulky paperwork to manage and no possibility of the shipper being able to alter this data once it was introduced in the chain."[82] So "from a technical perspective, blockchain is fit for the purpose of issuing a unique bill of lading record."[83] Some technologies, such as Wave, already seek to use blockchain to "connect[] all members of the international trade supply chain via a P2P network" that "allows a confidential direct exchange of official trade documents," including bills of lading.[84]

But blockchain itself is not enough. Yang also identifies a key problem: the "[g]uarantee of uniqueness is [an] essential requirement for electronic bill of lading to be recognised as paper bill of lading in that it is necessary to prevent multiple claims from being made on the same obligation."[85] But, he says, "it is difficult to guarantee uniqueness technically."[86] This problem also has plagued prior efforts to replace paper bills of lading with electronic bills of lading.[87] If somehow the same electronic bill of lading is placed in two blockchains, there is no easy technical way to distinguish which is the right one – and thus which possessor is entitled to the underlying goods.

Bills of Lading' [2018] Va. J. L. & Tech. at 81 ("An important characteristic of blockchain is that it is practically and effectively immutable, which means that one cannot change a record placed on blockchain. As such, it is secure, transparent, relatively fast, and potentially scalable"); JG Mazero & L MacPhee, 'Setting the Stage for a Best-in-Class Supply Chain: Part 2' [2021] Franchise L. J. at 412 ("Incorporating blockchain into the shipping process will make available a record of the bill of lading and the shipment's transport and transport history available [*sic*].").

[81] N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 82.

[82] K Brennan, 'Up in Flames: The Explosive Risks of Misdeclared Hazardous Cargo in Shipping Containers Following the *Maersk Honam* Fire' [2019] Loyola Mar. L. J. at 285.

[83] C Albrecht, 'Blockchain Bills of Lading: The End of History? Overcoming Paper-Based Transport Documents in Sea Carriage Through New Technologies' [2019] Tulane Mar. L. J. at 263.

[84] N Chetrit, M Danor, A Shavit, B Yona and D Greenbaum, 'Not Just for Illicit Trade in Contraband Anymore: Using Blockchain to solve a millennial-long problem with Bills of Lading' [2018] Va. J. L. & Tech. at 82, 92-94 (discussing Wave); DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 236-237 (discussing Wave); Dakota A. Larson, 'Comment: Mitigating Risky Business: Modernising Letters of Credit with Blockchain, Smart Contracts, and the Internet of Things' [2018] Michigan State Law Review 929 at 961 ("More recently, blockchain has also been used to generate documents like bills of lading in letter-of-credit transactions. Because international transactions involve many documents—potentially with multiple phases of correspondence--blockchain is an easy way to store, organize, and verify documents").

[85] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 123.

[86] Ibid. 124.

[87] M Dubovec, 'The Problems and Possibilities for Using Electronic Bills of Lading as Collateral' [2006] Ariz. J. Int'l & Comp. L. at 437.

It is not hard to imagine a situation where a blockchain supporting a bill of lading splits[88] or where two actors both claim the same bill of lading using different blockchains. And advances in quantum computing threaten to penetrate both hash functions and public/private key cryptography, rendering a blockchain more vulnerable to manipulation.[89] Even without quantum computers, though, "hacking of blockchain platforms has occurred, leading to cyber-security concerns over the possibility of fraudulent blockchain transactions."[90]

To fight fraud, Yang proposes that blockchain can single out the earliest transaction and void later transfers "using timestamping and cryptographic techniques."[91] But while this is a good way to detect and unwind fraud, it is an imperfect solution to the need for a truly unique bill of lading that cannot be copied or altered. An NFT bill of lading solves the problem, elegantly. Unlike blockchain tokens, NFTs are *by definition* unique.

4.3   Use of NFTs as Bills of Lading

As noted above, there have been many prior experiments with electronic waybills and even blockchain-based bills of lading. But none of these are cryptographically secure in the way NFTs are, and none of them combine proof of authenticity and proof of ownership in a single vehicle. Mere digital records do not resolve "the common concern related to digitisation, namely the loss of electronic data in the event of hardware or software failure."[92] This risk is particularly acute if the electronic registry or ledger is centralised.[93]

Professor Abdellatif proposes to tokenize bills of lading using a "Satoshi," the smallest Bitcoin denomination.[94] This has the virtue of leveraging an existing tokenisation platform, but Bitcoins have independent (consensus) value—if the value of the Satoshi exceeds the value of the underlying bill of lading, a holder may prefer to use the currency *as currency* rather than acquiesce in its function as a bill of lading, in much the same way the silver in old American quarters is worth more than the coin's nominal value of $0.25.[95] He proposes to address this problem by converting the bill of lading into

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[88] A blockchain splits where there is no consensus in the network about which of two competing and incompatible transactions is valid. See generally AKM Najmul Islam, Matti Mantiymaki & Marja Turunen, 'Why do blockchains split? An actor-network perspective on Bitcoin splits' [2019] Technological Forecasting and Social Change 148.
[89] LJ Trautman & MJ Molesky, 'A Primer for Blockchain' [2019] U. Missouri-Kansas City L. R. at 249-252.
[90] DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. at 237.
[91] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 125.
[92] NP Abdellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 254.
[93] Ibid. ("taking for granted that said administrator is competent and can be trusted not to act with malicious intent, this system introduces a clearly discernible centralised entity embodying a single point of failure").
[94] Ibid. 259-260.
[95] Quarter coins minted before 1964 are worth approximately $4 and fluctuate with the value of silver. 'Quarter Values Rising' (22 November 2021) <https://www.coinstudy.com/quarter-values.html> accessed 28 November 2021.

a smart contract on the Ethereum platform.[96] And he notes in passing that Ethereum standard ERC-721[97] enables NFTs, which "are useful in representing documents, such as deeds," and hence represents "the natural choice for a [bill of lading] token."[98] Leaving aside whether Ethereum is the preferred blockchain platform,[99] this is exactly right: blockchain-based NFTs are an ideal replacement for bills of lading and other documents reflecting passage of title.

Each change of ownership of an NFT is publicly documented in the NFT's blockchain ledger, but only the owner of any given block can use a private key to unlock or decrypt the NFT. Thus, the NFT itself embodies and includes a complete chain of custody, with ownership and access controlled inherently by the blockchain system.[100] The blockchain is distributed, so there is no risk that the data will be lost. And because the NFT is traceable back to its source, it also helps validate the provenance of goods that derive value from particular sources—whether Champagne from a DOC, coffee beans sourced from organic farms, or a particular shipment of microchips earmarked for a specific customer.

In order to achieve all of this, the bill of lading can be embedded as the blockchain's payload, such that an encrypted copy of the bill of lading itself is carried in the block and can be decrypted,[101] or the bill of lading can be "tokenised" (that is, replaced by a random and unique sequence of characters), such that "the transfer of token[s] between trading participants on the blockchain network can be performed in parallel with the movement of physical assets."[102] If the bill of lading is converted to an NFT—a non-fungible token—then it can be tracked uniquely across the chain of title, from shipper to freight forwarder to Customs to the recipient.

Shown very simply, the sequence would look something like the flowchart in Figure 2:

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[96] NP Abdellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 260-265.

[97] The standard is described at <http://erc721.org/> accessed 3 December 2021.

[98] NP Abdellatif, 'An Ethereum bill of lading under UNCITRAL MLETR' [2020] Maastricht J. Euro. & Comp. L. at 264.

[99] In 2021, the Ethereum blockchain split in two as a consequence of outmoded software. Luke Conway, 'Ethereum's Blockchain Just Split in Two' (27 August 2021) <https://www.thestreet.com/crypto/ethereum/ethereums-blockchain-just-split-in-two> accessed 9 December 2021 ("Ethereum's blockchain has split in two from a bug in a previous version of the chain's main node software. … This means that around 50% of Ethereum nodes are running a split-off chain with out-of-date and bugged software that could allow double-spends").

[100] For example, Britain's WiV Technology already is offering a blockchain-based way of investing in fine wines while tracking transactions in real time. See 'EY helps WiV Technology accelerate fine wine investing with blockchain' (August 2019) <https://www.ey.com/en_gl/news/2019/08/ey-helps-wiv-technology-accelerate-fine-wine-investing-with-blockchain> accessed 26 November 2021.

[101] ML Shope, 'The Bill of Lading on the Blockchain: An Analysis of its Compatibility with International Rules on Commercial Transactions' [2021] Minn. J. Law, Science & Tech at 168 ("The block body could contain any string of text, including the entire contents of a bill of lading").

[102] JH Yang, 'Applicability of Blockchain based Bill of Lading under the Rotterdam Rules and UNCITRAL Model Law on Electronic Transferrable Records' [2019] J. Korea Tr. at 120.
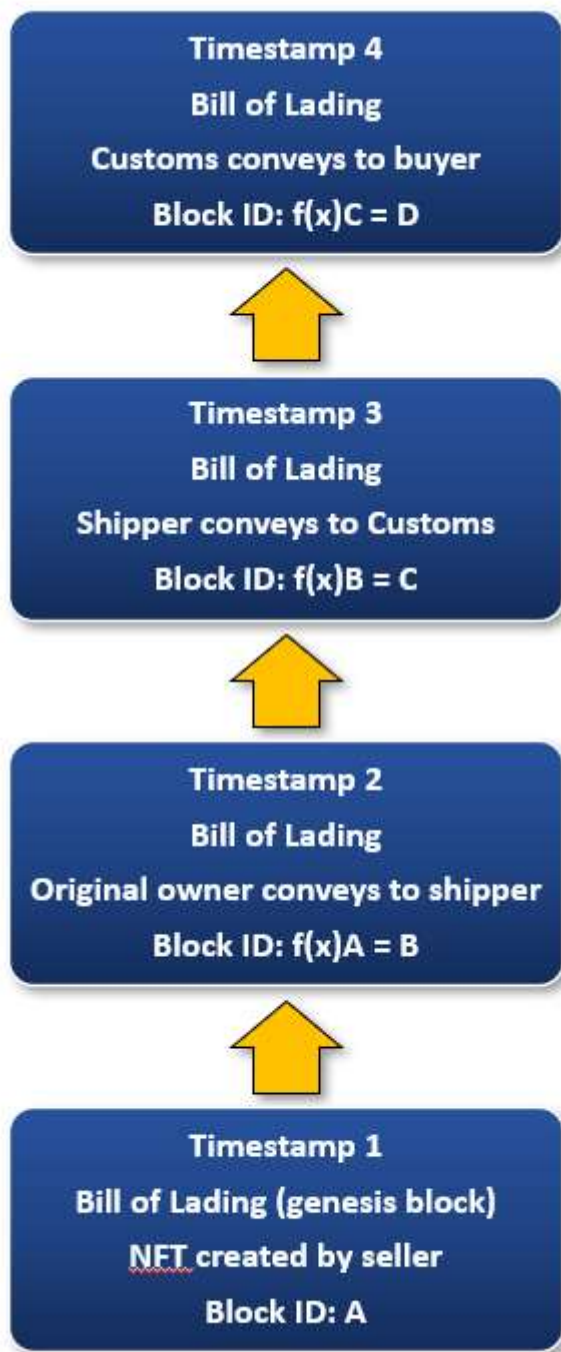
Figure 2: Simplified blockchain schematic for NFT-enabled bill of lading

Figure 2 is basically the same as Figure 1, except that the hypothetical transaction is now identified specifically as an NFT transacted via a blockchain. It shows how an NFT-enabled blockchain can function as a bill of lading. At Time 1, the seller creates an

electronic bill of lading (containing all of the information normally contained in a bill of lading) and encrypts it as a non-fungible token with Block ID A. At Time 2, the seller delivers the identified goods to the shipper and the NFT bill of lading is conveyed to the shipper in Block ID B (a mathematical transformation of Block ID A using a function we are calling *f(x)*). The buyer can see that the bill of lading has been passed by the seller to the shipper, but no one except the shipper is able to access or modify it. At Time 3 (Block ID C), goods and the NFT bill of lading are securely conveyed to Customs. At this point all of the participants—seller, shipper, and buyer—can see that Customs has the bill of lading and associated goods, but only Customs can access the bill of lading itself. Customs then releases the goods and the NFT bill of lading to the buyer at Time 4, Block ID D. At this point the seller takes possession of the goods and is able to access and modify the bill of lading.

In this way, the bill of lading is rendered essentially fraud-proof. It cannot be backdated, each transaction is transparent to all participants in the blockchain, and the payload (the bill of lading itself, including the description of goods) cannot be altered by a non-owner without detection.

Moreover, the fact that NFTs are extensible means a business can verify both components and finished goods. The NFTs accompanying particular chips shipped from Taiwan can be combined with NFTs accompanying circuit boards and other components in order to create an NFT validating a particular phone made in South Korea and shipped to Germany. Anyone with basic knowledge of the blockchain ledger could confirm the phone's true owner and the chain of title of every NFT-tagged component, as depicted (again, in a *very* simplified form) in Figure 3:
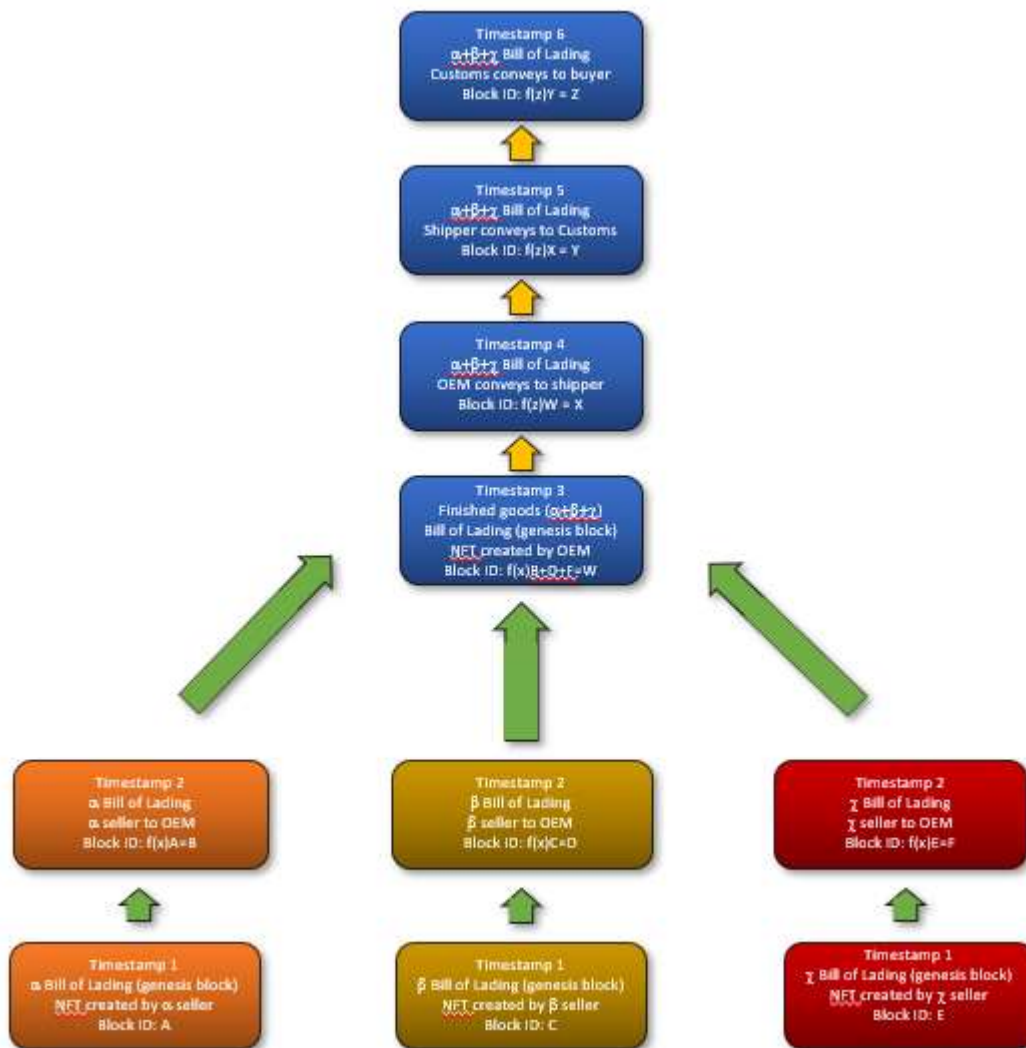
Figure 3: Simplified blockchain schematic for a good comprising three components, each using NFT-enabled bills of lading

In the simplified sequence depicted in Figure 3, three component makers (components α, β, and χ) each create NFT bills of lading at Time 1, using the same cryptographic system (designated as *f(x)*) and ship them to the original equipment manufacturer (OEM) at Time 2. The OEM folds all three NFT bills of lading into a single, combined bill of lading (using the extensible property of NFTs and the same *f(x)* transformation) at Time 3, and then ships the combined product α + β + χ, with an intact chain of title for each of the three components, via the same simplified shipping route depicted in Figure 2 to the buyer at Time 6.

Of course, a real bill of lading can go through dozens—even hundreds—of hands, especially when traced back to particular components of a finished good. But in the digital environment, that is no impediment at all. Indeed, the ability to pass secure documents through multiple hands without fraud or mistake is one way that the NFT-enabled blockchained bill of lading is superior to a fungible form of bill of lading on a blockchain. The NFT's extensibility means that NFTs can be combined with other NFTs in ways that can be easily and transparently traced. If the shipper at Time 5 wants to see the bill of lading for component β, it is right there in the blockchain and can be traced forward and backward in time.

5 Conclusion

Despite pandemics and conflicts, international trade has brought the world ever closer together. Business supply chains extend beyond national boundaries and hence businesses (and the societies they serve) are ever more interdependent. But the key document of title and transport that lubricates this system has remained largely unchanged for centuries. The need to replace this obsolete and expensive system for tracking goods across borders has never been more acute. Yet the quest to replace paper bills of lading has been, in the words of one scholar, "never-ending."[103]

Blockchain could finally break that logjam. The distributed, encrypted ledger enhances predictability and traceability, and is much harder to scam than traditional paper ledgers, or even centralised electronic ledgers. And so it is no surprise that multiple players in the shipping industry are already experimenting with blockchain-based electronic documents.[104]

But blockchain alone is not enough. The blockchain is merely a ledger of transactions—it traces but does not necessarily secure the payload, and encrypts blocks without necessarily capturing the uniqueness of what has been transacted. This is where non-fungible tokens come in. When the bill of lading is an NFT, the objections to blockchain-based bills of lading disappear.

Enhancing a blockchain-based bill of lading by use of NFTs is simple, elegant, tamper- and fraud-resistant, and satisfies all of the requirements for a functional bill of lading under the Rotterdam Rules, the UNCITRAL Model Law on Electronic Transferrable Records, and the Uniform Commercial Code. Of course, those are merely model statutes and treaties that have not yet come into effect. Saying that NFT-enabled

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[103] DA Bury, 'Comment: Electronic Bills of Lading: A Never-Ending Story?' [2016] Tulane Mar. L. J. 197.

[104] A Skopec, 'PIN Chagrin: The Glencore Heist and EDI Through the Lens of Delivery Orders [2017] Tulane Mar. L. J. at 242-246 (discussing IBM-Maersk blockchain project partnership and the Port of Rotterdam Blockchain Project); see also Jesse Marks, 'Distributed-ledger Technologies and Corruption: The Killer App?' [2018] Columbia Science & Technology Law Journal 42 at 78 (discussing IBM-Maersk project).

blockchain bills of lading are consistent with these statutes is no guarantee that those statutes will ever come into effect. The more salient point is that, excluding only the requirement of *paper*, an NFT-enabled bill of lading on a blockchain *already* satisfies all of the requirements of *existing* international trade laws, *e.g.*, the Vienna Convention, the Hague-Visby Rules, and the U.S. Carriage of Goods by Sea Act.

There is, in reality, no issue of practical reliability or legal impediment that should block the widespread adoption of NFT-enabled blockchain as an electronic bill of lading. It is only a question of will.

Jule Giegling[*]

IN BLOCKCHAIN WE TRUST? CERTIFICATES OF ORIGIN AS A CASE FOR DISTRIBUTED-LEDGER TECHNOLOGIES

ABSTRACT

Certificates of Origin are one of the most important documents in cross-border trade. They evidence that goods are wholly produced or manufactured in the issuing country, which makes them eligible for specific treatment, be it non-preferential (for example most-favored-nation treatment) or preferential (for example reduction or elimination of tariffs). The procedure of obtaining a Certificate of Origin is still largely manual and paper-based, which makes it time-consuming, costly and vulnerable to errors and fraud. Documents for processing the Certificate need to be handed in by multiple actors and each submission is coupled with the risk of being false or even fraudulently produced. To improve security and transparency, in recent years, states and private parties alike started experimenting with digitalising the whole procedure in order to streamline and facilitate it. However, even promising projects with e-Certificates did not entirely solve the underlying fundamental problem of the lack of trust between the parties involved in the process. With the rise of blockchain from 2008 onwards, all eyes are on this new technology which is supposed to fix exactly this issue: establishing trust between unknown parties, or even operating without trust between the parties as they only need to trust the code. Blockchain provides a fully traceable, auditable and transparent record of transactions and with the possibility of adding smart contracts it promises to fully automatize entire processes in order to significantly reduce cost, time and human resources needed for almost any kind of procedure. This technology sounds like a promising solution for the challenges Certificates of Origin are facing. Yet, it should not be blindly implemented. This paper therefore evaluates whether Certificates of Origin are indeed a case for blockchain and if so, which framework would need to be established in order to fully enjoy the benefits that the blockchain technology provides. It concludes that Certificates of Origin are a case for blockchain technology, albeit not in all cases. To fruitfully implement blockchain, a case-by-case evaluation of the individual project, including a balancing of the advantages and disadvantages, is necessary. Furthermore, a regional framework which enables the cross-border utilisation of blockchain in the issuing process must be established in order to reap the full benefits of the technology.

The methodological approach of this paper is twofold: on the question whether Certificates of Origin are a case for blockchain, a literature review as well as case studies were conducted. On the question of regulation, current regulatory attempts and discussions in international

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organisations, such as the WCO and the ICC, were examined to identify the areas of regulatory need. Based on the findings, regulatory considerations are drawn and presented.

JEL CLASSIFICATION: K22, K24, K33

SUMMARY
1 Introduction – 2 Certificates of Origin – a case for blockchain? – 3 The matter of regulation: what should be and what can be regulated? – 4 Conclusion

1   Introduction

Certificates of Origin (CoO) are essential documents of international trade which are required to prove the origin of a certain good to determine whether preferential treatment under existing Free Trade Agreements may be applied,[1] although some countries require them also as proof for non-preferential treatment.[2] Depending on the Agreement, CoO are either issued by the importer, the exporter or a specific governmental authority.[3] The issuance of a CoO oftentimes proves to be time-consuming and costly.[4] Furthermore, the risk of forgery is always present.[5] Regularly, authorities discover CoO which were produced fraudulently in order to benefit from preferential treatment in cases it would not be applicable or to circumvent embargoes or sanctions.[6] Even though there is the possibility to verify the authenticity and/or validity of a CoO, the current verification procedures require administrative cooperation between the relevant authorities, which comes with further challenges, such as the need for bi- or multilateral agreements that allow for the exchange of the necessary information.[7] A further common challenge for CoO is that usually only the producer and/or exporter has sufficiently detailed knowledge and information about the originating status of the good.[8]

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[1] World Customs Organisation (WCO), 'Comparative Study on Certification of Origin' (June 2020) <www.wcoomd.org/-/media/wco/public/global/pdf/topics/origin/instruments-and-tools/comparative-study/re-lated-documents/comparative-study-on-certification-of-origin_2020.pdf?db=web> accessed 27 July 2021, 11 ff.
[2] ibid 6, 8 ff.
[3] ibid 17.
[4] ibid 11.
[5] See for example United Nations Economic and Social Commission for Asia and the Pacific, 'Enhancing Regional Connectivity: Towards a Regional Arrangement for the Facilitation of Cross-Border Paperless Trade' (ESCAP Studies in Trade and Investment No. 78, 2016) 93.
[6] See Camarda, 'Blockchain-based Certificates of Origin Begin Moving into International Trade' <www.americanex-press.com/us/foreign-exchange/articles/blockchain-in-certificate-of-origin/> accessed 25 April 2021; cf Christine McDaniel and Hanna Norberg, 'Can Blockchain Technology Facilitate International Trade? (Mercatus Center at George Mason University, Trade and Immigration, Research Papers, April 2019) <www.mercatus.org/sys-tem/files/mcdaniel-blockchain-trade-mercatus-research-v2.pdf> accessed 25 April 2021, 13.
[7] Cf WCO, 'Comparative Study on Certification of Origin' (n 1) 11.
[8] ibid 20.

In recent years, an increasing number of private undertakings and governments aim to solve the challenges of CoO by introducing e-certificates based on distributed-ledger technology (DLT), most commonly referred to as blockchains. In 2018, the Singapore International Chamber of Commerce launched the first blockchain-based e-CoO.[9] Other countries followed, and there are several pilot projects and surveys currently being conducted to research the benefits of moving CoO entirely online.[10] Even though these projects appear promising, skepticism towards the usage of DLT for CoO remains, especially concerning its still insufficient regulation.[11]

This paper aims to shed light on the question whether the implementation of DLT, especially blockchain, can improve the issuing process and quality of CoO and the question which regulations would be necessary to pave the way for effectively implementing blockchain in the procedure.

2   Certificates of Origin – a case for blockchain?

Even though blockchain appears appealing as a solution to the various problems the concept of CoO faces in international trade it remains questionable whether CoO actually are a case for a Blockchain project. Considering that oftentimes new technologies are met with an overwhelming enthusiasm and stakeholders wish to apply said technology to every aspect possible, it is worth considering whether it actually makes sense to implement the respective technology in the chosen sector (or even a part of it).[12] A common justification for using blockchain is already seen in cases where multiple parties need to have access to the same data but mistrust each other in sharing them.[13] The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) finds blockchain valuable when it supports either new and improved services, faster processes and/or implementation or more economical processes and/or implementation and provides a "decision tree".[14] Wüst and Gervais consider blockchain as feasible in cases where there are multiple mistrusting entities, and there

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[9] eTrade for all, 'Singapore International Chamber of Commerce launches world's first blockchain-based e-Certificate of Origin' (14 May 2018) <https://etradeforall.org/news/singapore-international-chamber-of-commerce-launches-worlds-first-blockchain-based-e-certificate-of-origin/> accessed 27 July 2021.

[10] See WCO, 'Comparative Study on Certification of Origin' (n 1) 20 ff.; Camarda (n 6).

[11] Marc Barley, 'UK certificate of origin blockchain pilot' (Ledger Insights, 13 June 2018) < www.ledgerinsights.com/uk-certificate-origin-blockchain/> accessed 29 July 2021.

[12] See also Jorien Kerstens and James Canham, 'Blockchain: mapping new trade routes to trust' (WCO News 87, Focus, October 2018) <https://mag.wcoomd.org/magazine/wco-news-87/blockchain-mapping-new-trade-routes-to-trust/> accessed 16 July 2021, who assess the feasibility by evaluating four key areas of trade, namely proof of identity, asset transfer, pathfinder and border collaboration.

[13] Zahouani Saadaoui, 'Digitisation of ATA Carnets: how the Blockchain could enhance trust', ibid <https://mag.wcoomd.org/magazine/wco-news-87/digitisation-ata-carnets/> accessed 17 July 2021.

[14] United Nations Economic Commission for Europe/United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT), *Blockchain in Trade Facilitation* (White Paper, ECE/TRADE/457, Geneva, 2020) <https://unece.org/DAM/trade/Publications/ECE-TRADE-457E_WPBlockchainTF.pdf> accessed 29 July 2021, 16 ff.

is no agreement on who is an online trusted third party, there are multiple writers of data and there is data to be stored and the multiple mistrusting entities must want to interact and change the state of a system.[15] Lindman et al. propose a test for analyzing potential blockchain use cases. The test follows the rationale of whether blockchain for the specific project is viable (i.e. a viable solution considering the scope and limits of the technology); if so, whether it is valuable (does blockchain have clear benefits for the project?); and if so, whether it is vital (does blockchain have unique properties needed to implement the service?).[16] Only if these criteria are fulfilled cumulatively do Lindman et al. consider a project to be a blockchain use case. This test allows for a multi-layered in-depth evaluation, which is why it is considered appropriate for the evaluation of the compatibility of blockchain and CoO.

2.1   The challenges of Certificates of Origin

CoO are used since almost a century in cross-border trade; they establish trust between the traders and allow the parties involved from benefitting from trade agreements between their respective states as well as assisting authorities to monitor compliance with their internal regulations. As this function requires a high amount of legal certainty and reliability, the process of issuing a Certificate of Origin needs to be regulated and carefully executed. False CoO do not only damage the reputation of the trader but have a direct impact on the state's revenue in the form of loss of custom duties or taxes and are even used to cover illicit trade activities.[17] While the careful certification process is certainly necessary and understandable, it equally hinders the free cross-border-flow of goods and creates hurdles especially for small and medium-sised enterprises[18] and might even amount to a distortion of or a *de facto* barrier to trade.[19] Obtaining a Certificate of Origin proves to be costly and time-consuming,[20] even more so due the complexity of the procedure: there is a great variety of procedures to obtain a Certificate of Origin[21], involving varying competent authorities, documentation and requirements – procedural and formal alike. The increasing number of free trade

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[15] Karl Wüst and Arthur Gervais, 'Do you need a Blockchain?' (Crypto Valley Conference on Blockchain Technology (CVCBT), 2018) 46 <https://eprint.iacr.org/2017/375.pdf> accessed 29 July 2021.

[16] Juho Lindman and others, 'The uncertain promise of blockchain for government' (2020) OECD Working Papers on Public Governance No. 43, 12.

[17] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 48.

[18] Cf Emanuelle Ganne, *Can Blockchain revolutionize international trade?* (WTO Publications 2018) 83.

[19] International Chamber of Commerce, 'Non-Preferential Rules of Origin for Commercial Policy Purposes' (Policy Statement, Document No 104-80, June 2015) <https://iccwbo.org/publication/icc-policy-statement-on-non-preferential-rules-of-origin-for-commercial-policy-purposes/> accessed 26 July 2021, 1.

[20] Cf WCO, 'Guidelines on Certification of Origin' (July 2014, updated June 2018) <www.wcoomd.org/-/media/wco/public/global/pdf/topics/key-issues/revenue-package/guidelines-on-certification.pdf?la=fr> accessed 27 July 2021 7 ff; cf Luc Pugliatti and Bill Gain, 'Can Blockchain Revolutionize Trade?' (World Bank Blogs, 5 June 2018) <https://blogs.worldbank.org/trade/can-blockchain-revolutionize-trade> accessed 2 July 2021.

[21] WCO, 'Guidelines on Certification of Origin' (n 20) 7 ff.

agreements, each with its own rules of origin, creates a serious challenge for the issuing process.[22] There might even be different origin procedures for the same good in the same country as each trade agreement is negotiated differently with different trading partners. This complexity creates an administrative challenge for authorities and traders of all sizes alike.[23] Already for multinational companies identifying the correct procedure for the individual shipment is not an easy task and requires a great amount of resources.[24] It is unlike harder for small and medium-sised enterprises which cannot resort to comparable resources as multinational companies.[25] A further challenge is the lack of capacity on the side of the issuing competent authorities, be it in human or other resources, which is inextricably linked to the continuing increase of international trade.[26] Combined with the difficulty of having different stakeholders at the issuing and the receiving side,[27] this challenge adds a further layer to the already complex procedure.

The complexity of the procedure combined with it being manual and paper-based results in "blind-spots"[28] which present entry points for false information which may be exploited to fraudulently obtain a Certificate of Origin. The amount of documentation needed from multiple actors comes with the inherent risk of data inconsistencies which may result in false certifications.[29] In recent years a number of cases were reported which included forged CoO, such as Chinese zippers with declared origin in Indonesia to benefit from lower tariffs[30] or 80 cases of origin fraud in Vietnam within one year[31], with many aimed at evading trade sanctions or restrictions.[32]

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[22] WCO, 'WCO Origin Compendium' (May 2017) <www.wcoomd.org/-/media/wco/public/global/pdf/topics/origin/instruments-and-tools/guidelines/origin_compendium.pdf?db=web> accessed 27 July 2021, p. 23; WCO, 'Guidelines on Certification of Origin' (n 20) 8; International Chamber of Commerce, 'Non-Preferential Rules of Origin for Commercial Policy Purposes' (n 19) 1.

[23] Leonardo Macedo, 'Blockchain for trade facilitation: Ethereum, eWTP, COs and regulatory issues' (2018) 12(2) World Customs Journal 87, 90; WCO, 'WCO Origin Compendium' (n 22) 23; International Chamber of Commerce, 'Non-Preferential Rules of Origin for Commercial Policy Purposes' (n 19) 1.

[24] The cost of handling the paperwork might even exceed the cost of transport, McDaniel and Norberg (n 6) 11 (with further reference).

[25] Ganne (n 18) 83.

[26] WCO, 'Guidelines on Certification of Origin' (n 20) 8.

[27] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 93.

[28] Huseyin Yaren, 'Implementing blockchain technology in the customs environment to support the SAFE Framework of Standards' (2020) 14(1) World Customs Journal 127, 131.

[29] Cf Stewart Jeacocke and Norbert Kouwenhoven, 'TradeLens uses blockchain to help Customs authorities facilitate trade and increase compliance' (WCO News 87, Focus, October 2018) <https://mag.wcoomd.org/magazine/wco-news-87/tradelens/> accessed 17 July 2021.

[30] Jalelah Abu Baker, 'Company director fined $434,000 for submitting false information to Singapore Customs' *The Straits Times* (Singapore, 14 July 2015) <www.straitstimes.com/singapore/courts-crime/company-director-fined-434000-for-submitting-false-information-to-singapore> accessed 27 July 2021.

[31] Vietnam Law & Legal Forum, 'Origin Fraud Still Runs Rampant' *Vietnam.Net Bridge* (5 July 2013) <http://english.vietnamnet.vn/fms/business/78277/origin-certificate-fraud-still-runs-rampant.html>, accessed 27 July 2021.

[32] Camarda (n 6).

At the core of all these issues specific to the certification problems lies the problem of a general lack of trust in cross-border transactions.[33] This can not only be seen in the complex procedures in place – some countries, for example, require a paper document to be stamped by an embassy or consulate[34] – but also in the generally prevailing unwillingness or inability to find consensus to simplify processing of goods at the border.[35]

The aforementioned problems have been explicitly recognised by the members of the World Customs Organisation, which, in 2016, acknowledged that the development of a global system for paperless information exchange would be desirable, however that several obstacles, namely (a) legal issues; (b) data security and protection concerns; (c) a general lack of trust; (d) the need for an organisation that will be responsible for the system; (e) the complexity of setting up and financing such a system; and (f) the absence of initial investment funds would currently prevent the establishment of such a system.[36]

2.2 Viable

For a project to be a case for blockchain technology, the technology must first be a viable solution to the problem to be solved. Whether or not blockchain is a viable solution is to be determined based on the scope and limits of the technology, its general implementability and ultimately the compatibility with the needs of the project. The threshold for viability is not high; as soon as the project can be made to work by deploying the technology the requirement of viability is met.[37]

2.2.1 The scope and limits of the blockchain technology

Even though blockchain technology has been developed since more than a decade now, some consider it still to be in a nascent stage.[38] The huge community working on and with the technology constantly aims for the improvement and enhancement of

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[33] Macedo (n 23) 91.

[34] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 46, 95.

[35] ibid, 46.

[36] ibid.

[37] Lindman and others (n 16) 12.

[38] For example, Horst Treiblmaier, 'Toward More Rigorous Blockchain Research: Recommendations for Writing Blockchain Case Studies' in Horst Treiblmaier and Trevor Clohessy (eds), *Blockchain and Distributed-ledger Technology Use Cases. Applications and Lessons Learned* (Springer 2020) 1, 3; Lokke Moerel, 'Blockchain and Data Protection' in Larry DiMatteo, Michel Cannarsa and Cristina Poncibo (eds), *The Cambridge Handbook of Smart Contracts, Blockchain Technology and Digital Platforms* (CUP 2019) 213, 232; Marco Iansiti and Karim Lakhani, 'The Truth About Blockchain' (January-September 2017) Harvard Business Review 118 <https://hbr.org/2017/01/the-truth-about-blockchain> accessed 18 July 2021.

DLTs in order to solve issues connected to the increasing usage such as interoperability and scalability (see *infra*) and unlocks new means of application at great velocity. With this support and the willingness of the private and public sector to apply the technology whenever possible, the scope of blockchain seems virtually limitless. As can be seen in the great variety of projects based on the technology, there seems to be no part of international trade which could not be revolutionised by blockchain. Be it in the financial sector, transport, supply chain management, insurances or customs, most of the areas are already equipped with at least one pilot project in order to explore the implications of DLT in trade.[39]

Yet, the technology has its limits. Blockchain per se is not able to check the validity of the information added to the chain. While this might be mitigated by including smart contracts[40] in the process, blockchain is still limited to what is uploaded by its users. The technology is not by itself able to prevent false information from being fed into the ledger.[41] With the risk of having fraudulent documentation or information uploaded on the chain comes the issue that such information may not be deleted due to the immutability of the information added to the chain.[42] Hereby, the whole chain related to that specific transaction may be spoiled resulting in a deterioration of the trust established by the usage of blockchain in the first place.

The technology is – as of now – also not entirely secure. For example, there remains the risk of so-called 50+1 attacks whereby data may be tampered with when more than fifty percent of the nodes are taken over by a single entity which then is empowered to provide consensus for a transaction by itself.[43] Admittedly, the risk is small, as the computational power needed to execute such an attack and the cost related to it is high;[44] it is furthermore a risk rather specific to public permissionless than private and/or permissioned chains.[45]

Bearing this in mind, the benefits of the technology may only materialize as long as the information provided on the chain is correct.[46] This does not mean that the technology is not beneficial, it just needs to be kept in mind as a limit to the service blockchain provides for cross-border trade.

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[39] For an overview see for example Valentina Gatteschi, Fabrizio Lamberti and Claudio Demartini, 'Blockchain Technology Use Cases', in Shiho Kim and Ganesh Deka (eds), *Advanced Applications of Blockchain Technology* (Springer 2020) 91, 94 ff.

[40] Ganne (n 18) 6.

[41] Eliza Mik, 'Blockchains: A Technology for Decentralised Marketplaces' in DiMatteo, Cannarsa and Poncibò (n 38) 160, 172 ff.; Pugliatti and Gain (n 20); cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 19.

[42] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14), 20, 30; cf Philip Asuquo and others, 'Blockchain Meets Cybersecurity: Security, Privacy, Challenges, and Opportunity' in Kim and Deka (n 39) 115, 124.

[43] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 7.

[44] ibid.

[45] Ganne (n 18) 7; cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 9.

[46] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 19.

What blockchain can provide is undoubtedly an easily identifiable record of data which, once added to the chain, is almost tamper-proof. It can therefore establish a transparent, traceable and accessible record keeping, resulting in ensured and secured storage of documents[47] which enables a trust-relationship between strangers, a characteristic which cannot be underestimated in globalised trade.

2.2.2 Implementability with Certificates of Origin

To assess whether blockchain is a viable solution for CoO, it must be evaluated if CoO are compatible with the concept of blockchain. Here, it is of relevance whether, generally, the technology is implementable in this procedure and whether it is complementary to the needs of it.

For this it is necessary to recall the specificities of CoO. CoO are documents which are exchanged in international trade transactions to provide the trading partner and third parties, such as customs authorities, with evidence of origin in order to benefit from a specific treatment attached to a goods' origin, such as preferential tariffs or the exemption from sanctions or export bans (see *supra*, II.1.). The documentation is necessary to validate not only the specific conditions of the transaction, but also to establish trust between the parties: as liabilities in these relationship in connection to false documentation are generally clarified, the respective parties – at least theoretically – can rely on the provided documentation. CoO are key documents in cross-border trade, which makes them essential features, but equally makes them attractive targets for forgery or other fraudulent behavior in order to benefit from a certain originating status. In sum, CoO are vital elements for the integrity of cross-border processing, especially customs procedures.

Following these considerations, it is apparent that blockchain is implementable in the processing of CoO. Every step necessary in order to obtain such a certificate can be digitalised – a step already taken in some countries which rely on e-certification. There is no ultimate need for human interaction for the issuance of a Certificate of Origin. Generally, there is also no need for a physical inspection of the relevant goods which would hinder the digitisation of the procedure. Also, recalling the features of blockchain, all procedural steps for the certification process can be subjected to validation within a network. The certification process could also be (partially) automated, whereby the process could not only be transferred on-chain, but even complemented with smart contracts – whether or not that would be a feasible way to process certification requests.

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[47] Singapore Customs, 'Going beyond the national Single Window' (WCO News 87, Focus, October 2018) <https://mag.wcoomd.org/magazine/wco-news-87/going-beyond-the-single-window/> accessed 17 July 2021.

2.2.3 Compatibility with the needs of Certificates of Origin

As a general implementation is possible, it needs to be evaluated whether the technology can cater for the specific needs of CoO in light of their challenges.

What becomes apparent when considering the characteristics of the blockchain technology in light of the challenges CoO are facing is that, without going into further detail concerning the value of implementing the technology as a solution (see on this matter below), the challenges could be tackled by the features that blockchain would provide. Blockchain has the capacity to significantly reduce the time needed to process transactions, especially when combined with smart contracts for automated facilitation of contractual agreements. As automated facilitation based on verified data also requires less human intervention, the resources needed to effectuate a transaction would significantly decrease as well, and hereby the costs attached to it. Furthermore, due to the immutability and tamper-proof nature of the technology, the matter of general lack of trust in cross-border transactions can be effectively tackled. As every stakeholder of a cross-border transaction could theoretically have access to the data stored on the chain and would hereby be enabled to follow the information on the processing of the certificate in real-time the need for verification would be reduced and the process.[48] The digital nature of the process could not only be a great time-safer, but also ensure that no document would be lost and that documents which are required for more than one certificate, such as a valid exporter license, could be stored indefinitely in order to have it ready for any future transaction. This could also reduce the complexity of the procedure:[49] if regulations and procedures get harmonised, the process would be significantly streamlined which would grant easier access, especially for small and medium-sised enterprises.[50]

2.2.4 Conclusion

The foregoing considerations show that the scope and limits of the blockchain technology can encompass CoO. The technology would also generally be implementable, as the procedure itself contains no features which would prevent an entirely digitised processing, which is especially visible in e-certifications already used in several countries. When evaluated in light of the current challenges faced by CoO, the

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[48] Blockchain would, essentially, improve the current ICC Certificates of Origin verification platform (for the latter see International Chamber of Commerce, 'Certificates of Origin verification website' <https://iccwbo.org/resources-for-business/certificates-of-origin/certificates-origin-verification-website/> accessed 26 July 2021.

[49] Cf Wout Hofman, 'Supply Chain Visibility Ledger' in Treiblmaier and Clohessy (n 38) 305, 327 (on supply chains).

[50] Ganne (note 18), p. 85.

specific needs could theoretically (and without further valuation) be met by the characteristics of the technology. In conclusion it is apparent that blockchain is a viable solution for the challenges of CoO.

2.3 Valuable

As it can be established that blockchain is a viable technology for CoO, it has to be assessed whether it also presents a valuable solution. For this assessment considerations have to be made as to whether blockchain comes with clear benefits. This point follows the idea "just because something can be used does not mean it should be used."[51] To establish clear benefits, the disadvantages which would come with the introduction of the new technology need to be balanced against the benefits in order to establish whether the benefits outweigh the disadvantages. Only in such cases can blockchain be considered a valuable solution.

2.3.1 value added

Blockchain technology is praised for its many advantages in relationships which are established between parties without mutual trust. To establish whether or not these advantages would materialize in the specific case of CoO it needs to be evaluated whether the benefits of blockchain would be valuable for CoO and whether they are capable of actually improving the process.

Introducing blockchain technology into the certification process would make the processing faster,[52] paperless[53] and less costly.[54] Removing the need of physical documentation would also decrease the possibilities for fraud and errors[55] and possibly reduce cross-border trade frictions.[56] While these benefits are clearly valuable for the certification process, they are not unique to the blockchain technology and may be achieved by other forms of digitising CoO.[57] With the reduction of cost and time needed

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[51] See also Kerstens and Canham (n 12); Iansiti and Lakhani (n 38); Gatteschi, Lamberti and Demartino (n 39) 105 ff.

[52] Kerstens and Canham (n 12).

[53] Yotaro Okazaki, 'Unveiling the Potential of Blockchain for Customs' (WCO Research Paper No. 45, June 2018) <www.wcoomd.org/-/media/wco/public/global/pdf/topics/research/research-paper-series/45_yotaro_okazaki_un-veiling_the_potential_of_blockchain_for_customs.pdf?la=en> accessed 27 July 2021, 15; cf. Jeacocke and Kouwenho-ven (n 29).

[54] Macedo (n 23) 88; McDaniel and Norberg (n 6) 14, who estimate a cost reduction by 16.5 percent for low income countries, by 17.4 percent for lower-middle-income countries, by 14.6 percent for upper-middle-income countries, and by 11.8 percent for countries belonging to the Organisation for Economic Co-operation and Development.

[55] A finding validated by the IBM pilot, see Macedo (n 23) 90.

[56] Kerstens and Canham (n 12).

[57] See for example the case of TradeNet and e-Certifications: United Nations Economic and Social Commission for Asia and the Pacific (n 5) 14.

to process CoO the procedure would become less burdensome especially for small and medium-sised enterprises.[58] Especially when blockchain records are accepted as the single source of truth security will improve,[59] not least because immutable, digital, verified data improve the quality of risk assessments.[60] It might even improve cross-border collaboration between customs authorities by sharing information on malicious traders.[61] Using blockchain for CoO would create an immutable certification register with unlimited storage due to its decentralised nature with high security standards due to cryptography; when combined with smart contracts, the technological solution could pave the way for blockchain single windows and eHubs.[62] Another benefit which is valuable for the process is the timestamping feature of the technology, which leads to easier auditability and greater data authenticity and hence is beneficial when truthful records are needed.[63] The improvement of the auditability is further enhanced by the easy traceability of data,[64] which also results in greater transparency for customs clearance.[65] Due to the immutability, verification and timestamping data integrity is established; the accuracy and quality of data accessible to the relevant parties would improve[66] when compared with the current manual and paper-based procedure. Through all these features, the benefits of blockchains for CoO can improve the process insofar as it becomes more transparent, traceable, less costly, less time-consuming, enhances compliance with regulations and documentation and less vulnerable to fraud.[67] Finally, one of the most important values added is the establishment of mutual trust in relationships where there is none;[68] the more trustworthiness is needed, the more value could blockchain add.[69] The transparent and inclusive manner and the high reliability[70] which blockchain would bring into the certification process enables a trust-basis between unknown parties in cross-border trade, for example by establishing a traceable digital identity.[71] With the establishment of mutual trust, the number of intermediaries who are used in the majority of international trade (for example, 90% of

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[58] Ganne (n 18) 85; this is the main idea of the eWTP initiative that aims at reducing trade costs for SMEs by creating virtual free trade hubs, see Macedo (n 23) 89.

[59] Pugliatti and Gain (n 20); Yaren (n 28) 134.

[60] Yaren (n 28) 131, 134.

[61] Kerstens and Canham (n 12).

[62] Macedo (n 23) 91.

[63] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 30; Yaren (n 28) 129.

[64] Okazaki (n 53) 10.

[65] Yaren (n 28) 133 (with further references).

[66] Okazaki (n 53) 17; Pugliatti and Gain (n 20); Yaren (n 28) 129 (concerning supply chains).

[67] See also Yaren (n 28) 133 (with further references).

[68] Okazaki (n 53) 10; Macedo (n 23) 90.

[69] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 16.

[70] ibid 2; UN/CEFACT, *White Paper on the technical applications of Blockchain to United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) deliverables* (ECE/TRADE/C/CEFACT/2019/8, 17 January 2019) <https://unece.org/DAM/cefact/cf_plenary/2019_plenary/ECE_TRADE_C_CEFACT_2019_08E.pdf> accessed 30 July 2021, 2; cf WCO, 'Guidelines on Certification of Origin' (n 20) 2.

[71] Kerstens and Canham (n 12).

declarations involve a broker[72]) and the corresponding cost[73] and risk of errors could be significantly reduced.

2.3.2 disadvantages and challenges

Even though blockchain is considered to entirely disrupt transactions as we know it and the hype surrounding the technology pushes it into virtually every aspect of international trade, some meet it with careful criticism. Despite all its benefits, the usage of blockchain comes with disadvantages and challenges which need consideration.

The major concerns raised in relation to blockchain are scalability, sustainability, interoperability, data protection and privacy, mutual recognition, regulation and liabilities.

Especially due to the increasing prominence of blockchain the issue of scalability is often raised. Scalability is as of yet a not clearly defined term;[74] it may be defined as a system's capability of handling a growing amount of work,[75] which in the case of blockchain is still limited[76] and a specific problem of public blockchains[77] and barely an issue for consortium permissioned blockchains.[78] Scalability decreases the more nodes operate in the network.[79]

The issue of interoperability is raised when there is more than one blockchain involved, which would most likely be the case should blockchain become a standard-technology in international trade relations.[80] Interoperability may be defined as the "ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged"[81] or "the capacity of a system, product, or service to communicate and function together (that is, to be compatible) with other

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[72] ibid.

[73] Treiblmaier (n 38) 6; McDaniel and Norberg (n 6) 13 (who also hold Blockchain to be able to hereby reduce corruption).

[74] For a discussion of the technical matters see for example Zhijie Ren, 'What does "scalability" really mean in Blockchain?' (15 May 2019) <https://medium.com/vechain-foundation/what-does-scalability-really-mean-in-blockchain-b8b13b3181c6> accessed 27 July 2021.

[75] André Bondi, 'Characteristics of Scalability and Their Impact on Performance' in Association for Computing Machinery, *WOSP '00: Proceedings of the 2nd international workshop on Software and performance* (2020) 195 <https://dl.acm.org/doi/10.1145/350391.350432>, accessed 27 July 2021.

[76] Gatteschi, Lamberti and Demartino (n 39) 92.

[77] Treiblmaier (n 38) 7 ff; cf. UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 7; Ganne (n 18) 90.

[78] Ganne (n 18) 91.

[79] Fabian Knirsch, Andreas Unterweger and Dominik Engel, 'Implementing a blockchain from scratch: why, how, and what we learned' (2019) EURASIP Journal on Information Security 2019 <https://jis-eurasipjournals.springeropen.com/articles/10.1186/s13635-019-0085-3#citeas> accessed 27 July 2021.

[80] UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 7 ff.

[81] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 15 (with reference to the ISO/IEC standard and the International Telecommunications Union).

systems, products, or services which are technically different."[82] The various ledgers in operation usually perform different forms data transactions and handle different amounts of data processing. Generally, transmission of data between the various blockchain networks is not possible[83] which effectively prevents the users to enjoy the full benefits of DLT and creates a *de facto* technical boundary.[84]

Concerns on sustainability are in majority connected to public permissionless chains.[85] As the increasing amount of users requires an increasing amount of computational power in order to validate a transaction, the energy expense of blockchain transactions, especially in validations by Proof of Work, is high.[86] However, this appears to be a specific problem of public permissionless blockchains, especially Bitcoin;[87] as the forms of blockchain which would most likely be implemented in international trade would be permissioned and/or private, the disadvantage of sustainability would be – partially – mitigated as permissioned blockchains[88] and blockchains using other consensus mechanisms[89] require significantly less computational power.

Furthermore, concerns about data protection and data privacy are raised, especially concerning business critical information.[90] The data affected are different depending on the chain used; for example, in public chains, concerns evolve rather around data connected to the transaction,[91] such as production volumes, as the participants operate anonymously.[92] Nevertheless, it is also possible to identify users in public blockchains.[93] In relation to data protection regulations, it is argued that the technology may not be compliant with the General Data Protection Regulation of the European Union[94] which,

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[82] Paolo Tasca and Riccardo Piselli, The Blockchain Paradox, in Philip Hacker and others (eds), *Regulating Blockchain: Techno-Social and Legal Challenges* (OUP 2019) 27 35 (with further reference).

[83] ibid, 36 ff.

[84] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 15.

[85] Ganne (n 18) 92.

[86] Rosario Girasa, *Regulation of Cryptocurrencies and Blockchain Technologies. National and International Perspectives* (Palgrave McMillan 2018) 32; Ganne (n 18) 7; Knirsch, Unterweger and Engel (n 79).

[87] A study conducted by Guan Dabo at Tsinghua University in Beijing, China, and his colleagues calculated that the total carbon footprint of bitcoin mining in China will peak in 2024, releasing around 130 million metric tonnes of carbon (Donna Lu, 'Bitcoin mining emissions in China will hit 130 million tonnes by 2024' *New Scientist* (6 April 2021) <www.newscientist.com/article/2273672-bitcoin-mining-emissions-in-china-will-hit-130-million-tonnes-by-2024/#ixzz70bZ52cdf> accessed 27 July 2021) and a study by Cambridge researchers found that Bitcoin mining already uses more electricity annually than Argentina (Cristina Criddle, 'Bitcoin consumes "more electricity than Argentina"' *BBC News* (10 February 2021) <www.bbc.com/news/technology-56012952>, accessed 27 July 2021).

[88] Ganne (n 18) 10.

[89] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 22.

[90] Wüst and Gervais (n 15) 48; Treiblmaier (n 38) 6.

[91] Neha Gupta, 'Security and Privacy Issues of Blockchain Technology' in Kim and Deka (n 39) 207, 217; cf. Wüst and Gervais (n 15) 48.

[92] Or, more correctly, pseudonymously, Treiblmaier (n 38) 6.

[93] ibid; UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 32 ff; Michèle Finck, *Blockchain Regulation and Governance in Europe*, (CUP 2018) 53 ff.

[94] Wolfgang Radinger-Peer and Bernhard Kolm, 'A Blockchain-Driven Approach to Fulfill the GDPR Recording Requirements' in Treiblmaier and Clohessy (n 38) 133, 137 ff; Stefan Wunderlich and David Saive, 'The Electronic Bill of

should this be the case, might negatively affect the implementation in the European Union and herewith a big part of globalised trade. A major concern here is the immutability of the data, which, ironically, is one of the praised features of blockchain, because it interferes with the right of having one's data deleted (i.e., the right to be forgotten).[95] As modification of a chain is only possible with the consent of the majority of its users,[96] this might indeed present a problem.[97] Yet, of course, it would not be unsolvable, for example by implementing forks,[98] or at least implement an application that allows for new entries which will delete the impact of inaccurate data.[99] However, as these solutions do not entirely delete the data, alternatives such as redactable blockchains should be explored.[100] A further concern is the problem of cross-border paperless data exchange, a hot topic since years which in large parts still remains unsolved.[101] Furthermore, the level of security decreases the smaller the network of the ledger gets; especially permissioned chains are not as resistant against attacks as a public permissionless ledger.[102] Apart from hacking, security concerns evolve around for example 50%+1 attacks, double spending, mining pool attacks, forking or transaction privacy leakage.[103]

Especially in the realm of blockchain and CoO there are challenges concerning the question of mutual recognition and acceptance of e-certificates as well as the authenticity and accuracy of data. Along with these unanswered question goes the question of liability, which is clear in the current procedure but would need serious re-consideration with the introduction of blockchain.

2.3.3 Evaluation

Despite the great benefits of blockchain, which would be valuable for the issuing of CoO, there are disadvantages which cannot be ignored. Yet, most of the disadvantages can be mitigated by careful planning and execution of a blockchain-based certification process. The issue of scalability can be tackled by including smart contracts on the

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Lading. Challenges of Paperless Trade' in Javier Prieto and others (eds), *Blockchain and Applications. 2nd International Congress* (Springer 2020) 93, 97; in disagreement: Moerel (n 38) 217 ff.

[95] Radinger-Peer and Kolm (n 94) 136 ff; Treiblmaier (n 38) 10; cf Gupta (n 91) 217 ff; Wunderlich and Saive (n 94) 97; it has to be borne in mind, however, that this right is not absolute, see on this matter Moerel (n 38) 228.

[96] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 9.

[97] Gupta (n 91) 218.

[98] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 9 ff.

[99] ibid, 30 ff.

[100] Wunderlich and Saive (n 94) 97.

[101] UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 8; cf. United Nations Economic and Social Commission for Asia and the Pacific (n 5) 37 ff.

[102] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 10 f.; Id., *White Paper on the technical applications of Blockchain* (n 70) 8.

[103] Treiblmaier (n 38) 9; see for details Gupta (n 91) 210 ff, 218 ff.

chain[104] or implementing technologies which improve the scalability.[105] The question of interoperability is currently being worked on by expert groups and discussed in literature[106] as is the concern of "50%+1 attacks"[107] and other security concerns,[108] with promising solutions that can be implemented in future projects. Privacy concerns, especially when smart contracts are used, can be met with appropriate techniques, such as Hawk contracts, code obfuscation, application hardening or computing with trust[109] or privacy-by-design options.[110] The concerns raised about the sustainability of the technology would only be pressing should the project use a public and/or permissionless chain, a scenario unlikely in the context of CoO;[111] the question of sustainability is also subject to current developments.[112] The question of cost needs further evaluation, as implementing blockchain might trigger significant investments[113] and there will likely be transaction fees;[114] yet, it can be expected that in the long run the technology would safe more cost than its introduction and operation would require.[115] Questions of data protection and security are solvable through fitting regulations and can build on a basis of pre-existing data security frameworks which are already operational.[116] Also, the questions on mutual recognition and liabilities are solvable through specific (inter)state regulations.

In conclusion, the benefits of introducing blockchain into CoO clearly outweigh its disadvantages, not least because the disadvantages do not proof to be unsolvable with considerate planning and regulation.

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[104] Macedo (n 23) 88.

[105] See for an overview Ren (n 74).

[106] For example, the UN/CEFACT proposes a inter-ledger notary protocol, see UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 11 ff. Also, in the case of TradeLens: Jeacocke and Kouwenhoven (n 29). See also the development of Cross Chain Technology: Diego Geroni, 'Blockchain Interoperability: Why Is Cross Chain Technology Important?' (101Blockchains, 13 August 2021) <https://101blockchains.com/blockchain-interoperability/> accessed 18 July 2021; UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 12; Yucen He and others, 'A Novel Cross-Chain Mechanism for Blockchains' in Meikang Qiu (ed), *Smart Blockchain: First International Conference, SmartBlock 2018 Tokyo, Japan, December 10–12, 2018, Proceedings* (Springer 2018) 139; critically: Tasca and Piselli (n 82) 38 ff.

[107] For example, by Buterin, 'A Guide to 99% Fault Tolerant Consensus' (Vitalik Buterin's Website, 7 August 2018) <https://vitalik.ca/general/2018/08/07/99_fault_tolerant.html> accessed 24 July 2021.

[108] Gupta (n 91) 221 ff.

[109] ibid 224 ff.

[110] Moerel (n 38) 228 ff.

[111] Cf Gatteschi, Lamberti and Demartino (n 39) 106; Okazaki (n 53) 17.

[112] Girasa (n 86) 32; Gupta (n 91) 225.

[113] Gatteschi, Lamberti and Demartino (n 39) 106; UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 17, 21 ff.

[114] Ganne (n 18) 93.

[115] ibid, 82 ff.

[116] See for example United Nations Economic and Social Commission for Asia and the Pacific (n 5) 35.

2.4 Vital

Finally, blockchain should be a vital solution for CoO. For the technology to be vital it needs to hold unique properties beneficial for the needs of the project. This is the case if the project could not successfully run without the technology. Here, considerations need to be made as to whether there are easier solutions at a lower cost which could achieve the same result as implementing blockchain would.[117] Whether or not blockchain is a vital solution is the most relevant and critical part of the assessment as most projects with a solid concept can be considered viable and valuable.[118]

2.4.1 Unique properties of blockchain in relation to Certificates of Origin

Not all benefits of the blockchain technology are unique features. Some of them, like cost and paper reduction as well as timestamping, encryption, hashing or digital signatures, can also be found in other technologies.[119] Whether or not CoO are indeed a case for blockchain depends on its unique features and if they are advantageous to other technologies in a sense that the usage of other technologies would be neither technologically nor cost-wise be more beneficial than blockchain.

Unique features of blockchain are that the technology is nearly unhackable, the data trail is easily traceable and that it provides greater transparency and auditability[120] compared to other technologies. It enables the user to create an information pipeline with the possibility of digitised and automated filing of paperwork, the possibility of real-time tracking the progress and ensures that the data on the chain cannot be modified without the consensus and hereby knowledge of the network.[121] blockchain creates a complete visibility of all necessary data; competent authorities would be able to see the relevant data with accurate information, for example on the seller, buyer, price, quantity of the goods, carrier, the financing, the insurance, relevant licensed etc., that are directly linked to the goods[122] which would simplify the formalities of the certification process and reduce uncertainties as to the origin of the goods.[123] With the accuracy of data and the complete visibility of the goods' line of production[124] and transportation, the need for (manual) verification of the origin would be eradicated.[125]

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[117] Lindman and others (n 16) 12; see also UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 16.
[118] Lindman and others (n 16) 13.
[119] Ganne (n 18) 116.
[120] Yaren (n 28) 135.
[121] Okazaki (n 53) 14.
[122] ibid, 16.
[123] Pugliatti and Gain (n 20).
[124] Which leads to a holistic product life-cycle data management: Okazaki (n 53) 17.
[125] ibid.

Validations would be a matter of minutes instead of hours or days,[126] albeit it is expected that validation procedures would be rare if not non-existent with the introduction of blockchain. In the specific case of certificates blockchain ensures that the certificate is appropriately issued, properly (digitally) signed by a valid competent authority mandated for issuing the certificate and that the certificate cannot be altered or manipulated during the process.[127] This ensures that the applicant receives a valid certificate with ensured integrity of its content.

On the technical level, the uniqueness of blockchain stems from small but significant alterations of previous technologies in order to increase security, integrity and immutability.[128] This is achieved by, for example, including hash pointers in the added block that include the hash of the data inside the foregoing block, whereby a change of one block will cause a change in every previous block. Also, the manner of time stamping differs, from previously "trusted time-stamping" to distributed and tamper-proof time- tamping.[129]

Overall, blockchain can be an appropriate technology for solving the challenges of the Certificate of Origin issuing process. According to criteria for suitability of the technology, as established by the U.S. Department of Homeland Security, blockchain is appropriate when, for example, the project needs shared consistent data storage, more than one entity contributes to data, immutability, does not contain sensitive data, has issues related to changes in data storage control, and needs tamper-proof logging.[130] All these criteria are fulfilled in the case of CoO, as has been established earlier. The unique features of blockchain certainly carry a value which can be vital for the success of streamlining and simplifying the certification process.

2.4.2 Alternatives to blockchain

Finally, to determine whether or not blockchain would be a vital solution to the challenges of CoO, existing alternatives to the technology must be evaluated.[131] If the analysis shows that there are possibilities which are cheaper and easier to implement but would provide the same benefits, blockchain would not be vital. There is variety of projects that are piloting or even running since years to simplify certain processes which provide a valuable insight into alternatives to blockchain for a variety of services.

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[126] As can be deduced from, for example, the rapid tracking of tainted products when Blockchain technology is used, a finding from a trial run by Walmart and IBM, see Ganne (n 18) 79.
[127] Okazaki (n 53) 17.
[128] Ganne (n 18) 117.
[129] ibid.
[130] Lindman and others (n 16) 29 ff.
[131] See also UN/CEFACT, *White Paper on the technical applications of Blockchain* (no 70) 3, with an overview over other technologies at 5 ff.

The findings from these projects are helpful in determining whether there are viable alternative technologies that could be used instead of blockchain. For this, in the following, a selection of alternatives is evaluated.

A first example would be the Estonian Information Systems Authority. It is an early example of a blockchain-backed public service which uses a permissioned blockchain to store data for integral government serviced like the succession and health registry.[132] Initial versions of the registry already run since 2012 under the name of hash-linked time-stamping. It deviates from the current form of blockchain projects as it does not store the data itself on the chain but rather hashes that provide the integrity of the underlying data.[133] This form of blockchain-backed service guarantees the integrity of data and logs changes of data; however, it does not store data. Essentially, this results in off-chain data with proof for their existence on-chain.[134] While this version of implementing blockchain might mitigate the challenges of data security and privacy,[135] it would also mitigate the benefit of faster processing, as the data provided still need to be cross-checked which results in possible blind-spots.[136] Hence, as long as a blockchain-backed version would only be needed as a complementary in a sense that it versions and archives it is not vital;[137] if used as the only means it would not provide the full benefits of the technology for CoO.

A comparable possibility was proposed by Okazaki, where customs' databases would not take the form of a distributed-ledger but rather be interfaced with blockchain-based platforms. He considers that this would increase customs' visibility in the supply chain and would enable them to cross-check discrepancies between the data submitted by traders and the data on the public ledger.[138] Yet, these options would not provide the automation process which would significantly reduce the resources needed to certify.[139] Also, there remains the option of using a centralised database instead of a blockchain.[140] However, traditional databases are not immutable and do not have a consensus mechanism to validate transactions.[141] Furthermore, a blockchain solution might even be quicker and/or cheaper to implement.[142] A centralised database also needs to be

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[132] Lindman and others (n 16) 9.

[133] ibid, 11, 54.

[134] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 11.

[135] Saadaoui (n 13); UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 11, 31.

[136] This issue might be mitigated by applying smart contracts for consistency checks as used in the PoC project, Saadaoui (n 13).

[137] Lindman and others (n 16) 54; apparently considered to be the most likely scenario by UN/CEFACT: see its *White Paper on the technical applications of Blockchain* (n 70) 13.

[138] Lindman and others (n 16) 18.

[139] ibid.

[140] Wüst and Gervais (n 15) compare Blockchain to centralised databases and provide a thorough analysis on when Blockchain technology makes sense.

[141] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 10.

[142] ibid 17.

regularly backed up as it can be lost or destroyed.[143] Hence, also these options would not be equally beneficial.

Another technology which does not (yet) rely on blockchain technology is the current process of issuing of e-certificates. Several states explore the option and some have successfully implemented it in their certification procedure.[144] One successful example is the use of cross-border electronic CoO between the Republic of Korea and Taiwan Province of China.[145] It became known as a best practice for paperless cross-border trade and proved to be greatly cost- and time saving (a total of USD 205 and three days per shipment).[146] Yet, one major lesson learned from the process which has relevance for the present analysis is that the full benefit of the procedure could not be achieved without documentation covering the full international supply chain, which the procedure as is could not provide.[147] Such a complete visibility and traceability would be easily achievable when using blockchain.[148]

Apart from digitised procedures there remains the possibility of relying on established procedures in simplified forms.[149] The self-certification procedure, encouraged as the primary certification procedure by the World Customs Organisation,[150] would also reduce time and cost of the certification process. Equally, the Approved Exporter System could be beneficial in these matters.[151] The introduction of fully exporter[152] or fully importer[153] based systems could be beneficial to reduce the complexity of the certification process. However, these "classical" possibilities of simplification and the usage of blockchain are not mutually exclusive. For example, in the case of Authorised Economic Operators (AEO), blockchain is considered to even be beneficial as the AEO could easily provide a full record of compliance with Customs requirements and customs administrations could easily evaluate mutual recognition of the AEO status.[154] Without the usage of blockchain, the aforementioned simplified

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[143] ibid 30.

[144] For examples of paperless-trade-projects see United Nations Economic and Social Commission for Asia and the Pacific (n 5) 11 ff.

[145] For a thorough analysis see ibid 89 ff.

[146] ibid 97 f.

[147] ibid 99.

[148] Cf Ganne (n 18) 80.

[149] For an overview over current certification procedures under Free Trade Agreements see WCO, 'Comparative Study on Certification of Origin' (n 1) 13 ff.

[150] WCO, 'Guidelines on Certification of Origin' (n 20) 8 f.

[151] Sandra Corcuera Santamaria, 'CADENA, a blockchain enabled solution for the implementation of Mutual Recognition Arrangements/Agreements' (WCO News 87, Focus, October 2018) <https://mag.wcoomd.org/magazine/wco-news-87/cadena-a-blockchain-enabled-solution-for-the-implementation-of-mutual-recognition-arrangements-agreements/> accessed 17 July 2021; WCO, 'Guidelines on Certification of Origin' (n 20) 9.

[152] WCO, 'Guidelines on Certification of Origin' (n 20) 9.

[153] ibid 9 ff.

[154] A conclusion validated by the current CADENA initiative, see Corcuera Santamaria (n 151); see also Yaren (n 28) 134.

procedures are unable to provide the benefits of, for example, immutability and time-stamping. Hence, they cannot be considered feasible alternatives.

2.4.3 Pilot Projects

Several pilots in the private and public domain have been initiated in recent years to test the feasibility of the blockchain technology in customs procedures, for example the US Customs and Border Protection's intention to apply blockchain technology to NAFTA and CAFTA CoO[155] or the blockchain model for the exchange of CoO between Korea and Vietnam.[156] In the following, a few initiatives for DLT backed e-CoO which are at least in the piloting stage shall be presented to evaluate the state of the art and validate the finding based on the foregoing considerations that blockchain is a viable, valuable and vital solution.

In 2018, the Singapore International Chamber of Commerce in collaboration with cross-border trade facilitator vCargo Cloud unveiled the first blockchain-based platform for electronic CoO.[157] The platform hosts information on trade transactions on a private blockchain[158] built with Ethereum infrastructure[159] which can be authenticated and accessed by different users of the platform.[160] It also utilizes QR codes which can be scanned by smart phones and printed in a limited number to avoid duplicates.[161] Hereby, the paper-based procedure is not entirely eliminated, which helps in trade with less digitalised nations; however, this solution does not unfold the full potential of blockchain, as paper-based an digital run parallel and there is still the need for visual sightings by chamber staff to identify counterfeits.[162] The platform is expected to provide higher security, efficiency and flexibility while improving efficiency and minimising cost. In a press release, the initiative is titled as "a quantum leap in

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[155] See U.S. Customs and Border Protection, 'NAFTA/CAFTA Proof of Concept' (Whats' New Innovation, September 2018) <www.cbp.gov/trade/ace/whats-new-innovation> accessed 26 July 2021.

[156] Tae Il Kang, *Korea pilots blockchain technology as it prepares for the future*, (WCO news 88, Dossier, February 2019) <https://mag.wcoomd.org/magazine/wco-news-88/korea-pilots-blockchain-technology-as-it-prepares-for-the-future/> accessed 19 July 2021.

[157] Singapore International Chamber of Commerce and vCargo Cloud Pte. Ltd. (SICC/VCC), 'Singapore International Chamber of Commerce and vCargo Cloud Launch World's First Blockchain-Based eCertificate of Origin ("eCO")' (Press Release, 8 May 2018) <https://www.vcargocloud.com/wp-content/uploads/2018/05/Singapore-International-Chamber-of-Commerce-and-vCargo-Cloud-Launch-Worlds-First-Blockchain-Based-e-Certificate-of-Origin.pdf> accessed 27 July 2021.

[158] Company Announcement, 'Singapore: World's First Blockchain-Based e-Certificate of Origin' (Fintech News Singapore, 9 May 2018) <https://fintechnews.sg/19677/blockchain/blockchain-based-e-certificate-of-origin-singapore-chamber-of-commerce/> accessed 19 July 2021.

[159] Finbarr Bermingham, 'Singapore chamber brings trade documents onto blockchain' (General Trade Review News, 9 May 2018) <https://www.gtreview.com/news/asia/singapore-chamber-of-commerce-brings-trade-documents-onto-blockchain/> accessed 19 July 2021.

[160] SICC/VCC (n 157) 1.

[161] ibid 2.

[162] Bermingham, 'Singapore chamber brings trade documents onto blockchain' (n 159).

processing trade-related documents"[163] and a "a 21st century system."[164] vCargo Cloud currently works on implementing its concept in other states, reportedly Japan, Myanmar and Sri Lanka;[165] in 2018, it agreed with the Kenyan National Chamber of Commerce and Industry to introduce a slightly adapted version of the program implemented in Singapore in Kenya.[166]

eCOM Asia Ltd., a B2B data integration company, developed and operates its DLT based eCOM Registry™ which provides a network for the secured sharing and exchange of trusted data. While this solution is currently used for cross-border trade connectivity between Singapore and China, as a trading and finance platform for a large Chinese food importer and a MSME trade finance solution for the Hong, it aims at being implemented for *inter alia* CoO in the cross-border trade relationship between Singapore and China. This is enabled by the legal framework between these states which allows for a bi-directional exchange of customs import and export declarations.[167]

Another private initiative is edoxOnline. It links and interconnects the parties involved in an international trade transaction and aims at digitising international trade documents to streamline the issuing process and minimize errors. edoxOnline is a permissionless ledger based on Ethereum infrastructure. It already reaches a number of stakeholders, for example worldwide exporters and importers, chambers of commerce, transport companies, customs agents and official authorities. The trade documents which are handled by edoxOnline are for example e-CoO.[168]

TradeWindow and its solution "Cube" aim at facilitating end-to-end digital trade. It is a neutral platform built on API architecture which makes it interoperable with a variety of specific platforms and applications.[169] Currently, CoO appear not to be included in the solutions TradeWindow offers (even though "TradeWindow Origin" is mentioned on its homepage, yet without further information). However, the upcoming solution "Plus" seems to include the option of e-Certificates.[170]

Furthermore, there is the Latin-American project "CADENA". While this project does not specifically deal with CoO, it is still closely connected as it digitalizes the concept of the Authorised Economic Operator.[171] Based on Mutual Recognition Agreements,

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[163] SICC/VCC (n 157) 1.

[164] ibid 2.

[165] Bermingham, 'Singapore chamber brings trade documents onto blockchain' (n 159).

[166] Finbarr Bermingham, 'Blockchain-based certificates of origin come to Kenya' (Global Trade Review News, 20 June 2018) <https://www.gtreview.com/news/africa/blockchain-based-certificates-of-origin-come-to-kenya/> accessed 19 July 2021.

[167] Deepesh Patel and Emanuelle Ganne, *Blockchain & DLT in Trade: Where do we stand?* (White Paper, Trade Finance Global and WRO, November 2020) 36 ff.

[168] ibid 38.

[169] ibid 39.

[170] See the homepage of TradeWindow's website <https://tradewindow.io/tradedocs.html> accessed 19 July 2021.

[171] Corcuera Santamaria (n 151).

Customs administrations participating in CADENA can access the status of an AEO certificate in real time while the data remains protected due to high security, traceability and confidentiality standards. Equally, applicants for an AEO certificate can inform themselves about the issuing status of their certificate which increases trust and transparency. To make the individual applicants identifiable for each member of the network each AEO is assigned a unique number which relates to the relevant AEO master data. The results of the validation phase were promising: they showed an increase in efficiency, effectiveness, transparency, integrity of data and security.[172]

Already from this selection of initiatives it becomes apparent that there is an interest in DLT certification processes. A variety of private and public actors, oftentimes collaborating with each other, offer interesting solutions for the simplification and streamlining of the issuing of CoO and new projects are being launched and developed at increasing velocity. The successful initiation and continuous development of these projects indicates that blockchain indeed can not only be a viable and valuable but ultimately also a vital solution to the challenges of CoO.

2.5 Conclusion

Blockchain technology holds many benefits which could help to significantly facilitate international trade. Cross-border transactions prove to be very burdensome due to complicated, complex, costly and paper-based, manual procedures, and the risk of blind-spots which pave the way for fraud and forgery is constantly present. These challenges become especially apparent in certification processes, which also affects the issuing of CoO. The challenges of the certification process are accompanied by a general lack of trust, not only between traders, but also between traders and authorities and even between the competent authorities of different states. Following the foregoing analysis, blockchain proves to be at least a viable and valuable solution to the challenges that CoO face. It can also be considered a vital solution, albeit this finding is up to discussion. In any case, blockchain can improve the level of trust through its authentication methods which create a high level of reliability.[173] The disadvantages of the technology can be mitigated with careful planning and appropriate regulation (as addressed *infra*). What appears to be desirable – should blockchain find its way into the certification process – would be the introduction of a private permissioned chain[174]

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[172] Ibid.

[173] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 2.

[174] As is used in the case of Singapore's eCertificate, see Company Announcement (n 158); generally, see Gatteschi, Lamberti and Demartino (n 39) 106; permissioned chains are used, for example, by TradeLens, see Jeacocke and Kouwenhoven (n 29); see also Okazaki (n 53) 17; for a methodological approach on the question which Blockchain would be most suitable for a project see Wüst and Gervais (n 15).

which includes all relevant actors in the certification process. As the participants are known in private blockchains this would also allow legal accountability.[175] Yet, it has to be borne in mind that permissioned blockchains are more vulnerable to attacks.[176] Naturally, it is advisable to have the same chain in operation, or at least create chains which are interoperable.[177] Considerations could be made to include bridging tools, a suggestion put forward by UN/CEFACT.[178] Whether or not smart contracts should be included would depend on the desired result. Without smart contracts, the blockchain would essentially remain a database.[179] If full automatisation of the process shall be achieved, the inclusion is advisable, even though one should remain cautious about the decrease in security.[180] If smart contracts shall be implemented, it has to be borne in mind that they cannot be changed once they are deployed.[181]

Generally, CoO are a case for blockchain.[182] The consensus-based monitoring mechanism which involves every affected party ensures the credibility of transactions, the reliability, accuracy, quality and integrity of data, traceability an auditability of the entire process and a gapless record of the entire product life-cycle and its supply chain.[183] This is not only beneficial for the traders, who themselves can review the reliability of their producers and transporters, but also for customs and competent issuing authorities as they all remain fully informed and well-prepared for the certification process due to the increased visibility of key information.[184]

For its implementation one does not need to re-invent the wheel; following the increasing number of pilots, best practices and lessons learned can be carved out and implemented,[185] for example from the blockchain-based framework for issuance of CoO proposed by Tyagi and Goyal,[186] the hypothetical example provided by UN/CEFACT[187] or

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[175] Mik (n 41) 164.

[176] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 7 and 21; Id, *White Paper on the technical applications of Blockchain* (n 70) 8.

[177] Cf Hofman (n 49) 326.

[178] UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 12.

[179] Mik (n 41) 171.

[180] For example, DAO attacks, see Gupta (n 91) 219 f.; Gatteschi, Lamberti and Demartino (n 39) 108; Mike Orcutt, 'How secure is blockchain really? It turns out "secure" is a funny word to pin down' 2018 MIT Technology Review (The Blockchain Issue, 25 April 2018) <https://www.technologyreview.com/2018/04/25/143246/how-secure-is-blockchain-really/> accessed 19 July 2021.

[181] Mik (n 41) 175.

[182] See also UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 8; cf Kerstens and Canham (n 12).

[183] Cf Kerstens and Canham (n 12); see also Okazaki (n 53) 21.

[184] A benefit identified in the supply-chain management blockchain TradeLens, see Jeacocke and Kouwenhoven (n 29).

[185] For an overview over projects related to DLT digitisation of trade documents see Patel and Ganne (n 167) 34 ff.

[186] Niti Tyagi and Mukta Goyal, *Blockchain-based smart contract for the issuance of origin certificate for Indian Customs Export Clearance*, 2021 Concurrence and Computation Issue <https://onlinelibrary.wiley.com/doi/full/10.1002/cpe.6249> 8 ff, accessed 26 July 2021.

[187] UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 15 ff.

the (basic) idea for a digital ATA Carnet.[188] Yet, it is advisable to not use information older than 12 months as changes are made rapidly which might result in a deterioration of functionality.[189] Also, it should be borne in mind that the use of blockchain will most likely not be possible in isolation, which is why a correct "embedding" into running systems needs to be ensured.[190] In any case, international organisations with the relevant expertise, in the case of CoO for example the World Customs Organisation and the (International) Chamber(s) of Commerce, as well as experienced programmers must be involved in the development process. However, at best before going into the practical application, it is advisable to establish appropriate regulations – a matter which will be discussed in the following.

3   The matter of regulation: what should be and what can be regulated?

Whether or not blockchain technology would be a feasible option to solve the current challenges of CoO, there remains the question of regulation. In any case, there is the need for clearly established rules to guarantee a smooth procedure for cross-border transactions. Otherwise, the benefits of the technology could prospectively not materialize.[191] As is the case with any cross-border action, regulations involving more than one state will necessarily be a matter of inter-state cooperation. In the matter of blockchain it appears beneficial to not only introduce bi- or plurilateral regulations – as it is mostly the case when it comes to CoO – but rather strive for a global or at least regional framework to harmonize regulations and standards in order to benefit from the technology to the largest extend possible.[192]

3.1 Current state of regulation

Regulation on whether (preferential) CoO are required is mainly subject to bi- or plurilateral agreements between states.[193] Preferential rules of origin are considered part of a country's commercial policy.[194] They are inextricably linked to the provisions on rules of origin enshrined in several Free Trade Agreements which, if fulfilled, enable

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[188] Saadaoui (n 13).

[189] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 18.

[190] ibid 24.

[191] Cf Patel and Ganne (n 167) 21.

[192] See also United Nations Economic and Social Commission for Asia and the Pacific (n 5) 66; cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 21.

[193] Cf WCO, 'Guidelines on Certification of Origin' (n 20) 6.

[194] WCO, 'WCO Origin Compendium' (n 22) 21.

traders of the relevant goods to enjoy preferential treatment in their cross-border transactions, mainly in the form of reduction or elimination of tariffs.

The procedure of issuing a Certificate of Origin is regulated by national laws. They regulate which formalities must be fulfilled and which authority is competent to issue the Certificate of Origin.[195]

The current regulations mostly provide for a clear distribution of liabilities. The importer is accountable for the imported goods and obligated to provide the supporting documents; in importer-based systems, the importer is also accountable for the originating status of the goods.[196] The exporter is obligated to provide appropriate supporting documents on the originating status of the goods and is liable for the accuracy of the provided information. Should there be changes in the facts, it is the responsibility of the exporter to notify the other parties. The liability of the exporter ends with conclusion of the certification process. In cases of self-certification procedures, the exporter is also responsible for the content of the certificate.[197] The competent issuing authority is responsible for the publication and dissemination of the relevant information and is the contact point for verification procedures.[198]

Digital CoO (or their implementation) are almost exclusively regulated in bi- and plurilateral frameworks, often in the form of inter-state treaties. If such a framework is in place there is usually the need to adapt national laws in order to comply with the relevant agreement.[199]

Examples of regulations applicable to e-Certificates can be found in the Australia-Chile FTA, which regulates that customs administrations "will work towards implementing an electronic system for its customs reporting requirement" (Art. 5.11, Chapter 5) and that each party will endeavor to accept an electronic version of trade administration documents used by the other Party as the legal equivalent of paper documents (Article 16.9, Chapter 16). Comparable provisions can be found in the Australia-Thailand FTA (Article 309, Chapter 3 and Article 1107, Chapter 11) and the Australia-US FTA (Article 16.7, Chapter 16). The China-Peru FTA requires in Art. 61, Chapter 4 that customs administrations endeavor to use information technology that expedites procedures for the release of goods, including the submission and processing of information and data, as well as electronic or automated systems for risk management and targeting. The Japan-Singapore New Age Economic Partnership Agreement requires that the parties recognize the advantages of electronic filing and electronic versions of documents for the efficiency of trade through reductions in cost

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[195] For an overview on types of preferential origin certification systems see WCO, 'Comparative Study on Certification of Origin' (n 1), 13 ff.

[196] WCO, 'Guidelines on Certification of Origin' (n 20) 12 ff.

[197] ibid 12 ff.

[198] ibid 14.

[199] Cf United Nations Economic and Social Commission for Asia and the Pacific (n 5) 47, 61.

and time (Art. 40, Chapter 5). The Republic of Korea-Singapore FTA requires the parties to endeavor the acceptance of electronically submitted trade administration documents as the legal equivalent of the paper version (Art. 14, Chapter 14). The New Zealand-Singapore Closer Economic Partnership Agreement requires the parties to put in place an electronic environment that supports electronic business applications between their respective customs administrations and trading communities (Art. 12, Chapter 4). The New Zealand-Thailand Closer Economic Partnership Agreement requires the customs administrations to adopt, as soon as practicable, electronic procedures for all reporting requirements (Art. 10.6, Chapter 10).[200]

Even though there are quite a number of Free Trade Agreements which aim to regulate e-Certificates in international trade, a majority does not contain binding provisions on that matter. Oftentimes, the wording obliges the respective parties to "work towards" or act "in the best endeavor."[201] Yet, it shows a general openness towards the digitisation of CoO.

3.2   Matters which should be regulated

Even though some regulations touch upon the technicalities of the blockchain technology, especially data protection regulations, blockchain itself is still a largely unregulated field.[202] Yet, to effectively implement blockchain in a legally secure environment regulation which appropriately addresses relevant matters is essential.[203] Matters which need regulation before implementation are questions on how to ensure authenticity of the data which shall be shared on the blockchain, the protection of the shared data, the accuracy of the algorithm used, the cross-border exchange of data, the question of liabilities, dispute resolution and the mutual recognition of the Certificates which shall be issued.

Regulation on authenticity of data relates to the quality of the data provided. To achieve the highest quality of data possible, regulations are necessary to ensure that the data provided is accurate and complete[204] and how the data is securely entered and shared.[205] Any deterioration from relevant standards could result in loss of revenue due to a wrong declaration of the origin of the relevant goods.[206] What needs to be regulated

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[200] For details see United Nations Economic and Social Commission for Asia and the Pacific (n 5) 39 ff.

[201] ibid 66.

[202] Finck (n 93) 46.

[203] Governments must strike an appropriate balance between enabling and restrictive in order not to create an un-controllable environment (cf. Tasca and Piselli (n 82) 31; Finck (n 93) 62 ff) but still leave the technology enough room to develop (Moerel (n 38) 224 ff).

[204] As this cannot be done by the Blockchain itself, Mik (n 41) 172.

[205] Cf Ganne (n 18) 81.

[206] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 48.

is the control of the data input, the responsibility for data entries and the data processing in general,[207] including standardisation in order to align the semantics.[208] Especially relevant is regulation on submission errors and errors in the cross-border processing of data, equally to prevent errors but also concerning correction should an error occur.[209]

Standards and certifications for the algorithms used by the service providers as well as mutual recognition of certified algorithms need to be agreed upon. This ensures that the algorithms in use work accurately with the uploaded data and are in compliance with the relevant (international and national) rules. Here, there must be regulation to whether and if so how and by whom a code underlying the blockchain may be amended[210] in order to improve or erase malfunctions.

Regulations on data protection need to be harmonised. Even though there is a plethora of data protection laws worldwide, most of them differ greatly in their protective scope. As data protection and information security are inextricably linked to the usage of blockchain, harmonised regulation would significantly facilitate the cross-border exchange of data. Here, regulations which sanction unauthorised access to the data on the chain and which establish security features to protect the integrity of the involved facilities and parties need to be enacted. Furthermore, regulation is necessary concerning data storage and deletion – in the latter case arguably difficult when using blockchain. Also, a harmonised approach to the definition of "original documents" and their necessity is of relevance.[211]

Regulation on ownership of the data as well as liabilities for inaccurate data, loss of data, falsified information, errors in the programming, inaccuracies in the algorithm, unauthorised access and the general maintenance of the blockchain need to be clarified.[212] As the concept of blockchain is based on the very idea of not having a centralised oversight authority, liabilities need to be established and clearly communicated to every stakeholder. Even though it would be near impossible in a public chain,[213] private chains hold the possibility to establish liability.[214] Clear rules on liability would ensure legal security in the certification process and generally in the interactions between the parties involved in the cross-border transaction. Responsibility for the inaccuracy of data should remain with the data provider, as they

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[207] Ganne (n 18) 97.
[208] ibid 96 ff.
[209] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 30; United Nations Economic and Social Commission for Asia and the Pacific (n 5) 62.
[210] Mik (n 41) 170.
[211] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 62 ff.
[212] Cf Ganne (n 18) 100.
[213] Mik (n 41) 167.
[214] Finck (n 93) 46; Mik (n 41) 164, 167.

are the ones in control of the data,[215] while the maintenance of the chain, including programming failures and breakdowns of the computer system, should remain with the relevant authority as the prospective controller.[216]

Apart from the matters evolving around data per se, there needs to be regulations on the mutual recognition of certificates issued based on the data on the chain. It needs to be clarified which certification authority in the relevant country is authorised to issue a valid Certificate of Origin. Once this is determined, regulation which ensures that certificates issued by the competent authority is recognised as valid and hence accepted as evidence of origin in the receiving country.[217] The preferable option would be the inclusion of a mutual recognition agreement in the relevant regulation.[218]

Lastly, regulation on dispute resolution and enforcement must be established.[219] As cross-border transactions (and especially transactions carried out by blockchain) touch upon several jurisdictions it should be clarified which forum will be appropriate and how jurisdiction will be established.[220] Alternatively, alternative forms of dispute resolution could be introduced.[221] Apart from the appropriate forum, regulations must be enacted that contain appropriate remedies in cases of incorrect execution of the certification process, especially in cases where a Certificate of Origin is falsely issued or denied in a fully automated process (for example through the execution of a smart contract),[222] such as the possibility of reverse transactions.[223]

3.3 Current regulatory projects

With the rise of blockchain and the attention following it attempts to regulate and standardize the new technology are underway. This is equally true for the (inter)state level as well as international organisations or even private initiatives who are working on model laws, international agreements or standards in order to create legal security for the usage of the new technology or for paperless cross-border trade in general.[224]

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[215] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 63; cf Mik (n 41) 172.

[216] Cf Moerel (n 38) 217 ff, 226; Finck (n 93) 46.

[217] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 62

[218] Cf. UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 40.

[219] Although regulation might only be needed for public Blockchains due to self-regulation by the stakeholders as is argued by *Moerel,* see Moerel (n 38) 221 ff; self-regulation is also evaluated by Finck (n 93) 167 ff.

[220] Cf Girasa (n 86) 59 ff; cf. Finck (n 93) 58 ff; cf Ganne (n 18) 100.

[221] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 63.

[222] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 35 ff (referring to breaches of contract).

[223] Wunderlich and Saive (n 94) 98.

[224] For an overview (with focus on standardisation) see for example Patel and Ganne (n 167) 15 ff; for the regulatory strategies applied see Finck (n 93) 153 ff.

While some (model) laws and agreements already in existence prove to be applicable to blockchain,[225] some characteristics of blockchain require new regulation.

There is a variety of provisions which can be used to regulate blockchain in cross-border transactions. They are found in the UNCITRAL Model Law on Electronic Commerce, the UNCITRAL Model Law on Electronic Signatures, the United Nations Convention on the Use of Electronic Communications in International Contracts, and the Model Law on Electronic Transferable Records (2017). These regulations already served as bases for the regulation of paperless trade and e-certification and can equally be introduced in blockchain regulations.[226] With the implementation of their regulations into national laws, the way for cross-border paperless trade would be paved[227] and specific regulation on individual technologies could be developed.

Globally, there are surveys, studies and pilots which engage with the question of paperless cross-border trade, including regulating blockchain. The World Customs Organisation established Globally Networked Customs, including a Working Group tasked with "a comprehensive analysis of the potential to rationalize, harmonize and standardize the secure and efficient exchange of information between WCO Members."[228] Bearing in mind the current challenges of the system, the WCO aimed to establish a network which follows the lowest common denominator in order to achieve maximum acceptance with its members. Hence, the Network only contains a minimum level of automation, proposes a Unique Consignment Reference to easily track individual exchanges, expects its members to amend their national laws insofar as they enable cross-border data exchange and data protection and introduces a two-way track for data exchange, one on the commercial (systematic exchanges of Information) and one on the enforcement (exchange at the request of customs Administrations) level. The Network is split in Utility Blocks which refer to a specific part of the customs process in which Members then can exchange relevant information.[229] The Permanent Technical Committee, one of the working bodies for the GNC program, has considerations about blockchain on its agenda.[230]

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[225] Cf Finck (n 93) 155 ff.

[226] Irene Ng, 'UNCITRAL E-Commerce Law 2.0: Blockchain and Smart Contracts' (2018) LawTech.Asia (Guest post, 22 April 2018) <https://devsol.etradeforall.org/uncitral-e-commerce-law-2-0-blockchain-and-smart-contracts/> at 2. and 3. accessed 18 July 2021; Ganne (n 18) 98.

[227] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 54.

[228] WCO, 'Globally Networked Customs' <www.wcoomd.org/en/topics/facilitation/activities-and-pro-grammes/gnc.aspx> accessed 27 July 2021.

[229] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 46 ff; a comparable distinction is used by TradeLens in the form of channels, see Jeacocke and Kouwenhoven (n 29).

[230] WCO, *Coordinated Border Management -Globally Networked Customs – latest technologies brining momentum to the GNC*, (Permanent Technical Committee, Doc. PC0556Ea, 30 September 2019) <www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/ressources/permanent-technical-committee/225-226/pc0556ea.pdf?la=ru-RU> accessed 18 July 2021.

The United Nations Centre for Trade Facilitation and Electronic Business initiated the blockchain White Paper Project, which oversaw the publication of two white papers on the use of blockchain for trade facilitation. The first White Paper was published in January 2019,[231] a revised version of the second White Paper was published in September 2020.[232] Even though the first White Paper of 2019 dealt with blockchains' impact on the technical standards work of UN/CEFACT and specifically the implementation of blockchain in supply chains, the findings can be transferred to regulatory considerations for blockchain in international trade in general. The experts identified general provisions which they considered necessary for a successful regulatory framework. These are provisions on recognition of records in blockchains in courts of law, cross-border (cross-jurisdiction) boundary, dispute resolution, data capture, storage, ownership, sharing and security provisions, minimum standards for certification or compliance and registration of blockchains necessary.[233] The second White Paper (including its update) investigates use cases of blockchain in various sectors of international trade in order to evaluate how the technology may be used to facilitate trade and related business processes.[234] It specifically deals with legal aspects in the execution of smart contracts and proposes that developers and implementors of smart contracts consider actions that relate to the identification of variables that might change and methods for changing the variables without undermining the predictability and reliability of the underlying smart contract; identification of inputs where the possibility of errors exist and a plan for identifying, identification of where, at some point in time, a selected oracle might cease to exist or fail due to government re-organisation, bankruptcy, etc., and backup plans for their replacement if needed; identification of any instances where a smart contract might not finish execution and how such situations should be resolved; identification of the legal circumstances under which it would be necessary to identify the parties to a transaction and if, for example, this requires that the smart contract be implemented on a permissioned blockchain; designation, in advance and in a document separate from the code in the smart contract, of the applicable law, jurisdiction under which disputes should be settled; the method of dispute resolution to be used and general terms and conditions.[235]

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[231] UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70).

[232] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14); Id, 'White Paper on Blockchain in Trade Facilitation (ECE/TRADE/457)' (Release Announcement, September 2020) <https://unece.org/trade/publications/white-paper-blockchain-trade-facilitation-ecetrade457> accessed 27 July 2021.

[233] As rightly pointed out by UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70), 13.

[234] UN/CEFACT, 'White Paper on Blockchain in Trade Facilitation (ECE/TRADE/457)' (Release Announcement) (n 233).

[235] UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 40 ff.

3.4 Regulatory Considerations

Even though a global approach would be desirable, for now a regional approach to regulation appears the most feasible option.[236] While there are already a number of national and bilateral regulations in place, the necessity of a multilateral framework in order to reap the entirety of benefits of the technology becomes apparent when considering, for example, the paperless cross-border trade project between Korea and Taiwan, where one of the lessons learned was that an international arrangement - such as a regional agreement - could have sped up the negotiation process, which, without such a framework, took almost five years until a Memorandum of Understanding was concluded.[237] As not all states are yet at a technological stage which would allow for a global introduction of the technology[238] into customs procedures and consensus in this area marked by a general lack of trust cannot be reached easily,[239] a global approach as of today does not appear feasible.[240] Yet, in the long-term, a global regulatory framework[241] under the supervision of the World Customs Organisation, advised be the International Chamber of Commerce – as one of the major competent authorities for the issuance of CoO – should be endeavored. Especially the ICC WCF International Certificate of Origin Council should be involved in the drafting process of a global framework.

Of course, a regional agreement by itself does not suffice to create an enabling environment for blockchain e-certification. Hence, individual states should pave the way for the implementation by introducing appropriate laws into their national framework,[242] for example by accepting e-CoO issued through blockchain technology as the functional equivalent of the current paper-based documentation.[243] Valuable regulations to enable blockchain technology can be found in the UNCITRAL Model Law on Electronic Commerce, the UNCITRAL Model Law on Electronic Signatures, the United Nations Convention on the Use of Electronic Communications in International Contracts, and the Model Law on Electronic Transferable Records (2017), for example in Art. 8 of the UNCITRAL Model Law on Electronic Commerce, which enables the acceptance of electronic documentation as original when the integrity of the

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[236] Also in favor of a regional approach: United Nations Economic and Social Commission for Asia and the Pacific (n 5) 68 ff, 75 ff; cf Finck (n 93) 59 ff.

[237] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 99.

[238] Ganne (n 18) 86 ff.

[239] Cf Kerstens and Canham (n 12).

[240] Cf UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 10.

[241] Ganne (n 18) 100.

[242] Cf Ng (n 226) 8; Ganne (n 18) 99.

[243] The principle of functional equivalence was for example introduced by Germany to allow electronic Bills of Lading, see Wunderlich and Saive (n 94) 95 ff.

information is assured or in Art. 12 of the UNCITRAL Model Law on Electronic Signatures, which regulates the legal effect of electronic certificates.

When drafting a regional arrangement, considerations must be made as to the specificities of the blockchain technology.[244] It is especially advisable to first fully understand the technology in order to not produce premature and hence ill-suited regulations.[245] Finck considers three questions as fundamental: "First, what is the regulatory objective? Second, what is the appropriate regulatory access point to realize that objective? Third, what regulatory technique is best suited to make the regulatory access point fulfill the objective in the most efficient manner?".[246] Macedo proposes six principles for regulation, initially proposed for the regulation of cryptocurrencies, which should be followed in order to create a proper regulatory framework for the usage of blockchain. The six principles are

(1) understanding who and what can be the subject of regulation;
(2) clearly articulating the goals of a cryptocurrency regulatory policy;
(3) only regulating persons with 'control' over consumers' cryptocurrency;
(4) cooperating with businesses to preserve visibility;
(5) treating all cryptocurrencies equally;
(6) ensuring that regulatory requirements are reasonable.[247]

Naturally, "cryptocurrencies" need to be replaced by the relevant program, or most general with "blockchain". However, these principles provide a reasonable guideline which could be followed. Provisions on recognition of records in blockchains in courts of law, cross-border (cross-jurisdiction) boundary, dispute resolution, data capture, storage, ownership, sharing and security provisions, minimum standards for certification or compliance and registration of blockchains must be included.[248] Further guidance can be found in the (draft) proposal of a regional arrangement for cross-border paperless trade authored by UN/ESCAP. Even though it does not specifically deal with blockchain it contains valuable ideas on the realisation of an enabling framework.[249]

4   Conclusion

DLTs and especially blockchain undoubtedly are on the rise, and they have the potential to fundamentally change global trade. The unique features of the technology

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[244] For a thorough evaluation of the difficulties of regulating Blockchain see Finck (n 93) 58 ff.
[245] ibid 161 ff.
[246] ibid 165.
[247] Macedo (n 23) 92.
[248] As rightly pointed out by UN/CEFACT, *White Paper on the technical applications of Blockchain* (n 70) 13.
[249] United Nations Economic and Social Commission for Asia and the Pacific (n 5) 75 ff.

make it attractive for any relationship marked by a lack of trust and the need to exchange data with unknown counterparts. To validate transactions peer-to-peer makes the technology extremely inclusive and paves the way for greater transparency and reliability of paperless data exchange. CoO could benefit greatly from this new technology. It presents a prime example of a concept which needs the utmost level of reliability and accuracy of data in an environment where the involved parties are in large parts entirely unknown to each other. To bridge the lack of trust, CoO still rely heavily on paper-based and manual procedures. The documentation needed to issue a Certificate of Origin is provided by several actors which makes the issuing process vulnerable to inconsistencies and fraud. Fraudulent documentation is a problem which directly affects every party involved, be it the reputation of the trader or the revenue loss for the state. The need for accuracy and appropriate procedures to mitigate the risk of false certificates is obvious; the cost and time-consuming process, however, is not necessary. This was also recognised by various states which began to simplify and streamline the process, be it with the introduction of self-certification procedures or by digitalising the process (almost) entirely. Projects like the cross-border electronic CoO between the Republic of Korea and Taiwan Province of China or the collaboration between the Singapore International Chamber of Commerce and trade-facilitator vCloud show that digitalising cross-border trade holds many benefits. An increasing number of States follow their example with different technologies. Distributed-ledgers are now at the center of attention, quite understandably, given the benefits it has to offer. Yet, its implementation should be carefully considered, and benefits and disadvantages weighed against each other. Due to the hype surrounding the technology quite a few projects are initiated not aimed at solving a specific problem; rather, the initiators want to implement the technology and search for a project to apply it.[250] It should not be disregarded that blockchain comes with challenges and disadvantages that need to be addressed. First and foremost, blockchain needs regulation, definitely on the level of national regulations, desirably also on a regional or global level.

In conclusion, the initial question of this paper can be answered as follows. The introduction of DLT into CoO holds the potential to improve not only the quality of the certificates, but also to streamline and significantly simplify the issuing process, which would be very beneficial not only for the traders, and here especially small- and medium-sised enterprises, but also to the competent authorities. Yet, the implementation must be preceded by a careful and thorough consideration of the benefits and challenges for each individual project. Due to the great differences in the technological development of states there cannot be a one-size-fits-all solution for blockchain-based e-Certificates. In some cases, the disadvantages (for example costs)

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[250] Cf UN/CEFACT, *Blockchain in Trade Facilitation* (n 14) 127.

may outweigh the advantages; in such cases, implementing blockchain would not be beneficial. Generally, blockchain provides a viable, valuable and vital solution for the challenges CoO are facing. To reap the benefits of this technology, appropriate regulations need to be enacted to create an enabling framework, preferably on the inter-state level. At least provisions on mutual recognition of digital documents, cross-border (cross-jurisdiction) boundary, dispute resolution, data capture, storage, ownership, sharing and security provisions, minimum standards for certification or compliance, registration of blockchains are necessary, liabilities and the accuracy of the data and the algorithm are necessary. Considering that e-certificates issued based on blockchain will always be a matter of cross-border relations, states should endeavor to create at least regional frameworks which regulate the fundamentals of blockchain based trade.

While the enthusiasm surrounding blockchain is certainly understandable, it might not be perfect for every aspect of international trade. This paper advocates for a positive but careful approach to its implementation. Only where the technology is applied with the appropriate rationale and to cases in which it provides clear benefits it most certainly will prove to be revolutionary and very advantageous.

*Felipe Marquette de Sousa**

TOKEN-ART SYSTEM AND THE NEW INTERNATIONAL ART MARKET: THE IMPACTS OF NFT TECHNOLOGY AND THE LEGAL ASPECTS INVOLVED

ABSTRACT

The international expansion of arts events and the installation of museum franchises in different countries reinforces that the artistic sector has acquired a globalised sense. The online arts market has grown considerably through the influence of social media both for the discovery of new artists and to attract new potential customers. At the same time, technological innovations such as cryptocurrency and blockchain have a high capacity to transform the arts market. And within this scope, two extremely dynamic digital assets are increasingly being used: smart Contracts and NFTs - or "non-fungible tokens". Studies have shown that this technology applied in this market has presented advantages in the authenticity, origin and traceability of art sales. Such transactions, however, have legal effects especially on contracts and property rights. Thus, the present work aims to reflect on the legal implications, especially regarding the management of intellectual property and the adoption of smart contracts in commercial transactions in the international arts market, generated by the impact of NFT technology. The deductive methodology will be used, with theoretical-doctrinal analysis of the information obtained by primary and secondary bibliographic research.

JEL CLASSIFICATION: K22, K24, K33

SUMMARY

1 Introduction – 2 International Art Market – 3 Blockchain and NFT technologies – 4 Legal implications – 5 Conclusions

1 Introduction

Every human creative expression can be considered art if it transmits valuable or significant meaning to society. Therefore, art involves a diversity of segments. In a society impregnated by scarcity the system of exchange between producers and consumers aims the satisfaction of vital needs, providing a better quality of life to the

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population. In this sense, it seems that the art has lost its value, due to the usefulness factor our society requires from the assets in circulation, hence the works of art in general are considered superfluous goods. However, the art market has great influence in the global economic movement, as shown by some analytical reports of the segment.[1]

Throughout its history, the art market occupied an "elitist and reserved place for an exclusive public."[2] The arts market is considered exceptional: on the one hand it is a sector, among all economies, which is less transparent and less regulated; on the other, it is marked by the strong contradictory rationale between the logic of art and the logic of economy itself.[3] The lack of transparency of the art market can be caused by the fragmentation of the sector's regulation, the shortage of specialists or the absence of uniform standards that make it difficult to measure the benefits of this market.[4] This is because it is a highly ritualised trade, where there is a clear differentiation between art and economy. Art agents tend to prioritize the creative aspect of the product and its enterprises, while the economic character is never objectively clearly addressed.[5]

However, the international expansion of art events and the installation of franchises of world-renowned museums worldwide, which took place in recent decades, reveal how the artistic sector has acquired a globalised sense. But it is necessary to consider that the sphere of artistic production is different from the institutions that showcase the final artistic "product", since the productive source is not always a target of heavy investments, while institutions that hold the space and infrastructure have great capacities to move the business, expanding their collections.[6]

In recent years, also driven by the global pandemic, the online art market, has grown considerably through the influence of social media both for the discovery of new artists as well as to attract new potential customers.

Technological innovations such as cryptocurrency and blockchain are quite productive, with high capacity to transform the art market. Although such technologies are spread increasingly, presenting advantages, with the possibility of applying to different sectors of the economy, the art industry remains somewhat reticent, especially regarding the use of cryptocurrency, stating that there is a risk "to create a

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[1] There is some difficulty in obtaining complete data on the international movement of the arts, not only due to the lack of academic research due to the lack of attention given by art historians, and, therefore, it does not attract significant researchers in art and culture, but also because of the shortage of economic analysts specialising in art. Cf. Elena Sidorova, 'The Cyber Turn of the Contemporary Art Market ' [2019] 8(3) Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

[2] Naira C. R. Assis, 'As regras do mercado: dinâmicas e construção do valor no mercado de arte contemporânea' (Dissertation, Universidade de São Paulo 2017).

[3] Ibid.

[4] Irene Micheletti, 'Art-Tech: blockchain come opportunità di valorizzazione partecipata' (Bachelor's thesis, University Ca'Foscari Venezia 2020).

[5] Naira C. R. Assis, 'As regras do mercado: dinâmicas e construção do valor no mercado de arte contemporânea' (Dissertation, Universidade de São Paulo 2017).

[6] Ana Leticia Fialho, 'O mercado, os artistas, os colecionadores e as instituições' [2017] 13 Ouvirouver 378.

black market of dubious transactions and that can harm the reputation of the online market before new buyers."[7] On the other hand, within the scope of blockchain technology two extremely dynamic digital assets are being increasingly used: Smart Contracts and NFT - or "non-fungible token". Studies have shown that blockchain technology applied in art operations has been showing advantages either to improve the authenticity, the lawful origin and the potential of traceability of art sales, or to guarantee the protection of the collector's privacy.[8]

Undoubtedly, the full use of such technologies is already revolutionising the art market. However, more in-depth study is needed on the different legal aspects that involve these transactions, especially in the management of copyright and the contract stipulation. Regarding copyright, if the technological structure itself offers the protection and certification of property, it would no longer be necessary the bureaucratic notary publicity for proprietary registration. But how to legitimize public faith for a private entity like the blockchain? Or how to separate the right of possession, control, exclusion, to derive income, and the right of disposition, while property and possession rights in this chain of blocks? As for Smart Contracts: the contractual form is neither oral nor written, but in codified language; the legal relations between the parties occur by anticipation and no longer after the signing of the contract; they are self-executable without the need for intervention. All these situations use institutes that deserve further analysis because they give new legal contours in this complex and peculiar artistic industry.

Thus, this work aims to reflect on the legal implications, especially regarding the management of intellectual property and the adoption of smart contracts in commercial transactions in the international art market, generated by the impact of NFT technology. Deductive methodology will be used, with theoretical and doctrinal analysis of information obtained by primary and secondary bibliographic research.

2 International art market

The art market has a special characteristic: in a horizontal segmentation it can be classified into primary and secondary market; the vertical segmentation, on the other hand, is classified based on the quality of the product, such as the classic and contemporary market, the avant-garde market, the alternative, and the scrap market.[9]

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[7] Clare Mc Andrew, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' (2021) <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

[8] Elena Sidorova, 'The Cyber Turn of the Contemporary Art Market' [2019] 8(3) Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

[9] Ílina C. M. Pontes, 'Compliance e mercado da arte: uma análise do sistema de regulação multifacetado em transações de obras artísticas' (Dissertation, Universidade Federal da Paraíba 2019).

The most common markets are the primary and secondary, in which the classic and contemporary works are the most competitive, and the rest being of little importance.

The primary market is typically characterised by artists who produce new works of art, presenting them to dealers or commercial art galleries who sell their works through their businesses or at art fairs receiving a percentage of each sale as compensation for their work.[10] It is a market that consists of the initial contact between the artistic object and commercial exchanges, that is, the first time it will be marketed. In it you can find, basically, art fairs, artists' studios,[11] some collectors and art galleries.[12] In addition, newer works by renowned artists or works by younger artists can be found in this market.

The secondary market is generated from the negotiation of an existing work that has been in circulation for some time and its activity is exclusively focused on the resale of works of art. It is a market basically represented by auction houses.[13]

This market classification, however, practically refers to those works better known as the visual arts. Considering, however, that the art encompasses all human creations and that is quite extensive.

In this sense, the report released by the United Nations Conference on Trade and Development in 2019, finds that the trade in creative products[14] such as crafts, audiovisual, design (fashion, architecture, jewelry), performance (music, performing arts), publishing (books, newspapers, magazines), visual arts (antiques, painting, photography, sculpture) had consistent performances between 2002 and 2015, with an average growth rate of around 7% per year. In terms of monetary revenue it was registered the figures of US$ 208 billion and US$ 509 billion, respectively, in this period, the report also states that the creative economy can contribute substantially to the GDP of global trade, mainly by sharing various sectors and the adoption of technological innovations, which increase the quantity and quality of products, boosting demand.

Market size is generally measured by sales volume. Although the shared data is incomplete, it is possible to get a rough idea of the mechanisms. Most sales occur through public auctions, where large auction houses publish their movement, however, there are others that still persist in the practice of obscuring sales results.[15] It should also

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[10] Margherita Villa, 'Blockchain technology and the art market: discrepancies between the reception and the application of the technology by the art market its stakeholders' (Dissertation Master, Erasmus University Rotterdam 2019).

[11] The main international art fairs are the ArtBasel; FiacParis; Scope Art Show; EnterArt Fair; Pinta Miami; Frieze.

[12] As the main international art galleries can be mentioned the Sotheby's; David Zwirner; Balice Herting; Galerie Perrotin; Houser & Wirth; Pace Gallery; Victoria Miro; Gagosianme Ruth Benzacar. They are all located in the United States, Europe and Asia.

[13] The main international auction houses are the Sotherby's; Christie's; Bonhams; Phillips de Pury & Company; Dorotheum.

[14] UNCTAD, 'Creative Economy Outlook: trends in international trade in creative industries- 2002-2015' <https://unctad.org/webflyer/creative-economy-outlook-trends-international-trade-creative-industries> accessed 19 August 2021.

[15] Clare Mc Andrew, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' [2021] 169. <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

be noted that merchants' operations within collectors are not available, leading to the conclusion that the topic still lack importance in international economic overview.[16]

Even with this phenomenon of unreliable data, it is observed that the art market reaches impressive figures. The most recent Art Market report, from 2021,[17] shows that, despite the retraction observed in relation to 2019, global sales of art and antiques[18] reached about US$50.1 billion in 2020. This financial movement is dominated by the big three axes: The United States, the United Kingdom and Greater China, which together represent 82% of global sales. Individually, the United States leads with $21.3 billion, followed by Greater China, with $10.0 billion, and finally the United Kingdom, with $9.9 billion. But, based on the number of transactions, it is necessary to consider the leadership of Greater China, which, although the works reach medium and low prices at auctions, its movement is quite expressive, registering the revenue of several multimillions lots sold in Hong Kong and Beijing in the year of 2020.[19]

In terms of product quality, in 2020, the largest sector, with 55% of the business carried out, is made up of Contemporary Art and Modern Art, which together accounted for 81% of sales value.[20]

As a result of the global art fairs that had been planned for 2020, due to the health pandemic, 61% were canceled as face-to-face events. However, 62% of organizers offered an online viewing room or a digital version of their fairs, which in terms of monetary volumes represented only 13% of total sales.[21]

In other sectors, online sales also reached records: participation in e-commerce[22] with 25% in 2020, against 9% in 2019; and fine art auction,[23] with a participation of 22% in 2020, which represents the double of the previous year.[24]

The use of digital strategies was especially successful, bringing in new buyers to the auction industry, a trend that spread throughout 2020. As digital transformations continued, traders, auctioneers, dealers, and other categories invested heavily in new

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[16] Earp Fabio Sá and KORNIS George, 'O mercado de artes visuais: algumas características. Políticas Culturais: pesquisa e formação' (2019) IC 221.

[17] Clare Mc Andrew, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' [2021] 17. <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

[18] The global arts and antiques market comprise approximately 305,250 companies, generating direct jobs for around 2.9 million people. Clare Mc Andrew, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' [2021] 23. <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

[19] ibid 107.

[20] ibid 19.

[21] ibid 20.

[22] Online markets are digital platforms on websites, or social media, that ensure direct communication between artists, dealers and potential art buyers. Elena Sidorova, 'The Cyber Turn of the Contemporary Art Market ' [2019] Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

[23] Ibid. Auctions offer a way to bid in the comfort of your own home, avoiding social barriers, where bidders boast certain luxuries and wealth.

[24] Clare Mc Andrew, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' [2021] 21. <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

technologies, reaching $3.5 billions.[25] Although the improvement of technologies is crucial to maintain and increase sales, its development involves challenges. There are also those who understand that e-commerce does not allow, for example, to inspect the work of art before the purchase, causing difficulty in building consumer confidence, or establishing the seller's reputation.[26] Despite this imperfection, the online art market nurtures prospects for future development, expecting a significant increase in the coming years. The cybernetic turn has an influence not only on the modality of marketing and valuing art, but also on the gradual diversification of participants, with a potential increase in customers and future buyers.

3 Blockchain and NFT technologies

Since the waves of technological innovation emerged, they have not only streamlined the exchange of information but mostly have structurally changed the form of social and commercial relationships. Digital networks with a global reach have promoted changes within the functionalities in both public and private spheres, causing the rise of business models, the modification of work organisation, new forms of entertainment, potentialised the trend of sharing services and many other. However, the model was based on the dependence of central figure that works as an intermediary operator, generating a certain distrust in the operations among simple users[27].

The blockchain technology surges to invert the centralised logic to decentralised, in order to guarantee trust in a distributed way[28]. Blockchain was originally conceived as a technology applied in the creation of Bitcoin. Its basic essence is the structure of a chain of blocks, and the blockchain can be understood as a "decentralised network of electronic terminals (computers) distributed around the world and interconnected by the internet"[29]. Much like the internet, the blockchain technology is free and open; it does not belong to anyone and is considered a foundational technology[30]. As they have generative properties, they don't depend on the figure of a centralised server, allowing users, based on a trustworthy protocol, to promote data transfer. It is a peer-to-peer

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[25] Ibid 23.

[26] Elena Sidorova, 'The Cyber Turn of the Contemporary Art Market' [2019] Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

[27] Ferreira Ana F. C., 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

[28] Ibid.

[29] Rennan Thamay and Mauricio Tamer, Provas no Direito Digital (1 edn, Thomson Reuters/Revista dos Tribunais 2020) 171. According to these authors, the Internet is a system consisting of the set of logical protocols, structured on a world scale for public and unrestricted use, with the purpose of enabling the communication of data between terminals through different networks. Thus, any computer, electronic device, or computer structure, such as terminals, can be connected for the transmission of information. The blockchain network is also a network that takes advantage of this technical structure to promote specific exchange of information, but with its own dynamics.

[30] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

network, in which each user, voluntarily, makes their device available in favor of this decentralised mesh, which has a double function: receiver and server, and each device represents a node[31].

In Italy, blockchain has been legislated under the "Decreto legge n° 135 of 2018."[32] Being defined in its article 8-ter as "technology based in distributed datacenters, the technologies and informatic protocols that are used to keep and register data in a shared datacenter, distributed, reproduceable, accessible simultaneously, architecturally decentralised under cryptographic methods, permitting the registration, validation, update and archive of data in a clear way, protected by an unchangeable and verifiable cryptography by each user."

The blockchain system can support three modalities: the public, or without permission; the private, or authorised; and the hybrid. The public network admits the entry of any individual, without the need to obtain permission from other users; the private network limits members and requires access authorisation, in which case an owner or management entity is required.[33]

Formally a blockchain is a distributed and synchronised ledger.[34] It consists of a digital database, maintained by algorithm, and stored in several nodes (computers), so that each one can store a complete database.[35] The element that characterizes this technology is the block of chain (data container). Each block has a fingerprint called a hash[36] that is used to certify the block's information content. Blocks are concatenated chronologically into a chain, adding to each block, which is assigned a new hash including a field with the hash of the previous block.[37]

Blockchain technology uses asymmetric cryptography (also known as public key cryptography) to implement digital transaction signatures. Each transaction is signed with the sender's private key, and anyone can verify the transaction's authenticity using the sender's public key. Asymmetric encryption allows a reliable exchange between users who don't trust each other. Thus, when the ledger is distributed over a peer-to-

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[31] Rennan Thamay and Mauricio Tamer, Provas no Direito Digital (1 edn, Thomson Reuters/Revista dos Tribunais 2020) 172.

[32] Converted, with amendments, in law No. 12 of 11 February 2019 and published in 'Gazzetta Ufficiale' n. 36 in 12 Feb-ruary 2019.

[33] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

[34] Massimo Franceschet, 'HITS hits art' [2021] 1 ARXIV 1 <https://arxiv.org/abs/1907.07758> accessed 16 out 2021.

[35] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

[36] *Hash is an alphanumeric sequence generated after a mathematical operation is deciphered. It's basically small com-puter programs that transform any type of data into fixed-size bits.* Massimo Franceschet, 'HITS hits art' [2021] 1 ARXIV 1 <https://arxiv.org/abs/1907.07758> accessed 16 out 2021.

[37] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

peer network, each node in the network has a copy of the entire blockchain, making it difficult to tamper with the information.[38]

Any change in any transaction will completely change the hash of that block and the following ones, causing inconsistencies that compromise the entire system.[39]

Recently, the NFTs - Non-fungible-token in blockchain pattern was introduced, with great repercussion in the art market, working through interlaced data chain.[40] It consists of a special typology of encrypted token,[41] whose main characteristic is that it cannot be exchanged; it is not exchangeable or interchangeable.[42] The simple copy and paste mechanism can be done on the internet in general, which affects usage rights with effects on the economic value of photos or other works of art on the internet. With this technology, clandestine copying and counterfeiting problems can be resolved. Furthermore this new technological asset, especially those used for an artistic nature, become digitally rare precisely because they are not fungible.[43]

The usefulness of the NFT in works of art was demonstrated in an unusual way when executing the "Burned Picasso" project. The executers of this "transformation" justified their project stating that by burning the work, and printing it on an NFT, it becomes a store of value, translating the origin of the piece from the physical to the web 3.0 version.[44] Critics of the artistic sector were abundant. Some understood the meaning of this action, although experimental, as a form of preservation of a unique and unchanging piece that is going to be forever in the blockchain bringing the most

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[38] Massimo Franceschet, 'HITS hits art' (2021) 1 ARXIV 1 <https://arxiv.org/abs/1907.07758> accessed 16 out 2021.

[39] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

[40] Kochtkova Marina, 'Blockchain in the art Market: opportunities and challenges' (Bachelor's thesis, University of Appled Sciences 2020).

[41] It can be considered token, any hardware capable of generating and storing the encrypted keys that will compose the digital certificates. Represents a token the registration of an asset in digital format. *Cf.* Proto Nathália de C. G., 'Da lex mercatória à lex cryptographia: uma análise jurídica da regulamentação global do blockchain e os seus impactos no comércio internacional' (Dissertation, Universidade Federal de Pernambuco 2020). According to this author, tokens can be presented in four types: payment, those intended to be used as monetary units and means of payment; utilities, those designed to guarantee access to goods or services contained in digital platforms; asset tokens, which represent credit rights or equity interests; and hybrid tokens, those that are part utilities and part assets or payments. The non-fungible token is a kind of encrypted token that works under Ethereum base, and that can represent anything as unique.

[42] Simone Morabito, 'Profili giuridici degli NFT (Non fungible tokens) tra arte e blockchain in Italia' (*Business Jus website*, 2021) <https://www.businessjus.com/wp-content/uploads/2021/01/Profili-giuridici-degli-NFT.-Tra-Arte-e-blockchain.pdf> accessed 19 August 2021.

[43] Ibid.

[44] Silva Aila Regina da, 'Um quadro de Picasso encriptado: sobre NFT e desmaterialização' (*JORNAL DA USP*, 30/08/2021) <https://jornal.usp.br/artigos/um-quadro-de-picasso-encriptado-sobre-nft-e-desmaterializacao/> accessed 19 August 2021. According to the authors, the work called "Femeur V", was purchased at a Christie's auction, by the Fractal Studios group and registered at the Unique One Art Marketplace. Once tokenised, the original work was literally burned. Thus, two NFTs emerged, one called "The Burned Picasso 1", corresponding to the original work and the other, called "The Burned Picasso 2", corresponding to the burnt remains of the work, both registered in the Unique One Art Marketplace.

influential artist of all time into the new era of art.[45] But there are those who are against it, based on the notion that by erasing from reality and recreating digital reality, even if perpetuated by pixels, it removes from the work the fundamental and essential aspects of the piece as visualised by the author, in the case such as paper and paint. On the other hand, the effect of dematerialisation, in addition to giving the work another meaning, totally modifying the old paradigm, makes the work's value increase considerably,[46] leading the artistic community to reflect on the revelation of the essence of the creative market and that the content of a work is not the matter in itself, but the idea, that no extinguishing action is capable of destroying it.

Anyway, in 2018, the use of blockchain in the art market, had a remarkable increase, there were developments of experimental software, with special emphasis on the contemporary art market. These software were presented in forums, fairs and auctions, encouraging discussion on the adoption of this technology. Ideas from different artists were demonstrated at the time, and all transactions took place exclusively with the use of cryptocurrency.[47]

The Token-Art system has also been useful in the fractionation of ownership of the art, offering a portion to each interested party, resulting in greater compensation in financial terms, both for the selling company, and for the owner of the work.[48]

The NFT is also used as an important factor of "digital scarcity:"[49] that is, the idea is to make a scarce digital archive, associating it to a non-fungible token, because the artwork, in this case, would become unique. And, in the art market, the characteristic of uniqueness has a fundamental representativeness in its appreciation.

The NFT works together with the smart contract, as they are much more functional than those traditionally printed on paper. But conceptualising it is not easy. The literature on the subject establishes different concepts, the following can be cited: "agreement in a self-executed and self-implemented digital format;"[50] "user-defined programs that specify rules governing transactions and applied by a network of peers;"[51]

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[45]   <https://www.accesswire.com/653023/The-Burned-Picasso-NFT-to-Digitally-Preserve-Artistic-Legacy>   accessed 20 August 2022.

[46] Silva Aila Regina da, 'Um quadro de Picasso encriptado: sobre NFT e desmaterialização' (*JORNAL DA USP*, 30/08/2021) <https://jornal.usp.br/artigos/um-quadro-de-picasso-encriptado-sobre-nft-e-desmaterializacao/> accessed 19 August 2021.

[47] Sidorova Elena, 'The Cyber Turn of the Contemporary Art Market ' [2019] 8(3) Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

[48] Mc Andrew, Clare, 'The art market. ed. 2021. Art Basil and UBS. Switzerland' [2021]. <https://www.artbasel.com/about/initiatives/the-art-market> accessed 19 August 2021.

[49] Massimo Franceschet, 'HITS hits art' (2021) 1 ARXIV 1 <https://arxiv.org/abs/1907.07758> accessed 16 out 2021.

[50] Werbach Kevin and Nicolas Cornell, 'Contracts ex machina' [2017] 67(2) Duke Law Journal 320 <https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=3913&context=dlj> accessed 19 August 2021.

[51] Demolino Kevin and others, Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab. (IFCA, 2015).

"agreements in which the execution is automated by computer;"[52] "programs that perform a particular operation under certain conditions that operate automatically based on pre-established functions;"[53] "a promise, or group of them, crafted on a blockchain platform and executed by a computer system;"[54] "are legally binding contracts."[55]

In Italy, looking at the "Legge 12, del 11 febbraio 2019, comma 2, art. 8-ter" we can find the following definition about smart contracts: "A smart contract is a computer program that operates on technologies based on distributed registers and whose execution automatically binds two or more parties based on predefined effects. Smart contracts satisfy the requirement of the written form subject to computer identification of the interested parties, through a process having the requirements set by the "*Agenzia per l'italia digitale*" with guidelines to be adopted within ninety days from the date of entry into force of the law converting this decree".

It is observed that there are different points of view in the art community. It may be possible to differentiate between these concepts: on the one hand, there are the technicists, whose nature would be code-programmatic; on the other, jurists, whose nature would be contractual. The first ones are based on the premise that the "code is law,"[56] an idea that expresses the operation without a legal regulation and interpretation; in other words, its proponents argue that smart contracts, especially when stored and executed in a blockchain, do not require any legal system to operate.[57] However, this position is heavily criticised from a legal point of view. There is no doubt that smart contracts operate and execute automatically, however, there is no way of knowing whether the obligation of the contract was validly created, or even if the parties agreed to make the contract.[58] The literal and reductionist interpretation has also been criticised: the expression "intelligent" attached to the contract does not mean

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[52] Max Raskin, 'The Law and Legality of Smart Contracts' [2017] 304 Georgetown Law Technology Review <http://dx.doi.org/10.2139/ssrn.2842258 > accessed 19 August 2021.

[53] Simone Morabito, 'Profili giuridici degli NFT (Non fungible tokens) tra arte e blockchain in Italia' (*Business Jus website*, 2021) <https://www.businessjus.com/wp-content/uploads/2021/01/Profili-giuridici-degli-NFT.-Tra-Arte-e-blockchain.pdf> accessed 19 August 2021.

[54] Idan Shkaltz, 'Smart contracts or Smart Escrows? Legal analysis of blockchain based Smart Contract' (DPhil thesis, Harvard Law School, 2018)

[55] A Papantoniou, 'Smart contracts in the new era of contract law' [2020] 4(1) Digital Law Journal <https://doi.org/10.38044/2686-9136-2020-1-4-8-24> accessed 19 august 2021.

[56] Expression introduced by Lessig [1999], 'Commelles, Cristina Argelich 'Smart contracts o code is law: soluciones legales para la robotización contractual' (2020) 2 InDre 1.

[57] Giesela Ruhl, 'Smart (Legal) Contracts, or: Which (Contract) Law for Smart Contracts?' [2020] 4(0) Benedetta Cappiello & Gherardo Carullo (eds), Blockchain, Law and Governance <https://ssrn.com/abstract=3552004> accessed 20 August 2021.

[58] Ibid.

autonomous robot performance, but programming, so that calling it "intelligent contract" is too concise to express the function of these contracts.[59]

Such contracts, however, inseparable from the NFT file, can be carried out automatically, so that the entire transaction is registered in the blockchain, providing protection and security in the transaction.[60]

The main attributes highlighted by smart contracts are autonomy, decentralisation, self-sufficiency and security. Autonomy refers to the needlessness for any further participation by the contracting party in the process, since the system runs itself, when its conditions are satisfied and informed to the network; decentralisation refers to the inexistence of a central authority or server to guarantee its existence and authenticity, since the data is distributed over several network points; self-sufficiency concerns the capacity of these contracts to adopt means to allow greater storage capacity, not only in collecting money, but also in carrying out transactions; as for security, it is directly linked to the blockchain system, which operates as a ledger and creates consensus and trust in the direct communication between two or more parties, without the intermediation of third parties, providing greater privacy to those involved.[61]

To mention some, new buyers are not used to the operational form of auctions, there are diverse contractual aspects, that might interfere with structuring of incidental fees that if they are not properly managed, can lead to procedural and legal problems, reducing sales and increasing defaults.[62] There are also those who understand that e-commerce does not allow, for example, to inspect the work of art before the purchase, causing difficulty in building consumer confidence, or establishing the seller's reputation.[63] Despite this imperfection, the online art market nurtures prospects for future development, expecting a significant increase in the coming years. The cybernetic turn has an influence not only on the modality of marketing and valuing art, but also on the gradual diversification of participants, with a potential increase in customers and future buyers.

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[59] Commelles, Cristina Argelich 'Smart contracts o code is law: soluciones legales para la robotización contractual' (2020) 2 InDre 1.

[60] Cavalcanti Mariana O.M. and Nobrega Marcos, Smart contracts ou "contratos inteligentes": o direito na era da blockchain (2th edn, CERS 2020).

[61] Mariana O.M. Cavalcanti and Marcos Nobrega, Smart contracts ou "contratos inteligentes": o direito na era da blockchain (2th edn, CERS 2020). Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).
Nathália de C. G. Proto, 'Da lex mercatória à lex cryptographia: uma análise jurídica da regulamentação global do blockchain e os seus impactos no comércio internacional' (Dissertation, Universidade Federal de Pernambuco 2020).

[62] Ibid 168

[63] Elena Sidorova, 'The Cyber Turn of the Contemporary Art Market' [2019] 8(3) Art Markets and Digital Histories <https://doi.org/10.3390/arts8030084> accessed 20 August 2021.

4 Legal implications

From the blockchain technology perspective there are still many doubts and questions, especially regarding legal implications of NFT and smart contracts. It is required new theoretical approaches and new hermeneutics that adjusts itself to the peculiarities of digital facts. One of the main legal concerns is the language used by digital media, that is, algorithms. This "language" is not capable of formulating value of judgment[64] like humans do organically, demanding new postulates and paradigms to be studied and adopted in legal theory. It would be impossible, for example, to include clauses such as good faith, reasonableness, or fairness[65] to be measured, balanced and applied to each concrete case. In this universe, it will be necessary to overcome the existing dichotomy between digital language characterised by precision and certainty, and, the legal language whose concepts are essentially indeterminate and imprecise.

In the cyber phenomenon linked to the international art trade, there are undoubtedly advantages in applying the blockchain in art market operations, mainly to improve the authenticity and provenance of works of art, as well as to protect the privacy of collectors and the potential for product traceability. But two aspects are worth mentioning, given their implication in the legal world: the contractual effects and property rights.

4.1   Contractual Effects

The function of a traditional contract is to acquire, terminate or modify the parties' rights and obligations through a legal bond. In this sense, any agreement of will, including smart contracts, would, in the legal sense, be a contract, insofar as they operate as voluntary mechanisms that change the rights and duties of the parties.[66]

When it comes to international art trade, it is important to point out that each international legal system require different elements for the formation of the contract. If the system is common law, it constitutes a more open premise, based more on reason and contractual freedom; if it is civil law, the system is more closed, with greater rigidity and based on the law. Even under the common law aspect, the consideration of a legally binding contract is required.[67] Although there is still a lot of debate, in the United States, for example, for Smart Contracts to be considered a contract, it must be a legally

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[64] Mariana O.M. Cavalcanti and Marcos Nobrega, Smart contracts ou "contratos inteligentes": o direito na era da blockchain (2th edn, CERS 2020).

[65] Valentina Bellomia, 'Il contratto intelligente: questioni di diritto civile. *Judicium*: il processo civile in Italia e in Europa' (2020) <https://www.judicium.it/wp-content-uploads/2020/12/Valentina-Bellomia> acessed 19 ago 2021.

[66] A Papantoniou, 'Smart contracts in the new era of contract law' [2020] 4(1) Digital Law Journal 8-24 <https://doi.org/10.38044/2686-9136-2020-1-4-8-24> accessed 19 august 2021.

[67] Ibid.

questionable agreement,[68] so that smart contracts would be considered, not exactly contracts, but "gentlemen's agreement."[69]

In general, for contracts to be effective, it is necessary an agreement of will, with an objective verification, and the will must be manifested in actions or demonstrated through a declaration; it is also necessary for the instrument to have parties with legal capacity, the object to be lawful and that there is a motivation.[70] Regarding the manifestation of the will, according to some authors, the simple proposal is not representative of the will to contract, if there is no counterpart of acceptance; when the two parts fit together, the contractual link is born, not when the contract is loaded and executed in the blockchain.[71] According to Bellomia,[72] in computer language, execution, means beginning of the program on the computer and this is the moment that will definitively establish the link between the parties, so until then, there would not be a contract with force of law. Thus, the use of the smart Contract is not compatible with the will to perform the contract other than the automatically built instrument.

In these situations we can leverage that the legal sector conjecture the idea that in smart contracts there is an "anticipation of legal relations."[73] This means that, while in the traditional contract the pre-contractual phase, an opportunity in which the parties are in negotiations, analyzing the preliminary negotiations and the expectations of the parties and, therefore, the figure of the legal relationship is still absent, being almost a unilateral contract, where all of the clauses are predefined, in the smart contract this information is already codified and considered, since the object of the contract is connected to the digital network, although the improvement of the contract occurs at the moment in that the parties express their consent.[74] It is also necessary to consider that in relation to consent, the smart contract takes place immediately just directly in the personalisation of a contract or in the adherence to a predisposition which can give rise to the defects of consent.[75]

Another highly discussed aspect is the immutable nature of smart contracts, as once introduced and activated, it cannot be modified, and it will be executed automatically.

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[68] Kevin Werbach and Nicolas Cornell, 'Contracts ex machina' [2017] 67(2) Duke Law Journal <https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=3913&context=dlj> accessed 19 August 2021.
[69] Mariana O.M. Calvacanti and Nobrega Marcos, 'Smart contracts ou "contratos inteligentes": o direito na era da blockchain' (2th edn, CERS 2020).
[70] Alberto Castellano Pérez, 'Aproximaciones técnicas y jurídicas a la figura de los smart contractos em el odenamiento jurídico espeñol' (Dissertation, University of León 2019).
[71] Marta Marchesin, 'Gli smart contracts: profili giuridici' (Bachelor's thesis, University of Padova 2020).
[72] Valentina Bellomia, 'Il contratto intelligente: questioni di diritto civile. *Judicium*: il processo civile in Italia e in Europa' (2020) <https://www.judicium.it/wp-content-uploads/2020/12/Valentina-Bellomia> acessed 19 ago 2021.
[73] Junior José L. de M. F. and Roth Gabriela, 'Como a utilização do blockchain pode afetar institutos jurídicos tradicionais' (2019) 14 RJMPC 39.
[74] Commelles, Cristina Argelich 'Smart contracts o code is law: soluciones legales para la robotización contractual' (2020) 2 InDre 1.
[75] Ibid.

This situation can bring legal problems, considering that not all unpredictable events could be established ex ante in smart contracts, which are possibly correctable in traditional contracts. Thus, a smart contract may not be desirable, if it "differs from the intentions of the parties", even more when such codes are not written by the parties themselves.[76] In contractual law thesis it is applicable the *pacta sunt servanda* theory as the foundation of the binding force of contracts, although its proposition was mitigated over time by the principle of rebus sic stantibus, with the objective of protecting contracting parties against unforeseen and unexpected changes, relativising the absolute conception of the first brocade. However, when it comes to a smart contract, the applicability of this principle would be impossible. In such a way, the inflexibility of the smart contract would be a difficult problem to be solved, especially in the universe of business relationships, where the modification of the fulfillment of obligations is an intrinsic characteristic.[77] The immutability of these contracts can bring another consequence: the impossibility of termination.[78]

All these main contractual effects require from the legal order new methods of hermeneutics, a new way of understanding digital phenomena, greater interpretive flexibility, to change the scope and applicability of current legal institutes.

4.2 Effects on property rights

It is known that works of art are generally protected by copyright. In addition, works of art may also be subjected to ownership and private property rights. On this occasion, a legal analysis can be carried out about the main effects that can be observed in these institutes in the universe of the use of blockchain technology and the NFT in the aspect of international trade. Intellectual property rights will be referred to as copyright, and private property will be reference for ownership and real state proprietorship.

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[76] A Papantoniou, 'Smart contracts in the new era of contract law' [2020] 4(1) Digital Law Journal <https://doi.org/10.38044/2686-9136-2020-1-4-8-24> accessed 19 august 2021

[77] Uster João Lucas Danbrosi. 'Contratos inteligentes (smart contracts): possibilidade e desafios no ordenamento jurídico brasileiro' (Dissertation, Universidade Federal do Rio Grande do Sul 2020).
Rocha Debora C. de C., 'Smart contracts e the code is law: a problemática frente à base principiológica contratual contemporânea' (2020) 32 Percurso 113-137.

[78] Alexander Savelyev, 'Contract law 20: 'Smart' contracts as the beginning of the end of classic contract law' [2017] 26(2) Information & Communications Technology Law <https://doi.org/10.1080/13600834.2017.1301036> accessed 20 August 2021.

4.2.1 Copyright

The copyright, is considered as an inherent right to the author of the product that results from his intellectual creation, contains two aspects of rights: personal and patrimonial.

The personal rights under the copyright correspond to the protection of the creator's interests within the person's work aspects, that being the object that constitutes whether a representation, or an externalisation of the idea of the author. Therefore copyright constitutes the ownership power over an intellectual good (*jus is re intellectuali*), or a special faculty.[79] It is the creation of the work that guarantees protection. In this sense there is also reference in doctrinal studies as "paternity law" of a work,[80] to which the law attributes the legitimacy to plead their rights as a true author, preventing third parties from misappropriating themselves.

On the other hand, the rights of a patrimonial nature are the prerogatives that are attributable to the creator, as he is also the owner of the work, having the power to dispose of it in the way that best suits him, or to explore it with the objective of obtaining profit.[81]

In this way, copyrights refer both to protection under the personal and patrimonial aspects, even though they are independent from each other, even considered by some scholars as exclusive rights, since it is related to the monopoly in the exercise of economic activity.[82] It is an institute of significant importance in that it repays and gives value to the individual's creative work, the absence of which would limit their protection, probably only regarding unfair competition.[83]

At an international level, attention to copyright has two legitimate interests: on the one hand, the interest of the author, who wants not only the protection of his rights, but also that his work be disclosed for the knowledge of all; on the other, the interest of society, embodied in free access to cultural goods and information.[84] There are then two interests: author's rights and the right to culture, both considered fundamental rights by almost all national or international legal systems. At first sight, such interests seem antagonistic, but they can be considered complementary, since the author's right, as long as it is duly authorised and/or remunerated, would not represent major problems

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[79] Sergio Branco, 'A natureza jurídica dos direitos autorais' (2013) 2 RC.

[80] Ibid.

[81] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

[82] Ibid.

[83] João G. T. Fernandes, 'Os desafios da tecnologia blockchain no direito da propriedade intelectual. (Dissertation, Universidade Católica Portuguesa 2019).

[84] Messina Elena, 'La tutela del diritto d'autore alla luce della direttiva 2019/790 dell unione europea: la ricaduta di responsabilità sugli intermediari per i contenuti generati degli utenti' (Bachelor's thesis, University LUISS Guido Carli 2020).

in the use of the work. However, it is possible to obtain a solution, even in case of conflicts, with the application of the balancing system between the author's interests that need to be protected and the adequate means to grant this protection, and the form necessary use to satisfy the public interests.

Evidently, for the copyright to be attributed to its owner, conditions and criteria are imposed and must be fulfilled according to the pertinent legislation, when the owner is doing the registration of the work. Impositions must meet a reasonable balance between the legitimate interest of the author, who needs to safeguard his idea, but cannot imply a complete denial of access to the product when considered in the public interest.[85] Furthermore the bureaucratic procedure that authors must undergo to register their creation for many times may not effectively meet their interests.[86]

With Internet's expansion and facilitating instruments such as "copy and paste", the respect for copyright is even more important, because anyone with a minimum of knowledge in computer daily usage can easily change, modify, reproduce and disseminate worldwide any content protected by copyright, creating a lot of legal uncertainty among authors. The emerge of blockchain technology represents, therefore, a solution regarding the security and helps avoid the misuse of works that are subject to copyright protection.

As for the works of art registration through blockchain technology, specialised literature evaluates positively, contributing not only to protect the originality of a work,[87] but also to mitigate problems such as the lack of transparency of the information underlying the work.[88] In addition, the operational decentralisation of this technology guarantees safer registration than the one carried out by the official government agency;[89] while it also allows the registration of other rights added to the copyright, such as the terms or conditions of use of the work, recognising the possibility for the authors to control themselves the access to their works.[90] Since the fixation of the permanent and inviolable trademark would allow not only the other blocks to identify that the work is protected by the author's rights, but it will also possibly facilitate the proof of ownership of the right to the work in any conflicts.

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[85] João G. T. Fernandes, 'Os desafios da tecnologia blockchain no direito da propriedade intelectual. (Dissertation, Universidade Católica Portuguesa 2019).

[86] Junior José L. de M. F. and Roth Gabriela, 'Como a utilização do blockchain pode afetar institutos jurídicos tradicionais' (2019) 14 RJMPC 39.

[87] Ibid.

[88] João G. T. Fernandes, 'Os desafios da tecnologia blockchain no direito da propriedade intelectual. (Dissertation, Universidade Católica Portuguesa 2019).

[89] Junior José L. de M. F. and Roth Gabriela, 'Como a utilização do blockchain pode afetar institutos jurídicos tradicionais' (2019) 14 RJMPC 39.

[90] Elena Messina, 'La tutela del diritto d'autore alla luce della direttiva 2019/790 dell'Unione europea: la ricaduta di responsabilità sugli intermediari per i contenuti generati degli utenti' (Bachelor's thesis, University LUISS Guido Carli 2020).

The blockchain system is considered to be an important mechanism to detect infringement of a copyright, for example, if a certain work in digital format is sold on the secondary market without authorisation of the respective right holder,[91] it's going to be easier to solve because the work inserted in the blockchain is associated with a hash and any change to the content trackable facilitating the verification of the work's authenticity.[92]

It's useful to elucidate that the author's rights, in general, are limited in time. This means that after a time period determined by the relevant legislation, copyrights are no longer exclusive, passing to the public domain.

Copyright, in fact, can be transferred even to different people. The situation analyzed by Matulionyte[93] in this sense is the tokenisation of the copyright sold/assigned to different owners, there being, therefore, the co-ownership of copyright over a work of art. This means that each of the copyright holders would need everyone's prior permission each time they wanted to use the copyrighted work. Hypothetically, the author by stating the lease agreement must clearly provide for the parts the rights that each has listing the related rights can be exercised, what obligations exist, what responsibilities, as well as the sharing of the profits, in order to prevent the misuse of copyrights, as well as other violations that could eventually occur.

Another aspect to be analyzed is the immutability of the blockchain network contrasts with the dynamism of copyright, which is changeable.

One of the great difficulties in the efficient protection of copyright in the digital age is the insufficiency of international protection legislation, although there is a certain degree of multilateral coordination within delimitated systems such as the European community, in general the application system is still limited to the states domestically.[94] This is because most of the legislation applicable to copyright is still being used in the domestic sphere, arising from the internal legal system of each State. However, this panorama must change and be more comprehensive, given the significant expansion of international trade, especially when it comes to trade in works of art, but also within the music and movies industry for example.

Without a doubt, technology has changed the basis of copyright, causing changes that not only require updated legislation, but also the legal understanding of copyright protection, following the evolution of the digital age. Although the legal community is

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[91] João G. T. Fernandes, 'Os desafios da tecnologia blockchain no direito da propriedade intelectual. (Dissertation, Universidade Católica Portuguesa 2019). Although this author also argues that the blockchain would not allow the authors to control works in digital format, in order to disregard the application of the principle in the secondary market.
[92] Ibid.
[93] Rita Matulionyte, 'Can copyright be tokenised?' [2019] EIPR 12.
[94] Pedro Ivo Ribeiro Diniz, 'A tutela insuficiente do sistema internacional de proteção aos direitos autorais na era digital' (Dissertation, Universidade Federal de Minas Gerais 2010).

currently working on the subject, there are still many doubts, divergences and obstacles to be overcome for the effective management of copyright in the blockchain system.

4.2.2 Private Property Rights

The right to private property differs somewhat from the copyright: the copyright is considered an original right, while the other is a derived right, that comes from the original as a development of the first one. In this type of property, the right of possession, control, exclusion, to derive income, and the right of disposition over an available asset are ensured.[95] In this way, the works can be transferred to the open market, giving these owners the possibility to finalize sales contracts.

Considering that the NFT allows fractional trading of assets of a certain work of art, there will be a form of common ownership in the same thing, so that each joint owner owns a percentage of the entire property, even if the part belongs to each one, cannot be physically identified on the property.[96]

In this sense, each unit owner could use the property in its entirety at any time, with the prohibition of changing its destination without the consent of the other co-owners, as well as preventing its use by unauthorised third parties.[97] It will also be necessary to observe whether a given work of art is protected by copyright, a situation in which the community property right should only be exercised over the physical and not the intellectual property.

In the NFT system, as the name suggests – a non-fungible system, the domains of property law represent a major legal problem. It is known that for a property right to be made available or even transferred, within its characteristics in a non-changeable situation becomes insubstantial. This means that the property right must be interpreted under new guises, before it's incorporated into an NFT, as property would become immutable. It would be necessary to find a solution to harmonize the dynamics involving property rights with the attribute of immutability of the technological system.[98]

In the case of co-ownership, the problem is even worse, since each token would represent a part of the property, and the exercise of this right, by one of these parties, would require everyone's permission. There must be an agreement of will between all

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[95] Junior José L. de M. F. and Roth Gabriela, 'Como a utilização do blockchain pode afetar institutos jurídicos tradicionais' (2019) 14 RJMPC 39.

[96] Simone Morabito, 'Profili giuridici degli NFT (Non fungible tokens) tra arte e blockchain in Italia' (*Business Jus website*, 2021) <https://www.businessjus.com/wp-content/uploads/2021/01/Profili-giuridici-degli-NFT.-Tra-Arte-e-blockchain.pdf> accessed 19 August 2021.

[97] Ibid.

[98] Ana F. C. Ferreira, 'O uso da rede blockchain no mercado criativo: a gestão de direitos autorais de obras musicais no ambiente digital' (Dissertation, Universidade Católica de Pernambuco 2020).

of them, a harmonisation in the exercise of related rights, otherwise the co-ownership would lose its essence.

There are other aggravating factors when it comes to joint ownership in the NFT, which are the anonymity and distribution of rights. The Blockchain-NFT system strives for privacy and anonymity. However, anonymity is a difficult factor to solve if there is a conflict of interest in the exercise of joint ownership. And, if this conflict arises damage to either party, it would be difficult to identify the author in order to assign his responsibility. Although the differentiation in the distribution of faculties that are attributed to each co-owner may represent an additional problem, as ownership may be under the custody of one of the owners, but the right of enjoyment with another. These situations need further reflection from the part of legal operators, carefully examining the relevance and consequences of the use of technologies that impact legal institutes.

4.2.3 Registration of the work in the NFT

The registration of a work of art is optional and not mandatory, but its formalisation constitutes greater security and the formation of documentary evidence generated by the registration is attributed to legal force and relevance. It is by registering the work that its conservation and the individualisation of subjective rights is guaranteed.

The registry is predominantly public, since the registered bodies exercise functions under public law, in that it confers authenticity, security and effectiveness of legal acts in a preventive way, not only in terms of declaration, otherwise also in the constituent effect. Through the registration it is allowed the recognition of authorship, specifying the rights and establishments in terms of protection, constituting itself in a form proper to the preservation of culture.

Since it is embodied with public faith, the registration within the public registries generates presumption of authorship, so that the person who registers will be appointed as the author of the work.

When it comes to works of art, temporality is also precise and clear with the register. Thus, in the event of possible misuse by third parties, there is a presumption of the creation date attested by an official institution, and it is also easy to include certain works in the public domain collection.

From the standpoint of authenticity and security, blockchain technology and NFT certainly guarantee the unalterable treatment of the registration of a work, but this

characteristic refers to electronic security.[99] However, electronic security differs from legal security, as it is not enough for registration to preserve the work in an immutable and indestructible way; it is necessary that for those instruments to be endowed with important legal effects by previously qualifying the titles emanating from the registry.[100] It is observed, therefore, that the electronic registration does not generate the same effect as the official registration, since its embodied with public faith and the digital is constituted a private nature.

The fact that the registration of a work is done internally, in official bodies, makes it difficult not only to identify the authorship, but also in the legal limits of use when the work is for the trading market. This problem can be overcome if registered on the Blockchain, as it facilitates obtaining information about the work, its ownership, its legal role, if it is under copyright protection, or if it is in the public domain. In a nutshell, it allows a more effective management.

Although blockchain registration does not replace the one made in official registration institutions, it must be recognised that this technology guarantees not only the age of registration, but also the integrity of the content, authenticity and immutability of the document. Some countries have projects to implement blockchain technology in registry services,[101] not as a substitute, as the institutions have authority and public functions, which the technological system is not capable of obtaining,[102] but as a tool to help categorize the registered forms of art.

5 Conclusions

The current scenario of legal doctrine and examples are insufficient in terms of the understanding and scope of traditional institutes with the increasingly complex formatting of facts under revolutionary technologies that reach beyond borders.

The international expansion of the arts trade is a clear example of technological power and its high capacity to transform the market.

The new reality of facts arising from the application of blockchain, NFT and smart contract technology, from a technical point of view, promises agility, security, integrity and authenticity in the international trade of works of art. Effectively, technological resources have demonstrated that these instruments and procedures related to the international art trade are currently widely used, reflecting on the annual sales volume,

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[99] Vecchi Leonardo Garcia, 'O uso da tecnologia blockchain no serviço notarial e registral e seus reflexos nos custos da propriedade privada: um estudo da sua viabilidade técnica, jurídica e econômica' (Dissertation, University Federal de Goiás. Goiânia 2021).

[100] Ibid.

[101] Ibid.

[102] Ibid. Projects under development in Germany and Catalonia are mentioned, where the technological instrument is used to combat counterfeiting and not replace the public record; likewise in Japan, the aim is only to maintain greater control by simplifying and unifying the registry service.

reaching impressive levels. Alongside the euphoria of the art market with digital technology, it is also necessary to refer to the impacts of market transformations caused by the use of such technologies in the social environment.

The analysis of the main changes that occurred in this scenario raises interesting legal questions. Several institutes are impacted that have the need to reformulate the role of law, by having new ideas, expanding the interpretive effort causing the revisiting of the traditional legal institutes to be redefined in light of the potential of these technologies.

Traditionally, contracts are in oral or written form, the establishment of the legal relationship occurs after its signature and execution is driven by one of the parties; in smart contracts, on the other hand, the format is codified, there is anticipation of the legal relationship and they are self-executable; aspects of immutability and anonymity that do not exist in the traditional contract are also observed. These situations require an urgent review of the legal concepts inherent in the theory of contracts, as more and more participants are seeking the use of blockchain and smart contracts, as they are of essential importance, not only in the international art trade, but also in meeting different needs commercial and in different sectors.

Likewise, in the field of property rights, whether intellectual, more precisely author rights, or ownership rights and private property, it has been revolutionised through the use of technology translating itself in the form of the NFTs. In copyright, technologies promise authenticity and traceability of works, in order to avoid any violation of their rights. However, for the author's right to have effective protection, it is necessary to register it in an official body, which will give it public faith and legal certainty. Although the registration can be done in the blockchain itself, it will not have the effect of legal security nor will it embody public faith, which are exclusive attributes of the public function. These are innovative dimensions and challenges for public authority in re-dimensioning the nature of this function.

It is concluded, therefore, that as technology advances and the use of NTFs are becoming each day more and more in use for the art market, the approach of the traditional legal institutes and doctrine, seem to be no longer adequate, and a review of the concepts and nature of legal institutes should be adopted, reformulating the paradigms for the new legal, social and technological reality.

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