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Artificial Intelligence and Tax Law: Perspectives and Challenges

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Negli ultimi anni, le applicazioni di Intelligenza Artificiale (IA) basate sui big data hanno suscitato un enorme dibattito tra i giuristi. Il dibattito si è concentrato su come le nuove interazioni mediate dall'IA basata sui dati influiscano su diversi principi giuridici, mettano in discussione le norme esistenti e richiedano modifiche del quadro normativo. Sono stati discussi molti campi del diritto: diritto della protezione dei dati, diritto della protezione dei consumatori, diritto della proprietà intellettuale, ecc. Questo articolo fornisce una panoramica delle sfide e delle opportunità che si trovano all'intersezione tra le applicazioni dell'IA e il dominio della fiscalità e del diritto tributario. Nella prima parte, il documento esamina come gli attuali modelli economici basati sull'intelligenza artificiale rimodellano la catena del valore tradizionale e influenzano i concetti legali nella tassazione diretta e indiretta. La seconda parte discute in che modo l'IA viene applicata in diverse aree della compliance fiscale volontaria e dei controlli delle amministrazioni fiscali e come questi sviluppi generino nuove sfide per il diritto (fiscale).

In recent years, Artificial Intelligence (AI) applications based on big data have sparked a huge debate among lawyers. The debate has focused on how new interactions mediated by data-driven AI affect different legal principles, challenge existing rules, and require changes in the legal framework. Many traditional fields of law were covered: data protection law, consumer protection law, intellectual property law, etc. This article provides an overview of the challenges and opportunities that lie at the intersection of AI applications and the domain of taxation and tax law. In the first part, the paper examines how current AI-powered economic models reshape the traditional value chain and influence legal concepts in direct and indirect taxation. The second part discusses how AI is applied in different areas of voluntary tax compliance and tax administrations' controls, and how these developments generate new challenges for (tax) law.

1. Introduction[1]

This paper provides a survey of the challenges that lie at the intersection of tax law and Artificial Intelligence (henceforth "AI"). First, it will address how AI is reconfiguring the value chain and put into question traditional tax legal concepts. Second, it will review current applications of AI in the field of compliance and enforcement of tax law.

There are several added values in providing a mapping of current research topics. First, whether concerned with AI-powered business models or with application of AI in taxation, both research areas presuppose the knowledge of AI. We believe that such knowledge is a necessary precondition to correctly interpret the socio-technical and economic phenomena that are impacting on established legal system and to determine whether and how norms can and should adapt and possibly change. Secondly, the legal analysis of AI in the world of taxation should not only look at the impact of AI has on the current legal system. Rather, it is equally important to investigate the prospects of using AI for providing enhanced enforcement capabilities and improving efficiency and fairness in taxation system. Thirdly, the prospect of using AI technologies to automate certain tasks and processes within the compliance and tax enforcement system requires a careful legal analysis, in which tax lawyers as well as tax practitioners should take a leading role. Only with a knowledge base of the law, issues that might potentially arise from the use of AI in taxation systems can be adequately understood and addressed in the technology itself.

The paper is structured as follows. Section 2 offers some insights on the extent to which traditional concepts of tax law – such as taxable person, taxable event, and tax nexus – are adequate to catch the new ways of business to create value and ensure a fair taxation in the data-driven economy. Then, Section 3 looks at AI technologies as useful tools to improve the effectiveness of voluntary tax compliance and tax law enforcement and highlights related legal challenges.

2. Tax law for Artificial Intelligence

New forms of creation of value continuously come to light thanks to knowledge and technological innovation. In the last two centuries, the use of coal and steam engine, earlier, and of internal combustion engine, electricity, and oil, afterwards,

had a revolutionary impact on the economic models. More recently, the emergence of big data, AI and automation are deeply impacting on the structure of the value chain transforming the ownership-based industrial society into a service-driven information society.

In the current economy, technologies are increasingly widespread and pervasive. They are no longer mere tools for business operations but generate new forms of value which can be moved from one place to another with great speed and ease and give rise to new markets. The use of digital networks, whose economic potentialities are not limited by national boundaries, have changed the market, which is no longer a physical place where goods are exchanged, but rather an interconnected, easy-to-access, open space without borders where to freely exchange data, goods, and temporary use rights.

On the one hand, this environment is characterised by the synergy between data and data processing technologies, which allow to supply new digital services. The great data flows, facilitated by the increased number of computer-mediated transactions, have been integrated into a global interconnected data-processing infrastructure, centred on, but not limited to, the Internet. This infrastructure constitutes a universal medium for communicating, accessing data, and delivering any kind of private and public services. It enables citizens to shop, use banking and other services, pay taxes, get governmental benefits and entitlements, access information and knowledge, and build social connections. Algorithms - often powered by AI techniques - mediate citizens' access to content and services, selecting information and opportunities for them, while at the same time recording any activity. AI's *hunger* for data concerns any kind of information: from meteorological data to environmental ones, to those concerning industrial processes.

On the other hand, the digital economy is characterised by the increased use of robotics. Robotics can be simply defined as «*AI in action in the physical world*» (also called embodied AI). More precisely, a robot is a physical machine that must cope with the dynamics, the uncertainties, and the complexity of the physical world. Perception, reasoning, action, learning, as well as interaction capabilities with other systems are usually integrated in the control architecture of the robotic system. The uptake of robotics in the industry 4.0 is changing the production processes and the supply of goods and services. Robots improve work

efficiency through material handling processing operations, but also manage the organisation of work, through coordination and logistic.
These two fundamental characteristics of the new information economy create new challenges for tax law whose concepts have been developed for an economic system with different features. However, just as the shift from agricultural feudal economy to the industrial society had consequences for the tax legal systems (such as the emergence of income and consumption taxes), so too the emergence of the digital technologies requires an adaptation of traditional tax legal concepts - if not the creation of new ones - to meet the needs of new economic models.
In the following paragraphs, we will discuss the impact of AI-driven business models on three traditional tax law concepts: 1) taxable person; 2) taxable event; 3) tax nexus.

2.1. Taxable person

2.1.1. The proposal for a Robot Tax

The automation of business process is seen by many as a paradigm shift whose main features are the evolution in the AI use which is expected to radically affect the productions models, the new balance between labour and capital, and the re-organisation of work. The development of robotics and AI technologies in the environment are profoundly affecting both how the value is created and how the work is performed.
Faced with this scenario, there is a pessimistic view that emphasises that the use of AI in the production chain could lead to unemployment ('technological unemployment'), wage stagnation and income inequality.[2] More optimist positions suggest that AI will only bring a shift in required job skills[3] with the distinctive feature that the results of the digital revolution will be different from those of the industrial revolution in that not only routine but also non-routine cognitive tasks are at risk.[4] Since a considerable part of States' revenues comes from income taxes, payroll taxes and social security contributions, the shift from humans to automation is likely to challenge national tax systems and consequently current public financing systems.[5]
Such considerations provide the premise for using the fiscal policy in order to

contrast the negative consequences of technological innovation in the labour market, to balance the possible loss in terms of States' revenue, and to finance investments in education with social transfer and social expenditure measures, such as the Finnish Universal Basic Income (UBI).[6] In fact, taxation is one of the most effective tools to direct individuals' behaviour and societal changes, while at the same time, raising public revenues and sustain social welfare.[7]

2.1.2. The proposal for a Robot Tax

One of the possible answers to this scenario is the introduction of a Robot Tax. The idea was first proposed by the European Parliament in 2016 for the most sophisticated autonomous robots.[8] After the proposal, the perspective of introducing a Robot Tax and how to shape it have been objects of many politic and academic discussions.[9]

The establishment of a Robot Tax created lots of hype especially about the possibility of attributing legal status to robots.[10] The creation of such a tax would have important consequences on the concepts of *taxable person* that are generally recognised for the purposes of direct and indirect taxation. While there are reasons to think that a tax on robots seems to be motivated by a contingent concern about the sustainability of public finances of European welfare states caused by automation, it is worth asking whether such a radical solution is the best solution.

One of the central arguments for giving robots legal status is the increasing independence and autonomy from their human supervisors. In the most advanced AI techniques (such as unsupervised and reinforcement learning), robots, once programmed, can perceive the environment, and make decisions based on specific goals; they can learn and improve based on experience, without the need for human input.[11]

Proponents argue that giving legal status to robots would not be very different from the creation of the concept of "legal person" for businesses and corporations, which was introduced more than a century ago with the developments of capitalist society.[12] Moreover, the tax legislator, to identify the taxable person, frequently does not follow the civil law concepts and regulations. So, the lack of recognition of a legal status to robot under civil law does not

prevent to attribute such status under tax law.[13]
If robots have ability to pay and should have legal personality, there would be many ways to tax robots.[14] For example, in case the robot is employed by a company and replace human workers, an income tax could be levied on a hypothetical robot's salary. More reasonably, since robots do not actually receive a salary, a lump-sum could be introduced.[15] In both cases, specific tools, such as deductions, should be granted to the owner or employer of the robot to avoid double taxation.
If robots are given legal personality, one might wonder whether robots should also be subject to value added tax (VAT). In the case of VAT, the definition of taxable person is provided at the European level. According to Article 9 of the VAT Directive,[16] a taxable person is any person who, independently, carries out in any place an economic activity, whatever the purposes or results of that activity.
Considering the prospect of taxing robots with vat, the most interesting question would be to determine how and to what extent they can fulfil the condition of "independence" provided for in Article 9.[17]
However, giving legal personality to robots would raise many questions which have been extensively studied in the literature.
One of the most relevant problems would be to provide a legally relevant definition of a robot.[18] Taxes require a specific definition to identify taxable persons, to grant legal certainty to taxpayers. Therefore, to be subject to tax, a robot should be clearly determinable, which is quite difficult when there is no unique definition, neither at the European nor at the international level.[19]
Secondly, even if a clear definition could be provided, it would be difficult to justify in terms of tax neutrality a specific tax treatment of robots and not of other non-physical forms of AI. Tax neutrality requires decisions of firms or individuals to be made on their economic merits and, in this specific case, that businesses using physical application of AI are not treated differently from those using non-physical AI. Indeed, from an economic point of view, there seems to be no reason to treat physical and non-physical IA differently from a tax point of view, given that in both cases personal data are collected, processed, and acted upon by intelligent system. Moreover, also software systems may have access to sensor on the physical world (e.g., cameras) or govern physical devices (e.g.,

doors, lights, etc.).
Thirdly, even assuming that legal personality could be attributed only to robots, it would be difficult to assign the economic benefits deriving from their activities to the robots themselves. The subjects expressing taxable capacity would not be the robots, but their users, i.e., those who derive an economic benefit directly from their activities.[20] Hence, it is more reasonable not to tax the robot but rather the use of such robot by the owner or employer (not a "tax on robots" but a "tax on the use of robots").

2.1.3. Taxing robots beyond legal personality

A tax on robots would be feasible even if they were not given legal personality. This could be achieved through an object tax (e.g., car taxes) or a fee (e.g., business licence). In the first case, the tax would affect the ownership of the robots. It could be based on fixed or flexible rates depending on the type of robot.[21] The second hypothesis seems less plausible. A fee is defined as the compensation to the State for a service or another advantage granted by the latter. In case of robots, it would be difficult to identify the service or advantage obtained by the State.[22]
Finally, it has been suggested that a more comprehensive solution to finance public spending in data-intensive business models would be to increase or introduce new energy taxes.[23] The use of automated processes, including robots, requires the real-time processing and the analysis of large amounts of data, which in turn demand a high level of energy consumption.

2.2. Taxable event

2.2.1. The key role of data

Despite the different applications of AI in business models (e.g., targeted advertising and online searches, self-driving cars, software for translation intelligence, facial recognition cameras etc.), the possibility to obtain value from the use of technology depends on the availability of large amounts of data collected from users or in the physical environment. The availability of big data and technologies enabling intelligent processing and monetisation is profoundly

influencing the production of the value and is becoming an integral part of most digitised business models.[24]
Especially, data collected from online users have become essential for the provision of free services by new platforms intermediaries, such as the supply of cloud service, sharing of digital content, e-commerce marketplaces, or targeted search and advertising.[25] These new intermediaries tend to enjoy a monopoly or oligopoly position, as in information technology services size is usually an advantage, due to well-known aspects of the information economy, such as network effects, small marginal costs, the possibility of packaging and integrating multiple services, the advantage of possessing vast amounts of information. Much information is collected in the context of the provision of services: in online services to consumers a two-way transmission of information takes place, from the provider to the consumer, but also from the consumer to the provider. Computer systems run by providers/traders can observe, verify, and analyse many aspects of a transaction, recording what is typed on a keyboard and the links clicked. Thus, monopolies over the online provision of services tend to become monopolies over the collected data. Yet, although new data-driven models are clearly visible in the "web giants", data have now become an asset also for small and medium-sized enterprises and have become crucial for contemporary economy. This change could call, among others, for the identification of new taxes or new taxable events.

2.2.2. The EU Proposal for a Digital Service Tax

On 21 March 2018, the Commission presented a Package of Measures for the Fair Taxation of the Digital Economy, consisting of a Communication, a Recommendation[26] and two proposals for Directives: the first concerning the introduction of Digital Service Tax; the second regarding the Significant Digital Presence.[27]
In particular, the proposal for a Digital Service Tax (DST)[28] - which was defined by the Commission itself as "provisional" - was oriented towards the enterprises and business models which significantly rely on the contribution of users in the value chain.
As explicitly stated in the DST,[29] the tax applies to revenues generated by the

provision of certain digital services, which are fundamentally characterised by the users' contribution to the relevant activity. Among such services, Article 3, para 1, includes: 1) advertising services, i.e., the placing on a digital interface of advertisement targeted at users of that interface; 2) intermediation services, i.e., the provision of a multi-sided digital interface to users; 3) services of transmission of data collected on users. Hence, according to the European Commission, in the case of the Digital Service Tax the changes in the production chain and the centrality of data and user participation called for the identification of a new tax on the revenues derived from the supply of certain digital services by taxable persons (taxable transactions).

While the tax affects the revenue derived from the processing of user data, not the participation of the users themselves, the tax base is the gross revenue of the enterprise received in exchange for the provision of digital services, net of VAT and other similar taxes.

The underlying principles and rationale of EU Commission's proposal were used for building taxes such as the one introduced by Italy, France, Austria, and the Czech Republic and is one of the first cases in which transactions concerning data are considered taxable operations.[30]

2.2.3. The concept of "value creation"

The identification of new taxable supplies is linked, at the supra-national level, to the impetus that the OECD and the EU have recently given to the discussion on the blurred concept of "value creation" as a driver in the debate on how to tax digital businesses (according to the European Commission one of the main reasons for introducing a Digital Service Tax is that digital business have different characteristics than traditional ones in terms of how *value is created*).[31] The OECD claims that, even though with different degrees, user data contribute to "value creation", whereas the Commission has taken a clearer stance by explicitly recognising that data contribute to "value creation". In more general terms, the concept of "value creation" is gaining importance in tax policy instruments to identify new taxes in the digital economy.

Nonetheless, opinions on this issue diverge. On the one hand, "value creation" is considered by many to be a useful new paradigm for taxation in digital business

models, although not a traditional concept in international tax law.[32] The underlying idea is that the digitisation of the economy has challenged traditional concepts and rules for the taxation of corporate profits in supranational contexts. In this respect, the OECD has clearly stated that changes in the value chain require a better alignment between taxation and "value creation".[33] Consequently, the principle of "value creation" has become iconic for adapting tax systems to the economic models of the 21st century.

On the other hand, it has been observed that, given its vagueness and flexibility - an element that has determined its success in the Member States where it was introduced - the concept of "value creation" would reflect no more than the original cause of income or profit.[34] Therefore, its introduction into national tax systems would not mark a much-vaunted international tax revolution, but rather a more modest evolutionary reform. In this vein, the most significant repercussions would be - as we shall see in the following section - on the allocation of States' taxing rights in the international context.[35]

At the same time, the discussion on "value creation" questioned the role of users in the production chain. It was stressed that monetisation of users' data takes place in different ways and only a few companies are engaged in the direct sale of user data. Users' data as such do not constitute a source of wealth, but rather constitute the basis for AI techniques' ability to aggregate, analyse and build decision-making models, that allow making predictions or determinations based on which services can be offered.[36]

In any case, emphasising the role of users in production chain does not directly imply that transactions between users and society are taxable events or that the provision of free data can be a form of remuneration in kind in exchange for the free provision of services by the digital society. This would mean that every user would have to be considered a taxable person for the supply of data, which would give rise to tax liabilities for all users and thus costs the administration in recovering the tax debt. On the contrary, according to the Authors, the concept has mainly consequences on the identification of the tax nexus.

2.3. Tax nexus

2.3.1. The need for new proxies in direct taxation

As mentioned above, the use of big data and AI has repercussions on the determination of tax nexus, especially in the case of transnational activities. The concept of territoriality is used to identify the principle of levying tax only within the territorial jurisdiction of a sovereign tax authority or country.

In general, while the industrial society was strongly bound to the physical territory by virtue of the presence of production facilities, the digital one is not confined by territorial boundaries.[37] This feature is particularly noticeable in the case of data-driven AI, since the users' data that form the raw material of technologies can be physically located in different jurisdictions.

As already mentioned, both the proposals for a Digital Service Tax and Significant Digital Presence are based on the idea that user involvement should play a role in the allocation of the tax base concerning the profits generated by multinational firms in the digital economy.[38]

Under the existing rules dealing with the taxation of transnational activities, business profits are primarily taxed "at source", if there is a sufficient link between the economic activity generating the profits to be taxed and the territory where the income arises. In this regard, the concept of "permanent establishment" is crucial and is generally accepted as a criterion for the exercise of taxing rights by States other than the State of residence.

Digitalization allows businesses to "scale" globally across different countries and to be involved in the economic life of these countries without having significant physical presence ("mass") in these countries.

However, the digital economy has challenged the taxation of business profits at source because of several reasons. First, technology has facilitated the phenomenon of cross-jurisdictional scale without mass, in which businesses grow globally across different countries without having significant physical presence there.[39] Second, activities of an ancillary nature in traditional economic models (e.g., data storage and information processing) have become the core elements of the business model in the digital age. Such services are generally provided from a single country to many different jurisdictions (e.g., cloud service). Finally, users provide data that contribute to the production and profit of the enterprise.[40]

In this case, the value generated by users' data could be located at least in three

different places: the place of data collection (i.e., the place where data sources are located), the place of data processing, and the place of the company creating the system for data processing and analysis.
These key role of users in AI-powered business services implied taxation to be at least partially allocated to the market jurisdiction. Consequently, international tax law should attribute increasing importance to destination-based taxation, which should be identified where the user of the good or service is located. In fact, the jurisdiction where the user is located grants means of communication, legal and technical infrastructure from which service providers benefit.[41]
Among other initiatives, the European Commission's proposals, followed by part of the doctrine, have suggested the use of the concept of "digital presence" to justify a shift of taxing rights to market countries in double taxation treaties.[42]
This perspective could materialise with an amendment of the Model Tax Convention with a new paragraph in Article 5 or a stand-alone article on "digital presence" that would provide proxies for determining when a company has sufficient economic integration in a certain jurisdiction.[43]
The place where the user is located is the place where the device is when he or she accesses the digital interface to receive the service.

2.3.2. The Italian case of a Digital Service Tax

Following the European Commission's proposal for a DST, several European countries have adopted national legislation introducing taxes on digital services. Such taxes also take into consideration the concept of territoriality.
For example, in the Italian case, the territorial scope of the tax is determined in relation to the customers. The tax is applied to revenues received from operations carried out by resident and non-resident subjects, regardless of the place where the contract is concluded, when the user is located on the Italian territory and this location is confirmed via the IP address of the user's device or any other geo-localisation method.[44]
For each taxable service, there are specific rules for determining whether a user is in the Italian territory in the relevant tax period.[45]
There has been some criticism of this approach. On the one hand, the territorial linkage criteria envisaged would fail to effectively link the taxation (which applies

irrespective of nationality) and the community that the tax is supposed to finance.[46].

On another hand, the need to also consider qualitative factors, such as certain thresholds of users' base size (in terms of number of users or devices) and activity (e.g., in terms of clicks and attendance per user, intensity of use), was highlighted.[47]

The existing debate makes it clear that in the complex world of digital activity, it is hard to identify precise criteria for establishing a link or meaningful approximations between an economic activity and a certain territory.

2.3.3. The place of supply in Value Added Tax

VAT has undergone a radical metamorphosis over the past two decades.[48] For the purposes of this paper, it is particularly relevant that the provision of intangible goods and services has become increasingly important compared to the provision of tangible goods. Since different rules apply to determine the place of supply of services and the supply of goods, many problems in the qualification of certain operations as supplies of goods or services have arisen concerning the territoriality of VAT.

Differently from the field of direct taxation, both the OECD and the EU agree that the most appropriate system to ensure the effective taxation of consumption is the destination principle. In fact, according to the prevailing opinion, while direct taxes tend to be taxed at source, indirect taxes on consumption (such as VAT) are usually taxed in accordance with the destination principle. In the digital economy, the importance of the principle of destination was already marked by the European Commission with Directive 2008/8/EC, which introduced the destination principle for the de place of supply of telecommunication services, TV-radio diffusion and the B2C electronic services.[49]

The application of VAT to digital businesses was the topic of a study conducted by an expert working group appointed by the European Commission in 2014. In the final report, the experts argued that there is no need to subject digital enterprises to special legislation, but rather an adaptation of the existing rules is needed to ensure similar treatment between non-digital and digital enterprises.[50]

However, the main difficulties in applying VAT to economic transactions powered by AI concern the concrete payment methods at the place of consumption. These arrangements should not place an undue burden on suppliers.[51] A further difficulty is the qualification of the relevant transaction as a supply of goods or services on which the determination of territoriality depends.

3. Artificial Intelligence for tax law

While various proposals have been put forward to adapt tax concepts and rules to AI-powered business models, AI technologies have attracted a lot of interest due to their potential applications in tax procedures.

Many of tax-related activities underlying enforcement of tax law are to a large degree repetitive and time-consuming works: data collection, analysis and comparison, retrieval of factual and legal information, case-based decisions etc. Taxpayers as well need to collect data, audit records, and transfer data to tax system, prepare tax filing and tax accounting entries, etc. These activities can be regarded as input-output data procedures: based on certain information (corporate ledger, transactions, contracts, assets, properties, existing rules, fact of the case etc.), an expert human (tax administration employee or tax professional) makes a determination that might have some legal consequences under tax law (pay tax/not pay tax, tax rate, legal interpretation, evasion, anomaly pattern, etc.). Because of these characteristics, tax management has soon become a candidate domain for the application of AI research.[52] As early as the 1970s, tax law had been selected as one of the domains where first applications of knowledge-based systems were developed. These were sc. "expert systems", end-to-end software that would operate using a "knowledge base", a set of specialised information relevant to the particular domain, and inferential engine (procedural algorithms) that enabled the system to solve the problems connected to its task. The first example of expert systems developed in this first stage was Taxman.[53] The system, developed to test the consequences of certain corporate reorganisation transactions, was able to apply a complete set of statutory rules and concepts to a specific case in order to classify it for corporate tax purposes. Other systems were Taxman II (1979), TaxAdvisor (1982), Expertax (1986), Investor (1987).

As of the 2000s, rather than giving knowledge and rules to computer systems, AI research started to build systems from a great quantity of raw data. Based on such data, the systems themselves can construct implicit knowledge and apply such knowledge to new cases. These developments have been enabled by great advancements in probabilistic theories and statistical models, and by the increasing proliferation of machine learning research. This has led to a number of successful applications in many sectors—ranging from automated translation to industrial optimisation, marketing, robotic visions, movement control, etc.—and some of these applications have already had substantial economic and social impacts.

In taxation systems, AI and machine learning provide several possibilities.[54] Two applications are particularly relevant.

The first is predictive analytics. In this domain, AI and machine learning algorithms are used to extract patterns from large amount of data and to make predictions and assessments for different tax purposes, considering a much larger set of features.

The second is natural language processing (NLP). This provides techniques to program computers so that they can process and analyse large amounts of natural language data (including complex legal texts such as contracts, treaties, legislation, judgements) and give responses that humans can easily understand.

Against this background, the present section explores first how AI is applied in tax systems, both facilitating voluntary tax compliance and tax administrations' assessment and control procedures. Then, it reviews some legal challenges to ensure the lawfulness and fairness of the of AI use in tax systems.

3.1. AI for taxpayers

In tax compliance, AI applications are employed for 1) enhanced tax law cognition, 2) tax accounting, 3) tax requests and case predictions.

3.1.1. Tax law cognition

Legal cognition covers the practices aimed at establishing the law applicable to taxable operations. Nowadays, taxpayers are frequently confronted with a complex tax law environment where the retrieval and interpretation of rules is increasingly difficult because of many reasons, included the need to comply with supranational regulations.

In this field, AI provides promising applications to make tax law more accessible

and more easily comprehensible to taxpayers. For example, in the US, companies that must navigate the increasingly complex US Tax Code can use AI tools to track tax rates and calculations for multiple tax jurisdictions.[55] An example of such tool is Intuit Inc. which provides an application called Tax Knowledge Engine (TKE) helping users streamline tax preparation. The system delivers answers tailored to each taxpayer by gathering correlating more than 80.000 pages of US tax requirements and instructions based on an individual's unique financial situation. The implementation of such a tool demonstrates the awareness of the State on the possible usefulness of AI technologies in improving taxpayers' knowledge of the law.

AI software for legal cognition is also provided by large accounting firms. For example, KPMG has reported using IBM Watson to help clients secure R&D credits.[56] With the application, users can upload thousands of documents and analyse structured and unstructured data at rapid speed to help identify projects that are eligible for credits, using NLP to understand the economic context.[57] In Belgium, Deloitte has developed a chatbot that is capable of providing first-hand EU VAT advice, taking into account the place of supply rules, exemptions, domestic rates, etc.[58] Chatbot applications, powered by NLP and machine learning, are said to profoundly affect the accessibility for taxpayers to the law. Especially, the emergence of deep learning-based Q&A systems and speech-based virtual assistants are likely to empower taxpayers in addressing client-specific tax questions.[59] Even though according to the Authors chatbot applications cannot substitute human advises especially in complex matters, for example those entailing open clauses, they could be useful in easy cases and for problems which are frequently raised by taxpayers, as in the last scenario they could provide answers leaving interaction with lawyers and advisors for more complex issues.

3.1.2. Tax accounting

In the field of tax accounting is AI provides the promising applications which are quite different and cover a vast range of needs. For example, AI can be used for extracting critical data from tax documents and classify tax-sensitive transactions.[60] Intelligent algorithms can be used to identify assets that are incorrectly booked in the company's accounts based on historical classifications made by human employees.

Deloitte accounting department provides AI-powered solutions for a variety of

tax purposes. It developed a tax analytics application which analyses the company's tax obligations related to employees, and by analysing and aggregating the data, allows the company to manage its tax position. The tool is pre-loaded with curated knowledge including—business rules, training data, and a dictionary so that the machine understands the relevant terminology. For example, the firm uses natural language generators in its tax practice to provide targeted financial advice.[61]

Furthermore, Deloitte provides a service that consists of recovering refunds related to indirect taxes, such as sales taxes or VAT. For such purposes, Deloitte employs CognitiveTax InsightTM (CogTax), which can analyse the full population of accounts payable transactions by applying optical character recognition (OCR), machine learning algorithms, and analytics to identify over-payments and reduce the potential for over or underpayments in the future.[62]

As in the previous case, even if AI tools cannot probably completely substitute humans especially in relation to complicated issues, they can speed up processes automating easy tasks. For this reason, especially big accounting firms, are investing both in economical and advertising terms on the use of AI technologies.

3.1.3. Tax case prediction

Another field of application of AI that has recently developed concerns the prediction of judicial decisions in tax matters. Such applications are included in the field of "predictive justice".[63] This involves data analytics, machine learning and NLP techniques to analyse large amounts of judicial decisions and make predictions about the outcome of legal cases.

One of the seminal applications in this domain is the Blue J project created from a partnership between industry and researchers. The group has developed an AI application which provides taxpayers with answers on routine legal issues which arise in the Canadian tax law courts.[64] The system is able to classify workers either as self-employed or as employees for income tax purposes by looking at how the courts interpreted the law in the past.[65] The researchers used the 600 cases under Canadian law to develop a predictive system that maps trends in case law and anticipates tax authority interpretation.[66] The system was also equipped to make predictions relative to other types of problem (such as whether an individual is resident or not for tax purposes; whether the expenses related to work space in the home are deductible or not etc.). Even if research on this issue

appears promising and raised a certain interest in academic discussions, some issues are still open. As it has been noticed in relation to Blue J project, for example, the system does not provide satisfying results in relation to anti-abuse clauses.[67]

Another example is provided by the Italian research project LAILA (Legal Analytics for Italian Law) funded by the Italian Ministry of Research. The project is currently addressing the application of methods of legal analytics (LA) to a vast and diverse set of legal information: legislation, case law, and empirical legal data. It applies AI to infer undiscovered relationships and make data-driven predictions in the fields of tax law. At present, the research group is working on Italian case legal prediction on VAT tax law (the authors of this paper are members of the University of Bologna research group).[68]

Applications of predictive analytics, including in the tax domain, are also taking ground in the industry of legal tech, especially in the US. Some analytics companies are focused on understanding procedural aspects of courts (e.g., how long it takes for a judge to decide or how frequently they decide in favour of a certain category of litigants) or offering more specific services, such as outcome prediction, best litigation strategies, case law retrieval, and arguments mapping. Among such services are Bloomberg Law, Premonition, Lex Machina, LexisNexis.[69]

Even though these applications do not provide totally satisfying results yet, and hence cannot be used massively by taxpayers now, research are ongoing. In case they were reasonably accurate they could be useful, for example, for predicting whether it makes sense to appeal a certain decision. Nevertheless, the accuracy of the prediction still depends on the quality of the previous decisions and in some jurisdictions, such as Italy, the case-law of the tax judiciary is not always homogeneous.

3.2. AI for tax authorities

Besides supporting taxpayers in compliance procedures, AI applications are increasingly assisting tax authorities across a wide range of operational activities. Tax authorities have started to employ AI in (1) tax audit and fraud detection and in (2) tax payment and debt management. Other AI applications are used (3) by tax authorities and governmental actors for better policymaking.

3.2.1. Tax audit and fraud detection

Tax controls involve purely formal checks based on data and elements that can be directly deduced from the tax declaration, and more complex procedures. Among the latter, tax administrations perform (1) checks on the data in the declaration against other data which allow to presume the correctness of the data declared (such as those present by other taxpayers or collected by other tax authorities) and (2) tax investigations by means of inspections, audits and requests of information aimed at detecting tax evasion or fraud.

Traditionally, tax controls have taken an *ex-post* approach in the form of auditing. A tax audit is the examination of an organisation or individual's tax return to verify that financial information is being reported correctly and in compliance with the applicable law. Today, AI application can help tax administrations efficiently allocate resources for tax audits and control. In particular, it allows to prioritise certain controls based on the probability of actual non-compliance with tax law rules, and to detect tax fraud schemes.

A 2016 OECD survey showed that many tax administrations deploy AI to prioritise cases for investigation, audit or other compliance intervention.[70] According to the survey, generally, AI is used to analyse previous taxpayers' or evaders' data to identify hidden relationships or potentially high-risk tax non-compliance networks. For example, the Norwegian Tax Authority uses data analysis and machine learning techniques to improve efficiency in the selection of the cases to be inspected. The algorithm is trained with historical data to predict the possibility of non-compliance in VAT return. Each case is assigned a score and tax officials begin inspecting taxpayers with the highest scores. The more declarations are audited, the more data the algorithm will obtain for using it in the model, thus improving its accuracy.

Besides using AI for audit prioritisation, tax authorities employ data analytics and machine learning techniques to detect tax fraud cases.[71] For example, the Irish and the Dutch tax administrations have experimented with unsupervised techniques. These techniques represent a sectorial application of the broader cluster analysis through which it is possible to identify groups of taxpayers who are similar to each other in some significant respects, and dissimilar to the other groups identified.

The Belgian Government deploys an AI system that looks for fraud patterns in large amounts of data to detect corporate residence fraud. This type of fraud

occurs when companies deceitfully attempt to place their residency in a low-tax country in order to avoid paying the higher taxes of their real location. The data consists of two types of records: on the one hand, structured data on the Belgian companies (sector, city, etc), on the other hand, transactional data (invoicing logs) between Belgian and foreign companies.

Another application of automated analysis of fraud detection was supported by the Federal Ministry of Finance in Germany in a 2016 amendment of German Tax Law.[72] The reform has introduced a "fully automated procedure" for risk management, which allow the German tax authority to detect risk-fraught cases, and thereby to prevent tax evasion. The fully automated procedure is based on the data provided by the taxpayer, on the information already available to the tax authorities, and on data transmitted by third parties to the tax authorities. It is intended to ensure an appropriate risk of detection and corresponding verification possibilities, by automatically filtering out cases involving significant risk and submit them for comprehensive examination by public officials

3.2.2. Tax collection

Besides formality and substantive checks, tax administrations are in charge to secure correct and timely tax filing and tax payment. Especially, tax payment management is needed either in the case where tax evasion is previously detected and a sanction is imposed, or in the case where tax return is correct, but the taxpayer is insolvent. To secure tax collection, tax authorities can use AI in different way.

For example, the HMRC implemented a programme of risk modelling and experimentation that detect taxpayers who are likely to fail to meet filing obligations. The model uses supervised machine learning to predict taxpayer most likely to miss filing deadlines and target interventions to encourage compliance. Such application is based on profiling UK citizens behaviours to detect those that, based on their personal information and lifestyle, are most likely to incur in. It uses nudge theory to improve governments policy and services.[73]

On a similar line, in the field of taxpayer management, AI applications have been developed to support taxpayer services. These include the use of pro-active messaging, calling, information and consulting services to enhance the probability of taxpayers' complying with tax law.[74] One particularly innovative

service is provided by Singapore tax administration, where the text of incoming customer email is analysed with NLP to classify and gain insights into the content of taxpayers' inquiries.[75]

3.2.3. Tax policy evaluation

Although most applications are today employed to support operational decision-making of tax authorities, AI can be used also by authorities and other governmental bodies for tax policymaking. The most common applications in this field are (1) tax gap measurement and (2) tax policy change prediction.

Regarding the former, AI has been applied to carry out tax gap analysis considering large quantities of taxpayers' data. Analytics techniques allow tax administration to visualise what are the most problematic non-compliance tax issues, depending on the tax evaded, the geographical location of tax evasion, and potential patterns in tax fraud schemes. Such analysis provides insights that are actionable in new tax policies or tax law drafting.[76]

In tax policy domain, tax administration and governmental bodies can use AI and big data analytics to gather fine-grained insights into the behaviour of taxpayers in order model the predicted impact of candidate tax rules. For example, predictive analytics allow regulators to construct more precise laws tailored to individuals' circumstance, as well as to communicate directly to them.[77] AI techniques have been also employed to predict the amount rate of tax collected to improve government social welfare planning and optimal taxation for better social welfare.[78]

3.3. Legal challenges

As many public factsheets and industry reports show, the perspective of using AI in the tax system is likely to bring a lot of advantages to the tax system. Indeed, AI and related technologies allow for faster and more automated analysis of large amounts of data, reducing errors and saving time. However, such developments may come with corresponding risks, especially for privacy, fairness, transparency of tax assessment and collection procedures. Such risks are already partly addressed by current regulation, among which a prominent role is played by the General Data Protection Regulation (henceforth GDPR).[79] The GDPR is a general framework applicable to all natural and legal persons that process

personal data; it provides individuals with a series of ex-ante transparency rights before in order to control the access to personal data and ex-post actionable rights, while also imposing on data collectors a series of obligation to ensure that personal data are processed in the respect of citizens' fundamental rights.
In addition to that, due account should be given to the recent legislative developments in the field of AI. On 21 April 2021, the European Commission issued a proposal to regulate AI system in EU.[80] The proposal takes on a risk-based approach outlawing specific AI practices and providing a detailed regulation for high-risk systems. Crucially in this category, AI systems employed in tax law enforcement have been excluded, as made explicit in Recital 38.[81] This choice needs to be carefully considered.
The paragraphs that follow are limited to a review of some legal challenges that shall be considered in the prospect of using in tax systems.

3.3.1. Privacy and data protection

A crucial factor that determines the lawfulness of the use of AI technologies in tax law is the right balance between the tax administration' needs to have data concerning taxpayers and the privacy and data protection laws.[82] Indeed, many current AI applications for tax law involve the processing of personal data of taxpayers or of taxpayers' clients who are natural persons. There are multiple synergies between AI and taxpayers' data. On the one hand, taxpayers' data contribute to the datasets used by learning systems to draw knowledge from it. On the other hand, such models can be applied to taxpayers' personal data to draw inferences concerning them, such as the systems assessing the risk of non-compliance. In both cases, when the data concern natural persons, it is necessary to consider the GDPR.
The GDPR covers cases where taxpayers data are processed, regardless of whether they are disclosed by taxpayers or are collected by tax authorities from other sources, such as other data controllers or other authorities. The last two scenario are quite frequent in the field of tax law[83]. The GDPR applies to taxpayers' data, as long these can identify a natural person or render them identifiable and require tax authorities who process personal data to limit processing to one of the six conditions in Article 6. Letter e) is relevant for the tax law sphere. It states that

data processing is lawful when necessary for the performance of a task which is carried out in the public interest or in the exercise of official authority vested in the controller. Art. 6(3) establishes the need for a legal basis which shall be laid down by either by Union or Member state law to which the controller is subject and which shall be proportionate to the legitimate public interest aim pursued. Hence, this provision leaves to the member States the choice on how to balance taxpayers' rights and the exercise of tax administration tasks, within the limits of proportionality.

Tax authorities employing AI in tax system should also be compliant with the GDPR provisions on profiling and automated decision-making.[84] Article 22 provides for data subject's right not to be subject to a decision based solely on automated processing, including profiling. The prohibition[85] applies to all the cases where personal data are used for profiling taxpayers and automated systems are used to take some decision which produces legal effects or similarly significantly affects the data subject. This might apply when the tax decision is binding on the data subject or creates some legal obligations (e.g., where the taxpayer does not challenge it, if he or she does not comply with it, the tax assessment notice can be enforced by the relevant authorities), but also if it produces effects that «*similarly significantly affect[s]*» the taxpayers. The "significant" element is rather vague, and Article 29 Working Party has identified possible categories of decisions which can be considered such.[86] They include decisions affecting someone's access to health services, to education, decisions denying someone an employment opportunity or put them at a serious disadvantage and decisions affecting someone's financial circumstances. Even if the tax assessment notices affect the financial circumstances of the data subject, and, as such, Article 22 would apply,[87] the prohibition of automated decision-making, including profiling, is not absolute, and allows for important exemptions. Among the exemptions provided by Article 22, para 2, the authorisation by Union or Member State law will most likely offer safe grounds for the activities carried out by tax administrations and taxpayers employing AI systems. Moreover, Article 23 explicitly provides for derogations to the obligations and rights provided for in Articles 12 to 22 and Article 34, as well as Article 5 in taxation matters. However, as mentioned in Article 22 and more clearly in Article 23 GDPR, legislative initiatives restricting the prohibition of

Article 22 must respect the essence of the fundamental rights and freedoms and must be a necessary and proportionate measures.[88]
In Italy, Italian Privacy Regulation has been recently modified[89] to include the prevention and fight against tax evasion between the processing "necessary for reasons of substantial public interest" which allows for a limitation of the GDPR guarantees, thus providing for a balance between tax administration' needs and taxpayers rights whose adequacy and proportionality has not been assessed by Courts yet.

3.3.2. Transparency

Article 22 GDPR provides a series of safeguards when data controllers legitimately use forms of automated decision-making. Among the latter, one of the most relevant and highly debated in the literature is the right to explanation, to achieve transparency and accountability in automated decision-making.
The ability of AI systems to provide a rationale for decisions is essential in tax investigation and controls. Its importance is underlined by the fundamental right to a fair trial that applies also throughout the entire tax procedure.[90] This means that taxpayers must be allowed to effectively review the information on which the tax authorities base their decisions. For example, the taxpayer should be entitled to know the legal factors used to decide on an application of the tax law and the logic behind the AI model to be able to fully understand how the tax decision was reached. Otherwise, the taxpayers' ability to challenge the administrative decision and deliver evidence against it will be frustrated.[91]
The right to challenge the decision provided by AI systems is particularly important in determinations based on predictions. Indeed, the problem of the compatibility of using predictions to determine the amount of the tax obligation and fines with the procedural guarantee of taxpayers is not new. The issue is reminiscent of the questions of legitimacy that have been raised, for example, in Italy on the use of inductive methods to calculate the tax base.[92]
While a large debate has arisen concerning the extent to which the GDPR actually provides a right of explanation to users, it must be recalled that such a safeguard is anyway not explicitly foreseen when automated decision-making is allowed by Union law or Member States' law. This may entail that from the

GDPR it cannot be deduced that such requirement of transparency applies when AI systems are used by tax authorities allowed by Member State's law. Initiative must be taken at Member States' level.[93]

The problem of transparency in AI has been more extensively addressed in the recent proposal for an AI Act. The proposal reiterates the importance of transparency in the use of AI systems, in a new 'by design' perspective. Article 13 imposes several requirements for high-risk systems to be «*sufficiently transparent to enable users to intercept the system's output and use it appropriately*». These include, e.g., the intended purpose, level of accuracy, reasonably foreseeable misuse, which may lead to risks to the health and safety or fundamental rights etc. However, as mentioned above, Recital 38 exclude AI systems used for tax law enforcement from the category of high-risk system, which might affect the possibility of taxpayers to challenge the determination of tax authorities.

3.3.3. Fairness

Besides transparency, a key issue for ensuring fair use of AI in both tax compliance and tax control is that the automated determinations do not lead to discriminatory outcomes.

The prohibition of discrimination in conjunction with protection of property under the ECHR requires the tax authorities to deliver tax decisions in a non-discriminatory fashion, i.e., not to treat the taxpayers differently without objective and reasonable justification. According to relevant case law, the difference in treatment of taxpayers is permissible insofar as it appears both suited for realising the legitimate aim pursued by the tax administration, and necessary from its context.[94] In respect of tax law, it would be prohibited to treat taxpayers differently based solely on an attribute or set of attributes that are irrelevant for an application of concrete tax provisions, such as race or gender.

Such discriminatory tax treatment, however, may follow from undesired results of AI models. These have a tendency of suffering from bias, which may be a consequence of the imbalanced datasets that was used for training. This may lead to situation where an AI system grounds its decision on prohibited features (such as in the case of discrimination based on race, ethnicity, or gender) or on features that are not relevant for the decision at hand. There is a risk of the system

providing incorrect determinations, potentially because the available training data were too broad (including personal information not related to tax purposes) or too little (such as in the case, where only data about previously inspected, female taxpayers are used to build the model). Thus, another challenge emerges for AI deployers in tax domain – gathering substantial data which do not contain any bias and are capable of providing robust and reliable models.

3.3.4. Accountability and oversight

The use of AI technologies in taxation also brings up problems of who can be held responsible if the determinations of an AI tax system are wrong. This could happen when the administration or the system used by taxpayers errs in determining taxpayers' obligations.

The question acquires great significance in the case of AI systems used by tax administrations. In almost all tax legal systems, the principles of administrative law apply. Among this, the principle of accountability requires that there must always be a person in charge and responsible for an administrative decision. This principle demands that citizens shall be always able to know to whom they can seek redress in the case of a wrongdoing of the administration. In this regard, it has been observed that such principle would entail that there is always a human-supervisor responsible of machine determination, for which they remain responsible.[95]

In the field of taxation, the principle of accountability requires that taxpayers have the right to have an automated decision reviewed by a human. To effectively use such right, however, the taxpayer must first know how the AI model reached the decision. This reveals an interplay between the right to explanation and the right to human intervention – the latter cannot effectively be used without the former. Indeed, the right to obtain a human intervention in algorithmic decisions is one of the key ideas behind the proposal for an AI Act. Article 14 of the Proposal requires that high-risk AI systems «*shall be designed and developed in such a way, including with appropriate human-machine interface tools, that they can be effectively overseen by natural persons during the period in which the AI system is in use*».

Concerning the actual feasibility of human-in-control requirements, however,

due account must be taken of the fact that human supervision will be very difficult to realise in practice. Intuitively, it is highly unlikely that the human supervisor will take distance from the decision made by the AI system when aware that he or she is responsible for the final determination. Such a situation would raise a kind of dilemma: if the human supervisor thinks the decision of the machine is correct, the machine will have determined the outcome of the decision; if the human thinks the determination of the machine is wrong, he will not depart from it because of the risk of being held responsible and in this case too, the machine will have determined the outcome of the decision.

3.3.5. Prevent illegal actions

As it can be used to enhance voluntary tax compliance, AI technologies can also be misused to bypass the tax national or international rules, thus unfairly diverting resources from governments. For example, an AI system could be used to pinpoint uncertainties in tax legislation to exploit them and unlawfully optimise tax obligations. It could be used for statistical purposes to calculate the benefits of a certain tax avoidance scheme and the risk of performance of tax audits, or it may facilitate questionable practices of transfer pricing.[96] Therefore, questions should be raised as to what is required from regulatory standpoint to ensure that AI is not used by taxpayers to cheat and bypass the law, and to what extent some kind of oversight should be secured in the future.

4. Conclusion

In this paper, we have provided an overview of the most pressing challenges in the world of tax law arising from the use of AI. We have tackled how AI is reshaping the production process and the value chain and put into question traditional tax legal concepts. Furthermore, we have reviewed current and promising applications of AI for voluntary tax compliance and tax law enforcement.

As far as the first part is concerned, regarding the concept of taxable person, the paper has presented the ongoing debate concerning the perspective of attributing legal status to robots. Such perspective seems motivated by the need to counter the effects of automation of human tasks and to sustain national economies.

Nonetheless, the lack of a definition of robots and the difficulty to impute them an ability to pay --and not to the owner or the user-- calls for an alternative solution.

There is a hype at the international level on the new concept of "value creation" to justify the introduction of new tax rules in the digital economy. However, it seems that the concept is of great importance for the allocation of taxing rights at supranational level and is motivated by the political will to share the profits of digital multinational companies differently.[97]

The brief discussion concerning tax nexus could be an interesting starting point for thinking about the concept of territoriality in more general terms.

While the risks that AI poses to the sustainability of tax system shall neither be downgraded nor neglected, the second part of the paper argues that it is similarly important to consider the other face of AI, namely, the opportunities that the technology offers to tax systems. The assumption is that AI may help tax systems to counter the risks that AI and the broader phenomenon of digitisation poses to fair taxation and tax collection and strengthen their position relatively to unfair tax evasion practices.[98]

While this change takes place, however, a set of challenges must be duly considered to balance the efficiency of tax administration with individual taxpayers' rights.[99] We have explained what we consider the most important challenges: data protection, transparency in decision-making, fairness in AI determination, oversight and accountability, and prevention of unlawful AI uses. Many of these challenges are already addressed in the GDPR and are about to be regulated by the Proposal of AI regulation. However, while the first provides broad exemptions to data protection rights in the use of AI for public purposes (such as in the enforcement of tax law), the second does not even consider AI systems used in tax law as a source of concerns. A new course of action should be set to include tax law in the discussion.

Several actors must play a role and make a significant effort in this direction. First and foremost, domain experts should initiate an inter-disciplinary dialogue between public administrations and computer engineers. Researchers and academics should also strive to ensure that cutting-edge AI technologies work at the service of tax administration and taxpayers and do not infringe on individual taxpayer's rights and guarantees.

1. Although the contribution is due to the inseparable work of the two authors, Section 2 is attributed to Alessia Fidelangeli and Section 3 to Federico Galli. Section 1 and 4 are the result of a joint discussion.
2. According to OECD statistics, 14% of jobs are highly automatisable while 32% would face substantial changes because of automation. In 2015 OECD signalled that, because of massive use of robotic equipment, multinational enterprises would reduce their manufacturing activities offshore because of lower labour costs and that they may consider moving where consumers are.
3. A. Uricchio, *Intelligenza artificiale e diritto - robot tax: modelli di prelievo e prospettive di riforma*, in *Giur. It.*, Issue 7, 2019.
4. E. Brynjolfsson and A. McAfee, *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, WW Norton & Company, 2014.
5. According to a study made by Frey and Osborne, 47% of jobs are at risk because of automation while 53% would be at risk in Europe (C. B. Frey and M. A. Osborne, *The future of employment: How susceptible are jobs to computerisation? Technological forecasting and social change*, Volume 114, Issue C, 2017).
6. M. G. Lexer and L. Scarcella, *Artificial intelligence and labor markets. a critical analysis of solution models from a tax law and social security law perspective. Rivista italiana di informatica e diritto*, Issue 1, 2019.
7. OECD, *Taxation, Innovation and the Environment*, 2010.
8. European Parliament, *Report with Recommendations to the Commission on Civil Law Rules on Robotics*, (A8-0005/2017). In 2017, also Bill Gates proposed a robot tax according to which robots should be taxed at the same level as humans performing the same tasks to preserve tax systems during the first stage of automation.
9. A. Uricchio, *Intelligenza artificiale e diritto*, (see note 3); M. G. Lexer and L. Scarcella, *Artificial intelligence and labor markets*, (see note 6).; X. Oberson, *Taxing robots? from the emergence of an electronic ability to pay to a tax on robots or the use of robots. World Tax Journal*, Volume 9, Issue 2, 2017; V. Ooi and G. Goh, *Taxation of automation and artificial intelligence as a tool of labour policy. SMU Centre for AI & Data Governance Research Paper*, Issue 2, 2019.
10. The possibility of attributing legal personality to robots was not included in the final version of the Report voted by the European Parliament in February 2017. However, such a perspective has been taken into consideration in the 2017 European Parliament Resolution on Civil Law Rules on Robotics. The latter establishes that "creating a specific legal status for robots in the long run, so that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently".
11. A. Uricchio, *Intelligenza artificiale e diritto*, (see note 3) where the author stresses the importance of differentiating between "weak AI" and "strong AI" and highlights the fact

that the Proposal focuses on smart robots.

12. X. Oberson, *Taxing robots?*, (see note 9).
13. A. Uricchio, *Intelligenza artificiale e diritto*, (see note 3); G. A. Micheli, *Soggettività tributaria e categorie civilistiche*, In *Opere minori di diritto tributario. Vol. I - Il processo tributario*, Giuffrè, 1982.
14. W. Weismann. *How robots will kill tax administration and the funding of social insurance - part ii. Employee Benefit Plan Review*, Volume 69, Issue 10, 2014.
15. X. Oberson. *Taxing robots?*, (see note 9).
16. Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax.
17. X. Oberson, *Taxing robots?,* (see note 9).
18. *Ibid.*
19. N. Nevejans, *Les robots: tentative de definition, in les robots, objects scientifiques, objects de droit*, étude commandée par le Parlement européen (commission des affaires juridiques), PE 571.379, 2016. The common element in the existing definitions is the use of AI techniques that allow the machine sufficient autonomy and the ability to learn progress and make decisions. See also, X. Oberson. *Taxing robots?, cit.*
20. X. Oberson, *Taxing robots?,* (see note 9); M. G. Lexer and L. Scarcella, *Artificial intelligence and labor markets*, (see note 6).
21. X. Oberson, *Taxing robots?,* (see note 9).
22. *Ibid*.
23. E. Frey, *Wertschöpfungsabgabe: Abtauschen statt blockieren. Der Standard*, 21/08/16 at https://www.derstandard.at/story/2000043151671/wertschoepfungsabgabe-abtauschen-statt-blockieren.
24. OECD, *Tax Challenges Arising from Digitalisation - Interim Report 2018.*
25. For example, according to Google Privacy and Terms when a User upload, submit, store, send or receive content to or through its Services, it gives Google (and those who work with) a worldwide license to use host, store, reproduce, modify, create derivative works [...], communicate, publish, publicly perform, publicly display and distribute such content. Even though the terms and conditions specify that data are used with the aim of providing customised services, the vagueness of the terms used as well as the fact that also the use for economic purposes could fall within the definition when customised, leave the question open about the real use of data. This is confirmed by the fact that many of the services offered are for free while, at the same time, many of the activities from which GAFAM (Google, Apple, Facebook, Amazon, Microsoft) obtain income, such advertisements are much more effective when much information from users and AI technologies are available
26. The Recommendation proposes to the Member States the amendment of the conventions against double taxation with third jurisdictions to extend the concept of permanent establishment to the "significant digital presence".
27. European Commission, *Communication from the Commission to the European Parliament*

and the Council Time to establish a modern, fair and efficient taxation standard for the digital economy, COM(2018) 146 final. For a comment, see J. Sinnig. *The reflection of data-driven value creation in the 2018 OECD and EU proposals*, in *EC tax review*, 27(6), 2018.

28. European Commission, *Proposal for a Council Directive on the common system of a digital services tax on revenues resulting from the provision of certain digital services* COM(2018) 148 final.
29. The proposal has not yet become a directive.
30. See, e.g., for Italy, Article 1, para. 35-50, l. n. 145/2018.
31. OECD, *Tax Challenges Arising from Digitalisation - Interim Report 2018*; European Commission, *Commission recommendation of 21 March 2018 Relating to the Corporate Taxation of a Significant Digital Presence*, C(2018) 1650 final; European Commission, *Proposals of the European Commission on the introduction of Significant Digital Presence and a Digital Service Tax*, COM(2018) 147 final.
32. W. Schön, *Ten questions about why and how to tax the digitalized economy*, in *Bulletin for International Taxation* (IBFD-Bulletin), Volume 72, Issue 5, 2018; M. Olbert and C. Spengel, *International taxation in the digital economy: challenge accepted*, in *World tax journal*, Volume 9, Issue 3, 2017; N. Braun Binder, *Ai and taxation: Risk management in fully automated taxation procedures*, Springer, 2021.
33. OECD, *Tax Challenges Arising from Digitalisation - Interim Report 2018*.
34. J. Schwarz, *Value creation: Old wine in new bottles or new wine in old bottles?*, in *Kluwer International Tax Blog*, August 2018); M. Sapirie, *Permanent establishment and the digital economy,* in *Bulletin for International Taxation*, Volume 72, Issue 4a, 2018.
35. J. Becker and J. Englisch, *Taxing where value is created: Whats user involvement got to do with it*?, in *Intertax*, Volume 47, Issue 2, 2019.
36. *Ibid.*
37. A. Uricchio, *Intelligenza artificiale e diritto*, (see note 3).
38. European Commission, *Communication from the Commission to the European Parliament and the Council Time to establish a modern, fair and efficient taxation standard for the digital economy*, COM/2018/0146 final, paras. 1, 4, and 9.
39. J. Becker and J. Englisch, *Taxing where value is created,* (see note 34); A. Uricchio, *Intelligenza artificiale e diritto*, (see note 3).
40. According to the OECD, digitisation has reshaped the role of users, allowing the possibility for them to become increasingly involved in the value creation process (OECD, *Tax Challenges Arising from Digitalisation - Interim Report 2018*).
41. J. Becker and J. Englisch, *Taxing where value is created*, (see note 34); W. Schön, *Ten questions about why and how to tax the digitalized economy,* (see note 32).
42. Double tax conventions (DTCs) are bilateral agreements made by two countries to resolve issues involving double taxation of passive and active income of each of their respective citizens.
43. A. Uricchio and W. Spinapolice, *La corsa ad ostacoli della web taxation*, in *Rass. Trib.*,

Issue 3, 2018.

44. *Ibid.*
45. These rules include the following: 1) in the case of advertising services, if the advertising in question appears on the user's device at a time when the device is being used in Italy in that tax period to access a digital interface; 2) in the case of digital intermediation services: if the user uses a device in Italy in that tax period to access the digital interface and concludes an underlying transaction on that interface in that tax period; 3) in the case of social networking services, if the user has an account for all or part of that tax period allowing the user to access the digital interface, and that account was opened using a device in Italy; 4) in the case of services regarding the transmission of data, if transmitted data is generated from a user who used their device in Italy to access a digital interface, whether during the same tax period in which data are transmitted or any previous one.
46. G. Fransoni, *Note sul presupposto dell'imposta sui servizi digitali*, in *Rass. Trib.*, Issue 1, 2021.
47. J. Becker and J. Englisch, *Taxing where value is created*, (see note 34).
48. J. M. Vazquez, *Indirect taxation of digital services after BEPS: A multilateral instrument to achieve harmonization and effective enforcement*, in *Int'l Tax J.*, Volume 43, Issue 5, 2017.
49. Council Directive 2008/8/EC of 12 February 2008 amending Directive 2006/112/EC as regards the place of supply of services OJ L 44, 20.2.2008. The Directive expressly recognised that technological innovations have contributed to a transformation in the volume and structure of trade in services and, initiatives were needed to cope with this new situation and entered into force in 2015. Later, in the framework of the strategy for the digital single market in Europe (6 May 2015) and of the action plan on VAT so-called VAT Digital package (7 April 2016) the EU focused on proposals concerning the e-commerce and e-books.
50. Report of the Commission Expert Group on "Taxation of the Digital Economy", Paragraph 4.1.2.
51. An example in this direction is provided by MOSS and OSS.
52. B. Kuzniacki, *The marriage of artficial intelligence and tax law: Past, present, and future. Present, and Future*, Kluwer international Tax Blog, 25/01/19 at http://kluwertaxblog.com/2019/01/25/the-marriage-of-artificial-intelligence-and-tax-law-ii-presence-future/.
53. L. T. McCarty, *Reflections on TAXMAN: An experiment in Artificial Intelligence and legal reasoning*, in *Harv. L. Rev.*, Volume 90, Issue 5, 1976.
54. See OECD reports on "Technologies for better tax administrations: a Practical Guide for Revenue Bodies" and "Advanced Analytics for Tax Administrations".
55. D. Blanchard, *Finance, Big data analytics offer a solution to a taxing situation.*, in *Industry- Week: Advancing the Business of Manufacturing*, Volume 63, Issue 4, 2014.
56. IMB, at: https://www.ibm.com/watson/stories/kpmg.
57. N. Braun Binder, *AI and taxation: Risk management in fully automated taxation procedures*, 2018, Available at SSRN 3293577.

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76. For example, a recent paper has showed that AI can serve for recommendations for anti-

evasion tax rules for international treaty drafting. See B. Kuzniacki, *The marriage of artificial intelligence and tax law* (see note 51).

77. B. Alarie, A. Niblett, and A. H. Yoon, *Law in the future* (see note 64) argued that such predictive technologies may steer law onto a path towards "legal singularity," where the law will eventually be complete, with no genuinely grey areas remaining in the law.
78. OECD, *Database of national AI policies - AI strategies and policies in Brazil*, 2021.
79. Regulation (EU) 2016/679 of the European Parliament and of the Council 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, and repealing Directive 95/46/EC, OJ L 119, 4.5.2016.
80. European Commission, *Proposal for a Regulation of the European Parliament and of the Council laying down harmonized rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain union legislative acts*, COM(2021)206 final.
81. Specifically, Recital 38 states that "AI systems specifically intended to be used for administrative proceedings by tax and customs authorities should not be considered high-risk AI systems used by law enforcement authorities for the purposes of prevention, detection, investigation and prosecution of criminal offences."
82. Privacy and data protection here is used not merely as a synonymous of "tax confidentiality", but to the set of individual rights and freedom stemming from fundamental rights and data protection framework. For a discussion on the distinction, see E. Politou, E. Alepis, and C. Patsakis, *Profiling tax and financial behaviour with big data under the GDPR. Computer law & security review*, Volume 35, Issue 3, 2019.
83. See, for example, para. 7) and 7-bis) of Article 32 d.p.r. 600/1973 (Italy).
84. L. Scarcella, *Tax compliance and privacy rights in profiling and automated decision making. Internet Policy Review*, Volume 8, Issue 4, 2019.
85. Although the choice of the term "right" in the provision suggests that the Article applies when it is actively invoked by the data subject, the WP29 guidelines clarify that the article establishes a general prohibition for decision-making based solely on automated processing. See Article 29 o the Guidelines on automated individual decision-making and profiling for the purposes of regulation 2016/679, adopted on 3 October 2017.
86. I. Mendoza and L. A. Bygrave, *The right not to be subject to automated decisions based on profiling in EU Internet Law*, Springer, 2017.
87. Article 29 of the guidelines (see note 82)
88. It must also be recalled that, to ensure the respect of fundamental rights and freedom which also include the right to privacy, Art. 23 (2) provide a list of information which need to be included in the legislative measure allowing such restrictions. These include: a) the purposes of the processing or categories of processing; b) the categories of personal data; c) the scope of the restrictions introduced; d) the safeguards to prevent abuse or unlawful access or transfer; e) the specification of the controller or categories of controllers; f) the storage periods and the applicable safeguards taking into account the nature, scope and purposes of the processing or categories of processing; g) the risks to the

rights and freedoms of data subjects; and h) the right of data subjects to be informed about the restriction, unless that may be prejudicial to the purpose of the restriction.

89. Art. 1 para. 681-686 l. 27.12.2019 n. 160.
90. The right of a fair trial stems from Article 6 European Convention on Human Rights. See also the following judgements: European Court of Human Rights, judgment 21 February 2008, Application no. 13580/88, *Schmidt*.; See European Court of Human Rights, judgment 18 July 1994, Application no. 18497/03, *Ravon*; European Court of Human Rights, judgment 24 November 1993, Application no. 13972/88, *Imbrioscia*; European Court of Human Rights, judgment 24 April 2007, Application no. 38184/03, *Matyjek*; European Court of Human Rights, judgment 9 October 2008, Application no. 62936/00, *Moiseyev*.
91. A. Bal, *Ruled by algorithms: The use of black box models in tax law*, in *Tax Notes International*, Volume 95, Issue 12, 2019.
92. It has been observed that it is unconventional to calculate taxes based on statistical and presumptive indexes that do not necessarily correspond to reality. The same applies to AI. The determinations of AI systems are not based on logical deductions, according to which certain premises (e.g., income, exchange etc.) lead to certain conclusions (e.g., the amount of tax to be paid, the decision for inspections etc.). But it is based on statistical approach which apply rules that are discovered from the previous cases, and from which the algorithms provide probable answers (often a probability resembling certainty), but never certain answers.
93. A step in this direction has been taken by France, in the Law for the Digital Republic, which has introduced the right of citizens to have knowledge of automated decision making, as well as to have information about the functioning of the algorithm
94. See European Court of Human Rights, judgment 18 July 1994, Application no. 13580/88, *Schmidt*.
95. D.-U. Galetta and J. G. Corvalán, *Intelligenza artificiale per una pubblica amministrazione 4.0? Potenzialità, rischi e sfide della rivoluzione tecnologica in atto*, in *Federalismi.it*, Issue 3, 2019.
96. For example, KPMG Ignite platform provide Global Transfer Pricing Services (GTPS) to the firms' tax clients, which allow to establish prices for goods and services sold between enterprises under common ownership or control.
97. J. Sinnig, *The reflection of data-driven value creation in the 2018 OECD and EU proposals*, in *EC Tax Review*, Volume 27, Issue 6, 2018.
98. OECD, *Tax Challenges Arising from Digitalisation - Interim Report 2018*.
99. L. Quarta, *Impiego di sistemi AI da parte di Amministrazioni finanziarie ed agenzie fiscali. Interesse erariale versus privacy, trasparenza, proporzionalità e diritto di difesa*, in *Intelligenza Artificiale tra etica e diritti*, 2020, Cacucci, p. 247; A. J. Cockfield, *Sharing Tax Information in the 21st Century: Big Data Flows and Taxpayers as Data Subjects,* in *Canadian Tax Journal*, Volume 67, Issue 4, 2019, pp. 1179-1199.