The internet of things in Tax Law

Antón, Á.A.; del Blanco García, A.J.; Mosquera Valderrama, I.J.; Rozas, J.A.; Serrat Romaní, M.

THE INTERNET OF THINGS IN TAX LAW

Álvaro Antón Antón
Associate Professor (Universidad CEU Cardenal Herrera)

Álvaro Jesús del Blanco García
Advisor (Institute for Fiscal Studies of Spain)

Irma Mosquera Valderrama
Associate Professor (Leiden University)

José-Andrés Rozas
Full Professor (Universitat de Barcelona)

Marina Serrat Romaní
Assistant Professor (Maastricht University)

Recibido: Abril, 2021
Aceptado: Junio, 2021

https://dx.doi.org/10.47092/CT.22.1.5

ABSTRACT

Internet of Things (IoT) is currently a technology in expansion, which is used for multiple purposes. This article explores how Tax Law and Administrations could use it to improve the level of tax compliance and enforcement without overrunning the limits of taxpayers' rights, through five Sections: Tax Proof; Taxpayers' Rights; VAT & Customs; Fiscal Incentives; Energy taxation. Since is a very novel disruptive technology, this paper addresses common taxation topics, from a tax policy perspective, that can be related to any national or supranational regulations.

Keywords: Internet of Things, Tax evidence, Taxpayers' rights, VAT, Fiscal Incentives.

EL INTERNET DE LAS COSAS EN EL DERECHO TRIBUTARIO

Álvaro Antón Antón
Álvaro Jesús del Blanco García
Irma Mosquera Valderrama
José-Andrés Rozas
Marina Serrat Romaní

RESUMEN

Internet de las cosas *(IoT)* es una tecnología en expansión que se utiliza para múltiples propósitos. Este artículo explora cómo la ley y las administraciones tributarias podrían recurrir a *IoT* para mejorar los niveles de cumplimiento y exigencia de los tributos sin sobrepasar los límites de los derechos de los contribuyentes, a través de cinco secciones: prueba tributaria; derechos de los contribuyentes; IVA y Aduanas; Incentivos fiscales; fiscalidad de la energía. Dado que es una tecnología disruptiva novedosa, el documento aborda temas tributarios genéricos, de política fiscal, que pueden coligarse con cualquier ordenamiento nacional o supranacional.

Palabras clave: internet de las cosas, prueba tributaria, derechos de los contribuyentes, IVA, incentivos fiscales.

SUMMARY

1. INTRODUCTION

Even though there is no formal agreed definition for the Internet of Things (IoT), we can understand it as an infrastructure by which an ordinary device registers, collects and shares data with third parties through the Internet. IoT is currently a technology in expansion, which is used for multiple purposes. Due to its complex nature and its interrelation among different fields, such as cyber-security, intangible property, communications, environment, etc., the IoT poses several legal challenges for balancing fundamental rights, public powers and governance, also in fiscal issues.

This article explores how Tax Law and Tax Administrations could use the IoT to improve the level of tax compliance and enforcement without overrunning the limits of taxpayers' rights, through five Sections: Tax Proof (1); Taxpayers' Rights (2); VAT & Customs (3); Fiscal Incentives (4); Energy taxation (5).

Since the IoT is a very novel disruptive technology, the paper addresses common taxation topics, from a tax policy perspective, that can be related to any national or supranational regulations. Sec. 2 analyses how the IoT is changing the concept of evidence in Tax Law, with potentially deep consequences in the structural elements of many taxes and in the tax compliance and enforcement procedures. Sec. 3 takes an approach to the impact the IoT might have on the taxpayer bill of rights. Sec. 4 points out how Customs

and Tax Authorities could benefit from improving compliance within the supply chain flow. Sec. 5 explores whether the IoT can be useful to improve the way fiscal benefits are established, managed and evaluated. Sec. 6, finally, considers the main advantages of the IoT when tackling environmental issues from the perspective of energy taxation.

2. TAX PROOF

2.1. The technological level

The technology known as the "Internet of Things" (IoT) opens up previously unsuspected possibilities in terms of evidence and, from this perspective, in the structure and policies for compliance and control of many taxes.

The tools provided to Tax Administrations –and the taxpayers– by the technological progress in this respect, bring about a substantial transformation in the possibilities of both parties to prove what are rightfully their rights and obligations.

In the tax compliance procedure –as in the case of any legal regulation–, the first step of law enforcement focuses on establishing the facts; proving what happened, how, when, by whom and in what dimension: *da mihi factum, dabo tibi ius.*

Only afterwards –once the facts have been delimited and tested–, the legal qualification of such facts is tackled. Once the facts have been established and qualified under the applicable law, the tax consequences can be calculated: assessing the debt –quantifying, notifying it– and requiring its payment.

If the taxpayer disagrees with the assessment, they may challenge its legality by filing an appeal –administrative and/or judicial– in which, undoubtedly, a phase of proving the facts must be substantiated.

In fact, these new technologies (IoT) are going to provide both parties in the tax relationship with the possibility of proving the facts in an extraordinarily precise, simple, and much more cost-effective way than in the past.

All kind of small devices (sensors, thermostats, microchips…) send a huge volume of data to servers in real time; IoT can specify, know and prove (1) facts by enabling the processing of a lot of information about different things:

i) Location and movements: traceability (identify/track/trace) (2);

ii) Physical alterations, size, value, as well as the level of performance (3);

(1) See Barrio Andrés, M. (2020), for a general overview about technical bases of IoT and its legal framework.

(2) Using IoT, sensors and QR codes, it is already possible to determine the origin of merchandise, which is essential for the correct assessment of customs duties (González Frutos, 2018: 10). It is also possible to reconstruct the exact location of individuals, or the places where they have used their means of payment, which may be relevant to prove their physical link to a given tax jurisdiction for the purpose of proving their tax residence there.

(3) In sections four to six of this paper, there find many examples in this regard of movable and

iii) Possible changes in their ownership and property or use rights.

Tax law is built on facts (4). Firstly, a taxable event is outlined as an index of ability to pay. Sometimes, for each event, a quota is assigned. A second factor, or tax rate, is frequently applied to the estimated measurement of that economic capacity –the tax base– from which the tax liability is deducted.

If the ways to prove facts with tax implications have evolved, it is logical that tax law also evolves at the same pace. As the factual framework, i.e. the facts and their evidence, has varied substantially, it is convenient to also review the legal framework: the delimitation of the taxable events, the configuration of the elements to be taken into account in order to measure the ability to pay, as well as the way Tax Administrations act when auditing and assessing tax debts. Even in collection activities, it would be possible for Tax Administrations to use IoT to locate the taxpayer's assets and rights in order to seize them.

2.2. The definition of taxable events

Probably the taxes with the greatest tradition in the history of humanity are those that fall on the property of the real estate. Already Diocletian, Roman Emperor, established a tax on the ownership of land. In all contemporary tax systems, many and different taxes whose taxable matter is real estate can be identified, whereas it is regarding its purchase, ownership, transformation, transfer or use.

This is probably due to the fact that three circumstances converge in real estate property: it constitutes relevant evidence of the ability to pay; it is a kind of good that is difficult to hide; and it is quite simple to control its ownership and transfers, therefore, it is easy to identify the taxpayers, i.e. who is the "ultimate beneficiary owner".

Traditionally, the connection of individuals with a state for income taxation, was made through their establishment in a territory, their "residence" –household– in a certain state. This was due to the same reasons: the simplicity of the evidence and the logic behind the fact that residing in a specific place clearly shows the financial link of the person who occupies it with the state in whose territory it is located.

Tax Law usually connects fiscal residence with housing's ownership. Just a detail in a public register could be enough to demonstrate the effective link between the taxpayer and a fiscal jurisdiction, making it possible to tax their worldwide income. Nowadays, thanks to IoT, both parties in the tax relationship can access large amounts of other sig-

immovable properties whose physical and functional characteristics are taken as a reference for assessing the ability to pay of taxpayers in taxes levied on their ownership, transfer or consumption (VAT, customs, excise taxes, energy taxes, transfer taxes, inheritance gifts and wealth taxes).

(4) An element of uncertainty in the development of a tax relationship is the distance between what has happened (the material truth) and what can be proven (the formal truth). Through IoT technology it is possible to shorten this distance. In the words of the OECD's Forum on Tax Administration "Making tax just happen" (FTA, 2020: 15), particularly in business taxation, by approaching «the 'daily life and business sphere' and the 'tax administration sphere'» (*Ibidem,* 20).

nificant data, such as, for example, the number of days that the taxpayer's smart phone has been connected to the network of different countries; where they have been buying items on delivery platforms; details about their plane tickets, and so on.

Artificial Intelligence systems and big data analytics work with presumptions "if-then-else". In the past, it was usually hard for taxpayers and Tax Administrations to obtain a significant volume of "if's". At present, owing to the "IoT" –as Iriarte Yanicelli (2020: 299) points out–, it is much simpler to register a higher number of "if's" safely –by means of blockchain– and to prove the "else" through big data processing (5).

In the definition of the taxable events, it is necessary to delimit their objective and subjective borders, as well as to define the event in space and time, on the one hand, and to link it with a taxpayer, on the other hand.

Hence, IoT has improved the resources used by tax law for this purpose, which has brought about a change in the way this was traditionally done. A few years ago, the registration, inventory and administrative assessment of real estate and certain types of property, i.e. vehicles, works of art and historical heritage assets, was possible. Nowadays, it is becoming easier to trace the movements or establish the physical characteristics of a lot of different movable property and even humans.

For instance, under the Spanish law, the tax on the transfer of goods or real estate between individuals, known as "*Impuesto sobre Transmisiones Patrimoniales*" (ITP), in practice, has only been enforced for real estate transfers and other properties subject to registration, such as vehicles. Since IoT makes it easier to track the location of other movable property –and the relevant financial transactions–, the current capacity of Tax Administrations to control the return and payment of this tax is higher. Particularly for those transactions between consumers conducted through a digital platform (e.g. *Airbnb, Wallapop*) (6).

The Count-Duke of Olivares in Spain, in 1659, created the stamp duty: the legal effects of countless acts and businesses were linked to their printing on state paper ("*timbre*" in Spain; "*estampillas*" in Latin America; "*bollo*" in Italy; "stamp duty" in the Anglo-Saxon systems).

Although this taxable event, known in the Spanish law as "*Impuesto sobre Actos Jurídicos Documentados*" (IAJD), has endured for centuries, the truth is that the digital format of a significant part of the legal transactions, as well as the blockchain technology which can be used to formalize them safely and more, threatens its reason for being (7). Why

(5) A significant number of Spanish youtubers and athletes is currently buying houses in Andorra –a low-tax jurisdiction located between Spain and France– so that they become fiscal citizens of that country. The Spanish Tax Agency establishes that they have to prove a residence period of 183 days per year in Andorra and/or that they have no other significant economic and social links within Spain. Both of them –taxpayers and Tax authorities– could use IoT and big data for this purpose. See Serraller, M. (2021).

(6) In this sense, the Council Directive (EU) 2021/514 ('DAC7') extends the EU tax transparency rules to digital platforms and introduces an obligation for platform operators to provide information on income derived by sellers through platforms, as from 2023 onwards.

(7) Rozas, J. A. (2017) explains the profound transformation of this kind of taxes, adapting

pay to formalize a contract in a piece of paper –stamp, *timbre*– sealed by the State, if these documents are no longer used in digital transactions?

Along the same lines, there is the long-standing tradition in Spanish tax law of paying excise taxes on tobacco and alcohol with stamped paper. The stamp, i.e. the State paper, is fixed outside the pack or bottle in such a way that, at a glance, it is easy to distinguish counterfeit merchandise from that whose tax has been paid.

As outlined below (8), IoT technology can fulfil this objective in a much more advantageous way.

In the history of Tax Authorities, the facts considered to measure economic capacity, that is, the ability to pay, were mostly linked to property rights over things. At present, along with property rights, there are more complex manifestations of such capacity, which are connected with the rights of access to use and enjoyment –no longer the ownership– of certain goods and services.

Digital platforms have enabled the development of collaborative and commercial models for the use and enjoyment of goods and services; these rights of usage or access to things are actual expressions of ability to pay. In the triple dimension of the tax relationship: what to tax (taxable event), by whom (taxpayer), and in favor of whom (fiscal jurisdiction) (9).

The relevance of, for example, who owns the vehicle, is no longer as high as it is who has the right to use and enjoy it, under what conditions and for what purpose. In the same sense, a dwelling can be used simultaneously during the year as a workplace –houses and working habits have changed dramatically during the pandemic–, personal home, or even commercial use for short stays of third parties (*Airbnb*). The effective use of the house for fix residence, second residence, professional uses and/or renting has consequences in the Income Tax of the owner.

The effective testing of these various uses and accesses was not easy before the emergence of the technology we now know as IoT. Thanks to the new possibilities to track goods and people, as well as the massive analysis of such data by means of Artificial Intelligence (AI), things have changed and, for that reason, Tax Law has to create new taxable events and to reformulate, or cancel, those taxable events that have been in force so far (10).

---

them to the pace of the digital transformation of legal relations. If technology making it possible to bypass the intermediary as a guarantor of transactions (González Frutos, 2018: 10), the taxes conceived as a compensation for the legal certainty that States provide in commercial traffic are no longer meaningful.

(8) See below 3.2.2., the system of tobacco tax control by means of electronic devices in the Philippines.

(9) Regarding the challenges and opportunities tax law faces in the development of sharing and gig economy platforms, see Rozas, J. A. (2018), and OECD (2019f).

(10) The fiscal census, i.e. the cadastre, is the basis for taxes levied on real estate; that is why a useful tool for the treatment of data as an expression of ability to pay would be the establishment of an international register –European, at least– of contracts to access Internet browsing services (when, by whom, and for how much) in each country [Rozas, J. A. (2019)].

2.3. Setting up the tax bases

Regarding taxes with changing quotas, most of the tax liability is the result of applying the tax rate to the tax base, therefore assessing the ability to pay.

The theoretical construction of the tax base is strongly conditioned by the possibilities of measuring and controlling its effective amount. It does not make sense to configure it on parameters that are impossible or very difficult to measure and control.

That is why Tax Law has used –within reasonable logic and on many occasions– presumptive methods to simplify its assessment.

Under the evidentiary challenges, in its exact measure, the consequent fact that the legislator has outlined as a manifestation of economic capacity subject to taxation, is replaced by proving another –simpler– fact linked to the former by a relation of probability. If (A) –a simple fact to prove– is given, (B) –a difficult fact to prove directly– shall be consider as proven since both facts are connected by a likelihood relationship.

This is the technique behind, for example, the system of objective estimation of taxable bases for small businesses and self-employed individuals used in Spain for the calculation of Personal Income Tax (IRPF). According to this system, instead of assessing the income of such taxpayers –who carry out their business or professional activities on their own risk and according to their cash flow, that is, their effective revenues–, it is calculated by resorting to objective indications of profitability: number of employees, square meters of the business premises, vehicles used in the activity, energy consumption... Each indication is linked to an economic profitability rate and, with these elements, a presumptive calculation of the income obtained by the taxpayer throughout the tax period is carried out.

This same presumptive technique has been used in Spanish law, for instance, to assess the taxpayer's domestic furnishings for inheritance tax (ISD). Given the difficulties in carrying out an exhaustive inventory such furnishings, the legislator resorted –in the absence of direct proof of its value– to apply a subsidiary rule of valuation of the household goods, considering that its amount was equivalent to 3% of the real estate.

Many examples which fall in the abovementioned category have been included in other sections of this work, concerning the taxable bases of energy taxes, those that tax consumption, foreign trade in goods or business profits.

In all these cases, IoT can substantially transform both the specific taxable events, the taxable bases, and the systems for their measurement. Since, again, both the taxpayer and the tax authorities have many new possibilities to prove the facts and values on which the tax bases are established, their effective configuration should be subject to review.

Today it would not make sense to resort to presumptive techniques that had their *raison d'être* in difficulties to prove the facts that IoT has substantially changed. The inventory of goods –production or consumption–, tracking of their location, and tracing of the financial transactions carried out related to their transmission, generates a massive

amount of data which –processed by big data techniques (11)– enables both parties in the relationship, the taxpayer and the Tax Administration, to have accurate proof of the facts.

A simple example of this –amongst many others– is proving the use of a certain vehicle, by the individual who owns it, for professional or business purposes. The system followed in Spanish law in this respect is somewhat contradictory.

Broadly speaking, for VAT purposes, a presumptive rule is used whereby the vehicle is considered to be used for professional purposes 50% of the time; for Income Tax purposes, on the other hand –except for certain types of vehicle or activity– no proof of the fact that the vehicle is used simultaneously for personal purposes and in the performance of business or professional activities is allowed.

Nowadays, thanks to IoT technology it is –presumably– possible to trace back all the trips made by the vehicle during the tax period and link them to personal or professional uses. It will therefore be easier to demonstrate the extent to which it is used for one or another purpose, both for the taxpayer and the Administration, and to consequently modify the rules governing the allocation of the expenses deriving from its usage both in the VAT and in the tax levied on the profits of the professional activity in the Income Tax.

2.4. Checking facts with tax implications

Usually, the focus of the audit activity of the Tax Administrations is a comparison of the faithful image of the accounting statements of the businessmen and professionals. This is why accounting knowledge has been given a considerable role in the selection and training of tax officials for this service.

Such a profile when selecting and training the higher levels of civil servants at the service of the Treasury made sense while the standardisation and implementation of accounting techniques were at a primitive stage of development, digital technology was not available, and auditing was not as porous as it is today.

The role of tax authorities in controlling compliance with tax obligations in the present century should take other forms. It should be directed, on the one hand, towards the correct formalization and implementation of tax compliance frameworks –adapted to the needs of the different sectors and types of taxpayers– in a context of close cooperation with tax practitioners (12).

With regard to the investigation of undeclared facts, as well as the verification of the veracity of those that have been declared, at present, it is surely more relevant what can

(11) See Serrano Antón, F. *et al.* (2020).

(12) On the challenges and opportunities facing tax law in the development of collaborative and business models of economic relations, see Rozas, J. A. (2018).

be done in terms of the treatment and usage of the data available, that is, in obtaining the missing data, than the analysis of accounting statements (13).

It is therefore logical that in the selection and training of personnel at the service of the Tax authorities, emphasis should be placed on learning about information technologies, IoT and AI, and, specifically, on their use in the prosecution of illegal activities. In short, they should try to incorporate criminologists with a solid technological background to their staff, giving them the leading role they deserve. Alternatively, they should collaborate closely with other bodies of the Administration –Security Corps, Anti-Money Laundering Service, etc.– in which this type of professionals work.

3. TAXPAYERS' RIGHTS (14)

3.1. Need for taxpayers' rights in IoT

The collection of digital data by devices connected to the Internet (IoT) and the use of this data by companies and governments has been addressed in terms of governance (15), but little attention has been paid to the protection of taxpayer's rights in terms of privacy and the protection of personal (and sensitive) data, as well as the relevant safeguards to exchange and process the data.

The IoT has made it possible for tax administrations to tackle tax avoidance and tax evasion by using the information (digital data) collected by third parties. Some examples are, for instance, «to connect cash registers to tax administrations in order to help fight against tax fraud in sales, and the use of sensors in gas stations to help fight against fuel theft in the distribution chain» PWC (2017: 30).

The use of online cash registers (OCR) has been recently addressed in an OECD 2019 report which provided a case study for Russia (16). Regarding the data privacy concerns the OECD (2019: 21) stated the following:

(13) As noted, «digital technologies also have the potential to revolutionize enforcement and compliance work» [CESE (2019: 9)].

(14) «The writing and research carried out for this section is the result of the ERC research in the framework of the GLOBTAXGOV Project (2018-2023). This Project investigates international tax law making, including the adoption of OECD and EU standards by twelve countries. See GLOBTAXGOV [https://globtaxgov.weblog.leidenuniv.nl/]. The GLOBTAXGOV Project has received funding from the European Research Council (ERC) under the European Union's Seven Framework Programme (FP/2007-2013) (ERC Grant agreement n. 758671)».

(15) IoT governance has been defined by Florent Frederik Head RFID EU as the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making, procedures and programmes that shape the evolution and use of internet. See JRC Science Hub Communities (2019). See also OECD (2019b).

(16) For the OECD, «the introduction of the new online cash register system has improved fiscal transparency and already raised tax compliance significantly. It is also facilitating the creation of a level playing field for fair competition among retail businesses as well as contributing to the protection of consumers' rights, reducing compliance burdens and providing new opportunities for businesses» OECD (2019a: 3).

> «as regards the OCR systems which are in operation, they do not pose specific data privacy concerns as currently used. This is because the transaction records do not identify any details of the individual customers but just details of the transaction and the supplying business. While some verification systems may involve the registration of customers, the use of this information will be subject to data protection legislation and is optional for customers. In this respect, the data privacy issues for OCR systems are part of a wider public debate about the amount of data that it is appropriate to centralize in government hands. On the one hand, the sharing of data can bring benefits to taxpayers in terms of reduced burdens, increases in public revenue from tackling non-compliance and potentially better services from more joined-up government. On the other hand, this can raise concerns about the potential use of big data and the loss of individual control over data» (OECD, 2019: 21).

However, this report did not address the safeguards for privacy and data protection, nor did it require any additional conditions for governments to collect and process these data. The rules are left up to the countries.

In respect of data standards and security the OECD (2019: 25) stated that «The data collected by the OCR system is generally not open to the public. However in some countries access to data can be arranged for businesses that are the original source of such data or to selected public administration bodies. It is common for the data to be stored for periods of five to six years. However, in some countries the duration for information storage is not limited».

In domestic legislation, very few examples are found addressing IoT. For instance, one example regarding privacy is found in Canada where the Office of the Privacy Commissioner released privacy guidance for manufacturers of IoT devices with a list of "must do's and should do" (17). This is similar to a "privacy by design" principle (18)

Another example is found in the United States' Internal Revenue Manual (2020) which introduces several privacy principles, also including the duty of tax officials to keep in mind whilst working (mainly teleworking) that devices connected to internet (IoT) should be treated as if they were another person. Therefore, government officials while working on tax files, should be aware that these devices can take photos, videos or sound, and therefore, sensitive work should not be done within visual or audio range from such devices. These two examples show the importance of regulating IoT and also the need to introduce safeguards to protect privacy, data protection and the automatic processing of data.

The IoT has made it possible for the tax administration to collect high volumes of digital data which are used and processed by applying big data (19) analytics. Data analytics can be used for data mining and profiling of taxpayers (20). Data analytics can also be used to «ac-

(17) This guidance focuses on adherence with Canada's federal private-sector privacy law, the Personal Information Protection and Electronic Documents Act (PIPEDA). See Office of the Privacy Commissioner (2020)

(18) See Council of Europe Convention below: sec. 2.3.1.

(19) Big data refers to the process of gathering large quantities of information, structured and otherwise, and converting that information into usable values. See Van Hoult (2019).

(20) Data mining refers to pairing information by using algorithms. The goal is mostly to discover patterns in data sets. These patterns can be used to define profiles of taxpayers and to predict which tax returns generate the highest risk on mistakes (predictive modelling).

tively influence or even change consumer behaviour through personalized nudging» (21). As far as taxation is concerned, van Hoult (2020) has addressed the use of data analytics in tax nudging with the aim «to improve compliance and to stimulate taxpayers to pay their taxes in time».

The use of new technologies including IoT in the collection of data, represents a challenge for tax administrations, since the latter will be required to update their infrastructure (to adapt to new technologies), and increase the digital skills of personnel. In addition, the collection of data by tax administrations including the data obtained throughout the IoT requires countries to guarantee the rule of law in the processing of personal and business data. Hence, the following questions should be addressed by tax administrations collecting and processing this data (i) who has the taxpayer's data? (ii) is the taxpayers' data properly collected, stored and monitored? (iii) is the processing of the taxpayer's data allowed? And (iv) who owns the taxpayer's data? (22)

These questions are more relevant nowadays due to the use of machines in IoT, the amount of digital data to be exchanged and the use of data analytics to process big data that limits the human factor in this exchange (23). It may thus be possible that a tax assessment is being carried out based on data analytics and the use of algorithms without any tax official (human) intervention in the decision-making process (24).

In our view, the collection and processing of digital data from the IoT raise concerns regarding (i) taxpayer's rights including the right to confidentiality, secrecy, privacy and the rights to appeal decision making based in algorithms and (ii) safeguards for automatic processing of data i.e. big data (25) and personal (sensitive) data (i.e. biometric, genetic data). Some of these safeguards for data protection in automatic data processing have been addressed elsewhere by one of the authors (26).

(21) See Helberger, N. (2016: 135-161).

(22) See Mosquera Valderrama, I. J. (2019: 111-128).

(23) More recently (Nov. 2020) the UNCTAD, World Bank, other UN Offices (on Drugs and Crime) have stressed the need for a Global Data Convention instead of regional or national solutions. This Convention is needed in order to protect the individuals' privacy and shield them from misuse and abuse of data. See blogpost at the World Economic Forum (2020).

(24) *Cfr*. Scarcella, L. (2019).

(25) The term big data «usually identifies extremely large data sets that may be analysed computationally to extract inferences about data, patterns, trends and correlations», Mantelero, A. (2017: 584-602).

(26) According to Debelva and Mosquera, the following safeguards should be introduced for exchange of information including automatic exchange of information. (1) similar data can be received from the receiving State (reciprocity); (2) the receiving State ensures adequate protection of confidentiality and data privacy that is guaranteed by a follow up by the supplying State to guarantee the respect of such confidentiality in the receiving State; (3) the exchange is adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed; (4) the sending of data does not constitute an excessive burden for the tax administration that lacks of the administrative capacity or technical knowledge to develop a secure electronic system to exchange data; and (5) the principle of accuracy, stipulating that the data controller has the duty to carry out regular checks of the quality of personal data. Debelva, F. and Mosquera Valderrama, I. J. (2017: 362-381).

In light of the above, the following paragraphs will address tax secrecy and confidentiality (section 2), as well as the safeguards for the automatic processing of data applicable to the exchange of information and the processing of such data using big data analytics (section 3). The final section will address the EU instruments (Section 4).

3.2. Tax secrecy and confidentiality

In general, the data collected includes personal data [i.e. information relating to an identified or identifiable individual, as well as sensitive data such as genetic data and biometric data (27)] and business data [i.e. information relating to the operation of a business including trade secrets (28)]. These data can be regarded as taxpayer data and thus protected under the rules of secrecy and confidentiality set out in the Constitution and/or Tax Laws of the country (29).

In a 2017 paper on the rule of law and the effective protection of taxpayers' rights in developing countries, one of the authors provided a comparative study in 4 countries: Brazil, Colombia, South Africa and Uruguay. In this paper, we argued that «as part of the rule of law, taxpayers need to trust that the tax administration will protect their rights to confidentiality, privacy and the right to participate in the exchange of information» (30). We thus recommended the updating of the data protection rules of the countries which are mainly based in the 1995 Data Protection Directive and the exchange of best practices between countries. For instance, one best practice found in this study that could also be adopted by other countries is the training carried out in South Africa to familiarise tax officials with tax treaties, including the exchange of information in an international environment. This training has ensured that in every local revenue office there is at least one tax official who has the expertise to gather the information necessary to comply with an information exchange request.

Further research should be carried out into how the domestic rules have dealt with data originating in the IoT, how governments will ensure that the processing of these data, protects the confidentiality of this information, and which best practices can be exchanged between countries (31).

The following paragraphs will address two issues that have arisen regarding exchange of information, which can also influence the protection of data obtained throughout IoT. The

(27) Examples of biometric data are fingerprints, iris scan, and DNA. This data is protected as a special category of personal data in art. 9 GDPR. Art. 9 states that «processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be prohibited».

(28) See on trade secrets, D'souza, C. (2019).

(29) See Debelva, F. and Mosquera Valderrama, I. J. (2017: 362-381).

(30) See Mosquera Valderrama, I. J. *et al.* (2017).

(31) See an example, by Antonio Seco addressing the practices of IoT in Brazil, Singapore and the European Union available at CIAT 2017, blogpost [Seco, A. (2017)].

first issue is the leak of information to the press and third parties, and the second one is the taxpayer' right to privacy and data protection during the exchange of information (32).

3.2.1. *Leak of information to the press and third parties*

Countries and their tax administrations should prevent at all times, the leak of information exchanged to the press or third parties.

At an international level, the OECD (2019b: 20) has stated in the 2019 report to the G20 the need to ensure that the exchange of information «meets the expected standards of confidentiality and data safeguards». In addition, the OECD (2020) is providing technical assistance to members of the Global Forum on Transparency regarding data safeguards. However, despite the good efforts of the OECD, there is no specific multilateral instrument that provides for safeguards to protect the confidentiality of the information exchanged.

The misuse of the tax information exchanged and the leak to the press or third parties of personal and/or business data may result in financial consequences for the taxpayer. This has been the case in *Aloe Vera* which has been analyzed elsewhere by one of the authors:

> «The misuse of the tax information exchanged and the leak to the press of business data may result in financial consequences for the taxpayer. This was analyzed by the US Court of Appeals for the Ninth Circuit addressing *Aloe Vera of America vs. the United States* decided on 30th July 2009 (33). In this case, Aloe Vera claimed civil damages due to the unauthorized disclosure in the Japanese news of the information exchanged under the provisions of the DTT between the United States and Japan. Aloe Vera claimed damages based on the duty of the tax administration in the United States to ensure that the confidentiality of the exchange of information should be protected. The US Court of Appeals, when analyzing this case stated that it was not established whether the tax administration of the United States knowingly disclosed false information or knew that the foreign tax administration would misuse that information. For the US Court, negligence is not enough to find against the US Government» (34).

Another recent example, it is the breach of the Bulgarian tax agency's security systems in July 2019 which resulted in a data leak (35) that exposed the financial account information of four million Bulgarians and foreign taxpayers. This breach led to countries such as Switzerland (36) and other countries participating in the Global Forum on Transparency to stop information exchange with Bulgaria (37).

(32) See also Debelva, F. and Mosquera Valderrama, I. J. (2017: 362-381).

(33) *Aloe Vera of America v. United States*, case number 2:99-cv-01794 JAT, in the U.S. Court of Appeals for the Ninth Circuit [http://cdn.ca9.uscourts.gov/datastore/opinions/2012/11/15/10-17136.pdf].

(34) See for an analysis of this case *Aloe Vera*, Debelva, F. and Mosquera Valderrama, I. J. (2017: 376).

(35) See Krasimirov, A. and Tsolova, T. (2019).

(36) See Angeloni, C. (2019).

(37) See OECD (2019e).

In light of the above, and from a tax policy perspective, it is argued that the taxpayers should also have access to domestic and international legal instruments (38) and remedies (39) to ensure that the confidentiality and the use of personal data are respected. The use of IoT may result in more data available which may be difficult for tax administrations to safeguard the confidentiality and privacy of such information.

Therefore, and in respect of the information exchanged between states, the Supplying State should be able to effective monitor the provisions of confidentiality in the Receiving State. The control should not only be limited to the domestic provisions available in the country but also to the effective measures that are taken by countries to protect that information. Examples of these measures are for instance the use of electronic database systems, guidelines for tax administrations, the introduction of safeguards regarding data security, and the introduction of taxpayers' rights in an algorithmic decision-making context (see section 3.3. below).

3.2.2. *Right to privacy and right to data protection*

As one of the authors have argued elsewhere (40), at European level, the European Commission of Human Rights (ECHR) and the Court of Justice of the European Union (ECJ/CJEU) have also addressed the rights to privacy and data protection.

For instance in the ECHR case *F.S. v. Germany* (41), «the taxpayer in this case claimed that the information exchange on the basis of the old mutual assistance directive (77/799/EC) was contrary to its right to privacy as enshrined in Article 8 ECHR ('Right to respect for private and family life'). The Commission dismissed this claim, by stating that the exchange of information was indeed an interference with Article 8 ECHR, but this interference was justified as it was: (*i*) in accordance with the law; (*ii*) taken in the interest of the economic well-being of the country, and also aimed at the prevention of crime; and (*iii*) was necessary in a democratic society to achieve that aim. A similar approach was followed in the *Othyma Investments BV v. Netherlands* (42) and *G.S.B. v. Switzerland* case (43), (44)».

(38) See Section 3.3. below.

(39) See chapter 8 of the General Data Protection Regulation. 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. See also section 3.4. below.

(40) Debelva, F. and Mosquera Valderrama, I. J. (2017: 373-374). See also for an overview of the ECHR and CJEU cases [https://globtaxgov.weblog.leidenuniv.nl/files/2019/06/Mosquera-Lisbon.pdf].

(41) European Commission of Human Rights, 27 Nov. 1996, *F.S. v. Germany* (Application No. 30128/96).

(42) European Court of Human Rights, 16 June 2015, *Othyma Investments BV v. the Netherlands* (Application No. 75292/10).

(43) European Court of Human Rights, 22 December 2015, *G.S.B. v. Switzerland* (Application No. 28601/11).

(44) Debelva, F. and Mosquera Valderrama, I. J. (2017: 373).

The CJEU has addressed the right to data protection for instance in the *Satamedia* (45) case. In this case, «the CJEU confirmed that the collection and transfer of data relating to the earned and unearned income and assets of natural persons can be regarded as the processing of personal data of the 1995 Directive (*supra*) (46). Later on, the Court ruled in *Digital Rights Ireland* that the need for safeguards in relation to data is even greater where personal data are subjected to *automatic* processing and where there is a significant risk of unlawful access to those data (47). In the even more recent (October 1, 2015) *Bara* case, the Court specified that tax data should be considered as personal data and should thus fall within the scope of the Data Protection Directive (48). A few days later (October 6, 2015), the Court, in *Schrems*, again emphasized the need for an effective protection (49). On the basis of these cases, one can reluctantly conclude that the CJEU is increasingly taking notice of the right to privacy» (50).

In respect of IoT, the taxpayers' rights should be more present, especially since due to the amount of (big) data exchanged, the taxpayer may not have the opportunity to object to the exchange of data (51), or to receive protection in case that the data has been leaked to the press/third parties or the data has been used for other (non-tax) purposes (e.g. monitoring of compliance with environmental regulations).

(45) ECJ, 16 December 2008, C-73/07, *Tietosuojavaltuutettu v. Satakunnan Markkinapörssi Oy and Satamedia Oy*, §37.

(46) Satamedia also appealed to the ECHR following the ECJ decision stating that the decision to prohibit the processing of personal data was (i) contrary to art. 10 of the ECHR (i.e. freedom of expression) and (ii) the length of the proceedings was against art. 6 (right to a fair trial). The ECHR in decision of 21 July 2015 made its own analysis of art. 10 and concluded that the freedom of expression was not violated. The Court referred to the analysis made by the ECJ and the domestic courts. The Court concluded that the restrictions to the freedom of expression were necessary in a democratic society and that the domestic courts struck a fair balance between the competing interests at stake (i.e. freedom of expression *vs.* right to privacy). In respect of art. 6, the Court concluded that the length of the proceedings was in breach with the right to fair trial. For this breach, the amount of EUR 9500 was granted to the applicants. See ECtHR, 21 July 2015, *Satakunnan and Satamedia v. Finland*. European Court of Human Rights (Application no. 931/13).

(47) ECJ, 8 April 2014, C-293/12 and C-594/12, *Digital Rights Ireland Ltd.*, §55.

(48) ECJ, 1 October 2015, C-201/14, *Smaranda Bara*, §23.

(49) ECJ, 6 October 2015, C-362/14, *Maximillian Schrems*, §42.

(50) Debelva, F. and Mosquera Valderrama, I. J. (2017: 373).

(51) On the right to be notified and to object to the exchange of information mainly regarding the foreseeable relevance of the information exchanged see for instance, the *Sabou case* ECJ, 22 Oct. 2013, C-276/12, *Sabou*. This case has been addressed in Debelva, F. and Mosquera Valderrama, I. J. (2017: 373-374). Another case is the *Berlioz case* (Luxemburg), 16 May 2017 C-682/15. See on Berlioz Menita Giusy De Flora (2017): "Protection of the Taxpayer in the Information Exchange Procedure", 45, *Intertax*, Issue 6: 447-460. One recent case is *État luxembourgeois contre B*, C-245/19 and C-246/19. This case has been addressed in Moreno González, S. (2021): "Cross-border exchange of tax information upon request and fundamental rights – Can the right balance be struck?: Joined cases C-245/19 and C-246/2019, *État luxembourgeois contre B* EU:C:2020:795", *Maastricht Journal of European and Comparative Law*, June.

In our view, it is important to address the safeguards to protect the use, collection and processing of personal data also regarding the use of (big) data (52). As far as big data are concerned, the OECD (2016) has published one report on Advanced Analytics for Better Tax Administration, but no reference was made to taxpayer rights or safeguards.

In general, there are very few instruments available addressing safeguards to protect the privacy and confidentiality of the information exchanged between countries (53), but one binding instrument that can be useful is the Council of Europe Convention on the Automatic Processing of Personal Data open for ratification to member countries of the Council of Europe and third countries (outside the Council). At EU level two (binding) instruments should be mentioned the 2016 Directive (54) and Regulation (55) on Data Protection (in force since May 2018). The following paragraphs will address these international and European instruments that can be useful to safeguard the digital data collected in the IoT.

3.3. International Instruments for the privacy and safeguards for the Protection of the Automatic Processing of Data

3.3.1. *Council of Europe Convention on the Automatic Processing of Personal Data*

In 1981, the Council of Europe adopted the Convention 108 for the Protection of Individuals with Regard to Automatic Processing of Personal Data. This Convention protects the individual against abuses which may accompany the collection and processing of personal data and at the same time regulates the cross-border flow of personal data (56).

This Convention has been amended by two Protocols. The first Protocol was approved in 2001 and extended this Convention for approval by non-member countries (countries outside the Council of Europe). At the time of writing (November 2020), this Convention had been signed and ratified by the 47 members of the Council of Europe and 8 non-member countries, i.e. Argentina, Cape Verde, Mauritius, Mexico, Morocco, Senegal, Tunisia and Uruguay (57).

---

(52) This requires a multidisciplinary approach see Afuso, O.; Coco, A. & Mosquera Valderrama, I. J. (2019). See also Mosquera Valderrama, I. J. (2019).

(53) The OECD Manual on Information Exchange, the 1980 (updated in 2013) OECD Guidelines on the protection of privacy and Transborder Flows of personal data, the 2013 OECD Guide on the Protection of Confidentiality of Information Exchanged for Tax purposes and the UN 1990 Guidelines on Privacy and Data Protection. See Debelva, F. and Mosquera Valderrama, I. J. (2017: 362-381).

(54) Directive (EU) 2016/680 of the European Parliament and of the Council of 27 Apr. 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L0680&from=EN].

(55) General Data Protection Regulation 2016/679 (2016).

(56) Mosquera Valderrama, I. J. (2019).

(57) Table with ratifications and signatures available at Council of Europe (1985).

The second Protocol was approved in May 2018 and opened for signature as of 25 June 2018 (58). This Protocol addressed big data and pursued two main objectives: to deal with challenges resulting from the use of new information and communication technologies, and to strengthen the Convention's effective implementation. In addition, the Protocol stated the importance to «secure the human dignity and protection of the human rights and fundamental freedoms of every individual and, given the diversification, intensification and globalisation of data processing and personal data flows, personal autonomy based on a person's right to control his or her personal data and the processing of such data» (art. 1 modifying 3rd recital 2001 Preamble).

This Protocol has been signed by 38 of the 47 Members of the Council of Europe and 4 of 8 non-member countries. At the time of writing, this Convention has been ratified by 8 countries (Bulgaria, Croatia, Cyprus, Estonia, Lithuania, Malta, Poland and Serbia) and 1 non-member country (Mauritius) (59).

The number of non-member countries ratifying this Convention is still limited (i.e. 8 countries 2001 Protocol, and 1 country 2018 Protocol). Since this is the only multilateral binding convention that can have a worldwide application. In our view, more work should be carried out by the Council of Europe to promote the adoption of this Convention by non-member countries, and also the adoption of the 2018 Protocol by member and non-member countries.

3.3.2. *2001 Convention and its 2018 Protocol*

The Convention is applicable to automated personal data files and the automatic processing of personal data in the public and private sectors (art. 3) (60). Four articles of the Convention that may be relevant for the tax administrations in this digital administration era, are articles 5, 6, 7 and 8. Article 5 addresses the quality of data stating that «personal data undergoing automatic processing shall be obtained and processed fairly and lawfully, stored for specified and legitimate purposes and not used in a way incompatible with those purposes; adequate, relevant and not excessive in relation to the purposes for which they are stored; accurate and, where necessary, kept up to date; preserved in a form which permits identification of the data subjects for no longer than is required for the purpose for which those data are stored» (61).

(58) Text of the Protocol amending the 2001 Convention available at Council of Europe (2018).

(59) Table with ratifications and signatures available at Council of Europe (2018a).

(60) According to art. 2 "personal data" means any information relating to an identified or identifiable individual ("data subject"); "automated data file" means any set of data undergoing automatic processing; "automatic processing" includes the following operations if carried out wholly or partially by automated means: data storage, carrying out of logical and/or arithmetical operations on those data, their alteration, erasure, retrieval or dissemination and controller of the file means the natural or legal person, public authority, agency or any other body who is competent according to the national law to decide what should be the purpose of the automated data file, which categories of personal data should be stored and which operations should be applied to them. See Council of Europe (1981).

(61) Convention art. 5.

Furthermore, article 6 addresses the protection of special data categories, stating that «Personal data revealing racial origin, political opinions or religious or other beliefs, as well as personal data concerning health or sexual life, may not be processed automatically unless domestic law provides appropriate safeguards. The same shall apply to personal data relating to criminal convictions» (62).

Article 7 introduces the data security requirement stating that «appropriate security measures shall be taken for the protection of personal data stored in automated data files against accidental or unauthorized destruction or accidental loss as well as against unauthorized access, alteration or dissemination» (63).

Article 8 provides for additional safeguards for the data subject. Accordingly, «any person shall be enabled:

– to establish the existence of an automated personal data file, its main purposes, as well as the identity and habitual residence or principal place of business of the controller of the file;

– to obtain at reasonable intervals and without excessive delay or expense confirmation of whether personal data relating to him are stored in the automated data file as well as communication to him of such data in an intelligible form;

– to obtain, as the case may be, rectification or erase of such data if these have been processed contrary to the provisions of domestic law giving effect to the basic principles set out in Articles 5 and 6 of this Convention;

– to have a remedy if a request for confirmation or, as the case may be, communication, rectification or erasure as referred to in paragraphs b and c of this article is not complied with". (64)

3.3.3. *Guidelines and the 2018 Protocol*

The Convention has been in place since 1981 (more than 30 years) and so the Council of Europe decided in 2012 to modernize the Convention «to better address emerging privacy challenges resulting from the increasing use of new information and communication technologies (IT), the globalisation of processing operations and the ever greater flows of personal data» (65).

For this purpose, the Council of Europe commissioned a study and or new guidelines on the protection of individuals with regard to the processing of a personal data in a world of big data (66). These guidelines were discussed in the consultative committee of the Convention for the Protection of Individuals with regard to the Automatic Processing of Personal data.

(62) Convention art. 6.
(63) Convention art. 7.
(64) Convention art. 8.
(65) Council of Europe (2018b).
(66) Council of Europe (2017: 2).

The guidelines are applicable to big data and big data analytics. In this context the Guidelines state that

> «in terms of data protection, the main issues do not only concern the volume, velocity, and variety of processed data, but also the analysis of the data using software to extract new and predictive knowledge for decision-making purposes regarding individuals and groups» (67).

Therefore, the guidelines introduce a precautionary approach in regulating data protection and introducing risk assessment considering the legal, social, and ethical impact of the use of Big Data. In addition, controllers should adopt preventive policies to ensure the protection of persons with regard to the processing of personal data and introduce appropriate measures to identify and mitigate the risks of data processing by introducing measures such as "by design" and "by-default" solutions (68).

2018 Protocol

Following to some extent the Guidelines, the Protocol of 2018 provides for more transparency and protection in data processing and introduces the greater accountability of data controllers, and the obligation to declare data breaches. This Protocol also introduces the legitimacy of data processing (art. 7 amending art. 5 of the Convention) stating that such «processing shall be proportionate in relation to the legitimate purpose pursued and reflect at all stages of the processing a fair balance between all interests concerned, whether public or private, and the rights and freedoms at stake» (69).

Furthermore, the data processing included in art. 6 should also include genetic data, personal data, biometric data (art. 8 amending art. 6 of the Convention). The controller also has the requirement to notify data breaches.

In respect of big data and data analytics, this Protocol introduces new rights for people in an algorithmic decision-making context. These rights are particularly relevant in connection with the development of artificial intelligence. Accordingly, art. 11 of the 2018 Protocol states that (i) in order to obtain confirmation of the processing of personal data on request, at reasonable intervals, and without excessive delay or expense, the communication of the processed data must take place in an intelligible form in order to ensure the transparency of processing and (ii) the data subjects have the right not to be subject to a decision significantly affecting him or her based solely on an automated processing of data without having his or her views taken into consideration (70).

(67) Council of Europe (2017: 2).

(68) By design refers to appropriate technical and organizational measures taken into account throughout the entire process of data management, from the earliest design stages, to implement legal principles in an effective manner and build data protection safeguards into products and services. According to the "by default" approach to data protection, the measures that safeguard the rights to data protection are the default setting, and they notably ensure that only personal information necessary for a given processing is processed". Council of Europe (2017: 2).

(69) Art. 7 2018 Protocol.

(70) Mosquera Valderrama, I. J. (2019).

Privacy by design and privacy by default

In addition, the Protocol includes the obligation of the controller and data processors to introduce a privacy by design principle and privacy by default (art. 12 introducing a new article 10 in the Convention).

For privacy by design, these obligations include: «(i) the implementation by controllers/processors of technical and organisational measures, which take into account the implications of the right to the protection of personal data at all stages of the data processing; (ii) the examination, prior to the commencing of such processing, of the likely impact of intended data processing on data subjects' rights and fundamental freedoms; and (iii) the design of the data processing in such a way that it prevents (or minimizes) the risks of interference with those rights and fundamental freedoms. These changes aim to make data controllers/processors aware of the data protection risks of processing big data, and to take them into account when designing their data processing systems (71).

For privacy by default, the Protocol states that controllers and processors should implement technical and organizational measures which take into account the implications of the right to the protection of personal data at all stages of the data processing [new art. 10(3)]. The explanatory statement to the Protocol further elaborates on this privacy by default principle stating that

> «When setting up the technical requirements for default settings, controllers and processors should choose privacy-friendly standard configurations so that the usage of applications and software does not infringe the rights of the data subjects (data protection by default), notably to avoid processing more data than necessary to achieve the legitimate purpose. For example, social networks should be configured by default so as to share posts or pictures only with restricted and chosen circles and not with the whole internet». (72)

3.4. European Instruments for personal data protection

Art. 29 of the 1995 Directive on Data Protection created a Working Party for the Protection of Individuals with regard to the Processing of Personal Data (WP 29). The working party had an advisory status and acted independently from the European Commission. This working party was required to transmit annual reports on the situation regarding the protection of natural persons with regard to the processing of personal data in the EU and in third countries (73). With the introduction of the new Directive on Data Protection and its regulation, this working party ceased to exist in May 2018, and it was replaced by the European Data Protection Board (74).

(71) Mosquera Valderrama, I. J. (2019).
(72) Para. 89 at Council of Europe (2018b: 15), Para. 89 Explanatory Statement.
(73) Justice and Consumers (2021).
(74) Justice and Consumers (2018).

The working party, in addition to the annual report, also published opinions, working documents, letters regarding issues of importance for the implementation and the enforcement of the data protection rules in the EU.

Regarding the IoT, the WP 29 published Opinion 8/2014 with the aim «to contribute to the uniform application of the legal data protection framework in the IoT as well as to the development of a high level of protection with regard to the protection of personal data in the EU. Compliance with this framework is key to meeting legal and technical issues, but also, since it relies on the qualification of data protection as a fundamental human right» (75).

In order to do so, the WP 29 introduced a set of recommendations addressed to «the different stakeholders concerned (device manufacturers, application developers, social platforms, further data recipients, data platforms and standardisation bodies) to help them implement privacy and data protection in their products and services» (76).

Reference is made to developers to follow 'privacy by design approach' and minimise the amount of collected data required. However, no reference is made to how this can be used by governments, and in the case of taxation, by tax administrations.

3.4.1. *EU General Data Protection Directive and Regulation*

The EU Data Protection Directive (EU) 2016/680 and the Regulation (EU) 2016/679 apply to the processing of personal data wholly or partially by automated means as well as to non-automatic processing.

Like the Council of Europe Convention, the Regulation introduces the obligation of data controllers to introduce privacy by design or by default mechanisms. The Regulation states that

> «the controller should adopt internal policies and implement measures which meet in particular the principles of data protection by design and data protection by default. Such measures could consist, *inter alia*, of minimising the processing of personal data, pseudonymising personal data as soon as possible, transparency with regard to the functions and processing of personal data, enabling the data subject to monitor the data processing, enabling the controller to create and improve security features. When developing, designing, selecting and using applications, services and products that are based on the processing of personal data or processing personal data to fulfil their task, producers of the products, services and applications should be encouraged to take into account the right to data protection when developing and designing such products, services and applications and, with due regard to the state of the art, to make sure that controllers and processors are able to fulfil their data protection obligations» (77).

(75) Article 29 Working Party (2014: 3).

(76) Article 29 Working Part (2014: 3).

(77) Para. 78 General Data Protection Regulation (2016), Para. 63, Directive on the Protection of natural persons with regard to the processing of personal data by competent authorities (2016).

In addition, the Directive and Regulation updated the data that can be obtained to include biometric and genetic data (78). However, unlike the Council of Europe Convention explained in Section 3 above, no reference is made in these instruments to big data or data analytics or the right of persons in an algorithmic decision-making context (see art. 11 2018 Protocol Council of Europe Convention).

Therefore, in our view regarding the use of big data and IoT (79), we can argue that the Council of Europe Convention and its Protocol should be the instrument that countries need to ratify by European countries and countries around the world (80). Further research should be carried out on the application of this Convention to the collection and exchange of taxpayer's information including the use of IoT. Finally, since the Council of Europe Convention is only applicable to personal data, in our view it is also important to extend the protection of this Convention to business data including trade secrets.

4. VAT & CUSTOMS

This part of the article aims to analyse how the Internet of Things (IoT) could be a helpful resource for Tax and Customs Authorities to solve managerial issues in the collection of VAT and Customs' duties. The section aims to answer the questions: what state of the art we can find? Are there any pilot trials or measures already implemented? How keen on using IoT are States and Governments for tax purposes? Are there advancements on tax policies and regulations to use IoT for helping Tax and Customs authorities with their obligations?

In order to answer these questions, the reader is provided with the following section structure: an initial brief approach to the state of the art of IoT for general tax purposes, followed by some practical examples of the first pioneer countries that dared to start exploring how to take advantage of IoT in the fields of taxation and customs and, finally, a consideration on how IoT could be used as another tool to counteract fraud and avoidance for tax authorities in VAT/GST and Customs.

(78) Para. 13 and 14 General Data Protection Regulation (2016).

(79) See also the blogpost van Hout (2019).

(80) The Directive and Regulation also refer to the Council of Europe Convention, Para. 68, Directive and para. 105. Regulation stating that it will take into account the commitment of the country to the Council of Europe Convention, Para. 68 «Apart from the international commitments the third country or international organisation has entered into, the Commission should also take account of obligations arising from the third country's or international organisation's participation in multilateral or regional systems, in particular in relation to the protection of personal data, as well as the implementation of such obligations. In particular the third country's accession to the Council of Europe Convention of 28 January 1981 for the Protection of Individuals with regard to the Automatic Processing of Personal Data and its Additional Protocol should be taken into account».

4.1. Internet of Things: an unexplored territory for Tax Authorities

Internet is everywhere. Since that first experiment in 1982 where a group of students at Carnegie Mellon University (Pittsburgh, Pennsylvania) connected ARPANET –the current Internet precursor (81)– to a coke machine to know whether cold bottles and cans were available (82); and Dan Lynch's toaster connected to the Internet (83) to control the on and off power and the precise moment to automatically pop a slice of toast –which was classified as the very first IoT device–; IoT technology has substantially advanced and nowadays we can find it in lockers, watches, lights and even e-textiles and IoT clothing (84).

This substantial advancement in the connectivity of ordinary objects allowed us to create a full network of devices interconnected between them. Today we find vehicles, buildings and cities filled with many different devices, sensors and software trained to collect and exchange data of all kind. These vehicles, buildings and cities are what we call smart cars, smart homes, or smart cities. Businesses take advantage of such technology to improve the day-to-day management, resource consumption or the outcomes. Monitoring the production chain or even the supply chain is also possible. Reaching this point, such technology is resourceful for Public Administrations to collect data for general interests such as taxation and customs.

The IoT can play an important role in the logistics process. Once monitored goods have left the manufacturer's installations, tracing the packages of goods at all times would not be that difficult. The amount of data generated by such devices might include information considered relevant for tax purposes. Tax Administrations could be able to track and trace movements of goods, collect exact data on certain service providers or even on product consumption (Seco, 2017). According to the IBM White paper on *Tax Administration 2025* «Revenue agencies could potentially use this capability for tracking the movement of goods to both ease the burden on business taxpayers in complying with VAT/General Sales Tax (GST), and excise and customs taxes. Policies regarding IoT data are yet to be set in many instances, and it is not apparent that tax policymakers are representing their interests» (Lutes, 2016: 13). Even though there are many countries with IoT initiatives in the public sphere (85), *a priori* it seems that the potential of IoT for tax purposes is still unexplored for the majority of jurisdictions. Nonetheless, some countries have already started some pilot programmes to test the capacity of this disruptive technology.

(81) See Abbate (1999: 133) and ff, and Ceruzzi (2012: 121) and ff.

(82) Teicher (2018).

(83) Romkey (2017).

(84) Fernández-Caramés, Fraga-Lamas (2018: 405-44).

(85) The most exponential case is the Chinese Social Credit System (See Lee, 2019: 952-970 or Mac Sithigh and Siems, 2019). Nevertheless, there are other cases not that extreme and holistic but more focused on singular fields such as education, environment, wildlife conservation, energy or healthcare (see Harbert, 2017; Olvsrud, 2017).

4.2. Practical examples of the implementation of IoT for VAT/GST and Customs purposes

This part of the section aims to expose the different initiatives taken by some Tax Authorities to use IoT on the field of VAT/GST. The governments of those territories allowed Tax Authorities to implement some pilot programmes within their borders to test how useful it could be to integrate IoT devices in the field of indirect taxation and customs and excise duties. The selected countries are Singapore, Philippines, Indonesia and Brazil, as they are the ones with more advanced initiatives with tangible results.

4.2.1. *Singapore*

In 2011 the Singaporean Inland Revenue Authority (IRAS) launched the first electronic Tourist Refund Scheme (eTRS) as explained in Global Blue (2011). The eTRS «connects multiple Central Refund Agencies and retailers on a single platform, offering tourists a seamless, hassle-free experience when they shop in Singapore and look for refunds for the Goods & Services Tax (GST) paid before leaving Singapore» says the Inland Revenue Authority of Singapore (n.d.). Via Changi International Airport or Seletar Airpor. According to Poh (2013), to receive the refunds, the tourists (86) have to show the retailers their passports, as they are the link to target all the purchases of goods [services are not eligible for the refund (87)]. The passport and the payment method details are introduced in the database, and in this way, they can automatically tag the target (88).Tourists have to claim the refunds at the Airport "Kiosks", which are internet-connected stands that access the central database. The tourists first have to scan their passports at the Kiosk, then verify their purchases and finally choose the refund method (in cash, to a specified credit card or an Alipay account). However, if an inspection of goods occurs, the tourist should have either the goods and the original receipts and tickets to proof it. Singaporean Authorities aimed to speed up the processing times for retailers and tourists, as well as reducing the number of the mistakes that might happen when manually executing the process.

On the other hand, Singapore is also trying to combine IoT with Blockchain technology to improve customs management. In collaboration with IBM, the IT Corporation, Singaporean Customs Authorities initiated a pilot project to update the customs flow system, from the origin to its destination, using several Blockchain mechanisms (89). «Customs would be able to see the necessary and accurate data (seller, buyer, price, quantity, carrier, finance, insurance, etc.) that have been tied with the goods to be de-

(86) See also IBFD (2017).

(87) This exclusion happens as the GST is a sales tax. The reimbursement is on sales taxed, which goods are going to be exported. Tourists take them outside the territory. Exported goods are supposed to be declared and taxed in their destination. When entering the destination country, as imported goods, they should be taxes with an equivalent sales tax.

(88) The credit card worked in a first version of the system as a token to which all purchase details are automatically tagged.

(89) Seco (2017).

clared and also keep track of the location and status of such goods in real time» (90). By adding Blockchain technology, Customs Authorities could extract necessary information directly from the primary sources. This would improve the capacity of risk analysis and targeting, as the quality of data would be superior.

4.2.2. *Philippines*

On the 27th March 2013, the Philippine Bureau of Internal Revenue (BIR) published the Memorandum Order 8-2013, by which it prescribed a series of policies and guidelines to implement the Mobile Revenue Collection Officers System (MRCOS). The MRCOS is the MRCOS is «an automated and integrated system that provides all authorized collection officers the means for the immediate capture of tax and non-tax payments, as well as receipt of no-payment tax returns, and the issuance of Revenue Official Receipts (RORs), Official Receipts (ORs), or Acknowledgment Receipts (ARs), as the case may be, the automatic generation of pertinent reports, and secured real-time reporting of collection information to the BIR internal systems» (91). The Revenue Officers would be equipped with a wireless device connected to the Internet and able to print the different ROR, OR and ARs via Collection Officer Receipting Devices (CORDs).

The CORD comprises a printer and a wireless device equipped with an Internet connection and general packet radio service access. On 15 April 2014, the BIR published the Revenue Memorandum Order 17-2014, which contained additional guidelines to implement the MRCOS and it also contains penalties and sanctions (92). In other words, the Philippine Tax Authorities equipped their officers with mobile devices that not only allow them to generate tax receipts *in situ* but also allows them to consult and exchange information in a real-time basis with the central data base. Moreover, the devices are geo-localisable. Thus, the officers can be monitored (93), and the routes they follow can be optimized in terms of time/costs saving.

Apart from the additional guidelines, the BIR is also trying to broaden the central databases with additional information on the taxpayers, especially companies. Where are they located and which is its business purposes, to identify which specific goods go out from each company and which services are provided. The idea is to cross that information with a stamp system that can be inspected in the market-place. The official stamp would certify the tax compliance of that product, since the Officers could use the CORDs to instantly detect which products have fake stamps or are simply unregistered products, and thus detect tax evasion cases (94). The scan of the product would allow the officers to link the product to a specific taxpayer and check the tax compliance at the same time. This proposal came out as part of President Duarte's campaign against tax evasion and smuggling, especially focused on the tobacco industry. The progressive increase of the Philippine excise tax on tobacco boosted the smuggling of said pro-

(90) Okazaki (2018: 16).
(91) Revenue Memorandum Order, n.º 8 (2013).
(92) Revenue Memorandum Order, n.º 17 (2014).
(93) Ho (2017).
(94) Ho (2017).

duct (95), and at the same time caused a tremendous impact on VAT losses (96). The use of MRCOS and the CORD device together with a stamp system would help to plug tax leakages.

4.2.3. *Indonesia*

Indonesian orography makes tax compliance control particularly difficult. More than 17.000 islands go to make up the country. For this reason, the Indonesian government aims to use drones to improve the tax collection coming from agricultural and mining activities. Small drones are cheaper than satellites and helicopters, and they are equipped with more precise cameras. These characteristics make them ideal for flying over fields and plantations, for showing the exact extent of plantations and also the exact extent of the mineral extraction areas. The drones take pictures every five seconds that are computed and mapped. Then these collected data are compared to the tax returns previously submitted by the owners and taxpayers exploiting of the fields (97). Although it is mainly used for income taxation, it could also be useful for indirect taxation purposes. Depending on the results: extension of the fields, number of trees, plants, etc.… it could help to detect if the amount of turnover declared matches the real capacity of a plantation of that size, or if the turnover declared is lower than what would be expected from the correct dimensions of a particular field. This could thus be a first step towards justifying a tax audit of the warehouses and factories that exploit said piece of land.

4.2.4. *Brazil*

Brazil started a pilot project called Brazil-ID. Even though it is not purely an IoT based system, the philosophy behind it is the same as the IoT one. Brazil-ID is a system to identify and authenticate and trace merchandises, based on radio frequency technology (RFID) together with other wireless communications. The project initiated in 2009 as a joint initiative of Federal Tax Administration and the Tax Administrations of the Brazilian States.

The Tax Authorities intended to collaborate with research centres and logistic and transport companies to «develop and implement a technological infrastructure of hardware and software that guarantees the identification, tracking and authentication of goods produced and in circulation in Brazil, with the use of RFID chips, aiming to standardise, unify, interact, integrate, simplify, reduce bureaucracy and accelerate the process of production, logistics and inspection of goods by the country» (98).

The ultimate goal is to have full control of the transit of goods circulating within the whole Brazilian territory and also to manage the ICMS (*Imposto sobre Circulação de Mer-*

(95) The pressure on stopping tobacco tax leakage accelerated when even tobacco packages with fake stamps were sold on the giant Alibaba. See Venzon (2017).

(96) See Padin (2019).

(97) See The Business Times (2015) and also see Ho (2017).

(98) Sistema de Identificação, Rastreamento e Autenticação de Mercadorias, (2013).

cadorias e Serviços) or the Tax on the circulation of goods and services (99). In 2017, 13 out of the 27 federal states were participating in the project and installed radio antennas on the main roads to identify the different goods, packages, cargos and vehicles that are provided with RFID chips and sensors and also tax documents, for which holding a *smart card* (100) is necessary since they will link the transported products and to access the e-tax documents. Finally, an electronic cargo carrier seal will be necessary to bond the cargo to a smart card –the tax documents– and the vehicle identifier (101). With this system, Brazilian authorities aim a double objective: on the one site they aim to standardise, unify, interact, integrate, simplify the logistics process and at the same time cut the red tape and accelerate the tax processes (102).

RFID technology combined with IoT technology allows a more precise «inventory control with greater reliability of data provided at the time of the events at any point in the production chain» (103), and at the same time, it allows data to be transferred on a real-time basis with Customs and Tax Authorities, to know the routes merchandises would follow.

4.3. Commentaries on the use of IoT for VAT/GST and Customs purposes

Southeast Asia and the ASEAN countries in general are the ones which have a more advanced implementation of IoT policies, in a general sense (104) and also in a tax-oriented sense. The European Union is starting to develop some IoT guidelines, but not focused on taxation purposes (105). By the time the EU started to draw up common standards and guidelines to implement IoT (106), Asian countries were already starting to run the first pilot programmes using such technology purely for tax purposes.

With this in mind, in 2017, Spain regulated for the first time the figure of "drones" (107). The regulation aims to provide a framework of requirements that this type of aircraft must comply with in terms of identification, security or design. It also establishes certain limitations to fly over some areas. The prohibitions and limitations depend on the purpose to use the images. For instance, R&D activities, forestall and agricultural activities, patrolling and surveillance or filming for radio, TV broadcasts or advertisements require a special airworthiness certificate. Following the same pattern as the Spanish standard, due to an increasing number of drones and other unnamed aircraft, the European Commission is about to provide a common Regulation for the EU

(99) Seco (2017).

(100) The e-card is called Cartão de Documentos Fiscais Eletrônico (FDC-e). More information is available at Sistema de Identificação, Rastreamento e Autenticação de Mercadorias (2013).

(101) Identificação, Rastreamento e Autenticação de Mercadorias (2013).

(102) See RFDI Systems, n.d.

(103) Gomes Grande (2013).

(104) See OECD (2019d).

(105) See European Commission, (n.d.)

(106) See European Commission (2016).

(107) See Real Decreto 1036/2017, de 15 de diciembre.

territory (108) whose implementation has been delayed due to the COVID-19 pandemic (109). The EU wishes to introduce listed categories of drones according to the types of operations the drones might carry out and level of risk they entail. The riskier the operations, the more restrictions, certifications and limitations are going to be required, especially regarding the pilots.

Tax audits that require the assessment of physical facts with tax relevance can be carried out in a much easier and more precise way with drones. However, drones also have their drawbacks. Although they do not pollute with CO_2 emissions, sound pollution, even for the small, non-commercial drones, is considerable (110). In the opinion of Sastre Beceiro (2020), whenever a drone captures graphic data (images) that might be somehow related to geolocation data which might determine the identification of the owner of the parcel of land, GDPR limitations are at stake. From the time that an individual can be identified, it means that those graphic data could be considered as personal data, and so special care should be taken to ask for consent to fly over private property. Notwithstanding such regulations in domestic and EU legislation, and the relevance of the GDPR, the standards do not provide any limitation or even mention the use of drones for taxation purposes, as they are conceived as private law regulations. Thus, tax authorities within the EU could take advantage of using drones for their tax audits whenever required, as Article 23 restricts the application of the GDPR for taxation and budgetary matters.

Nowadays, attention seems to be more focused on research into the potential applicability of Blockchain mechanisms to plug VAT/GST leakages or improve effectiveness as well as reduce the timing of the whole supply. This is the case of initiatives such as the IBM and Singaporean Pacific International Lines (PIL) project to develop an electronic Bill of Lading employing Blockchain technology (111); the interest of the European Commission's Directorate General for Taxation and Customs in this particularly disruptive technology (112); or the innovative work of Ainsworth and Todorov, presenting a challenging *Digital Invoice Customs Exchange (DICE) to solve the major EU VAT issues. The DICE is* «a technology-intensive tax compliance regime for VAT/GST that utilises invoice encryption to safeguard transactional data exchanged between seller and buyer in both domestic and import/export contexts while simultaneously notifying concerned jurisdictions about the transaction details» (113). Such a system would enable real-time VAT/GST enforcement, thereby reducing one of the major concerns in terms of VAT/GST: the missing trader fraud, as it «relies on a real-time exchange of encrypted data» (114). However, there are still many inherent risks in the Blockchain technology (115).

(108) See Regulation (EU) 2019/947, of 24 May (2019).

(109) Commission Implementing Regulation (EU) 2020/746 of 4 June 2020.

(110) In this sense, see Paine (2019) for the videos and charts that prove the loud levels of the buzzing emissions of drones.

(111) See The Bitcoinmag (2018), n.d.

(112) See, Taxation and Customs, n.d.

(113) Ainsworth and Todorov (2013).

(114) Ainsworth and Todorov (2016: 1171).

(115) Unauthenticated users are not part of the system, data is fed by humans, and that always leaves an open door to error or the high costs of the whole system, to name a few examples. [See Biçimseven and Kocaman, (n.d.): N.:16-17].

Nonetheless, the combination of IoT and Blockchain technology seems to be the future of supply chain management. Using IoT devices, together with the level of security brought by Blockchain encrypted documents, would solve most of the major customs problems: misclassification, customs clearance, inadequate documentation or missing trader fraud. IoT devices can track assets, monitor the locations and operations of vehicles on a synchronized basis, foresee the arrival of specific products within the packages and even notify any delays. Moreover, IoT could also be capable of collecting data from machines [robots (116)] in a factory and warehouse (117). Machines provided with a wireless connection, are able to collect and transfer specific and accurate data about many aspects of interest to Customs and Tax Authorities: the nature of those products they are manufacturing, the quantity they produce, how many units, which unit is packed in a particular box or container, when the products (and which specific ones) leave the factory to go to a warehouse, and when how many of them are leaving the warehouse towards a specific destination (118).

Both IoT and Blockchain are technologies that require close collaboration between the Tax Authorities and the logistics and distribution companies, especially in the field of VAT and Customs. Meanwhile, they can be really useful for reducing tax management costs as it is a brand new technology that not many people are using. Equipping taxpayers with such technologies for tax purposes is going to be difficult unless the Tax Authorities ease the way by granting some tax incentives, such as reducing the tax compliance cost for those taxpayers willing to collaborate. Those taxpayers need to compensate the costs and investment in such technology. Moreover, the tax authorities would also need to make an investment, updating their tax assessment systems to make them more interactive with the IoT technology. Thus, even though IoT (and its combination with Blockchain) might entail an important reduction in tax management costs regarding the control on tax compliance, as information would flow much easily, its implementation is pricey, as it would require an intense collaboration between taxpayers, IT companies and the tax authorities to provide good evaluation and coverage.

IoT technology is right at the very dawn of its implementation, especially for Public Authorities. More advances lay ahead, especially with the introduction of 5G technology, which has been «conceived mainly for a future in which tens of billions of devices and sensors are connected to the Internet» (119). Even though not many governments have dared to allow Tax Authorities the usage of IoT capacities for Customs and VAT/GST, the progressive increase in the number of such devices will facilitate (or at least encourage) the adoption of tax policies on the matter.

(116) See OECD (2018: 33).

(117) See Channel 4 Documentary (2019)

(118) «The technical infrastructure of these systems is mainly made up of intelligent devices connected to internet and sensor technologies such as RFID, GPS or similar […] China Smart Factory 1.0 project is trying to catch up with the process. In a pilot project implemented at the Bosch Rexroth Plant in Hamburg; people, machines and products work interconnectedly» [Biçimseven and Kocaman, (n.d.): 14].

(119) OECD (2019: 19).

4.4. Final remarks

Governmental initiatives to use IoT in different aspects of public policies are taking off. However, the applicability of IoT in the taxation area is still at an initial phase. In contrast to Blockchain technology that seems to have wider acceptance, IoT is still at a dormant stage, particularly in the field of indirect taxation. Nevertheless, interesting initiatives are seeking to prove the advantages of incorporating IoT devices and capabilities in the taxation field to reduce bureaucratic processes, saving time and costs for both parties, Administration and Taxpayers, and improving the current compliance control tools.

The Singaporean Electronic Tourist Refund system has proven during the last decade how the "Kiosks" streamlined the whole managerial process to refund tourists the GST when leaving the country, and it also helped to improve the level of tax compliance, reducing small errors, for instance, the misplacement of receipts, mistakes with the manual introduction of data. The centralized database linked to a token (first a credit card, later the passport) reduced bureaucratic processes and improved the results. The same occurred with the Philippine MRCOS. The integrated database together with the wired electronic device allows the Tax Officers to detect fake tax stamps *in situ*, and thus immediately identify the taxpayers who have evaded custom excise and VAT/GST taxes.

The Brazilian radiofrequency ID system aims to localize the merchandise from its origin to its destiny. The incorporation of IoT within the supply chain allows the immediate gathering of information from relevant data for determining the VAT/GST amount and its taxable subject, also allowing the possibility of following the whole product shipment process, making it possible not to skip any Customs steps or lose any key document. Finally, the ingenious Indonesian drone control proves how disruptive technology is an ally for improving the functioning of the whole fiscal system. All the different examples seem to rely on the data quality and precision of the IoT devices to inform the tax authorities in a faster and more efficient way, with less human mistakes. Using drones properly equipped to send images in real time to the tax authorities, might substantially improve those tax audits that require a territorial inspection as well as the assessment, even through the sound pollution they emit.

Despite all the advancements, the EU is still a long way behind Asian countries in terms of using disruptive technologies for tax purposes, and particularly the IoT one. Interesting initiatives and proposals try to provide a solution to the major problems experienced within the field of VAT and Customs. However, the EU is still acting prudently regarding IoT. The lack of regulation and the potential perils for taxpayers' rights require an unhurried implementation of such a mechanism. Nevertheless, there is a far more advanced study and even trial of another disruptive technology, Blockchain.

The future of IoT on VAT/GST and Customs seems to pass through the combination of IoT and Blockchain together. The security levels of Blockchain plus the capacity of gathering and exchanging data of IoT seem to be the perfect combination for modernising the supply chain tax and customs duties. Even though not many governments have dared to allow Tax Authorities to use IoT capacities for Customs and VAT/GST, it is just a matter of time. We need to wait for the 5G connection capacity to reach its full splendour to see the whole potential of such devices.

5. FISCAL INCENTIVES

The Independent Authority for Fiscal Responsibility of Spain (AIReF) has recently presented an evaluation analysis of 13 fiscal benefits of our fiscal system (120), in which it analyses and evaluates whether said benefits are, in fact, reaching the aims for which they were created, as well as to determining whether they are distorting the market in any way that makes its reformulation necessary.

Spain has, therefore, started to systematically check fiscal benefits in its fiscal system, trying to fulfil the permanent demand of the doctrine (121).

However, we have to consider that a rigorous analysis for an adequate fiscal benefit structure, or for an adequate evaluation of the aim or suitability of such benefits necessarily requires a large amount of information that the public administration needs to provide, information that has to be relevant and adequate.

As long as the IoT allows to automatically connect machines or devices with no human interaction, we are facing a very interesting system that could help design and evaluate fiscal benefits.

Amongst the main advantages of the IoT are the possibility of obtaining a large amount of real and factual information from citizens/taxpayers in areas of interest and relevance for the creation, reformulation or, if applicable, elimination of fiscal benefits.

At the same time, being able to obtain such information in a constant manner, allows the State to monitor compliance and analyse whether the reasons behind certain fiscal benefits are still applicable, or, where applicable, allows the State to detect a problem and whether said problem could be adequately solved. It could also help to evaluate fiscal benefits before and after being applied.

The IoT would mean that any fiscal system or regulation based on projections would no longer be necessary, as the system could get direct information in real time. As such, we are facing an issue which, as we will soon explain, can be basic to reformulate or even eliminate some of our fiscal benefits. At the same time, the IoT would allow us to create fiscal incentives that are easily controllable, which, in practice, would let us create such incentives.

Another advantage of the IoT is, on the one hand, the reduction or elimination of administrative costs that it would mean for citizens and taxpayers when it comes to applying for such benefits; and, on the other hand, the lower cost and immediacy for its concession or denial.

Finally, we cannot forget two problems that the IoT has and must be considered for its correct implementation: firstly, the privacy of the information received, related with the rights and guarantees of the taxpayers (122); and also the possible problems when

(120) See AIReF (2020).

(121) The economic literature, as well as several international organizations, have pointed out repeatedly the need for a fiscal benefit analysis, due to the loss of tax collection that those benefits produce in State budget [Domínguez Martínez, J. M. (2014)].

(122) This question is analysed in depth in the previous section 2.

it comes to the transmission of the information, as we cannot forget we are considering a very complex system.

5.1. Application of the IoT in fiscal benefits

5.1.1. *Procedure of concession of applied for fiscal benefits*

We are currently seeing the difficulties of different public administrations to process, in a reasonable timeframe, the concession of grants or public assistance. As a clear example, we are facing the problems of the public administration to process nowadays the requests for employment assistance as a consequence of the health crisis, or the requests for public assistance for the poorest. In most cases, the delay in the process comes, on the one hand, from the inability of the public administration to process the petitions that are presented in a short timeframe; and on the other hand, the high number of documents, certifications and paperwork necessary to be submitted by citizens and companies to meet the requirements to apply for said benefits.

In the fiscal department, this kind of problems also happen when people have to apply for fiscal benefits, in other words, when taxpayers and citizens have to apply for a certain fiscal benefit to receive it, and they must also present the documents to prove they can apply for it.

The procedure is regulated in articles 136 and 137 of Royal Decree 1065/2007, July 27th (123). Article 137.1 of RD 1065/2007 establishes that fiscal benefits will be applicable from such time as the law establishes, or as from such time as they are granted (124).

In this way, if a citizen does not know they have the right to apply for a certain fiscal benefit, or if the application is delayed because the citizen needs to collect documents and apply for it, the citizen will not receive the fiscal benefit merely because of a formal and bureaucratic issue. In the same way, a delay in the concession would also harm the citizen (125).

In our opinion, the technological advance of the IoT would allow to progressively eliminate the number of fiscal benefits that have to be applied by the citizens, and at some point, eliminate all of them; or, at least, it would mean we need to reformulate the recognition process for such benefits, as we could automate the process, and in many

(123) Letter c), part 1, article 117 of General Tax Law 58/2003, December 17th, contemplates within administrative activity the general tax administration, and the recognition and verification of the origin of tax benefits, according to the regulation law regarding such procedure.

(124) This question has been analysed, *inter alia*, by Acín Ferrer, A. (2009: 258-262) and Moreno Serrano, B. (2012: 2753-2758).

(125) It is interesting to point out the non-binding resolution by the Directorate-General of Taxation, 0010-13, April 29th 2013, according to which, before the Royal Decree 1065/2007 was passed, article 57 of Law 30/1992 was applicable, whereby it was allowed to apply retroactivity to any fiscal benefit as from such time as the citizen fulfilled the conditions, unless it had expired. However, after the passing of the Royal Decree it became clear that, unless the standard itself sets a certain date for the taking effect, said incentive will be applicable from such time as it is granted.

cases, the IoT would enable the public administration to receive the information automatically.

In this case we have to distinguish between two cases:

– Firstly, those cases in which no public administration has the information to accredit the right to the fiscal benefit, but such information could be obtained directly through the automatic connection between the good that could give such info, and the public administration itself.

– Secondly, any situation in which the information is already known by the public administration.

The second case is considered, in a very limited way, in article 34.1.h) of LGT in which taxpayers have the right not to give the public administration those documents that have already been presented by them to the public administration, as long as the taxpayer states the date and the procedure when said information was given (126).

Art. 28.2 of Law 39/2015 is even more ambitious, as it does not require the taxpayer to determine when the information was given. Also, if the documents were produced by any public administration, the taxpayer will not be required to present them in any case. Such regulation would be meaningless without art. 155 of Law 40/2015, as it obligates any public administration to grant access to any information in its power, including information about conditions, protocols and criteria needed to access such information.

All this regulation is based on a "once-only" approach and, in our opinion, the IoT could improve the current regulation to make it more automatic, which would lower the administrative burden and costs and would mean less public employees working in such roles, and improve the effectiveness of the application of fiscal benefits, as it would not depend on the citizen applying for them, but on the citizen actually having the right to receive such fiscal benefits.

5.1.2. *Better control and tracing of fiscal benefits*

The IoT could give the public administration a better system to obtain information. In this way, all machines that have any kind of relationship with the taxpayer activities could transmit the data directly and automatically to the competent fiscal authority.

This possibility makes all tax systems not based on factual information unnecessary, as the IoT would make it possible for the public administration to get any information needed in an accurate, speedy manner.

(126) It is a classic right of administrative law. It was Law 30/1992 which determined this right in favour of citizens in article 35.f), as it established the right of «not presenting any documents not asked for in the applicable law of the procedure itself, or that are already in the hands of the administration». Later, Law 11/2007, July 22nd, in its article 6.2.b), regulated the law of «not giving data and documents that are already owned by the public administrations, which will use electronic means to get such information», where data protection was guaranteed. Currently, the right we are talking about is regulated in article 28.2 of Law 39/2015, October 1st.

It is possible to identify some cases, within the Spanish Tax Law, to this end:

Objective estimation regime

The objective estimation regime method is regulated in article 31 of LIRPF and it is a method to determine the voluntary tax base based on indices, signs or modules founded on the type of economic activity as long as certain dimensions are not surpassed. The economic activities and modules are regulated in Order HAC/1164/2019.

The fundamentals of this method are based on helping small companies calculate and determine the tax base and, therefore, reduce the administrative costs as much as possible, linked to the objective estimation regime. At the same time, the Tax Administration simplifies its inspection role. However, this method is being increasingly questioned as the activities that it comprises are taxed, as a general rule, in line with the amount it could be taxed if it were included in the direct estimation regime. This is due to the modules themselves, as they become progressively outdated, and taxpayer pressure so that these activities are not highly taxed. As such, tax law has been lowering the maximum net return limit that can apply to such a system.

From this perspective, the objective estimation regime could be considered as a preferential fiscal regime with lower taxation, and, as such, as a tax benefit, considering taxpayers subject to direct estimation regimes.

The IoT would allow for a major reform of this method, so that all those activities that could be controlled by a machine could start paying taxes through a direct estimation regime. Clear examples would be: firstly, when it comes to transportation, be it goods or people, as the activity could be easily monitored and, secondly, those sectors that produce or manufacture goods through a machine, as the machine itself could control the output (for instance, those goods produced in an oven or a similar device, such as bread).

Obviously, we would need to perform an exhaustive analysis, of each activity, and eliminate all activities that could easily be controlled through the IoT.

Goods subject to taxes set potentially or lump sum

The tax regulation establishes several elements that influence when it comes to calculate the tax quote, determining parameters and fixed amounts, but that the IoT could reconfigure and be set according to reality.

Some examples of such elements would be:

– The depreciation of goods could be changed by the IoT, as it would allow the adaptation of the percentage of the yearly depreciation to the actual depreciation that is happening to the good itself.

– The transport expenses exempt from taxes (art. 9 IRPF Regulation) could also be adjusted to reality, instead of fixing an amount per km.

– Some taxes and tax benefits, basically those that could be considered as a green tax, have been configured potentially based on the good technology in line with

the difficulties or the impossibility to obtain real information about the contamination. Based on the principle of "whoever pollutes, pays", the tax base of this kind of taxes with no fiscal purposes is based on taxpayers internalizing costs, or assuming higher payments based on the pollution that they produce or generate. Through the IoT it would be fairly easy to have access to real data about the pollution produced, both by cars and industries and, in general, by any machine that consumes energy. in this way, fiscal incentives or, where applicable, extra tax payments, could be design based, not on the potential level of pollution, but on the actual contamination it produces, irrespective of the technology used for its production.

New opportunities to design fiscal incentives

The improvement that the IoT could mean for the monitoring and controlling of activities with fiscal consequences could be translated into the implementation of fiscal incentives that would be difficult to apply nowadays because of the public administration limits, as they cannot be traced to control the adequate use.

By way of example, we can consider some fiscal propositions that were made to fill certain parts of Spain that have little or no population. New technologies and work-from-home opportunities make it much easier and viable to live in a place different from the place where the physical office is. For instance, a political party proposed reducing the rent taxation by 60% to all residents of such places. This could be a great opportunity to reduce the depopulation problem that some areas are suffering in Spain. In fact, the possibility of fiscally promoting such places could become a reality through the IoT, as the public administration could prove the real residency of the taxpayer.

At the same time, in the event that the State wished to promote working from home through fiscal benefits, controlling it would become much easier.

5.1.3. *Better analysis for the evaluation of fiscal benefits*

New technologies and smart things open up many possibilities with new ways of living, working etc., and the IoT will allow everything to be monitored, with a large volume of data and information, constantly being transmitted. This situation would allow for a recurrent and constant evaluation, both before and after, and both in terms of efficiency and impact, of all the tax benefits, both those that it is wished to implement, and those already established.

The Tax Benefits Budget is a very interesting and relevant document that allows us to know the tax expenses or the income that the public administration has not received as a consequence of tax benefits. It is true that the methodology of the document has been progressively improved, and has incorporated more precise and interesting information, such as, for instance, the classification of fiscal benefits in each and every expense category. However, although it has been cleared both by some authors [Del Blanco Garcia, A. J. (2017) and Ibañez García, I. (2018)] and by the Supreme Audit Institution (2017), it lacks analysis and evaluation that determine the fulfilment of the aims that the fiscal benefits are seeking.

The large amount of real data about conduct and economic activity that could be obtained through the IoT, would pave the way to a new era of efficiency, efficacy and impact evaluation which could be incorporated into government budgets, allowing for a better understanding and management of public expenses, in this case on the taxation side of the equation, and, finally, better transparency and understanding of the budget by the general population.

Special reference to taxes with a non-fiscal purpose

The IoT can be particularly relevant when it comes to analysing those fiscal incentives or taxes that are regulated with a non-fiscal purpose, such as health, environment or better access to housing, *inter alia*.

Several fiscal measures are currently being analysed to protect the environment or help citizens adopt healthier habits, either by taxing more or proposing new taxes, or by setting new fiscal incentives that drive forward better consumer habits. The IoT is particularly focused on transport and health, so that, in the near future, we will find many smart things that will collect and transmit data regarding said two activities. By way of example, and following the health example, if many or all households had a smart fridge, and the data regarding the consumption of food and goods could be directly transmitted to the public administrations, the State would be able to analyse in a very precise way whether certain fiscal incentives are, in fact, modifying citizens' consumption habits.

5.2. Final remarks

The IoT is a technology which is still developing and it is not possible as of today to use it in those measures that help design and manage fiscal benefits. However, we are facing a new technology that will, sooner rather than later, evolve, and once established, it will hopefully help to improve the fiscal system and, in particular, fiscal incentives, as has already been explained throughout the article. On the one hand, it would allow for a better management of applications for fiscal benefits, helping public administrations get the information they need to manage it; on the other hand, it would make it necessary for governments to reform and adapt lump sum or potentially set fiscal benefits.

Lastly, it would be a turning point allowing an improvement in the evaluation of fiscal benefits and certifying the fulfilment of their aims, as well as their efficiency and impact.

However, the IoT creates new challenges for public administrations, and the need to adapt the regulation when it comes to the guarantees and rights of the taxpayers.

6. ENERGY TAXATION

The road transport sector is the largest emitter of CO_2 in the transport sector. Therefore, if the objective of the EU European Green Deal is the radical reduction of the EU's

climate impact, it is imperative to incorporate the transport sector and households emissions into carbon pricing tools, including the Energy Tax Directive (ETD) (127).

The ETD has not been reviewed since 2003 and it needs updating if the European Commission is serious about deploying its Green Deal. A new restructured ETD should send the right pricing signals to influence behaviour and investment towards low emissions energy sources for sectors, such as transport or households. However, bearing in mind the economic situation caused by COVID-19, fundamentally, in households, new barriers could arise that might block the approval of the revision of this Directive.

If the ETD is not finally amended, EU Member States (MS) will have to continue to rely on unilateral instruments to reduce emissions in sectors excluded from the EU Emission Trading System (non-ETD Sectors). However, the emergence of new disruptive technologies, such as the Internet of Things (IoT), can be used in order to design these taxes and reduce the negative effects that energy taxes can have on social fairness.

In this regard, it should be noted how the aforementioned technology allows the measurement of different parameters related to environmental protection –CO_2 emission, energy consumption etc.–, making possible the subsequent transmission, even in real time, of the data collected by the aforementioned sensors to the corresponding Administrations. Consequently, we could have an instrument to design environmental taxes that might be easier to administer and apply. At the same time, these technologies could allow the automatic cross-referencing of data with the personal and economic situation of the user and with the utilization patterns (distances travelled, existing alternatives for collective transport on routes, number of occupants etc.). All these parameters could thus be used to adapt the tax burden to the personal circumstances of the taxpayer.

Starting from the existence of these technologies, in this chapter we intend to make an unusual proposal to face some of the barriers wielded by some States for the adoption of energy taxes with a true environmental objective. The above, without prejudice to always bearing in mind that the current reality is that the IoT is at a stage of a "peak of exaggerated expectations". Consequently, that this technology is at a stage in which it is supposed to be widely applied, but without properly tested cases.

6.1. Energy taxation in the context of COVID-19

Due to the health crisis caused by COVID-19, the EU and its MS have had to adopt emergency measures to preserve the health of citizens and prevent a collapse of the economy. In that context, the European Council adopted in July 2020 a recovery package combining the future Multiannual Financial Framework (MFF) and a specific Recovery effort under Next Generation EU (NGEU) (128).

(127) European Commission (2019).

(128) The new Multiannual Financial Framework (MFF) will cover seven years (2021-2027). The budget will enable the EU to respond to current and future challenges and to fulfil its political priorities. The MFF, reinforced by "Next Generation EU" (NGEU), will also be the main instrument for implementing the recovery package in response to the socio-economic consequences of the COVID-19 pandemic. The maximum total figure for expenditure for the EU-27 for the period is

The European Council has agreed that the plan for EU recovery will need massive public and private investment at EU level to set the Union firmly on the path towards sustainable, resilient recovery, creating jobs and repairing the immediate damage caused by the COVID-19 pandemic whilst supporting the Union's green and digital priorities (129). In fact, in order to have access to the EU Recovery and Resilience grants, MS shall prepare national plans setting out the reform and investment agenda that need to be assessed by the European Commission (EC) and approved by the Council. In these plans, an effective contribution to the green and digital transition shall be a prerequisite for a positive assessment (130).

In order to reach this agreement and finance the recovery plan, MS have committed to reforming the EU's own resources system and introducing new own resources whose proceeds will be used for the early repayment of borrowing related to the recovery plan: 1) A new own resource based on non-recycled plastic waste; 2) A Carbon border adjustment mechanism; 3) A digital levy; 4) A proposal on a revised ETS scheme, possibly extending it to aviation and maritime; 5) Financial Transaction Tax (131).

Finally, the possibility of modifying the current European framework for energy taxation has also been included in the "Fit for 55" package presented by the EC. The EC has recognized that the achievement of its Green Deal objectives will require effective carbon pricing and the removal of fossil fuel subsidies (132). In that sense, well-designed environmental taxes will play a direct role and, in particular, energy taxes should be designed in such a way that they send the right price signals to reduce emissions over time, improve resource efficiency and incentivize sustainable practices of producers, users and consumers.

However, the modification of the current ETD will not be easy. Specially, in the context of the exceptional nature of the economic and social crisis, which requires extraordinary measures to support the recovery of the economies of the MS and citizens (133). A situation

EUR 1,074,300 million in appropriations for commitments, including the integration of the European Development Fund, and EUR 1,061,058 million in appropriations for payments. [*Vid.:* https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf].

(129) European Commission (2020).

(130) «Reflecting the importance of tackling climate change in line with the Union's commitments to implement the Paris Agreement and the UN Sustainable Development Goals, programmes and instruments should contribute to mainstream climate actions and to the achievement of an overall target of at least 30% of the total amount of EU budget and NGEU expenditures supporting climate objectives. EU expenditure should be consistent with Paris Agreement objectives and the "do no harm" principle of the European Green Deal». *Ibid.*

(131) *Ibid.*

(132) Fossil fuel subsidies in the EU have not decreased and are estimated to be EUR 55 bn, remaining roughly stable across the sector. Subsidies to petroleum products (mainly tax reductions) account for the largest share within fossil fuels. *Vid.* European Commission (2019a).

(133) EU households paid almost half (49%) of all energy tax revenue collected by governments in 2017. The contribution of businesses, mainly from the services and manufacturing industries, was nearly identical (48%). The remainder (3%) relates to the amounts payable by non-residents or that could not be allocated to a specific group of payers. On average, transport taxes paid by households accounted in 2017 for a larger share (67%) of the EU transport taxes than those paid by the business sector (33%). This is because households are the main payer of the motor ve-

in which the problems of fairness linked to energy taxation could be a weapon used by some MS to not go ahead, once again, with the necessary revision of this instrument.

In this sense, the EC itself recognizes that, whilst tax increases for fossil fuels in the transport or heating sector are powerful incentives towards behavioural change, in the short term, consumers may not be easily able to change their consumption patterns when an important share of their income is involved. Of course, addressing these aspects will be necessary to ensure that the transition and the EU's delivery of its Paris Climate Agreement commitments provide economic opportunities for industry and households alike.

Therefore, although energy transition will bring benefits, it will also generate transitional, social and distributional problems. According to some studies (Gago *et al.*, 2020), the distributional effects of energy-environmental taxation will depend on how the generated revenue is employed. Consequently, how the revenue is recycled is critical in a tax reform proposal such as the revision of the ETD.

Hence, additional measures are necessary in order to prevent energy taxation from generating inequalities and having unintended regressive effects that can exacerbate energy poverty. Precisely in order to address the social and economic consequences of the objective of reaching climate neutrality by 2050 and the Union's new 2030 climate target, a Just Transition Mechanism, including a Just Transition Fund, will be created in the EU. Along with this, the Digital Europe programme will invest in key strategic digital capacities such as the EU's high-performance computing, artificial intelligence and cybersecurity. It will complement other instruments, notably Horizon Europe and CEF, in supporting the digital transformation of Europe (134).

Taking into account these programmes, and the potential to obtain resources associated with energy taxes, in the following sections we have set forth a new approach towards dealing with the social problems associated with the adoption of an energy tax whilst moving towards a digital transition. Specifically, we propose to allocate part of these funds and the collection obtained through these taxes, not only to finance public expenses or invest in renewable energy; but to add to these policies the adoption of IoT technologies, which could help both to reduce the energy bill of households and to design energy taxes more efficiently.

6.2. The lack of a truly environmental component in the EU´s energy tax system

The current European framework for energy taxation is Directive 2003/96/EC (ETD), which lays down the EU rules for the taxation of energy products used as motor fuel or heating fuel and electricity (135).

---

hicle tax revenue (an important component of transport tax revenue) in the EU. *Vid.*, European Commission (2019a).

(134) The financial envelope for the implementation of the Digital Europe programme for the period 2021-2027 will be EUR 6.761 million.

(135) Other uses of energy products and electricity (i.e. energy products such as raw material) fall outside the remit of the ETD.

The ETD sets minimum levels of taxation for energy products used as motor fuel, heating, and electricity; while allowing MS to apply the national rate above these minimum rates as well as to introduce additional taxes. This structure makes it a potentially suitable instrument for these products to reflect in their prices the cost to society of the CO_2 emissions resulting from their use. The idea was precisely for the ETD to become an instrument so MS could use taxation policy to support policies such as: environmental protection and the achievement of international climate-related commitments, energy efficiency, promotion of the EU economy by maintaining the competitiveness of EU companies in the international framework, consideration of transport policies and redirection of fiscal policy to combat unemployment.

However, the EU framework has remained unchanged since 2003 and is outdated. As a result, the current ETD hardly delivers on key objectives such as the diversification of energy sources and energy carriers or the improvement in the energy efficiency of production and consumption. Moreover, the absence of an increase in its minimum rates for more than a decade has eroded the tax-induced price signal necessary to encourage investment in energy-efficient technology and behaviour.

Furthermore, the minimum rates are not indexed to external developments such as inflation or a CO_2 benchmark –i.e. the EU Allowance (EUA) price (price of 1 tonne of CO_2 in the EU ETS)–. Along with the above, the ETD does not ensure a favourable tax treatment of low carbon fuels and uses. As stressed by the EC (2019 b), the taxation of fuels according to volume and not according to their energy content discriminates against renewable fuels in favour of conventional fuels, in particular gas oil, thus contradicting an energy policy geared towards fuel switching and the promotion of renewable and other clean energy sources. This works, for example, in a situation where, as long as the minimum rates are respected, renewable energy can be taxed at a higher rate than a competing fossil fuel (136). In addition, the current ETD also allows MS to grant exemptions and reductions, which are not systematically based on the potential of energy savings or emission reductions.

Therefore, the ETD not only fails to achieve its primary objective any more in relation to the proper functioning of the internal market (137); but neither is it adapted to the EU climate change and energy policy. All this, despite the fact that the EU institutions consider that taxation is set to play an important role in the achievement of these objectives. In fact, the EC (2019 b) emphasized that a future energy taxation framework should: (i) support the clean energy transition; (ii) contribute to sustainable and fair growth; and (iii) reflect social equity considerations.

(136) This is particularly negative in the case of biofuels. Under the ETD the taxation of biofuels is based on volume (the rate applicable to the volume is the rate applicable to the fossil fuel replaced by the renewable alternative). Thereby the ETD does not take into account the lower energy content of these products, which, ultimately, leads to a potentially higher tax burden on biofuels compared to the same volume of the competing fossil fuel.

(137) In the last decade, some MS have increased their national level of taxation whilst others have not. As a result, there is risk of the growing distortion of competition in the Single Market and an erosion of the tax base in high-taxing countries (i.e. motor fuels that can be easily and legally transported across borders).

For these reasons, in 2019, as part of the European Green Deal, the EC presented an initiative to revise the ETD in 2021. The main objectives of the review of the ETD would be: i) Aligning the taxation of energy products and electricity with EU energy and climate policies with a view to contributing to the EU 2030 targets and climate neutrality by 2050 in the context of the EU Green Deal. ii) Preserving the EU internal market by updating the scope and the structure of rates as well as by rationalising the use of optional tax exemptions and reductions by Member States.

In 2011 the Commission had already sought to amend the scope and structure of the ETD (138). Amongst other issues, the objective was to tax energy products in a way that reflects both their energy content and CO_2 emissions. The revision was aimed at the following objectives: i) To ensure consistent treatment of energy sources within the ETD in order to provide a genuine level playing field for energy consumers (by setting a minimum rate for taxation based on energy content and CO_2 emissions, with an equal taxation for competing products); ii) To provide an adapted framework for the taxation of renewable energies; iii) To provide a framework for the use of CO_2 taxation to complement the carbon price signal established by the EU ETS while avoiding overlaps between the two instruments (139).

Nevertheless, given the requirement for unanimity between MS set by art. 113 of the Treaty on the Functioning of the European Union (TFEU) (140), and after almost four years of negotiations, MS could not agree on the main political aspects of the proposal and, finally, the Commission withdrew its proposal in 2015 (141).

To be precise, the main novelty of the new proposal is not so much its content but the legal basis on which the EC intends to base its adoption. According to the EC (2019b), as the revision of the ETD will be focused on environmental issues, in the context of the European Green Deal, it would be possible to avoid the requirement for unanimity between MS set by art. 113. In particular, the EC proposed to use article 192 of the TFEU (environmental measures including measures of fiscal nature) that allows European Parliament and the Council to adopt proposals in this area through the ordinary legislative procedure by Qualified Majority Voting rather than by unanimity in the Council.

However, even if the Commission can finally overcome the unanimity barrier, the adoption of the new proposal could face obstacles and reluctance related to its potential social impacts.

---

(138) Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, COM(2011) 0169 final - CNS 2011/0092 of 13.4.2011.

(139) Antón, A. and Villar M. (2014).

(140) The legal basis for the ETD is Article 113 of the TFEU for the harmonisation of indirect taxes, including excise duties, to ensure the establishment and the functioning of the internal market and to avoid the distortion of competition. According to this article, the Council shall, acting unanimously, adopt provisions for the harmonisation of turnover taxes, excise duties and other forms of indirect taxation to the extent that such harmonisation is necessary to ensure the establishment and the functioning of the internal market and to avoid the distortion of competition.

(141) Withdrawal of Commission proposals (OJ C 80, 7.3.2015: 17–23).

6.3. Energy Taxes, social equity considerations and IoT solutions

The tax system has been used with a non-fiscal function in environmental matters, pursuing the incentive or disincentive of harmful or environmentally protective behaviours. As academics have stated, the correct setting of carbon pricing instruments helps countries steer their economies towards and along a carbon-neutral growth path and with well-designed rates, base and revenue use is good climate policy and good fiscal policy (142). Therefore, according to the EC, a correct design of the ETD will reduce emissions by increasing the price of carbon intensive products, reducing the demand for them and increasing the demand for carbon-efficient products, because they become cheaper than carbon-intensive products (143).

Whilst carbon prices support the adoption of clean technologies over time, there are also immediate negative effects when they are introduced or increases, in particular, associated with energy taxes that are levied on transportation or heating fuels consumed by households (144). As they apply, normally, the same tax rate without exemptions or reductions, the energy costs and tax burdens may represent a higher proportion of expenditure in low-income households, which tend to consume more energy-intensive products given their limited possibilities to move to cleaner technologies –e.g. electric vehicles, heat pumps or roof-top installed solar panels (Gago *et al.*, 2020)–.

The distributional impact of energy taxes depends on the energy product considered (Gago *et al.*, 2018). In that sense, transport taxes are generally less regressive than those levied on electricity or heating fuels because households in lower income deciles are less likely to own a car and therefore spend less on motor fuels. However, road transport fuel taxes have largely been based on fiscal reasons, mainly, due to the low-price elasticity of automobile fuels. Meaning that taxes on them have limited effects on consumption and, therefore, on the volume and stability of revenue. The same authors conclude that taxes on transport are usually less regressive than those on other energy products. However, an increase in fuel tax rates would also have serious distributive impacts because it would raise the fiscal burden on the drivers of less efficient vehicles, especially those using heavy working vehicles and those who cannot afford more efficient vehicles.

Therefore, the main negative impact of ETD is associated with effects on household income distribution. Addressing these aspects will be necessary to ensure that the transition and the EU's delivery of its Paris Climate Agreement commitments provide economic opportunities for industry and households alike (Gago *et al.*, 2020).

(142) Flues, F.and van Dender, K. (2020).

(143) European Commission (2019a).

(144) «Carbon pricing encourages the use of clean energy and investment in clean technologies, i.e. renewable electricity and heating. It also encourages households to refrain from carbon-intensive activities that are of low value to them». However, «Higher prices do not reduce demand, if demand is entirely fixed, but this is a rare circumstance. Fixed demand requires the absence of substitution and income effects and can only occur as a short-run phenomenon for small subsets of energy users». Flues, F.and van Dender, K. (2020).

In this regard, economic science advocates that compensation is not only possible but could be designed to maintain the previous distribution of income or even improve it. Initially, one common policy recommendation for MS to face these challenges was to shift taxes away from labour to other tax bases (i.e. environmental taxes) in view of the expected positive effects on growth and employment (145). However, the current ETD has not contributed to this tax shift (146).

6.3.1. *IoT investment as a compensation measure*

As an alternative –or as a complement– to the latter compensation measure, the EC (2011) suggested that additional revenue from energy taxation of polluting sources could also be used to mitigate the impact of underlying policies on household income by compensating less well-off sections of the population (147). Following this train of thought, authors like Flues and van Dender (2017 and 2020) consider that the overall immediate effects of carbon prices on households depends on the use of revenues from carbon prices. Particularly, that an increase in carbon prices can improve overall domestic energy affordability if about one-third of the additional revenues from the carbon price are recycled back to poor households. Some of the possibilities listed by economists for recycling some of the additional revenue back to poor households include: 1) Social benefit systems; 2) Income-proven tax credits; 3) Targeted support for the poor; 4) Support in the form of lump-sum payments to all households. In the latter case, however, they point out that, although lump-sum payments ensure that more households benefit from the support, the poor will receive less than they would have received with specific targeted transfers. Moreover, the empirical evidence advocates compensating the adverse distributional effects through targeted transfers (Gago *et al*., 2020).

Taking into account the distributional problem, one way to face these negative impacts could be the allocation of the additional revenue to low-income households not only through targeted programmes to promote the use of renewable energy sources (148).

(145) Arnold, J. (2008) and Johansson, A. *et at*. (2008).

(146) Shift in the taxation on the overall percentage of tax revenues from environmental taxes in the EU has remained relatively unchanged over the last decade. See Eurostat - Environmental taxes in the EU: countries compared [https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190212-1].

(147) In 2016, the European MS collected 275 billion euros from energy taxes. These energy taxes are typically not recycled for specific use, but as a part of governmental income and they thus play an important role for general government spending purposes such as deficit reduction and infrastructure financing [*vid*.: https://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics].

(148) European energy subsidies have increased in recent years, from EUR 148 bn in 2008 to EUR 169 bn in 2016, with the energy sector being the main beneficiary (EUR 102 bn in 2016), followed by the residential sector (EUR 24 bn), the energy intensive manufacturing industry (EUR 18 bn) and transport (EUR 13 bn). The increase was driven by the growth in renewable energy subsidies which reached EUR 76 bn in 2016. Over the period 2008-2016, free emission allowances fell from EUR 41 bn to EUR 4 bn, due to decreasing carbon prices and fewer eligible sectors for receiving free ETS allowances. European Commission (2019a).

But also, through support systems to make accessible to them the use of IoT and smart devices that could enable energy networks and consumers to become more energy efficient in general. In this regard, for example, several MS have introduced 'dynamic price contracts' which take advantage of new technologies to provide flexible and market responsive pricing through automated services and smart metering. This can empower households and reduce their energy bill, even without requiring any change in behaviour (149).

Once again, one of the main problems with this approach would be the issues of equity related to growth in IoT device use and the resulting data analytics from their use. Therefore, despite the potential of IoT applications some factors, such us the lack of access to the internet or the price of the device, could also make things worse for low-income households. The concern is the cumulative impact of inequality and how some consumers may be left out of the benefits of IoT (150). Therefore, if the public sector does not implement policies to encourage equitable deployment «the IoT could exacerbate existing inequalities by providing the benefits of data-driven decision making only to some people, and placing already underserved communities at an even greater disadvantage» (151).

The EU recognises that the smart integration of renewables, energy efficiency and other sustainable solutions across sectors will help to achieve decarbonisation at the lowest possible cost. The rapid decrease in the cost of renewables, combined with the improved design of support policies, has already reduced the impact on households' energy bills of renewables deployment. Moreover, the EU is aware of the need to address energy poverty so households can afford key energy services to ensure a basic standard of living. For this reason, shuffles, among other measures, some financing schemes for households to renovate their houses in order to reduce energy bills.

Thus, the recycling of the additional revenue back to households could be associated with specific programmes to promote the deployment of technologies for environmental considerations –such smart meters– and become part of the range of measures that are in place at EU and national level to facilitate decarbonisation and innovation in the energy sector, households and transport. Thus, these programmes could become an alternative to traditional measures to address energy poverty –based on price support or price relief, such as regulated prices to fix energy prices– that, according to the EC, do not target low-income households and weakens price incentives for producers and consumers (152).

However, as Milne (2019) has pointed out, the digital world not only brings significant improvements, such as the ability to more effectively integrate renewable energy into the electricity grid and control household energy consumption. It may also have negative effects in the form of increased electronic waste or demands for energy.

(149) European Commission (2019a).
(150) White House (2014).
(151) U.S. Department of Commerce (2017).
(152) European Commission (2019a).

One option to avoid this possible inconvenience and, at the same time, reduce the energy bill of citizens –although in an indirect and general way– could consist of allocating the collection of environmental taxes, not to the acquisition of devices of this type by households, but to public bodies to use them to invest in public domain infrastructures. (For example, in smart traffic management systems that may reduce road congestion and emissions from cars or in smart energy systems installed in public facilities and spaces to make them more energy efficient). In this scenario, the number of devices produced might be reduced whilst the number of users and positive impacts could increase.

One of the problems of this approach, *inter alia*, is that not only would it not help the neediest households as direct specific targeted transfers would, but also that it would not take into account, once again, that «[…] the ostensible cleanness of the digital world, which often comes from its ethereal, remote nature, should not cloak its real carbon footprint». Therefore, the possible benefits of these initiatives should not be valued without taking into account their negative impacts on the environment and, specifically, their carbon footprint (153).

Consequently, when designing a support system for these technologies, not only their benefits should be taken into account, but also their negative externalities. Externalities which, in the future, might even make necessary a set of environmental pricing instruments to correct them. Along with all the above, there are also social and ethical issues, such as the acceptance by the older adults and the privacy and confidentiality that should also be a requirement of any environmental solutions. However, as explained below, these technologies also have the potential to address some of the current issues related, precisely, with the setting and administration of instruments related with environmental pricing.

6.3.2. *IoT technologies and the design of environmental taxes*

In principle, a correct design of the ETD will reduce CO_2 emissions by increasing the price of carbon intensive products, reducing demand for them, and increasing the demand for carbon-efficient products –they become cheaper than carbon-intensive products– [Flues, F. and van Dender, K. (2020)]. However, in most cases, the design of these economic instruments has not been based on environmental estimates due to the difficulties of real measurements (154).

(153) To support this claim, Milne (2019) argues that the keystone of the digital era, the ITC (data centres that process and store data, networks that transmit the data or connect devices and users), are huge consumers of energy which, in many cases, does not have a renewable origin. This assertion is supported by studies by Greenpeace or the IEA which estimate the information technology sector, including manufacturing, could account for 12 percent of global electricity demand in 2017, up from 7 percent in 2012. Moreover, the data centres consumed about 1 percent of global electricity and data networks accounted for another 1 percent.

(154) Moreover, literature in environmental taxes continues to discuss the question of *how to set such tax rates correctly* (what to tax and by how much) (Voulis, N. *et al.*, 2019).

The increase in new disruptive technologies, such as IoT, can be of great help in the field of environmental taxation. In this regard, due consideration should be given to the potential of these technologies to measure in real time different parameters related with environmental protection (CO_2 emission, energy consumption, etc.), allowing the subsequent transmission, even in real time, of the data collected by the sensors to the corresponding tax administrations or public bodies. Therefore, environmental sensors driven by IoT technologies could play an important role in carbon compliance and governance, in particular through the expansion of carbon monitoring and its taxation.

Therefore, we could have an important instrument to design environmental taxes that are easily administrable. At the same time, these technologies could allow the automatic cross-referencing of data with the personal and economic situation of the user and with the utilization patterns (distances travelled, existing alternatives for collective transport on routes, number of occupants etc.). All these parameters could thus be used to adapt the tax burden to the personal circumstances of the taxpayer.

Consequently, both for the purpose of taxing harmful behaviours against the environment, and in terms of environmental tax benefits, we could have an important instrument to validate and activate the measures adopted, based on compliance with the defined environmental parameters, through the information received from the aforementioned technologies.

The case of transport taxation may be an example of the role of these technologies in improving tax performance with an environmental nature. Currently, the three main categories of road transport taxes are: taxes on vehicles, taxes on fuels and taxes for access to infrastructure and cities.

If the Directive were properly designed to take into account behaviour in terms of GHG emissions of each fuel –and as there is a direct link between the consumption of fuels and CO_2 emissions– it would be an effective environmental tax on fuel and an efficient tool for dealing with the problem of climate change. However, to date, road transport taxes, including energy taxes adopted in the framework of the ETD, have largely been based on fiscal reasons. For example, due to the fact that the low price elasticity on automobile fuels have limited effects of taxation on consumption and, therefore, on the volume and stability of revenue (Gago *et al.*, 2018).

In fact, some studies warn that, in order to be an efficient carbon-pricing instrument, the tax rate of fuel taxes should be increased to a point where they could generate significant socio-economic and budgetary impacts (Santos, 2017). Moreover, taxes on fuels are not useful for facing other externalities associated with road transport and that do not depend on consumption but on factors such as the place and time of use or the type of vehicle used (local pollution, climate change, congestion, noise pollution). Dealing with all these externalities may translate into an increase in the number of taxes that have to be applied at the same time. Which, in turn, results in administrative difficulties and may translate into unequal, inefficient tax pressure.

IoT technologies open up the possibility of both redefining and redesigning these types of taxes so that they are more efficient and effective in dealing with the diffe-

rent externalities. For example, through technical advances in geolocation systems, remote vehicle identification and sensors that measure in real time the carbon emissions in vehicle exhaust systems and sends data to the tax administration.

However, the reality is that IoT could remain at the stage of the "peak of exaggerated expectations", meaning that its widespread application is assumed, but without duly evaluated cases of use (155). However, the EU's commitment to digitisation is a promising scenario for these technologies to reach the "productivity level" in the field of environmental protection and, therefore, to develop technologies and products with a defined and realistic use. Or, at least, lead to a state of affairs where public administrations support pilot projects, also in the field of IoT and environmental taxation.

7. CONCLUSIONS

The Internet of Things provides tax law with a significant range of technical resources for the collection, usage and transmission of all kinds of data on things and people: information about their location, physical characteristics, traceability or performance, which can be encrypted, exchanged and exploited by means of artificial intelligence systems.

Its development offers, both to taxpayers and tax administrations, a horizon of reliability in terms of evidence of the facts on which tax law is configured and applied which had gone unnoticed until now.

It is thus a technology that can have a remarkable impact –it is already beginning to do so– on the design and running of tax systems in areas such as, for example:

i) the identification, tracking and valuation of goods in international traffic;

ii) the calculation of the environmental footprint of products for import purposes;

iii) the capture of data by tax administrations, relevant for tax compliance and enforcement work;

iv) both the design of tax benefits and the evaluation of their effects and the control of the requirements foreseen for their application;

v) the design and measurement of environmental incentives in the management of energy taxes.

(155) As Seco (2017) has stated, «according to the *Gartner Group*, new technologies follow a particular cycle of evolution, divided into five stages, from conception until it reaches the development of usable products». It is observed that IoT is currently at Stage 2, called the "peak of exaggerated expectations", when a widespread application of the technology is assumed, without duly evaluated cases of use. If the technology thrives, it will go through two more steps to reach Stage 5, "Productivity Level", when the proper uses are more clearly defined and with market-ready products.

However, it is a technology whose implementation is not free of risks and costs that must be evaluated:

i) first of all, it involves such a large volume of collection and processing of sensitive data that, when using it, it is necessary to consider the respect for the fundamental rights of taxpayers recognized by conventional and constitutional law;

ii) on the other hand, it can generate additional costs in energy consumption or in its discriminatory application that would entail risks at an environmental level or in terms of regressivity.

All this has been discussed in this paper, which demonstrates the substantial practical usefulness of IoT in the present and, above all, the future, of tax law.

BIBLIOGRAPHY

Abbate, J. (1999): *Inventing the Internet*, The MIT Press, Boston.

Acín Ferrer, A. (2009): "Efectividad de los beneficios fiscales de carácter rogado", *La administración práctica: enciclopedia de administración municipal*, n.º 3: 258-262.

Afuso, O.; Coco, A. and Mosquera Valderrama, I. J. (2019): "A Multidisciplinary regulatory approach to big data and the rule of law", *Globtaxgov*, [https://globtaxgov.weblog.leidenuniv.nl/2019/01/01/a-multidisciplinary-regulatory-approach-to-big-data-and-the-rule-of-law/].

Ainsworth, R. T. and Todorov, G. (2013): DICE – Digital Invoice Customs Exchange, *Boston University School of Law, Law and Economics Research Paper*, 13-40 [http://dx.doi.org/10.2139/ssrn.2314478].

Ainsworth, R. T. and Todorov, G. (2016): "Blockchain Technology Might Solve VAT Fraud", *Tax Notes International*, n.º 83(16): 1165-1174.

AIReF (2020): *Spending Review Fase II: Beneficios fiscales* [https://www.airef.es/es/noticias/la-airef-resalta-el-coste-de-oportunidad-que-suponen-los-beneficios-fiscales-y-la-importancia-de-garantizar-su-eficacia/].

Angeloni, C. (2019): "Switzerland stops information exchange with Bulgaria", *International Adviser*, n.º 8, October [https://international-adviser.com/switzerland-stops-information-exchange-with-bulgaria/].

Antón, A. and Villar M. (2014): "Inherent Logic of EU Energy Taxes: Toward a Balance Between Market Protection and Environment Protection", in Larry Kreiser *et al.* (eds.): *Environmental Taxation and Green Fiscal Reform: Theory and Impact*, Critical Issues in Environmental Taxation, Vol. XIV, Edward Elgar: 55-69.

Arnold, J. (2008): "Do Tax Structures Affect Aggregate Economic Growth? Empirical Evidence from a Panel of OECD Countries", *OECD Economic Department Papers,* 643

Article 29 Working Party (2014): *Opinion 8/2014 on the on Recent Developments on the Internet of Things* [https://ec.europa.eu/justice/article-29/documentation/opinion-recommendation/files/2014/wp223_en.pdf].

Barrio Andrés, M. (2020): *Internet de las Cosas*, 2.ª ed., Reus Ed.

Biçimseven, B. and Kocaman, S. K. (n.d.): *Internet of Things and Customs: New Technologies on the Way to Customs4.0, RFID, Blockchain and Beyond* [https://www.academia.edu/40836135/

Internet_of_Things_and_Customs_New_Technologies_on_the_Way_to_Customs_4_0_RFID_Blockchain_and_Beyond?auto=download].

Del Blanco Garcia, A. J. (2017): "Propuestas de mejora en la evaluación de los beneficios fiscales en España", *ECJ leading cases* [https://ecjleadingcases.wordpress.com/2017/07/07/articulo-cientifico-alvaro-del-blanco-garcia-alvaro-del-blanco-garcia-propuestas-de-mejora-en-la-evaluacion-de-los-beneficios-fiscales-en-espana/].

Ceruzzi, P. E. (2012): *Computing: A Concise History*, The MIT Press, Boston.

Channel 4 Documentary (2019): *Amazon Warehouse is Run by Robots?,* Youtube, [https://www.youtube.com/watch?v=TUx-ljgB-5Q&ab_channel=Channel4Documentary].

Comité Económico y Social Europeo, CES (2019): *La fiscalidad de la economía digitalizada*, Dictamen de iniciativa ECO/458.

Council of Europe (1981): *Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data*, European Treaty Series, n.º 108, Strasbourg [https://rm.coe.int/1680078b37].

Council of Europe (1985): *Chart of signatures and ratifications of Treaty 108. Convention* for *the Protection of Individuals with regard to Automatic Processing of Personal Data* [https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/108/signatures].

Council of Europe (2017): *Guidelines on the protection of individuals with regard to the processing of personal data in a world of Big Data*, Directorate General of Human Rights and Rule of Law, Strasbourg [https://rm.coe.int/t-pd-2017-1-bigdataguidelines-en/16806f06d0].

Council of Europe (2018): *Protocol amending the Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data*, Council of Europe Treaty Series, n.º 223, Strasbourg [https://rm.coe.int/16808ac918].

Council of Europe (2018a): *Details of Treaty n.º 223. Protocol amending the Convention for the* Protection *of Individuals with regard to Automatic Processing of Personal Data* [https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/223].

Council of Europe (2018b): *Explanatory Report to the Protocol amending the* Convention *for the Protection of Individuals with regard to Automatic Processing of Personal Data*, *Council of Europe Treaty Series, n.º 223*, Strasbourg, 10.10.2018 [https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016808ac91a].

Court of Auditors of Spain (2017): *Informe de fiscalización de las actuaciones de la Agencia Tributaria en relación con los beneficios fiscales del ejercicio 2015,* n.º 1.249.

Debelva, F. and Mosquera Valderrama, I. J. (2017): "Privacy and Confidentiality in Exchange of Information Procedures: Some Uncertainties, Many Issues, but Few Solutions", *Intertax,* n.º 45(5): 362-381.

Domínguez Martínez, J. M. (2014): Los gastos fiscales en la teoría y en la práctica: la merma recaudatoria de un concepto elusivo, *Instituto Universitario de Análisis Económico y Social de la Universidad de Alcalá de Henares*, n.º 5: 1-41

D'Souza, C. (2019): Big Data and Trade Secrets (A General Analysis) (January 15, 2019). [https://ssrn.com/abstract=3316328 or http://dx.doi.org/10.2139/ssrn.3316328].

European Commission (2011): *Smarter energy taxation for the EU: proposal for a revision of the Energy Taxation Directive*, COM (2011)168/3.

European Commission (2016): *Advancing the Internet of Things in Europe accompanying the document of Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions Digitising*

European Industry Reaping the full benefits of a Digital Single Market, COM(2016) 180 final. Staff Working Document SWD (2016) 110 final. [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016SC0110&from=EN].

European Commission (2019): *The European Green Deal*, COM(2019) 640 final.

European Commission (2019 a): *Energy prices and costs in Europe*, COM(2019)1 final.

European Commission (2019 b): *A more efficient and democratic decision making in EU energy and climate policy*, COM (2019) 177 final.

European Commission (2020): *Europe's moment: Repair and Prepare for the Next Generation,* COM(2020) 456 final.

European Commission (n.d.): *The Internet of Things* [https://ec.europa.eu/digital-single-market/en/policies/internet-things].

European Commission (n.d. a): *Taxation and Customs. VAT in the Digital Age* [https://ec.europa.eu/taxation_customs/events/vat-digital-age_en].

Fernández-Caramés, T. M. and Fraga-Lamas, P. (2018): "Towards The Internet of Smart Clothing: A Review on IoT Wearables and Garments for Creating Intelligent Connected E-Textiles", *Electronics*, n.º 7(12): 405-441.

Flues, F. and Van Dender, K. (2017): "The impact of energy taxes on the affordability of domestic energy", *OECD Taxation Working Papers*, n.º 30, OECD Publishing, Paris.

Flues, F. and Van Dender, K. (2020): "Carbon pricing design: Effectiveness, efficiency and feasibility: An investment perspective", *OECD Taxation Working Papers*, n.º 48, OECD Publishing, Paris.

Gago, A.; Labandeira, X.; Labeaga, J. M. and López-Otero, X. (2020): "Transport Taxes and Decarbonization in Spain: Distributional Impacts and Compensation", *Hacienda Pública Española* [https://hpe-rpe.org/wpfd_file/characterization-and-detection-of-potential-fraud-taxpayers-in-personal-income-tax-using-data-mining-techniques/].

Gago, A.; Labandeira, X. and López-Otero, X. (2018): "Road Transport Taxation: Crisis and Reform", *Economics for Energy*, WP 01/2018.

Global Blue (2011): *IRA Singapore and GB launch electronic tourist refund scheme* [https://www.globalblue.com/corporate/media/press/ira-singapore-and-gb-launch-electronic-tourist-refund-scheme/#:~:text=SINGAPORE%2C%20November%209%2C%202011%20%E2%80%93,Tourist%20Refund%20Scheme%20(eTRS)].

Gomes Grande, E. T. and Lellis Vieira, S. (2013): "Beef traceability by radio frequency identification system in the production process of a slaughterhouse", *Journal of Information Systems and Technology Management*, n.º 10 (1) [https://doi.org/10.1590/S1807-17752013000100007].

González de Frutos, U. (2018): "La fiscalidad en el mundo Blockchain", *Revista de Contabilidad y Tributación (CEF)*, n.º 425-426: 5-36.

Giusy De Flora, M. (2017): "Protection of the Taxpayer in the Information Exchange Procedure', 45", *Intertax*, Issue 6: 447-460.

Harbert, T. (2017): "Practical Uses of the Internet of Things in Government Are Everywhere", *Government Technology*, January/February [https://www.govtech.com/network/Practical-Uses-of-the-Internet-of-Things-in-Government-Are-Everywhere.html].

Helberger, N. (2016): "Profiling and targeting consumers in the Internet of Things - A new challenge for consumerlaw", in R. Schulze & D. Staudenmayer (eds.): *Digital Revolution:*

challenges for contract law in practice: 135-161, Nomos, Baden-Baden [https://doi.org/10.5771/9783845273488-135].

Ho, E. (2017): *How the Internet of Things is improving tax Services in the ASEAN* [https://www.linkedin.com/pulse/how-internet-things-improving-tax-services-asean-ernest-ho/].

Ibañez García, I. (2018): "La necesaria evaluación de los beneficios fiscales en España, ¿llegó la hora?", *ECJ leading cases* [https://ecjleadingcases.wordpress.com/2018/03/30/isaac-ibanez-garcia-la-necesaria-evaluacion-de-los-beneficios-fiscales-en-espana-llego-la-hora/].

IBFD (2017): "Singapore - E-tax guides on GST Tourist Refund Scheme", *News IBFD*.

Inland Revenue Authority of Singapore (n.d.): *Electronic Tourist refund Scheme* [https://www.iras.gov.sg/irashome/Schemes/GST/Tourist-Refund-Scheme--for-retailers-/#:~:text=Electronic%20Tourist%20Refund%20Scheme%20(eTRS),-Background%20on%20eTRS&text=eTRS%2C%20which%20connects%20multiple%20Central,GST%20paid%20before%20leaving%20Singapore].

Iriarte Yanicelli, A. A. (2020): "Derechos y garantías de los contribuyentes en la cuarta revolución industrial: Aproximación desde las transformaciones de la relación jurídica tributaria en la era de la inteligencia artificial", en F. Serrano Antón (dir.): *Fiscalidad e inteligencia artificial: Administración tributaria y contribuyentes en la Era digital*: 221-295, Aranzadi, Cizur Menor.

Johansson, A.; Heady, C.; Arnold, J.; Brys, B. and L. Vartia (2008): "Taxation and Economic Growth", *OECD Economics Department Working Papers*, 620.

JRC Science Hub Communities (2019): *JRC Conference workshop May 2019 EU Digital Transcope (Digital Transformation and the Governance of Human Society) Project* [Final Report Workshop: https://ec.europa.eu/jrc/communities/en/node/1286/event/workshop-internet-things-implications-governance-may-13-14-2019].

Krasimirov, A. and Tsolova, T. (2019): "In systemic breach, hackers steal millions of Bulgarians' financial data", *Reuters* [https://www.reuters.com/article/us-bulgaria-cybersecurity-idUSKCN1UB0MA].

Lai, K. (2019): "Primer: China's social credit system", *International Financial Law Review*, Pn. pa.

Lee C. S. (2019): "Datafication, dataveillance, and the social credit system as China's new normal", *Online Information Review*, n.º 43(6): 952-970.

Lutes, T. (2016): "Tax Administration 2025. What is the global outlook for the next decade?", *IBM White Paper* [https://www.ibm.com/downloads/cas/BVAQ09RV].

Mac Sithigh, D. and Siems, M. (2019): "The chinese social credit system: a model for other countries?", *Modern Law Review*, n.º 82(6): 1034–1071.

Mantelero, A. (2017): "Regulating Big Data. The Guidelines of the Council of Europe in the Context of the European Data Protection Framework", in *Computer Law & Security Review,* n.º 33/5: 584-602.

Microsoft & PWC (2017): *Digital Transformation of Tax Administration* [https://www.pwc.nl/nl/assets/documents/pwc-digital-transformation-tax-oct2017.pdf].

Milne, J. E. (2019): "Environmental taxation in the digital world", in M. Villar Ezcurra, J. E. Milne, H. Ashiabor and M. Skou Andersen (eds.): *Environmental Fiscal Challenges for Cities and Transport*: 2-17, Edward Elgar Publishing.

Moreno González, S. (2021): "Cross-border exchange of tax information upon request and fundamental rights – Can the right balance be struck?: Joined cases C-245/19 and

C-246/2019, État luxembourgeois contre B EU:C:2020:795", *Maastricht Journal of European and Comparative Law*, DOI:10.1177/1023263X211021549.

Moreno Serrano, B. (2012): "Irretroactividad de los beneficios fiscales de carácter rogado", *El Consultor de los ayuntamientos y de los juzgados: Revista técnica especializada en administración local y justicia municipal*, n.º 24: 2753-2758.

Mosquera Valderrama, I. J. (2019): "Processing Personal and Business Data and the rule of law in the era of digital trade", *Central European Political Science Review*, vol. 20, n.º 76: 111-128.

Mosquera Valderrama, I. J. *et al.* (2017): "The Rule of Law and the Effective Protection of Taxpayers' Rights in Developing Countries", *WU International Taxation Research Paper Series* (10) [https://globtaxgov.weblog.leidenuniv.nl/files/2020/06/WU-SSRN-vienna-taxpayers-rights.pdf].

OECD (2018): *IoT Measurements and Applications*, OECD publishing, Paris.

OECD (2019): *Going Digital: Shaping Policies, Improving Lives*, OECD publishing, Paris.

OECD (2019a): *Implementing Online Cash Registers: Benefits, Considerations and Guidance*, OECD publishing, Paris [www.oecd.org/tax/forum-on-tax-administration/publications-and-products/implementing-online-cash-registersbenefits-considerations-and-guidance.htm].

OECD (2019b): *Measuring the Digital Transformation: A Roadmap for the future*, OECD publishing, Paris [https://doi.org/10.1787/2abc4f98-en].

OECD (2019c): *Secretary-General Report to the G20 finance ministers and central bank governors*, OECD publishing, Paris [http://www.oecd.org/ctp/oecd-secretary-general-tax-report-g20-finance-ministers-june-2019.pdf].

OECD (2019d): *Southeast Asia Going Digital. Connecting SMEs,* OECD publishing, Paris.

OECD (2019e): *Statement on the data breach in the National Revenue Agency of Bulgaria* [http://www.oecd.org/tax/transparency/documents/statement-on-the-data-breach-in-the-national-revenue-agency-of-bulgaria.htm].

OECD (2019f): *The Sharing and Gig Economy: Effective Taxation of Platform Sellers,* OECD publishing, Paris.

OECD (2020): Technical Assistance on Confidentiality and Data Safeguards, OECD [http://www.oecd.org/tax/transparency/what-we-do/technical-assistance/technical-assistance-on-confidentiality-and-data-safeguards.htm].

OECD's Forum on Tax Administration (FTA) (2020): *Tax Administration 3.0: The Digital Transformation of Tax Administration,* OECD publishing, Paris.

Office of the Privacy Commissioner (2020): *Privacy Guidance for manufacturers of Internet of Things* [https://www.priv.gc.ca/en/privacy-topics/technology/gd_iot_man/].

Olvsrud, T. (2017): *10 internet of things success stories*, CIO [https://www.cio.com/article/3229671/10-internet-of-things-success-stories.html].

Okazaki, O. (2018): "Unveiling the Potential of Blockchain for Customs", *WCO Research paper*, n.º 45.

Padin, M. G. (2019): "Special Report: Government cracks down on cigarette smuggling, counterfeiting", *Philstar Global* [https://www.philstar.com/headlines/2019/03/04/1898507/special-report-government-cracks-down-cigarette-smuggling-counterfeiting].

Paine, G. (2019): "Drones to deliver incessant buzzing noise, and packages", *The Conversation* [https://theconversation.com/drones-to-deliver-incessant-buzzing-noise-and-packages-116257].

Poh, E. H. (2013): "GST on Goods in Singapore's Open Economy", *International VAT Monitor*, n.º 24(3), IBFD, Amsterdam.

RFDI Systems (n.d.): *Brasil ID* [http://www.rfidsystems.com.br/en/brasil-id.html].

Romkey, J. (2017): "Toast of the IoT: The 1990 Interop Internet Toaster", *IEEE Consumer Electronics Magazine*, n.º 6 (1): 116-119.

Rozas, J. A. (2017): ¿Hacia un impuesto de actos jurídicos digitales?, *Revista de privacidad y Derecho digital,* n.º II (8): 133-155.

Rozas, J. A. (2018): "Retos tributarios en torno a la economía colaborativa digital", in G. Rubio Gimeno and A. Ortí Vallejo (dirs.): *Propuestas de regulación de las plataformas de Economía colaborativa: perspectivas general y sectoriales*: 339-358, Aranzadi, Cizur Menor.

Rozas, J. A. (2019): "Un impuesto europeo de acceso a internet", in G. Luchena Mazo and E. Sánchez López (dirs.): *Los retos del Derecho financiero y tributario desde una perspectiva internacional*: 277-296, Atelier, Barcelona.

Rozas, J. A. (2020): "Fundamentos y acicates de las políticas de *Compliance* tributario", *Forum Fiscal*, n.º 266: 1-19.

Santos, G. (2017): "Road fuel taxes in Europe: do they internalize road transport externalities?", *Transport Policy*, n.º 53: 120-134.

Sastre Beceiro, M. (2020): "El sobrevuelo de drones en explotaciones agrarias", *FENACORE* [http://www.fenacore.org/empresas/fenacoreweb/RJuridico/Art.Tec.Newsletter_Nov2020.pdf].

Scarcella, L. (2019): "Tax compliance and privacy rights in profiling and automated decision making", *Internet Policy Review*, n.º 8(4). DOI: 10.14763/2019.4.1422.

Seco, A. (2017): *The Internet of things and tax administrations: concepts, challenges and opportunities (i)*, CIAT [https://www.ciat.org/the-internet-of-things-and-tax-administrations-concepts-challenges-and-opportunities-i/?lang=en].

Serraller, M. (2021): "Hacienda pone el foco en los españoles que simulan residir en el extranjero", *Expansión* [http://rsocial.expansionpro.orbyt.es/epaper/xml_epaper/Expansi%C3%B3n/02_02_2021/pla_3634_Nacional/xml_arts/art_19052003.xml?SHARE=6C23C0F29C6C4F158F7CA6264B486305B2D91CBF1120E9DB62AB8AABDFE9864B8588A32927CB704DAEA45CBEA5F868831653CF776AE98B8D5B217EF5DCA9051B470FA4F0AA4087FD054594C7A6DD7E5AE5EA8A5C3A12FC48B35C3B92F8D982B8].

Serrano Antón, F. (dir.) (2020): *Fiscalidad e inteligencia artificial: Administración tributaria y contribuyentes en la Era digital*, Aranzadi, Cizur Menor.

Sistema de Identificação, Rastreamento e Autenticação de Mercadorias (n.d.): *O Brasil ID* [http://brasil-id.org.br/sistema-nacional-de-identificacao/].

Sistema de Identificação, Rastreamento e Autenticação de Mercadorias (2013): *Manual de Orientação do Contribuinte Brasil-ID Cartão de Documentos Fiscais Eletrônico – CDF-e Versão Preliminar* [http://brasil-id.org.br/wp-content/uploads/2017/08/MOC_CDFe_preliminar_v1.0.pdf].

Teicher, J. (2018): *The little-known story of the first IoT device*, IBM [https://www.ibm.com/blogs/industries/little-known-story-first-iot-device/].

The Bitcoinmag (n.d.): *IBM & Singapore Shipping Line to Trial E-Bill-of-Landing* [https://thebitcoinmag.com/ibm-singapore-shipping-line-to-trial-e-bill-of-lading/2749/].

The Business Times (2015): *Drones target tax cheats in Indonesia's palm oil plantations* [https://www.businesstimes.com.sg/energy-commodities/drones-target-tax-cheats-in-indonesias-palm-oil-plantations/].

U.S. Department of Commerce (2017): *Fostering Advancement of the Internet of Things* [https://www.ntia.doc.gov/files/ntia/publications/iot_green_paper_01122017.pdf].

Van Hout, D. (2019): "Legal protection in the era of big data", *Globtaxgov* [https://globtaxgov.weblog.leidenuniv.nl/2019/02/22/legal-protection-in-the-era-of-big-data/].

Van Hout, D. (2020): "Behavioural insights in tax law: are you nudged?", *Globtaxgov* [https://globtaxgov.weblog.leidenuniv.nl/2020/01/31/behavioural-insights-in-tax-law-are-you-nudged/].

Venzon, C. (2017): "Jack Ma asked to pull fake cigarette tax stamps off Alibaba", *Nikkei Asia* [https://asia.nikkei.com/Politics/Jack-Ma-asked-to-pull-fake-cigarette-tax-stamps-off-Alibaba2].

Voulis, N. *et. al.* (2019): "Rethinking European energy taxation to incentivise consumer demand response participation", *Energy Policy, Elsevier*, vol. 124(C): 156-168.

White House (2014): Big Data: Seizing Opportunities, Preserving Values [https://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_5.1.14_final_print.pdf].

World Economic Forum (2020): *We urgently need a Global Data Convention. Here's why* [https://www.weforum.org/agenda/2020/11/global-data-convention/].