Applying modern, disruptive technologies to improve the effectiveness of tax treaty dispute resolution

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Abstract
It is clear that international tax dispute resolution needs improvement. The OECD, the EU and the UN have all recently taken critical action to improve international tax dispute resolution by promoting prevention and timely resolution of treaty-related disputes. The stakes are high. As determined by the OECD, cross-border tax disputes are one of the main sources of international tax uncertainty, which in turn has a detrimental effect on FDI. The number of disputes concerning OECD countries has tripled since 2006. The policy shift in the post-BEPS era is expected to exacerbate the multiplication of international tax disputes in the foreseeable future. However, none of the previously mentioned recommendations take into account technology. In this context, the paper examines whether the emergence of new and disruptive technologies such as blockchain, artificial intelligence, shared-data platforms, and cloud-based solutions could complement MAP and supplementary arbitration and render them more effective by speeding up the resolution, reducing costs and establishing trust between the tax administration and the taxpayers.

To answer this question, the authors will briefly analyze the main drawbacks of the existing tax treaty dispute resolution process from the perspective of various stakeholders. Second, the paper will focus on the fundamental features of a few significant types of technology and analyze how they may improve this process. Emphasis will be placed on technology that reconciles effectiveness (timely and less costly resolution) and certainty with security, confidentiality and sovereignty.

Third, the authors make some specific suggestions of how the analyzed technologies can be used to improve the MAP and supplementary solutions. This will include electronic filing and checking of the MAP request with respect to documentation requirements, the use of artificial intelligence to review past cases allowing easier assignment to case workers, depending on their schedule, and thus, easier and more timely solutions based on precedents, automatic notification as regards the deadline before arbitration is triggered and automatic forwarding of request and information to the other competent authority(ies), automatic notification of the taxpayer of each material step taken in the resolution of the case (without providing access to secure data), communication and exchange of information between competent authorities via secure electronic means in real time.

1 This article has not considered the interim report 2018 of the OECD/G20 Inclusive framework on BEPS relating to tax challenges arising from digitalization, published on 16 of March 2018.
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time, and information storage in secure shared-data platforms (i.e. controlled access) allowing access to competent authorities and even to the arbitral panel, where required.

Finally, our proposal would posit that due to communication requirements, costs and security considerations, the implementation of technology solutions requires a global coordinated approach, which should be spearheaded and managed by the OECD. The implementation may be completed in several stages and could be subject to peer reviews. The aim of this paper is to encourage the various policy organizations working on making tax treaty dispute resolution more effective to consider the potential of disruptive technologies in their work.
1. **INTRODUCTION**

The emergence of disruptive technologies has transformed how business is conducted. Tax administrations ought to respond to the challenges digitalization poses by establishing a technology-driven culture via the implementation of information and communication technology (ICT) models that will enable the effective and efficient exercise of their competences. Effectiveness and efficiency in this context refer to the timely completion of procedures by the tax administrations, in a cost-effective, secure and transparent manner. In addition, from the perspective of the taxpayers, convenience and certainty are crucial. However, in a digital environment driven by mobile technologies and thriving through enormous data flows, there are concerns relating to the security of sensitive information exchanged. Data privacy, protection and confidentiality need to be assured for both tax administrations and taxpayers when taking advantage of such new opportunities. Based on the above, the digital transformation of tax administration procedures must be accompanied by the implementation of adequate technological models that have to be tailored according to each tax administration’s digital maturity and resource capacity.

Interestingly, several tax administrations in both developed and developing countries have already seized the opportunity to integrate ICT models in their tax procedures with a view to achieve improved tax compliance and revenue collection. Nevertheless, the use of technology has not yet been embraced with respect to international tax dispute resolution. This is particularly so as regards the Mutual Agreement Procedure (MAP), a dispute resolution mechanism involving tax authorities from two States attempting to amicably resolve a dispute arising in relation to a double taxation convention (DTC or tax treaty). This is potentially due to challenges related to the diversification of data protection regulations among different jurisdictions and confidentiality concerns, as well as due to divergences in the digital maturity of each tax administration. However, since the MAP has been criticized in the past as being cumbersome, opaque and time-consuming.

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3 See OECD (2016), Technologies for Better Tax Administration: A Practical Guide for Revenue Bodies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264256439-en, where it is specified that disruptive technologies raise interesting questions for revenue bodies, not just as tax collectors, but also about the way they go about their business activities, the way they manage service and compliance risk; and, importantly, how they support the development of environments that can make tax compliance less burdensome and more effective for taxpayers.

4 Transparency refers both to the information that the taxpayers provide to the tax administration and the information on which tax administration relies for assessing compliance.

5 Enabling of communication with the tax authorities via digital means and readily access to relevant information.

6 Indicatively, whether a taxpayer’s case is being reviewed by a specific official, how long the procedure might last, what sort of information the tax authorities are making use of etc.


8 See for instance the Nigerian Federal Inland Revenue State’s (FIRS) various ICT initiatives, amongst which is the web-based Stamp Duty Portal that facilitates online assessment and payment of Stamp Duties based on figures inputted in the relevant fields by Nigerian Taxpayers. The solution went live on 1 March, 2017. It can be accessed at http://stampduty.gov.ng. According to Wale Shonekan (Executive Chairman, (FIRS)), the stamp duty collection for 2017, 10 months after the above initiative was adopted, has surpassed the total collection of 2015 and 2016. See the presentation of Wale Shonekan in the conference on “Digital Tax Transformation”, the third meeting in the Multi-stakeholder series, 18-19 of December 2017, organized by the Global Tax Policy Center, WU, Vienna.
and resource consuming for taxpayers and tax administrations alike, there is a lot of scope for technology to improve the functioning of the MAP and other binding and non-binding solutions that supplement MAP. Through this paper, the authors propose possible improvements to the MAP and solutions to supplement MAP by means of technological tools, recommending a model for Technology Facilitated Mutual Agreement Procedure (TEFAMAP). This would be different from Technology Mediated Dispute Resolution (TMDR), which would involve a fully automated procedure and entails the introduction of technologies to improve and facilitate the MAP.

In this regard, this paper starts off by discussing the current status of the MAP while assessing the need of improving its effectiveness (Section 2). Further, selected technological models and trends will be described, with an emphasis on particular models that may address the effectiveness of the MAP (Section 3). The authors then attempt to integrate said technologies into the MAP with a view to balancing possible improvements to the MAP with the risks that the implementation of these technologies might entail (Section 4). Finally, the main results are summarized in the conclusion to the paper (Section 5).

2. PERCEIVED DEFICIENCIES IN THE MAP

2.1 General background

Taxation is traditionally considered a pure sovereign function of individual States. It is based on connecting factors with a jurisdiction. Therefore, simultaneous exercise of taxing rights by two States owing to different connecting factors, in a cross-border transaction, can lead to double taxation of the same income. States have entered into bilateral tax treaties that allocate the taxing rights between them to avoid such ‘double taxation’ in most cases.

However, a tax treaty has separate rules for different varieties of income and there may be differences in the way States interpret the same treaty. If, owing to different interpretations or even a failure to apply a tax treaty in a proper manner, the States tax a transaction in a manner that is not in accordance with the tax treaty, the taxpayer may either raise a dispute before domestic courts, or follow the dispute resolution remedy in the tax treaty itself. The dedicated dispute resolution procedure provided in a tax treaty is known as the MAP.

Article 25 of the OECD Model Convention provides for the MAP where a taxpayer, within three years from the unauthorized taxation, has the right to approach a designated governmental authority in either his residence State or the source State, the competent authority (CA), to raise a claim if he is taxed not in accordance with the tax treaty by either State. If his claim is justified in the opinion of the competent authority, the requested competent authority would approach the competent authority of the other State.

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10 A cross-border transaction may be taxed by the State of residence of the taxpayer i.e. the residence State as well as the State where the income arises i.e. the source State.
11 Since the OECD Model Convention is the most commonly accepted model for tax treaties and since most tax treaties contain an almost identically worded provision, we refer to this provision as our frame of reference.
State and ‘endeavour’ to resolve the dispute by ‘mutual agreement’. This is considered to be an inter-governmental process of dispute resolution between the CAs in which the taxpayers are usually not involved following the application for its initiation. Further, no obligation is placed on the competent authorities to resolve the dispute and no time-limit is prescribed within which the MAP should be concluded. Finally, tax administrations have struggled to devote resources to MAP and to manage large case volumes effectively. Owing to such factors, the MAP has been often criticized as not being an entirely effective remedy.  

In the following sub-sections, we explore perceived issues in the MAP, both from the perspective of the States and from the perspective of the taxpayer that may be improved by the use of technology.

### 2.2 Issues from the perspective of the Governments

There are several challenges that Governments face while implementing the MAP. Some of the most noteworthy issues that may be improved by the use of ICT are described below.

The broadest and most crucial challenge faced by the Governments in a MAP is the lack of resources. The CA function of the Government of a State usually consists of multiple divisions. At the very least, there are two divisions: the first for negotiation of new tax treaties and the second for dealing with MAP cases initiated by the taxpayer. In some cases, a third division is also created to deal with policy issues concerning the application and interpretation of a tax treaty.  

However, many developing countries have limited resources and are not able to devote much personnel to one function within a tax department. This is particularly so as regards the competent authority function since only highly qualified officials who understand complex issues concerning tax treaties may be given such responsibilities. In a developing country, where the international tax division itself only has limited personnel, it is difficult to allocate many people to the CA function and specifically, to deal with MAP cases. Further, if the same people are involved in the audit function and the competent authority function, there may be a concern since the CA may have a vested interest in upholding the audit assessment regardless of its validity and information obtained during a MAP may be used in the audit process.

Further, engaging in the MAP necessarily involves financial outlay on the part of States. Since MAP is a remedy that involves discussions between two CAs to attempt to arrive at a solution, governments face travel and accommodation expenses as well as translation costs for face-to-face meetings. This is particularly important since many CAs regard face-to-face meetings as more efficient compared to phone calls or e-mails.

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for the resolution of a MAP case.  

15 Ensuring access to information specific to a particular industry or a taxpayer may entail travel as well. From a broader perspective, in order to bring in more personnel to deal with such issues, Governments would also need to put in dedicated training and capacity building initiatives, which would be a financial load for many States.  

16 Resource constraints may also affect the implementation of multilateral efforts to improve the functioning of MAP. Owing to Action Plan 14 of the Base Erosion and Profit Shifting (BEPS) Project, States that are part of the OECD inclusive framework are bound to put into place some minimum standards as regards MAP.  

17 This includes an undertaking to effectively implement MAP and allow timely resolution of MAP cases, with specific commitments such as concluding cases within 24 months, ensuring adequate resources, ensuring separation between the CA and audit functions, providing MAP guidelines and rules for taxpayers, publishing detailed MAP statistics and country profiles, and becoming part of the OECD Forum on Tax Administration (FTA) MAP forum. The governments of participant States are at present being peer reviewed for such compliance by the OECD and are all working towards ensuring compliance with the stated standards. However, for governments of developing countries with limited resources, ensuring compliance with these standards would be extremely difficult since many States would not have the personnel or the funding to put in place a CA function that is independent from the audit function, to publish guidance or to send representatives to the FTA MAP forum discussions.  

18 This applies specifically for the compilation of statistics as well since this is done manually and there are no common standards among various bodies such as the OECD and the EU as regards date thresholds etc. required for such compilation, so the various statistics need to be compiled separately.

Another concern that deserves discussion is the management of the inventory of MAP cases by each CA. Since some pairs of States have a significant number of cases with each other and very few cases with other states, it may be difficult for CAs to give equal importance to all cases. For example, States A and B may have several cases dealing with cross-border employment owing to their geographical proximity and it may be difficult for the State A CA to devote equal attention to the hundreds of such cases and a single case arising with State C from another continent. Inventory management also becomes a challenge where different legal instruments that provide for the MAP are all applicable in a case and prescribe different procedures and deadlines for the MAP. Such is the case with the EU Arbitration Convention, the EU Dispute Resolution


16 Prozzo C., Supra, at p. 176, 177.


18 For example, in the Stage 1 peer review report of the Netherlands, it is pointed out that the CA function may not be completely independent from the audit function and that of Italy points out previous statistics as showing lack of adequate staffing in the past. Similar peer reviews of several developing countries may point out harsher results as regards this point. See OECD (2017), Making Dispute Resolution More Effective - MAP Peer Review Report, The Netherlands (Stage 1), p. 48-49; OECD (2017), Making Dispute Resolution More Effective - MAP Peer Review Report, Italy (Stage 1), p. 48-51.
There are broader issues with regard to case management as well. In the previous example it was assumed that states are aware of the number and nature of cases they have with each other. However, presently, most Governments have no systems put in place to understand if cases similar to a MAP request have been decided before. Knowledge of previous cases is instead usually dependent on the experience of the personnel of the CA function. This would also make it difficult for a CA to understand, e.g., whether and where a framework agreement is required to attempt to ensure that there is a similar agreement in identical cases. Similarly, the status of domestic proceedings in relation to a MAP request is difficult to obtain for the CAs, requiring further inquiries from their side. Further, the processing of a MAP case often requires the involvement of the tax authorities of the State for the clarification of issues, which is time-consuming and slow. Finally, performing diagnostics in relation to inventory at the end of a year or during a year is difficult since there are no or no advanced systems in place in many States to record such cases.

As regards personnel management, many MAP cases are often entirely dependent on the person from the CA function handling it and therefore, any change in personnel or transition within the CA function may keep a case pending without immediate reassignment to another case worker if the worker leaving the case does not pass on the information properly.

Therefore, from the perspective of States, any technology that may assist in making MAP more cost-efficient and less resource reliant would definitely be a blessing.

2.3 Issues from the perspective of the taxpayer

Concerns raised by taxpayers as regards MAP are more widely documented in academic literature by now. Therefore, without delving into too much detail, the most significant of these concerns are briefly described below.

The most pressing concern in the eyes of a taxpayer is that MAP places no obligation on the competent authorities to arrive at an agreement or to remove ‘double taxation’. Further, MAP creates no time limitation within which the process should be concluded. Moreover, taxpayers have next to no access to the proceedings post initiation. This has led to the assertion that as far as the taxpayers are concerned, the MAP is like a

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20 Even in OECD countries, the record of MAP cases is sometimes kept in a simple Excel sheet that only contains the most basic information.


22 The lack of transparency could be a major concern for the taxpayer since information obtained under MAP may be used for future audits as well.
‘black box’ owing to its lack of transparency, certainty and taxpayer involvement. This has also led to further practical concerns such as use of information received in the MAP for audit purposes, exertion of influence by the jurisdiction to put pressure on the taxpayer to accept a reduced assessment and forego access to MAP in return and horse-trading of MAP cases between CAs.

Several practical concerns have also been regularly cited by taxpayers. This includes the lack of adequate resources in developing countries, leading to a lack of enthusiasm on the part of the CAs to finalize MAP cases. This has led taxpayers to prefer domestic remedies as opposed to MAP in several States. Some taxpayers may even have concerns as regards the security of transmitting sensitive and confidential information to CAs when the function is not funded well enough for secure data protection and encryption standards. Further, total case volumes have been increasing in MAP every year. Finally, MAP is known to be time consuming and this is especially so in States that have capacity constraints, since they not only have less case workers for MAP, but also less auditors with the willingness and time to prepare good supporting documentation supporting the original assessment that could be used to argue the case with the other CA.

Some procedural concerns may also be important to consider. In many States, there is no clarity as regards the formal requirements of a MAP application i.e. no clear forms, no clarity as regards information that is required in a MAP and no information on who the MAP request should be sent to. Further, CAs may take a long time to process a MAP request and taxpayers are generally not notified of the progress of the case in any way. Taxpayers are generally even unaware of the personnel in the CA function that are working on their case, allowing no easy means to establish contact for enquiries during the process.

It is clear from the above that there are several ways in which technology may improve the functioning and effectiveness of the MAP from the perspective of a taxpayer. However, even while trying to address these issues, some constraints from the perspective of tax administrations should be kept in mind as well. First, the implementation of technologies should be cost-effective, and the benefits must far outweigh the costs involved. Second, the MAP is an inter-governmental procedure and

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24 The lack of a distinction between their audit and competent authority functions and the creation of revenue-based performance incentives for competent authority staff in the past have escalated these concerns.
26 Per the OECD MAP Statistics, 2015, there was a sharp rise in total inventory and new cases as compared to the previous year. Since the OECD MAP Statistics, 2016 include several new States, a direct comparison of the total number of cases is not possible. However, pending cases for States reporting in previous years have approximately tripled.
27 Kollmann J. & Turcan L., Supra, p. 25.
thus, competent authorities may not be comfortable with taxpayers being directly involved in the process, since this may lead to taxpayers influencing outcomes of cases.

3. **IN SEARCH OF TECH-BASED EFFECTIVENESS**

Technologies may contribute to the effectiveness of the MAP while preserving the necessary security standards. Emerging technologies and relevant trends such as the Internet of Things (IoT), Big Data and cloud computing, as well as more specific innovations, namely Blockchain and Artificial Intelligence (AI) – based technologies, are only some of the most representative examples of the digital revolution which *ab initio* seem adequate to address the above aims. In the following section, the compatibility of these technologies with the MAP and their suitability in reaching the desired outcomes shall be analyzed based on their key features.

This analysis will feature two main parts. The first part shall focus on the types of technologies that allow the prevention of disputes and thus, MAP requests before they are likely to be raised (3. 1. Technologies Aiding with Dispute Avoidance). The second part shall deal with technologies that make MAP more effective for those tax cases where a MAP is unavoidable, or for which a MAP is already pending, (3. 2. Technologies Increasing MAP Effectiveness). In both cases, the technologies intended to be used in the MAP context are scrutinized in order to ensure that the goals of cost savings and acceleration of the procedure as well as security of any sensitive information, are achieved.

3.1 **Technologies Aiding with Dispute Avoidance**

3.1.1 **Big Data opportunities**

The digital revolution is almost synonymous with significant flows of data collected from multiple sources of internet based devices i.e. the ‘Internet of Things’ (IoT). The trend of IoT has transformed the way people interact and transact, providing an enormous bundle of information that can be used for tax purposes.

Even though the term IoT is not new, the functions currently ascribed to the term have been further developed and extended since its original use, resulting in multiple definitions of the term. As used in this paper, IoT refers to “a global infrastructure for the Information Society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies”. The above definition provides a comprehensive description of the IoT, while other proposed definitions tend to emphasize one of the particular characteristics of the IoT such as the concept of “things” that are connected

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29 See Sharma V., Sharma V. and Mishra N. (2017), Internet of Things: Concepts, Applications and Challenges, in: *Exploring the Convergence of Big data and the Internet of Things*, IGI Global Disseminator of Knowledge, p.73, where the authors attribute the origin of the term to K. Ashton (1999) and state that the technology of the IoT consists of pre-existing components that have become more affordable in the meantime (i.e. sensors).


to the Internet, the internet protocols, the network technology or the capacity for information storage and the volume of information stored. 32

In broad terms, the IoT encompasses a great number of physical objects or things (mobile devices) that are embedded with technology, which enables them to interact with the environment, including people and other devices, in real time. Based on this definition, the main function of the IoT consists of the collection of data from the surrounding environment through sensors. The data collected may be of a personal nature or not. 33 These data are transmitted and often stored in a cloud-based system and subsequently processed by business and – potentially – the tax administration for decision making purposes. 34 The three procedural steps of the IoT function which led to a new business model in data analytics are: data collection, data storage and data processing. 35 The vast amount of data transmitted by the connected devices is analyzed by algorithms which then allows businesses (and potentially governments) to direct their decisions, allocate their resources and adapt their policy to the demands of the environment in real time. 36 The use of data storage and processing techniques to support decisions justifies why the IoT and the data collected through it have been considered as innovation drivers. 37

The above-mentioned business strategy of data accumulation through the interaction of the users with the internet38 has resulted in a vast amount of data, often referred to as

33 Often, there is no clear dividing line between these categories, see OECD (2015), BEPS Action 1, Addressing the Tax Challenges of the Digital Economy-Final Report (hereinafter “OECD, BEPS Action 1”), par. 4.3.2.
36 See OECD, BEPS Action 1, par. 3.2.1, and 3.2.3. An improved form of the IoT combined with machine learning has applications in robotics. Robotics based on the IoT already monopolized the manufacturing sector and are used more and more often in the service sector.
38 For instance, the analysis of consumer behaviour based on the number of clicks on certain web pages, search engine entries and peer reviews of products.
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“Big Data”. The relevant literature focuses on three main characteristics of “Big Data” also known as “the 3 V’s”: volume, variety and velocity. Volume refers to the large amount of data being collected. The type of data collected, which may differ as the ongoing flow of information changes, is labelled variety. Finally, velocity indicates how frequently data is generated. Nevertheless, in addition to the abovementioned three –technical – characteristics of Big Data, the OECD also describes “Big Data” by the “Value” factor (the fourth “V”). In this respect, the OECD seems to approach Big Data from a socio-economic perspective as it attempts to measure, precisely, the “the potential economic and social value that ultimately motivates the accumulation, processing and use of data”, which should then be considered as a “new production factor”.

Following the example of business, tax administrations should consider taking advantage of Big Data opportunities in order to be able to render services tailored to the specific needs of the taxpayers. For instance, the application of Big Data technology to the analysis of tax returns filed may lead to significant improvements in the monitoring of risks and the assessment of compliance. In fact, certain OECD countries have already implemented Big Data technology in combination with electronic filing and e-audit assessments and are currently experimenting with its use for the provision of tax services. However, the potential contribution of Big Data technology towards cost and time efficiency in connection with tax dispute resolution procedures and, specifically, with MAP and procedures to supplement MAP, has not yet been discussed. In the context of MAP, the use of Big Data technology could enable

39 In OECD (2013), Exploring Data-Driven Innovation as a New Source of Growth: Mapping the Policy Issues Raised by “Big Data”, p. 7 (Introduction), “Big Data” is defined in broad terms as the result of both the growing influence of information and communication technologies (ICTs) and the declining costs of storing the generated data, as well as the accelerated migration of socio-economic activities to the Internet. Thus, Big Data is the phenomenon that inaugurated a data-driven economy, in which data enhances economic competitiveness and drives innovation and equitable and sustainable development.

40 Unfortunately, an exact definition of “Big Data” is not easy come by since any definition is in continuous flux due to the constant evolution of storage technology. Additionally, different disciplines generally do not agree on a common conception of Big Data. Presumably, this is due to the different approach of these disciplines with respect to policy analysis. For instance, management science emphasizes how big data can be used to predict customer behavior, as it is mentioned in Cockfield A.J. (2016), Big Data and Tax Haven Secrecy, Florida Tax Review, vol. 18, no 8, p. 497-498.


42 Ibid.

43 In a digitally mature tax administration, matching transactions and tax returns may be done in real time or near real time rather than at a subsequent stage following a risk examination analysis. Besides, “the pathway for revenue bodies is to move from analysing historic transactions to a position where they can review near real-time interactions with taxpayers both on the compliance and service sides of business”, see OECD (2016), Technologies for Better Tax Administration, p. 54.

44 Recently, the OECD has proposed the term “smart portals” which refers to “a ‘web portal’ that brings information together from diverse sources in a way that allows for a degree of tailoring by both the administration and the user. This configuration and customisation allows information to be presented to the user either proactively or in response to service requests, in ways that reflect past use or preference. To deliver a service, a smart portal draws information from a variety of sources, particularly accessing Big Data”. Smart portals are thus an attempt to integrate existing web services into the modern, highly mobile, digitalized environment or to propose a model for web services that could be accessed by wireless smart devices and which would take advantage of Big Data opportunities. A web portal encompassing these features (smart portal) departs from the functioning of a traditional web portal (see infra III.2.1.) as it is embedded with smart elements allowing the evaluation of data in real time and the provision of personalized services to taxpayers based on the analysis of previous data of the same and other taxpayers, see OECD (2016), Technologies for Better Tax Administration, p. 71-78.
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tax authorities to act in a timely manner and even prevent MAP requests from even being put forward. Additionally, Big Data offers an extraordinary opportunity for CAs to build a taxpayer’s risk profile in this regard (low, medium, high), corresponding to the probability that he will initiate a MAP request, as well as a tax profile including all information relating to international tax. In other words, Big Data could primarily assist in dispute avoidance. Finally, Big Data could help tax administrations generate statistics and country profiles in a more efficient manner and use such information to further improve the efficiency of the MAP in their countries. These proposals are further developed in Section 4.2.

3.1.2 Artificial Intelligence (AI)-based technologies

Artificial intelligence (AI) is a general field in cognitive sciences that defines any procedure relating to “imbuing machines with ‘intelligence,’ with the goal of emulating a human being’s unique reasoning faculties”. Human intelligence includes, inter alia, the ability to understand and monitor information, interact, predict and continuously learn and improve. The procedure under which machines attempt to mimic and eventually come close to, human behavior is called “machine learning” and constitutes a specific category of AI. Machine learning, as the name indicates, is focused on conferring upon machines the ability to “learn”. “Learning” is achieved by the use of algorithms “that discover patterns and generate insights from the data they are exposed to, for application to future decision-making and predictions”.

The main advertised advantages of machine learning techniques are the effective reduction of backlogs and costs, the greater ease in overcoming resource limitations, the fact that workers are freed from repetitive routine tasks and can thus focus on higher competence activities, as well as the accuracy of predictions. The most common machine learning applications are found in translations, facial recognition and targeted online advertisements. However, since artificial intelligence has already surpassed human competence at certain tasks in terms of accuracy and effectiveness, it is thought that it could be used to aid in tasks that humans cannot undertake on their own, including predicting fraudulent transactions, and any tasks that require sifting through millions of documents in real time in order to identify the relevant content.

The potential advantages of an implementation of AI in the public sector, more specifically, in tax administration, are significant. In addition, the application of AI in tax administration, in specific, compared to public administration, in general may prove less controversial. This is because the tax administrations’ competences are less based on discretionary power. Applying machine learning techniques would allow

47 Ibid.
50 Interestingly, AI projects in tax administration’s functions have been discussed since 1990, see particularly Flesher Tonya K, Hicks, Sam A. (1990), The IRS Artificial Intelligence Laboratory, The Tax Adviser, 21, 1; ABI/INFORM Global, p. 51.
51 The application of machine learning to procedures involving discretionary powers might be problematic a from constitutional law perspective. However, one might argue that, under specific
enormous amounts of data to be analyzed, cross-checked and filtered for relevant information within a minimal amount of time\textsuperscript{52} and would lead to substantial cost savings as well as reductions in the administrative burdens. In addition, machine learning could allow tasks to be performed at a previously impractical scale, speed, and volume, saving time and costs, but also optimizing resource distribution and the allocation of tasks. \textsuperscript{53} Nonetheless, in order to allow machine learning processes to autonomously perform tasks, particular attention must be paid to the design and functioning of the “learning” process in order to ensure that it achieves the intended results.

Section 4.3 discusses potential applications of AI in the context of dispute resolution, primarily in the context of MAP.

3.2 Technologies Increasing the Effectiveness of MAP

3.2.1 Web portals and cloud systems

Web portals are not new in the electronic government (e-government). \textsuperscript{54} The expression originally referred to web-based applications that provide organized access to the resources of the Internet through search engines and lists of web sites. Such applications are already used in the majority of tax administrations for the electronic filing of tax returns and payments. However, the term “portal”, due to its ambiguity, has been applied to systems that differ widely in capabilities and complexity, from static web pages to applications providing access to multiple heterogeneous data sources and applications. \textsuperscript{55}

In short “portal” is defined, among others, as “an infrastructure providing secure, customizable, personalizable, integrated access to dynamic content from a variety of circumstances, even AI applications in the sphere of the tax administration’s discretionary powers, might be advantageous, as they could provide more rational and / or a-political solutions; see in this respect, Barth T.J., and Arnold E., (1999), Artificial Intelligence and Administrative Discretion-Implications for Public Administration, American Review of Public Administration, Vol. 29 No. 4, p. 332-351, where the authors examine the potential application of AI in cases where pubic administration has discretion in decision making, under three themes. The theme of responsiveness, meaning more rational decisions through tools that can apply a known or specified range of values or biases, the theme of judgement, in which the ability to develop machines that can sense subtle aspects or changes in the environment suggests tools that can make political or situational assessments and the theme of accountability indicating that machines that can learn to learn independently suggest a tool without precedence that may exceed the capacity of humans to scan the environment, assess situations, and make decisions in a timely manner without human supervision.


\textsuperscript{54} E-government broadly refers to the use of ICT in the public administration, specifically including internal or external administrative processes. Internal administrative processes comprise all intra-authority processes (flow of files) in the respective field of work, and cross-authority co-operation in the settling of issues. External administrative processes are processes which are not part of the intra-administrative workflow in a narrow sense but still fall within the scope of administrative issues, for instance processes involving the relationship of administration with constituents such as taxpayers, see in this respect Müllner T. and Grimm D., (2004), Applications and Interfaces for e-Government, in: Traummüller R., Electronic Government, Third International Conference EGOV, Springer, p. 472-475.

sources, in a variety of source formats, wherever it is needed”. 56 Depending on the complexity of the web portal architecture, it can lead to so-called back office reorganization within tax administrations, which benefits both governments and citizens. 57 A broad online presence embedded into a governmental portal can be the first step in abolishing the fragmentation of administrative services and promoting the integration of services within a government agency or even across agencies. 58 Information available to one agency would be automatically made available to other agencies, thus eliminating the need for inter-agency requests for information which in the past constituted much of the workload of a given agency.

However, due regard must be given to data protection regulations. Intergovernmental exchange of information would fall under article 6 of the Regulation (EU) 2016/679, of 27 April 2016 on the protection of natural persons59 with regard to the processing of personal data and on the free movement of such data, according to which the processing of personal data is legitimized in case it is necessary, among others, “for compliance with a legal obligation to which the controller is subject” and/or “for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller”60. In addition, at the country level, implementation of the above proposals may only be done in compliance with domestic data protection laws.

The integration of auxiliary services like payment or digital signature and a monitoring or tracking function for the customer would lead to an even smoother interaction between citizens and the government and increased efficiency in processing payments and documentation. It has been noted that “from the government’s (i.e. the supplier’s) point of view, the main arguments for back office re-organisation are increased cost effectiveness and quality improvement of eGovernment services. Both decisively depend upon the degree of integration between the services themselves, and how they are presented to users and the government agencies responsible for delivering the services as well as any non-government agencies.”61

In the framework of MAP, a customized and personalized system can be achieved by implementing a web application through which a large amount of taxpayer data is gathered, matched with each taxpayer’s tax identification number and used to create a

56 Ibid.
58 Such a fragmentation may be perceived as artificial, from the citizens’ perspective. Ibid.
59 See recital 30 and article 1 par. 1 and 2 of the 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 (General Data Protection Regulation), available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016R0679. Legal entities in principle fall outside the scope of the EU Data protection Regulation unless the data accumulated and processed, even under a business framework, can potentially identify the natural person’s identity. See Patrick Breyer v Germany, C-582/14, European Court of Justice (ECJ), of 19 October 2016, available at http://curia.europa.eu/juris/document/document.jsf?docid=184668&doclang=EN, where it was held that an IP address is personal data when held by an ISP, but does not constitute personal data if held by a party that does not have the “means likely reasonably to be used to identify the individual”.
60 See article 6 par. 1 (c) and (e) of the EU Data Protection Regulation (EU) 2016/67927 of 27 April 2016.
61 Ibid. “The latter typically involves the integration, or cooperation, between different back offices, and must involve the digitalisation of a back office work flow process, typically between existing so-called legacy applications which are often up to twenty years old and which form the basis of existing workflows.”
profile for each taxpayer. This profile could be accessed by both taxpayers and tax authorities by means of a code (see section 4.4).

The migration of the web service applications to cloud computing systems would also accommodate economies of scale and allow a significant extension of the above mentioned services. Cloud computing refers to “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e. g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”. Cloud computing service providers offer different types of services: they provide the customer with computer infrastructure (Infrastructure as a Service or IaaS) or with software applications (Software as a Service or SaaS) or allow the customer to deploy onto the cloud applications it has created or acquired using programming languages, libraries, services, and tools supported by the provider (Platform as a Service or PaaS).

At its core, cloud computing relies on the sharing of hardware and software by many users, at the same time, from wherever they are located. The administration of a cloud platform requires the optimal allocation of resources among users at any given time. To this end, following a user’s request, the administrative program of the cloud platform allocates resources based on availability at the time of request. This requires a calculation of the computing resources required to fulfill the request as well as the total resources available at the time of the request. In order to be able to track resources, copies of the user data and the relevant software are made available to other servers. Whenever a request is submitted by a given user, it is directed to whichever server the data of that user and the necessary software are stored on, regardless of the location of the user.

Besides its benefits, cloud computing also involves a certain amount of risk in terms of the security of the data stored on the servers. The potential security risk might be mitigated by the implementation of additional security measures, which on the other hand, could potentially increase the cost of the cloud service provided and thus, somewhat diminish its benefits. One possible way to reach a compromise between security and cost effectiveness is to make the cloud private instead of public. A private cloud differs from a public one in that the “computing services [. . . ] may be offered either over the Internet or a private internal network but only to select users instead of the general public. It offers many of the benefits of a public cloud - including self-

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64 See OECD, BEPS Action 1, par. 4.2.5. These are only the most well-known types of services. Other service models are possible, including any number of combinations of types of content or data provided.
65 This would be the case in the most comprehensive type of cloud computing model, IaaS. See Shakow J., (2013), The Taxation of Cloud Computing and Digital Content, Faculty Scholarship, 475, available at http://scholarship.law.upenn.edu/faculty_scholarship/475, wherein the functioning of cloud computing as well as the challenges of taxing such models are described in detail.
66 See for instance Sandeen S.K. (2014), Lost in the Cloud: Information Flows and the Implications of Cloud Computing for Trade Secret Protection, Virginia Journal of Law & Technology vol. 19, No. 01, p. 29-32, where the author examines various terms of cloud computing service agreements in order to assess the security risks of cloud computing for trade secrets from the perspective of disclaimers of responsibility clauses included on behalf of the service providers.
service, scalability, and elasticity - with the additional control and customization available from dedicated resources over a computing infrastructure hosted on-premises. In addition, private clouds deliver a higher level of security and privacy through both company firewalls and internal hosting to ensure operations and sensitive data are not accessible to third-party providers.67 Regardless of the extensive and prolonged discussion as to which type of cloud service is cheaper,68 the question that really matters is whether an organization makes efficient use of the infrastructure and hardware resources at its disposal and uses labor efficiently. In this regard, it has been argued that a private cloud might be the financially more attractive option than the public cloud especially where the security and control inherent in private clouds could outweigh any relevant financial considerations.

3.2.2 Blockchain

Blockchain was first utilized in connection with, and thus became inextricably linked to, the Bitcoin electronic cash system introduced in late 2008 by Satoshi Nakamoto.70 This system consists of an open source platform enabling transactions in digital currencies. Since 2008, the potential of Blockchain technology was further explored and its technical characteristics were further developed. Interestingly, Blockchain is currently used by some countries to improve their tax administrations’ effectiveness, mainly in the tax compliance processes.71 In addition, it is used to ensure the security of communications and record keeping in the context of e-governance.72 China and Estonia are among the biggest users of Blockchain technologies in the public sector, but other countries, such as Finland, Sweden and even Rwanda are now following suit.73

68 The private cloud concept is not really separate from that of cloud computing as a whole. Although many different definitions for both concepts are available, they generally simply describe differing infrastructural and organizational approaches to implementing service-oriented cloud computing, some of which are excessively expensive. This idea was put forward by Schmelzer, see Schmelzer R., (2010), Private Cloud: Reality or Fog?, The Open Source Business Resource, Ottawa, p. 20-22.
73 According to Prof. Jeffrey Owens, “Estonia is among the leaders of blockchain use in tax administration, China’s tax administration is exploring the use of blockchain as its digital data on taxpayers grow to ensure the information is secure. It is also considering using the technology to deal
Although the term Blockchain encompasses numerous variations of the same technology with slightly different technical characteristics adapted to particular needs, there are some shared essential features. The core structural elements of the blockchain technology are:

a) a database and / or a platform (i.e. a structured collection of information), which constitutes a self-sustaining environment that does not require an intermediary for verification and / or

b) a ledger, which is distributed among all participants called “miners” or “nodes”. Specifically, every user who can record a transaction and put it in a “block” together with other new transactions is called a “miner”. The “block” contains hashes (encryptions) of previous transactions as well as new data. The block itself is also hashed before entering into a new block and being added in the chain. Each addition of a new block in the chain automatically updates the ledger which is held by all users. In parallel, the “nodes” correspond to the users, each of which technically represents a node of the whole peer-to-peer network. Each node may store a local copy either of the entire blockchain or a subset of it. Nodes discover and maintain connections with other nodes across the peer-to-peer network. Once they receive a new block from another node they check its validity by checking the proposed transaction against a list of previous transactions. In recognition of their function of verifying transactions and thereby ensuring security of the system, nodes are also described as “validators”. Any person can become a ‘node’ by downloading and running the relevant software and storing the blockchain archive on his / her local machine. The distributive nature of the ledger achieves the so called “decentralization”, which is one of blockchain’s core

with the use of false identities and ensure effective registration and authentication of taxpayers.

Meanwhile, smaller countries are also looking into blockchain's applications. Rwanda, for example, is considering introducing blockchain to help administer its VAT system. Sweden is looking at how it can use blockchain to help it tax land and property, and Finland is beginning to use blockchain for payroll taxes”, see Euromoney Institutional Investor PLC (2017), Blockchain, International Tax Review, Global Tax 50.


75 Blockchain offers the same record-keeping functionality as a ledger, without a centralized architecture. The central authority that would otherwise legitimize the transactions is replaced by a decentralized ledger, a copy of which is distributed to each user. See indicatively, Boucher P. (2017), How blockchain technology could change our lives, p. 5, European Parliament Research Service (EPRS), available at http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/581948/EPRS_IDA(2017)581948_EN.pdf.

76 The term “miners” is borrowed by the blockchain technology used for the bitcoin, where, a miner refers to the person who can actually “mine” a new bitcoin, namely discover a complex algorithm that will enable him to build a new block in the blockchain. See specifically, Antonopoulos A.M. (2014), Mastering Bitcoin: Unlocking Digital Cryptocurrencies, available at https://unglueit-files.s3.amazonaws.com/ebd/05db7df43184d0a873d6eca14dec28d.pdf. For the difficulties created by the fluctuating terminology associated with blockchain, see Welch A. (2016/2017), The Path of Blockchain Lexicon, Review of Banking and Finance Law, vol. 36, p. 713-740. “Nodes” or “miners” are different (overlapping) terms for the actors / participants in the blockchain.

77 ibid.

78 ibid.

79 Its decentralized nature, combined with the ledger function, identify blockchain as a distributed ledger technology (DLT). For a definition of DLTs with respect to securities in post trading, see Pinna A. and Ruttenberg W. (2016), Distributed ledger technologies in securities post-trading Revolution or evolution?, European Central Bank Occasional Paper Series, No 172, available at https://www.ecb.europa.eu/pub/pdf/scops/ecbop172.en.pdf. According to the authors “DLTs allow their users to store and access information relating to a given set of assets and their holders in a shared database of either transactions or account balances. This information is distributed among users, who

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benefits. Since a blockchain constitutes in essence a distributive ledger, enabling the distribution and storage of data-records among its participants, it is completely independent of any third party intervention and therefore, is a self-organized system. This “independence” reveals that a blockchain is by no means a static infrastructure that simply records transactions. On the contrary, the distributed ledger itself is a “living” organism which is transformed each and every time a new transaction is inserted in a block. This is because, before a transaction enters a block, it is subject to validation by specific AI based algorithms and this is autonomously obtained based on pre-determined criteria of the so called “consensus”80. For this reason, the above mechanism is also known as a “smart contract”81.

c) a blockchain achieves data integrity and identity authentication by using cryptography82.

An essential requirement for Peers to participate in the blockchain is their willingness to transact with other parties without any intermediary (decentralization). The lack of intermediaries normally generates the risk that the transactions may be invalid and therefore, the data exchanged may be inaccurate, inconsistent and insecure. However, in the context of blockchain, data integrity is ensured via the consensus process: all transactions are aggregated into blocks, securitized through hashing. 83 Each block thus validated is cryptographically signed by the hash of the prior block creating an immutable sequence of blocks in the chain. This “proof of work”84 ensures both trust amongst the parties involved and the security of the data exchanged.

could then use it to settle their transfers of, e.g. securities and cash, without needing to rely on a trusted central validation system”. See also Meunier S. (2016), Blockchain technology—a very special kind of Distributed Database, available at https://medium.com/@sbmeunier/blockchain-technology-a-very-special-kind-of-distributed-database-e63d00781118, who highlights the fact that by contrast to relational databases (RDBMS), “which remain essentially centralized i.e. located, stored, and maintained in a single location”, Distributed Ledgers or databases (DDBMS) refer to “storage devices that are not all attached to a common processing unit but are spread across a network”. This offers the ability of processing “huge amounts of structured & unstructured data, and that could scale across networks”. Decentralization, in the sense of the absence of any intermediary third party, also refers to the fact that any user can insert a transaction into the blockchain upon request, but subject to the rest of the parties’ acceptance (“consensus”). The acceptance requires the authentication of the request by each user. This is done reliably and automatically, creating a very fast and secure ledger system that is remarkably tamper-proof.

80 Ibid.
81 Smart contracts as such are not new and in fact predate the emergence of blockchain by almost two decades. They combine electronic contracting and cryptography. Smart contracts are essentially autonomous software agents and this is why they raise significant issues with respect to contract law, in particular in the area legal enforcement. For a complete analysis see Werbach K. and Cornell N. (2017), Contracts ex Machina, Duke L.J. 67, 313.
82 Coppersmith D. (2000), Cryptography, IBM Journal of Research and Development, 44, ½, p. 246, defines cryptography simply as “the art of secret writing or devising ways of transmitting messages so that others cannot read them”. For an analysis of different types of cryptography (symmetric and asymmetric) and their legal implications, see Simon P.A. (1999), Understanding contemporary cryptography and its wider impact upon the general law, International Review of Law, Computers & Technology, 13, 2; p. 95.
84 “Proof of work” (PoW), a cryptocurrency term, defines the process that allows miners to independently try to find the next block and, once the next block is found (verified), transmit the solution throughout the network, see Krawisz D., (2013), The Proof-of-Work Concept, available at http://nakamotoinstitute.org/mempool/the-proof-of-work-concept/#selection-11.8-17.19
The consensus process used to ensure data integrity goes hand in hand with the concept of immutability. Immutability is considered to be at the heart of blockchain technology, since it helps establish the trust that is considered the core benefit of blockchain. Immutability means that all data recorded are “permanent” and “unchangeable”. Based on this permanence, all transactions can be reliably traced back to the “genesis block”86 by following the sequence of the chain, without the risk that the data would be altered.

In addition, blockchain is popular for the security it provides by virtue of cryptography. Participants of the blockchain “have their own private keys that are assigned to the transactions they make and act as a personal digital signature. If a record is altered, the signature will become invalid and the peer network will know right away that something has happened”.87 These keys represent a cryptographic access to the database that verifies whether the user is connected to the right network and is indeed the user that participates in the operated transactions.88

All the above-mentioned features vary depending on whether the distributed ledger is a permissionless (public) or permission (private) one. This categorization is based on the extent of the access to the blockchain’s data.89 In particular, on public blockchains anyone can operate a mining node and maintain a copy of the ledger in his/her computer. There are no restrictions as to who can read blockchain data (which may, however, be encrypted) and add transactions to the blockchain or as to who may process these transactions. On the contrary, a private blockchain provides direct access to data and the transactions that can be inserted into the blockchain are limited to those that are identified and pre-agreed by the parties. A private blockchain is, therefore, more centralized and does not necessarily use mechanisms based on cryptography.90 Since private blockchains do not rely on public access databases but require the set-up of a new sharing infrastructure, they may end up being more costly to implement as they

85 However, in conceptual terms, the term “immutability” appears problematic, because changes of records may indeed occur, albeit rarely. In case of such a change of records, the chain is cleaved and traceability is only available for blocks created before the event causing the change. Following that modification, a new set of records is created based on the new data inserted. See Walch A. (2017), The Path of Blockchain Lexicon, p. 737-738.

86 “The first block in the blockchain is called the genesis block and was created in 2009. It is the “common ancestor” of all the blocks in the blockchain, meaning that if you start at any block and follow the chain backwards in time, you will eventually arrive at the genesis block. Every node always starts with a blockchain of at least one block because the genesis block is statically encoded within the bitcoin client software, such that it cannot be altered”, see Antonopoulos A.M. (2014), Mastering Bitcoin: Unlocking Digital Cryptocurrencies, available at https://unglueit-files.s3.amazonaws.com/ebf/05db7df4f31840f0a873d6eca14dce28d.pdf, p. 166.


88 This method of encryption is called public key cryptography. Essentially, it involves two keys: a public key known to all and a private key known only to the recipient. The public key encrypts data, and the corresponding private key is used for decryption. Only the person who has the corresponding private key can decrypt the information, see How PGP Works, available at http://users.ecc.cmu.edu/~adrian/630-f04/PGP-intro.html, text is taken from chapter 1 of the document Introduction to Cryptography in the PGP 6.5.1 documentation, Copyright © 1990-1999 Network Associates, Inc. and its Affiliated Companies.


require a re-establishment of central control. However, due to the premise that trust in private blockchain is not at stake, the resources that the system consumes for verifying a new transaction are less than in the public blockchain.

The question which type of blockchain is feasible for a given organization is fundamentally a governance question, not a computer science one. For tax administration purposes, especially, it is essential to identify the goals the tax administration seeks to achieve and then adapt the blockchain to serve these purposes. Thus, a blockchain with private access for data writing and public access for reading data (“semi-private” blockchain) may be one option suited for governmental use. Another option would be a (strictly) private blockchain in which only the limited number of parties participating could write and read data.

In sum, the major advantages of blockchain technology are the distributed network offered and the consistency and security achieved by means of an algorithmically enforced blockchain protocol, which removes the human factor from the equation and thereby reduces the costs. An advantage blockchain has over other technologies is that it is a state-of-the-art solution in cases where multiple parties need to be brought together at the same time and reach agreements based on common factual data. These agreements are recorded in the blocks of the chain and are visible to all parties involved for consensus purposes. Thus, the use of blockchain eliminates the need for a time consuming prior aggregation of the necessary data and evaluation of their consistency. Moreover, due to the immutability of the blocks, the data recorded cannot be modified later. This results in a permanent storage of data-records that does not run the risk of getting lost or tampered with. In addition to data preservation, blockchain provides evidence of the identity of the party operating each transaction recorded in the chain. Therefore, “responsibility” can be attributed not only accurately, but almost automatically. Since every party maintains a copy of the ledger, which is dynamically updated with each transaction, thus ensuring that all copies remain identical, blockchain provides confidence for the transactions and ensures the integrity of the data stored without the need for intermediation by any third party. Security and trust are further enhanced by the digital cryptography securing the functioning of the whole system.

4. THE IMPROVEMENT OF MAP BY MEANS OF ICT

4.1 The use of video conferencing in MAP

It is clear from the above that ICT can help improve the MAP not just by assisting in the avoidance of disputes, but also by increasing the effectiveness of the MAP. In this section, we discuss how the technologies discussed in Section 3 (above) can help resolve the issues discussed in Section 2 (above) from the perspective of both the States and the taxpayers.

At the outset, where communication with the taxpayer or the CA of another jurisdiction requires in-person contact and must be made immediately, technologies enabling video

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conferencing may always be a solution. Interactive communication through video conferencing, apart from saving travel costs, may also preserve the effectiveness of a face-to-face meeting, erstwhile seen as a necessity by competent authorities as noted above. Video-conferencing technology, thus, contributes to the transparency of the procedure between CAs and to building trust. Further, video-conferencing decreases the location dependence in dispute resolution and thus, reduces costs. However, it must be noted that States having limited broadband connectivity may find it difficult to implement such technologies and setting up such technologies through the telecommunication network may prove to be expensive.

4.2 The use of Big data in MAP

As previously mentioned (see section 3.1.), Big Data technology could be applied not only to cut down the costs and duration of the MAP, but also to assist in dispute avoidance. The latter may be achieved through the use of predictive analytics.

According to the OECD, “Predictive analytics...aims simply to anticipate likely problems – for instance with the accuracy of a tax return or the timeliness of a payment – so that tax administrations can consider which actions should be taken and when....”

In cases where a taxpayer’s data qualifies as “Big Data” as described above and are available to the tax authorities, data analytics could serve as a valuable tool for the prevention of MAP. This is especially so in the case of businesses. Specifically, information found on business web sites, which are by default in the public domain, may offer an enormous amount of data which, after being stored and then algorithmically processed, could provide significant information relevant for MAP purposes. These results may reflect the nature of business activities, the geographical region in which business activities are carried out and/or the frequency of engagement in international transactions. Based on these outcomes and combined with information already at the disposal of tax authorities, taxpayers could be subsequently classified in specific risk groups (low, medium, high) according to the level of risk of initiating a MAP in the future. Accordingly, tax authorities may adapt their actions and take preventive measures. These actions could potentially consist of an early communication with the taxpayer or the competent authority of the other jurisdiction for exchange of information and a holistic examination of the taxpayer’s tax profile in advance that would provide information on his compliance attitude. This would help prepare the competent authorities in the event of a MAP. However, the information used for such analytics should be collected after the consent of the taxpayer and should not include data revealing trade or other secrets.

Within the “high risk” category, the classification may be further refined based on data concerning the business profile of the taxpayer and its tax file, data concerning the scope

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95 See, OECD (2016), Technologies for Better Tax Administration, p. 48 onwards.
96 Revealing consent, in principle, by the data owners to the use of data by tax administrations. Since the websites relate to business data rather than personal data, they are normally not subject to the specific provisions of the EU Data protection regulation, except in the special cases mentioned, see supra III.2.1. Nevertheless, they may be subject to domestic data protection laws and regulations.
97 Qualifying as “Big Data” and being subject to the relevant Big Data architecture requirements which establish a strategic roadmap of big data analysis e.g. OECD (2016), Technologies for better tax administration, p. 62 onwards: “the structure of integrated platforms: data platform, data discovery
and significance of its international transactional activity, as well as its likelihood of engaging in litigation activity or tax dispute resolution procedures. These data, after being processed by means of data analytics, would result in an evaluation of the potential of a MAP request being filed.

Depending on the factual background, tax authorities may also take preventive measures, at first at a domestic level and then at the international level for this “high risk” category. A closer monitoring of taxpayer activities would generally be recommended in such cases. However, the increased audit focus should be complemented by earlier contact with the tax administrations of the other taxpayers involved by means of joint or simultaneous audits with the aim of preventing double taxation and thus a dispute from arising. At the international level, as far as the transfer prices for the international transactions are concerned, the tax administration could take the initiative in suggesting an APA to the taxpayer and its counterparts in order to agree on the correct allocation of taxing rights for the particular type of transactions that caused the increased MAP risk.

‘Big data’ may be useful after a MAP request is filed as well. Predictive analytics can be used to cross-check information in tax returns with the information included in the MAP request and automatically flag any differences, thus alerting tax authorities to the potential need for further enquiries in that case. This could help save valuable time in the assessment stage of the MAP request. This first stage, which according to the OECD should ideally take about 2-3 months, often takes a lot longer than that, even close to a year in very difficult transfer pricing cases. The reason is that in most cases in practice, the competent authorities do not have direct access to the tax file of the taxpayer. Instead, upon receiving a MAP request and determining that the documentation provided by the taxpayer is sufficient in order to make an assessment on the merits of the case, competent authorities need to contact the local tax office responsible for the taxpayer in order to ask for additional information with respect to the case, such as the tax file, the last audit report, any irregularities with respect to the behavior of the taxpayer that may be known to the local tax office due to its frequent and more intense interaction with the taxpayer, etc. Valuable processing time and work time of the local tax officer responsible is lost in:

-reading the MAP request sent along by the competent authority;

-retrieving the audit file;

-checking it against the MAP request and

-checking it for additional relevant information and then, finally

-compiling the results of the analysis (usually in the form of a standardized report and


\[\text{See supra note 33, OECD (2016), Advanced Analytics for Better Tax Administration: Putting Data to Work, p. 17.}\]

-sending the report to the competent authority.

In addition, it should be taken into account that such requests for information only add to the already full workload of the local tax office. Moreover, the performance of local tax offices is usually monitored based on indicators such as the number of tax assessments completed, the number of complaints against said tax assessments dealt with, the number of information requests from taxpayers that were answered etc. The response to information requests from the competent authorities is generally not part of the assessment criteria. Thus, the additional workload generated by the MAP requests also has a negative impact on the performance of the given tax officer, leading to slower and perhaps less thorough compliance with the request.

All these issues could be avoided if the analytics system responsible for the initial assessment of the substance of the MAP request had access to the tax file of the taxpayer and could compare and contrast the information in the MAP request with the information in the tax file. Ideally, additional relevant information from the tax file, such as whether criminal proceedings had ever been filed against the taxpayer due to tax evasion or other breaches of its tax obligations could also be highlighted and flagged. This could be accomplished by tagging the types of relevant information with selected keywords and programming the analytics algorithm to search for these keywords. Separately, ‘Big Data’ technology may also be used by tax administrations to compile MAP statistics and country profiles as required under BEPS Action 14 and under the auspices of different forums such as the EU, OECD and the UN. This would be an efficient and cost effective way for developing countries to ensure that analytical work on data is performed without use of human resources for this matter.

Figure 1: MAP’s Data ecosystem illustration
4.3 The use of AI in MAP

The first step towards improving the effectiveness of tax administration is to break down the activities undertaken by tax officials and assess how susceptible to automation each of them is. Automation is likely to exponentially improve the effectiveness of the MAP. In many countries, a significant number of MAP cases are, in fact, routine cases. This is true, for instance, of certain types of cases involving cross-border workers, which tend to involve similar fact patterns based on the economic realities of the countries involved. Similarly, cases of dual residency of individuals boil down to the analysis of several aspects of the fact pattern, such as the location of the family or the employment, which are necessarily very similar across cases. However, even in transfer pricing cases, which are generally considered more difficult than treaty interpretation cases, certain types of transactions are often characteristic of a country’s economy and relationships to other countries. Such was the case between India and the US. The two countries had a significant backlog of MAP cases (over 250), often involving very similar types of transactions, specifically information technology enabled services (ITeS) and software development. In order to allow a quick resolution of these cases, US and Indian tax officials agreed on a framework for the resolution of this particular type of cases, i.e. the general criteria to be used in the allocation of taxing rights and a range for acceptable transfer prices. The agreement extended to approximately 200 of the pending cases and led to the resolution of a staggering 100 cases within only one year.

Machine learning, applied to the inventory of MAP cases, would enable the identification of the main drivers of disputes and the types of cases in the inventory. Broadening the scope of the analysis to past cases and how they were resolved would enable the identification of patterns of resolution. Routine cases, for which straightforward solutions were provided, as well as groups of cases involving the same fact pattern with the same partner country, which thus received similar resolutions, could be identified. Particularly, cases where it is evident –based on pre-determined objective criteria- that a MAP request is inadmissible could be dealt with by an automated procedure which shall examine the facts of the request and identify relevant patterns. This would help clear cases that are clearly inadmissible while at the same time providing a safe exercise for the machine learning process, helping develop it to the desirable extent. The more data enters into the system, the more effective the machine learning becomes thus enabling it to cover cases involving ever increasing risks.

In cases of blatant inadmissibility, a standard answer would be produced by the system itself and the case would be considered solved without any human involvement. In case a MAP request is not blatantly inadmissible, but considered low risk, i.e. routine and merely fact-based, a potential automatized MAP decision based on previous cases

101 i.e. MAP filed after the relevant deadline has expired. In cases where a deadline has been suspended, AI may also be useful, provided the circumstances of the suspension are fed into the learning process.
and that would not put at stake either the taxpayer’s or the competent authorities’ interests, should take into account the following criteria:\(^{102}\):

- the factual background of the MAP case, which should be identical to cases examined in the past,
- the tax treaty provisions relied upon, which should also be identical (in substance) to the provisions applicable in the cases matching the pattern,
- the competent authorities involved, which should ideally be identical to those involved in the cases setting the precedent and
- communications exchanged with other competent authorities on the subject matter and confirmation of the results.

Thus, potentially, a significant part of the pending MAP cases may be decided through automation. When a MAP request for a more difficult case, that is nevertheless very similar to a number of past cases with the same country, is received, the software would alert the case worker assigned to the case of the similarity between the current request and past cases. Moreover, by using machine learning, a rough solution could already be suggested based on an extrapolation of the previous solutions and taking into account the specific facts and circumstances involved in the new case. The case worker would then merely adapt this rough draft of the solution based on his / her own judgment and the special requirements of the case.

Additionally, the identification of patterns in MAP cases based on their level of difficulty, or the competent authorities involved, or similarities in the fact patterns, or even based on the tax official assigned to them, may contribute to an optimized allocation of tasks within the hierarchical structure of the tax administration and thus, significantly increase the effectiveness of the MAP. Allocating similar cases to a tax official that is already familiar with such cases or grouping the cases by country, so that the official is already familiar with their counterparts, would allow a much swifter assessment and / or discussion of the case.

AI could also help the CA with time management concerning MAP cases.\(^{103}\) Since the deadline within which the MAP has to be solved and the timeframes recommended for certain actions within that deadline are automatically calculated by the AI, an additional electronic notification shall be sent as an “alert” to each of the officials assigned to a MAP case, letting them know that the deadline to complete a specific action or the MAP as a whole is fast approaching. This alert notification would prevent a MAP from being automatically transferred to arbitration and generally accelerate the resolution of cases. AI can and shall also consider any long periods of absence of the tax officials (i. e. maternity leaves) and factor them into the alerts, immediately letting the superiors of the case workers know when a case needs to be reassigned due to a longer period of absence.

\(^{102}\) These criteria could constitute the principles for the design of the machine learning process.

\(^{103}\) The Canadian Revenue Administration (CRA) has an internal management system, which is an automated system that informs the officials involved in a MAP case of deadlines and thus, assists in case management. See OECD (2017), *Making Dispute Resolution More Effective - MAP Peer Review Report*, Canada (Stage 1), p. 40, available at [http://www.oecd.org/tax/making-dispute-resolution-more-effective-map-peer-review-report-canada-stage-1-9789264282612-en.htm](http://www.oecd.org/tax/making-dispute-resolution-more-effective-map-peer-review-report-canada-stage-1-9789264282612-en.htm)
In addition, the automatic electronic assignment would avoid conflicts where a tax official may be assigned multiple cases which expire on the same date and which cannot be handled by the same tax official appropriately. Moreover, taking into account that competent authorities are likely to raise the same arguments in multiple MAP cases across different time periods, or claim the same evidence documentation, AI could have a valuable contribution in allowing for a more accurate and much swifter retrieval of information about previous arguments made and the documentation used in supporting them, thus increasing time and cost efficiency.

**Table 1: Automated MAP decision**

<table>
<thead>
<tr>
<th>Automated decision</th>
<th>Criteria</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases of blatant inadmissibility</td>
<td>• identity of facts and substance of the applicable provision</td>
<td>Production of automated decision uploaded to the portal in the taxpayer’s electronic file</td>
</tr>
<tr>
<td></td>
<td>• pattern of answers in previous identical cases</td>
<td></td>
</tr>
<tr>
<td>Factual straightforward cases</td>
<td>identification of pattern of:</td>
<td>Automated decision communicated via the portal to the other CA(s)</td>
</tr>
<tr>
<td></td>
<td>• factual background</td>
<td>Deadline for confirmation of the other CA(s)</td>
</tr>
<tr>
<td></td>
<td>• treaty provisions applicable</td>
<td>• Approval = upload to the taxpayer’s electronic file</td>
</tr>
<tr>
<td></td>
<td>• fiscal period</td>
<td>• Rejection = return to the CA and assignment of case worker for initiation of more in-depth communications.</td>
</tr>
<tr>
<td></td>
<td>• CA involved</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2: Workflow of AI resource allocation**

- e-filing of MAP request
  - similar experience of MAP cases handled in the past
  - availability

- MAP case assigned
  - automatic calculation of deadline
  - electronic notification before expiration

- MAP decision
  - MAP decision upload if unilaterally solved
  - Communication s with counter CA if appropriate
4.4 The Use of web portals and cloud computing in MAP

The use of a web portal in the framework of MAP would allow far-ranging personalization and customization of tax services based on the individual taxpayer’s profile, which would encompass all data available on that taxpayer in the tax administration system, including data gathered from the MAP requests submitted. In addition, web based applications aid in ensuring continuity of records, especially in developing countries where the staff in charge of MAPs frequently changes.

The web portal for MAP might, for instance, be partially based on the case management system used in many countries for judicial case management. This system collects all the structured and unstructured information from the integrated court system and transforms it into an easily accessible resource for stakeholders. At the same time, it verifies the information collected by relying on an interoperable platform, e.g. a combined web portal of the Ministry of Justice and the Ministry of Finance104.

A MAP web portal must in any case encompass the following essential features:105

i) provide easy access to the portal for both taxpayers and tax authorities via a personalized and encrypted path (e.g. a code);

ii) provide the possibility of filing a MAP request by uploading it to the portal, together with the accompanying documentation;

iii) issue an electronic protocol that would be directly linked with the taxpayer’s electronic tax profile;

iv) enable a classification of MAP requests and their grouping into electronic folders according to their subject (e.g. based on the article of the double tax treaty involved, or, on a more basic level, into transfer pricing cases and “other” cases);

v) offer the possibility of software calculations of the deadlines for MAP (e.g. the deadline for the request for information, the ideal time frame suggested by the OECD for the transmission of the position paper, etc) and notification of the tax official in charge in due time before the respective deadline, especially the deadline for MAP resolution in cases where an arbitration clause is applicable, expires;

vi) allow the taxpayer to track the general status of the case (e.g. “assessment of the request”, “waiting for additional information”, “preparation of position paper”, “consultation between competent authorities”, “finalization”) and inform it of important developments, such as when the request is approved or when agreement is reached between the competent authorities;

vii) offer the possibility of secure electronic communication through the portal between tax authorities and tax authorities and taxpayers, although with different levels of access to certain information for each category of user. For


these purposes, taxpayers would have restricted access, i.e. only be able to view the documentation they submitted and upload new documents, whereas tax authorities would receive full access to the taxpayer documents as well as their own and read-only access to the documents (e.g. position paper) produced by the other tax administration. Potentially, there would also be different levels of access depending on the seniority of the individual staff members within their own administration (i.e. a higher ranking tax official would have broader access and may be the only person authorized to approve a position paper for transmission to the other tax administration).

In general, the web portal should serve as an overall project management tool for the MAP unit, allowing the head of the competent authority to gain an easy overview of the overall workload, the general status of cases, the individual workload of a given officer and other essential information. This, along with the case content analysis performed by means of machine learning and with the help of Big Data, would allow a quick allocation of cases to the officers most likely to be able to resolve them very swiftly, while ensuring that none of the personnel is overburdened by the workload.

The above-mentioned web applications would enhance MAP’s effectiveness when migrated into a cloud system. This would provide the opportunity of accessing an enormous amount of data stored in remote databases (to which a single tax administration cannot in principle have access otherwise), in real time from different server locations while ensuring the security of these data. In a centralized system, in order for the tax authorities to be able to both communicate and have access to all data necessary in real time, it is crucial that all tax authorities have access to the same data, through the same web portal. This might be potentially achieved by the architecture of a central system either functioning at a global level or at a regional level. The global level coordination of the centralized system could be assigned to the OECD, which would have control of the data inserted in the common database, and could potentially help design a system for the allocation of the costs of the architecture of such a cloud based system. In that centralized system, each tax authority would be a “user” and enter the common portal with a code. After authentication, the user can upload data as well as mine data. However, institutions acting at a regional level could play a more important role in managing a centralized web system. This might be the case of the African Tax Administration Forum (ATAF), which aims to provide assistance in establishing efficient and effective tax administrations throughout Africa and to serve as a network for the region.

As regards the use of cloud computing in the context of the MAP, data security is the primary concern, both from the perspective of the tax administration and from the perspective of the taxpayer. Consequently, only private clouds would be even worth

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106 OECD has already succeeded in setting up a similar portal in order to implement the standard for the Automatic Exchange of Information (AEOI). The cloud based MAP portal could borrow characteristics from the AEOI portal, both from a design perspective and concerning the cost allocation; see indicatively, the OECD (2014), *Global Forum on Transparency and Exchange of Information for Tax Purposes Automatic Exchange of Information: A Roadmap For Developing Countries Participation*, Final Report to the G20 Development Working Group, available at https://www.oecd.org/tax/exchange-of-tax-information/global-forum-AEOI-roadmap-for-developing-countries.pdf.

107 In terms of a security risk, however, the security concerns as such are not greater than those seen in traditional MAP.
considering\textsuperscript{108}. The private cloud guarantees the confidentiality of the information and communications exchanged\textsuperscript{109}. Access to the cloud shall not be available to taxpayers. Instead, the taxpayer can have access to the web portal with a security code which shall be his digital identity key in order to be able to communicate with the tax authority of his state of residence and monitor his tax profile as well as the status of his requests and applications. In this way both the transparency of the tax administrations acts and the security of information are achieved.

However, the cost of setting up such a private cloud might be quite high in some circumstances, depending on the use of the relevant IT resources, especially when considered from the perspective of developing country tax administrations which often lack even the most basic resources. One possible solution to a likely cost problem would be cost-sharing for a common cloud developed and maintained by a number of tax administrations, from both developed and developing tax administrations. The costs could be shared based on the number of cases filed in each country, which also affects the share of the space and computing resources that needs to be allocated to each country. Another factor could be the GDP of each country. Following both these models, developed OECD countries would bear the brunt of the expense of the platform, as they should, given the fact that most MAP cases (95\% according to the OECD itself) take place between a small number of prominent OECD countries\textsuperscript{110}.

Web application services stored in a private cloud system can provide quite promising advantages for tax administrations seeking to improve their MAP-related services. A private network could be set up between predefined users (e.g. the tax administrations of a sub-set of countries), accessible in real time by any competent authority in a jurisdiction which is part of the network. The network would store both taxpayers’ and tax authorities’ data. This approach could help overcome the chronic delays – between requests for information and its provision, between competent authorities’ communications, between the start of the MAP and its conclusion – that MAP has become synonymous with.

In the absence of an agreement on the set-up of such a shared private cloud, an alternative solution might be a public cloud implementation for which special security measures are developed. Such measures must include software providing a high-grade multi-part encryption, special staff responsible for the maintenance of the system and which can react instantly in case of a breach and other similar measures. Again, any costs would need to be shared among countries to permit the participation of developing

\textsuperscript{108} I.e. a closed network accessible only by pre-determined agents. This private cloud model is likely to be based on the IaaS model, according to which tax authorities will be provided with the power to control processes, manage storage, the network and other fundamental computing resources which are helpful in managing arbitrary software.

\textsuperscript{109} Security refers to both the confidentiality of information exchanged between tax administrations and data integrity. Confidentiality tends to address vulnerabilities to potential data attacks and non-disclosure of information exchanged between CAs to taxpayers. Integrity is connected with authentication of data provided by each CA.

countries. Such a well-secured public cloud would provide the same advantages as a private cloud.

In cases where communication through the web portal in writing might not be adequate for a particular case and a physical communication with the CA of the other jurisdiction is needed, the web portal may provide for video-conferencing arrangements. Such arrangements shall be made online with both CAs able to have access to the information in the portal and potentially share screens during the conference. Apart from the benefits of avoiding travel costs and the resource savings supplementing any previous communication with the video conference option would enable tax authorities to have a clear image of the documents shared, reach an interactive common understanding of the message communicated in the previous stages and achieve a more efficient outcome via the face-to-face communication which makes the whole procedure more transparent.

4.5 The use of The use of blockchain in MAP

Blockchain technology represents a revolutionary approach to decentralized data systems. By contrast to the cloud based model described above, which represents a centralized system, blockchain offers the possibility of data transmission and real time exchange of information and communications that could be superior to centralized cloud based options in terms of cyber security and data privacy.

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111 CISCO is considered to provide high quality web telecommunication services, see CISCO, TelePresence, Video Conferencing System Technology: FAQs, available at https://www.cisco.com/c/en/us/solutions/telepresence/telepresence_video_conferencing_system.html

112 I.e. since the tax official charged with the MAP case is required to travel, he/she would be prevented from completing other tasks at the same time.

113 The type of blockchain system examined in this paper is intended to address the issue of an inefficient management of the international tax dispute resolution in itself and thus, the proposal for a potential implementation of such technology shall focus on how to facilitate the tax dispute resolution after the dispute has arisen. However, as already suggested in the relevant literature, the potential of blockchain could go much further than a simple organization/management of a tax dispute procedure in logistic terms. It could actually assist in capturing all transactions in which taxpayers are engaged, i.e. whole supply chain of business activities and assess the tax liabilities of the businesses involved in real time and for each of the involved tax jurisdictions. This application would effectively render the MAP and similar tax dispute resolution procedures obsolete. Nevertheless, since this is not yet a realistic scenario and it would necessarily require substantial changes to the currently applicable tax rules, we restrict ourselves to examining the potential of blockchain as a better tech management tool that could render MAP more efficient. For interesting proposals of blockchain models in the tax area, see for instance, Ainsworth R.T. and Shact A. (2017), Blockchain (Distributed Ledger Technology) Solves VAT Fraud, Boston Univ. School of Law, Law and Economics Research Paper No. 16-41. Available at SSRN: https://ssrn.com/abstract=2853428 or http://dx.doi.org/10.2139/ssrn.2853428

114 It should be noted that both a centralized cloud-based system and blockchain can be designed in a way that addresses the issues of security, privacy and cost savings, see for instance Bertrand, J. (2017), Blockchain and Cloud kissing cousins, Finextra, Retrieved from https://www.finextra.com/blogposting/13780/blockchain-and-cloud-kissing-cousins (where it is stated that "both cloud and blockchain have security protection baked into them and the data is fully encrypted. Cloud’s options of private, community and public deployment models mirror blockchain’s ability to target specific members in the chain, including regulators and auditors. Both are strongly resistant to cyber-crime... And of course, both cloud and blockchain significantly reduce costs. Blockchain, like cloud, removes the inefficiencies from its processes"). For a more illustrative explanation of similarities and differences between cloud and blockchain and an assessment of blockchain’s superiority in terms of security and privacy protection see Kshetri N. (2017), Blockchain’s roles in strengthening cybersecurity and protecting privacy, Telecommunications Policy, vol. 41, issue 10, p. 1027–1038, available online https://doi.org/10.1016/j.telpol.2017.09.003.
Based on plausible concerns expressed with respect to the level of ensured privacy and security that cloud based systems may provide,\textsuperscript{115} which may risk outweighing their benefits, blockchain is examined as an alternative that could address these concerns more efficiently, especially with regard to MAP.

Therefore, a potential blockchain-type system in MAP would take the form of a permission-based blockchain in which “MAP transactions” would be recorded. The term “MAP transaction” refers to any sort of MAP related documents, tax data exchange and MAP files that could be included in a “block”. In the case at hand, the permission-based ledger shall not be based on trust, despite the fact that CAs obviously trust each other when they consent to exchange information during MAP, but rather on the principle of efficiency\textsuperscript{116}. This type of blockchain would avoid excess consumption of resources that is crucial for tax administrations’ cost savings. The resource savings could potentially be achieved by a more relaxed “consensus charter”. This means that the criteria (to achieve consensus) based on which a MAP transaction that enters a block would be validated shall not be many and complex. For instance, a MAP transaction could include: a) the MAP request reference and b) references of indicative supportive documentation (invoices, contracts, bank accounts, tax returns filed etc). These “MAP data” references would be validated by virtue of the consensus process, after being identified somewhere in the chain in the previous blocks\textsuperscript{117}. All taxpayer’s tax data whose references exist in the blocks shall exist in the database of each competent authority. In addition, specific algorithms would be able to validate the transaction by also identifying the applicable tax treaty provisions. In case all these requirements are fulfilled, the MAP transaction is considered valid and recorded in the blockchain. Each tax authority would take the role of a node or miner\textsuperscript{118}. Each time a tax authority considers entering a block in the chain (mining), the nodes receiving the request of a new transaction in the blockchain would need to verify the transaction by virtue of the “consensus process” on which all parties of the blockchain would have a priori agreed. All parties could be able to see that block. Subsequently, all parties would be able to monitor the request and assess the supporting documentation after a MAP request is

\textsuperscript{115} See Tillery S. (2010), *How safe is the cloud?*, available at http://www.baselinemag.com/c/a/Security/How-Safe-Is-the-Cloud-273226 (the author suggests that these concerns might be better addressed via the establishment of stricter access control policies, such as “deploy[ing] a layered approach that combines stringent yet flexible access control to sensitive data with ongoing employee education about the security rules and processes the organization is required to follow”, combined with “a protocol on how all employees—from interns and contractors to senior-level executives—can access, store and share all types of data and information across the organization and with outside parties. The system should also be set up to automatically deny access—without exception—to current and former employees who do not have a permissible reason to gain entry to certain data. Such a system must include the ability to efficiently terminate access to former employees or consultants who are no longer working for the business”).

\textsuperscript{116} See for instance, Forde B. (2017), *How blockchain can help create better public services*, available at https://betterworkingworld.ey.com/digital/how-blockchain-can-help-create-better-public-services (where it is argued that “Private blockchains provide incredible operational efficiencies. Implementing a private blockchain means that efficiency is your main goal, not decentralization. But if the goals are decentralization, interoperability and independent security, a public blockchain is going to be more important. So if governments want solutions that are secure, interoperable and transparent to create the kind of trust that allow for these conditions, they will have to figure out a way to leverage public blockchains”).

\textsuperscript{117} The consensus process is effectuated by an AI, which needs to have been previously trained to identify the consensus criteria.

\textsuperscript{118} The difference between the two terms, which is critical for bitcoin, is irrelevant in the present model, since every tax authority could be a miner in terms of its potential of entering a new block in the blockchain.
filed. Thus, all parties could have a clear image of the nature of, and the persons involved, in all transactions that have taken place in case of the initiation of a MAP between CAs. The security and stability of the blockchain network assure that even where a computer is hacked, each “node” (computer) of the blockchain would have kept a copy of the ledger and thus, all parties would retain all relevant information. In the case of a completely private blockchain, as could be potentially used for MAP, the blockchain takes on a more centralised functioning. The competent authorities would have central control of the blockchain and be the only ones who receive the access required to write data in the blockchain. At the same time, the taxpayers may also have access to the blockchain, but only to read the relevant data. In addition, since access to reading the entire blockchain data would entail the risk of taxpayers finding and revealing confidential information exchanged between competent authorities, their access will be further restricted. This would mean that competent authorities have absolute control of the information inserted into the blockchain and would be able to identify the origin of the data and the time it was inserted and blocked in the chain.

Despite the potential of private blockchains to be more costly due to centralization, the deployment of less expensive consensus algorithms compared to those used in public blockchains mitigates this risk. Consensus algorithms in private blockchains do not need to be complicated, since permission-based ledgers do not require the same level of Proof of Work commitment. In any case, the advantages of blockchain (security, trust, cost and time savings, automatic identification, etc.) would have to be weighed against the costs of implementing such a private blockchain.

Figure 3: A type of blockchain that could be used for MAP

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119 See Piechowski D. (2017), Blockchain for Governments, available at http://www.businessofgovernment.org/blog/business-government/blockchain-government-0 (“Blockchain can bring together data that was previously held in various siloes, with different people or organizations owning different pieces. That complexity and lack of visibility into the full process can create inefficiencies that can slow or disrupt service”).

As previously mentioned (see section 3.2.2.), blockchain offers a state-of-the-art solution for cases where multiple unfamiliar parties need to achieve consensus based on common factual data. As such, blockchain would be ideally suited to application in transfer pricing disputes, which are mostly concerned with achieving a common understanding of facts. Such disputes generally involve at least two different taxpayers part of the same multinational group and two competent authorities. However, given the increasingly globalized nature of the economy, transfer pricing increasingly affects multiple jurisdictions, requiring resolution by means of multilateral MAPs. Since multilateral MAPs are still fairly uncommon and few tax administrations have any experience with running such a complex procedure, any potential advantage offered by the use of ICT becomes all the more important.

4.6 Capacity Building and ICTs

The importance of capacity building through training and similar initiatives should also be emphasized. Sophisticated technologies may aid in this process as well i.e. training through video-conferencing, the use of big data to assign training modules and evaluate the performance of staff (including provision of incentives), the use of AI to improve and develop training models etc. Multilaterally accepted e-training systems under the framework of the international organizations would be ideal for capacity building. In this respect, the work of the United Nations capacity development program on international tax cooperation in developing such online training modules that are made available to developing countries must be commended.

5. CONCLUDING REMARKS

It is clear that tax treaty dispute resolution mechanisms are outdated and are weighed down by a procedure such as the MAP that requires substantial human and financial resources for efficient functioning. In many countries, tax administrations do not have the means to conduct MAPs and thus, taxpayers do not have any confidence in the process. Therefore, tax treaty disputes remain unresolved or move towards the already overburdened Courts. However, with the dawn of the ‘BEPS’ era, it is clear that one can indeed expect a ‘tsunami’ of tax treaty disputes that now involve developing countries as well. Unless these countries are better prepared to handle such disputes, the ‘paper’ implementation of the ‘minimum standards’ in BEPS would be put to waste. Further, while the G-20 is gearing for ‘tax certainty’, it is clear that a sharp increase in unresolved disputes would result in more uncertainty and lead to a loss of foreign direct investment for developing countries, money that may be crucial for their achieving sustainable development goals.

As in the case of general tax administration issues, developing countries are increasingly starting to look at technology to put in place efficient processes using limited resources.

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As discussed in this paper, various ICTs may be used by these countries to improve their tax treaty dispute resolution framework as a whole and specifically, the functioning of the MAP. This would be in the interest of the efficiency of the tax treaty network as a whole – especially since countries are moving towards coordination in treaty dispute resolution through instruments such as the MLI.

However, there are some hurdles. While some of the solutions proposed are cost efficient, many of the solutions may involve initial capital outlay, which may be difficult for some developing and the least developed countries. Since the Platform for Collaboration on Tax (Platform), a joint effort launched by the OECD, the UN, the World Bank and the International Monetary Fund, has recently emphasized how taxation may be used as a means to achieve sustainable development goals, these international organizations may be implored to step in and provide such countries with the initial capital to invest in such technologies.

Eventually, our proposal is that the implementation of technology solutions requires a global coordinated approach, which should be spearheaded and managed by international organizations such as the OECD, the UN or the Platform. Much like the BEPS Project, the implementation may be completed in several stages and could be subject to peer reviews. Existing IT systems, such as the system used for the automatic exchange of information, may even be relied on, utilized and adapted to avoid a complete overhaul. In sum, the aim of this project would be to encourage consideration of such a proposal while the various policy organizations continue to work on making tax treaty dispute resolution more effective.

Only such a global coordinated approach will allow developing countries to resolve tax treaty disputes, foster an environment of ‘tax certainty’ and to eventually, collect locked-up revenues that may be used for promoting developmental goals.

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125 The proposal draws inspiration from the discussions in various meetings organized by the ‘Digital Economy Taxation Foundation’, a program which provides a neutral platform for policy research on the digital economy launched by the Singapore University of Social Science (SUSS), National University of Singapore (NUS), Exeter University, Xiamen University of China and Vienna University of Economics and Business (WU), which are focused on the transformation of tax administrations through the use of technology. See https://www.wu.ac.at/fileadmin/wu/dii/taxlaw/institute/WU_Global_Tax_Policy_Center/Tax___Technology/Digital_Tax_Transformation_Brochure.pdf (accessed 12 March, 2018)
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