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Applying Modern, Disruptive Technologies to Improve the Effectiveness of Tax Treaty Dispute Resolution: Part 1

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This comprehensive two-part article addresses how modern, disruptive technologies can be used to improve the effectiveness of tax treaty dispute resolution.

It is clear that international tax dispute resolution needs improvement. The OECD, the European Union and the United Nations have all recently taken measures to this effect by promoting the prevention and timely resolution of treaty-related disputes. However, none of these recommendations considers technology.

In this context, this article examines whether the emergence of new and disruptive technologies such as artificial intelligence, shared-data platforms, cloud-based solutions and blockchain could complement the mutual agreement procedure (MAP) and supplementary arbitration and render them more effective by speeding up the resolution, reducing costs and establishing trust between tax administrations and taxpayers.

To answer this question, in Part 1 of this article, the authors briefly analyse the main drawbacks of the existing tax treaty dispute resolution process from the perspective of various stakeholders. Next, the article focuses on the fundamental features of a few significant types of technology and analyses how they could improve this process.

In Part 2 of this article, the authors will use the analysis from Part 1 to make some specific suggestions as to how the technologies discussed can be used to improve the MAP and supplementary solutions, with an aim to encourage the above-mentioned policy organizations 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 posed by digitalization by establishing a technology-driven culture via the implementation of information and communications technology (ICT) models that will enable the effective and efficient exercise of their competences.[1] Effectiveness and efficiency in this context refer to the timely completion of procedures by tax administrations, in a cost-effective, secure and transparent[2] manner. In addition, from the taxpayer perspective, convenience[3] and certainty[4] are crucial. However, in a digital environment driven by mobile technologies and thriving because of 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 must be tailored according to each tax administration's digital maturity and resource capacity.[5]

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1 OECD, *Technologies for Better Tax Administration: A Practical Guide for Revenue Bodies* (OECD Publishing 13 May 2016). This report specifies 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.

2 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.

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

4 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.

5 *See* e.g. EY, *Tax Authorities Are Going Digital: Stay Ahead and Comply with Confidence* (2017) (tax authorities across Europe, Middle East, India and Africa are classified based on their level of digitization (level 1: e-filing, level 2: e-accounting, level 3: e-match, level 4: e-audit, and level 5: e-assess)).

Notably, 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 achieving improved tax compliance and revenue collection.[6] 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 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, as the MAP has been criticized in the past as being cumbersome, opaque and time and resource consuming for taxpayers and tax administrations alike, there is a significant scope for technology to improve the functioning of the MAP and other binding and non-binding solutions that supplement the MAP. Through this article, the authors propose possible improvements to the MAP and solutions to supplement the MAP by means of technological tools, recommending a model for the technology-facilitated MAP. As the MAP, in its essence, requires negotiation and discussions among the authorities of the states, this proposal would be different from technology mediated dispute resolution, which would involve a fully automated procedure,[7] and entails the introduction of technologies to improve and facilitate the conduct of the MAP from a procedural perspective.

In this regard, Part 1 of this article begins by discussing the current status of the MAP while assessing the need of improving its effectiveness (section 2). Furthermore, selected technological models and trends are described, with an emphasis on particular models that could address the effectiveness of the MAP (section 3). In Part 2, the authors will then suggest possible ways to integrate these technologies into the MAP with a view to balancing potential improvements to the MAP with the risks that the implementation of these technologies might entail.

2 Perceived deficiencies in the MAP

2.1 *General Background*

Taxation is traditionally considered a purely 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.[8] 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 types 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 applicable tax treaty, the taxpayer may either bring the dispute before domestic courts, or follow the dispute resolution remedy provided under 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[9] provides for the MAP where a taxpayer, within three years from the first notification of the taxation considered to not be in accordance with the tax treaty, has the right to approach a designated governmental authority (the competent authority) in the taxpayer's residence state, the source state or both to raise a claim. If the taxpayer's claim is justified in the opinion of the competent authorities receiving it and this (these) competent authorities cannot resolve the dispute unilaterally, the requested competent authorities would approach the competent authority of the other state and 'endeavour' to resolve the dispute by 'mutual agreement'. This is considered to be an inter-governmental process of dispute resolution between the competent authorities in which the taxpayers are not parties and are usually not involved after the application for its initiation. Furthermore, no obligation is placed on the competent authorities to resolve the dispute, and no deadline is prescribed for the conclusion of the MAP. Finally, tax administrations have struggled to devote resources to the MAP and to manage large case volumes effectively. Owing to such concerns, the MAP has often been criticized as not being an entirely effective remedy (Figure 1).[10]

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6 *See* e.g. 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 Mar. 2017, http://stampduty.gov.ng. (accessed 25 Apr. 2018). According to Wale Shonekan (Executive Chairman, FIRS), the stamp duty collection for 2017, 10 months after the initiative above was adopted, has surpassed the total collection of 2015 and 2016. *See* the presentation by Wale Shonekan at the conference on 'Digital Tax Transformation', the third meeting in the Multi-stakeholder series, 18–19 Dec. 2017, organized by the Global Tax Policy Center, WU, Vienna.

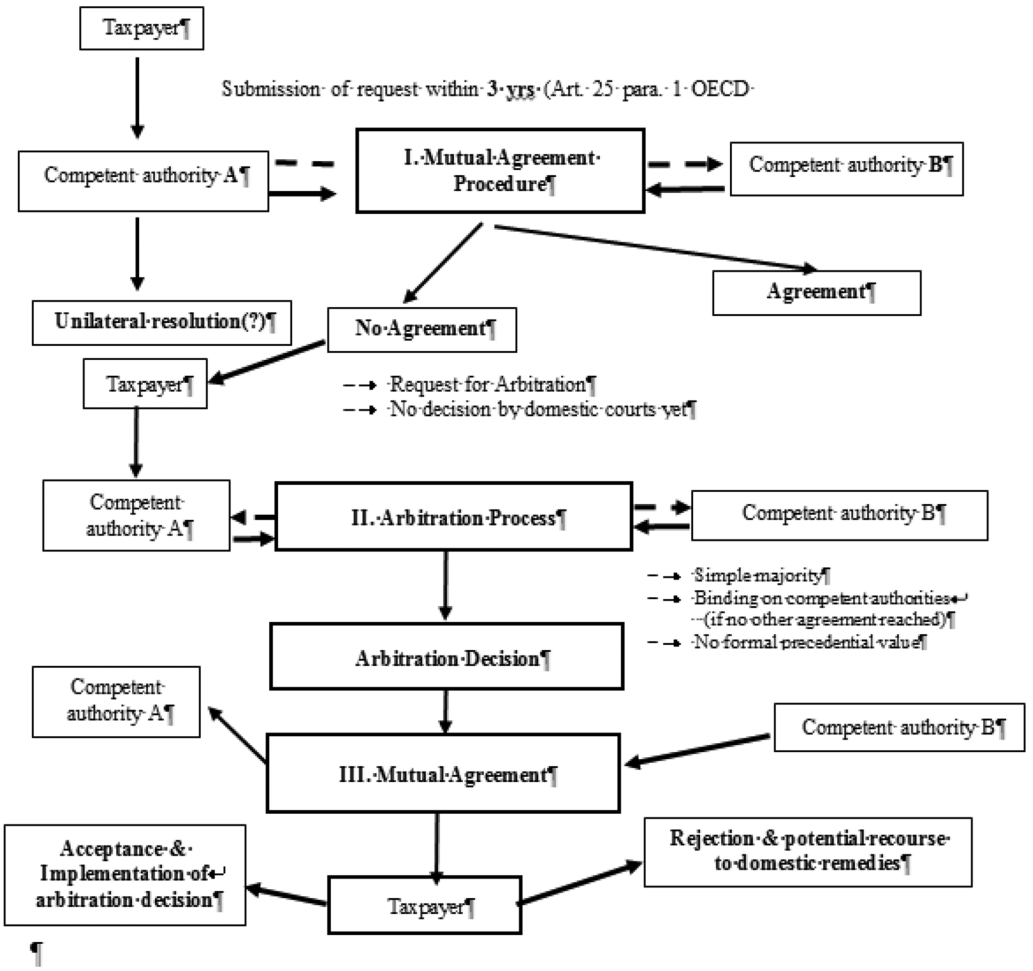
7 In this respect, *see* D. A. Larson, *Technology Mediated Dispute Resolution (TMDR): A New Paradigm for ADR*, 21(3) Ohio St. J. Disp. Resol. 629 (2006).

8 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.

9 OECD, *Model Tax Convention on Income and on Capital*, condensed version (OECD Publishing 21 Nov. 2017). As (1) the OECD Model Convention is the most commonly accepted model for tax treaties and (2) most tax treaties contain an almost identically worded provision, the authors refer to this provision as the authors' frame of reference.

10 R. Ismer, *Art. 25: The Mutual Agreement Procedure*, in *Klaus Vogel on Double Taxation Conventions* vol. 1801, 1810 (E. Reimer & A. Rust eds, 4th ed., Wolters Kluwer 2015); M. Lang, *Introduction to the Law of Double Taxation Conventions* vol. 148, 149 (2nd ed., Linde 2013); J. Kollmann & L. Turcan, *Overview of the Existing Mechanisms to Resolve*

Figure 1: Flowchart Showing How MAP is Conducted Under the OECD Model



The discussion below explores perceived issues in the MAP, both from the perspective of the states and from the perspective of the taxpayer, which issues could be improved by the use of technology.

2.2 *Issues from the Perspective of Governments*

The broadest and most crucial challenge faced by the governments in a MAP is the lack of resources. The competent authority function of the government of a state usually consists of multiple divisions. At the very least, there ought to be two divisions: the first for negotiation of new tax treaties and the second for dealing with MAP cases initiated by taxpayers. In some cases, a third division could also be created to deal with policy issues concerning the application and interpretation of tax treaties.[11] Furthermore, there could be a specific division dealing with issues concerning the exchange of information.

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, as only highly qualified officials who understand complex issues concerning tax treaties should be given such responsibilities. In a developing country, where the international tax division itself typically has only limited personnel, it would be difficult to allocate many people to the competent authority function and, specifically, to deal with MAP cases.[12] In some developing countries, the competent authority function is carried out by only one person. In addition, if the same people are involved in the audit function and the competent authority function, there

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Disputes and Their Challenges, in *International Arbitration in Tax Matters* 25 (M. Lang & J. Owens eds, IBFD 2015); R. Biçer, *The Effectiveness of Mutual Agreement Procedures as a Means for Settling International Transfer Pricing Disputes*, 21(2) Intl. Transfer Pricing J. 79 (2014).

[11] C. Protto, *Mutual Agreement Procedures in Tax Treaties: Problems and Needs in Developing Countries and Countries in Transition*, 42(3) Intertax 176 (2014).

[12] *Ibid.*, at 176, 177.

could be concerns, as (1) the competent authority may have a vested interest in upholding the audit assessment regardless of its validity and (2) information obtained during a MAP could be used in the audit process in future.

Furthermore, engaging in the MAP necessarily involves financial outlay on the part of states. As the MAP is a remedy that involves discussions between two competent authorities 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 significant, as most competent authorities regard face-to-face meetings as more efficient compared to phone calls or e-mails for the resolution of a MAP case.[13] Ensuring access to information specific to a particular industry or a taxpayer could 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 implement dedicated training and capacity building initiatives, which would be a financial load for many states.[14]

Resource constraints can also affect the implementation of multilateral efforts to improve the functioning of the MAP. Owing to Action 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 the MAP.[15] This includes an undertaking to effectively implement the MAP and allow timely resolution of MAP cases, with specific commitments such as concluding cases within an average of 24 months; ensuring adequate resources; ensuring separation between the competent authority 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 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.[16] However, for governments of developing countries with limited resources, ensuring compliance with these standards would be extremely difficult, as many states do not have the personnel or the funding to put in place a competent authority function that is independent from the audit function, to publish guidance or to send representatives to the Forum on Tax Administration MAP Forum discussions. As the peer review reports show, OECD countries themselves cannot meet all the requirements.[17] This applies specifically to the compilation of statistics, as well, because 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 and, thus, the various statistics need to be compiled separately.

Another concern that deserves discussion is the management of the inventory of MAP cases by each competent authority. As some pairs of states have a significant number of cases with each other and very few cases with other states, it can be difficult for competent authorities to give equal attention 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* competent authority 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,[18] the EU Dispute Resolution Directive,[19] the stand-alone tax treaty and then, the OECD multilateral instrument (MLI)[20] modifying the application of such tax treaty.[21]

There are broader issues with regard to case management, as well. The previous example assumed that states

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[13] This is considered a best practice in the OECD Manual on Effective Mutual Agreement Procedures. *See* OECD, *Manual on Effective Mutual Agreement Procedures*, Best Practice No. 15 (OECD Publishing Feb. 2007).

[14] Protto, *supra* n. 11, at 176, 177.

[15] OECD, *Making Dispute Resolution Mechanisms More Effective – Action 14: 2015 Final Report*, OECD/G20 Base Erosion and Profit Shifting Project (OECD Publishing 5 Oct. 2015).

[16] The peer reviews for the first four batches of the Stage 1 review have been completed and approved. *See* OECD, *BEPS Action 14 Peer Review and Monitoring*, http://www.oecd.org/tax/beps/beps-action-14-peer-review-and-monitoring.htm (accessed 15 Aug. 2018).

[17] E.g. the Stage 1 peer review report on Italy and Austria notes that previous statistics show a 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, *Making Dispute Resolution More Effective: MAP Peer Review Report – Austria (Stage 1)* 42–46 (OECD Publishing 15 Dec. 2017); OECD, *Making Dispute Resolution More Effective: MAP Peer Review Report – Italy (Stage 1)* 48–51 (OECD Publishing 15 Dec. 2017).

[18] EU Arbitration Convention (1990): Convention 90/436/EEC of 23 July 1990 on the Elimination of Double Taxation in Connection with the Adjustment of Profits of Associated Enterprises, OJ L225/10 (20 Aug. 1990).

[19] EU Directive on Tax Dispute Resolution Mechanisms: Council Directive (EU) 2017/1852 of 10 Oct. 2017 on Tax Dispute Resolution Mechanisms in the European Union, OJ L265/1 (14 Oct. 2017).

[20] OECD, *Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting* (OECD Nov. 2016) (the MLI). The MLI was developed as a result of BEPS Action 15. OECD, *Developing a Multilateral Instrument to Modify Bilateral Tax Treaties – Action 15: 2015 Final Report*, OECD/G20 Base Erosion and Profit Shifting Project (OECD Publishing 5 Oct. 2015).

[21] *See* generally S. Govind & L. Turcan, *The Changing Contours of Dispute Resolution in the International Tax World: Comparing the OECD Multilateral Instrument and the Proposed EU Arbitration Directive*, 71(3/4) Bull. Int'l Tax'n (2017); S. Govind & L. Turcan, *Cross-border Tax Dispute Resolution in the 21st Century: A Comparative Study of Existing Bilateral and Multilateral Remedies*, 19(5) Deriv. & Fin. Instrum. (2017) (providing a broad perspective on differing deadlines in each of these instruments).

are aware of the number and nature of cases they have with each other. However, presently, most governments have no systems in place to ascertain whether any cases similar to a given MAP request have already been decided. Knowledge of previous cases is instead usually dependent on the experience of the personnel of the competent authority function, and thus varies widely among competent authorities and within a competent authority for different divisions, as well as over time, depending on the individuals involved. Thus, talent management is essential for a competent authority and can have a disproportionate impact on its performance. Unfortunately, it seems that there is significant room for improvement within tax administrations with respect to talent management, recruitment and retention.[22] Depending on the experience and personal knowledge of staff, it can be difficult for a competent authority to understand, for example, whether and where a framework agreement is required to attempt to ensure that there is a similar agreement in identical cases, or even to ensure that very similar cases are treated in a similar manner over time. It could furthermore be argued that even if a competent authority staffed with especially knowledgeable and experienced personnel can achieve an efficient inventory management and a consistent resolution of cases, the fact that this outcome depends almost entirely on the uncertain human factor creates a risk that should be mitigated by designing a more impersonal procedure.

Furthermore, the processing of a MAP case often requires the involvement of the local tax authorities of the state responsible for the tax return that led to the MAP request for the clarification of issues, which is typically a time-consuming and slow process. Similarly, the status of domestic proceedings in relation to a MAP request is difficult to ascertain for the competent authorities, requiring further inquiries from their side, as there is generally no automated flow of information between courts and tax administrations regarding the status of proceedings. Finally, performing diagnostics in relation to inventory at the end of a year or during a year is difficult, as there are no systems in place in many states to record such cases (or where such systems are in place, they are not sufficiently developed).[23]

As regards personnel management, in addition to the considerations mentioned above, the handling of MAP cases and the efficiency and consistency of resolution thereof are often entirely dependent on the person from the competent authority function handling it. Therefore, any change in personnel or transition within the competent authority function could:

- keep a case pending without immediate re-assignment to another case worker if the worker leaving the case does not pass on the information concerning the existence of the case properly and there is no adequate inventory management system in place;
- unduly delay the resolution of the case if essential aspects of the case are not passed on and there is no central repository where such information is recorded and can be accessed by the case worker taking on the case;
- in most cases, lead to a slower resolution, especially if the new case worker is inexperienced with a certain type of dispute and must first acquire the necessary general background knowledge; or even
- lead to a block in the case if, due to personal differences between case workers of different competent authorities, no solution can be reached.[24]

Therefore, from the perspective of the governments of states, any technology that could assist in making the MAP more cost-efficient and less resource reliant, especially with respect to human resources, would definitely be a welcomed development.

2.3 *Issues from the Perspective of the Taxpayer*

Concerns raised by taxpayers as regards the 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 taxpayers is that the MAP places no obligation on the competent authorities to arrive at an agreement or to remove 'double taxation'. Furthermore, the MAP creates no timeframe within which the process should be concluded.[25] Moreover, taxpayers have next to no access to the proceedings subsequent to initiation.[26] It has often been asserted that as far as taxpayers are concerned, the MAP is like a

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[22] A study conducted by McKinsey found that only 10% of tax authorities take extraordinary measures to retain top talent and, similarly, only 5% offer very high-quality training, *see* A. Barnay, J. Davis, J. Dimson, E. Gibbs & D. Korn, *Four Innovations Reshaping Tax Administration* (McKinsey&Company Jan. 2018). An OECD study also found fairly high attrition rates for tax administration staff (up to 13% in 2013 in Mexico) and surprisingly, that a significant percentage of employees – e.g. in the case of the US more than 50% – do not have a degree, *see* OECD, *Tax Administration 2015 Comparative Information on OECD and Other Advanced and Emerging Economies* 162 (OECD Publishing 11 Aug. 2015).

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

[24] If such personal differences occur at the highest levels of the competent authority, they can block the resolution of the entire case inventory between the two states affected, sometimes for several years.

[25] Kollmann & Turcan, *supra* n. 10, at 25; Z. D. Altman, *Dispute Resolution under Tax Treaties* (IBFD 2005), para. 5.3.2, citing L. Maktouf, *Resolving International Tax Disputes Through Arbitration*, 4(1) Arb. Int'l 32, 42 (1988).

[26] The lack of transparency could be a major concern for the taxpayer, as information obtained under MAP may be used for future audits as well.

black box, owing to its lack of transparency, certainty and taxpayer involvement.[27]

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 competent authorities.

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 competent authorities to finalize MAP cases.[28] This has led taxpayers to prefer domestic remedies as opposed to the MAP in several states.[29] Some taxpayers even have concerns as regards the security of transmitting sensitive and confidential information to competent authorities when the function is not sufficiently funded for secure data protection and encryption standards. Furthermore, total case volumes of MAPs have been increasing every year.[30]

Finally, the MAP is known to be time consuming, especially in states that have capacity constraints, as they not only have fewer case workers for MAPs, 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 competent authority.[31]

Some procedural concerns are also 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.[32] Furthermore, competent authorities may take a long time to process a MAP request, and taxpayers are generally not notified in any way of the progress in the case. Taxpayers are generally even unaware of the personnel in the competent authority function who are working on their case, allowing no easy means to establish contact for enquiries during the process.[33]

It is thus clear that there are several ways in which technology could improve the functioning and effectiveness of the MAP from a taxpayer perspective. 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, thus, competent authorities might not be comfortable with taxpayers being directly involved in the process, as this carries with it the potential for taxpayers to influence the outcomes of cases.

3 In search of tech-based effectiveness

Technologies could contribute to the effectiveness of the MAP while preserving the necessary security standards. Emerging technologies and relevant trends such as the Internet of Things, Big Data and cloud computing, as well as more specific innovations, namely Blockchain- and artificial intelligence-based technologies, are only some of the most representative examples of the digital revolution which *ab initio* seem adequate to address the above-mentioned aims. The compatibility of these technologies with the MAP and their suitability in achieving the desired outcomes will be analysed below based on their key features.

This analysis will feature three main parts. The first part focuses on the status quo of the technological capacity of tax administration, while the second part will consider the types of technologies that allow the prevention of disputes and, thus, MAP requests, before they are likely to be raised. The third part deals with technologies that make MAPs more effective for those tax cases where a MAP is unavoidable, or for which a MAP is already pending. In the latter two parts, 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 *The Status Quo: Tax Administration and Technology*

Dispute resolution is an area of tax administration that is very intimately tied to the design and functioning

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[27] P. A. Brown, *Enhancing the Mutual Agreement Procedure by Adopting Appropriate Arbitration Provisions*, in *International Arbitration in Tax Matters* (M. Lang & J. Owens eds, IBFD 2015).

[28] 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.

[29] E.g. a report by a government-constituted body in India reviewing tax dispute resolution procedures cites the fact that taxpayers distrust the MAP in India. IN: Ministry of Finance, Tax Administration Reform Commission, *First Report* 245 (30 May 2014).

[30] Per the OECD MAP Statistics, 2015, there was a sharp rise in total inventory and new cases as compared to the previous year. As 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.

[31] Kollmann & Turcan, *supra* n. 10, at 25.

[32] This reflects the Indian experience prior to the BEPS work. S. Govind & S. Rao, *Designing an Inclusive and Equitable Model for International Tax Arbitration: An Indian Perspective*, 46(4) Intertax 313 (2018).

[33] In fact, for most tax administrations, only the head of the competent authority is mentioned as the contact point in official guidance as well as in the OECD MAP Profile, *See* OECD, *MAP Profiles*, http://www.oecd.org/tax/dispute/country-map-profiles.htm (accessed 25 July 2018). It is possible that at least some tax administrations deliberately prevent direct contact between the case worker and the taxpayer as an anti-corruption measure.

of the administration in general, especially with respect to the first steps undertaken in the process. A technologically mature tax administration will have a much higher information technology (IT) reliance with respect to the submission of a request for MAP and the further handling and assessment of the request with respect to the question of granting unilateral relief. Therefore, in order to make practical recommendations on how technology could be used to improve tax treaty dispute resolution, it is first necessary to assess the starting point, i.e. the current level of technological sophistication of tax administrations. Figure 2 below distinguishes five different stages of digitization,[34] which can be used to assess the level of digitization in a tax administration. Studies conducted by advisors have found that tax administrations have very different levels of digitization, not only among each other, but also with respect to certain data or type of taxes.[35] In general, few administrations seem to have reached notably high levels of digital development.[36]

Nevertheless, the speed and extent of digitization continues to increase as a result of, for example, the OECD BEPS Project. For instance BEPS Action 13, which mandates the preparation and automatic exchange of country-by-country reports by certain multinational enterprises (MNEs), will provide tax administrations with substantial and concentrated data on the international activities of such MNEs and the key economic indicators per jurisdiction and, in future, per group entity.[38] In general, tax administrations are collecting ever more data at an increasingly early stage. In order to be able to adequately and swiftly process the vast amounts of data, tax administrations will need to use advanced data analytics. Correct handling of data will help increase the effectiveness of tax services.

This article highlights the potential of disruptive technologies, which have thus far not been used in tax administration at all or have been used only very sparingly by the most advanced administrations, in making the MAP a more resource-efficient tool. However, as shown in this article, non-disruptive IT tools also harbour significant potential for increasing MAP efficiency, for those tax

Figure 2: Levels of Digitization in Tax Administrations[37]

Level 1	Level 2		Level 3	Level 4		Level 5
"E-file"	"E-accounting"		"E-match"	"E-audit"		"E-assess"
Corporate entities required or have the option to use a standardized electronic form for filing tax returns. Other income data (e.g., payroll, financial) filed electronically and matched annually.	Corporate entities required to submit accounting or other source data to support filings (invoices, trial balances, etc.) in a defined electronic format at a defined frequency. Additions and changes at this level occur frequently.	Paradigm shift	Corporate entities required to submit additional accounting and source data, government accesses additional data (bank statements). Government begins to match data across tax types, potentially across taxpayers and jurisdictions in real time or near real time.	Corporate entities' Level 2 data is analyzed by government entities and cross-checked to filings in real time or near real time to prevent fraud, unintended errors, and to map the geographic economic ecosystem. Governments send taxpayers electronic audit assessments with a limited window to respond.	Disruptive	Government entities use submitted data from corporate entities to assess tax without the need for tax forms. Taxpayers have a limited window of time to audit government-calculated tax.

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[34] The five stages were developed by EY, *see* EY, *Tax Administration Is Going Digital*, (2016), https://www.ey.com/us/en/services/tax/ey-tax-administration-is-going-digital (accessed 25 July 2018).

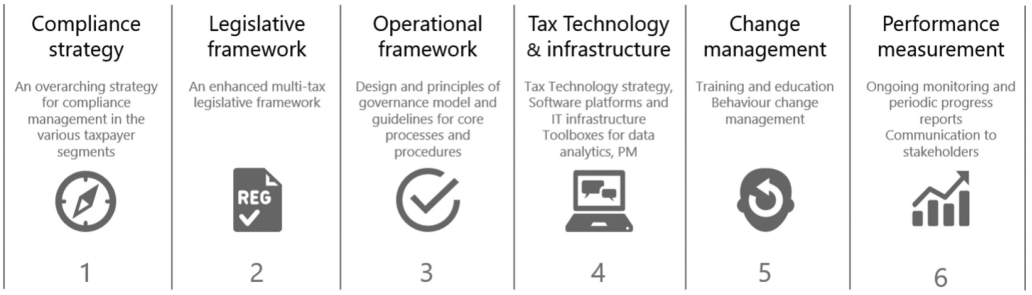
[35] The digitization process very often commences with value-added taxes (VAT), *see* EY Tax Insights, *Tax Administration Goes Digital*, https://taxinsights.ey.com/archive/archive-articles/tax-administration-continues-to-go-digital.aspx (accessed 25 July 2018). Furthermore, while e-filing of tax returns is fairly common, e-invoicing and data analytics are not employed as often.

[36] A study conducted by McKinsey in 2018 highlights the low penetration of IT within tax administrations. Barnay, Davis, Dimson, Gibbs & Korn, *supra* n. 22. The study shows that only 5% of tax administrations offer differentiated taxpayer service and only 11% offer a fully integrated taxpayer account management system. While most tax authorities use advanced analytics, only 5% apply them to achieve dynamic taxpayer risk scoring. On the other hand, 20% employ a sophisticated case selection system based on algorithms. 5% of tax administrations apply IT to automate internal processes, but none of the 21 tax administration examined allowed taxpayers to access automated documents and services. *See* EY, *supra* n. 34 for a snapshot of the levels of tax digitization in the Americas as of 2016. *See* also K. Baisalbayeva, E. van der Enden, V. Ion & H. Tsavdaris, *Digital Transformation of Tax Administration* 32 (Microsoft and PwC 2017) https://www.pwc.nl/nl/assets/documents/pwc-digital-transformation-tax-oct2017.pdf (accessed 25 July 2018) (providing examples of digital transformation initiatives in different countries).

[37] EY, *supra* n. 34. The order of the stages is not necessarily respected, nor is the progression linear: certain stages in the development of digital maturity may be entirely skipped.

[38] OECD, *Transfer Pricing Documentation and Country-by-Country Reporting – Action 13: 2015 Final Report*, OECD/G20 Base Erosion and Profit Shifting Project (OECD Publishing 5 Oct. 2015).

Figure 3: Key Components of a Successful Digital Transformation



administrations which have thus far not made full use of them.

The implementation of technological changes within a tax administration, especially changes based on disruptive technologies, requires more than the mere installation of the necessary software and/or hardware. Successful digital transformation is a complex, multi-step process that requires advance planning and integration of several different aspects, such as the legal and personnel requirements along with the IT and IT infrastructure (Figure 3).

3.2 *Technologies that Help to Prevent Disputes*

3.2.1 *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'. The trend of the Internet of Things 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 'Internet of Things' is not new,[40] the functions currently ascribed to the term have been further developed and extended since its original use, resulting in multiple definitions of the term.[41] As used in this article, the Internet of Things 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'.[42] This definition provides a comprehensive description of the Internet of Things, while other proposed definitions tend to emphasize one of the particular characteristics of the Internet of Things such as the concept of 'things' that are connected to the Internet, the Internet protocols, the network technology or the capacity for information storage and the volume of information stored.[43]

In broad terms, the Internet of Things 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 Internet of Things consists of the collection of data from the surrounding environment through sensors. The data collected can be of a personal nature or not.[44] These data are transmitted and often stored in a cloud-based system, and subsequently processed by business and – potentially – a tax administration for decision making purposes.[45]

The three procedural steps of the Internet of Things function which led to a new business model in data analytics are: data collection, data storage and data processing.[46] The vast amount of data transmitted by the connected devices is analysed by algorithms, which

Notes

[39] Baisalbayeva, van der Enden, Ion & Tsavdaris, *supra* n. 36 (providing further details on the potential design of the different stages). *See also* EY, *supra* n. 34, at 16.

[40] V. Sharma, V. Sharma & N. Mishra, *Internet of Things: Concepts, Applications and Challenges*, in *Exploring the Convergence of Big Data and the Internet of Things* 73 (A. V. Krishna Prasad ed., K. L. University 2017) (attributing the origin of the term to Kevin Ashton (1999) and state that the technology of the Internet of Things consists of pre-existing components that have become more affordable in the meantime (i.e. sensors)).

[41] US: Federal Trade Commission, FTC Staff Report, *Internet of Things: Privacy & Security in a Connected World* 5 (Jan. 2015).

[42] International Telecommunication Union (ITU), *Overview of the Internet of Things*, Recommendation ITU-T Y.2060 (2012) http://handle.itu.int/11.1002/1000/11559 (accessed 12 Feb. 2018).

[43] F. Wortmann & K. Flüchter, *Internet of Things: Technology and Value Added*, 57(3) Bus. & Info. Syst. Eng. 221 (2015).

[44] Often, there is no clear dividing line between these categories. OECD, *Addressing the Tax Challenges of the Digital Economy – Action 1: 2015 Final Report*, OECD/G20 Base Erosion and Profit Shifting Project (OECD Publishing 5 Oct. 2015), para. 4.3.2.

[45] M. Paez & M. La Marca, *The Internet of Things: Emerging Legal Issues for Businesses*, 43 N. Ky. L. Rev. 29, 31 (2016).

[46] Defined as the use of data storage and processing techniques to support business decisions. Even though this definition principally applies to business activity in the private sector, its principles may equally apply to the public sector. T. Lutes, *Better Tax Administration Through Better Use of Data*, IBM Government Industry Blog (1 Apr. 2015), citing IBM Institute for Business Value, *The New Hero of Big Data and Analytics: The Chief Data Officer* (2014), https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?subtype=XB&infotype=PM&appname=GBSE_GB_TI_USEN&htmlfid=GBE03607USEN&attachment=GBE03607USEN.PDF (accessed 25 July 2018). For the definition

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.[47] The use of data storage and processing techniques to support decisions justifies why the Internet of Things and the data collected through it have been considered as innovation drivers.[48]

The above-mentioned business strategy of data accumulation through the interaction of users with the Internet[49] has resulted in a vast amount of data, often referred to as 'Big Data'.[50,51] The relevant literature focuses on three main characteristics of Big Data, also known as 'the three V's': volume, variety and velocity.[52] *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 are generated. Nevertheless, in addition to the above-mentioned three – technical – characteristics of Big Data, the OECD also describes Big Data as 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'.[53]

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 taxpayers. For example the application of Big Data technology to the analysis of tax returns filed could lead to significant improvements in the monitoring of risks and the assessment of compliance.-[54] 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.[55]

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 the MAP, has not yet been discussed. In the context of the MAP, the use of Big Data technology could enable tax authorities to act in a timely manner and even prevent MAP requests from even being submitted. Additionally, Big Data offers an extraordinary opportunity for competent authorities to build a taxpayer's risk profile (low, medium, high), corresponding to the probability that the taxpayer 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, such as those required on a yearly basis by the OECD and the EU Joint Transfer Pricing Forum,[56] in a more efficient manner, and use

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and implementation of 'advanced data analytics' in tax administration, *see* OECD, *Advanced Analytics for Better Tax Administration: Putting Data to Work* 17–29 (OECD Publishing 13 May 2016) (defining 'advanced analytics' as the practice of using statistical techniques to make predictions and infer cause and effect. It is further stated that data analytics may prove to be an extremely valuable tool in improving the effectiveness of tax administrations).

47 OECD, *Action 1 Final Report, supra* n. 44, paras 3.2.1 and 3.2.3. An improved form of the Internet of Things combined with machine learning has applications in robotics. Robotics based on the Internet of Things already monopolized the manufacturing sector and are being used more and more often in the service sector.

48 OECD, *Action 1 Final Report, supra* n. 44, para. 4.3.2; OECD, *Exploring Data-Driven Innovation as a New Source of Growth: Mapping the Policy Issues Raised by 'Big Data'* Digital Economy Papers 222, 10–12 (OECD Publishing 18 June 2013).

49 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.

50 In OECD, *Exploring Data-Driven Innovation as a New Source of Growth: Mapping the Policy Issues Raised by 'Big Data', supra* n. 48, at 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.

51 Unfortunately, an exact definition of 'Big Data' is not easy to come by, as 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. E.g. management science emphasizes how big data can be used to predict customer behaviour, as mentioned in A. J. Cockfield, *Big Data and Tax Haven Secrecy*, 18(8) Fla. Tax Rev., 497–498 (2016).

52 P. Bhargavi & S. Jyothi, *Big Data and Internet of Things for Analysing and Designing Systems Based on Hyperspectral Images*, in *Exploring the Convergence of Big Data and the Internet of Things* 242 (A.V. Krishna Prasad ed., K. L. University 2017).

53 Bhargavi & Jyothi, *supra* n. 52, at 242.

54 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'. OECD, *Technologies for Better Tax Administration, supra* n. 1, at 54.

55 EY, *supra* n. 34.

56 Since 2006, the OECD has been compiling annual statistics on the MAP caseloads of all its member countries and of partner economies that agreed to provide such statistics. The 2006–2015 statistics are available at OECD, *Mutual Agreement Procedure Statistics 2006–2015*, http://www.oecd.org/tax/dispute/map-statistics-2006-2015.htm (accessed 25 July 2018). Beginning in 2016, the reporting of MAP statistics to the OECD is mandatory for all members of the Inclusive Framework on BEPS (IF) under the minimum standard developed in the Action 14 Final Report and follows the reporting framework agreed as part of the work on Action 14. OECD, *Action 14 Final Report, supra* n. 15, at 16; OECD, *BEPS Action 14 on More Effective Dispute Resolution Mechanisms – Peer Review Documents*, 31 et seq. (OECD Publishing, Oct. 2016). The 2016 statistics are available at OECD, *Mutual Agreement Procedure Statistics for 2016*, http://www.oecd.org/tax/dispute/mutual-agreement-procedure-statistics.htm (accessed 25 July 2018). They cover all the members that joined the IF prior to 2017.
In parallel, the EU Joint Transfer Pricing Forum has been collecting statistics on the MAP cases under the EU Arbitration Convention since 2005 and, more recently, statistics on Advance Pricing Arrangements (APAs) entered into by the EU countries. The most recent statistics can be found at European Commission, Joint Transfer Pricing Forum, *Member States' Statistics*, https://ec.europa.eu/taxation_customs/business/company-tax/transfer-pricing-eu-context/joint-transfer-pricing-forum_en (accessed 25 July 2018).

such information to further improve the efficiency of the MAP in their countries. These proposals are further developed in Part 2.

3.2.2 *Artificial Intelligence-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'.[57]

Human intelligence includes the ability to understand and monitor information, interact, predict and continuously learn and improve. The procedure by which machines attempt to mimic and eventually come close to, human behaviour 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'.[58] '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'.[59]

The main perceived 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.[60] The most common machine learning applications are found in translations, facial recognition and targeted online advertisements. However, as 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.[61]

The potential advantages of the implementation of AI in the public sector, more specifically, in tax administration, are significant.[62] In addition, the application of AI in tax administration specifically (compared to public administration) could prove less controversial. This is because the competences of tax administrations are less based on discretionary power. However, one could argue that competent authorities have broader discretionary powers within the context of the MAP than tax administrations in general. While tax administrations are rule-bound and must follow both domestic laws and the provisions of tax treaties and other international agreements, MAP cases tend to arise where the same fact pattern can lead to different, equally valid, interpretations under the existing legal norms. In reaching a compromise between these interpretations, competent authorities can exercise discretion. While the application of machine learning to procedures involving discretionary powers might be problematic from a constitutional law perspective, one could also argue that, under specific circumstances, even AI applications in the sphere of a tax administration's discretionary powers, might be advantageous, as they could provide more rational and/or apolitical solutions.[63]

Applying machine learning techniques would allow enormous amounts of data to be analysed, cross-checked and filtered for relevant information within a minimal amount of time[64] and would lead to substantial cost savings, as well as reductions in 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.[65]

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. In implementing AI in the context of the MAP, tax administrations need to proceed with caution and keep potential limitations in mind.

Part 2 discusses potential applications of AI in the context of dispute resolution, primarily in the context of the MAP.

Notes

[57] C. de Jesus & T. Jaquith, *Artificial Intelligence: What It Is and How It Really Works*, Futurism (1 Jan. 2017).

[58] *Ibid.*, citing A. L. Samuel, *Some Studies in Machine Learning Using the Game of Checkers*, 3 IBM J. Research & Devel. 221–229 (1959).

[59] De Jesus & Jaquith, *supra* n. 57, *citing* Samuel, *supra* n. 58, at 221–229.

[60] W. D. Eggers, D. Schatsky & P. Viechnicki, *AI-Augmented Government: Using Cognitive Technologies to Redesign Public Sector Work* 5 (Deloitte Ctr. for Govt. Insights, Deloitte University Press 2017).

[61] *Ibid.*, at 2–7.

[62] Notably, AI projects in tax administration's functions have been discussed since 1990. T. K. Flesher & S. A. Hicks, *The IRS Artificial Intelligence Laboratory*, 21(1) Tax Adviser 51 (1990).

[63] In this respect, *see* T. J. Barth & E. Arnold, *Artificial Intelligence and Administrative Discretion-Implications for Public Administration*, 29(4) Amer. Rev. Pub. Admin. 332–351 (1999). Barth and Arnold 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 judgment, 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.

[64] A. A. Kershaw, *Automated Document Review Proves Its Reliability*, 5(11) Digital Discovery & e-Evidence 10–12 (2005).

[65] H. Mehr, *Artificial Intelligence for Citizen Services and Government*, Ash Center for Democratic Governance and Innovation, Harvard Kennedy School 6 (2017).

3.3 *Technologies Increasing the Effectiveness of MAP*

3.3.1 *Web Portals and Cloud Systems*

Web portals are not new in electronic government (e-government).[66] This expression originally referred to web-based applications that provide organized access to the resources of the Internet through search engines and lists of websites. Such applications are already used in a majority of tax administrations in the world 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.[67] In short, 'portal' can be defined as 'an infrastructure providing secure, customizable, integrated access to dynamic content from a variety of sources, in a variety of source formats, wherever it is needed'.[68]

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.[69] 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.[70] 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.

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.[71]

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 (*see* section 3.2.1). A smart portal departs from the functioning of a traditional web portal, 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.

However, due regard must be given to data protection regulations. For example in an EU context, intergovernmental exchange of information could possibly fall under Article 6 of Regulation (EU) 2016/679 of 27 April 2016 on the protection of natural persons[72] 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'.[73]

In addition, at an international level and on a country by country basis, implementation of the above proposals must 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:

Notes

66 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. In this respect, *see* T. Müllner & D. Grimm, *Applications and Interfaces for e-Government*, in *Electronic Government* 472–475 (R. Traunmueller ed., Springer 2004).

67 M. A. Smith, *Portals: Toward an Application Framework for Interoperability*, 47(10) Commun. ACM 93–94 (2004).

68 *Ibid.*

69 H. Westholm, *Models of Improving e-Governance by Back Office Re-Organisation and Integration*, 25(1) J. Pub. Pol. 99–132 (2005).

70 Such a fragmentation may be perceived as artificial, from the citizens' perspective. *See* Westholm, *supra* n. 69.

71 OECD, *Technologies for Better Tax Administration, supra* n. 1, at 77–78.

72 Recital 30 and Art. 1(1) and (2) of the EU Data Protection Regulation (EU) 2016/679: Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 Apr. 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC, OJ L119/1 (4 May 2016). 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. DE: ECJ, 19 Oct. 2016, Case C-582/14, *Patrick Breyer v. Germany*, ECLI:EU:C:2016:779 (holding 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 data subject').

73 Art. 6(1)(c) & (e) EU Data Protection Regulation (EU) 2016/679, *supra* n. 72.

> from the government's (i.e. the supplier's) point of view, the main arguments for back office re-organization 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.[74]

In the framework of the 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 profile for each taxpayer. This profile could be accessed by both taxpayers and tax authorities by means of a code (*see* Part 2 of this article).

The migration of web service applications to cloud computing systems would also accommodate economies of scale and allow a significant expansion of the above-mentioned services.[75] 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'.[76] Cloud computing service providers offer different types of services: they provide the customer with computer infrastructure (infrastructure as a service) or with software applications (software as a service), 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).[77]

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 fulfil 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.[78]

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.[79] One possible way to achieve a compromise between security and cost effectiveness is to make the cloud private instead of public.[80] A private cloud differs from a public as:

> The private cloud is defined as computing services offered either over the Internet or a private internal network but only to select users instead of the general public. Also called an internal or corporate cloud, private cloud computing gives businesses many of the benefits of a public cloud - including self-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.[81]

Notes

[74] *See* Westholm, *supra* n. 69. 'The latter typically involves the integration, or cooperation, between different back offices, and must involve the digitisation 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'.

[75] R. Kurdi, A. Taleb-Bendiab, M. Randles & M. M. Taylor, *E-Government Information Systems and Cloud Computing (Readiness and Analysis)*, in *Developments in E-Systems Engineering*, 4th International Conference in Dubai, 404–409 (IEEE 2011).

[76] US: Dept. of Commerce, National Institute of Standards and Technology (NIST), *The NIST Definition of Cloud Computing* (Sept. 2011), http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf (accessed 25 July 2018).

[77] OECD, *Action 1 Final Report, supra* n. 44, para. 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.

[78] This would be the case in the most comprehensive type of cloud computing model, IaaS. D. Shakow, *The Taxation of Cloud Computing and Digital Content*, U. Penn. Law School, Faculty Scholarship 475 (2013) (describing in detail the functioning of cloud computing, as well as the challenges of taxing such models).

[79] *See* e.g. S. K. Sandeen, *Lost in the Cloud: Information Flows and the Implications of Cloud Computing for Trade Secret Protection*, 19(1) Va. J. L. & Tech. 29–32 (2014). Sandeen 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.

[80] 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 R. Schmelzer, *Private Cloud: Reality or Fog?*, Tech. Innovation Mgmt. Rev. 20–22 (Apr. 2010), https://timreview.ca/article/342 (accessed 25 July 2018).

[81] Microsoft Azure, *What is a Private Cloud?* (2017), https://azure.microsoft.com/en-us/overview/what-is-a-private-cloud/ (accessed 25 July 2018).

An extensive and prolonged discussion as to which type of cloud service is cheaper has been going on in specialized literature.[82] However, regardless of the expenses, the question that really matters is whether an organization can make efficient use of the infrastructure and hardware resources at its disposal and use labour efficiently. In this regard, it has been argued that a private cloud might be the more attractive option than the pubic cloud, as the security and control inherent in private clouds could outweigh any relevant financial considerations.

3.3.2 *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.[83] 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 the effectiveness of their tax administrations, mainly in the tax compliance processes.[84] In addition, it is used to ensure the security of communications and record keeping in the context of e-governance.[85] 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.[86] 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.[87] Indeed, there are three core structural elements of the blockchain technology.

The first element consists of 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.

The second element consists of a ledger,[88] which is distributed among all participants called 'miners'[89] or 'nodes'.[90] 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 of either the entire blockchain or a subset thereof. 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.[91] The distributive nature of the ledger achieves the so called

Notes

[82] B. Butler, *Which Is Cheaper: Public or Private Clouds?*, Network World (19 Oct. 2016). Butler states the findings of a Report by 451 Research. *See also* S. Singh & T. Jangwal, *Cost Breakdown of Public Cloud Computing and Private Cloud Computing and Security Issues*, 4(2) Intl. J. Computer Sci. & Info. Tech. (2012).

[83] S. Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* 1–9 (2008), https://bitcoin.org/bitcoin.pdf (accessed 25 July 2018).

[84] *See* e.g. e-Estonia, Estonian Blockchain Technology, https://e-estonia.com/wp-content/uploads/faq-a4-v02-blockchain.pdf (accessed 25 July 2018). For an overview of the potential of Blockchain in improving tax administration, *see* Deloitte, *Blockchain Technology and Its Potential in Taxes* 1–20 (2017), https://www2.deloitte.com/content/dam/Deloitte/pl/Documents/Reports/pl_Blockchain-technology-and-its-potential-in-taxes-2017-EN.PDF (accessed 25 July 2018).

[85] See the note prepared by the WU Global Tax Policy Center at the Institute for Austrian and International Tax Law of Vienna University of Business and Economics (WU, Wirtschaftsuniversität Wien), *Blockchain 101 For Governments*, for the Committee of Experts on International Cooperation in Tax Matters Fifteenth session, Geneva (2017), http://www.un.org/esa/ffd/wp-content/uploads/2017/10/15STM_Blockchain-101.pdf ('"e-Government" services and applications include identity management, tax collection, land registry, distribution of benefits, digital currencies and any type of government record. Blockchain technology could allow records to be verified and created with greater speed, transparency and security') (accessed 25 July 2018).

[86] '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 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, e.g. 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* International Tax Review, *Blockchain*, International Tax Review, Global Tax 50 (13 Dec. 2017).

[87] For a clear explanation of how Blockchain works, *see* e.g. J. Bacon, J. D. Michels, C. Millard & J. Singh, *Blockchain Demystified*, Queen Mary School of Law Legal Studies Research Paper 268/2017 (2017).

[88] 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* e.g. P. Boucher, S. Nascimento & M. Kritikos, *How Blockchain Technology Could Change Our Lives*, European Parliamentary Research Service 5 (European Union 2017).

[89] The term 'miners' is borrowed from 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* A. M. Antonopoulos, *Mastering Bitcoin: Unlocking Digital Cryptocurrencies* 177 et seq (2nd ed., O'Reilly UK Ltd 2017). For the difficulties created by the fluctuating terminology associated with Blockchain, *see* A. Walch, *The Path of Blockchain Lexicon*, 36 Rev. Banking & Fin. L. 713–740 (2017). 'Nodes' or 'miners' are different (overlapping) terms for the actors/participants in the Blockchain.

[90] *See* Walch, *supra* n. 89, at 720.

[91] *See* Walch, *supra* n. 89.

'decentralization',[92] which is one of Blockchain's core benefits. As 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'.[93] For this reason, the mechanism above is also known as a 'smart contract'.[94]

The third element is cryptography, by means of which a Blockchain achieves data integrity and identity authentication.[95]

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 could be invalid and therefore, the data exchanged might 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.[96] 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'[97] ensures both trust amongst the parties involved and the security of the data exchanged.

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, as it helps establish the trust that is considered the core benefit of blockchain. Immutability means that all data recorded are 'permanent' and 'unchangeable'.[98] Based on this permanence, all transactions can be reliably traced back to the 'genesis block'[99] by following the sequence of the chain, without the risk that the data could be altered. In addition, Blockchain is popular for the security it provides by virtue of cryptography. Participants in 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'.[100]

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.[101]

All of the above-mentioned features vary depending on whether the distributed ledger is a permissionless (public)

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[92] Its decentralized nature, combined with the ledger function, identify Blockchain as a distributed ledger technology (DLT). For a definition of distributed ledger technology with respect to securities in post trading, *see* A. Pinna & W. Ruttenberg, *Distributed Ledger Technologies in Securities Post-Trading: Revolution or Evolution?*, European Central Bank Occasional Paper Series, No. 172 (Apr. 2016). 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 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* S. Meunier, *Blockchain Technology: A Very Special Kind of Distributed Database*, Medium (2016), https://medium.com/@sbmeunier/blockchain-technology-a-very-special-kind-of-distributed-database-e63d00781118 (accessed 25 July 2018). Meunier 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.

[93] *See* Meunier, *supra* n. 92.

[94] 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* K. Werbach & N. Cornell, *Contracts ex Machina*, 67 Duke L. J. 313 (2017).

[95] D. Coppersmith, *Cryptography*, 44(1/2) IBM J. Research & Devel. 246 (2000). Coppersmith 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* S. A. Price, *Understanding Contemporary Cryptography and Its Wider Impact upon the General Law*, 13(2) Intl. Rev. Law, Computers & Tech. 95 (1999).

[96] K. D. Werbach, *Trust, But Verify: Why the Blockchain Needs the Law*, 32 Berkeley Tech. L. J. 12–14 (forthcoming 2018).

[97] '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. D. Krawisz, *The Proof-of-Work Concept*, Satoshi Nakamoto Inst. (24 June 2013), http://nakamotoinstitute.org/mempool/the-proof-of-work-concept/#selection-11.8-17.19 (accessed 25 July 2018).

[98] 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, *supra* n. 89, at 737–738.

[99] A. M. Antonopoulos, *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*, at 166 (O'Reilly Media 2017) ('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').

[100] C. Miles, *Blockchain Security: What Keeps Your Transaction Data Safe?*, IBM Blockchain Blog (12 Dec. 2017).

[101] 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. CMU, *How PGP Works*, from *Introduction to Cryptography*, http://users.ece.cmu.edu/~adrian/630-f04/PGP-intro.html (accessed 25 July 2018).

or permission (private) one. This categorization is based on the extent of the access to the Blockchain's data.[102] 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.[103] As private Blockchains do not rely on public access databases but require the set-up of a new sharing infrastructure, they can end up being more costly to implement, as they require a re-establishment of central control.[104] However, due to the premise that trust is not at stake in the contexts where private Blockchain is or would be applied, the system consumes less resources for verifying a new transaction than the public Blockchain.

The question as to which type of Blockchain is feasible or desirable for a given organization is fundamentally a governance question and not a computer science one. For tax administration purposes, especially, it is essential to identify the goals that 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) could be one option suited for governmental use. Another option is a (strictly) private Blockchain in which only the pre-determined limited number of parties participating are able to write and read data.[105] The potential advantages of employing blockchain technology in the context of the MAP are further explored in Part 2 of this Article. Part 2 also expands on the discussion on the choice of type of blockchain to be used.

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[106] and thereby reduces costs. An advantage that 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 do not run the risk of being 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. As 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 Interim conclusions

It is clear that tax treaty dispute resolution mechanisms are outdated and are weighed down by a procedure such as the MAP, which 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' under the OECD/G20 BEPS project would be put to waste. Furthermore, while the G20 is gearing for 'tax certainty',[107] it is clear that a sharp increase in unresolved disputes would result in more uncertainty[108] and lead to a

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[102] BitFury Group & J. Garzik, *Public versus Private Blockchains* 1–23 (20 Oct. 2015), https://bitfury.com/content/downloads/public-vs-private-pt1-1.pdf (accessed 25 July 2018).

[103] D. Guégan, *Public Blockchain versus Private Blockchain*, Documents de travail du Centre d'Economie de la Sorbonne 3 (2017), https://halshs.archives-ouvertes.fr/halshs-01524440/document (accessed 25 July 2018).

[104] Werbach, *supra* n. 96, at 22.

[105] *See* e.g. G. Gabison, *Policy Considerations for the Blockchain Technology Public and Private Applications*, 19 SMU Sci. & Tech. L. Rev. 345 et seq. (2016); Guégan, *supra* n. 103, at 5.

[106] BitFury Group & Garzik, *supra* n. 102, at 17–20.

[107] *G20 Leaders' Communique Hangzhou Summit*, European Commission Statement/16/2967 (5 Sept. 2016), http://europa.eu/rapid/press-release_STATEMENT-16-2967_en.htm (accessed 25 July 2018).

[108] OECD & IMF, *Report for the G20 Finance Ministers: Tax Certainty* 22, 31–32 (Mar. 2017). This report was later updated in July, 2018 as well highlighting measures that have already been taken for resolution of international tax disputes.

loss of foreign direct investment for developing countries – money that may be crucial for their achieving sustainable development goals.

It is also clear that the technologies describe above offer several avenues for tax administrations to explore. As discussed, technologies could contribute to the effectiveness of the MAP while preserving the necessary security standards, and technologies such as Big Data and cloud computing, artificial intelligence-based technologies and blockchain provide various advantages that suit this goal.

In Part 2 of this article (forthcoming), the authors will develop proposals as to how the technologies analysed in this Part can be used to improve the MAP and supplementary solutions.

Figure 4: MAP's Data Ecosystem

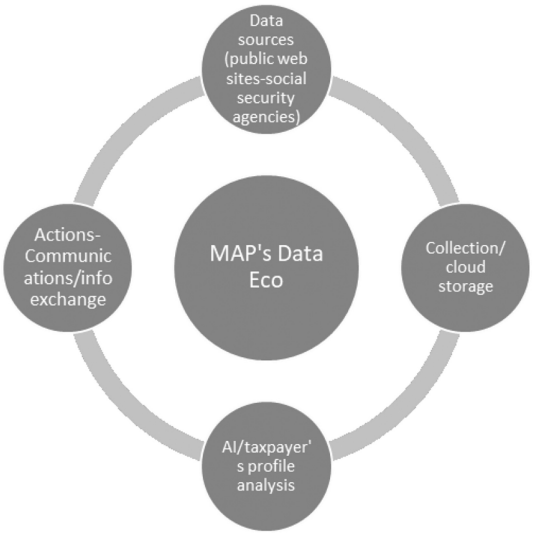

Figure 5 Workflow of AI Resource Allocation

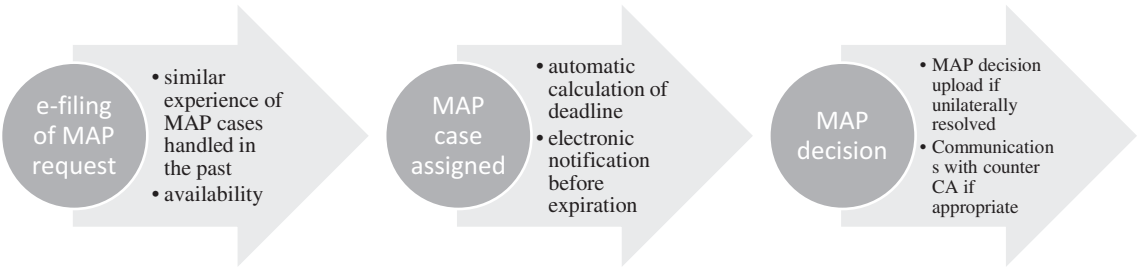

Figure 6 A Type of Blockchain That Could Be Used for the MAP

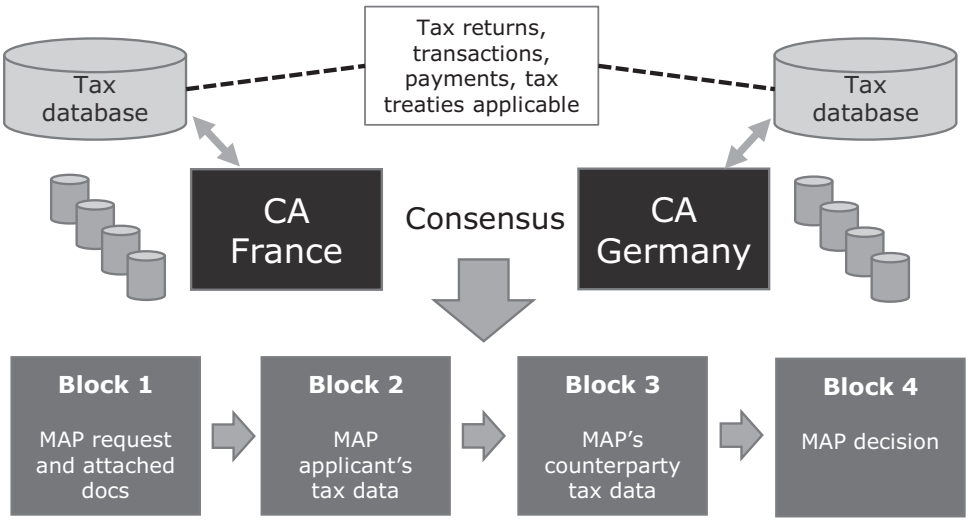

Table 1 Automated MAP decision

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

ARTICLE

Applying Modern, Disruptive Technologies to Improve the Effectiveness of Tax Treaty Dispute Resolution: Part 2

Christina Dimitropoulou*, Sriram Govind* & Laura Turcan**

In Part 1 of this article, the authors analysed the main drawbacks of the existing tax treaty dispute resolution process and considered the fundamental features of the main types of disruptive technology, keeping in mind how they could improve this process.

In this part, the authors make some specific suggestions as to how the analysed technologies can be used to improve the mutual agreement procedure (MAP) and supplementary solutions. This will include the use of video conferencing to cut costs and speed up resolution (section 2); electronic filing and checking of the MAP request with respect to documentation requirements (section 3); automatic notification as regards the deadline before arbitration is triggered and automatic forwarding of the request and any supplementary 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; 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 (section 3); the use of data analytics to cluster cases by type, allowing for easier inventory management, and to generate risk profiles that could help in both the prevention of MAP cases and the speedier resolution thereof (section 4); the use of artificial intelligence to review past cases, thereby allowing easier assignment to case workers, depending on their schedule, and thus, easier and more timely solutions based on precedents (section 5); and the use of blockchain to validate transactions and information and to remove the need for trust, thus allowing for an easier and quicker resolution, especially in multilateral cases (section 6).

Finally, the authors' proposal posits 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 international organizations such as the OECD and the UN. The implementation could be completed in several stages and be subject to peer reviews.

1 Introduction

Part 1 of this article discussed how tax treaty dispute resolution mechanisms are outdated and require substantial human and financial resources for efficient functioning, citing various concerns raised by the governments of the states, as well as the taxpayers. While the concerns of the former include issues such as lack of resources, limited personnel, expenses and inventory management, the concerns of the latter are based on how the MAP is a so-called black-box with limited taxpayer involvement and which does not guarantee an outcome.

Part 1 also discussed a selection of emerging technologies such as Big Data, cloud computing, artificial intelligence and blockchain, including their salient features that could contribute to the improvement of the MAP. For this purpose, following a brief analysis of the general state of digitization in tax administrations, these technologies were divided into those that could assist in the avoidance of disputes and those that could assist in the prevention of disputes.

In this part, the authors develop proposals as to how the discussed technologies can be used to improve the MAP and supplementary solutions. These range from simple and straightforward solutions (such as how video conferencing could improve the MAP) to more complex solutions (such as the use of artificial intelligence to aid the conduct of MAP).

2 The use of video conferencing in the MAP

This section discusses how the technologies discussed in section 3 of Part 1 of this article can help resolve

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the issues discussed in section 2 of Part 1. from the perspective of both states and taxpayers. 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.

As mentioned in section 3.1. of Part 1 of this article, not all tax administrations have achieved a high level of digitalization, and even in digitally mature administrations, the use of technology may not have penetrated all aspects of the administration. A MAP, a negotiation between the competent authorities of two sovereign states, which is subject to secrecy even with respect to the persons affected by the question of taxation to be discussed, is a process that has often remained almost untouched by the progress of the technological capacity of administrations, especially at the level of the actual discussions between competent authorities. Thus, this article commences with a discussion of more simple and straightforward IT processes, before moving on to disruptive technologies.

At the outset, where communication with the taxpayer or the competent authority of another jurisdiction requires in-person contact and must be made swiftly, technologies enabling video conferencing can 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 mentioned above. Video-conferencing technology thus contributes to the transparency of the procedure between competent authorities and to building trust.[1] Furthermore, video-conferencing decreases the location dependence in dispute resolution and, thus, reduces costs. Apart from the benefits of avoiding travel costs and the resource savings,[2] 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.

However, states having limited broadband connectivity might find it difficult to implement such technologies, and setting up such technologies through the telecommunication network may prove to be expensive. In addition, security concerns must be taken into account. Thus, the use of specialized applications and/or encryption may be necessary.

3 The use of web portals and cloud computing in the MAP

The use of a web portal in the framework of the 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 the MAP could be partially based, for example, 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 Finance.[3]

Essential features of a MAP web portal are that it will[4]:

- provide easy access to the portal for both taxpayers and tax authorities via a personalized and encrypted path (e.g. a code);
- provide the possibility of filing a MAP request by uploading it to the portal, together with the accompanying documentation;
- issue an electronic protocol that would be directly linked with the taxpayer's electronic tax profile;
- enable a classification of MAP requests and their grouping into electronic folders according to their subject (e.g. based on the article of the applicable tax treaty, or, on a more basic level, into transfer pricing cases and 'other' cases);
- offer the possibility of software calculations of the deadlines for the 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) 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;
- allow the taxpayer to track the general status of the case by sending pre-designed notices once the case reaches a certain stage (e.g. 'assessment of the request', 'waiting for additional information', 'preparation of position paper', 'consultation between competent

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[1] *See* e.g. L. Mommers, *Visualization of Dispute Resolution: Establishing Trust by Recycling Reputation*, 15(2) Info. & Comm. Tech. L. 175–187 (2006).

[2] I.e. as 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.

[3] *See* e.g. D. Sarantis, *The Challenge of Accelerating Greek Judicial Procedure*, in *Electronic Government and the Information Systems Perspective*, 6th International Conference, EGOVIS 2017 257 (A. K⊠ & E. Francesconi eds, Springer 2017).

[4] H. Westholm, *Models of Improving e-Governance by Back Office Re-Organisation and Integration*, 25(1) J. Pub. Pol. 99–132 (2005).

authorities', 'finalization') and inform it of important developments, such as when the request is approved or when agreement is reached between the competent authorities; and
– offer the possibility of secure electronic communication through the portal between tax authorities, as well as between 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 (*see* below, in the respective sections), 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.

Ideally, the portal would be linked to the e-filing system that the tax administration employs, so that the aspects of the MAP request directly relating to the tax returns could automatically be matched and verified.[5] This would also allow easy communication with other levels of tax administration, such as the local tax office that is generally involved at the beginning and end of the MAP process.[6] Thus, the competent authority could directly access important documentation stored by the local tax office. The local tax office or the auditor involved in the case could also, if the administrative procedures allow this and insofar as it is in line with the minimum standard under BEPS Action 14,[7] receive read-only access to the documentation prepared by the competent authority in order to give substantive inputs and assist in an accurate depiction of the facts of the case, as well as the reasoning behind the adjustment. Furthermore, due to its involvement, the local tax office must also be informed of important developments in the MAP process, such as the fact that an agreement could be reached and it is now obliged to implement it, or that temporary measures such as a suspension in collection can be cancelled and (partial) collection can take place. A web portal would ensure that the relevant information is immediately passed to and from the local tax office and that the local tax office is alerted with respect to essential deadlines. Moreover, the integrated portal could assist in keeping track of the activities of the local tax office, especially the implementation of MAP agreements, which is required by the minimum standard.[8]

The above-mentioned web applications would enhance the MAP's effectiveness when migrated into a cloud system. This would provide the opportunity to access 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 could possibly be achieved by the architecture of a central system functioning at either a global level or at a regional level. The global level coordination of the centralized system could be assigned to an international organization such as the OECD or the UN,[9] which would have control of the data inserted in the common database, and could potentially help design a system for the

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[5] Big data could play an essential role in the verification and prevent currently occurring delays at this stage in the MAP. *See also* s. 4., *infra.*

[6] In the beginning of the MAP process, the local tax office may be contacted by the competent authority if additional information on the assessment is necessary and cannot (solely) be procured from the taxpayer. This is most often the case for complicated transfer pricing adjustments that are based on extensive foreknowledge of the given industry, the circumstances of the taxpayer and the extensive documentation prepared and provided by the taxpayer for purposes of the original assessment. At the end of the MAP process, if an agreement could be reached or an arbitration panel has issued a decision and the decision has been transformed into a corresponding MAP agreement, the agreement is generally implemented not by the competent authority itself, but by the local tax office. The local tax office can also become involved if there is no agreement, if e.g., unilateral relief must be granted in a given case.

[7] The minimum standard requires that the competent authority function be independent of the audit function and that the competent authority is not unduly influenced by the tax administration personnel that made the original adjustment. *See* OECD, *Making Dispute Resolution Mechanisms More Effective – Action 14: 2015 Final Report*, OECD/G20 Base Erosion and Profit Shifting Project 18 (OECD Publishing 5 Oct. 2015).

[8] OECD, *Action 14 Final Report*, *supra* n. 7, at 13. For instance the Canada 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. OECD, *Making Dispute Resolution More Effective: MAP Peer Review Report, Canada (Stage 1)* 40 (OECD Publishing 26 Sept. 2017), http://www.oecd.org/tax/making-dispute-resolution-more-effective-map-peer-review-report-canada-stage-1-9789264282612-en.htm (accessed 25 July 2018).

[9] The 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* e.g. OECD, 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* (OECD Publishing 5 Aug. 2014).

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 could upload data, as well as mine data. However, institutions acting at a regional level could play a more significant role in managing a centralized web system. This might be the case of the African Tax Administration Forum, which aims to provide assistance in establishing efficient and effective tax administrations throughout Africa and to serve as a network for the region.[10]

As regards the use of cloud computing in the context of the MAP, data security is the primary concern, from the perspectives of both the tax administration and the taxpayer.[11] Consequently, only private clouds would be even worth considering.[12] A private cloud guarantees the confidentiality of the information and communications exchanged.[13] Access to the cloud would not be available to taxpayers. Instead, the taxpayer would have access to the web portal with a security code, which serves as the taxpayer's digital identity key in order to be able to communicate with the tax authority of the taxpayer's state of residence and monitor the taxpayer's tax profile, as well as the status of the taxpayer's requests and applications. In this way, both the transparency of the tax administration's actions 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, and 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 states. 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 of these models, developed OECD countries could 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.[14]

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 data of both taxpayers and the tax authorities. This approach could help overcome the chronic delays – between requests for information and the provision thereof, between competent authorities' communications, between the start of the MAP and its conclusion – that the 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 high-grade, multi-part encryption, special staff responsible for the maintenance of the system and which can react instantly in the event of a breach and other similar measures. Again, any costs would need to be shared among countries to permit the participation of developing 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 competent authority of the other jurisdiction is needed, the web portal could provide for video-conferencing arrangements, to implement the suggestions made in section 2 of Part 1 of this article.[15]

4 The use of big data in MAP

As mentioned (*see* section 3 of Part 1 of this article), Big Data technology could be applied not only to cut down the costs and duration of a MAP, but also to assist in dispute avoidance. The latter could be achieved using

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[10] IE: ECJ, 6 Oct. 2015, Case C-362/14, *Maximillian Schrems v. Data Protection Commissioner*, ECLI:EU:C:2015:650, para. 42 (with relation to data transfers from the EU to third countries). Again, the ECJ control was restricted to identify the proportionality of any violation of the rights to privacy and confidentiality of the data subject.

[11] In terms of a security risk, however, the security concerns as such are not greater than those seen in traditional MAP.

[12] 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.

[13] 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 competent authorities to taxpayers. Integrity is connected with authentication of data provided by each competent authority.

[14] Similar proposals for cost arrangements for dispute resolution in developing countries have been made in UN Committee of Experts on International Cooperation in Tax Matters, *Secretariat Paper on Alternative Dispute Resolution in Taxation*, E/C.18/2015/CRP.8 (8 Oct. 2015), http://www.un.org/esa/ffd/wp-content/uploads/2015/10/11STM_CRP8_DisputeResolution.pdf (accessed 25 July 2018); J. Owens, A. Gildemeister & L. Turcan, *Proposal for a New Institutional Framework for Mandatory Dispute Resolution*, 82(10) Tax Notes Int'l 1001 (2016); S. Govind & S. Rao, *Designing an Inclusive and Equitable Model for International Tax Arbitration: An Indian Perspective*, 46(4) Intertax 334–335 (2018).

[15] CISCO is considered to provide high quality web telecommunication services. *See* CISCO, TelePresence, Video Conferencing System Technology: FAQs, https://www.cisco.com/c/en/us/solutions/telepresence/telepresence_video_conferencing_system.html (accessed 25 July 2018).

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 '.[16]

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 preventing the need for the MAP. This is especially so in the case of businesses. Specifically, information found on business websites, which are by default in the public domain,[17] can offer an enormous amount of data, which, after being stored and then algorithmically processed, could provide significant information relevant for MAP purposes. These results could 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. Similar information can be gathered from country-by-country reports, which also require processing by means of data analytics due to the nature of the information, the format in which it is provided (XML) as well as the sheer number of data points – country-by-country reports are received for every constituent entity, i.e. essentially every company part of an MNE and any PE of such a company, within the territory of a state. Following the implementation of country-by-country reporting, a tax authority will need to develop processes to make use of the information it receives, either from a group directly or from a foreign tax authority. Country-by-country reports are meant to serve as a tool for the detection and identification of transfer pricing risk and other BEPS-related risks, and, thus, aid tax administrations in developing audit schedules based on accurate multi-year risk profiles for MNEs and ensure a more effective and efficient use of resources in auditing.[18]

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 and high) according to the level of risk of initiating a MAP in future. Accordingly, tax authorities could 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 the taxpayer's compliance attitude. This would help prepare the competent authorities in the event of a MAP.

Within the high-risk category, the classification could be further refined based on data[19] concerning the business profile of the taxpayer and its tax file, data concerning the scope 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,[20] would result in an evaluation of the potential of a MAP request being filed.

Depending on the factual background, tax authorities could also take preventive measures, at first at the 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 in the transactions by means of joint or simultaneous audits with the aim of preventing double taxation and thus a dispute from arising. As far as transfer prices are concerned, the tax administration could take the initiative in suggesting an APA to the taxpayer and its counterparties 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 crosscheck 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.[21] 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 approximately two to three months, often takes much longer than that – even close to a year in

Notes

[16] OECD, *Technologies for Better Tax Administration: A Practical Guide for Revenue Bodies* 48 et. seq. (OECD Publishing 13 May 2016). The use of algorithms by tax administrations to use data available to them presently in also discussed in the recent OECD/G20 Interim report on digitalization. OECD, *Tax Challenges Arising from Digitalisation: Interim Report 2018 – Inclusive Framework on BEPS*, OECD/G20 BEPS Project 203 (OECD Publishing 16 Mar. 2018).

[17] Revealing consent, in principle, by the data owners to the use of data by tax administrations. As 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* s. 3.2, Part 1 of this article. Nevertheless, they may be subject to domestic data protection laws and regulations.

[18] In order to assist in the risk assessment process, the OECD developed a Handbook. OECD, *BEPS Action 13 Country-by-Country Reporting: Handbook on Effective Tax Risk Assessment* (OECD Publishing 29 Sept. 2017).

[19] Qualifying as 'Big Data' and being subject to the relevant Big Data architecture requirements which establish a strategic roadmap of big data analysis. *See* e.g. OECD, *Technologies for Better Tax Administration*, *supra* n. 16, at 61–64, with reference to P. Heller, D. Piziak, R. Stackowiak, A. Licht, T. Luckenbach, B. Cauthen, A. Misra, J. Wyant & J. Knudsen, *An Enterprise Architect's Guide to Big Data: Reference Architecture Overview*, Oracle Enterprise Architecture White Paper (Mar. 2016).

[20] OECD, *Advanced Analytics for Better Tax Administration: Putting Data to Work* 17 (OECD Publishing 13 May 2016).

[21] In order to allow this process to take place, the electronic system in which the MAP request is filed would need to be the same as the one in which the taxpayer files its tax returns, or the two systems would need to be linked. *See also* s. 3.

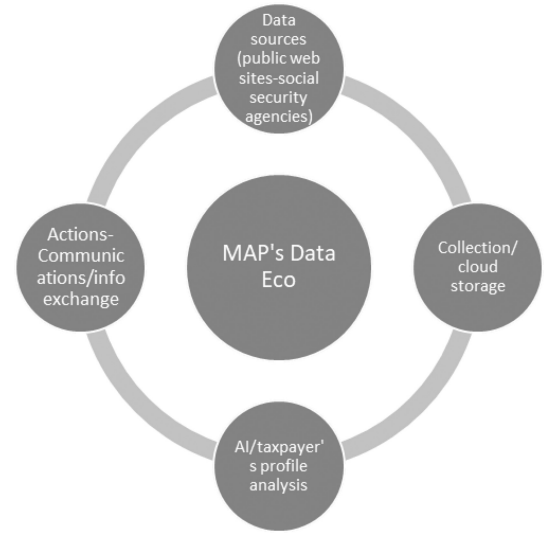
very difficult transfer pricing cases.[22] The reason is that in most cases in practice, the competent authorities do not have direct access to the tax file of the taxpayer. Instead, upon receiving a MAP request and determining that the documentation provided by the taxpayer is sufficient in order to 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 request, for example, additional information with respect to the case, such as the tax file, the last audit report, any irregularities with respect to the behaviour of the taxpayer that might be known to the local tax office due to its frequent and more intense interaction with the taxpayer. Valuable processing time and work time of the local tax officer(s) responsible is lost in:

- reading the MAP request sent along by the competent authority;
- retrieving the audit file;
- checking it against the MAP request;
- checking it for additional relevant information;
- compiling the results of the analysis (usually in the form of a standardized report); and
- 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 and the number of information requests from taxpayers that were answered.[23] The response to information requests from the competent authorities is generally not part of the assessment criteria. Thus, the additional workload generated by 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, as well as delays in carrying out other responsibilities.

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 could 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 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 on this matter.

Figure 1: MAP's Data Ecosystem Illustration



However, the information used for such analytics should be collected after the consent of the taxpayer in general, but in any case, after the taxpayer is informed about the collection and processing of the taxpayer's data.[24] In addition, the data used should not include trade or other secrets. It goes without saying that the quality of the data collected, the rules governing the institution in charge of the processing thereof and the relevant purpose (i.e. preventing disputes, ensuring transparency and efficiency of the procedure) should comply with the principle of proportionality at all stages. This would ensure that even if certain restrictions on the taxpayer's right to privacy are put in place, data collection would be justified and, thus, be deemed legitimate.[25]

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[22] OECD, *MAP Statistics for 2016*, http://www.oecd.org/tax/dispute/mutual-agreement-procedure-statistics.htm (accessed 25 July 2018).

[23] Ideally, the performance indicators should not be linked to monetary values, such as the additional tax revenue generated, as this has been proven to create an incentive to over-assess and thus lead to more disputes. *See* OECD, *Action 14 Final Report*, *supra* n. 7, at 19.

[24] By analogy, *see* RO: ECJ, 1 Oct. 2015, Case C-201/14, *Smaranda Bara and Others v. Casa Naţională de Asigurări de Sănătate and Others*, ECLI:EU:C:2015:638, paras 29, 34 & 46 (relating to whether tax data qualify as personal data and the need for the taxpayer to be informed about his data transferred to other jurisdictions).

[25] To that effect, *see* IE/DE: ECJ, 8 Apr. 2014, Joined Cases C-293/12 & C-594/12, *Digital Rights Ireland Ltd v. Minister for Communications, Marine and Natural Resources and Others and Kärntner Landesregierung and Others*, ECLI:EU:C:2014:238, para. 40 et. seq.; SE/UK: ECJ, 21 Dec. 2016, Joined Cases C-203/15 & C-698/15, *Tele2 Sverige AB and Tom Watson and Others* ECLI:EU:C:2016:970, paras 100 et. seq., where a potential procedural guarantee of the conditions of personal data transfer by electronic providers would be ensured by a previous review of a body qualifying as 'Court'. However, in the case of the MAP, in order to avoid more delays of the procedure, any procedural guarantees of the process under which data are collected and exchanged between several tax authorities shall be incorporated and combined with the procedure already in place for the automatic exchange of information under the auspices of OECD.

5 The use of artificial intelligence in the MAP

The first step towards improving the effectiveness of tax administration, in general and by means of AI in particular, 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 example, 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 United States. These two countries had a significant backlog of MAP cases (over 250), often involving very similar types of transactions, specifically information technology-enabled services 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 case, 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 two hundred of the pending cases and led to the resolution of a staggering hundred cases within only one year.[26]

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[27] could be dealt with – in a first step – by an automated procedure, which would 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 to develop it to the desired 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 resolved without any human involvement. If a MAP request is not blatantly inadmissible, but considered low risk, i.e. routine and merely fact-based, a potential preliminary automated MAP decision could be issued by the AI based on previous cases. Such a decision should take into account the following criteria[28]:

- 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 involve in the cases setting the precedent; and
- communications exchanged with other competent authorities on the subject matter and confirmation of the results.

The MAP cases preliminarily rejected by the AI may, as a second step, be reviewed by MAP caseworkers with respect to the legitimacy of the rejection, in order to ensure the sound functioning of the algorithm, which is essential especially in the beginning of the learning process. This would also alleviate potential concerns with respect to the delegation of essential discretionary decisions of the tax administration to AI (*see* section 3.2.2, Part 1 of this article). While this process still involves the human resources of the competent authority, it is much more efficient than the classic case evaluation, as the initial assessment and documentation have already been carried out and need only be reviewed and, if necessary, adjusted, by the case worker. As in most cases, there will not be an adjustment required or the adjustment would be minor, the duration of the review per case would be significantly reduced compared to a full assessment.

Furthermore, in cases where an automated MAP decision applies, the outcome of the decision is still subject to the approval of the taxpayer, who is still allowed to proceed in litigation if the MAP outcome is not satisfactory to the taxpayer.

Thus, potentially, a significant portion of pending MAP cases could be resolved much quicker through automation. When a MAP request for a more difficult case, which is

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[26] EY, Global Tax Alert, *US and India Tax Authorities Agree on Framework for Resolving Certain Double Tax Cases* (28 Jan. 2015); *India and US Settle 100 Tax Disputes*, Business Standard (29 Jan. 2016).

[27] 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.

[28] These criteria could constitute the principles for the design of the machine learning process.

nevertheless very similar to a number of past cases with the same country, is received, the software would alert the caseworker 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 facts and circumstances involved in the new case. The caseworker would then merely adapt this rough draft of the resolution based on the caseworker's 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 factual basis, or even based on the tax official assigned to them, could 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 competent authority with time management concerning MAP cases.[29] As the number of different mandatory dispute resolution procedures keeps increasing at the international level[30] and because the timely resolution of MAP cases has been mandated by the OECD as a minimum standard,[31] effective time management of MAP cases is becoming increasingly critical from the perspective of tax administrations.

The deadline within which the MAP must be resolved and the timeframes recommended for certain actions within that deadline would be automatically calculated by the AI, and an additional electronic notification would 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 would generally accelerate the resolution of cases. AI can also consider any long periods of absence of the tax officials (e.g. maternity leave) 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.

In addition, the automatic electronic assignment would avoid conflicts where a tax official might 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 make a valuable contribution in allowing for a more accurate and much swifter retrieval of information about previous arguments made and the documentation used to support them, thus increasing time and cost efficiency.

Table 1 Automated MAP Decision

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

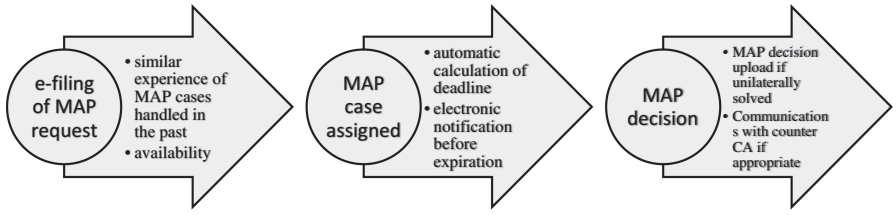
Notes

[29] The Canada 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. OECD, *Making Dispute Resolution More Effective: MAP Peer Review Report, Canada (Stage 1)* 40 (OECD Publishing 26 Sept. 2017). AI could be used to create and implement a tracking system for cases, which may be utilized in conjunction with an integrated web portal, as suggested in s. 3.

[30] Currently, taxpayers can potentially have recourse to are four tax instruments with mandatory binding arbitration: the EU Arbitration Convention, the EU Dispute Resolution Directive, arbitration clauses under tax treaties and the MLI arbitration clause. *See* s. 2.2, Part 1 of this article. The different instruments have different time frames for different steps of the procedure. In addition, some deadlines can be changed on a case-by-case basis, depending on the instrument. Thus, competent authorities will need to keep track of a multitude of different deadlines.

[31] OECD, *Action 14 Final Report*, *supra* n. 7, at 15. The OECD requires the resolution of MAP cases within an average timeframe of twenty-four months.

Figure 2: Workflow of AI Resource Allocation



6 THE USE OF BLOCKCHAIN[32] IN THE MAP

Blockchain technology represents a revolutionary approach to decentralized data systems. By contrast to the cloud-based model described above (*see* section 3.2, Part 1 of this article), 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.[33]

Based on plausible concerns expressed with respect to the level of ensured privacy and security that cloud-based systems can provide,[34] which could risk outweighing their benefits, Blockchain is examined as an alternative that could address these concerns more efficiently, especially with regard to the MAP. However, blockchain technology represents an ambitious option with respect to the MAP and it might be more appropriate to be examined in the situation where a tax administration has already decided to use such type of technology for the overall digital management of tax procedures. On top of that and especially in the context of the MAP, the most serious drawback of Blockchain consists of the interruption of the automated data recording in sequence, in cases where negotiation between the competent authorities is indispensable. Despite the above and until a more comprehensive application of Blockchain in the MAP becomes a realistic option, this article proposes a simplified solution that would potentially be subject to further development in the future.

A potential simplified Blockchain-type system in the MAP would take the form of a permission-based Blockchain in which 'MAP transactions' would be recorded. The term 'MAP transaction' refers to any type of MAP-related documents, tax data exchange[35] and MAP files that could be included in a 'block'.

For example a MAP transaction could include: (1) the MAP request reference and (2) references of indicative supporting documentation (e.g. invoices, contracts, bank accounts, tax returns filed). These 'MAP data' references would be validated by virtue of the consensus process, after being identified somewhere in the chain in the previous blocks.[36] All taxpayer's tax data the references of which exist in the blocks, will 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. If all these requirements are fulfilled, the MAP transaction is considered valid and recorded in the Blockchain. Each tax authority involved in the case would take the role of a node or miner.[37] 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

Notes

[32] The type of Blockchain system examined in this article 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. the 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, as this is not yet a realistic scenario and it would necessarily require substantial changes to the currently applicable tax rules, the authors 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* e.g. R. T. Ainsworth & A. Shact, *Blockchain Technology Might Solve VAT Fraud*, 83(13) Tax Notes Int'l 1165 (2016).

[33] 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* e.g. FinExtra, *Blockchain and Cloud: Kissing Cousins* (2 Mar. 2017). That article states 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* N. Kshetri, *Blockchain's Roles in Strengthening Cybersecurity and Protecting Privacy*, 41(10) Telecomm. Pol'y 1027–1038 (2017).

[34] S. Tillery, *How Safe Is the Cloud?*, Baseline (15 Oct. 2010). 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'.

[35] Data protection requirements discussed in previous sections and Part 1 of the article are equally applied.

[36] The consensus process is effectuated by an AI, which needs to have been previously trained to identify the consensus criteria.

[37] The difference between the two terms, which is critical for bitcoin, is irrelevant in the present model, as every tax authority could be a miner in terms of its potential of entering a new block in the Blockchain.

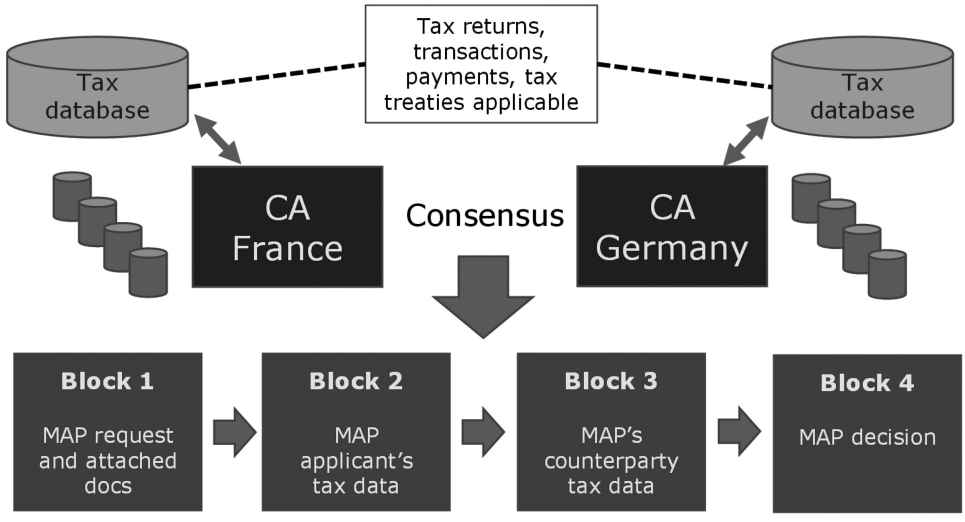
by virtue of the 'consensus process' on which all parties of the Blockchain would have a priori agreed. All parties to the dispute would be able to see that block. Subsequently, all parties to the dispute would be able to monitor the request and assess the supporting documentation after a MAP request is filed.

In the proposed implementation, the permission-based ledger would not be based on trust (despite the fact that competent authorities obviously trust each other when they consent to exchange information during a MAP), but rather on the principle of efficiency.[38] This type of Blockchain would avoid the 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 the consensus based on which a MAP transaction that enters a block is validated, must not be many and complex. These criteria need to be agreed beforehand among the participating tax administrations.

Pursuant to the proposed system, 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 competent authorities.[39] The security and stability of the blockchain network assures that even were a computer to be 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 a MAP, the Blockchain takes on a more centralized functioning. The competent authorities involved in a dispute 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, taxpayers may also be granted access to the Blockchain, but only to read the relevant data. As access to reading the entire Blockchain data would entail the risk of taxpayers finding and revealing confidential information exchanged between competent authorities, their access would need to 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, as well as 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, as permission-based ledgers do not require the same level of proof-of-work commitment.[40] In any case, the advantages of Blockchain (e.g. security, trust, cost and time savings, automatic identification) 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



Notes

[38] *See* e.g. A. Potter, *How Blockchain Can Help Create Better Public Services*, https://betterworkingworld.ey.com/digital/how-blockchain-can-help-create-better-public-services (accessed 25 July 2018). Potter argues 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'.

[39] D. Piechowski, *Blockchain for Government*, IBM Center for the Business of Government (21 Dec. 2017) ('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.').

[40] A. Pinna & W. Ruttenberg, *Distributed Ledger Technologies in Securities Post-Trading: Revolution or Evolution?*, European Central Bank Occasional Paper Series, No. 172, 10–14 (Apr. 2016).

As mentioned (*see* section 3.3.2, Part 1 of this article), 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 and, given the increasingly globalized nature of the economy, routinely involve similar transactions across multiple jurisdictions and thus, likely more than two tax administrations. As multilateral MAPs and/or APAs 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.

However, once again, even from a technology perspective, Blockchain remains largely unexplored and much remains to be seen as regards how its use could be beneficial. In this context, this might be one of the options that could be explored by states with financial resources and have an advanced MAP programme having other basic safeguards in place.

7 Capacity building and information and communications technology

The importance of capacity building through training and similar initiatives should also be emphasized, especially from the perspective of developing countries. Sophisticated technologies can aid in this process, as well, such as training through video-conferencing, the use of Big Data to assign training modules and evaluate the performance of staff (including provision of incentives) and the use of AI to improve and develop training models. Multilaterally accepted e-training systems under the framework of international organizations would be ideal for capacity building. In this respect, the work of the United Nations capacity development programme on international tax cooperation in developing such online training modules that are made available to developing countries must be commended.[41] The OECD Global Relations Programme in taxation is also launching several e-learning and blended learning events on issues such as BEPS and transfer pricing.[42]

8 Conclusion

As in the case of general tax administration processes, developing countries are increasingly starting to look at technology to put in place efficient processes using limited resources.[43] As discussed in this article, various ICTs could 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 because countries are moving towards coordination in treaty dispute resolution through instruments such as the MLI. Even if the MAP is essentially a procedure that requires discussions and thus, human intervention, in general, many of the procedural and capacity-related hurdles associated with the MAP could be overcome using technology as discussed here.

However, there are some hurdles. While some of the solutions proposed are cost efficient, many of the solutions could involve an initial capital outlay, which might be difficult for some developing and 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 can be used as a means to achieve sustainable development goals,[44] these international organizations could be implored to step in and provide such countries with the initial capital to invest in such technologies.

Eventually, the authors are of the view 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 could be completed in several stages and be subject to peer reviews. Existing IT systems, such as the existing system used for the automatic exchange of information, could 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.[45]

Only such a global, coordinated approach would allow developing countries to resolve tax treaty disputes, to foster an environment of tax certainty and, eventually, to collect locked-up revenues that could be used to promote developmental goals.

Notes

[41] UN, Committee of Experts on International Cooperation in Tax Matters, *Report on the Fifteenth Session* E/C.18/2017/4, 21 (17–20 Oct. 2017).

[42] OECD, *Global Relations Calendar of Events 2018*, http://www.oecd.org/ctp/tax-global/global-relations-calendar-of-events.htm (accessed 25 July 2018).

[43] The role of digitalization in tax compliance, improving taxpayer services and reducing compliance burdens is specifically discussed in the OECD interim report on digitalization. OECD, *Tax Challenges Arising from Digitalisation: Interim Report 2018*, *supra* n. 16, at 202–208.

[44] Platform for Collaboration on Tax, *Taxation and the Sustainable Development Goals*, First Global Conference, New York (14–16 Feb. 2018), http://www.worldbank.org/en/events/2017/06/06/first-global-conference-of-the-platform-for-collaboration-on-tax (accessed 16 Aug. 2018).

[45] 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. WU, *Digital Tax Transformation: Opportunities And Challenges of New Technologies*, https://www.wu.ac.at/fileadmin/wu/d/i/taxlaw/institute/WU_Global_Tax_Policy_Center/Tax___Technology/Digital_Tax_Transformation_Brochure.pdf (accessed 25 July 2018).