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“Developing an Artificial Intelligence’s Tax Assistant in International Tax Avoidance Cases: The Case Study under the PPT”

1 Introduction

As of the end of 2015, US based multinational enterprises (MNEs), using various tax avoidance methods, had more than \$2 trillion of their foreign income stockpiled in low-tax jurisdictions. This allowed them to avoid paying about \$700 billion in US taxes,¹ almost 15 times what the World Bank estimated in 2002 was needed to achieve the UN Millennium Development Goal of halving world poverty by 2015.² More globally, the Organisation for Economic Co-operation and Development (OECD), under its base erosion and profit shifting (BEPS) project,³ has estimated the scale of tax avoidance by MNEs to amount to between \$100 and \$240 billion annually, entailing revenue losses of between 4 and 10 percent of global corporate income tax (CIT) revenues.⁴ International avoidance therefore increases the competitiveness of the involved taxpayers, but has a severely negative impact on concerned parties.⁵ It comes therefore as no surprise that the problem of international tax avoidance is currently attracting a great deal of attention nationally and globally.

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¹ See R. S. Avi-Yonah and H. Xu, *Evaluating BEPS: A Reconsideration of the Benefits Principle and Proposal for UN Oversight*, 62 Harvard Business Law Review, 2016, p. 191.

² See more in UN, *The Millennium Development Goals Report 2015*, pp. 1–75, available online at: [http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%2015\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%2015).pdf) (access: 3/8/2017). Cf. Tax Justice Network, *Tax havens cause poverty: IMF endorses capital controls*, February 22, 2010, available online at: <http://taxjustice.blogspot.sg/2010/02/tax-havens-cause-poverty-imf-endorses.html> (access: 3/8/2017).

³ See OECD, *Addressing Base Erosion and Profit Shifting*, Paris: OECD, 2013.

⁴ See OECD, *Measuring and Monitoring BEPS*, Action 11: 2015 Final Report, Paris: 2015, p. 15.

⁵ See OECD, *Action Plan on Base Erosion and Profit Shifting*, Paris: OECD, 2013, p. 8. In particular, international tax avoidance may be seen as one of the factors undermining the realization of economic and social rights as a universal resource for all. See D. Beetham, *Universality, historical specificity and cultural difference in human rights*, in *Strategic Visions for Human Rights: Essays in Honour of Professor Kevin Boyle*, G. Gilbert, F. Hampson, and C. Sandoval (eds.), London: Routledge, 2010, p. 51.

The biggest and most ambitious international initiative against international tax avoidance at the moment is the OECD's BEPS project, with its 15 action plans.⁶

The avalanche of new anti-avoidance rules triggered by the BEPS's project and its derivatives, such as the Anti-Tax Avoidance Directive (ATAD),⁷ which includes a minimum standard for addressing international tax avoidance by all Member States,⁸ and domestic anti-BEPS measures (e.g. diverted profits tax in the UK, Australia, and France),⁹ increases the complexity of tax laws, further exacerbating the difficulties with tax compliance and tax supervision. Such a high complexity may also decrease the effectiveness of anti-tax avoidance rules.

But what if taxpayers, tax authorities, and courts could be supported in addressing international tax avoidance by artificial intelligence (AI)?¹⁰ A self-learning tax avoidance algorithm (one and the same for all potential users) could be used to determine the result of application of various anti-tax avoidance rules without bias stemming from the ever-changing and vastly diverging fiscal agendas of different countries and jurisdictions. It would seem to be a particularly good approach to solving potential problems arising from the principal purpose test (PPT),¹¹ especially since it could reach even further than the MLI (i.e. more than 84 countries and

⁶ The OECD received mandate to advance its work on BEPS already at the summit of G20's Leaders Los Cabos, Mexico, June 19, 2012. See *G20 Los Cabos Communiqué*, 18-19 June 2012, para. 48. For more information on the process regarding G20's mandate given the OECD to work over BEPS and its legitimacy, see S. Fung, *The Questionable Legitimacy of the OECD/G20 BEPS Project*, 10 *Erasmus Law Review* 76, 2017, pp. 76–88.

⁷ See the Council Directive (EU) 2016/1164 of 12 July 2016 laying down rules against tax avoidance practices that directly affect the functioning of the internal market, Official Journal L 193/1, 19/07/2016, pp. 1–14.

⁸ The GAAR constitutes an element of that standard. See Article 6 of the ATAD.

⁹ See, for example, <http://blogs.deloitte.ch/tax/2017/01/france-diverted-profits-tax-finally-struck-down-by-the-french-constitutional-council.html>.

¹⁰ AI is a very broad term and therefore may be confusing. For the purpose of this study, AI is understood broadly as “activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment.” See more in N. Nilsson, *The Quest for Artificial Intelligence: A History of Ideas and Achievements*, New York: Cambridge University Press, 2009, p. 13. “The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience.” Such activities/processes are highly multidisciplinary, including engineering, statistics, linguistics, logic, and computer science. See B. J. Copeland, *Artificial intelligence*, last updated: 1/17/2018, available online at: <https://www.britannica.com/technology/artificial-intelligence>. To avoid a confusion, technically, machine learning is a subfield of AI. See P. Domingos, *The Master Algorithm: How the Quest for the Ultimate Learning Machine will Remake Our World*, New York: Basic Books, 2015, p. 8.

¹¹ By incorporating in their tax treaties the new wording of titles, preambles, and the principal purpose test (PPT), as enshrined in the Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting (MLI, <http://www.oecd.org/tax/treaties/multilateral-convention-to-implement-tax-treaty-related-measures-to-prevent-beps.htm>) ((accessed: 2/10/2018), governments and jurisdictions will have met the minimum standard promulgated by action 6. See OECD, *Preventing the Granting of Treaty Benefits in Inappropriate Circumstance, Action 6 – 2015 Final Report*, Paris: OECD, 2015, paragraph 22 at p. 19. Under the PPT, a benefit under the tax treaty shall not be granted in respect of an item of income or capital if “it is reasonable to conclude, having regard to all relevant facts and circumstances, that obtaining that benefit was one of the principal purposes of

jurisdictions), such as protocols to many tax treaties have recently demonstrated.¹² This reveals the global potential of using AI in treaty abuse cases covered by the PPT and would enhance the scalability of AI in that domain, something which is extremely rare in the area of law in general. But while the rules and provisions of the PPT and the GAAR under the ATAD (the ATAD's GAAR) are very broad and vague, leaving significant discretionary powers to the tax authorities in tax avoidance cases,¹³ this study focuses on the PPT only. In the future, more research can be done on those broader issues, including the possible use of AI in cases involving the ATAD's GAAR and other anti-tax avoidance rules. The approach presented in this study can also be used by analogy to

any arrangement or transaction that resulted directly or indirectly in that benefit". This is a *conditio sine qua non* for denying the treaty benefit because, once this condition has been met, the benefit can be denied only if the taxpayer fails to establish that granting that benefit given the relevant facts and circumstances would be in accordance with the purpose of the relevant provisions of the tax treaty. In this light, the first part (one of the principal purposes) and second part (in accordance with the purpose of the relevant provisions of the tax treaty) of the PPT are equally important to the question of granting or denying treaty benefits. See M. Lang *BEPS Action 6: Introducing an Antiabuse Rule in Tax Treaties*, Tax Notes International, May 19, (2014), pp. 660-661; R. Kok, *The Principal Purpose Test in Tax Treaties under BEPS 6*, 44 Intertax 5, p. 408. More generally on GAARs and tax treaties, see F. Zimmer, *General Report, in Form and Substance in Tax Law*, pp. 61-62 (IFA Cahiers vol. 87A, 2002), Online Books IBFD; J. Sasseville, *Tax Treaty Perspective: Special Issues, in Tax Treaties and Domestic Law, EC & International Tax Law Services*, pp. 55-59 (Maisto ed., IBFD 2006), Online Books IBFD; S. Van Weeghel, *The Improper Use of Tax Treaties: With Particular Reference to the Netherlands and the United States*, p. 258 (Kluwer L. Intern. 1998).

¹² See, for example, protocols to tax treaties between Switzerland and UK, Uzbekistan and UK, and Brazil and Argentina which amended the respective tax treaties by, among other things, including the rule with the wording of the PPT, although neither Uzbekistan nor Brazil is party to the MLI, while the Swiss-UK tax treaty is not included in the list of Covered Tax Agreements by the UK and Swiss governments. See J. Schwarz, *Multilateral or bilateral Implementation of BEPS Treaty-related measures? Swiss-UK and UK-Uzbekistan Protocol show the way*, Kluwer International Tax Blog, February 21, 2018, available online at <http://kluwertaxblog.com/2018/02/21/multilateral-bilateral-implementation-beps-treaty-related-measures/>. For the Brazil-Argentina protocol see R. Tomazela, *Brazil's absence from the Multilateral BEPS Convention and the new amending protocol signed between Brazil and Argentina*, Kluwer International Tax Blog, September 5, 2017, available online at http://kluwertaxblog.com/2017/09/05/brazils-absence-multilateral-beps-convention-new-amending-protocol-signed-brazil-argentina/?print=print#_ftn10. There are other examples of a PPT that is similar to article 7(1) of the MLI being incorporated in tax treaties in 2017, e.g. China-Kenya tax treaty, Ireland-Kazakhstan tax treaty, Kosovo-Switzerland tax treaty, and Belarus-United Kingdom tax treaty. Already in 2014, Portugal-Senegal tax treaty included PPT similar to article 7(1). See J. Hattingh, *The Impact of the BEPS Multilateral Instrument on International Tax Policies*, sec. 2.3.1, 72 Bull. Intern. Taxn. 4/5 (2018, Journals IBFD).

¹³ For the PPT, see Lang, *supra* n. 11, pp. 661-663; L. De Broe & J. Luts, *BEPS Action 6: Tax Treaty Abuse*, 43 Intertax 2, (2015), pp. 133-134; A. B. Moreno, *GAARs and Treaties: From the Guiding Principle to the Principal Purpose Test. What Have We Gained from BEPS Action 6?*, 45 Intertax 6/7, (2017), pp. 440-441; B. Kuźniacki, *Discretionary Benefits Provisions under the MLI – A Vicious or Virtuous Circle?*, Tax Notes International, 31 July, (2017), pp. 39-51. See, however, Weber who argues that the PPT does not trigger serious issues under EU law and, particularly, the discretion given by it to tax authorities is not too big to equip them with an arbitrary anti-avoidance rule. See D. Weber, *The Reasonableness Test of the Principal Purpose Test Rule in OECD BEPS Action 6 (Tax Treaty Abuse) versus the EU Principle of Legal Certainty and the EU Abuse of Law Case Law*, 10 Erasmus Law Review 48, 2017, p. 59. For the ATAD's GAAR, see J. Bundgaard & P. Koerver Schmidt, *Uncertainties Following the Final EU Anti-Tax Avoidance Directive*, Kluwer International Tax Blog, 17 October, 2016, available online at: <http://kluwertaxblog.com/2016/10/17/uncertainties-following-final-eu-anti-tax-avoidance-directive/> (accessed: 17/1/2018).

further research on AI and anti-tax avoidance rules, notably in respect of the ATAD's GAAR and domestic GAARs, due to the PPT's resemblance to a GAAR.¹⁴

The purpose of this study is thus to examine the reasons for and the possibility of developing and applying AI in international tax avoidance cases that are covered by the PPT – the AI tax treaty assistant (AITTA). In practical terms, the author will address the following questions. Why is there a need of an AI tax treaty and is it suitable to applications of the PPT? How does an AI tax treaty assistant actually work in practice?¹⁵

2 Why AI is needed and suitable to the applications of the PPT?

2.1 Addressing treaty abuse globally

Although the MLI permits countries to choose between a simplified limitation on benefits (LOB) rule and PPT, the latter is favoured mainly because it is a default and self-standing option that meets the minimum standard.¹⁶ Moreover, the PPT rule aims to prevent treaty abuse in general: (i) treaty shopping; (ii) rule shopping; and (iii) circumvention of domestic law (here the PPT rule delineates the scope of treaty compatible applications of domestic anti-tax avoidance measures). This implies that the usefulness of the PPT in preventing treaty abuse under the MLI is very extensive.

Accordingly, the PPT appears to be the king of the minimum standards under BEPS Action 6. It was not surprising to see that all current Signatories of the MLI decided to introduce this rule into their tax treaties to meet the minimum standard,¹⁷ while only 12 of them have chosen to supplement the PPT with the MLI's LOB rule.¹⁸ Choosing the PPT was not only the easiest way

¹⁴ With the main, although irrelevant for the purposes of this analysis, difference that the PPT applies only to taxpayers who are seeking benefits under tax treaties while a GAAR has a way wider coverage, including tax benefits under tax treaties and purely domestic tax laws. Scholars underlie the resemblance of the PPT to the ATA's GAAR. *See* Bundgaard & Koerver Schmidt, *supra* n. 13.

¹⁵ Due to the lack of experience and education of the author in the domain of AI, the arguments in this study are made theoretically.

¹⁶ *See* OECD, *supra* n. 10, para. 22, indicates that countries should implement at least one of the following: (i) a PPT alone; (ii) a PPT and either a simplified or detailed LOB rule; or (iii) a detailed LOB rule, supplemented by a mechanism that can deal with conduit arrangements not already dealt with in tax treaties. *See* also the Explanatory Statement (ES) to MLI, paragraphs 89-90, p. 22.

¹⁷ Sixty-eight countries and jurisdictions signed the MLI at the MLI ceremony in Paris, 7 June, 2017. Later, the MLI was also signed by Mauritius (5 July, 2017), Cameroon (11 July, 2017), and Nigeria (15 August, 2017). The following jurisdictions have expressed their intent to sign the MLI: Ivory Coast, Estonia, Jamaica, Lebanon, Panama, and Tunisia. *See* <http://www.oecd.org/tax/treaties/beps-ml-signatories-and-parties.pdf> (accessed 14/9/2017).

¹⁸ Precisely 1246 as of 8 April 2018. *See* OECD, *BEPS - Frequently Asked Questions*, question 43, available online at: <http://www.oecd.org/ctp/beps-frequentlyaskedquestions.htm#Action6> and OECD, *Frequently Asked Questions on the*

to meet the minimum standard, it was also probably seen as the most preferable option by tax administrations of the Signatories insofar as it would give them more discretionary power than the detailed and complex MLI's LOB rule.

Most importantly for this study, the PPT is a truly global rule, which is going to be included more than 1200 tax treaties listed under the MLI¹⁹ among 84 countries²⁰ (or more in the future) with exactly the same wording based on its MLI's version in English language. This is for the first time in the history of international tax law that a tax treaty GAAR is proposed on an international level by means of a multinational convention. Moreover, as the most recent tax treaty practice under many tax treaties implies,²¹ there will be more countries and jurisdictions and tax treaties with the rules identical to the PPT than the amount which follows from the MLI. Hence, there is a unique opportunity for tax law and AI experts to unite their expertise and develop an AI that, just by applying that single rule (the PPT), may assist in dealing with treaty abuse on a global level. This testifies to the global potential of the use of AI technology in treaty abuse cases and thus enhances its scalability, something which is extremely rare in the area of law in general.

It is also worth noting that one of the biggest challenges for lawyers, and thus for an AI program assisting them in their work, is the ever-changing content of laws (both statutory and case law). Although tax treaty law is not immune to changes, it is argued in the literature that tax treaties are not as susceptible to change as domestic tax laws since their terminology must comprise terms that are known and applied under the domestic laws of the contracting states and ideally remain relevant in the face of future amendments to the laws.²² In other words, once the PPT is incorporated in the tax treaties across the world, it will not be changed soon, at least not as soon as domestic GAARs or other legal provisions of a similar nature and scope. This relative stability in

Multilateral Instrument (MLI), June, 2017, question 4, pp. 3–4, available online at: <https://www.oecd.org/tax/treaties/MLI-frequently-asked-questions.pdf>. The following Countries decided to supplement the PPT with a simplified LOB rule: Argentina, Armenia, Bulgaria, Chile, Colombia, India, Indonesia, Mexico, Russia, Senegal, Slovak Republic and Uruguay.

¹⁹ See OECD, *Table 1: Reservations and Choice of Optional Provisions*, available at www.oecd.org/tax/treaties/application-toolkit-multilateral-instrument-for-beps-tax-treatymeasures.htm.

²⁰ See Signatories and Parties to the Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting, Status as of 27 September 2018, <http://www.oecd.org/tax/treaties/beps-mli-signatories-and-parties.pdf> (accessed: 1/10/2018).

²¹ See *supra* n. 12 at sec. 1.

²² See K. Vogel & V. G. Prokisch, *General Report: Interpretation of Double Taxation Conventions*, 78a Cahiers de droit fiscal international, 1993, p. 68; J. Wilson & J. Welch, *The GAAR and Canada's Tax Treaties: Which is Trump?*, in *Special Seminar on Canadian Tax Treaties: Policy and Practice*, (B. Arnold & J. Sasseville), Kingston: International Fiscal Association, Canadian Branch, 2001, pp. 6:13-14.

the content and structure of the PPT is good for developing AI technology, as less frequent updates will be needed and it will be possible to achieve a more consistent approach to its application than used in connection with purely domestic rules.

2.2 Making the Unpredictable Predictable

The PPT is embodied within Article 7(1) of the MLI. It reads as follows:

Notwithstanding any provisions of a Covered Tax Agreement, a benefit under the Covered Tax Agreement shall not be granted in respect of an item of income or capital if it is reasonable to conclude, having regard to all relevant facts and circumstances, that obtaining that benefit was one of the principal purposes of any arrangement or transaction that resulted directly or indirectly in that benefit, unless it is established that granting that benefit in these circumstances would be in accordance with the object and purpose of the relevant provisions of the Covered Tax Agreement.

In the recent studies, many authors,²³ and this author too,²⁴ independently demonstrated via a thorough legal analysis that the OECD has incorporated an ambiguous concept of treaty abuse in an ambiguous way, bringing additional complexity and lack of legal certainty that may render the PPT hardly applicable and foreseeable at all.²⁵ In practice, at least at the level of tax authorities, the PPT is capable of everything, as the US Committee on Foreign Relations observed with respect to the US–Sweden tax treaty,²⁶ the principal purpose test “*may be applied leniently* (so that any colorable business purpose suffices to preserve treaty benefits), or it *may be applied strictly* (so that any significant intent to obtain treaty benefits suffices to deny them).”²⁷ Everything *in between* is also possible, since, as noted by the US Committee on Foreign Relations, a narrow reading of the PPT could operate to deny benefits in potentially abusive situations more often than a LOB

²³ See P. A. Barreto & C. A. Takano, *The Prevention of Tax Treaty Abuse in the BEPS Action 6: A Brazilian Perspective*, 43 Intertax 12, p. 838 (2015); See P. Baker, *The Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting*, British Tax Review 3, 2017, p. 283; Lang, *supra* n. 11, p. 660; E. Pinetz, *Final Report on Action 6 of the OECD/G20 Base Erosion and Profit Shifting Initiative: Prevention of Treaty Abuse*, 70 Bull. Intl. Taxn. 1/2, p. 117 (2016), Journals IBFD; E. Traversa & C.A. Herbain, *General Assessment of BEPS and EU law: Hybrid Mismatches, Interest Deductions, Abuse of Tax Treaties and CFC rules*, in *Base Erosion and Profit Shifting (BEPS): Impact for European and international tax policy*, p. 306 (R. Danon ed., Schulthess 2016).

²⁴ See B. Kuźniacki, *The Principal Purpose Test (PPT) in BEPS Action 6 and the MLI: Exploring Challenges Arising from Its Legal Implementation and Practical Application*, 10 World Tax Journal 2, (2018), Journals IBFD.

²⁵ See A. Rust, *Article 1 – Persons Covered*, in *Klaus Vogel on Double Taxation Conventions*, vol. 1, , marg. n. 25, p. 126 (4th ed., A. Rust & E. Reimer eds., Wolters Kluwer Law & Business 2015); M. Lang, *Introduction to the Law of Double Taxation Conventions*, p. 68 (2nd ed., IBFD & Linde Verlag 2013).

²⁶ The Convention Between the Government of the United States of America and the Government of Sweden for the Avoidance of Double Taxation and the Prevention of Fiscal Evasion with Respect to Taxes on Income signed at Stockholm on September 1, 1994 [hereinafter the US–Sweden Income Tax Treaty], Treaties IBFD.

²⁷ Committee Comments on Treaty Shopping, *Committee on Foreign Relations report to the ratification of the US–Sweden Income Tax Treaty*, 104th Congress Exec Rept. Senate 1st Session 104–4, August 10, p. 12 (1995).

rule.²⁸ The point, however, is that the application of the PPT in its current wording (as included in the MLI) cannot guarantee a narrow reading. That would depend on the tax authorities which, given their close ties to the fiscal interests of their countries and jurisdictions, may vary as widely as their countries and jurisdictions' views on treaty shopping.

Consequently, the PPT could easily become a legal conundrum.²⁹ It should be emphasised, therefore, that the mentioned *in between* scenario, which may lead to the *desired balance* under the PPT, should be reflected in its wording. All proposals made by this author in the previous research have an ambitious, albeit not unappeasable, intention to ensure that the way of application of the PPT will provide such a balance under the PPT.³⁰ The proposals stem from an application of the rule of interpretation germane to international law (Articles 31–33 of the VCLT). In this regard, the foremost interpretative material constitutes the wording of the PPT, its context, and purposes of a tax treaty (Article 31(1) of the VCLT) and its provisions (their wording and the relevant passages of the Action 6 and the Commentary to the 2017 OECD MC). This aims to contribute to the scalability of an AI technology in the sense that its functioning will be based on the rule of interpretation common to all countries rather than different interpretative approaches as followed by tax authorities and courts in various countries. The AI program would be designed to recommend an application of the PPT in a desired, balanced way, with the aim to increase legal certainty substantially in that domain.

2.3 Ensuring the appropriate application of tax treaties

The research³¹ implies that the adoption of the PPT will largely depend on the tax authorities' approach, something that may vary significantly among countries or jurisdictions.³² Such variation

²⁸ See Committee Comments on Treaty Shopping, *supra* n. 215, p. 12.

²⁹ See, for example, the clear opposition of the US Senate Committee to including a main purpose test in the Convention between the Government of the United States of America and the Government of the Italian Republic for the Avoidance of Double Taxation with respect to Taxes on Income and the Prevention of Fraud or Fiscal Evasion done at Washington on 25 August, 1999, Treaties IBFD. See Senate Executive Report, Exec. Rpt. Senate 1st Session, 106-8, p. 4, See also K. A. Parillo, *Italy-U.S. Tax Treaty Enters Into Force*, Tax Notes International, January 4, p. 37 (2010).

³⁰ See Kuźniacki, *supra* n. 24, secs. 2.1–2.6.

³¹ See Kuźniacki, *supra* n. 24; Baker, *supra* n. 22; P. Baker & T. Liao, *Improper Use of Tax Treaties: The New Commentary on Article 1 and the Amended Article 13(5)*, Bulletin for International Taxation 2012, Vol. 66, No. 11.

³² As put by Stuart, “[t]his is likely to cause contested issues to be hidden in a non-transparent process that carries risks for administrative abuses of power and also for corruption and capture or, at least, a negotiated settlement in which it could be said that the wrong amount of tax has been paid.” See M. Stuart, *Abuse and Economic Substance in a Digital BEPS World*, 69 Bulletin for International Taxation 6/7, p. 407 (2015) Journals IBFD.

in responses may deepen the defragmentation of a common approach to interpretation and application of tax treaties, although their ultimate purpose is one and the same – to enhance international commerce by eliminating double taxation. There is a likelihood for large numbers of disputes between taxpayers involved in cross-border activities and tax authorities denying them treaty benefits under the PPT. This avalanche of disputes may continue to grow and will hit the courts sooner or later, which may strike down most of the decisions of the tax authorities, if they are minded to act aggressively. Ultimately, the appropriate functioning of tax treaties may be seriously endangered since they will generate more uncertainty than foreseeability for taxpayers involved in international business and investment.

All in all, then, the PPT does not secure a proper balance between different countries, jurisdictions, taxpayers, and tax authorities. The PPT speaks more to tax authorities, especially in developed countries and jurisdictions with a significant interest in preventing the abuse of their tax treaties.³³ Even there, however, the PPT may cause concerns at a tax treaty level – diverging fiscal agendas of contracting states may jeopardise the effectiveness of tax treaties by applying the PPT in favour of fiscal interests rather than to effectuate the purpose of tax treaties.

Taking all stakeholders into consideration and with a mind to the need for tax treaties to function appropriately, recommendations by an AI program concerning the application of the PPT in the balanced way should go a long way to ensure the appropriate application of tax treaties, something which is currently endangered by the PPT.

3 How AITTA can function?

3.1 Knowledge-based AI

The idea presented below obviously requires further refinement in collaboration with AI experts. At this stage, however, and based on the selected literature and discussions with AI experts, the most suitable AI technologies for the purpose of developing AI for use in cases involving the PPT

³³ Interestingly, in the context of the MLI, the US decided not to join this club insofar as it took part in negotiations on the draft MLI text on condition that it was not obliged to accede to the MLI as a signatory, at least not with respect to the implementation of the MLI's LOB rule, due to the fulfilment of the BEPS's minimum standard under its tax treaties beyond the MLI, i.e., by implementing a comprehensive LOB provision to its tax treaties as included in the 2016 US Model and addressing conduit financing structures by domestic rules. *See* Article 7(15)(a) of the MLI. Cf. Hattingh, *supra* n. 12, section 3.2.

include a knowledge-based AI (KBAI)³⁴ which will be reliant on a supervised learning classifier system combined with semi-supervised pattern recognition.³⁵³⁶ The purpose of the AI (KBAI) project is to determine whether or not an arrangement or transaction constitutes treaty abuse according to the PPT.

KBAI can trace its roots back to one of the first AI technologies, “Dendral”, developed in 1965 by Edward Feigenbaum, was created to deduce the molecular structure of organic compounds using scientific instrument data.³⁷ Such AI technologies, called also “ruled-based” or “expert systems”, have been historically used to develop tax-law-related AI ideas, including Taxman. Hence, the current approach is to reinvent the previous, classical approach to AI and tax law in the era of ever growing access to wide-coverage semantic knowledge, and the ability of current technologies to extract information using powerful statistical methods. This has enabled significant advances in KBAI applications by enhancing their deep understanding capabilities via, for instance,

³⁴ For the re-birth of KBAI see M. Bergman, *Knowledge-based Artificial Intelligence: What Goes Around, Comes Around, Only Now with Real Knowledge*, November 17, 2014, available at: <http://www.mkbergman.com/1816/knowledge-based-artificial-intelligence/> (accessed 16/2/2018). According to Bergman, the specific identification of KBAI was first made in a Carnegie-Mellon University report to DARPA in 1975. See more in L. Gomes, *Machine-Learning Maestro Michael Jordan on the Delusions of Big Data and Other Huge Engineering Efforts*, in *IEEE Spectrum*, 20 October 2014, <https://spectrum.ieee.org/robotics/artificial-intelligence/machinelearning-maestro-michael-jordan-on-the-delusions-of-big-data-and-other-huge-engineering-efforts>. The first known patent citing KBAI is from 1992. See *Method for converting a programmable logic controller hardware configuration and corresponding control program for use on a first programmable logic controller to use on a second programmable logic controller*, US Patent No 5142469 A, August 25, 1992, <https://www.patents.justia.com/patent/5142469>.

³⁵ As neatly explained by one of the most prominent experts in AI and law, “[s]upervised learning is sometimes called learning with a teacher. If a system is learning a classification scheme, this means that the training examples are all labelled with the names of the categories. Unsupervised learning has no labelled examples, and the system is supposed to construct categories on its own. Semi-supervised learning is a hybrid: some of the examples are labelled; others, usually many more, are not. It seems clear that most human learning is semi-supervised, in this sense, since we have been given a few labelled examples from our parents and teachers, but otherwise we are on our own.” See L. T. McCarty, *Finding the Right Balance in Artificial Intelligence and Law*, sec. 3 at pp. 15–16, in *Research Handbook on Law and Artificial Intelligence*, (Edward Elgar, W. Barfield & U. Pagallo (eds.), 2017/18 (forthcoming)). This chapter is available online at: https://www.researchgate.net/publication/321335588_Finding_the_Right_Balance_in_Artificial_Intelligence_and_Law (accessed: 1/10/2018).

³⁶ As clarified in the literature, the idea that algorithms are “learning” is a large metaphor and which by no means implies that machine learning systems based on algorithms replicate the advanced cognitive processes of human learning. Instead, these algorithms should be seen as learning in a functional sense, i.e. they are capable of adjusting their behaviour to facilitate their performance on a pre-determined task by profiting from experience. See I. H. Witten, *Data Mining: Practical Machine Learning Tools and Techniques*, § 1.3 (3d ed. 2011). Providing machine learning algorithms perform well, they can produce automated results that approximate those that would have been achieved by a similarly situated person, including experts in different domains (e.g. tax law). In other words, a well-performing algorithm is able to produce automated results that appear “intelligent”. Machine learning is therefore often considered a subfield of AI. See S. Russel & P. Norvig, *Artificial Intelligence: A Modern Approach*, p. 693 (3d ed. 2010).

³⁷ See more in A. A. Berk, *LISP: the Language of Artificial Intelligence*, New York: Van Nostrand Reinhold Company, 1985, pp. 1–25.

question-answering engines (classifiers) and information retrieval (a natural language recognition).³⁸

The combination of question-answering engines (supervised classifier system) and information retrieval (semi-supervised natural language recognition) could represent two complementary ways to obtain relevant information by AITTA.³⁹

The supervised classifier system could be based on fact patterns stemming from the understanding of the terms under the PPT as follows from their interpretation under Article 31 of the VCLT, which includes references to the examples from the 2017 OECD Commentary, and relevant tax treaty case law (including the CJEU case law). As the previous research demonstrates,⁴⁰ the identification of fact patterns to determine treaty abuse under the PPT is strictly related to the existence or the absence of economic substance and non-tax business purpose. By receiving answers to individual questions, the classifier engine will assess the relative significance of each factor to the client's case in order to determine whether or not an arrangement or transaction in question constitutes treaty abuse.

The semi-supervised natural language recognition will allow, in turn, AI to obtain information directly via its natural language recognition engine. The engine will read the contracts between companies and/or description of existing or planned tax schemes. Here, AI will focus and assess the relative significance of predetermined phrases and words in order to determine whether or not an arrangement or transaction described in these documents constitutes treaty abuse. The phrases and words will be selected based on their relative relevance under the wording of the PPT and relevant interpretative materials, such as the 2017 OECD Commentary and tax treaty case law. Ultimately, the aim of the natural language recognition engine is to discover hidden patterns in data (contracts, tax planning schemes), which have not been pre-determined, but most likely are germane to determining treaty abuse.

³⁸ See E. Hovy, R. Navigli, and S. Paolo Ponzetto, *Collaboratively Built Semi-Structured Content and Artificial Intelligence: The Story So Far*, *Artificial Intelligence* 194, 2013, p. 1, http://wwwusers.di.uniroma1.it/~navigli/pubs/AIJ_2012_Hovy_Navigli_Ponzetto.pdf.

³⁹ It is by no means irrelevant to consider other AI technologies, such as deep neural network systems. At the current stage, however, the author “feels” that the best approach is the one based on the combination of question-answering engines (supervised classifier system) and information retrieval (semi-supervised natural language recognition). It would be wonderful to work with AI experts to verify the current assumptions in order to pick the AI technology best suited to the discussed solution.

⁴⁰ See Kuźniacki, *supra* n. 24, secs. in 2.3.1 & 2.4.

The AI tax treaty assistant will function *as a* predictive algorithm.⁴¹ It will start out by searching for the single most important factor (fact pattern and/or phrases) rather than jumping to a multi-factor model. Only after finding that first factor will the treaty abuse algorithm look for the next most important factor to add to the outcome (treaty abuse or not), then the next, and so on. It is therefore possible to prevent the algorithm from becoming overly complex simply by terminating the process of recognizing treaty abuse, before what's known as overfitting has had a chance to creep in.⁴² Simple approaches to the functioning of AI are preferable because they incur lower cognitive costs (for use) and lower computational costs (for algorithm), not because one necessarily expects them to be more accurate.⁴³

The combination of a supervised and semi-supervised approach to learning by AI appears well suited to automating many tasks that are currently done by people, especially in areas of pattern matching, classification, prediction, and recommendation.⁴⁴ *Ergo*, the supervised and semi-supervised approach to learning by AI will also be very suitable when it comes to developing the AI tax treaty assistant and AI use in other areas of tax law. The literature on AI also indicates that an injection of initial knowledge helps the program to effectively learn by algorithms.⁴⁵ In other words, letting identified fact patterns input explicit data to an algorithm seems to be a good starting point for AITTA to learn how determine the existence of treaty abuse.

This approach to learning by AI resembles the way people learn a second language: AI relies on fact patterns already recognized as necessary to its functioning just as adults learn a second language by having knowledge of and understanding their first language.⁴⁶ Such an approach to learning by AITTA is necessary at the beginning to address treaty abuse insofar as there is a scarcity

⁴¹ Hence, the AI *will not be* a predictive algorithm, but only works similarly to it. Instead of predicting outcome of tax authorities or courts' decision, the AI will recommend the most appropriate outcome of an application of the PPT. The very fact that it should be or will be diverging with the outcome of tax authorities or courts' decision may only be a very nice side effect of functioning of the AI's tax treaty assistant.

⁴² See B. Christian & T. Griffiths, *Algorithms to Live By: The Computer Science of Human Decisions*, New York: Picador, 2017, pp. 165–166. The term “overfitting” in machine learning typically is related to the use of models or procedures that include more adjustable parameters than are ultimately optimal, or use a more complicated approach than is ultimately optimal. See M. D. Hawkins, *The problem of overfitting*, 44 *Journal of Chemical Information and Modeling* 1, pp. 1-12.

⁴³ See P. Domingos, *supra* n. 10, p. 78.

⁴⁴ See A. McAfee & E. Brynjolfsson, *Machine. Platform. Crowd: Harnessing Our Digital Future*, New York: W. W. Norton & Company, 2017, pp. 85-86.

⁴⁵ As said by Domingos, “[t]here’s no such thing as learning without knowledge. Data alone is not enough. [(…)] Machine learning is a kind of knowledge pump: we can use it to extract a lot of knowledge from data, but first we have to prime the pump. See Domingos, *supra* n. 10, pp. 24 and 64.

⁴⁶ Cf. McAfee & Brynjolfsson, *supra* n. 44, p. 69.

of real life cases and other available data regarding treaty abuse, and no real life cases on the PPT yet. Accordingly, AITTA cannot be exposed to a sufficient number of examples and data to learn how to detect treaty abuse under the PPT without any initial knowledge. This excludes the possibility to develop AITTA based solely on the approach to learning a first language used by children, i.e. without an initial knowledge but with exposure to a massive amount of examples.⁴⁷

Furthermore, learning with the initial knowledge will allow AITTA to move effectively towards semi-supervised learning regarding the determination of treaty abuse. Here, by reading contracts between companies and/or tax planning schemes, AITTA will gradually uncover new fact patterns, a process which does indeed resemble the way a child learns its first language.

There may be therefore a virtuous circle between a supervised and semi-supervised process of learning by AITTA. The recognized fact patterns allow this AI to incorporate and use background knowledge step by step, a process whereby it can eventually recognize treaty abuse by assessing answers to pre-determined questions. By amassing more and more answers to questions in various different situations, AITTA semi-supervised recognition capacity will be increasingly equipped determine treaty abuse by reading contracts and/or tax planning schemes. This, in turn, will allow AITTA to uncover new fact patterns of relevance in treaty abuse and therefore be better prepared to recognize such phenomena holistically. Ultimately, AITTA could evolve into an unsupervised learning algorithm based on the deep neural networks trained by a novel combination of supervised learning from the input of human experts with the use of classifier system (question-answering engine).

3.2 An illustration of the AITTA functioning in practice

This sections will briefly illustrate the way in which the AITTA functions in relation to example E at para. 182 of the Commentary to the PPT (a hypothetical use case).⁴⁸ The facts regarding Example E are as follows.

RCO is a company resident of State R and, for the last 5 years, has held 24 per cent of the shares of company SCO, a resident of State S. Following the entry-into-force of a tax treaty between States R and S (Article 10 of which is identical to Article 10 of this Model), RCO decides to increase to

⁴⁷ Cf. McAfee & Brynjolfsson, *supra* n. 44, pp. 69 and 75.

⁴⁸ The choice of this example was triggered by fact that it is on the borderline of abuse and non-abuse and therefore belong to group of rather hard examples in comparison to all others. Hence, it would be interesting to see how the AITTA would address such situation. Moreover, Example E is a bit special insofar as it is only the one of two examples under which the Commentary explicitly refers to an individual tax treaty provision. Second is Example J at para. 187 of the Commentary to the PPT. But that Example illustrates clearly abusive arrangement and therefore it was more challenging to use Example E in this research as a case study than Example J.

25 per cent its ownership of the shares of SCO. The facts and circumstances reveal that the decision to acquire these additional shares has been made primarily in order to obtain the benefit of the lower rate of tax provided by Article 10(2)a) of the treaty.

In this case, the tax authorities of State S and/or board of directors of company SCO⁴⁹ are investigating whether the structure implemented by RCO entails treaty abuse under the PPT, as included in the tax treaty between State R and S. For this purpose, they use AITTA.

The tax authorities and the directors of SCO provide answers to the pre-selected questions – either “yes”, “no”, or “I do not know” – which stem from treaty abuse fact patterns.⁵⁰ Based on these answers, the AITTA will determine the likelihood (in percentage) of treaty abuse under the PPT in respect to the transaction. The AITTA will also provide a justification for its assessment of the risk of treaty abuse based on the analysis of the answers. The areas triggering a high risk of treaty abuse will be highlighted in order to let SCO re-structure the transaction accordingly.

It is noteworthy that all questions are highly interrelated and play a distinctive role in the proper functioning of the treaty abuse algorithm. At the general level, the algorithm has three steps. Step one: Answers to the group of questions focusing on the transaction are received and evaluated by the classifier system. If it indicates certain likelihood (in per cent) of treaty abuse (‘very high’ for example), there will be no need to answer the questions regarding the entities participating in the transaction. If the likelihood is not very high, step two needs to be taken. Step two: Answers to all questions need to be fed into the classifier system. Step three: The initial value of all the questions is calculated and either retained or re-adjusted in accordance with the system of weighting the questions. This will provide the final value and determine the likelihood of treaty abuse.

With regard to Example E, the AITTA indicated an 18.84 per cent likelihood of treaty abuse, which should be translated into a low (below 20 per cent) risk of treaty abuse. This can be seen as being in line with the conclusions of the OECD to that Example.⁵¹

Currently, the AITTA is based on the treaty abuse algorithm, which is capable of delivering “intelligent” results in complex tasks pertaining to an application of the PPT without human-level

⁴⁹ The tax authorities do so to detect treaty abuse and consider denying a treaty benefit (lower withholding taxation on dividends) in respect to the transaction in question while the directors to assess the tax risk of that transaction under the PPT.

⁵⁰ For the fact patterns relevant to treaty abuse algorithm *see* Kuźniacki, *supra* n. 24, secs. 2.3.1 and 2.4.3.2.

⁵¹ See para. 182 of the Commentary to the PPT, pp. 593–594. In fact, the way of functioning of the AITTA (including the Example E) was presented by the author on various scientific events. See, for example, <https://www.youtube.com/watch?v=etuqip5TsSQ>.

cognition.⁵² Soon, however, the algorithm will be trained to recognize treaty abuse fact patterns (known as the treaty abuse “training set”). The goal of such training is to enable the algorithm to create an internal computer model of treaty abuse that can be generalized and applied to new, never-before-seen examples of that phenomenon (semi-supervised learning). Ultimately, the goal of the AITTA is to read contracts, tax planning schemes, and balance sheets/financial statements of entities engaged in cross-border arrangements or transactions for the purpose of determining the risk of treaty abuse under the PPT (unsupervised learning).

The current stage of the development of the AITTA – where it relies solely on the treaty abuse algorithm – was achieved without using much financial resources. Indeed, a few months of interdisciplinary work on tax law and algorithms (by the author) and coding (by the author’s partner in implementing the idea) was sufficient to develop the algorithmically augmented assistant in an application of the PPT. Roughly speaking, building the AITTA with a proper AI technology could cost around EURO 100 000. Considering the advances in natural-language processing (NLP),⁵³ the AITTA could soon cope not only with English, but also many other languages. Also, although the treaty abuse algorithm is currently designed to reflect internationally recognized interpretative approach to an application of tax treaties and thus the PPT, the AITTA could be country-specific in the sense that the treaty abuse algorithm will include adjustments compatible with diverging views among tax authorities/courts of various countries on what constitutes tax avoidance and treaty abuse. This is an important feature of the AITTA insofar as the attraction of the PPT to most governments is that they have control of its application in specific cases; they are not looking for rules that confine their decision-making. Hence, diverging applications of the PPT among countries seems to be inevitable.

⁵² Such automated results can be considered “intelligent” to the extent that they approximate those that would have been produced by a similarly situated person employing high-level human cognitive processes, i.e. a tax lawyer with expertise in an application of tax treaties. As aptly put by Surden, “[t]his is an outcome-oriented view of intelligence-assessing based upon whether the results that were produced were sensible and useful-rather than whether the underlying process that produced them was “cognitive” in nature.” See H. Surden, *Machine learning and law*, 89 *Washington Law Review* 1, pp. 95–96 (2014). See more about the combination of human intelligence and computer-based analytics in the domain of law in D. M. Katz, *Quantitative Legal Prediction-or How I Learned to Stop Worrying and Start Preparing for the Data-Driven Future of the Legal Services Industry*, 62 *Emory Law Journal* 4, p. 912 (2013).

⁵³ See, for example, Y. Goldberg, *A Primer on Neural Network Models for Natural Language Processing*, 57 *Journal of Artificial Intelligence Research* 57, pp. 345–420.

4 Conclusions

AITTA, when it becomes available, will be the very first version of the Algorithmically Augmented Lawyer (AAL) in the tax law domain. The global coverage of the PPT gives us reason to believe that AITTA will be further developed and applied by around 100 countries in the world, not only by MNEs and their tax advisers, but also by governments, and maybe by judges. There will no longer be any room for treaty abuse, because every abusive arrangement or transaction will be precisely anticipated based on one and the same algorithm by currently adversary sides of the game.

Because the PPT is very complex and ambiguous, what AI learns in dealing with those cases could be put to use for other rules of a similar degree of complexity and ambiguity and with a largely similar purpose and nature, i.e. domestic GAARs, could be addressed by an approach very similar to that as presented by the author in this article. AI could eventually be applied to all types of anti-tax avoidance legislation. By augmenting the power of AI, a very effective means of preventing tax avoidance on a global scale should be possible. The question is only if countries and jurisdictions across the world would welcome AI. AI could help them draft the most effective anti-tax avoidance laws and enforce them accordingly. The application of AI in the domain of international tax avoidance is likely to be a “game changer” in this author’s opinion, by not only improving the work of tax advisers and tax administrations across the world, but also the performance of tax systems globally.