The AI landscape for tax in Europe today. How Tax Authorities use AI and machine learning to facilitate their tax process

El panorama actual del uso de la inteligencia artificial para la fiscalización en Europa. Cómo las autoridades fiscales utilizan la inteligencia artificial y el aprendizaje automático para facilitar sus procedimientos fiscales

O panorama atual do uso da inteligência artificial para a fiscalização na Europa. Como as autoridades fiscais utilizam a inteligência artificial e o aprendizado de máquinas para facilitar seus procedimentos fiscais

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Abstract

European tax authorities are using AI and AI-related techniques like Machine Learning for specific tasks only. A focus on the 'compliance by design' approach, as explained in the 2020 OECD publication on 'Tax Administration 3.0 - The Digital Transformation of Tax Administration', will be crucial for tax authorities to succeed in their digital transformation process, as well as the collaboration through public-private initiatives. This article addresses the status of tax authorities as well as corporates in their digital transition and transformation processes. It provides a long list of digital initiatives adopted by European as well as non-European tax authorities. However, the fragmentation could mean tax authorities move at a different pace in the digital journey, leaving opportunities to coordinate between tax authorities and to collaborate with taxpayers unused. The 'building blocks' for Tax Administration 3.0 to take a holistic approach are (i) define your digital identity (ii) clarify the taxpayers' touchpoints (iii) create data management and data standards (iv) develop tax rule management tools & applications (v) drive new skill sets of tax officials and (vi) provide a proper governance model.

Benefits for both tax administrations and taxpayers include: Corporates share data with tax authorities, who, through "compliance by design," deal with all tax-related compliance; AI offers tax authorities real-time insight into the completeness and accuracy of tax-relevant data; corporates obtain (almost) real-time security regarding their tax positions, i.e., can release todays' provisions reported on the uncertain tax positions; tax authorities can use secure and trusted vendors for tax-driven (middleware-base) solutions to accelerate the roll-out on the "Tax Made Digital" world and almost half of the international disputes between parties can be resolved through the use of AI between tax authorities without taxpayer involvement.

Keywords: AI, Artificial Intelligence, Building blocks for tax, Compliance by Design, Digital transformation,Machine Learning, Tax Administration 3.0, Tax and Technology, Tax Car Wash Approach, Tax Technology, Taxpayers profiles in 2030.

Resumen

Por el momento las autoridades fiscales europeas están utilizando la inteligencia artificial (**"IA"**) y técnicas relacionadas con la IA - como el aprendizaje automático - solo para tareas específicas. Enfocarse en el planteamiento de 'cumplimiento desde el diseño', tal como se explica en la publicación de la OCDE de 2020 sobre *'Administración tributaria 3.0 - La transformación digital de la administración tributaria*', será crucial para que las autoridades tributarias tengan éxito en su proceso de transformación digital y la colaboración a través de iniciativas público-privadas.

Este artículo aborda la coyuntura tanto de las autoridades fiscales como de las empresas en sus procesos de transición y transformación digital. Proporciona una larga lista de iniciativas digitales adoptadas por las autoridades fiscales europeas y no europeas. Sin embargo, esta fragmentación podría significar que las autoridades fiscales se muevan a un ritmo más lento en el viaje digital, dejando de aprovechar oportunidades para coordinar entre las autoridades fiscales y colaborar con los contribuyentes. Los componentes básicos (*building blocks*) para que la Administración Tributaria 3.0 adopte un enfoque holístico son: (i) definir su identidad digital; (ii) aclarar los puntos de contacto de los contribuyentes; (iii) crear la gestión de datos y estándares de datos; (iv) desarrollar herramientas y aplicaciones de gestión de las normas fiscales; (v) impulsar nuevos conjuntos de habilidades de los funcionarios tributarios y (vi) proporcionar un modelo de gobernanza apropiado.

Los beneficios, tanto para las administraciones tributarias como para los contribuyentes, incluyen: las empresas comparten datos con las autoridades fiscales, quienes, a través del "cumplimiento desde el diseño", se ocupan de todo el cumplimiento relacionado con los impuestos; IA ofrece a las autoridades fiscales información en tiempo real sobre la integridad y precisión de los datos relevantes para los impuestos; las empresas obtienen seguridad (casi) en tiempo real con respecto a sus posiciones fiscales, es decir, pueden liberar las provisiones de hoy informadas sobre las posiciones fiscales inciertas; las autoridades fiscales pueden utilizar proveedores seguros y confiables para soluciones basadas en impuestos (*middleware*) para acelerar la implementación en el mundo del impuesto vuelto digital (*Tax Made Digital*) y asi la mitad de las disputas internacionales entre las partes pueden resolverse mediante el uso de IA entre autoridades tributarias sin la participación de los contribuyentes.

Palabras clave: IA, Inteligencia Artificial, Componentes básicos (*Building blocks*) fiscales, Cumplimiento desde el Diseño, Transformación digital, Aprendizaje Automático (*Machine Learning*), Administración Tributaria 3.0, Impuestos y Tecnología, Enfoque Fiscal tipo Autolavado (*Tax Car Wash Approach*), Tecnología Fiscal, Perfil del Contribuyente en 2030.

Resumo

No momento, as autoridades fiscais europeias estão usando inteligência artificial ("**IA**") e técnicas relacionadas à IA - como o aprendizado de máquinas - apenas para tarefas específicas. O foco na abordagem "conformidade desde o projeto", como explicado no relatório da OCDE de 2020 '*Administração Tributária 3.0 - A Transformação Digital da Administração Tributária*', será crucial para que as autoridades fiscais tenham sucesso em seu processo de transformação digital e colaboração através de iniciativas público-privadas. Este artigo aborda o cenário tanto das autoridades

fiscais quanto das empresas em seus processos de transição e transformação digital. Fornece uma longa lista de iniciativas digitais tomadas pelas autoridades fiscais europeias e não europeias. Entretanto, esta fragmentação pode significar que as autoridades fiscais se movimentam a um ritmo mais lento na jornada digital, perdendo oportunidades de coordenação entre as autoridades fiscais e de colaboração com os contribuintes. Os elementos básicos (*building blocks*) para que a Administração Tributária 3.0 adote uma abordagem holística são: (i) definir sua identidade digital; (ii) esclarecer os pontos de contato dos contribuintes; (iii) criar gerenciamento e padrões de dados; (iv) desenvolver ferramentas e aplicações de gerenciamento de regras fiscais; (v) alavancar novos conjuntos de habilidades de funcionários fiscais; e (vi) fornecer um modelo de governança apropriado. Os benefícios tanto para as administrações fiscais quanto para os contribuintes incluem: as empresas compartilham dados com as autoridades fiscais, que, através da "conformidade desde o projeto", cuidam de todo o cumprimento fiscal; a AI fornece às autoridades fiscais informações em tempo real sobre a integridade e exatidão dos dados relevantes aos impostos; as empresas ganham (quase) certeza em tempo real em relação às suas posições fiscais, ou seja, podem liberar as disposições atuais informadas sobre posições fiscais incertas; as autoridades fiscais podem utilizar fornecedores seguros e confiáveis de soluções baseadas em impostos (*middleware*) para acelerar a implementação no mundo do imposto digital (*Tax Made Digital*), dessa maneira, a metade das disputas internacionais entre as partes pode ser resolvida usando AI entre as autoridades fiscais sem o envolvimento dos contribuintes.

Palavras-chave: IA, Inteligência Artificial, Elementos básicos (*Building Blocks*) fiscais, Conformidade desde o Projeto, Transformação Digital, Aprendizado de Máquina, Administração Tributária 3.0, Impostos e Tecnologia, Abordagem Fiscal tipo lavagem de carros (*Tax Car Wash Approach*), Tecnologia Tributária, Perfil do Contribuinte em 2030.

Sumario

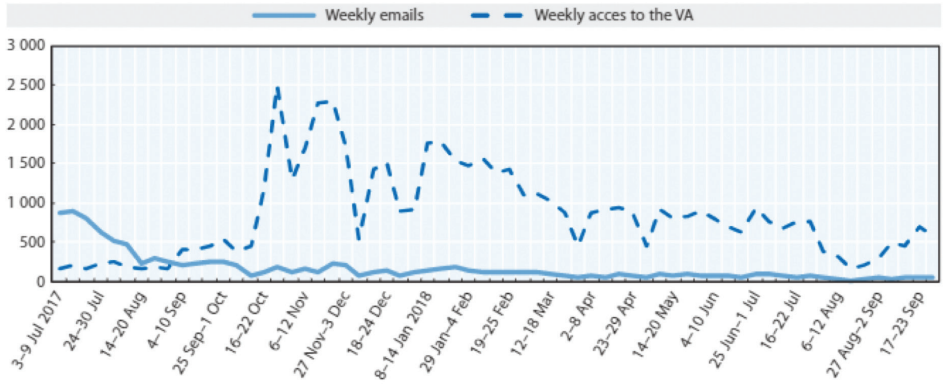
1. Different stakeholders on tax and digital transformation

Both governments and companies need to establish and utilize Artificial Intelligence (AI) and Machine Learning (ML) in taxation. The prominent reason to

embed AI in the taxation system is its capability to process and analyse tremendous amounts of data. As such, it helps both to understand clients better and to simulate future business scenarios.

It is clear that AI will need to be included in the processes of tax administrations as tax administrations can get overwhelmed with e-mail traffic, as demonstrated in Figure 1.

Figure 1.



Source: OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.180, OECD Paris.

This figure indicates the number of emails the Spanish tax administration received when the option to access the Virtual Assistant provided by the tax administration was available. The significant demands placed upon the small amount of SII specialists caused the Spanish tax administration management to opt for AI as a means for being able to meet this demand for information automatically.

AI enables both tax authorities as well as corporates:

- To develop advanced tools for monitoring behaviour and activities in real-time.
- To continuously improve their monitoring capabilities; and
- To increase transparency regarding regulatory compliance and corporate governance.
- To support parties to manage their risks through tax analytics and predictions pro-actively.

For instance, AI can be used by tax authorities to more accurately predict the probability of a particular corporate defaulting on payment of their taxes. Corporates could use AI to automate part of their compliance process.

Thus, to establish a balance between the information shared between Tax Authorities and the companies, both sides are required to deploy AI tools.

Certainly, this will drastically impact the nature of communication between governmental bodies and citizens/customers. The transition from the well-established human to human interaction towards human-to-bot interaction is happening at a high pace.

Such a transition has also happened in taxation, where taxpayers will soon have to get used to having almost all their questions answered by bots, their data being processed by AI, and accessing to human interaction in the later stages of the conflict resolution process, only if the problem could not be solved with technology-based solutions.

In today's tax practice, we recognize four generations of tax and technology to facilitate the three major roles of corporate tax professionals: (i) communication with stakeholders (ii) running a full tax compliance cycle, and (iii) making a tax risks assessment.

The four generations of tax and technology are as follows:[2]

1. The first generation is performing its tasks on a 'standalone' base, mainly covering one or more tax workflows 'in isolation';
2. The second generation is being integrated into an Enterprise Resource Planning (ERP) platform as an enhanced tax engine dealing both with the compliance and the tax risk management aspects;
3. The third generation has taken the applications from the second generation but makes each of the applications separately accessible in a cloud-driven setup, i.e., an i-store for tax applications;
4. a common data configuration drives the fourth generation for all major tax filings. Tax Authorities are only accepting the prepared packages of data fitting through their digital mailbox, fully in line with the pre-defined coding and XML conversions standards as provided by the (Organization for Economic Cooperation and Development (OECD).[3] Often, countries have added a taxpayer's identification process, which is more country-specific.

In the world of the fourth generation, tax authorities will develop a middleware tax engine, which is allowing them to screen taxpayer behavior, scan files/reports by

2 Huibregtse, S. and Gerardu, R., "*Whitepaper on 'The Future of Tax in 2025 - A Data Driven Version of the Tax World*", 2021.

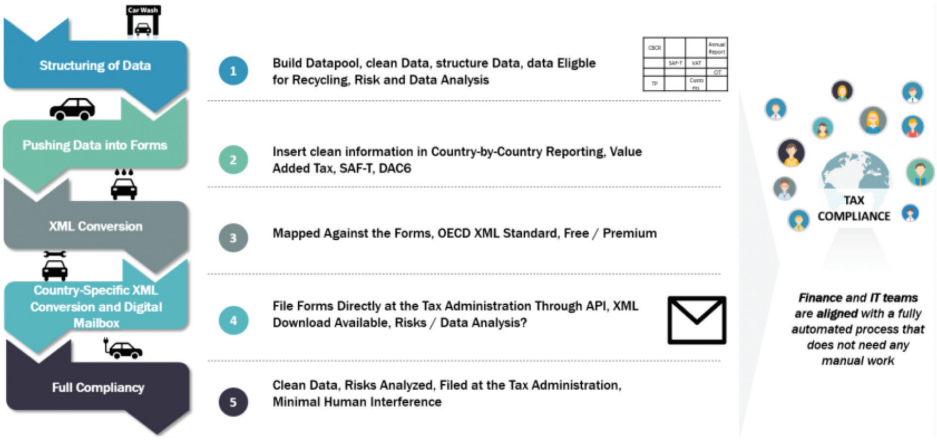
3 XML, Extensible Markup Language, is a markup language defining a certain set of rules allowing the encoding of documents in a way that both a human and a machine can read it.

the taxpayer, monitor timely compliance by taxpayers, request data, address outliers, predict tax collection patterns, identify fraud cases, among others. The role of the Tax Authorities will be limited to:

- Licensing this software to large enterprises for their particular use, while the reporting by the middleware will provide tax authorities all necessary transparency on all taxable transactions on a 'real-time' base;
- Licensing this software to aggregators, e.g., big tax technology and accounting firms, who manage the tax affairs of smaller enterprises that do not have sufficient professionals on board to manage this more sophisticated 'data to dashboard' process;
- IDRs will be automatically released to taxpayers in case of any breach of quality on the data collected, data reworked, data completed into forms, addressing the delta between 'expected' versus 'actual' reporting of taxes;
- Blockchain will become scalable technically and economically affordable by 2023, adding to the more critical aspects of this enhanced and digital relationship between taxpayers and tax authorities.

On the other side, corporates will start using so-called 'tax car wash facilities,' where the 'dirty data' is getting cleaned, injected into tax forms, clean tax data converted into XML, before sending it through the 'digital mailbox' of the tax authorities. The dynamic of the car wash for tax facilities are depicted on Figure 2.

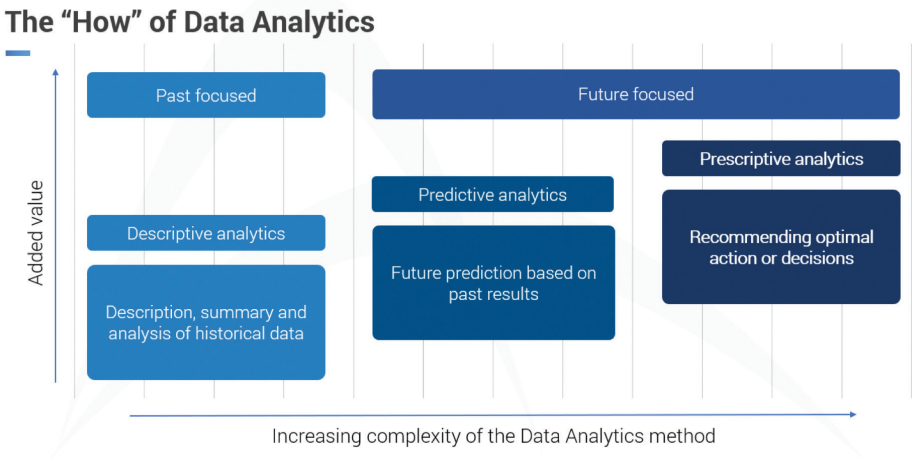
Figure 2.



Source: e-Bright 2021, "*Webinar series "Building Blocks for Tax*"

Figure 3 showcases that the first three generations of tax technology are mostly compliance-driven and, therefore, are focused on the past, while the fourth generation is also considered to address a focus on future positions.

Figure 3. The "how" of Data Analytics



Source: e-Bright, "*Tax Technology Course*".

Given the top 10 strategic technology trends 2020 published by Gartner, the world is going to face the following revolutionary trends in technology:[4]

- By 2020, Gartner expects digitally trustworthy companies will generate 20% more online profits than those that are not; The six elements of trust include: ethics, integrity, openness, accountability, competence, and consistency;
- By 2021, at least one-third of enterprises will have deployed a multi-experience development platform to support mobile, web, conversational, and augmented reality development;
- From 2022 onwards, 30% of all AI cyberattacks will leverage training-data poisoning, AI model theft, or adversarial samples to attack AI-powered systems.
- By 2022, application integrations delivered with robotic process automation (RPA) will grow by 40% year over year;
- By 2024, 75% of large enterprises will be using at least four low-code development tools for both IT application development and citizen development initiatives;

4 Gartner 2019, "*Top Strategic Technology Trends for 2020*".

- By 2024, most cloud service platforms will provide at least some services that execute at the point of need;

So, as an illustration, this is how technological advances could impact the tax workflows and tax professionals:

- Robotic Process Automation (RPA) will be a more extensive application for pushing tax relevant data to the proper forms in the correct format;
- Future tax work spots will be complemented beyond today's simple desktop computer set up;
- Low-coding will allow 'basic functionality' to be the groundwork to shorten development time and reduce the cost of tax software applications with a factor of 10 or more;
- Similar to what happened with Xero - an ERP platform - where accountants from all over the world were adding their application to the app store of Xero, tax middleware solutions will offer a range of tax applications – preferably through PAAS or SAAS based solutions at affordable prices;
- Trust in tax software will be measured against the level of acceptance of such solutions for Tax Authorities, i.e., "does the dataset in XML you have produced fit the digital mailbox of your tax authorities?" will become the only 'norm of being compliant';
- If in today's world there are limited devices used in the tax workflows, it is expected that number to grow exponentially;
- Cloud solutions will deliver nearby execution points for taxes as well;
- Blockchain could bridge the gap of distrust between parties who either never worked together, or have conflicting interests, potentially like the taxpayer versus the tax authorities;

How do these trends stack up to the fourth generation of tax technology offered nowadays, and how much AI-driven technology is already being used?

Sections 2 and 3 will highlight the latest interest and usage of tax technology by tax authorities and corporates. Section 4 indicates that tax authorities are using technology and how it is ranked by showing a tax technology heat map.

To discover the use of AI —or more specifically, the Machine Learning component of AI— section 5 explains the types of applications of ML in the tax arena.

Given that the fourth generation of tax technology is the most advanced one, Section 6 offers the reader an insight into what AI functionalities this generation could bring or what it has already made available. Specifically, Section 6 will be looking into how tax authorities use AI —Machine Learning— to get their grip on tax-relevant data when running tax audits on corporate taxpayers. Although the article focuses on Europe, some illustration on the use of AI in other parts of the world is being shared.

Section 7 will address how this fourth generation will develop in the coming years and how it could facilitate the involvement of tax professionals in digital transition and transformation projects.

2. Tax authority's perspective

Tax authorities are the only institutions to access the increasing amount of tax-related data regarding taxpayers; this gives them a unique position. With the right processes and analyses, the tax authorities are allowed to gain insights that taxpayers cannot, allowing them to learn about trends and anticipate contingencies. To exploit this position fully, the data the tax authorities are sitting on needs to be handled correctly, which places a massive burden on them, as the volume of data is ever-increasing.

Tax professionals benefit the most from Machine Learning, which is a branch of AI. In this space, algorithms are used to sift through volumes of data, often complex, to elicit inferences, and subsequently, insights from that data.

AI, and in particular Machine Learning, can help provide insights to tax authorities early in the data collection life-cycle. Given the ever-progressing alignment of data models data sharing within the tax space, e.g., FATCA, Common Reporting Standard, Country-by-Country Reporting (CbCR), among others. There is a high possibility of gaining greater insights from this data. Machine Learning is ideally suited to analyzing this structured and voluminous data mined from multiple jurisdictions utilizing the same scheme —such as CbC reporting—, thus providing greater assured global tax compliance.

Tax administrations, having access to taxpayers' data, can now start using the power of analytical software. Machine Learning techniques provide opportunities to analyse data to the degree that other traditional methods cannot. By applying Machine Learning methods, tax administrations can:

- Have machines perform the screening and checking of the data. This shifts a significant burden from humans over to the machines, allowing the employees'

time to be spent on other workflows. This also entails that employees will need to be adaptive in using technology within their work routine. This would increase the efficiency within the tax authority and enable it to cover a large percentage of tax returns instead of reviewing only a few of these.

- Provide equal treatment to taxpayers, as machines do not consider any form of emotion when looking at data, where humans can be prejudiced. Today it is clear that some tax authorities have been biased on the definition of 'taxpayer committing fraud' by, for example, given a higher risk ranking in the AI tools to individuals with two or more nationalities. However, machines are not 100% neutral since the humans creating the engines have their own limited set of references, which always bias lands in AI tools.

Running analyses on large volumes of data provides insights on the taxpayer's positions, risks, behaviour, and tax needs and challenges. This information can be used to anticipate compliance contingencies rather than wait for a tax dispute to arise and indicate that a process or article in the domestic tax statutes should be amended. A different view on this is that the tax legislation, which tends to lag regarding developments in the economy, requires another approach to be implemented when turning from 'legal language' to how to treat 'tax relevant data. Alternatively, tax legislators could develop responsive regulations that modify the tone and approach to taxpayers based on their status of compliance. This changing landscape carries the implied expectation that tax authorities continue to comply with the principles that, according to IOTA, govern all administrative actions by governments, including:[5]

- The principle of **prudence**, according to which the algorithms' complexity or the scope of the projects in which they are used, is to be avoided. Progress is best made based on obtaining secure results or running pilot programs. Countries would have to apply a cost-benefit analysis on each of the options available to find useful data;
- The principle of **non-discrimination**. As we know, algorithms are based on hypotheses developed by data scientists. This entails the risk that human errors or biases may be transferred onto the algorithm itself, conditioning the validity of the new hypotheses and their results. Thus, authorities must ensure that AI systems are not discriminatory;
- In the third place, the principle of **proportionality**, which evaluates the degree of interference in the taxpayers' rights and guarantees, stems from

5 IOTA 2018, "*Impact of Digitalization on the Transformation of Tax Administrations*", Budapest.

the decisions derived from AI programs. A tax authority could encourage voluntary compliance by informing a taxpayer of certain information regarding his tax situation.

- Fourthly, the principle of **transparency** implies addopting measures that will enable taxpayers to know why a decision has been taken, without limiting their defense rights . The interesting French model includes, in the Law for the Digital Republic, the right of the administered to know the suite of algorithms used for individual decision-making, as well as to be informed about how the algorithm functions, e.g., how and to what extent the processed data and processing parameters have contributed to the decision-making. In a supreme court case on Dutch real estate tax, the Dutch Supreme Court decided that the formulae to calculate the 'levy base' for the real estate tax had to be fully disclosed, while a 'profiling by the tax authorities' included in the algorithm did not need to be disclosed to the taxpayer;[6]

- Finally, **data governance** is relevant to ensure data security, for which tax administrations are responsible while respecting privacy and confidentiality. In addition, administrations should also take responsibility for the quality of the data, and the integration of all information —not a selection only— should be encouraged.

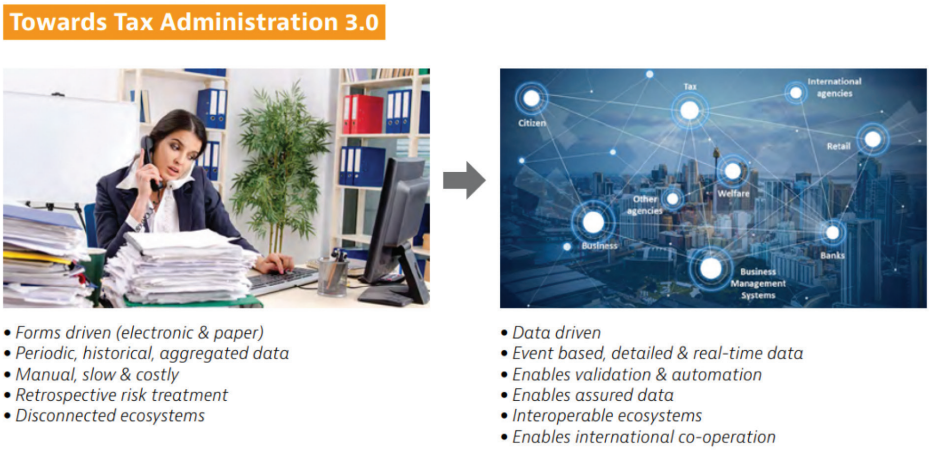
Following these principles, the OECD Forum on Tax Administration published in 2020 the "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*" report, addressing the following conclusions:[7]

- Figure 4 regarding tax administrations 3.0 indicates a high awareness level, i.e. a clear signal of a burning platform.

6 ECLI: NL: HR: 2018: 1315, ECLI: NL: HR: 2018: 1316, ECLI: NL: HR: 2018: 1319 and ECLI: NL: HR: 2018: 1371.

7 OECD 2020, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*".

Figure 4. Towards Tax administration 3.0



Source: OECD 2020, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations",* p.8, OECD Paris.

- Whereas "Tax Administration 2.0" is often focussed on a "downstream" and often a stand-alone activity, "Tax Administration 3.0" delivers an embedded approach with taxpayers' natural systems.
- Like in the 4th generation of tax technology, outlined in section 1 of this text, many digital platforms will become agents of the tax authorities by carrying out "Tax Automation" processes within their systems, which leads to the Administration becoming a real-time certainty provider.
- Outdated features like backward-looking audits and tax returns compiled by taxpayers need to be addressed, some of which are not a priority for many taxpayers.
- The OECD paper provided 3 taxpayer profiles to visualize the "Tax Administration 3.0" in practice in 2030:
    - Mary has embraced the My365 platform and app, which supports her in many aspects of her life. She connects with much different public and private actors supporting her life events in a coordinated and holistic manner via My365.[8]
    - Kim, a self-employed entrepreneur who knows that tax is mainly taken care of automatically through her business solution MyBusiness. The

8 OECD 2020, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*, p.27.

platform guides her in case of certain business decisions and their tax consequences.[9]

- o Smart Falcon is an MNE using dashboards for tax-driven solutions provided by government-trusted vendors. Their business systems are updated with correct tax-relevant rules, algorithms, and data from government platforms before business transactions are completed.[10]

- Tax is assessed, reported, and collected automatically, where tax authorities use AI to flag risks and support negotiations between national tax authorities without relying on any corporate involvement.
- In the future, the core of modern revenue bodies will consist of data processing organizations. As such, there will be an increased vulnerability to disruptive ICT innovations.
- Sections 4 and 6 of this article provide various practical examples of how tax authorities enter public-private collaborations. However, there is a serious risk that tax authorities continue to treat the digital transformation of their own "Tax Administration" as a pure public event. The series of events initialed and funded bears the risk of not creating a level playing field yet again.[11]

3. Corporate perspective

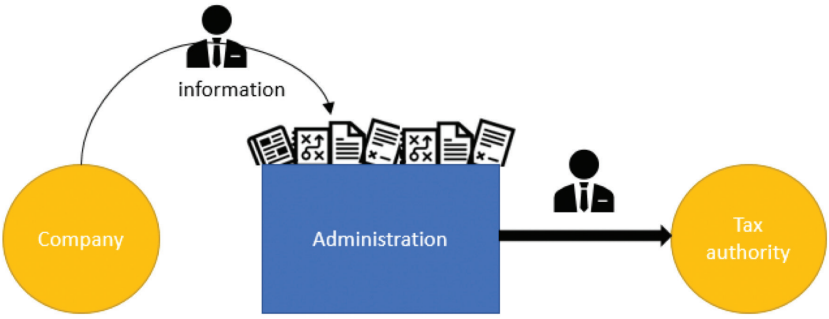
Nowadays, the tax professional has a vital role in managing all the data needed for tax purposes, i.e., some of these professionals spend up to 80% of their time collecting the data relevant for taxes. These datasets are used to satisfy the need by the tax inspector – and are provided either in a structured manner – e.g., through tax returns – or in an unstructured way, by responding to tax IDRs. This way of working is visualised In Figure 5.

9 OECD 2020, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*, p.29.

10 *OECD 2020, "Tax Administration 3.0: The Digital Transformation of Tax Administrations*, p.31.

11 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.195.

Figure 5.

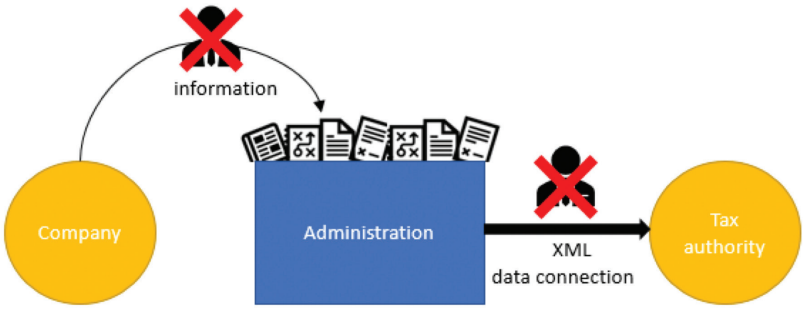


Source: e-Bright 2019, "Tax Technology Course".

The figure below visualises the new way of working: A company collects all its tax-relevant information in an administration box. This administration box typically consists of one or more ERP systems, a legal database, HR and tax databases, data warehouse, business intelligence, among others.

This so-called administration box is, in turn, directly connected with the tax authorities. The tax technology software selects all relevant data for the tax return and files the tax return to the tax authority in the requested XML format. For example, when a transaction gets booked into the general ledger in Brazil, the Brazilian Tax Authorities can review the entries and cross-check them against other sources available in 'real time'. The tax authorities use various degrees of Machine Learning to assess the completeness and accuracy of the dataset upon its creation in the general ledger of the Brazilian taxpayer (Figure 6).

Figure 6.



Source: e-Bright 2019, "Tax Technology Course".

Due to digitization and automation, the role of tax professionals has changed dramatically. Data processes have been automated and, as a result, might not require manual work by the tax professional any longer. Automated and integrated tax provision and compliance processes and data source systems have partially replaced spreadsheets to generate real-time, tax-ready information with greater efficiency. These efficient systems have the consequence that the time needed to complete tax reporting progress is significantly reduced.

Advanced tax technology software makes it possible to file tax returns automatically in the required XML format. In order to have, for example, CbC Reports in a consistent format and to allow for automation, an electronic template has been developed. The electronic template is an XML schema (extensible mark-up language). This facilitates electronic preparation, filing, and exchange of the CbC Reports.

As an illustration, the cycle from a transaction into an annual financial report converted into a corporate income tax return, which could be followed up by a tax audit years later, could easily take up to 5 or more years. In the new way of working, such cycles will sometimes be reduced to less than 1-3 months, the time between the original transactions being booked and the final tax assessment and payment process is completed.

Concluding this section, having in-house tax workflows described in a structured manner creates process descriptions essential for any translation and selection of technology. A few sample cases are listed below:

- With a detailed CbCR manual, prepared by TPA Global, various corporates have been able to use one of the 'source tier' engines to auto-generate all data points to feed directly into the CbCR tables;
- With a detailed services catalog for headquarter services (including shared service fees and BU services hubs) produced by TPA Global, various corporates have organized their own —within SAP— a collection of data and auto-produced invoicing system, which on top can showcase the 'benefit' to the recipient of the service by simply clicking on the 'inter-company invoice' to retrieve the 'source data' the invoice was based on;
- With a detailed audit manual on 'how to segment the P&L for tax and transfer pricing' made by TPA Global, various corporates have been driving semi-full automation of this exercise by using a variety of existing BI tools;

- To enable 'true ups' per transaction and entities, various corporates have been implementing a 'real-time per month true up' mechanism, mostly run on an automatic pilot, with minimal human intervention.[12]

Through the experience obtained in practice by TPA and its partners, several use cases can be addressed. A summary of these use cases where corporates use tax technology is presented below.

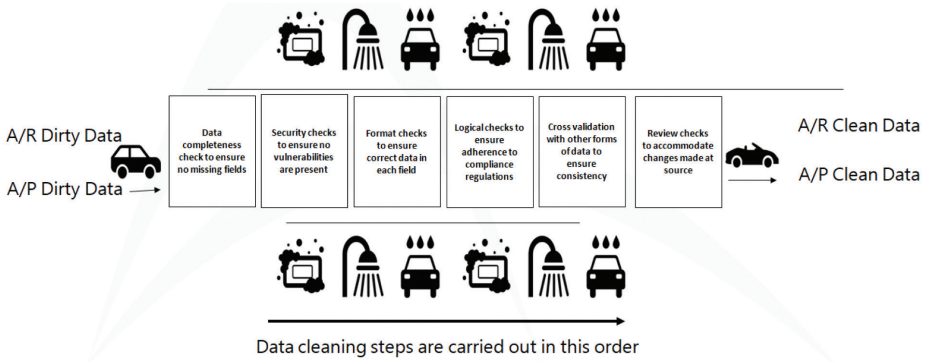
1. **Compliance Tracking Process:** Have a complete set of triggers that help identify and track the status of each document in just a few clicks. Gain full control of the communication process.
2. **HQ/SSC/BU Cost Allocation, Audit Trail, and Perform a Benefit Test**: Map information of HQ/SSC/BU cost allocation to service invoices and drill down digitally to the audit trail of the service provider.
3. **CbC Report Automation**: Extract data from source tier directly to a CbCR template and XML-conversion and filing process.
4. **CIT Report Automation**: Extract data from source tier and directly create local Corporate Income Tax reports and XML-conversions and filing.
5. **Customs Report Automation**: Extract data from a SQL-source tier for a variety of custom and reporting analytics.
6. **VAT Report Automation**: Extract data from the source tier and directly create and file VAT reports in the correct XML format.
7. **Tax Accounting Entries and Provisions**: Automatically create tax accounting entries and tax provisions based on real-time information.
8. **Transfer Intercompany Matrix into Transfer Pricing Documentation**: Extract data from the source tier, create an intercompany matrix and segmented statutory accounts and transform these into transfer pricing documentation.
9. **Real-Time Transfer Pricing Adjustments**: Make transactional modifications to impact transfer pricing prices and margins automatically in real-time.
10. **DAC6 Automation**: Feed an intercompany matrix into the DAC6 tool and file reportable transactions in XML format.

Use cases 3 and 6 can be explained through the "Car Wash"-approach developed by TPA Global. This approach considers the best way to deal with data as

12 The definition of "true ups" is an additional intercompany transaction generated by the system to bring both group companies involved at an arm's length compensation.

a general process of data gathering, structuring, and, insofar needed and possible, cleaning. By running the process through a "Car Wash," the data is collected for multiple purposes at once, instead of the common silo'd approach where data is collected per type of tax. These silos would generally not interact with each other regarding their data, while their data can be quite similar to another type of tax. For instance, the data collected for VAT could also be used for the intercompany matrix in transfer pricing and the assessments made for the Mandatory Disclosure Rules (DAC6). This bundle of data is then cleaned according to the following process, starting at the accounts payable and receivable with their dirty data (Figure 7).

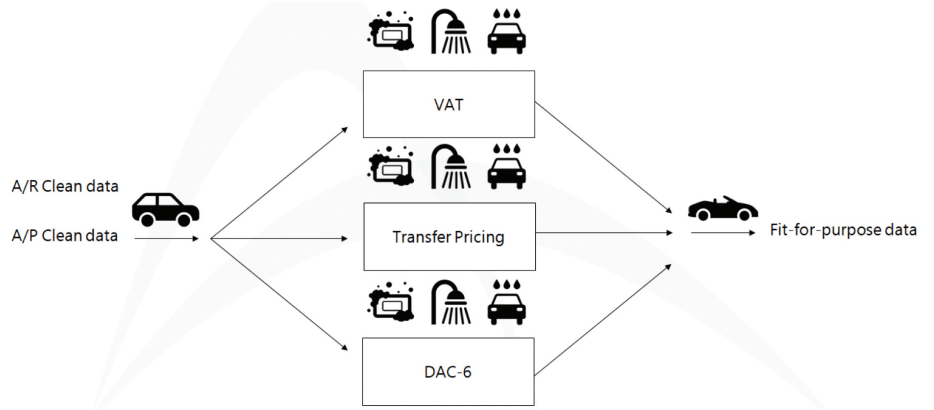
Figure 7.



Source:

Subsequently, the clean data is only structured to its tax purpose, i.e., the data is pushed into the direction of the type of tax where the data needs to be used. The following example (Figure 8) would be either a DAC6 assessment, a VAT report or transfer pricing documentation.

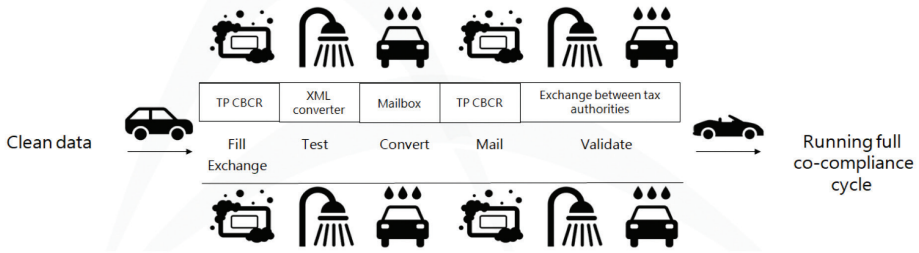
Figure 8.



Source:

Additionally, use cases 3 and 6 can be visualized in more detail. Figure 9 is an indication regarding the process for a CbCR creation, use case 3, through a "Car Wash." This starts at the clean and structured data derived from the previous step and ends at the tax administration.

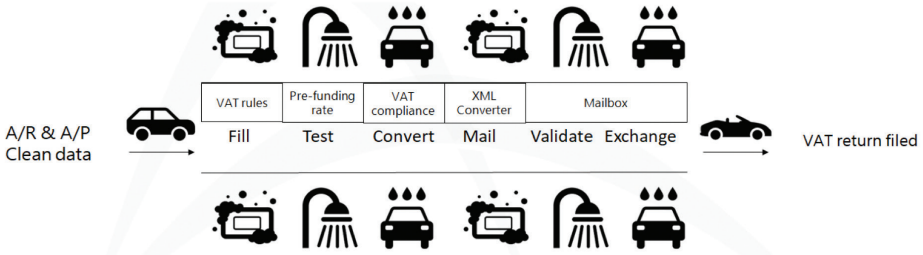
Figure 9.



Source:

Lastly, indicated in Figure 10 is the process of VAT reporting. Again, this starts at the clean and structured data derived from the previous step and ends at the tax administration.

Figure 10.



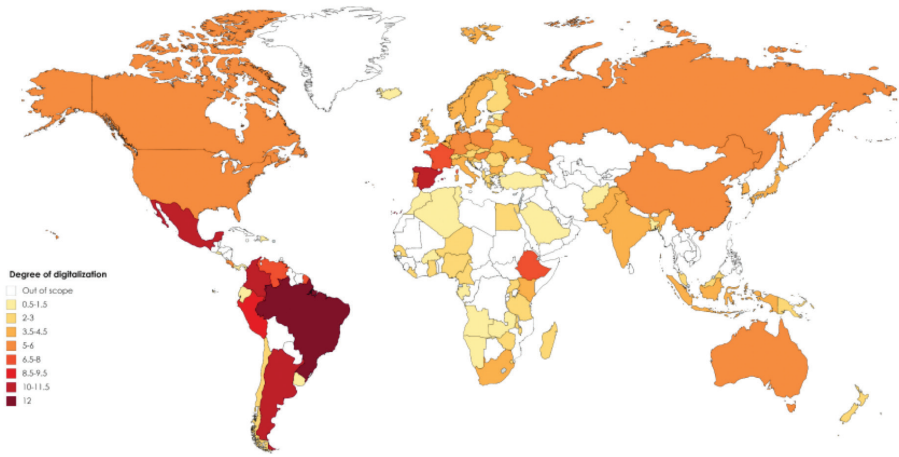
Source:

4. To what degree do Tax Authorities use data and digital tools?

Once tax authorities start using technology tools, the rules governing the interaction between tax authorities and taxpayers are critical for maintaining a good relationship. For example, if a complaint cannot be filed or the bots reporting outliers that corporates have to communicate with do not cover the full spectrum of human interaction, a fundamental breach in communication could happen.

A global heat map prepared by TPA Global (Figure 11), provides the reader an idea of where tax authorities have already introduced a degree of technology regarding the following six areas of taxation: (i) VAT (ii) Wages tax (iii) corporate income tax (iv) personal income tax and (vi) transfer pricing.

Figure 11.



Source: e-Bright 2019, "Tax Technology Course".

Based on this heat map, dating from early 2020, we can conclude that the level of automation by tax authorities in LATAM countries is higher than that displayed in other regions of the world.

In June 2021, China and Australia would require a significant upgrade on the scoring at the moment of writing. In addition, we are aware that the Brazilian tax authorities are training European and Asian tax authorities on their approach to tax technology.

To give an impression of the scoring, please check Table 1.

Table 1.

Country	VAT		Wages Tax		CIT		Personal Income Tax		Customs		Transfer Pricing		Rounded result	Comment
Australia	1	0,5			0,5		0,5					1	3,5	E-Filing of tax returns is possible, not mandatory E-Invoicing is optional, filing a VAT return is mandatory on an turnover of 20 million AUD or above
Brazil	1	1	1	1	1	1	1	1	1	1	1	1	12	• Monthly electronic filing is required from companies where the detailed throughput of goods and services are to be reported to the authorities. • Brazil's digital bookkeeping system, SPED, entails several different reporting arms, among them an annual digital tax accounting bookkeeping report (called ECD) containing information such as the general ledger, all tax accounting information and the tax accounting plan. It also includes an annual income tax report (ECF). • E-filing required on CIT, including both accounting and tax records/books • The e-DBV is an online system where it is possible to declare which items are being brought to Brazil that should be declared, namely those that were acquired abroad and may be subject to tax ation. Marina to find interviews with LATAM Tax Authorities
China	1	0,5	1			1	0,5		1			1	6	• e-Declaration module covers required e-filing functions: online submission and validation of declaration; data transfer to back-office system SIGTAS, receipt to the taxpayer after successful e-filing. • e-Payment module enabling e-user to pay taxes using e-services of the system. • The e-Services portal is the recommended avenue for filing value added tax, corporate income tax, excise tax and personal income tax returns and making payments.
South Africa	0,5				1		0,5		1			1	4	• E-filing required for most large businesses • Taxpayers required to use electronic system to submit monthly tax payments and withholding CbCR must file filed through XML, also MF and LF can be filed through SAR's electronic platform In terms of Government Botice R814 dated 31 July 2009, SARS is legally mandated to enfore the use of Electronic Data Interchange (EDI) for the submissing of certain cargo and goods declarations and declarations electronically to Customs
Spain	1	1	1	1	1	1	0,5	1	0,5	0,5	1	1	10,5	All tax forms are electronically filled in the tax authorities website: See http://www.sunat.gob.pe/empresas.html Customs: Forms are not filled electronically. See https://www.diariodelexportador.com/2018/04/tramites-aduaneros-en-peru-la.html The SII real-time electronic VAT system comes into force in the Basque Country and Navarra Regional Communities on January 1, 2018. MF and LF can be filed electronically, CbCR must be filed through XML
Switzerland	0,5				0,5		0,5		0,5			1	3	Each year persons liable for tax in Switzerland have to complete and submit a tax return. This can be done manually, using special software or online.

Source: e-Bright 2019, "Tax Technology Course".

If we look at the vast amount of data being exchanged between tax authorities, only the tip of the iceberg of data is being used by the receiving government. Thus, it is clear that today, not having sufficient access to AI/machine learning tools taxpayers' vast amount of reporting is not being looked at and not being assessed by tax authorities. This is an apparent breach of the principle of proportionality as outlined under section 2.

For illustration purposes, we refer to the European Court of Auditors (ECA).

The ECA, the guardians of the EU finances, released a report in 2021 on how much data is exchanged between tax authorities in the EU and the actual usage by the receiving EU tax authorities.[13] The EU is clearly in the lead concerning the quantity of data that governments share. However, using the data to support a fair and equitable tax system is far from perfect. According to the ECA, the following challenges are not being met at this moment:

- The EU set up directives to facilitate the exchange of tax-relevant data but forgot to include essential features such as 'cryptocurrencies';[14]

13 ECA 2021, "*Exchanging Tax Information in the EU: Solid Foundation, Cracks in the Implementation*".

14 The DACs give regulations regarding tax and financial matters. In this example, DAC8 would be applicable.

- Based on research on 5 of the 27 EU-countries, it can be concluded that the quality of 'automatic exchange of information' is fairly poor, e.g., the TIN/tax identification number is often not included in the data exchange between governments;
- Not all countries digitally connect their own data with the set received from other EU countries, which means that the receiving EU country is actually using less than 10% of the exchanged, and this seems like a very low number.

On the contrary, the process to exchange data either 'upon request' or 'spontaneously' is working appropriately. The five countries involved were Cyprus, Italy, Netherlands, Poland, and Spain.

- Based on a somewhat outdated —2015 guesstimate— by the EU, the ECA reports between Euro 50-70 billion of missed taxes being levied per year. This would support a more active and structured approach to exchanging tax data between EU member states.

An initial set of conclusions could be:

- Tax authorities subject to public and political pressure increase the level of reporting by corporate and other taxpayers to a point where it stops being valuable data since tax authorities lack the time, tools, and other means to make a reasonable judgement on the vast amounts of data collected;
- A consistent approach throughout the OECD has been started, but the type, level of detail, and ranking of datasets are still not being examined from a holistic perspective. Taxpayers are delivering the same data to comply with different tax reporting obligations, i.e., the duplication of efforts by taxpayers is making a tax compliance cycle a much too complex and costly exercise. Tax authorities would be better off spending their time and money on syncing data architecture with a very defined manual describing how tax data on cross-border transactions would be unified.
- In addition, tax authorities might want to clarify their priorities on which forms and which means of data collection relevant for taxes will be used for digital data architecture, i.e., this will allow corporates to sync their system —through the use of 'a tax car wash' concept— and make their tax compliance cycle more effective and efficient for both authorities and corporates;

Very much in line with the above description, the vast amounts of data should make it evident that tax authorities should drive investments into AI and Machine Learning tools —beyond a 'base tax data configuration' like a 'universal tax audit file'— which contains all data relevant for tax-related processes.

The higher awareness among tax authorities regarding getting ready for a digital future is outlined in the 2020 OECD publication, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*" (see section 2).

5. What is the scope and purpose of the AI and Machine Learning tools?

In order to fully understand the capabilities of AI and how tax authorities can use it, it is important to set out a definition of AI. AI is the learning ability of a machine that increases its intelligence without it being programmed to do so and allows the machine to perform actions based on its knowledge.

This Machine Learning includes algorithms, which allow for processing large volumes of data, screening these details, and gaining insights, such as analysing the data for possible risks. Using AI in taxation is new but fully in sync with how tax authorities organize the tax process.

Therefore, AI can be used in the following ways when looking at tax matters:

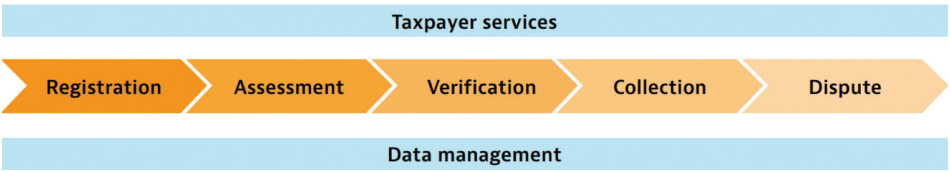
- Data Quality: Analyzing large volumes of data to establish the data's quality and perform risk analyses based on historical patterns. An example is the Chilean tax authority utilizing AI and Machine Learning for cross-checking VAT returns. Working with sets of data to identify risks and opportunities can be seen as "predictive analytics."
- Behavioural insights: Acting as the virtual assistant or chatbots for taxpayers' and tax authorities' benefit, e.g., the co-operation between the Spanish government and Watson (IBM) to provide 'immediate supply of VAT information.' The behavioural issue would be relying on AI to systematize observations and, through inductive reasoning, better understand how taxpayers (and in an audit-like manner) how tax administrations behave, what determines their compliance and collection behaviour. In the People, Process, and Technology approach taken on projects by the authors, the behavioural aspects of the people involved are the cornerstone of running a successful digital transformation.
- Fraud identification: Tracking fraud through the use of big data with AI in countries like Spain, the UK, the US, and Canada, in other words 'profiling and classifying taxpayers'. The latter would open the opportunity for tax authorities to come up with responsive regulations, i.e., defined tone of the response based on the profile and classification of the individual taxpayer, rather than a reactive or even a repressive approach;

- Tax risk assessments: Support in audits, which increases the administration's efficiency by reducing the time spent by the administration for collection and tax investigations, since the government has 'real-time' information available;
- Dynamic knowledge management systems - Automation of administrative functions, e.g., a General Directorate of Cadastre in Spain;
- Collection risk identification - Automation of the collection process, where AI predicts bad debt to prioritize the enforced collection in Finland, Ireland, Singapore, or Sweden;

Based on a 2019 OECD publication on the "Tax Administration 2019 - *Comparative information on OECD and other Advanced and Emerging Economies*", 40 Tax Authorities have embraced AI, ten had implemented a degree of AI, seven were implementing it, and 23 others were planning to do so.

According to the OECD, the typical tax administration processes are the following (Figure 12):

Figure 12.



Source: OECD 2020, "*Tax Administration 3.0: The Digital Transformation of Tax Administrations*", p.10, OECD Paris.

The 2019 OECD publication is the second round of the international survey on revenue administrations (ISORA), where four partners, CIAT, IMF, IOTA, and OECD, worked together. The 58 jurisdictions which contributed represent more than 1.5 million staff and more than EUR 11 trillion of net revenue collected. A few observations from the report are:

- A focus on "compliance by design", i.e. where an integration of accounting systems and tax rules will take place.
- The international co-operation through ICAP and the international exchange of information, e.g. CbCR, are essential.
- The innovative techniques used by the 58 jurisdictions are depicted in Figure 13.

Figure 13.

	Chatbots	Artificial intelligence	Information on website	Tools and calculators on website	Online services	Digital mailbox
Already in place	10	5	58	57	53	52
Implementing	7	8				
Planning to use	23	30				

Source: OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.41, OECD Paris.

- The use of AI and AI-relevant tools may increase rapidly in servicing taxpayers and tax officials. However, a slower pace in using AI decision-making processes is expected, given public concerns.
- Data is sourced from devices, banks, suppliers, customers, unstructured data concerning the taxpayers, government agencies, and international partners, all of which make the use of innovative techniques a "must-have" feature. However, only 35 of the 58 jurisdictions in 2019 were employing data scientists.
- A major concern of change management is that, in the Americas and Europe, a large percentage of the tax staff is older than 54 years.

6. Which data and AI/machine learning tools are being used by which tax authorities?

The number of cases published by tax authorities is limited. The following list provides some examples:

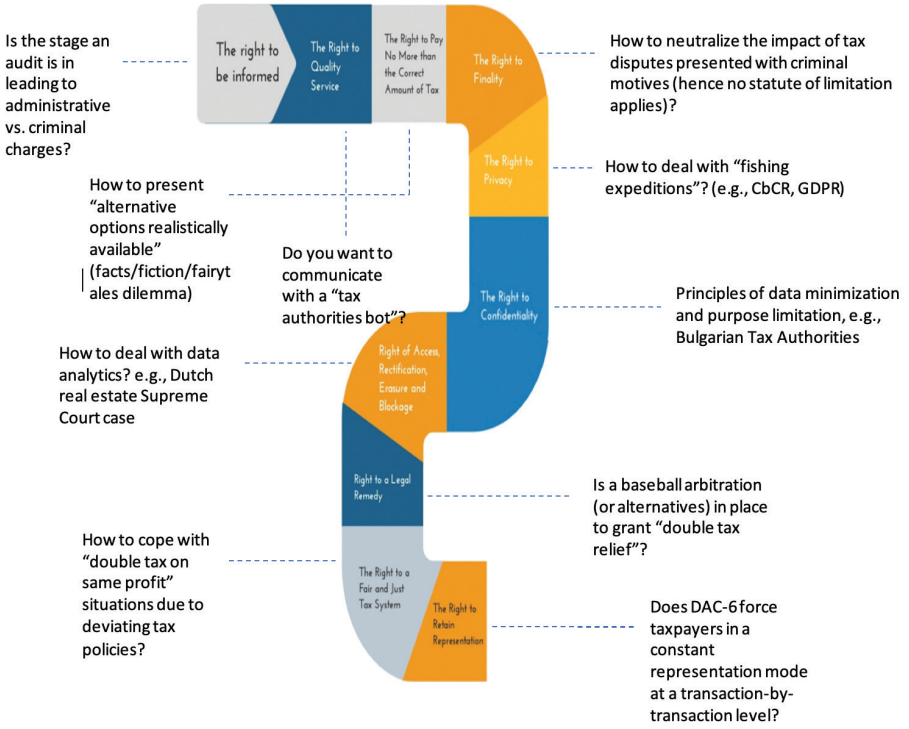
Examples of use by European tax authorities:

- Belgium: four predictive models, have been developed and led to a reduction in tax debt. The so-called Iris model helps risk managing VAT and withholding tax debts and predicts if a person or a company will pay their debt within 14 days after receiving a phone call from the DRM unit. The Pegasus model will predict if they will pay after sending a bailiff. The Hermes model is a payment prediction model predicting whether a person or a company will pay within one year, using the high-risk non-compliant accounts identified in the Delphi model, which in turn predicts the solvency rate for companies, the self-employed, and individuals.[15]

15 OECD 2019, "Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies", p.50.

- Estonia: The ECTB is developing a new e-service for Tax Behavior Information. Data on turnover, number of employees, average salary, tax debts, and shortcomings in complying with tax law, managerial background, and other information will be used to construct several criteria. A tax compliant rating will then be calculated, including the risk of a tax audit, for each legal person registered in Estonia. Taxpayers can share this rating with other service users of the service to assess whether a user's tax affairs are in order, thus helping to incentivize compliant behavior.[16] However, the downside of such a rating system is (1) the creator could bias the system, (2) the system could, when the rating is shared outside the system, the closed-loop of stakeholders damages the reputation of individuals and corporates (wall-of-shame dynamics) and (3) such ratings leave taxpayers being vulnerable without a proper process around taxpayers' rights (the base erosion of citizens rights has started). The image depicts below visualizes the reducing taxpayers' available rights.

Figure 14.



Source: TPA Global, Global Tax Controversy convention

16 OECD 2019, "Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies", p.55.

- Ireland: Robotics have been used for processing tax return exceptions. The additional processing gave rise to several exceptions which required a manual review or update by a tax official. The work processed robotically included creating and validating taxpayer records and relationships based on the data reported in the tax return and applying the correct basis of assessment for those taxpayers.[17] Once Robotics Process Automation (RPA) is well-defined, we see in practice the accuracy of in- and output of data points go up with a factor of 10 to 100. For example, one data cell can easily be validated by such s system against fifteen other complementary sources, which for manual handling is virtually impossible.
- Italy: Following the introduction of e-invoicing requirements in the public subcontracting sector and the supply of fuel, a general B2B and B2C e-invoicing obligation became operational from January 1, 2019, regarding all transactions performed between persons established or resident in Italy. It was estimated that 1.5 billion electronic invoices would be transmitted through the Interchange System in 2019.[18]
- The Netherlands: The NTCA created computer-assisted document processing services based on Natural Language Processing (NLP) technology in order to understand better, correctly route and promptly respond to potentially hundreds of thousands of unstructured messages sent to the NTCA every year. For a single case where 12.000 compliant letters that would have otherwise taken hundreds of man-days to read and respond to, 80% of the letters were directly answered through the use of NLP algorithms, escalating the remaining 20% for human handling. Tailoring and verifying the system's algorithms for this use case cost two data scientists two weeks.[19]
- The Netherlands: In Figure 15, the country, industry, and activity type were the variables. It showed the AI data processing mechanism used by the tax authorities, relying on data received from a sales entity operating within the pharmaceutical industry in Belgium. After the input data has been processed through all three engines, output data is generated. The output data is then used for the final tax and risk assessment.

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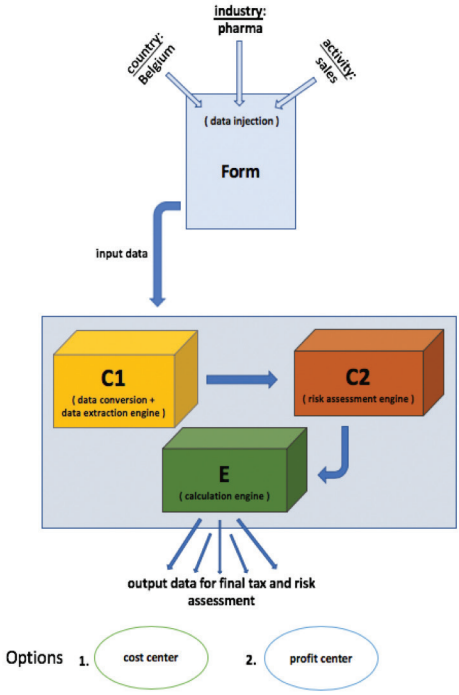
17 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.57.

18 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.52.

19 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.58.

Figure 15.

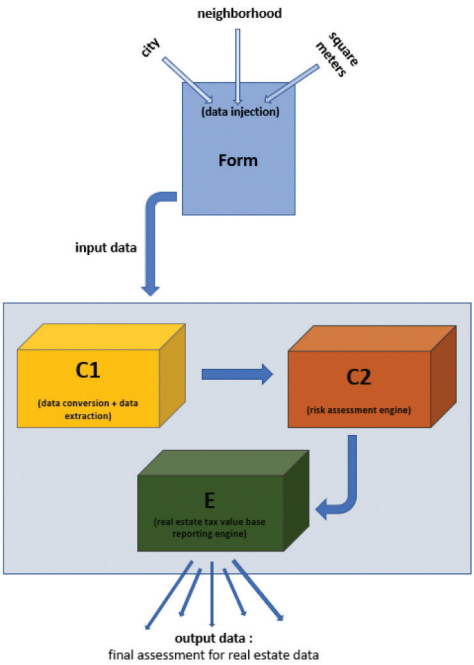


Source: e-Bright 2019, "Tax Technology Course".

- The Netherlands: Another example of this process is a Dutch real estate case[20] where the variables are: the name of the city, the neighborhood where the property was located, and the number of square meters the property has (Figure 16).

20 Supreme Court of The Netherlands (ECLI: NL: HR: 2018: 1315, ECLI: NL: HR: 2018: 1316, ECLI: NL: HR: 2018: 1319 and ECLI: NL: HR: 2018: 1371).

Figure 16.



Source: e-Bright 2019, "*Tax Technology Course*".

- In this particular case, the variables (the square meters, the city, and the neighborhood) were provided to the tax authorities. Then the information was converted through a formula (the three engines) into a real estate tax assessment value. As shown above, C is the engine that did the calculations, and E is the engine that reported the real estate tax value base (on which the tax rate was going to be applied). This led to two types of engines being applied to the data.
- The issue, in this case, was that it was unclear for the taxpayer how exactly the tax authorities arrived at the outcome. The taxpayer contested the tax authorities' measure and required the TA to inform the taxpayer of the exact mechanism applied to his case when real estate value was calculated.
- According to the Dutch Supreme Court, the risk assessment part (C2) does not have to be disclosed by the tax authorities, but the part of the purely mechanical calculations of the input variables being converted and gaining a certain value (C1) have to be disclosed. The reason for

this, as quoted from the decision itself, is that "art. 40 of the WOZ Act does not stand in the way that the base of the decision must be provided to the taxpayer [if requested]. The obligation to make the documents relating to the case available for perusal *does not extend to information that the administrative body itself cannot consult*."[21]

- Norway: The NTA developed a user-friendly digital tax calculation tool for personal taxpayers, integrated on the NTA website. The tool can be used to calculate their expected tax at any time throughout the year.[22]
- Norway: The NTA is developing a new, user-friendly self-assessment tax return for individual taxpayers and businesses together with a new case-processing system, which will be launched in 2021. It aims to simplify business reporting requirements by aligning them to their business development processes and re-using data.[23]
- Russia: The FTS is continuing to develop an Integrated Risk Management system to engage with large business taxpayers to flag risks early so that they can be addressed upfront, minimizing the risk of future disputes. The embedded data mining functions can quickly assess the taxpayers' current operations and predict future non-compliance.[24]
- Spain: The AEAT developed "Hermes," a step further in the path to reach a single system for taxpayers 'risk analysis and the selection of intervention options. The tool leverages the significant amount of taxpayers' data incorporated into the AEAT's database, issuing standardized reports after the risk analysis process. It also optimizes the use of new international sources of information, i.e., automatic exchange of financial account information, CbCR and exchange rulings.[25]
- Spain: AI opens a new horizon for tax administrations to develop strategic approaches to manage and collect data. In Spain, this became a reality with the "Virtual Assistant." It allows the Spanish Tax Agency to provide information to the taxpayers by solving FAQs automatically, thus freeing up tax

21 Supreme Court of The Netherlands (ECLI: NL: HR: 2018: 1315, ECLI: NL: HR: 2018: 1316, ECLI: NL: HR: 2018: 1319 and ECLI: NL: HR: 2018: 1371).

22 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.42.

23 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.58.

24 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.58.

25 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.51.

officials to work on more complex issues. The first stage of the project made sure the Virtual Assistant provided information about a single aspect of VAT: online VAT books. Due to positive results, the scope was widened to the whole breadth of VAT.[26]

Examples of use by tax authorities located outside Europe:

- Australia: Apart from China, AI has also been adopted in Australia, where the Australian Taxation Office (ATO) partnered with Accenture to create and implement an integrated information technology platform by combining ATO's main functions into two systems. One is used for client registration, processing, and accounting (Integrated Core Processing – "ICP") and one for case management, collections, and customer relationship management (Siebel).
- Australia: The creation of online court settings is one of the recent developments that prove that there is the will amongst certain jurisdictions to change the old ways of rendering justice to a more accessible and convenient way that considers the interests of both the government and the citizens. The Ministry of Justice of the UK has already expressed back in 2016 its intention of launching the process of digitization of proceedings by enabling cases to be started and managed electronically and having the courts as the ultimate solution when there is no other alternative.[27]
- Australia: Arbitration, for instance, is already an area of adjudication where AI is being implemented.[28] If it were to be implemented on a larger scale, it would help discharge the system of potential blockages caused by a significant influx of legal cases. Also, it would speed rendering judgment in generic cases, therefore expanding effective access to justice.
    - Australia: Online Alternative Dispute Resolution (OADR) could be defined as "dispute resolution outside the courts, based on the information and communications technology."[29] It certainly comes as a simplification for the judicial system, as parties can now present their supporting documents online and wait for the so-called "expert system"

26 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.173.

27 Ministry of Justice of the United Kingdom and Her Majesty's Courts and Tribunal Service, Transforming Our Justice System, Policy Paper, September 2016, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/553261/joint-vision-statement.pdf.

28 Legg, M., The Future of Dispute Resolution: Online ADR and Online Courts, Australasian Dispute Resolution Journal p. 227-228, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2848097 (accessed on 23.08.2019).

29 Julia Hornle, 'Online Dispute Resolution in the EU and Beyond – Keeping Costs Low or Standards High?' in Christoper Hodges and Astrid Stadler, Resolving Mass Disputes (Edward Elgar 2013) 294.

decision, built by system designers who are gathering the knowledge from experts in the field of law and encoding it into rules. Therefore, the rules are applied by collecting the information needed from the user through interview-type questions, which allow it to give answers based on a decision-tree mechanism.[30]

- Australia: Virtual Assistant Alex responds to requests from clients and supports them when needed. Alex understands conversational language and is essentially a highly sophisticated search engine. In 2019, Alex understood 84.000 question variations, with the amount increasing every day. Since Alex went live, 2.7 million conversations have been held, with an 88% first contact resolution rate.[31]
- Canada: The "auto-fill my return" has been introduced, which helps to fill in parts of the income tax return with data already available to the CRA. For the 2018 tax filing season, Canadians used this auto-fill service over 9.9 million times. During that same tax season, Canadians used ReFILE 123.609 times to submit online adjustments for income tax and benefit returns through certified software.[32]
- Canada: The CRA extracts data from several CRA systems to identify the highest-risk taxpayers in the SME population. Data mining and machine learning algorithms, including cluster analysis, decision trees, neural networks, and deep learning, are used to develop the SME predictive models for income tax and GST.[33]
- China: IDRs will be automatically released to taxpayers in case of any breach of quality on the data collected, data reworked, data completed into forms, addressing the delta between 'expected' versus 'actual' reporting of taxes; e.g., in a recent filing of a transfer pricing document with the SAT—Chinese Tax Authorities— an IDR was released back to the taxpayer within 5 hours of filing, an obvious case of AI application.
- China: In China, with the development of AI, more standardized policies have emerged, like the "New Generation Artificial Intelligence Development

30 Legg, M., The Future of Dispute Resolution: Online ADR and Online Courts, Australasian Dispute Resolution Journal p. 3, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2848097 (accessed on 23.08.2019).

31 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.42.

32 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.42.

33 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.50.

Plan." AI is a new and strategic technology that leads the future, enhances the country's competitiveness, and maintains national security, undoubtedly positive influences on the development of AI. China has begun to promote AI in taxation. In Guangdong, a tax robot has been introduced. It has completed a total of 12,000 times of cases similar to human-computer transactions in reality for individual, industrial, and commercial taxpayers. Its contribution accounts for 54.91% of regular business, thereby halving the workload and reducing the burden on civil servants.

- China: In the Dianbai District of Maoming City, Guangdong Province, the Taxation Bureau Office has introduced China's first "face-to-face tax" intelligent robot. It can collect taxpayer information, such as a photograph of their face, ID card, and contact number through scanners duringdate submission; once this information is authenticated, the taxpayer's identity can be verified, thus improving efficiency. Meanwhile, the "taxation bureau of Shanghai Fengxian District" operates the "Fengxian Tax" WeChat public forum and mobile phone tax software, enabling taxpayers to check tax-related information concerning, for example, policy updates, tax processes, and information disclosure.
- China: The STA had introduced a cloud-based big data platform, collecting four main types of core business data, being individual income tax administration, VAT invoices, export tax rebates, and external and historical data. The number of database tables from which the data is applied to 264 data models to manage risk is over 200.000.[34]
- Chile: The Chilean tax authority has been using AI and Machine Learning for cross-checking VAT returns. Working with sets of data to identify risks and opportunities can be seen as "predictive analytics."
- Kenya: The KRA implemented a CRM solution to achieve full electronic customer service and enhance operational efficiency. The platform allows for inquiries, service requests, complaints, and compliments to be lodged and tracked from the point of entry into the system to closure, thus providing a single view of taxpayers' interactions with the KRA.[35]
- Singapore: The IRAS launched an APU marketplace in 2017, giving third-party developers direct access to a suite of API services integrated into the

34 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.50.

35 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.42.

taxpayers' natural systems. Its first use case allowed employers to submit payroll information to the IRA with a single click on their payroll software.[36]

- Singapore: The mantra of the IRAS is "No Need for service is the Best Service," defining the ultimate goal of enabling taxpayers to meet their tax obligations without requiring their involvement. The final goal is to provide taxpayers with a taxpaying environment that is fuss-free and low in compliance cost.[37]
- Singapore: Virtual Assistant Ask Jamie is offered as a digital service across government agencies in Singapore. Jamie leverages from its NLP engine to understand the questions typed by the public and respond appropriately. The IRAS has enhanced Ask Jamie with APIs developed by the IRAS to allow taxpayers to authenticate using SingPass (a national 2-factor authentication mechanism) to handle personalized queries relating to tax matters. In FY2018, ASK Jamie handled around 630.000 inquiries from taxpayers.[38]
- Singapore: To facilitate co-creating with the software development community on digital tax solutions, IRAS launched the Application Programming Interface Marketplace, a community platform for software developers to access IRAS' services or data for the creation of tax-related services. API Marketplace allows integration of tax seamlessly into the natural systems of taxpayers. Examples of such services are the direct transmission of GST returns and transactions listings, seamless ACRA (Singapore's corporate register), and IRAS filing for small businesses using XBRL.[39]
- United States: The IRS is developing a data-driven risk assessment product that uses machine learning to identify high, medium, and low-risk potential among the entire large business and international corporate return population. The Data Science Team used a Bayasian analytical model to instruct the product on the type of return currently used in the relevant taxpayer groups.[40]

The 2019 OECD publication on the "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*" provides

36 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.43.

37 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.168.

38 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.168.

39 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.170.

40 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies*", p.51.

an example of how the Dutch Tax Authority relied on a public-private initiative, where:[41]

- The focus was to create an automatic profit tax return using "compliance by design" standards for freelancers.
- Through standard accounting schedule/reference ledger schedule, around 80 points of data, out of a total of 3.000, were selected and considered relevant for freelancers.
- During a 2018 pilot, a sample of 300 freelancers participated in filing their returns using the accounting schedule and pay their VAT due via the online payment system of iDeal.
- During a 2019 pilot, approximately 30 freelancers were invited to have their data entered into the accounting schedule, which created an automatic tax return and filed it.

The above examples illustrates the need for more public-private initiatives, i.e. only if tax authorities and taxpayers see all the benefits for both parties will this enhances action to digitally streamline their relationship.

7. What about the AI landscape for tax in Europe today?

Currently, AI and AI-related techniques seem to be underused in Europe, something that seems like a missed opportunity from a tax authority's perspective.

Once corporates embrace the the "compliance by design" ethos, this will integrate the corporate accounting and its natural systems with the tax compliance services facilitated by tax administrations.

The move to a co-compliance approach where taxpayers and tax authorities exchange data has been highlighted in this article and section 6, where the minimum level of facilitation by the tax authorities should include:

- Their digital identity;
- The touchpoints offered to taxpayers;
- The data management and data standards used;
- The tax rule management and applications prescribed;

41 OECD 2019, "*Tax Administration 2019 – Comparative Information on OECD and Other Advanced and Emerging Economies".*

- The new skill sets to train; and
- What governance frameworks to set up.

The list of benefits for both stakeholders, the tax authorities and taxpayers, is quite convincing:

- Corporates share data with tax authorities, who, through "compliance by design," deal with all tax-related compliance.
- AI offers tax authorities real-time insight into the completeness and accuracy of tax-relevant data.
- Corporates get (almost) real-time security in tax positions, i.e., can release today's provisions reported on the uncertain tax positions. However, this assumes a competent and willing tax authority in this process. In case of tax authorities —despite having received all information and data from taxpayers— delay in or refuse to provide certainty, particularly in areas that it sees as strategic, borderline, or where there are political and reputational considerations involved, could undermine a proper treatment and judgment on the case at hand.
- Tax authorities can use secure and trusted vendors for tax-driven (middleware-base) solutions to accelerate the roll-out on the "Tax Made Digital" world."
- Almost half of the disputes between parties can be resolved by using AI between tax authorities with limited corporate involvement. A formal process for more complex cases is given by ICAP, which obviously will require human intelligence to resolve the more complex components in most cases.

In summary, the article has been illustrative on how AI for tax authorities will play a crucial role in its future business model, including the following main observations:

- Most tax authorities have automated less than 10% of their value chain;
- Co-compliance model between the taxpayer and the tax authority requires a better synchronization between the needs of the tax authorities for data and the efficiency with which corporates can collect, clean, and deliver such data.
- The 2030 visualization in the OECD publication '*Tax Administration 3.0 - The Digital Transformation of Tax Administration*, is the best illustration so far of how the interplay and communication between taxpayers and tax authorities would be fully technology-supported.

- The absence of an OECD and UN standard for data architecture and data management by governments, including the communication standards with taxpayers (i.e., XML standards), creates a significant delay in the whole digital transformation process.
- The People, Process, and Technology approach inspires people, determines tax workflows, and starts using technology that facilitates the people and processes. This approach defines in practice the success rate on a digital transformation.
- The illustration of a Car Wash for Tax drives affordable tax technology solutions for all players in the market.
- Various corporates, governments, and universities are building use cases — of which a variety is displayed in this article— to accelerate this digital transformation process of the tax world.

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Appendix 1. Tax Administrations Raise the Playing Field with Technological Solutions[42]

10. Tax administrations raise the playing field with technological solutions

10.1 Are tax administrations paving the path towards digitalization?

Tax administrations worldwide are increasingly relying on digital technologies for data gathering, the exchange of information, and analytics. Digital systems that are already in place can even provide real-time tax collections, reconciliations, and assessments. Furthermore, data exchange among tax authorities is becoming an automated process that can provide tax authorities with a holistic view of multinationals to help them conduct audits and investigations, creating a more transparent world.

Big data, blockchain, robotics, and business intelligence are not futuristic ideas from the world of science fiction but are part of our current world and are happening right now. Several revenue services are precursors to an automated and intelligent administration. They are already developing and using tools that can, for example, link taxpayer's data held internally with information from external sources, such as media reports and financial transactions in order to develop a broader taxpayer 'X-Ray' picture.

10.2 How far can Tax Authorities' systems go?

Imagine a scenario in which a high-tech solution can handle the annual workload of over 350 tax inspectors in only three months. In Hungary, there has been an increase in VAT revenue of 10-23% in specific sectors, using online cash registers, time series analysis of turnover, and technical data implemented by

42 e-Bright 2019, "*How Tax Technology Changes Your World*".

the National Tax and Customs Administration (NTCA). Automation is a trend that already shows results, and no one wants to lose any more revenue. The game is simple, using high-tech tools to excel in real-time tax compliance and collection.

Another leading example is the Australian Taxation Office (ATO), which introduced the 'Smarter Data Program'. The aim is to use data analytics to improve decisions, services, and compliance. Similarly, the Irish Revenue authority relies on data analytics and risk assessment to identify and cross-check non-compliant behaviours. The focus is on maximizing the use of data and deploying analytics to identify the incidence, scale, and materiality of non-compliance and to target resources effectively to overcome those risks.

Additionally, Japan's National Tax Agency maintains its own electronic information system, called the KSK system ('Kokuzei Sogo Kanri'), which links all Regional Taxation Bureaus and Tax Offices and centralizes more than 300 million information returns each year. The KSK system also systematically combines the data, enabling central management of national tax claims and liabilities. Moreover, the system allows information to be extracted through directed queries and shared with other jurisdictions. The Director of the International Operations Division of Japan's Tax Agency reports that many requests from foreign jurisdictions have been responded to through the provision of information maintained in the KSK system.

10.3 Brazil's unique system - OECD BEPS 'best practice'

Brazil's Federal Revenue (RFB) introduced a digital system in 2007 that collects accounting, e-invoicing, and tax records. All levels of taxation in Brazil (federal, state, and municipal administrations) are integrated into the Public Digital Bookkeeping (SPED) system, and tax administrations can access and cross-check real-time data. It unifies reception, validation, storage, and authentication of electronic documents, and it keeps a trail record of any modifications made during the filing process.

The standard 'XML' file first introduced by the Brazilian SPED system inspired the 'SAF-T' (Standard Audit File for Tax) implemented by the Portuguese Tax Administration in Europe, which later spread to various EU member states.

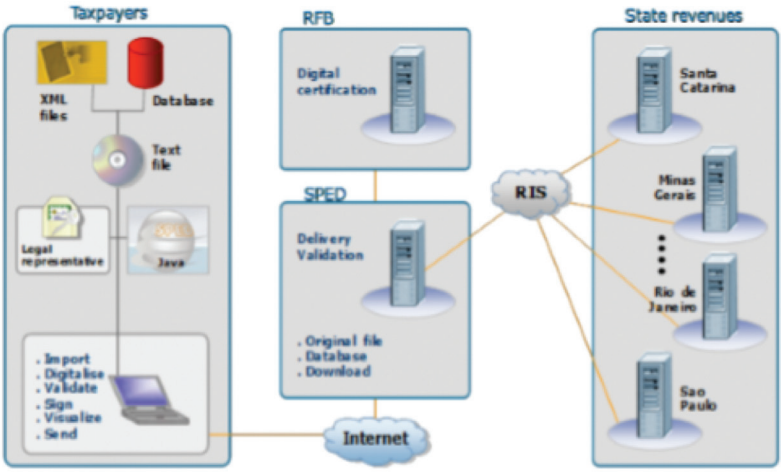
10.4 Is it the end of tax returns? - Moving towards real-time data

The Brazilian SPED system aims to move towards 'natural systems' models that integrate tax compliance into natural business processes and real-time trans-

actions. The system is comprised of three major sub-projects, divided into 12 modules.

Digital Tax Bookkeeping - EFD

The EFD is an electronic file comprised of a set of tax bookkeeping documents, such as Value-Added Tax and Excise Tax (EFD ICMS IPI), Payroll (eSocial and Reinf), Social Contributions (EFD Contribuições), Transfer Pricing, CBCR and Corporate Taxes (ECF) returns and documentation, according to a pre-defined layout.

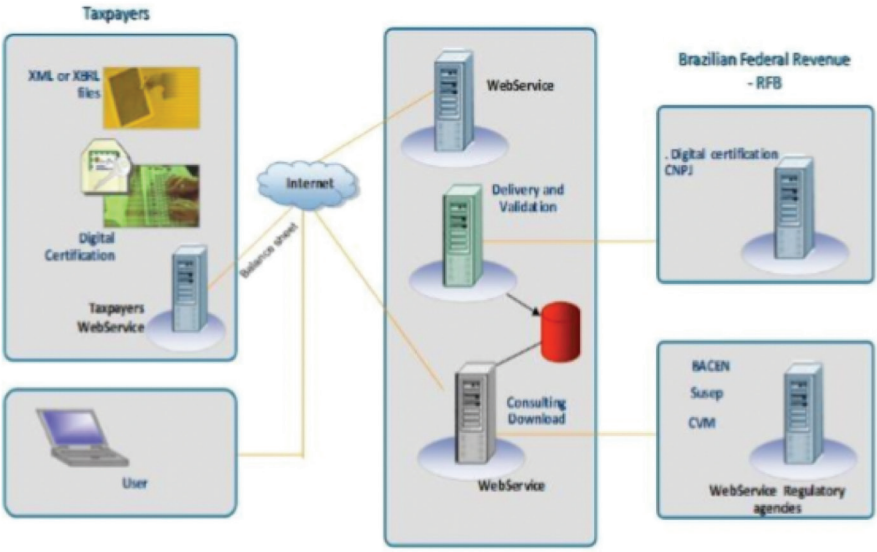


Source: Brazilian Federal Revenue

Digital Accounting Bookkeeping - ECD

The ECD is an electronic file comprised of accounting bookkeeping documents, such as general ledgers and sub-ledgers, journal registers and supporting records, and daily trial balances and balance sheets. The digital file aims to provide tax administrations with full disclosure of financial statements and accounting records, including filing bills of materials (so-called 'Block K'). Taxpayers must generate a single file from their accounting systems according to a pre-defined layout.

This file must be digitally signed by the company's legal representatives and then submitted to the SPED system, whose operating procedures are demonstrated below:

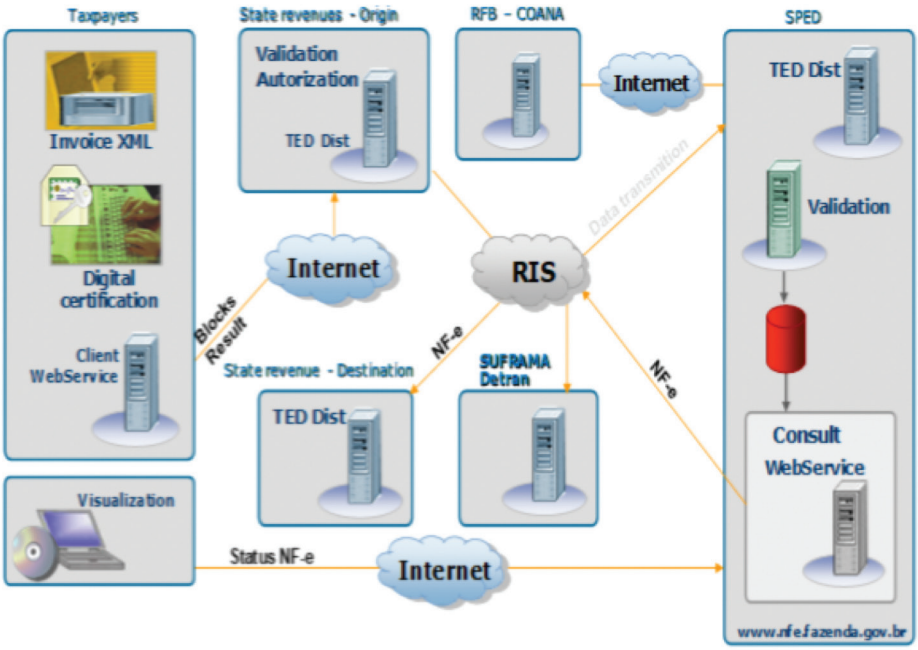


Source: Brazilian Federal Revenue

Electronic Invoices (NF-e, NFS-e and CT-e)

E-invoicing is an electronic filing method for invoicing sales and purchases of products, services, and bills of lading documentation and controls. An electronic file containing the tax information of commercial operations must be digitally signed. This electronic invoicing system is filed online on the SPED system. The RFB prevalidates the file and gives a receiving protocol (Use Authorization). This means that goods cannot be transported or delivered without this preliminary authorization protocol: in other words, non-compliance with the filing can stop companies' core operations.

The NF-e is also submitted to the Federal Revenue of Brazil, the national database of all the NF-e's (National Environment) filed. The RFB's system (National Environment) allows those who hold the key access to the electronic document to check the information online, as is explained below:



Source: Brazilian Federal Revenue

The success of the SPED system has shown a clear disruptive movement away from the old models of tax returns towards a new paradigm of real-time data analytics. The idea of reinventing tax compliance in line with real-time analysis has led to numerous initiatives worldwide, such as the International Compliance Assurance Programme (ICAP) and the 'Intelligent Tax' Innovation Laboratory in China, among others.

10.5 Are you ready?

Tax administrations are stepping up their game with massive digitalization, now collecting cash faster through electronic systems, automation, and data analytics. Considering this, companies should adapt quickly to get an equal footing in the world of new digital technologies, not only mitigate their tax positions but, more importantly, to efficiently control their global business so they can be ready to make real-time decisions when necessary.