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Tax Disruption Report 2021/2022

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Content

Foreword

By now, in the midst of the digital revolution, it should be clear that the relationship between the tax function and the tax authority will significantly change. What's less clear is how exactly this relationship will change.

Technological advances at tax administrations and in the corresponding legal frameworks are increasingly becoming the decisive aspects in this relationship. This means that the tax function of the future will need to focus primarily on external factors. Its dependence on these external factors makes the tax function particularly prone to external disruption. That is the reason we coined the term **'tax disruption'**.[1] As result, digitally transforming a tax function is quite different than transforming other back-office functions. It's open-heart surgery – transforming within a (quickly) transforming environment.

As if this weren't challenging enough, there's another circumstance that makes it even trickier: unfortunately, the digital transformation process at tax administrations mostly happens in the dark. So it's difficult for tax functions to take the changing environment into account.

This report intends to change that and shed light on what the tax authorities are up to. We seek to answer the question of how the tax authorities will change in the digital age. Only if they are armed with this knowledge will corporate taxpayers be able to explore how they need to adapt.

We start with the big picture. We reflect on how the tax authorities are embedded in the digital transformation of the government sector and how they depend on other global developments. From there, we draw nearer and have a look at major developments relating to tax administrations' digital journey in 2021/22. Finally, we zoom in on the country level to monitor the specific use of digital technologies by 27 tax administrations around the world. For ease of use, each country section can be read independently. If you are eager right now to have a good feel of what's state of the art in data analytics, jump straight to Mexico (p. 54) or Australia (p. 45). If you want to know what's cutting edge in terms of automating a tax authority's task, check out the Netherlands (p. 38). China (p. 46) would be a good starting point regarding comprehensive data collecting and exchange efforts. And if you want to know what's possible overall, just look at Brazil (p. 51).

We hope that this report will lead to new insights. It should deepen understanding of how the world of tax is changing and help tax functions steer successfully through an ever-more rapidly changing environment.

We also hope to encourage a debate about the current developments – both at state and corporate level – and to provide valuable input for further discussions.

Executive summary

This report begins with a bird's eye view. In 2019, we published a book with the title 'What happens when the taxman gets superpowers? – A guide to the digital world of tax'.[2] At the time of publication, the whole topic was still in its infancy. In that book, we made twelve crucial predictions about the future of the whole tax environment. Since then a lot has happened. That's the reason why we decided to revisit our predictions of 2019. In the first part of the present report we want to check which predictions are still valid and which ones may have to be adapted. For this edition we have picked four predictions about the future of the tax authorities we judge to be worth discussing in more detail again:

1. **Tax authorities will be the first civil government bodies to embrace digitalisation on a large scale.**

- **Still valid?** Yes, if the COVID-19 pandemic is pushed further out of the limelight and soaring public debt – as a consequence of extensive COVID aid payments, rising military spending and the significant costs of dealing with the climate crisis and demographic change – comes to the fore (again).

  The last two years put the topic of digitalisation on top of most government agendas. Public health care and 'smart mobility' in particular emerged as hot trends. However, stricter enforcement of tax compliance remains one of the easiest ways for a government to raise revenue, as it exploits already existing, but hidden potential. Hence, in the tightening competition for investment resources, tax authorities can offer a direct return on investment to justify significant expenditures on digital technologies. Compared with other government agencies, this advantage becomes more unbeatable the more the pockets empty.

2. **Digitally transforming tax authorities means that they will significantly expand the volume of data they collect, as well as the depth, breadth and velocity of their analysis capabilities. They will increasingly exchange data and derive information from third party data sources.**

- **Still valid?** Yes, if the tax authorities overcome the shortage of skills and organisational flaws.

  The more that tax authorities are under pressure to raise revenue, the more they will rely on the newly emerged internal and external data streams unlocked by the pandemic to improve their efficiency and productivity in order to close the 'tax gap'. The resulting large appetite for data can already be observed in changes in legislation. Still, in fierce global competition for skilled employees, the public sector faces the disadvantage of paying lower wages. On the other hand, this might be counterbalanced in times of insecurity, when many people start to look for safe jobs. At the same time, we can observe many government efforts to re-invent the way they work, to become more agile and attract tech-savvy talent.

3. **We are about to enter an 'upward information spiral': more digital data leads to more transparency, which in turn leads to even more data generation and more transparency and so on (resulting in increasing control possibilities for tax authorities).**

- **Still valid?** Probably yes, but the final outcome is not so clear.

  We started heading down that road a couple of years ago, when we were still at the beginning of the spiral. Digital technologies and data streams have opened up completely new data sources. Simultaneously, we have seen the emergence of many new data disclosure obligations. In addition, tax has increasingly become integrated within the broader sustainability (ESG) landscape, establishing (voluntary) tax transparency as a new trend. During the COVID-19 pandemic, privacy concerns were even more on the retreat than they were before. Nevertheless, strong counterforces have also started to pool their resources. On the company side of things, a variety of legal tools are being positioned as defence measures against a further increase in transparency towards both the government and the public. In a development originating in the Anglo-Saxon world, trade secrets and intellectual property rights are increasingly being utilised to safeguard all kinds of internal data.

4. **All tax authorities around the world will be affected sooner or later, yet they progress in different ways at different speeds.**

- **Still valid?** Yes, but we cannot observe any regularities in the process yet. Nor does a best practice approach seem to be crystallising. This brings us directly to the next two parts of the report.

In Part 2, we'll have a closer look at major developments regarding tax administrations' journey from digitisation to digital transformation in 2021/22. In the last two years, the gap between the various tax authorities has grown. Indeed, while a large number of tax administrations have, for example, already moved to digital tax returns, a minority continue to operate with a paper-based format. To a certain extent, this gap may be explained by the price tax administrations are able and willing to pay for their digital transformation. On average, tax administrations spend around ten percent of their operating budget on upgrading digital technologies. However, there are also tax administrations, such as those in Denmark and Singapore, that already spend more than a quarter of their operating budget on digital technologies and processes.

The digital technologies that tax administrations focus on vary considerably. Application programming interfaces (APIs) and data analysis tools are particularly popular and are used by more than 100 tax administrations around the world. Many tax administrations, however, see the future in the advanced use of cloud computing, artificial intelligence and digital ledger technology.

The digital journey of tax administrations has undoubtably been accompanied by novel and intensified efforts to exchange information and data at the global, regional and national level. The Organisation for Economic Co-operation and Development, for instance, employs an array of digital technologies to track the activities of the world's largest 500 multinational enterprises across countries on a daily basis. Beyond the work of international organisations, tax administrations rely on cross-regional and regional forums such as the Joint Chiefs of Global Tax Enforcement and the Financial and/or Criminal Investigations Network to exchange information and data. The European Union supports its member tax administrations with the creation and exchange of information and expertise, and explicitly encourages the use of artificial intelligence, blockchain technology and data analytics. Fiscalis, the programme behind these efforts, has only recently received a budget increase of 20%.

In Part 3, we zoom in closer on the specific use of digital technologies by 27 tax administrations around the world. The examples provided are not aimed to be exhaustive and complete, but rather illustrative of the diverse facets of tax administrations' digital journey. In our view, tax authorities often seem to follow the skills and ideas of their current talent pool or the lead of frontrunners in neighbouring countries. They tend to pursue a bottom-up approach rather than a clear top-down strategy, with more trial-and-error or 'generate and test' than other problem-solving strategies. This results in very complex and varied digital evolution.

Latin America has really pushed the use of e-invoicing, while tax administrations in Hungary, Italy and Spain are leading the way in the implementation of (real-time) invoicing systems in Europe. Poland has established a novel split payment system, and the Netherlands and Norway are pushing the boundaries of natural language processing. Tax administrations in Belgium and Latvia are cooperating closely with academic researchers to explore the benefits of behavioural insight analysis and nudging, while Australia and the United Kingdom are employing sophisticated network analysis to examine huge databases compiled from a myriad of sources. The tax administration of China uses digital technologies to connect with other tax administrations along the Belt and Road Initiative, while Brazil advocates the use of blockchain to facilitate trade among Mercosur countries. India has implemented a digital identification system for taxpayers based on biometric information. The tax administration of New Zealand follows a quite unique commercial off-the-shelf approach to its digital transformation, while Singapore has established a marketplace for application programming interface (API) solutions. South Korea's tax administration has recently opened a big data centre, while Mexico operates in a hybrid cloud environment. The tax administrations of Armenia and Canada employ digital technologies mainly to detect fraud, while Estonia and Finland focus on the use of digital technologies for intra-government communication and process improvements. Kenya's tax administration employs digital technologies to extract tax-related information from social networks, whereas the Russian Federation uses digital technologies mainly to track and trace goods from production to use.

At this stage, our impression is that the principal driver of the development is neither the availability of technology nor technological skills. Today, technology is accessible in almost all countries in the world, and it's also possible to attract enough talent anywhere with the right incentives. We believe that the velocity and direction of a tax administration's development depend more on institutional settings and the political and societal situation of a country. However, the view is still blurred; decisive factors are not so clear yet. For the time being, there is no best practice approach visible. No 'winner strategy' promising to create the most revenue for a government has surfaced yet. But please take a more detailed look for yourself at what the tax authorities are up to and what we think of what's going on!

Part 1

The big picture: tax amidst the Fourth Industrial Revolution

I Introduction

The Fourth Industrial Revolution – the digital transformation of the society by the means of artificial intelligence, advanced robotics, the internet of things, increased interconnectivity and so on – has a firm grip on the world in the 21st century. And tax is increasingly becoming an integral part of this development. In 2019, we published a book with the title 'What happens when the taxman gets superpowers? – A guide to the digital world of tax'.[3] This book takes a holistic view of the challenging digital transformation of tax functions. Tax functions are less an island than other corporate functions; they depend heavily on the approaches and actions of the tax authorities. A tax function has to be very aware of external developments outside the company, as taxes are a crucial factor when it comes to financing the upcoming challenges of many countries, especially those with ageing societies and high public debt.

When we published the book, the whole topic was still in its infancy. In it we made twelve crucial predictions intended to outline the mechanisms behind the developments and help anticipate future scenarios.

This was a challenging task, because dealing with the future always means entering the realm of uncertainty. We have to rely on assumptions, especially for the more distant future. A lot has happened since 2019. We witnessed a health crisis unlike any that had occurred in many, many years; we had to learn how vulnerable our supply chains are; we were surprised to suddenly find digital transformation on top of most government's agendas; we observed public debt rising to unexpected highs; we even saw a war breaking out in Europe – to name just a few. All these developments have left their mark on the evolution of the world of tax.

That's the reason why we decided to revisit our predictions of 2019. We want to re-evaluate them today – with a fresh view.

II Overview: the 12 predictions

We want to check which of the predictions we made 2019 are still valid and which may have to be adapted. We made six predictions about digitally transforming tax authorities and the future of the broader environment in which tax functions operate. We also made six predictions about the impact of digital tax authorities on the future of tax functions.

Six predictions about digitally transforming tax authorities and the future of the tax environment

1. **Tax authorities will be the first civil government bodies to embrace digitalisation on a large scale.**
2. **Digitally transforming tax authorities means that they will significantly expand the volume of data they collect, as well as the depth, breadth and velocity of their analysis capabilities. They will increasingly exchange data and derive information from third party data sources.**
3. **We are about to enter an 'upward information spiral': more digital data leads to more transparency, which in turn leads to even more data generation and more transparency and so on (resulting in increasing control possibilities for tax authorities).**
4. **All tax authorities around the world will be affected sooner or later, yet they progress in different ways at different speeds.**
5. Tax authorities' digital progress is mostly invisible, but business will feel the impact suddenly and heavily once key technologies are rolled out.
6. As a result of their new digital capabilities, many tax administrations will soon confront companies with significantly more inquiries and probing questions.

Six predictions about the impact of digital tax authorities on the future of tax functions

1. The evolution of tax authorities will result in novel financial and reputational risks for companies and a more urgent need to avoid surprises.
2. The digital transformation of an organisation's tax function will be different from the digital transformation of other functions.
3. Companies need to make sure that they're able to control their internal and external data flows and paint a coherent picture of business activity to avoid novel costs of incoherence.
4. Timing will be a crucial factor in a company's efforts to update its tax function.
5. Companies will need a 'Tax CDO' sooner or later.
6. In the long run there will be less room for manoeuvre for a tax function to steer through a digital world of tax.

- **We have picked four predictions from the first category worth discussing more in detail subsequently in this report.** We have saved the other predictions for a sequel to this report. We'd already like to invite you to re-join us for more discussions in the next report!

III Four predictions in detail

1 Tax authorities will be the first civil government bodies to embrace digitalisation on a large scale.

In detail:
In the wake of the Global Financial Crisis of 2007-08 and amid rising pressure to secure revenues, we observed tax authorities in many countries embarking on significant investment projects to develop new digital capabilities.

In addition, we pointed out that it will be a lot easier for tax administrations than for other government bodies to employ digital technologies. This applies both to their mindset and to the subject of their work.[4]

These special prerequisites, in combination with the fact that taxation is so crucial for a country and also very important for the success of individual politicians, provides a strong incentive to put additional pressure on the tax authorities to employ digital technologies more rapidly than other state agencies to improve their performance and yield more revenue.

▶ Still valid?

Yes, if the COVID-19 pandemic is pushed further out of the limelight and soaring public debt – as a consequence of extensive COVID aid payments, rising military expenditures, and the significant costs of dealing with the climate crisis and demographic change – come to the fore (again).

In the last two years we have experienced the global COVID-19 pandemic and its vast impact on many aspects of our lives. As one of the many results, we have seen more funds being allocated to the health sector. We therefore want to examine whether health departments might outpace tax administrations as digital frontrunners.

Many health departments have advanced since 2020. They have abandoned analogue information collection by fax or paper and have built new data processing capabilities to monitor the pandemic. In many countries, we can see dashboards presenting the current status in near real time, often down to local level. [5] We have witnessed the development and spread of COVID-19 apps for digital contact tracing. Some countries decided to also track the mobile phones of their citizens to enforce quarantine, [6] while others started to hand out tracking devices like wristbands for the same reason.[7] Some health departments started to work closely with law enforcement agencies.

Germany, for example, concluded the Pact for the Public Health Service on 29 September 2020. Over the course of six years, EUR 4 billion are to go to more staff and digitalisation, including a new digital central reporting and information system, a modern IT infrastructure and new software applications (Digital Health Office 2025). [8] Of course, at first glance, an investment of EUR 4 billion looks remarkable. Considering this figure on annual basis and deducting the costs of at least 4,000 FTE of medical and administrative personnel included in the Pact, however, the remaining investment in digitalisation doesn't look that impressive any more[9] – especially not in relation to other e-government investments. For example, the additional budget for the implementation of the German Online Access Law alone is EUR 1.4 billion in 2021 and EUR 1.9 billion in 2022.[10] It also doesn't look so impressive compared with investments in the tax field. In 2018, the German state of Baden-Württemberg invested EUR 3,125 million solely in a pilot tax office called Tax Office of the Future (keep in mind that in total there are more than 500 tax offices in Germany).[11] In its recent Capital Investment Plan, the Internal Revenue Service (IRS) of the United States increased its budget for modernising its operations for 2022 by more than seventeen times compared with 2020.[12]

In addition, we assume that the high investments in the health sector are likely to be more short term in nature. By now, mass vaccination programmes have been rolled out in many parts of the world. With increasing immunisation of the population over the course of 2022, the fight against COVID-19 will (hopefully) become less and less important. We have concluded that the chances are good that the pandemic will likely be pushed out of the limelight again. Furthermore, the ability to process and analyse health information may also be limited, as the acceptance of data collection in this very personal sphere may quickly drop as the immediate health risk declines and privacy concerns rise again. On the other hand, in ageing societies the health care sector will continuously grow more important in the long run, leaving us with the need to monitor this development closely.

However, the (difficult) overall economic situation will probably be brought into focus again soon. Many governments all around the world are facing the same challenges: soaring public debt and growing budget

deficits. Over the course of the last two years, many countries have lost significant parts of their tax income as a consequence of economic turmoil caused by lockdown measures. The UN agency International Labour Organisation (ILO) estimates that the global labour income losses amount to USD 3.5 trillion in the first three quarters of 2020 alone.[13] The consequences for state revenues are clear. The labour income losses directly translate into income taxes losses (in addition to other tax losses, of course). Furthermore, many governments opted for strong income support measures and large-scale fiscal stimulus packages. As result we have witnessed vast budget deficits and rising public debt to close the gap in the last two years.

As if the COVID-crisis weren't enough, another crisis with global impact unfolded in early 2022: the Russian invasion of Ukraine. In the wake of the war, many governments, especially in European countries from Sweden to Spain, but also in other parts of the world, are boosting their military spend, taking another bite out of their budget. Germany, for example, decided to supply an additional EUR 100 billion for military investments in 2022 alone and to permanently increase its spending to more than 2% of its economic output in an historic policy shift. [14] We might even observe the beginning of a new arms race. In addition, the unfolding of a strict sanctions regime against a country as rich in resources as Russia will have perceptible long-term consequences for the global economy of which we are not yet fully aware. Initial signs, such as energy costs going through the roof, indicate that economic growth will be dampened once again, with a negative impact on tax income.

Hand in hand with this development, acceptance of investment in sustainable energy is growing. While some sections of the population have already embraced investments in green power as a means of dealing with the climate crises, other sections jumped on the bandwagon only recently in an attempt to gain independence in geopolitical terms. However, rebuilding the energy sector is very expensive and will further burden the budget of many governments.

We consider ourselves optimists, expecting most countries to successfully deal with these issues. Nevertheless, in our opinion the ascent back to solid state finances will likely be long-term rather than short-term. The main obstacle to a quick recovery might not even be the debt, but the expected persistent budget deficit and the lack of economic growth.

What options do the governments have to deal with continuous budget deficits and high public debt?

Of course, a country can always choose not to pay back the debt. As we all know from the history books, defaulting might not be a valid option nowadays. Five main options thus remain:

1. Reducing spending, i.e. austerity measures
2. Raising inflation to devalue the debt
3. Monetising public debt
4. Increasing public revenue by means of economic growth
5. Increasing public revenue by raising existing taxes or introducing new taxes and enforcing tax compliance more strictly to close the 'tax gap'

Let's have a closer look at the options. Many governments will likely (have to) reduce spending. However, this measure is dangerous and therefore restricted, as it might further curb economic growth and trigger a 'downward spiral'. Option two, raising inflation, is also not easy; it is very unpopular in most societies and comes with its own risk. 'Monetising' public debt, where public debt is eventually bought by the central bank, is the latest rabbit to be pulled out of the hat. Some economies will try to go down that road. The long-term impact of this measure is still extremely controversial. Even if it seems expedient for now, it still turns public debt into growing annual interest payments, also cutting economic growth. In addition, it won't make the budget deficit go away. Increasing revenue by economic growth would, of course, be the most elegant solution. Unfortunately, the importance of labour (working hours) for economic growth and the rising interest payments for the higher public debt in combination with declining global trade and growing government influence, as extra by-products of the COVID-19 pandemic and the Ukraine crisis, will make steady and significant growth in the next couple of years unlikely. Therefore, the majority of governments will have to rely on the last option. They have to increase their revenue by raising existing taxes or introducing new ones and by enforcing tax compliance more strictly.

Of course, in the end we will see a mixture of all five options, albeit with varying intensity. However, the last option (increasing revenue by means of taxes) is the easiest to implement and the safest in terms of direct success. It will therefore probably be the most intensely used alternative, as we can already observe. In recent years, completely new taxes have seen the light of day, such us 'carbon taxes' [15] as well as a variety of 'plastic taxes' and similar taxes on packaging. Moreover, the scope of these kinds of green taxes is being and will be constantly extended to cover other harmful gases, such as methane and nitrous oxide or other unwanted content such as sulphur. Other taxes have been introduced in countries that haven't raised these taxes in the past, for example taxes on water. And other taxes are in the process of being raised, namely corporate taxes.[16]

Nevertheless, stricter enforcement of tax compliance is even more popular than raising taxes or introducing new taxes, as it exploits existing, but hidden potential. Digital technologies promise to reach that goal and close the 'tax gap'. The European Commission's Action Plan for Fair and Simple Taxation Supporting the Recovery Strategy already gives us an initial idea of what to expect.[17]

The last two years have put the topic of digitalisation at the top of most government agendas. Besides public health care, in many countries 'smart mobility' has emerged as another hot topic. Transport authorities could use the topic's connection with the climate crisis to push their capabilities and challenge the tax authorities' position as frontrunner. This is another development we should keep in mind over the next few years. However, in the currently ongoing competition for investment resources, the tax authorities can offer a direct return on investment to justify spending on digital technologies. Compared with other government agencies, this is an almost unbeatable advantage in times of empty coffers.

At this point we have come to full circle. After the financial crisis of 2007-08 we observed tax authorities in many countries embarking on significant investment projects to develop new digital capabilities in a first wave of digital transformation. Now we are starting to observe the same thing again. Furthermore, given the dimension of the current and expected public budget deficits, it would be no surprise if the digitalisation efforts of tax authorities in the upcoming second wave of digital transformation significantly exceeded the efforts of the first wave, leaving health departments and other government agencies behind (again). Or as the OECD puts it in its Tax and Fiscal Policy in Response the Coronavirus Crisis report, 'increased revenue needs should prompt investments in strengthened tax administrations, through increased use of new technologies and digitalisation'.[18]

In recent years, completely new taxes have seen the light of day, such us 'carbon taxes' as well as a variety of 'plastic taxes' and similar taxes on packaging.

2 Digitally transforming tax authorities means that they will significantly expand the volume of data they collect, as well as the depth, breadth and velocity of their analysis capabilities. They will increasingly exchange data and derive information from third party data sources.

In detail:
In the last two decades, the private sector has laid the foundation for the digital transformation of public administration by generating more and more digitised information the authorities can suddenly gain access to.

In utilising this data with digital technologies, tax administrations see an obvious response to the pressure to increase tax revenue and the challenge of delivering more with less in an environment of continuing constraints on both budgets and human resources. Moreover, they might even be able to expand their sphere of influence by increasing efficiency when it comes to (digital) control and compliance.

In a globalised world of technological change where capital is increasingly mobile, analogue tax administrations consider themselves too slow to act appropriately and administer growing complexity without using the data available.

▶ Still valid?

Yes, if the tax authorities overcome the shortage of skills and organisational flaws.

In the last two years, the global COVID-19 pandemic has also accelerated digitalisation in general, not just in the health sector. Suddenly, many employees were working from home with the help of a diverse range of remote tools. In most companies, new IT applications were rolled out within weeks. We witnessed an e-commerce boom and the intensification of social media use. The share of products/services that are digitised reached a new high. The digital transformation of the banking sector and the trend from cash to digital payments also sped up massively. Even in some countries in Europe where the acceptance of digital payments was very low owing to privacy concerns, the tide has turned in favour of the health benefits. In Switzerland, for example, cash payments still accounted for 70% of all transactions in 2017.[19] By the end of 2021 this number had fallen to 30%.[20] For Germany, an EHI study finds that cash transactions declined by 1 billion in 2020, a value of EUR 27.93 billion.[21] A tipping point has been reached where returning to the old analogue world no longer seems possible.

Digitalisation has also stepped up the pace in less obvious areas. A notable example is the way sales of customer data to manufacturers have increased, enabling them to respond promptly to quick changes in demand.

Companies have worked hard to enhance interactions with consumers through digital channels. The COVID-19 pandemic has also mercilessly exposed the weaknesses of global supply chains, resulting in a post trade war trend to nearshoring, robotics and smart manufacturing. The Ukraine crisis will further strengthen this trend and prompt the global economy to partially unravel its interdependencies.

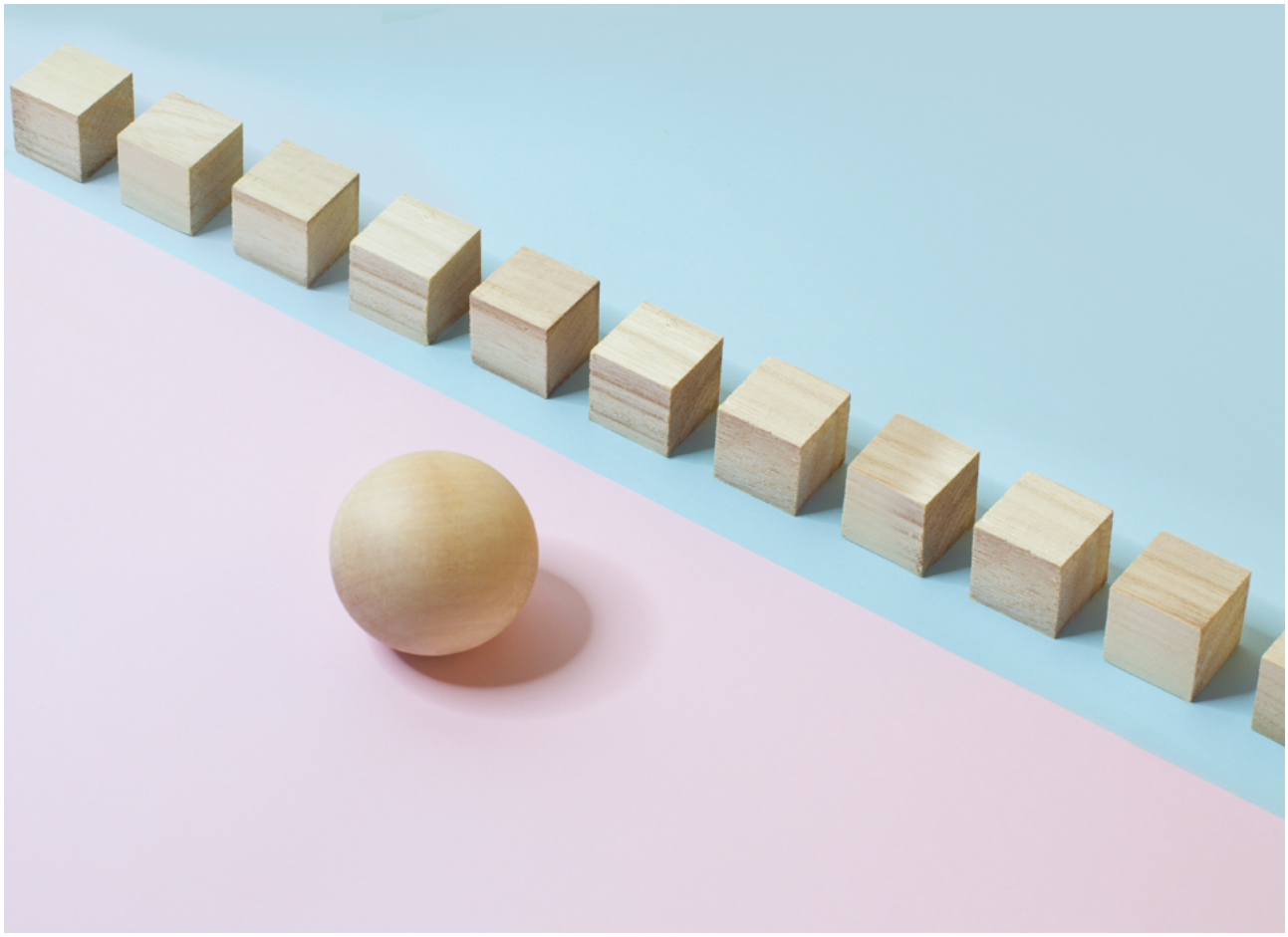
All these digital developments are leading to the availability of an even wider range of data. As we saw above, one of the options, and maybe the most important 'quick fix' to increase government revenue, is a stricter compliance regime. How can the tax authorities achieve this quickly? By utilising the newly emerged internal and external data streams unlocked by the pandemic to improve their efficiency and productivity and generate additional tax revenue.

The resulting strong appetite for data can already be observed in changes in legislation. A good example is the EU Data Act proposed by the European Commission in February 2022.[22] Article 14 introduces a new obligation to make data available to public sector bodies demonstrating an 'exceptional need'. Interestingly enough, an 'exceptional need' occurs not only, as one might think, in the event of a public emergency. According to Article 15 of the proposal, public sector bodies can also request data from data holders if:

"the lack of available data prevents the public sector body or Union institution, agency or body from fulfilling a specific task in the public interest that has been explicitly provided by law; and

(1) the public sector body or Union institution, agency or body has been unable to obtain such data by alternative means, including by purchasing the data on the market at market rates or by relying on existing obligations to make data available, and the adoption of new legislative measures cannot ensure the timely availability of the data; or

(2) obtaining the data in line with the procedure laid down in this Chapter would substantively reduce the administrative burden for data holders or other enterprises."



If enacted this way, such a rule would significantly increase public institutions' access to data produced by private companies. It can be viewed as one of the first large-scale attempts to grant the authorities comprehensive access to privately held data.[23] The second option in particular seems perfectly suited to the needs of tax administrations. They could demand all the necessary financial data from a company in order to calculate its tax liability without any specific reporting from the company itself. This would substantively reduce the administrative burden on the company, wouldn't it?

Expanding data collection isn't the only objective of digitally transforming tax authorities. Digital technologies also simplify information exchange. Tax administrations do not all necessarily have to develop sophisticated information collection systems, as long as they share information with other tax administrations. The COVID-19 pandemic might have opened a political window of opportunity in this area. For example, the European Commission's Action Plan for Fair and Simple Taxation Supporting the Recovery Strategy mentions the need for better and more detailed exchange of information five times.[24] The OECD states that 'tax cooperation will be even more essential'.[25]

However, to unlock the full potential of the new technologies, tax administrations still have to overcome a major obstacle. Digital experts don't grow on trees. In a fierce global competition for skilled employees, the public sector faces the disadvantage of paying lower wages. On the other hand, this might be counterbalanced in times of insecurity, when many people start to look for safe jobs. At the same time, we are observing many efforts on the part of governments to re-invent the way they work, to become more agile and attract tech-savvy talents.[26] The general mindset of public servants might also have changed in the meantime. Many tax authorities have experienced reduced staff capacity and lockdowns. This has raised staff awareness of the potential of digitalisation and increased acceptance levels for employing digital technologies. All of a sudden, remote audits or e-audits harnessing large volumes of digital data have become more promising.

Taking all these developments into account, we feel confident in concluding that the 'smart supervisor' is moving closer, maybe even more quickly than we expected.

3 We are about to enter an 'upward information spiral': more digital data leads to more transparency, which in turn leads to even more data generation and more transparency and so on (resulting in increasing control possibilities for tax authorities).

In detail:
The continuously increasing amount of digital information available for processing means that we are moving towards an age of tax transparency with sophisticated and manifold analytics techniques and real-time access to business data.

Why do we think that? One important factor driving the 'upward information spiral' is familiar from the digital economy. Digital goods have a unique feature: it's extremely cheap to make another perfect copy and send it around the planet. In technical terms, the marginal costs of reproduction are close to zero. Translated into the realm of tax administrations, this means that they will be able to carry out countless tasks and duties at the same time without the need to hire more and more people. Once the necessary digital systems are live and running, the reach of (digital) control and monitoring can be extended further and further, at almost zero cost (of operation). We call this development the Zero Cost of Control phenomenon: enormous growth in productivity within the public sector enhancing the authorities' capabilities for controlling compliance with the law enabled by the use of digital technologies.[27]

For every new insight gained from analysing data, more questions will come up. And it will become cheaper and cheaper for the tax authorities to answer them, raising new questions again. As a result, we will likely enter an age of 'forced' transparency, where the relationship between taxpayer and tax authority will fundamentally change.

▶ Still valid?
Probably yes, but the final outcome is not so clear.

We started heading down that road a couple of years ago, when we were still at the beginning of the spiral. Digital technologies and data streams have opened up completely new data sources. For example, tax authorities have started to use social media information, satellite and drone footage or information from online marketplaces about its participants for their purposes. Data brokers have signed contracts with government agencies. Tax-related leaks have made information easily accessible in searchable databases that otherwise would be difficult to obtain.[28] Simultaneously, we have seen many new obligations to disclose data to the tax authorities, such as FATCA, CRS for the automatic exchange of information (AEOI), CbCR under OECD BEPS, and DAC6. It feels as if the tax administration/taxpayer relationship is almost 'naturally' evolving towards overall transparency at some point. As stated, tax administrations have strong internal incentives to pursue the path to transparency.

But it's not just that. Tax has increasingly become integrated within the broader sustainability (ESG) landscape. (Voluntary) tax transparency has increased across the FTSE100 for the eighth consecutive year.[29] And some of the obligations to disclose information to the tax administrations have even turned into public disclosure obligations. In November 2021 the European Union formally adopted a directive for public country-by-country reporting forcing large multinationals with at least a medium-sized presence in the EU to publish important financial information.[30] And that's not the end of the road. The EU Commission is pursuing a broader tax transparency agenda and is expected to propose additional legislation with more transparency measures. This kind of publicly available data is then used by other stakeholders to create even more transparency and to increase pressure on the tax authorities and the political sphere. The Tax Justice Network, for example, runs a well-executed Illicit Financial Flows Vulnerability Tracker, which measures and visualises each country's risk to enable money laundering and corruption.[31] In this manner, the transparency spiral turns further. It is only likely to slow down if political will, strong stakeholders, civil society and/or legal institutions oppose this 'natural' trend. Has anything in the last two years pointed in this direction?

Rather not. Instead, we have seen that more obstacles to greater disclosure have been removed. During the COVID-19 pandemic, privacy concerns were on the retreat. Many emergency measures taken by governments around the world to protect their populations during the health crisis 'have affected the enjoyment of the rights to privacy and data protection', as the '2020 Data Protection Report – Digital Solutions to Fight COVID-19' by the Council of Europe[32] puts it. In addition, transparency and information exchange have been promoted as a countermeasure to the threat of COVID-19 in many areas: researchers publicly shared their findings, situation reports transparently monitored the course of the pandemic, individuals shared information about their movements and contacts to enable contact tracing, to name just a few.

All these events seemed to have changed public opinion, outstripping privacy and data protection issues – maybe not just for the time being.

Nevertheless, strong counterforces have also started to pool their resources. On the company side, a variety of legal tools are being positioned as a defence measure against too much transparency, vis-à-vis both the government and the public. In a development originating from the Anglo-Saxon world, trade secrets and intellectual property rights are increasingly utilised to safeguard all kinds of internal data.[33]

We have the impression that (tax) transparency has now gained additional momentum, further accelerating the 'upward information spiral'. If the digital economy has taught us one thing, it is that hunger for data is endless once you've developed an appetite. The chances are high that this will also apply to the public sector. Still, the final outcome is not so clear yet.

4 All tax authorities around the world will be affected sooner or later, yet they progress in different ways at different speeds.

In detail:
In an increasingly complex and fast-paced world, added value increasingly derives from quickly moving intangibles, a growing number of goods and services are digitally offered via the internet, and capital flows are also very mobile. All tax authorities must adapt to these new conditions sooner or later if they want to continue to be able to serve their purpose and supervise tax payments in a digital word. However, they are adapting in very different ways; they're doing it at different speeds, to a varying extent and with different focuses.

▶ Still valid?

Yes, but we cannot observe any regularities in the process yet. Nor does a best practice approach seem to be crystallising.

Currently we are observing many incremental changes, a variety of approaches and a constant stream of diverse digital initiatives by different tax administrations. All these efforts to digitally transform are unfolding with widely varying rapidity and different scope around the globe. Some readers might be surprised to learn which countries are taking the lead in what areas. Latin America may not have gained the reputation as a global innovation hub. Nevertheless, in no other region has e-invoicing been so widely adopted. Even in Africa, often considered as a laggard by global economic standards, one can observe thoroughgoing developments, as shown by the example of Kenya featured in this report.

At this stage, our impression is that the principal driver of the development is neither the availability of technology nor of technological skills. Today, technology is accessible in almost all countries in the world, and it's also possible to attract enough talent anywhere with the right incentives. We believe that the velocity and direction of a tax administration's development depends more on institutional settings and the political and societal situation of a country. In some countries, for example, opposing government forces block each other and prevent quick change. In other countries, emerging societal negotiation processes create a fragmented and non-homogeneous picture of a governments' digital efforts.[34] That's probably why countries with strong federalist mechanisms, such as Switzerland, or with pronounced privacy concerns, such as Germany, currently lag behind. At the same time, there are no grounds to believe that a lively civil society always slows a tax administration's digital progress, as the example of the United Kingdom demonstrates. Also, centralised and autocratic regimes are not able to establish themselves as constant digital frontrunners – as we assumed in an earlier paper.[35] The view is still blurred, and decisive factors are not so clear yet.

Sometimes tax authorities seem to simply follow the skills and ideas of their current talent pool, driven by a bottom-up approach rather than a clear top-down strategy, pursuing more of a trial-and-error or generate-and-test approach than other problem-solving strategies. In other cases, tax authorities' priorities seem to be affected by what neighbouring countries are doing. They appear to follow the lead of certain early adopters and their approach in a specific region. The quick spread of e-invoicing in Latin America might be a good example of that. In addition, increased cross-border cooperation and cross-loss collaboration are causing the spheres of the different tax types and jurisdictions to mingle in some areas but not in others. This makes it even harder to perceive a general trend.

Nevertheless, we have identified something of a structure in what is a very complex and manifold development. Four main areas of action are emerging. Some tax authorities are focusing on access to data. They want to know more about the taxpayer. They're starting to combine their growing data collections with information from other tax types and jurisdictions to create 'network analytics effects'. Other tax authorities are concentrating their energies on automating tax return preparation with the help of pre-fill availabilities and virtual assistants. Some tax administrations are trying to use digital technologies primarily for audit selection. They're rolling out sophisticated algorithms to assess risk, identify outliers and prioritise and select targets. For other tax administrations, the audit process itself is more important. They are moving from sample testing to digital real-time auditing, from on-site to remote auditing.

For the time being, there is no best practice approach visible. No 'winner strategy' promising to create the most revenue for a government has crystallised yet. But please look for yourself at part 2 and 3 of this report to get a better flavour of what's really going on.

You can also look forward to the sequel of the present Tax Disruption Report, where we will discuss our remaining predictions.

Part 2

Major developments in 2020/2021

I Digital journey: from digitisation to digital transformation

At this point we leave the big picture and turn to a narrower view. Part 2 provides an overview of the major developments in the last two years or the present state of progress. This means that we will have a quick look at the investments in digital technologies tax authorities are making. It will help you to get an idea of the importance of digital transformation efforts compared with other priorities. We will also give an overview of the main digital technologies tax authorities have focused on lately.

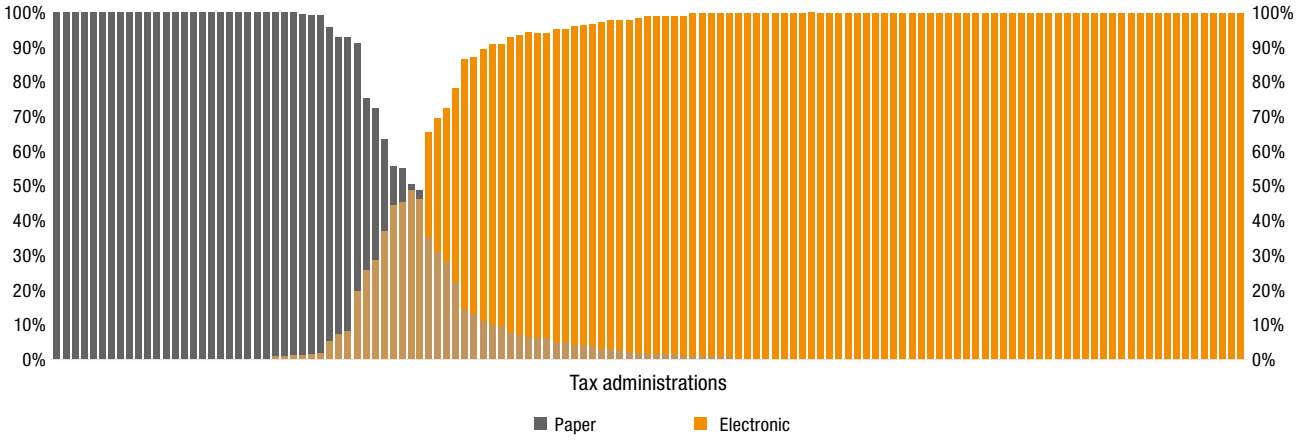
To begin with, we have chosen to take a quick glance at one of tax authorities' four main areas of action as described above in prediction no. 4: digital tax returns.

1. Digital tax returns

During the early phase of their digital journey, tax administrations concentrated simply on digitisation – the process of converting information from analogue to digital format. Only during the later phases of their digital journey did they start to engage in true digital transformation – the process of changing the business model to accommodate and maximise the use of digital technologies.[36] Paper-based tax returns have been among the first things many tax administrations attempted to digitise. For this reason digital tax returns might serve as a good indicator of the current status of tax authorities' evolution.

Most tax administrations receive tax returns either in paper-based form or digitally; only a minority of tax administrations use both channels.[38] On average, tax administrations worldwide now receive 30% of corporate tax returns on paper and 70% by digital means (Figure 1). Of the returns received digitally, a large majority (80%) are not yet prefilled. Around 16% are partially prefilled and four percent are already fully prefilled.

Figure 1: Corporate income tax returns received

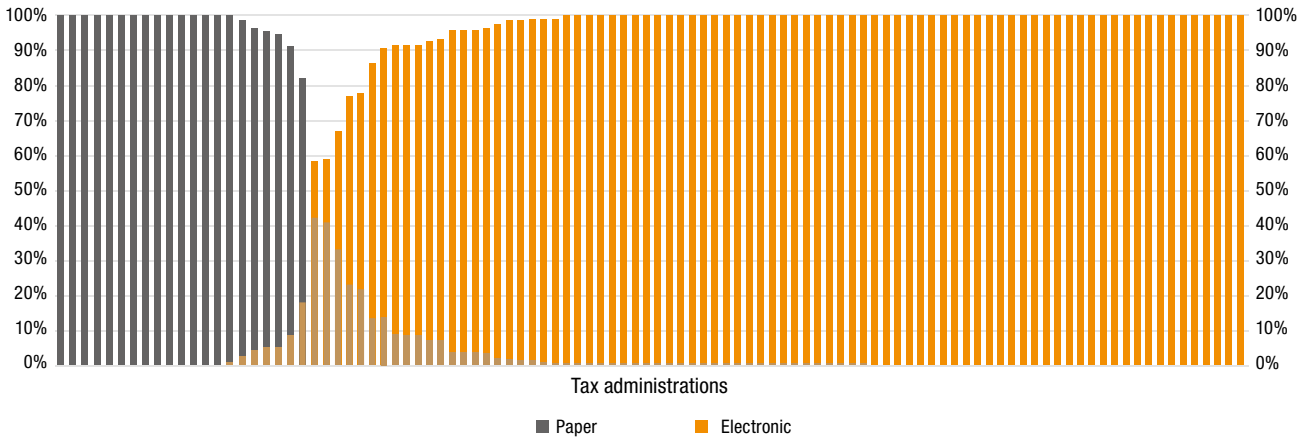


Source: Calculation and illustration based on ISORA (2020).[37]

The latest data on value-added tax returns paints a similar picture (Figure 2). On average, tax administrations around the world receive 75% of value-added tax returns digitally and 25% in paper-based form. Of the VAT returns received digitally, 85% are not yet prefilled, ten percent are partially prefilled, and five percent are fully prefilled.

There are two important take-aways: First, the large majority of tax administrations worldwide have moved from paper-based to digital processes. In other words, most tax administrations have already passed the digitisation phase of the digital journey and have turned to true digital transformation. Second, most tax return processes are not yet automated.

Figure 2: Value added tax returns received



Source: Calculation and illustration based on ISORA (2020).[39]

2. Investments in digital technologies

Digital transformation comes at a cost – a cost many tax administrations appear to be willing to pay. Indeed, tax administrations around the world spend a considerable part of their operating budget on digital technologies. The latest data indicates that tax administrations spend an average of ten percent of their operating budget on digital technologies (Figure 3). With 26 percent, Singapore and Denmark leading the way in this area.

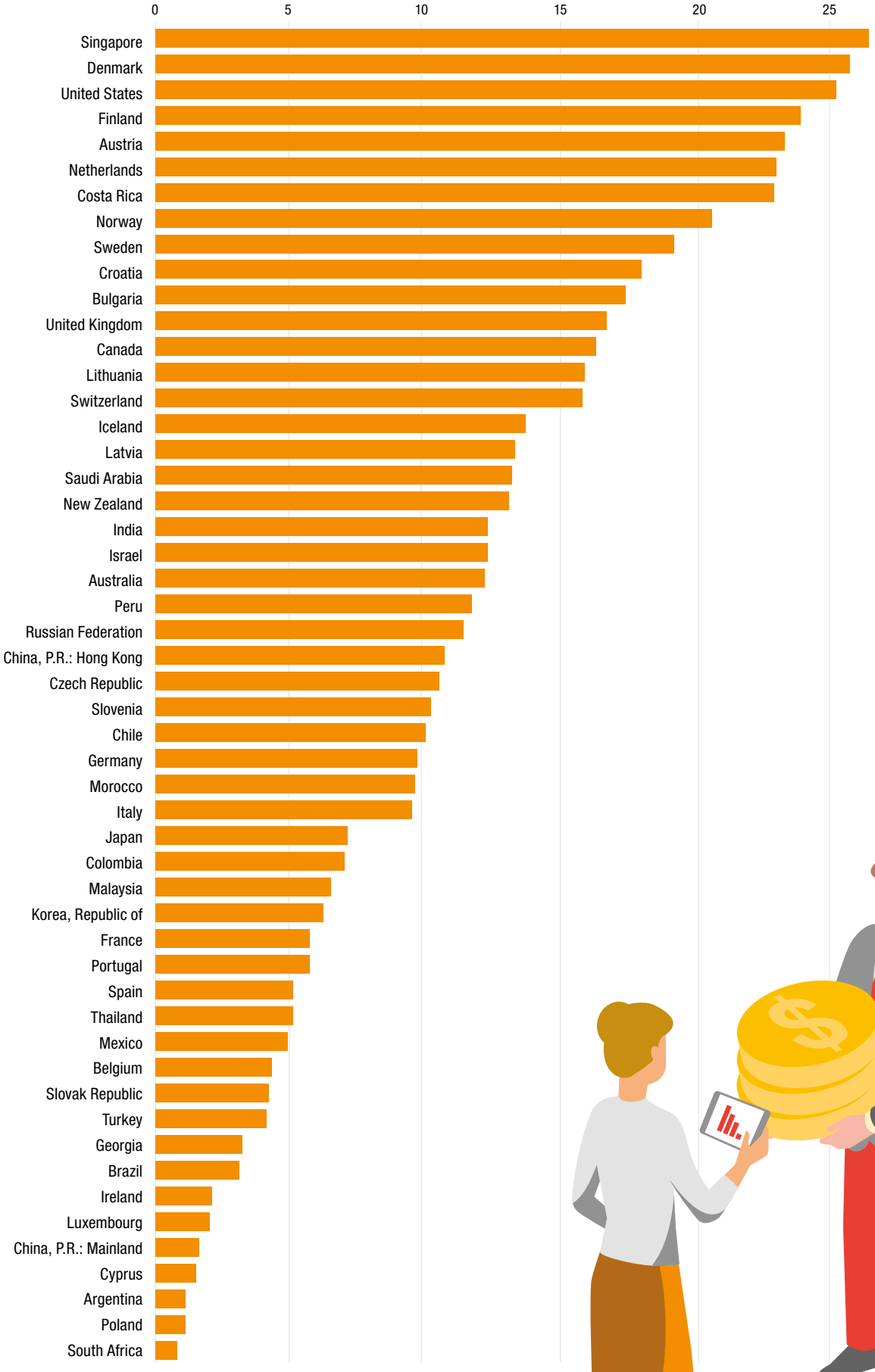
The US is close behind this with 25 percent. In its most recent Capital Investment Plan (2022), the Internal Revenue Service (IRS) commits to a modernisation of its operations and the increased use of 'innovative technologies and processes, such as Cloud, Agile, DevOps, application programming interfaces, robotic process automation, and next generation infrastructure to reduce costs and manual effort' (p. 33). From 2020 to 2021, the IRS increased its budget for the modernisation of its operations by a remarkable 1,500 percent.

Even after this outstanding increase, the IRS committed to another budget increase of seven percent from 2021 to 2022.[40]

10%

The average percent of operating budget that tax administrations around the world spend on technology.

Figure 3: Digital technology spending as a percentage of operating expenditure by tax administration

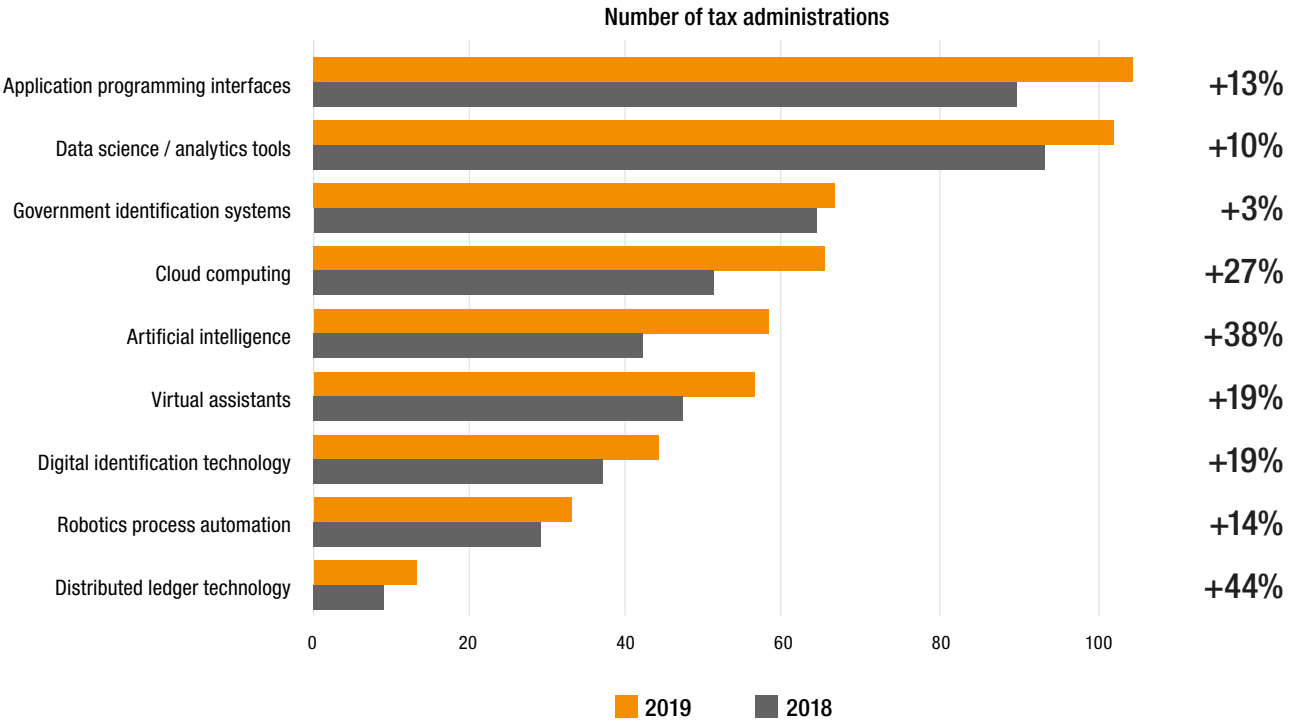


Source: Calculation and illustration based on ISORA (2020).[41]

3. Main digital technologies tax authorities focus on

The latest data indicates that there are at least nine digital technologies which tax administrations around the world employ – and all of them are becoming increasingly popular (Figure 4). The following sections will discuss a subset of these digital technologies in further detail.

Figure 4: Implementation of digital technologies by tax administrations



Source: Calculation based on ISORA (2020).[42]

a) Application programming interfaces

Application programming interfaces (APIs) are the most commonly used digital technology among tax administrations. APIs essentially generate a connection between computers or computer systems to allow the exchange of information between them. At least 104 tax administrations currently use this digital technology, for instance to connect to the systems of business taxpayers.

The tax administration of Singapore, for example, offers a marketplace for tax-related APIs. This marketplace serves as a platform for developers to create related solutions for taxpayers, tax agents and tax-related service providers. Taxpayers use the authorisation system Corppass to give consent for transmitting data directly to the tax administration's servers, on the basis of which they receive immediate feedback on the validation or processing status of the submission. The list of available application programming interfaces is rapidly growing and already includes the submission of corporate tax records, goods and services tax returns, and tax clearance for foreign employees.[43]

104

The number of tax administrations that use application programming interfaces.

b) Data science and analytics tools

Another set of digital technologies popular among tax administrations is data science and data analysis tools. The latest data indicates that at least 102 tax administrations worldwide use data science and analytics tools. The latter are used to understand historical data while the former focus on predictive modelling, often using machine learning.

102

The number of tax administrations that use data science and analytics.

The tax administration of Australia, for instance, uses a so-called Automated Network & Grouping Identification Engine to combat tax avoidance by identifying large and complex networks of relationships of multinational enterprises, large public and private businesses, and associated individuals. Structured data is provided from the tax administration's Teradata enterprise data warehouse and combined with semi-structured and unstructured data sourced from its Cloudera enterprise data hub. Interestingly, the data analytics processes are also supported by two private companies.[44]

c) Cloud computing

One other digital technology that has become increasingly popular among tax administrations is cloud computing. Cloud computing describes the on-demand availability of computer system resources, including data storage and computing power, without direct active management by the user. The latest data indicates that at least 65 tax administrations rely on cloud computing technologies.

65

The number of tax administrations that use cloud computing.

The Mexican tax administration, for instance, operates a hybrid cloud – a computing environment that orchestrates between private, community and public clouds. This environment covers internal and external services (taxpayers, authorised certification provider, third parties) and seeks to consolidate data processing, storage and exchange. By using cloud computing, the Mexican tax administration ensures technical neutrality and an infrastructure which can be dynamically scaled according to the volume of taxpayers' demands. The cloud is operated with the support of two private companies which, in addition, support the Mexican tax administration with the integration of artificial intelligence and robotic process automation in its information technology processes.[45]

d) Artificial intelligence

Artificial intelligence is another digital technology that is increasingly used by tax administrations around the world. Artificial intelligence essentially simulates human intelligence processes through machines and computer systems. In this area, many tax administrations rely on tools such as Cognos, Neo4j, SAS, SPSS, R, Python, SQL and Julia.[46]

58

The number of tax administrations that use artificial intelligence.

The tax administration of the United States, for example, cooperates with Stanford University on an active-learning system that uses artificial intelligence to decide which tax returns are more worthy of an audit. While conventional machine-learning approaches train a model with a specific dataset, an active-learning approach continuously and iteratively selects data to update a model. If, for instance, the active-learning system recognises that certain types of deductions are more likely to lead to a miscalculation of tax owed, the system would begin flagging returns with these deductions for audit.[47]

e) Virtual assistants

Artificial intelligence is also used in many of the virtual assistants tax administrations use to communicate with taxpayers. Virtual assistants, often referred to as chatbots, simulate human-like conversations with clients and are used by at least 56 tax administrations globally.

The Spanish tax administration, for instance, has recently launched the so-called PIT Informant, a virtual assistant that helps taxpayers complete their personal income tax (PIT) return. A decision tree and consecutive levels of drop-down menus guide taxpayers through topics such as identification issues, liability, taxation options, immovable property, deduction, and modification of submitted returns. The Spanish tax administration also employs virtual assistant tools for tax registry, economic activities tax and valued-added tax.[48]

56

The number of tax administrations that use virtual assistants.

f) Distributed ledger technology

Distributed ledger technology is the least commonly used, but fastest growing, digital technology employed by tax administrations. Distributed ledger is a technological infrastructure that allows simultaneous access, validation and record updating which cannot be altered, and which is spread across multiple entities or locations. The blockchain is only one type of distributed ledger technology.

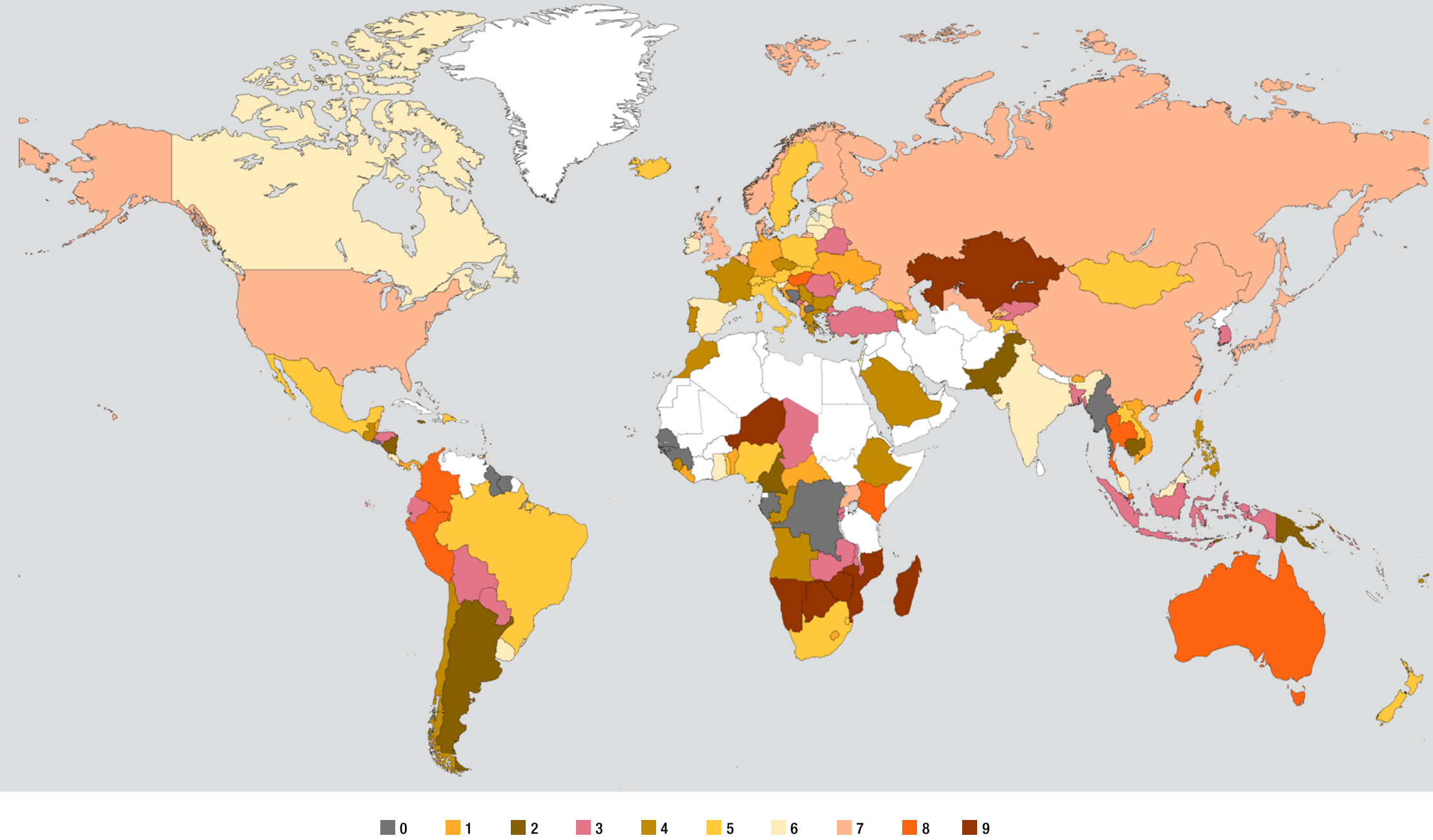
The Brazilian tax administration, for example, uses blockchain technology to register and share taxpayers' information between municipal, state and federal government departments. The blockchain is based on auditable open-source software and allows only authorised entities to participate. To gain authorisation, entities request data access through smart contracts. The blockchain solution is developed jointly with a private company.[49]

13

The number of tax administrations that use distributed ledger technology.

The previous discussion vividly demonstrates that tax administrations around the world have many options to move in different ways. Indeed, only a small number of tax administrations have already implemented all or most of the digital technologies discussed above (Figure 5). The large majority of tax administrations currently use a subset of these digital technologies according to their own priorities.[50]

Figure 5: World map of technology implementation



Source: Calculation based on ISORA (2020).[51]

II Regional and global initiatives: information and data exchange

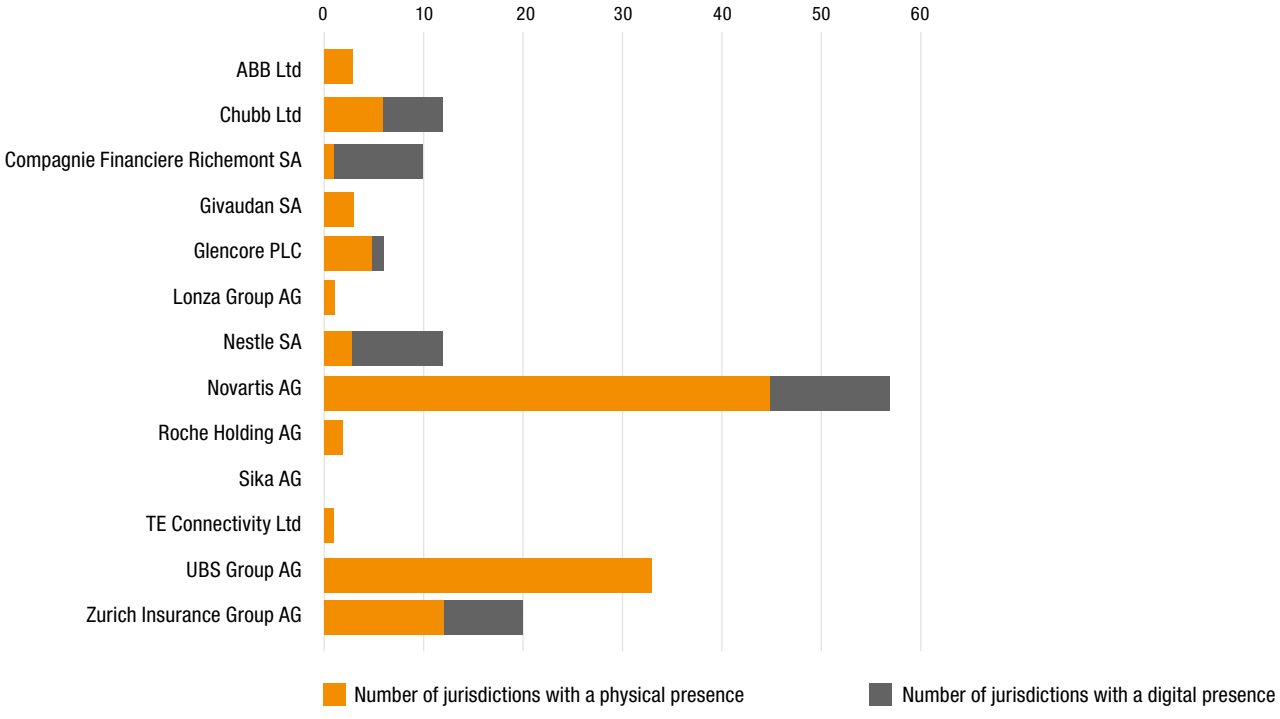
The increased use of digital technologies by tax administrations facilitates not only the direct collection, processing and analysis, but also the exchange of tax-relevant data. Indeed, there are a number of regional and global initiatives in which tax administrations are increasingly exchanging information. We have picked three as illustrative examples that have gained momentum in the last two years.

1. Analytical Database on Individual Multinationals and Affiliates (ADIMA)

The Organisation for Economic Co-operation and Development (OECD), for instance, has developed the Analytical Database on Individual Multinationals and Affiliates (ADIMA), which uses a number of big data sources to provide insights on the world's largest 500 multinational enterprises. ADIMA has grown significantly in the recent past.

Based on these generally publicly available sources, the OECD is able to reconcile the number of jurisdictions declared in multinational enterprises' annual reports with the number of jurisdictions with a physical or digital presence identified in ADMIA. Thirteen of these 500 multinational enterprises have their headquarters in Switzerland – the latest, publicly available, insights on these enterprises are illustrated in Figure 6.

Figure 6: Number of jurisdictions with a physical and digital presence according to ADIMA – multinational enterprises headquartered in Switzerland



Source: Illustration based on OECD (2021).[52]

In addition, the OECD has tried to implement a monitoring tool to identify corporate events such as large company restructurings and headquarter relocations. This tool extracts relevant search terms from WikiData and then analyses multinational enterprises' media coverage on a daily basis. These insights are complemented with information on media coverage extracted from the Global Database of Events, Language and Tone. Relevant articles and information on multinational enterprises' location are automatically extracted using natural language processing. The tool is also able to monitor daily Wikipedia views related to multinational enterprises and to detect anomalies by comparing the actual and the predicted number of views. These anomalies provide ADIMA with another indication that restructurings or headquarter relocations are upcoming or already in progress.[53]

2. Joint Chiefs of Global Tax Enforcement (J5), and the Financial and/or Criminal Investigations Network (FCInet)

The Joint Chiefs of Global Tax Enforcement (J5) represents another initiative that facilitates international data exchange. Formed already in 2018, the J5 includes the tax administrations of Australia, the UK, the US, Canada and the Netherlands. The focus of the J5 is on cybercrime and crypto-currency as well as enablers of global tax evasion. To achieve its purpose, the J5 is working towards the exchange of intelligence and data in near real time. Only one year after its establishment, the J5 tax administrations had already exchanged more data than in the previous ten years combined.

One platform through which the J5 exchanges data is the Financial and/or Criminal Investigations Network (FCInet). In addition to the J5 tax administrations, FCInet also includes the tax administrations of Belgium, Denmark, Finland, Iceland and Norway. The platform is a non-commercial, decentralised computer system developed by the member governments. Essentially, FCInet allows its members to connect information without collecting it. More precisely, the information is sent from one member to another through a filter and is only revealed to the receiving member if that member already possesses identical data. As FCInet members put it, the platform **'doesn't collect data, rather it connects data'**.[54]

It's not only about data collection, but data connection.

The core technology behind FCInet is ma^{3}tch, where a^3 stands for autonomous anonymous analysis. Ma^{3}tch, developed by the Dutch Ministry of Justice and Security, allows secure and pseudonymised datasets to be shared through the abovementioned filters. These filters use advanced algorithms such as fuzzy logic, hash tables, Bloom filters, transliteration, n-grams and approximation techniques to anonymise, aggregate and compare information.[55]

3. Fiscalis

The European Union has recently initiated the Fiscalis 2021-27 programme to support national tax administrations with the creation and the exchange of information and expertise. Compared with the previous 2014-20 programme, the budget has increased significantly from EUR 223 million to EUR 269 million. As part of the programme, standardised forms for the automatic exchange of data are being developed. Furthermore, Fiscalis funds core information technology systems such as the Value Added Tax Information Exchange System (VIES) and the Transaction Network Analysis (TNA), a real-time information system to detect cross-border value-added tax fraud using algorithms based on network theories. The programme explicitly facilitates the use of emerging solutions such as blockchain, artificial intelligence and data analytics as well as the swift exchange of information and joint processing and analysis of data.[56]

Part 3

Country overview: tax authorities' use of digital technologies around the world

I Introduction

In Part 3, we zoom closer into the use of digital technologies by 27 tax administrations around the world. The examples provided are not aimed to be exhaustive and complete, but rather illustrative of the diverse facets of tax administrations' digital journey.

Part 3 is organised according to geographic regions. The first section focuses on tax administrations in Europe, the Middle East and Africa (EMEA). The second section examines tax authorities in the Asia and Pacific region (APAC), while the third discusses various tax administrations in the Americas (AMER).

Within each geographic region, the country examples are organised alphabetically. The selection of tax administrations covered is also driven by the availability of credible information. The scope and level of detail therefore varies from tax administration to tax administration. Nonetheless, each example is intended to illustrate at least one important feature of the respective tax administration's use of digital technology. We invite you to skip examples and focus on those that interest you.

II Europe, the Middle East and Africa (EMEA)

Armenia	Belgium	Egypt	Estonia	Finland
Hungary	Italy	Kenya	Latvia	Netherlands
Norway	Poland	Russian Federation	Spain	South Africa
Switzerland	United Kingdom			

Within the regional group of Europe, the Middle East and Africa, tax administrations' focuses vary considerably. There are certain patterns, however. The tax administrations of Hungary, Italy and Spain, for example, are known for early advances in the area of real-time invoicing for value-added tax. Also in the area of value-added tax, Poland's tax administration was one of the first to introduce a split payment system. The tax administrations of Belgium and Latvia are examples of how behavioural insight analysis can be used to improve tax compliance. Other tax administrations, such as in Armenia and in the Russian Federation, employ digital technologies to fight the illegal production and trade of goods and the tax frauds associated with it. The examples of the tax administrations of Estonia and Finland illustrate how digital technologies can help to improve information exchange and processing. The tax authorities of the Netherlands and Norway are pushing the boundaries of natural language processing, while the UK's tax administration was among the first to use digital technologies to compile and analyse huge datasets from various sources. Kenya, along with other tax administrations in this regional group, focuses increasingly on reconciling taxpayers' data with their social media profiles. The tax administration of Switzerland is either careful not to reveal too much information on its use of digital technologies or simply lags behind its regional peers.

1. Armenia

The tax administration of Armenia (State Revenue Committee, SRC) employs a variety of data analysis techniques including anomaly detection, behavioural insight analysis, prediction, risk and statistical analysis, tax fraud identification and traceability analysis.

For example, the SRC uses advanced machine learning approaches – so-called gradient boosted regression trees to be precise – for audit and fraud prediction. Using data from previous years, the algorithm is able to predict audits with above 90% accuracy and fraud above 70% accuracy. Audits based on the first decile of the data are found to be almost twice as successful as audits based on random selection.

70%

The reported accuracy with which algorithms detect fraud.

The SRC also uses advanced techniques to identify interconnections between taxpayers. More precisely, the SRC links information using three approaches: by importers, by sellers and by employees. The first approach matches the origin country and origin business of imports (data retrieved from the Single Administrative Document (SAD)) with the storage facility of imported goods (data retrieved from the invoice) to find out whether different taxpayers have the same owner. The second approach reconciles the addresses of cashier machines, the registration data of taxpayers and data on storage facilities to identify ownership structures behind different taxpayers. The third approach relies on the employee's Public Service Number (PSN) to investigate interconnections between different taxpayers. Based on these approaches, the SRC is able, for instance, to detect illegal alcohol production and related tax fraud. Indeed, the SRC analyses data on the importation and sales of wheat and ethyl alcohol to investigate the extent to which the two ingredients are used to illegally produce vodka and to avoid excise taxes.

The SRC is not only advanced with regard to data analysis, but also in terms of data exchange. The SRC exchanges data with a long list of other government agencies including the ministries of Finance, Health, Justice, Labour and Social Affairs, Nature Protection, and Transport, Communication and Information Technologies. In addition, the SRC exchanges data with regional organisations such as the Eurasian Economic Union and international organisations such as the International Road Transport Union.[57]

2. Belgium

The Belgian tax administration (Federal Public Service Finance, FPS) has partnered with a group of researchers to explore the role of behavioural insights analysis, so-called nudging, in encouraging taxpayers to pay their due taxes on time. The researchers designed and implemented a randomised controlled trial at the national level, a type of scientific experiment which randomly assigns the subjects of research – here personal income taxpayers – into the control or the treatment group. The random allocation of taxpayers allows a statistical investigation into the causal effects of nudging on taxpayers' compliance behaviour.

The type of nudging taxpayers receive depends on the group they are in. The standard communication from the FPS to taxpayers consists of a request to file a tax return and a request to pay taxes. Follow-up correspondence takes place in the event taxpayers are late in either filing their tax return or paying their tax dues. As a first nudge (the simplification treatment), the FPS sent out simplified, shorter letters with less information and highlighted action-relevant instructions. As a second nudge (the deterrence treatment), the FPS added a message to the simplified letter that made the financial penalties explicit and/or highlighted the enforcement actions in case of noncompliance. As a third nudge (the moral treatment), the tax administration added a message that highlighted the value of tax expenditures to the public good and/or the social norms attached to filing and paying taxes on time.

The simplification treatment and the deterrence treatment increased subsequent tax filing by eight percent relative to the standard reminder, while the moral treatment did not affect tax compliance in a statistically significant way. The simplification treatment alone increased tax collection by EUR 17 million – a huge win considering the nudging intervention only cost EUR 80,000.[58]

Nudging based on behavioural insights can generate large benefits at a low cost.

In addition to nudging, the FPS reportedly uses artificial intelligence to automatically web-scrape taxpayer data from e-commerce and e-sharing platforms (e.g. Amazon, Airbnb, eBay, etc.), to construct networks of individual taxpayers using graph theory and to perform internal as well as external risk management.[59]

3. Egypt

The Egyptian Ministry of Finance has recently announced its intention to automate the tax system as part of the government's digital transformation strategy. The implementation of the new digital system is scheduled to proceed in four stages from Greater Cairo to Alexandria and West Delta, to East Delta, the Canal and Sinai, and then to Upper Egypt.[60] With the support of a number of private companies, the ministry plans to introduce artificial intelligence into its processes and offer taxpayers and other stakeholders a more automated and well-governed taxation experience.[61] The principal objectives of the digital transformation are related to the improved ability to monitor taxpayers, to expand the tax base and to integrate the informal economy into the formal economy.[62]

4. Estonia

The Estonian Tax and Customs Board (Maksu- ja Tollimet, MTA) follows a so-called Once-Only-Principle: once a citizen or business has provided information to a state authority, no other government agency may request the submission of the same information again. As a consequence, information and data exchange play an important part in the MTA's operations.

This exchange is facilitated by a secure data exchange layer called X-tee (formerly called X-Road), which connects more than 1,200 information technology systems between almost 2,700 services of participating government agencies and institutions. Data is exchanged online, and each exchange is encrypted, logged and time stamped. Rather than being a single, master database, X-tee is designed as an open-ended and decentralised infrastructure. The exchange of information is further facilitated by the fact that all natural persons and all entities in Estonia have a unique identification code used for all public purposes.

Once-Only-Principle requires secure and efficient data exchange between different government agencies.

Currently, the MTA is also exploring how artificial intelligence can be applied in taxpayer service as well as in risk analysis. A first pilot project, for instance, explores how artificial intelligence can help to tackle unregistered labour and underreported labour taxes.[63] A second project, Tax Behaviour Rating (TBR), uses artificial intelligence to compare information provided by taxpayers with information submitted by other taxpayers as well as information obtained from public data sources. The algorithm then rates taxpayers according to their compliance and adequacy behaviour.[64]

5. Finland

The Finnish tax administration uses software robots to test tax software and to monitor emails. To test its GenTax software, around 30 different software robots are employed. Software robots are also used to monitor the tax collection email inbox, which receives up to 3,000 messages every month, and transfers these emails and their attachments directly to GenTax.[65]

The Finnish tax administration also uses artificial intelligence to train its Virtanen chatbot. This chatbot provides taxpayers automated guidance on the MyTax platform. The latest available data suggests that Virtanen is able to solve around 80 percent of requests, and automatically forwards the remaining 20 percent to human tax agents.[66]

6. Hungary

The National Tax and Customs Administration of Hungary (Nemzeti Adoes Vamhivatai, NAV) initially introduced a real-time invoice reporting obligation in 2018. The obligation requires taxpayers registered for value-added tax purposes in Hungary (issuing an invoice with a value-added tax amount greater than or equal to HUF 100,000) to report e-invoice data immediately and automatically without human intervention to the NAV. To do so, companies are required to adapt their invoicing processes and enterprise resource planning systems in order to be able to produce and submit the appropriate XML files.[67]

In 2021, the real-time invoice reporting obligation was updated. Since then, all business-to-business and business-to-consumer transactions must be reported to the NAV through the so-called NAV Online 3.0 system in real time, regardless of the transaction amount. For the NAV, the large amount of invoice data provides an opportunity for rapid risk analysis and tax audit as well as the tracing of economic activities and processes.[68]

The NAV is also reported to use artificial intelligence to conduct risk detection and external risk management. The algorithms are employed in the areas of value-added tax, customs, corporate and personal taxation as well as the automatic exchange of information.[69]

7. Italy

The tax administration of Italy (Revenue Agency, RA) was among the first tax administrations to implement electronic invoicing. The use of electronic invoices in public procurement for ministries, tax agencies, and other government agencies, for instance, has been mandatory since 2014. Only one year later, electronic invoices became mandatory for all public entities.

In 2019, the RA introduced mandatory real-time electronic sales invoice issuance and reporting through an exchange system (Sistema de Interscambio, SDI). The SDI performs formal controls on the submitted electronic invoices and then, using a Unique Office Code, forwards the invoice to the State General Accounting Department and other contracting authorities. In total, the SDI processes around two billion business-to-business electronic invoices per year.[70]

There are similarities between the SDI and the Immediate Supply of Information on VAT (Suministro Inmediato de Información del IVA, SII) implemented in Spain. However, the SDI differs from SII in the sense that it is a real-time pre-approval invoice reporting system in which invoices are required to be submitted live at the time of creation.[71]

The tax administration of Italy also employs a number of digital technologies. The RA, for instance, employs data mining techniques to reconcile data from tax returns, tax payments, and the Automatic Exchange of Information mechanism facilitated by the Organisation for Economic Co-operation and Development. The RA also employs network analysis tools to identify and model potential relationships between individuals and/or companies in order to identify high-risk instances of tax fraud. This data is enhanced by information extracted through web scraping and text mining techniques.[72]

8. Kenya

The tax administration of Kenya (Kenya Revenue Authority, KRA) explicitly mentions the use of digital technologies including automation technology, artificial intelligence, blockchain technology, data mining and machine learning as a strategic focus in its corporate plan 2021/2022 – 2023/2024.[73]

The KRA already uses blockchain, artificial intelligence, machine learning and data mining technologies to enforce tax compliance by reconciling taxpayers' social media posts with their tax declarations.[74] Interestingly, parts of the technology were provided and employees trained by the UK's National Crime Agency and Her Majesty's Revenue and Customs.[75] Using the Kenyan government's multi-agency team framework, the KRA administration can also combine gathered insights with data from other government agencies.[76]

Furthermore, the KRA has implemented application programming interfaces to enable system integration with 43 banks and other government departments including the Central Bank of Kenya, the Kenya Trade Network Agency, the Kenya Ports Authority and the National Treasury. Kenya's tax administration is now working towards extending these application programming interfaces to facilitate integration with taxpayers' internal systems.[77]

Digital technologies are used to mine social media for tax-related information.

9. Latvia

The tax administration of Latvia (State Revenue Service, SRS) has cooperated with a group of researchers to explore the use of behavioural insights to nudge taxpayers into being compliant with the tax law. The research design is comparable with the previously outlined experiment run in Belgium. A sample of taxpayers were randomly allocated to control and treatment groups to allow a statistical analysis of the nudging messages' impact on taxpayers' compliance behaviour. A first nudging message (T1) was a simple reminder to taxpayers to pay their taxes due. A second nudging message (T2) included the content from T1 but additionally stated that while previously missed deadlines had been considered as unintentional and inadvertent, future failures would be considered as deliberate acts of non-compliance. A third nudging message (T3) included the content form T1 but additionally highlighted the social norm and importance of contributing to society through tax compliance. The analysis shows that T2 performed best and increased timely submissions by almost ten percent.[78]

In addition to nudging, the SRS is also reported to use a machine-learning algorithm called ESCORT to rank companies according to their predicted level of risk of fraud in the context of undeclared labour.[79]

10. Netherlands

The tax administration of the Netherlands (Netherlands Tax and Customs Administration, NTCA) has long been working with technical solutions to reduce the tax-related administrative burdens on companies. What started as the Dutch Taxonomy Project in 2004 became the Standard Business Reporting (SBR) Programme in 2008.

The SBR is a national standard that facilitates the exchange of business information between different government departments and banks. As the SBR applies international open standards such as XBRL, processes from data gathering and transfer to validation and processing can be automated. The NTCA relies on the SBR for sales tax reports, corporate tax return reports and (pre-entered) income tax reports as well as surcharges and assessment service notifications. In its SBR Roadmap 2020-2025, the NTCA foresees an increased use of artificial intelligence and blockchain methodology as well as advanced technologies in the field of identification, authentication and authorisation.[80]

One of the NTCA's recent innovations driven by digital technology is the Agile Law Execution Factory (ALEF). The ALEF aims to automatically adapt existing information technology systems to changes in tax legislation. More precisely, the ALEF is a management environment which uses a controlled natural language called RegelSpraak to transform legislation into coded rules for automated decision making. Multidisciplinary teams of lawyers, tax experts and information technology specialists first separate laws into small pieces and determine their legal meaning, also in relation to other small pieces of legislation. Each piece is then translated into code that is understandable to both people and computers. These teams also draft example cases which will be used to test the decision making capabilities of the code. The ALEF is implemented with the support of a private company.[81]

Natural language processing is used to transform tax legislation to code for automated decision-making.

Another tool the NTCA has been employing is the artificial intelligence-empowered web-scrapping tool XENON. Indeed, initially developed in 2004, the tool has been used to automatically collect tax-relevant data for almost 20 years. In addition to this, the NTCA is reported to use artificial intelligence for social network analysis, external risk-management and behavioural insight analysis.[82]

11. Norway

The Norwegian Tax Administration (NTA) uses digital technologies in a number of different ways. The first example is an algorithm trained with historical data which is employed to predict the probability of mistakes in value-added tax declarations. The algorithm rates each declaration with a grade, allowing the NTA to focus on auditing taxpayers with the highest grades. Importantly, the more declarations are audited, the more data is available to train the algorithm, the more precise the algorithm becomes. Initially, 500 different variables were tested for their relevance to the model. Ultimately, only 30 variables were included in the model, primarily relying on information such as the tax allowances in taxpayers' last two tax returns, their age, financial details relating to their income and assets, and data relating to individual tax return items.[83]

Natural language processing is used to improve answering taxpayers' questions.

A second example of how the NTA uses digital technologies is related to natural language processing. In this context, the NTA uses digital technologies to facilitate responses to taxpayers' questions, complaints and suggestions online. Around 80% of complaints are now answered automatically through natural language processing algorithms.[84]

12. Poland

The tax administration of Poland (Krajowa Administracja Skarbowa, KAS) introduced a voluntary split payment mechanism for value-added taxes in 2018. In 2019, one year earlier than initially anticipated, the value-added tax split mechanism became mandatory.[85]

The mechanism requires each company to hold two bank accounts – one is an ordinary bank account, the other is exclusively for value-added tax purposes. If a transaction occurs, it is the responsibility of the purchaser to use a certain transfer sheet and to provide information such as the invoice number, the supplier's value-added tax identification and the value-added tax to be paid. Based on this, the bank automatically splits the payment into the standard bank account and the value-added tax bank account. The funds of the value-added tax bank account may then be used to pay the value-added tax from invoices received by other suppliers, pay other tax obligations or be transferred to the standard bank account if authorised by the KAS.[86] This type of value-added tax account scheme is also implemented by Bulgaria and Romania. France and the UK, in contrast, have adopted a second type of split payment based on a value-added tax withholding scheme. The Czech Republic and Italy use a mix of these two mechanisms.[87]

Along with its split payment system, the KAS also implemented the Communication and Information System of the Clearing House (System Teleinformatyczny Izby Rozliczeniowej, STIR) in 2018. The STIR system intermediates the exchange of information between the financial sector (banks and credit unions), the National Revenue Administration and the Central Register of Tax Data, and enables a largely automated risk analysis of the collected and exchanged data. This risk analysis is based on algorithms which take into consideration criteria of economic, geographic, subjective and the behavioural nature of taxpayers as well as links between them.[88] In 2019, less than two years after STIR had been implemented, the system had already collected information on more than six billion financial transactions.[89]

Finally, the KAS is reported to use the machine-learning empowered social network analysis tool ARANEUM to identify links between individual taxpayers based on graph theory.[90]

13. Russian Federation

The Russian Federation implemented one of the world's most advanced track and trace systems – called Chestny ZNAK ('Honest mark') – in 2017. In 2019, the marking of certain products became mandatory, and the system has been expending since. Created by the Centre for Research in Perspective Technologies, Chestny ZNAK aims to guarantee the authenticity and correct tax declaration of products in five steps. In a first step, a unique code – a so-called Data Matrix code – is placed on the products. This code consists of two parts: the identification code, which determines the product's position in the track and trace system as well as the unified catalogue of products; and the verification code, which is generated by the operator using domestic cryptography technology. The Data Matrix enables the product to be tracked throughout its transport – step 2. In step 3, the Data Matrix code is scanned when the product arrives in the store, and in step 4 when the product is sold and leaves the store. The purchaser of the product can then, in step 5, use the Chestny ZNAK application to trace the journey of the product and verify its quality and legality. Currently, Chestny ZNAK covers dairy, bottled water, medications, tobacco, light industry, footwear, fur, perfumes, tyres and photo cameras and flashbulbs. In future, Chestny ZNAK might be extended to also include dietary supplements, beer, bicycles and wheelchairs.[91]

Data Matrix codes help tracking and tracing supply chains.

Another well-established programme from the Russian tax administration (Federal Tax Service, FTS) is the Tax Monitoring Programme. Introduced as a pilot project in 2012, the programme was incorporated into the Russian Tax Code in 2014.[92] The Tax Monitoring Programme is based on voluntary participation by companies which grant the FTS remote access to their accounting and reporting systems through application programming interfaces. In exchange for the real-time data exchange, the participating companies are exempted from conventional tax control and can minimise their compliance costs and mitigate their tax risks. The number of participating companies has continuously grown over the past years – by 2021, 209 companies from 15 sectors of the Russian economy had joined the programme.[93]

14. Spain

The tax administration of Spain (La Agencia Estatal de Administración Tributaria, AEAT) implemented a real-time value-added tax reporting system called Immediate Supply of Information on VAT (Suministro Inmediato de Información del IVA, SII) in 2017. SII was the first near real-time system In the European Union. In 2021, the new SII version 1.1 came into force. Taxpayers subject to SII are required to provide the AEAT with the electronic invoicing records of invoices issued, invoices received, certain intra-Community transactions, and investment goods. These submissions are required to be completed within four working days of the issuance or receipt of an invoice and be sent electronically using XML files. To create these XML files, companies can use an extension of their enterprise resource planning system or third-party software solutions.[94]

Two other areas of digital technology in which the AEAT is advanced include data analytics and virtual assistants. With regard to data analytics, the tax administration uses a machine-learning algorithm called TESEO to identify suspicious taxpayers through anomaly detection. The data includes almost 50 different types of relationship between taxpayers, including family, commercial and legal relationships. The AEAT is also said to have developed neural network techniques which, however, generate results that are more difficult to interpret for tax inspectors than more ordinary network analysis results.[95]

With regard to the use of virtual assistants, the AEAT has recently launched the so-called PIT informant, a virtual assistant that helps taxpayers complete their personal income tax (PIT) return. A decision tree and consecutive levels of drop-down menus guide taxpayers through topics such as identification issues, liability, taxation options, immovable property, deduction and modification of submitted returns. The AEAT also employs virtual assistant tools for tax registry, economic activities tax and valued-added tax.[96]

The AEAT was not only among one of the earliest digital technology adopters; it is also set to continue this path in future. In its Tax Control Plan 2021, the AEAT focuses on five areas of strategic data use. The first area is related to the systematic analysis of residence of taxpayers who are listed as non-residents. In this context, the AEAT monitors potentially fictitious addresses abroad with the help of around 70 data sources. A second area in which the AEAT relies on the strategic use of data is related to reducing errors in taxpayers' tax return submission. Here, the AEAT employs behavioural insight techniques and so-called nudging to improve the correctness of submitted tax returns. A third area in which the AEAT increasingly relies on digital technologies such as artificial intelligence, big data and data mining is the prevention and suppression of smuggling, drug trafficking and money laundering. The AEAT also uses digital technologies to increase the efficiency of selecting taxpayers for audit. The fifth area which the AEAT identifies as strategically important is the development of a new automated transfer pricing risk analysis system.[97]

Network analysis techniques are used to identify complex, multi-layered relationships between taxpayers.

15. South Africa

The tax administration of South Africa (South African Revenue Service, SARS) employs machine learning and big data analytics to enhance its non-compliance detection capability. These digital technologies are used to investigate a range of domestic and international data sources.[98]

At the domestic level, SARS relies on third-party sources such as banks, retirement funds, medical insurance providers, the properties deeds office and the companies register. Beyond this, SARS has access to data from the national register of motor vehicles, the national treasury's central supplier database and the national population register. At the international level, SARS relies on several mutual administrative agreements with partner organisations as well as the automatic exchange of information on South Africans with offshore financial assets from around 100 jurisdictions.[99]

SARS's digital journey also includes a deliberate effort to attract and recruit talented professionals and executives who can drive and accelerate the use of digital technologies in the tax and customs environment.[100]

16. Switzerland

Tax administration in Switzerland has recently become more digitally enabled. In the area of value-added tax (VAT), for instance, the Swiss tax administration (Federal Tax Administration, Eidgenössische Steuerverwaltung, ESTV) introduced the mandatory digital submission of VAT returns in January 2021. Along with this shift, the ESTV has complemented the ESTV SuisseTax application, which has been in place since 2015, with a new VAT Return Easy application which facilitates the more simplified submission of VAT returns.[101]

To complete their VAT returns, companies can use a single, unique and unchangeable business identification number (Unternehmens-Identifikationsnummer, UID). The UID contains nine randomly allocated digits and therefore does not reveal any information on the company. Beyond the calculation of value-added taxes, companies can use the UID for commercial registry entries, insurance contributions, and customs declarations. Key data such as the company's name and address are publicly available. However, there is also additional data that can only be accessed by the UID company itself and the government, as well as system data which is only accessible to the Federal Statistical Office.[102]

A particular characteristic of Switzerland's tax administration is its cantonal differentiation. The Canton of Zug, for example, started to accept tax payments of up to CHF 100,000 by companies and private individuals with the cryptocurrencies bitcoin and ether in February 2021. The Canton of Zug, home to a large number of companies in the crypto industry, aims to consolidate its reputation as the Swiss Crypto Valley, and is working with a private company to implement its blockchain solution.[103]

17. United Kingdom

The tax administration of the UK (Her Majesty's Revenue and Customs, HRMC) was one of the first tax administrations to launch an ambitious data collection and analysis programme. Introduced in 2010 and developed with the help of BAE systems, the Connect system collects data from a wide range of sources, analyses this data to detect and predict risks, and stores the data for future purposes.[104] More precisely, the programme includes at least 30 different databases with information on:[105]

- Tax returns (including VAT, PAYE, income tax and corporation tax returns)
- Bank accounts and pensions
- Credit reference agencies
- Credit and debit card accounts
- Online payment providers such as PayPal
- Foreign tax jurisdictions (including treaties and automatic exchange agreements) and the common reporting standard
- Government agencies such as Companies House, the Land Registry and the Border Agency
- Online social networking
- Property websites such as Zoopla and Rightmove
- Amazon, eBay, Gumtree and similar sales websites
- Google Street View
- Council tax records
- Driver and Vehicle Licensing Agency records
- Delivery versus Payment records
- Electoral roll
- Insurance companies
- Charities Commission
- Flight sales and passenger information

The Connect system is used by about 3,000 members of HRMC staff, and in particular its Risk and Intelligence Services. Since its launch, the Connect system is said to have generated GBP 3 billion in taxes – a considerable figure, particularly considering the system is said to have come at a cost of 'only' GBP 100 million.[106]

Another programme introduced by the HMRC more recently is Making Tax Digital (MTD). Initially implemented in 2019, the MTD was limited to value-added taxes and applied only to businesses with a turnover above the value-added tax threshold of GBP 85,000. After April 2022, the MTD will also enter into force for businesses below this threshold. The MTD requires companies to employ digital record-keeping tools and submit tax return

Digital transformation often starts with value-added tax but then continues with income and corporate tax.

data using MTD-compatible software. By early 2020, the software industry had already produced more than 500 MTD-compatible software products for businesses to choose from. The HMRC estimates that the MTD for value-added tax will lead to an additional tax revenue of GBP 1.2 billion by 2023 and 2024. From April 2024, the MTD will be extended to income tax and apply to self-employed businesses and landlords with an annual income above GBP £10,000. A consultation on extending MTD for corporation tax has recently concluded. According to the HMRC, the MTD for corporation tax will not enter into force before 2026.[107]

The focus of the HRMC on digital technologies is also reflected in its talent acquisition strategy. For example, it recruits data analytics managers with educational backgrounds in engineering, mathematics or computer science with desirable experience in utilising data analytics on enterprise resource planning systems as well as using data analytics and visualisation tools such as Power BI, IDEA and Denodo. The HMRC also recruits senior data analysts for its open-source data analysis team who are skilled in the effective use of analytical software and languages such as SAS Enterprise Guide, SQL, R, PowerBI, Tableau and Python.[108]

III Asia and Pacific (APAC)

Australia	China	India
New Zealand	Singapore	South Korea

Within the Asia and Pacific group, Australia's tax administration arguably leads the way when it comes to the use of digital technologies. Indeed, the Australian tax administration is able to exploit detailed sources of data with advanced network and graph technologies.

However, the tax administrations of China and India are increasingly catching up. Both benefit immensely from the large number of taxpayers in their countries, particularly when it comes to creating vast databases upon which to train algorithms.

New Zealand, Singapore and South Korea set standards in terms of innovative public-private partnerships and commitment to big data analytics.

1. Australia

The tax administration of Australia (Australian Taxation Office, ATO) is one of the most advanced tax administrations worldwide when it comes to the use of digital technologies. As previously mentioned, the ATO, for example, uses an Automated Network & Grouping Identification Engine (ANGIE) to automatically identify complex, multi-layered relationships between taxpayers. Structured data is provided from the tax administration's Teradata enterprise data warehouse and combined with semi-structured and unstructured data sourced from its Cloudera enterprise data hub. While the original version of ANGIE was only able to connect three steps between taxpayers, an enhanced version was launched in 2021 which can identify connections about 20 steps deep. The enhanced version is based on a graph database and implemented in cooperation with two private companies.[109]

With the use of graph technology, the ATO is at the forefront of global data and analytics trends. Indeed, graph technologies have been repeatedly identified by Gartner as Top 10 Trends for a few years now. In 2019, Gartner predicted that the application of graph processing and graph databases will grow at an annual rate of 100% as users aim to accelerate data preparation and enable more complex and adaptive data science.[110] In 2020, graph technologies were predicted to facilitate rapid contextualisation for decisionmaking in 30% of organisations worldwide by 2023.[111] Most recently, graph technologies have been identified as the foundation of data analytics, able to enhance and improve user collaboration, machine learning models and explainable artificial intelligence.[112]

Beyond graph technology, the ATO employs a number of other digital technology solutions. To reduce errors or omissions in individual taxpayers' income tax returns, for instance, the ATO has developed different operational analytics solutions which use data to identify and automatically adjust tax returns. The adjustments are recorded and shared with taxpayers, who then can disagree with the adjustments made.[113] Using such digital technologies, the ATO receives, matches, and pre-fills large volumes of data from an increasing variety of third-party providers (such as banks, health funds and other government departments) – allowing the ATO to share information about taxpayers' affairs before they lodge a tax return. In 2020 alone, over 85 million data points were pre-filled.[114]

The ATO is also advanced with regard to using behavioural insight methodologies, so-called nudging. More precisely, the ATO uses real-time analytics to nudge taxpayers while they complete their tax returns online in myTax. Using nearest neighbour matching methods, the tax administration compares a taxpayer's entries with the entries of other taxpayers with a similar profile. If there is a significant discrepancy, the taxpayers are automatically prompted to double-check the entries. In 2020, around eight percent of myTax users received such pop-up messages; the revenue impact of prompted adjustments is estimated at AUD 37 million.[115]

COVID-19 accelerated data exchange between different government agencies.

The last digital technology to be mentioned here is the ATO's use of virtual assistant Alex. Alex was initially launched in 2016, but its capabilities and knowledge were recently boosted to address skyrocketing requests from taxpayers during the COVID-19 pandemic. Alex is already able to provide a final answer to around 90% of taxpayers' requests, and further improvements are being implemented.[116]

COVID-19 has not only influenced the ATO's use of digital technologies; the pandemic has also encouraged more information and data exchange between the ATO and other government agencies. More precisely, the ATO and the Australian Business Registrar (ABR) provided other Australian government agencies with data to match the job type and/or location of workers and businesses with the highest COVID-19 related risk factors. Other eligible government agencies can access ABR data through the ABR Explorer to search, query, visualise and export data.[117]

When it comes to the use of digital technologies, the ATO is likely to remain among the leading tax administrations worldwide. In its Corporate Plan 2021-2022, the ATO commits to further deliverables by 2024. More precisely, it aims to standardise data-sourcing priorities and processes, expand the use of verifiable data for pre-filling, raise data literacy skills across staff, deliver a new architecture of risk models and implement contemporary cloud capabilities.[118] One initiative that may be representative of this innovative approach is the ATO's Digital Partnership Office, in which digital service providers can co-design future digital solutions to improve taxpayers' experience. The ATO supports these providers with the integration of tax requirements into the development life cycle of software that may eventually be integrated into natural business systems – for instance through real-time, event-based application programming interfaces.[119]

30%

The percent of organisations which are predicted to use graph technologies for decisionmaking by 2023.

2. China

In its current Five-Year Plan (2021-25), the Chinese government states that '[r]eforms will be deepened in the administration of tax collection and smart taxation will be developed to modernise the administration of tax collection.'[120] The recently announced fourth phase of the Golden Tax System (GTS) will play an integral part in this modernisation.[121]

The GTS was initially launched almost 30 years ago in 1994. The main goal was to establish a value-added tax collection and management system, and to integrate processes more closely with the People's Bank of China. In 1998, the Chinese tax administration (State Taxation Administration, STA) began the development of the second phase, GTS II, which was implemented in 2001. GTS II is often described as 'one network, four subsystems', where 'network' refers to the main computer network which connects the SAT with the tax administrations at the provincial, municipal and county level. The 'four subsystems' refer to China's Value-Added Tax Special Invoices, certifying Value-Added Tax Special Invoices, cross-checking and inspecting Value-Added Tax Special Invoices, and coordinating investigations.[122]

The current system, GTS III, was launched in 2016, along with a new Value-Added Tax Invoice Processing System. GTS III uses advanced digital technology – including cloud computing, big data, and other modern computation technology[123] – which allows automatic data verification, matching and reconciliation.[124] Compared with its predecessor, GTS III therefore brings considerable improvements with regard to real-time collection, cross-checking and exchange of data.[125] Indeed, GTS III allows the STA to trace companies' economic activities from various sources and to impute companies' true tax liability. More precisely, GTS III incorporates the VAT invoice system to give the STA access to information on the goods and services flow of companies. Rather than relying on offline invoicing and regular reporting, GTS III relies on online, real-time uploading of information from sellers and purchasers. Furthermore, the GTS III provides broader access to third-party data and has increased the computing power of the STA.[126]

Smart taxation is the goal of tax administration modernisation.

The Chinese government describes the recently launched GTS IV as all-round, all-business, all-process and all-intelligent. The Head of the STA further points out that "[b]y upgrading the system, we'll transition from 'managing tax through invoices' to 'managing tax through big data and the cloud'. […] It's taxation innovation and can be used for reference by other countries." Indeed, GTS IV will rely even more heavily on big data, cloud and artificial intelligence technology. More specifically, the GTS IV will go beyond GTS III in a number of features. GTS IV will, for instance, not only monitor tax-related issues, but will also manage non-tax-related issues such as social insurance premiums. Furthermore, GTS IV will allow more extensive information sharing and verification across government agencies, commissions, banks and other participating institutions. Finally, GTS IV is expected to be able to verify submitted tax data through the comprehensive use of third-party sources. The tax authorities' vast data collection capabilities include information about taxpayers' bank accounts, bank accounts of company staff, related account data of upstream and downstream companies. It allows them to reconcile the given information with revenue, costs and profits of other companies in the same industry. This also applies to historical tax data.[127]

Non-tax-related data plays a role in smart taxation.

As part of the GTS, the STA recently conducted its first annual reconciliation of individual income tax using cloud computing and big data methodologies. More precisely, the STA built the largest transaction cloud in China's

Smart taxation is part of international economic policy.

e-government. which allowed 120,000 simultaneous transactions per second. For each of the 100 million or so individual taxpayers, the STA built a profile based on real-time, real-name identity identification, which is also shared with other government agencies.[128]

Beyond the modernisation of the GTS, the STA is actively advancing its data collection and exchange efforts in other areas too. The STA, for example, has been collaborating with a company to enable blockchain invoicing in the city of Shenzhen.[129]

The Chinese government also integrates tax administration into its international economic agenda and, more specifically, its Belt and Road Initiative (BRI). Indeed, China is an active member and hosts the secretariat of the Belt and Road Initiative Tax Administration Cooperation Mechanism (BRITACOM). Launched in 2019, BRITACOM defines itself as a non-profit official mechanism for tax administration cooperation among the jurisdictions that subscribe to the BRI. BRITACOM's council currently includes 36 members tax administrations[130] and 30 observer tax administrations and organisations[131]. BRITACOM is organised around five programmes, one of which focuses on digitalising tax administration. Within this programme, more precisely under the Wuzhen Action Plan[132], BRITACOM conducts surveys among members to assess the current stage of digitalisation, to identify legal, administrative and cultural barriers to technological upgrading, and to discuss required actions. Beyond formulating strategic plans for digitalisation, BRITACOM also aims to conduct pilot projects and assist in the upgrading of information systems.[133]

3. India

The Indian tax administration can rely on the world's largest biometric identification system – Aadhaar – to identify and process taxpayers' concerns. Aadhaar is a 12-digit unique identity number based on people's biometric (photo, iris, fingerprints) and demographic (name, address, gender, age) data collected by the Unique Identification Authority of India. Along with the permanent account number (PAN), the Aadhaar identity card is mandatory for filing income tax returns.[134]

The Indian government not only holds a large amount of data, but is also looking to process this data further. In its 2021-22 budget, the Ministry of Finance commits to increasingly employing data analytics, artificial intelligence and machine learning. In this budget, the ministry also confirms that deep analytics and artificial intelligence are deployed to identify tax evaders and fake billers.

India's Income Tax Department initially started using data analytics when it launched Project Insight in 2019. Developed and supported by a private company, Project Insight aims to collect information about taxpayers' foreign bank accounts as well as details about their property transactions, rental income and motor vehicle purchases, in order to reconcile this information with their reported income and eventually detect and combat tax evasion. High-risk individuals receive text messages, phone calls and emails to nudge them into complying with the tax laws.[135]

Biometric and demographic information is required for filing tax returns.

The Indian tax administration has also started tracking radio-frequency identification on commercial vehicles to identify goods and services tax evasion and fraud. More precisely, the tax administration reconciles the electronic permits issued for transporting goods with the radio-frequency identification tags of the commercial vehicles. The objective is to detect firms which transport goods different to the ones declared.[136]

Radio-frequency identification helps detecting fraud.

4. New Zealand

The tax administration of New Zealand (Inland Revenue, IR) follows a commercial-off-the-shelf (COTS) approach to its digital transformation. SAS, an analytics software specialist, manages the IR's platform, which in turn is provided by the private company Snowflake. The whole system is hosted on SAS Cloud, allowing the IR to use SAS's data science and analytical tools such as Viya. Using these capabilities, the IR has improved its visibility over general tax compliance and its ability to identify taxpayers with higher risk of non-compliance and mark them automatically for an audit.[137]

5. Singapore

Since 2017, the tax administration of Singapore (Inland Revenue Agency of Singapore, IRAS) has been developing an application programming interface (API) marketplace. This marketplace functions as a community platform on which developers can create innovative solutions for corporate taxpayers. Such solutions, for instance, allow taxpayers to integrate their accounting and payroll systems with the tax administration through submission-based application programming interfaces. Using their Corppass Authentication, taxpayers provide consent to the software to directly transmit data on their behalf to the IRAS. The IRAS, for its part, is able to provide immediate feedback on the validation or processing status of the transmitted data. In 2020, the IRAS launched its Roadmap 2.0, which provides advanced features in the areas of accounting and taxation, property, and payroll and income.[138] This example of Singapore's marketplace is illustrative of a more general trend towards increased cooperation between enterprise resource planning system providers and tax systems.[139]

6. South Korea

The South Korean National Tax Service (NTS) opened a big data centre in 2019.[140] Integrated in the NTS' Information and Communication Technology Management Bureau, the big data centre is now an integral part of the tax administration.[141] As one of its first projects, the NTS developed a big data analytics system based on artificial intelligence to analyse various data, including tax invoices, cash and foreign exchange receipts, and data of relatives and friends. The objective of this system is to combat tax evasion using borrowed-name accounts.[142]

The Korea Customs Service (KCS) now also plans to increase the use of big data analysis and artificial intelligence. In January 2022, the KCS announced it would open a big data portal later this year. The primary purpose is to intensify the fight against trade crimes such as the import of narcotics and illegal currency exchange using virtual currency. However, the portal is also expected to allow exporters to directly report their exports to cut clearance costs and automatically issue customs duty refunds.[143]

Commercial-off-the-shelf solutions facilitate tax administrations' digital transformation.

Tax administrations rely on big data centres and platforms.

IV The Americas (AMER)

Brazil | Canada | Mexico | United States of America

The Americas are a particularly intriguing regional group with a strong focus on e-invoicing in the South and one of the earliest technology adopters (Brazil). While the US tax administration has been committed to modernising its operations, only little information is publicly available on its use of digital technologies. With a few exceptions, this is also true for Canada's tax administration. The tax administrations of Brazil and Mexico, by contrast, are relatively transparent about their advances in blockchain technology and cloud computing.

1. Brazil

The tax administration of Brazil (Federal Revenue Service, RFB) was one of the first tax administrations that shifted towards standardised and digital processes. Introduced in 2008, for instance, the Digital Public Digital Bookkeeping System (SPED – Sistema Público de Escrituração) – is a standardised financial recording scheme designed to facilitate the interaction between the RFP and taxpayers. Initially, SPED comprised three modules: digital bookkeeping (Escrituração Contábil Digital, ECD), digital tax bookkeeping (Escrituracao Fiscal Digital, EFD), and electronic invoicing (Nota Fiscal Eletrônica, NF-e).

Since then, SPED has evolved considerably. In addition to the three initial modules, SPED now also includes modules for balance sheets (Central de Balanços), billing freight costs (Conhecimento de Transporte eletrônico, CT-e), tax accounting bookkeeping (Escrituração Contábil Fiscal, ECF), contributions (EFD-Contribuições), taxes on the movement of goods and the provision of services (Imposto sobre Circulação de Mercadorias e Prestação de Serviços, EFD-ICMS), withholdings and other tax information (Escrituração Fiscal Digital de Retenções e Outras Informações Fiscais, EFD-Reinf), finance (e-Financeira), social security and labour obligations (Sistema de Escrituração Digital das Obrigações Fiscais, Previdenciárias e Trabalhistas, eSocial), manifests of tax documents (Manifesto Eletrônico de Documentos Fiscais, MDF-e), consumer invoices (Nota Fiscal de Consumidor Eletrônica, NFC-e) and service invoices (Nota Fiscal de Serviços Eletrônica, NFS-e).[144] SPED represents a shift from a traditional model of tax return to a new paradigm of real-time or almost real-time analytics.[145]

The RFB is also advanced in its use of blockchain technology for the storage and exchange of data at the federal, state and municipal level. In most cases, these blockchain technologies are developed by Dataprev and Serpo, two government-owned companies. Blockchain technology is used, for instance, for the Natural Persons Register (Cadastro de Pessoas Físicas, CPF) and the National Register of Legal Entities (Cadastro Nacional da Pessoa Jurídica, CNPJ). The blockchain-enabled versions of the CPF and the CNPJ, respectively referred to as b-CPF and b-CNPJ, can also be accessed through the more recently developed b-Cadastros. In addition to the data from b-CPF and b-CNPJ, b-Cadastros also includes information from the Register of Economic Activities of Individuals (Cadastro das Atividades Econômicas das Pessoas Físicas, CAEPF) and the National Register of Works (Cadastro Nacional de Obras, CNO).[146]

Blockchain technology facilitates intra-governmental data exchange.

Blockchain technology not only allows the RFB to exchange data with other government agencies, but also with other governments. Indeed, the b-Connect platform facilitates data exchange between the Mercosur countries Argentina, Brazil, Paraguay and Uruguay, and aims to facilitate cross-border trade. The use of b-Connect is restricted to so-called Authorised Economic Operators, which may include registered companies, brokers, airport authorities or similar institutions.[147]

Artificial intelligence is another digital technology employed by the RFB. Only recently, the RFB established the Center of Excellence in Artificial Intelligence (CEIA), which includes experienced staff members with post-graduate and doctoral degrees in the field. The CEIA is now part of an interdisciplinary team that also includes tax experts, lawyers and accountants.

Artificial intelligence is used to classify large numbers of tax appeals.

One of the first projects explored the use of artificial intelligence for the classification of tax appeals. Currently, the RFB has a backlog of more than 100,000 files which are waiting for a decision. The group of experts estimated that these files could be classified under 94 different labels, and then modelled the problem as a multilabel supervised learning task. More precisely, the RFB used logistic regression, XGBoost, Support Vector Machine and Complement Naïve Bayes to train a supervised machine learning algorithm for the thematic classification of tax appeal files related to personal income tax. In this context, the RFB works in a Python 3 environment and uses Numpy, Pandas and Scikit-Learn libraries.[148]

Such a list of labels might not always be available or feasible to create. The RFB therefore also worked on an unsupervised machine learning algorithm to extract relevant information from the decision summaries, which could then be used for classification. This approach entails first creating and cleaning a corpus of decision summaries. Once thematic similarities were identified, the experts still had to clean the decision summaries using tokenisation, stemming and lemmatisation. In other words, the texts had to be broken down into words, and these words had to be converted to their stem, and/or reduced to their normalised dictionary form. In addition, noise such as stop-words, typos and residual characters had to be removed. A second challenge is posed by the many-topics nature of summary decisions. In the end, the RFB used a variety of techniques including Term Frequency–Inverse Document Frequency, k-means clustering, probability mass and Latent Dirichlet Allocation to identify the most prominent words which could be used as labels for classification.[149]

Tax administrations use supervised and unsupervised algorithms.

99%

The accuracy with which the use of binding legal precedents can be predicted using artificial intelligence.

To facilitate the use of the generated classification, the RFB also developed a so-called directed acyclic graph model (DAG). Simply put, a DAG is formed by vertices (here words) and edges connecting pairs of vertices. The edges have an orientation and are directed from one vertex to another vertex. Users can use the DAG model to visually drill down from the classification labels to the more detailed content of the decision summary.[150]

The previous sections illustrate how the RFB employs artificial intelligence to thematically classify enormous numbers of tax appeals. In addition, the RFB uses artificial intelligence to facilitate the tax litigation process. More precisely, the RFB has developed a model that predicts the use of so-called binding legal precedents (BLPs). BLPs represent legal rules or principles articulated by higher courts which must be followed by lower courts within a given jurisdiction. The model developed by the RFB predicts, on the basis of the documents submitted before the trial, which of the 161 BLPs currently in force will likely be added by the appeal officer later. The model was developed in PyCaret, an open-source, low-code machine learning library in Python that automates machine learning workflows and which allows testing of several natural language processing and classification models simultaneously. Different algorithms were found to perform differently for different BLPs. The best performing models included Ridge, Random Forest, Random Forest and Boost, and Naïve Bayes and Boost, and generated results with an accuracy of between 87% and 99%.[151]

2. Canada

The tax administration of Canada (Canada Revenue Agency, CRA) states in its 2021-2022 Departmental Plan and in its 2021-2022 Corporate Business Plan that the enhancement of operations and the use of data is one of its priority objectives. The CRA indicates, for instance, that it aims to accelerate service improvements using data and behavioural insights, and to maximise the use of data, business intelligence, analytics, and artificial intelligence. In its plans, the CRA commits to a time plan which, for example, outlines its commitment to improve data analytics and business intelligence through machine learning and other web-based platforms by September 2022.[152]

The CRA is also in the process of developing models for machine learning and, more specifically, for data-scraping algorithms. The objective of this initiative is to reduce the manual workload of scraping news articles by automatically gathering and categorising relevant news articles through key word recognition as well as by automatically extracting and summarising information.[153]

Another initiative in which CRA is currently involved includes a collaboration with Lakehead University to develop the so-called Simplifier. The Simplifier is a tool which

Natural language processing and artificial intelligence is used to simplify tax-related information.

helps to reduce text complexity and therefore enhances CRA's ability to deliver easy-to-understand answers to common tax questions raised online. The tool applies artificial intelligence and natural language processing.[154]

From an organisational point of view, the focus on data-driven processes is well established within the CRA. Its Service, Innovation and Integration Branch (SIIB) is headed by a chief data officer and leads the development and implementation of the CRA's data and analytics strategy. The SIIB also represents the principal source of statistics to the CRA and other government agencies, as well as serving a clearing house for data and providing direction for the stewardship of data.[155]

The CRA's focus on data-driven processes also becomes evident in its human resource strategy. Its Compliance Programs Branch (CPB), for instance, increasingly uses non-traditional data sources such as international electronic funds transfers, offshore tax informants, foreign reporting forms and third-party data.[156] In its published career opportunities, the CPB is often looking for economists, statisticians, sociologists, mathematicians, computer scientists and data scientists with strong analytical and interpersonal skills who are able to process large amounts of data with advanced tools and extract important business insights. Candidates are required to have extensive experience in SQL, SAS, R, and/or Python.[157]

The CRA employs strategic data use and artificial intelligence in different areas to improve taxpayer service, non-compliance detection and internal programme efficiency. More specifically, the CRA uses artificial intelligence techniques for tax control research, the development and implementation of risk identification algorithms for the classification of taxpayer activities, and the development and implementation of taxpayer selection systems for CRA employees. These techniques allow the CRA to obtain detailed information on economic and legal relations, to analyse non-compliance more horizontally, and to assess data sources systematically to understand and profile tax non-compliance.[158]

The CRA also uses digital technologies to more accurately identify taxpayer risk in the small and medium-sized enterprise segment. First, information is checked for incorrect or incomplete data. The data is then cross-checked against tax return-filing compliance and various databases on tax settlements, tax risk profiles, tax audits, tax collection procedures and tax claims. Tax compliance for income tax and VAT purposes is then estimated in predictive modelling using digital technologies such as data mining and machine learning algorithms, cluster analyses, decision trees, neural networks and deep learning.[159]

Tax administrations hire economists, statisticians, sociologists, mathematicians, and computer and data scientists.

3. Mexico

The Mexican tax administration (Servicio de Administración Tributaria, SAT) operates a hybrid cloud (Servicios de Nube Híbrida Administrada, SENHA) – a computing environment that orchestrates private, community and public clouds. SENHA covers internal and external services (taxpayers, authorised certification providers, third parties) and seeks to consolidate data processing, storage and exchange. By using cloud computing, the Mexican tax administration ensures technical neutrality and an infrastructure which can be dynamically scaled according to the volume of taxpayers' demands.[160] The cloud is operated with the support of private companies which also support the Mexican tax administration with the integration of artificial intelligence and robotic process automation in its information technology processes.[161]

A recently published research article gives an idea of the wealth of data the SAT has access to. In cooperation with the SAT, the researchers investigate how network science tools and machine learning algorithms can be employed to identify tax evasion in Mexico. In this project, the researchers can benefit from the fact that the SAT has kept electronic records of all taxable transaction since 2014 by means of a digital receipt or invoice known as Comprobante Fiscal Digital por Internet (CFDI). CFDIs are documents in XML format with technical specifications updated and certified annually by the SAT. Each CFDI includes data on the product or service exchanged between taxpayers, the date of transaction, the cost and the corresponding tax amount. In total, the researchers have access to almost seven billion monthly aggregations of invoices from more than 80 million individuals and companies. This data includes a list of almost ten thousand taxpayers already identified as tax evaders. Using a subset of this list, the researchers employ two machine learning methods – deep neural networks and random forests – to model the remaining taxpayers on the list. Both machine learning methods are found to achieve an accuracy of more than 90%. The researchers then use the trained algorithms on the complete dataset and identify more than 100 thousand suspects for tax evasion. This list is further reduced by only analysing taxpayers that are identified by both algorithms, and which are with a short network distance from known tax evaders. Ultimately, the associated value of undetected tax evasion, by about ten thousand taxpayers, is estimated to be in the order of USD 10 billion per year.[162]

Cloud computing ensures technical neutrality and scalable infrastructure.

4. United States of America

The tax administration of the US (Internal Revenue Service, IRS) has a long history of employing technology in its operations. Sixty years ago, in 1962, the IRS was one of the first tax administrations in the world to use computers for the selection of audits. In 1964, the IRS introduced the Taxpayer Compliance Measurement Program (TCMP) to randomly select around 50,000 returns every three years for detailed audit. Based on the TCMP results, the IRS built its first dataset of noncompliance for discriminant function analysis (DIF), an automated programme which calculates the probability of noncompliance for each return.[163]

Since then, the IRS has improved its operations continuously. Even though there is only limited publicly available information on the IRS's use of digital technologies, it has become known that it procures data from data brokers, the internet and other governmental agencies, and employs artificial intelligence and machine learning techniques to analyse this data.[164]

The IRS's commitment to the use of digital technologies also becomes evident from its recent Capital Investment Plans. From 2020 to 2021, the IRS increased its budget for the modernisation of its operations by a remarkable 1,500 percent. Even after this outstanding increase, the IRS committed to another budget increase from 2021 to 2022 of seven percent.[165]

As laid out in its latest Capital Investment Plan of 2022, this budget is supposed to increase the use of innovative technologies and processes such as Cloud, Agile, DevOps, application programming interfaces, robotic process automation and next generation infrastructure. These technologies are envisaged to support taxpayer application access, analytics-based decisionmaking and efficient process execution though increased automation of transactional repeatable activities. Over the past years, the IRS has also invested heavily in Greenplum – a purpose-built appliance which integrates database, compute, storage and network for massive parallel processing, and which is geared towards big data analytics.[166]

Tax administrations' digital transformation benefits from partnerships with university research centres.

One specific project that the IRS is conducting in partnership with Stanford University's Institute for Human-Centered Artificial Intelligence is related to the modernisation of the tax collection system using artificial intelligence. More precisely, the partnership focuses on developing an active-learning system that uses an artificial intelligence algorithm to decide which tax returns should be the subject of an audit. While a conventional machine-learning approach would train a model with a specific dataset to then apply to new data, an active-learning approach learns continuously and iteratively by intentionally selecting data to update the model. If the system recognised, for instance, that certain types of deductions were more likely to lead to a miscalculation of tax owed, it would begin flagging returns with these deductions for audit.[167]

The IRS has also entered into a partnership with private companies to help enforce the reporting of crypto-assets on business and individual tax returns[168], and to verify taxpayer identities using video selfies.[169]

Outlook

This Tax Disruption Report 2021/2022 just marks the beginning of a series. On a regular basis, we want to monitor tax administrations' technological advances, accompanying them while they evolve into a new digital era. It will be interesting to see which of the tax authorities' diverse approaches to digital transformation will prevail as best practice over time. Once the 'veil of ignorance' is lifted, a 'winner strategy' might crystalise.

We also want to constantly revisit our predictions to deepen the general understanding of how the world of tax is changing. We are convinced that this kind of knowledge will prove crucial for corporate taxpayers to successfully steer through an ever-more rapidly changing tax environment.

We would be happy if we could encourage a debate about the current developments – both at a state and corporate level – and provide valuable input for further discussions.

It would be great to receive your feedback and have you on board again for more insights and thoughts in the next report!

Footnotes

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