



# TRENDS IN TAX

**2020 AND BEYOND**

A Capgemini Survey

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# Preface

Tax agencies all around the globe put significant effort in evolving their operational model up to the demands of the digital era and the increasing demand for digital services by taxpayers. Substantial investments are made in improving the customer experience and the operational excellence. Over the last years we also see a significant acceleration of investments in the development of data driven or intelligence driven compliance supported by advanced analytics and predictive modelling. This trends report on taxation gives an overview of global trends which potentially impact the taxation domain and describes the most important enabling technologies tax agencies are adopting around the globe or are most likely to adopt in the near future.

The report is based on what we see and hear from our clients worldwide, supplemented by our own research and business insights. Experiences and knowhow are exchanged in Capgemini's Global Tax & Welfare Community.

Being a multinational consulting and technology company, we focus on technological trends. This is our core business. But the Capgemini way of working is to work closely with our clients and bring a deep business understanding to the table that we have built up over more than 5 decades as well.

This report is not an academic dissertation but a popular description of the way tax agencies

can use technology to be successful in obtaining their primary goal: ensuring that the national treasuries are supplied with the necessary revenues.

Because the young are our future, we invited students from the Rotterdam School of Management, Erasmus University to review the final draft and to give their comments. They emphasized a couple of interesting views on taxation like "please unburden taxpayers", "one click tax", "use chatbots for annual income tax declaration" and "be transparent about the data sources used for taxation; show where the information is coming from". These observations show the increasing importance of IT to support customer experience as well as the operational excellence of tax agencies.

In the annex to this report we will specifically zoom in on four technology related capabilities that we think will play a more and more important role the next years in the day to day operations of tax agencies. These are: Data and Analytics, Automation (RPA/AI), Blockchain and The Internet of Things (IoT).

Finally, to complete our survey we interviewed key executives from tax agencies around the world. When asked about their biggest challenges and concerns towards the near future, a number of tax officials replied: "Our biggest concern is how to keep up". So, interesting times ahead of us: 2020 and beyond.



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# Management Summary

The impact of disruptive technologies and innovations on our society is now bigger than ever. Tax agencies are required to anticipate on these developments swiftly, in order to meet the changing citizens' demands.

We determined the future focal areas of tax agencies by examining their primary functions, namely: imposing and collecting taxes and reaping the social benefits associated with these activities. Our vision is therefore that the strategy of a tax agency could be based on two pillars: a thrive to make being compliant with tax laws as easy as possible, while making it very unattractive and difficult for taxpayers to evade their obligations. The adoption and utilization of (emerging) technologies is more than once essential

for tax agencies willing to keep up.

This report is primarily technology driven. However, to get a good understanding of the context in which technology trends are embedded we have studied a number of dominant global trends that are likely to have an impact on tax agencies' agendas globally. For example, we touched upon the increased mobility of people and goods, the debate on climate resilience, the rise of the 'gig-economy' and the increased emphasis on security and privacy as dominant – non technological - trends. These non-technological trends impact both taxation and the way in which tax agencies have to operate. In a lot of cases new technologies are used by tax agencies to adapt their modus operandus to these changes.

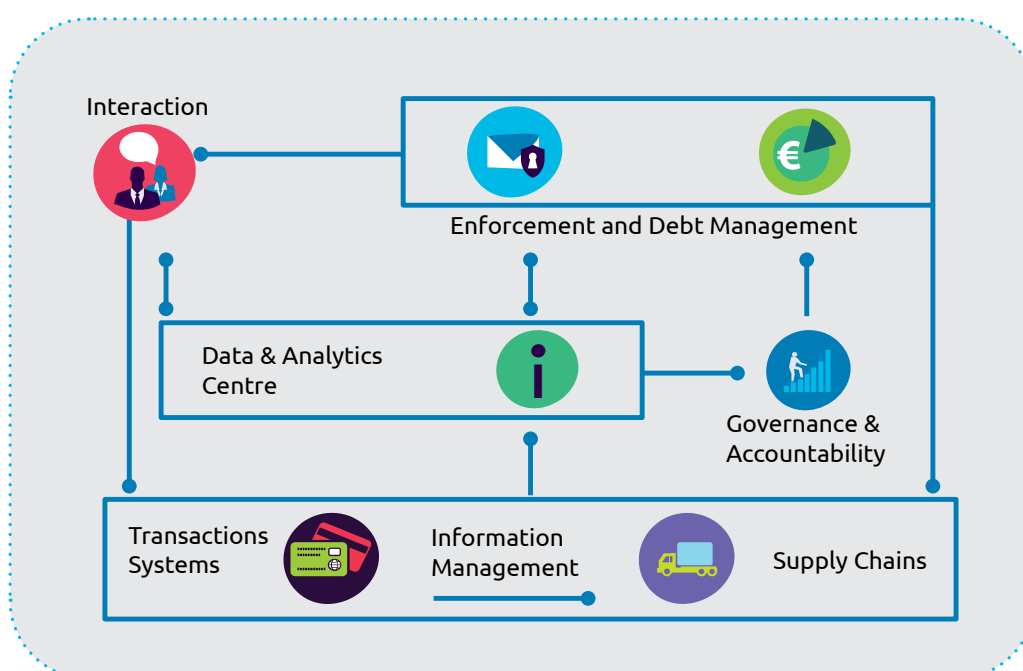


Figure 1: Simplified data & analytics centered target operating model of a Tax Agency.

Our findings are acknowledged by tax officials we surveyed. The primary concern that was mentioned by tax officials is the struggle for tax agencies to simply keep up with the speed of technological developments. We noticed tax agencies are willing to become more agile and develop their digital tax strategy but are often restricted by a variety of 'legacy' challenges.

When consolidating trends, we observed from our interviews, we isolated tax-domain specific take-aways:

The first one is the need to transform the tax agency into a more agile organization that will be able to keep up with the speed of the digital era, meeting customer demands in terms of speed and personalization and meeting changes in taxation and tax reforms.

The second dominant trend is the development towards an intelligence driven operating model for the tax agency. Most tax agencies struggle with really transforming their operating model and putting data and analytics at the heart of their operation,





it is clear that all of them are on a path towards an organization that is data driven and analytics enabled in order to keep up with the digital society.

A third, but less dominant trend we observe is the growing use of automation to improve operational excellence and customer service. Speed of transaction and even customer interaction processes can be increased, and error can be reduced by automating repetitive tasks.

The above three take-aways are consolidations of what we have heard during our interviews and surveys combined with our industry knowledge. Below we have stated a number of other findings

which came forward during the interview sessions:

- Today's possibilities of data & analytics hold huge potential benefits for tax agencies by improving operational excellence, customer experience and accountability. The full potential can only be realized when the data & analytics capabilities are positioned at the heart of the operating model, which proves to be a challenge for many organizations. In our annex we describe how tax agencies can implement data & analytics experiments into their operations.
- We observe the growing use of automation to improve operational excellence and customer

service. As stated, speed of transaction and even customer interaction processes can be increased, and errors can be reduced by automating repetitive tasks. But another important effect next to the improved results of the tax agencies performance, this also leads to the possible freeing up of scarce Human Intelligence that is needed for other tasks within the tax agency. Skilled tax professionals are becoming relatively scarce in a lot of countries due to the ageing population not only in society itself but also inside the tax agencies.

- According to a World Economic Forum survey, governments will collect tax for the first time via Blockchain in 2023. Blockchain has the potential to simplify and enable automation of tax collection. The technology can be used for verifying, appraising, approving and auditing the information provided by citizens, thus driving efficiency and accuracy. Automation of calculation for taxation can become more efficient and time-saving, and thus reduce costs and administrative burden of tax systems. Moreover, Blockchain can be used to view transactions in real time, making it easier for tax agencies to detect fraud and errors.

- The Internet of Things (IoT) will continue to impact our daily lives. More and more companies change their business model from selling products, to selling a pay-per use service. Changes like these can be applicable to taxation as well. In the future, there might even be individualized tax rates based on usage. When companies buy tangible assets - such as equipment, machines and vehicles – given that they have been equipped to become smart objects – depreciation could be calculated by use and place of the object. Here, tax agencies become part of a bigger IoT solution.

Based on these technological developments, a better (personalized) experience can be delivered. The customer experience can be increased by means of convenience.



## The way tax agencies operate is changing

*A dominant trend we see is the transformation of tax agencies into more agile organizations to be able to keep up with the speed of the digital era, meeting customer demands in terms of speed and personalization and meeting upcoming changes in taxation and tax reforms. Many tax agencies will have to unleash themselves from the IT and processes legacy landscape that still runs their current business. Making tax truly digital could be the metaphor for this transition.*

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## 1 INTRODUCTION:

# The tax agency's operating model

**D**isruptive forces like urbanization, accelerating technology and global connectivity develop a need for tax authorities to move fast. Along with an ever-increasing demand for operational excellence (speed) and improved (personalized) customer service, these developments in technology and global connectivity also create new opportunities for digital tax fraudsters and evaders. We see an industrialization of fraud in the digital era.

Tax agencies are thus forced to anticipate on rapid technological and social developments. But how?

## The essence of taxation – closing the tax gap

To understand how and why tax agencies leverage technology in their day to day operation, one should have a closer look at the essence of tax agencies and the requirements for successful taxation.

Taxation can be considered successful when the primary tasks of a tax agency are being carried out, namely: imposing and collecting taxes and reaping the social benefits associated with these activities. Although different tax agencies use different definitions of their primary tasks and subtasks, the essence of Taxation is ensuring that treasury is supplied with the necessary revenues. tax agencies must make sure

that these activities are being carried out in a smooth way. For this reason, tax agencies have large-scale processes in place, auditing activities and services, and people at the tax agencies with their specific knowledge, skillset and experience. The execution of a tax agencies primary tasks is what we call the production part of the taxation machine.

Although the ability to execute its primary tasks is of great importance for tax agencies, the machine does not function when tax payers do not fill out their tax return forms completely and correctly. In other words, taxpayers need to actually comply with the Tax obligations, they need to be “compliant”. Tax payers should demonstrate a certain type of desirable behavior. In an academic context, we



call this construct the “behavioral compliance” of a taxpayer. Tax agencies can improve the motivation of tax payers, by providing them with excellent service. Not only the tax agencies needs to carry out its own primary processes very efficient (high speed, flawless, low cost) but being compliant should be made easy to the max for the taxpayer. For this reason, tax authorities should put great effort into increasing the knowledge level of the taxpayer on topics such as: the tax agencies rules, processes and abundant opportunities for them to comply with their obligations. At the same time, being non-compliant must be extremely unattractive for the tax payer. The chance of being caught and punished must be high. In short one could say that a tax agencies compliance strategy consists of two pillars: a thrive to make being compliant with tax laws very smooth and easy and being non-compliant very unattractive.

## The use of technology by tax agencies

Over the last two decades tax agencies have put great effort in evolving their operating model up to the demands of the digital era and the increasing demands for digital service by taxpayers. Three main paths of investment have therefore been: improving customer experience and developing a SMAC (Social, Mobile, Analytics, Cloud) suite next to improving operational excellence in their digital operating model. A third path has been the development of data driven or intelligence driven Compliance. Over the last 5 years an enormous acceleration can be witnessed in the field of advanced analytics and predictive modelling. Tax agencies are leveraging new data sources and sophisticated modelling tools and data mining to improve targeting of high-risk cases, detection of fraud and retrieval of debt.





## 2 TRENDS IN TAX: An outside-in perspective

**A**s this report focuses on assessing the value of (emerging) technologies for tax agencies, a better understanding of the context in which these technologies are embedded was needed. We studied dominant global forces which potentially impact the taxation domain. The results of this research guided the assessment of tax agencies' agendas for the coming years and, thus, the degree of relevance of specific technologies to the problems tax agencies face and will face in the future. The global trends studied, have been divided in the following 4 categories: social trends, economic trends, legal trends and political trends.

### Social trends

We currently observe three dominant social trends with an impact on society as a whole: increased mobility of people and goods, an increasingly growing population and a constantly extending life expectancy.



## **The increased mobility of people and goods**

Fueled by globalization, the mobility of both people and goods between different cities or even different countries has spiked. It has become easy and relatively cheap for citizens to -temporarily- move abroad, or to order goods from shops in different countries. This increased mobility of goods impacts the way of working and success of our tax revenue collection efforts. The impact of this increased mobility differs per country. Some countries, which focus more on “easily collectable” consumption-type taxes, are likely to be better prepared for their citizens moving around the world than countries focusing on more difficult to collect income- and corporate taxes. As mentioned before, comparable challenges arise when assessing the movement of goods. tax agencies can find themselves facing issues like: “How to assess taxation when individuals orders goods online in one country, while having these goods delivered to their home in another country?”

## **The ongoing debate on climate resilience and sustainability**

On a similar note, the increased mobility of people and goods has also sparked a greater public debate on climate resilience. Society as a whole finds itself questioning whether or not big “polluters” should be taxed based on an equal share of the carbon emissions they produce. Although the outcomes of these debates are still to be discovered, it is something tax agencies should consider when defining their agenda for years to come.

These debates will most likely include pricing mechanisms to influence human and corporate behavior. We see numerous countries implementing new forms of taxation as a means to influence behavior in fields like the usage of energy, water, packaging materials, aviation, carbon emission, mobility, waste disposal, and so on. tax agencies should therefore prepare to implement new types of

taxation into their business models leading to significant changes in their operating model.

We also foresee a shift in the taxation of taxable objects based on the ability-to-pay principle like (corporate) income tax, wealth tax, and – to a certain extend – consumption taxes likes VAT to taxes imposed on expenditures. The first category of taxes are traditionally based on (annual or monthly) declarations by tax payers that are assessed by the tax agencies. Taxes on expenditures will have to be levied and collected on a transaction base. This implies a completely different way of levying and collecting these taxes including the way compliance is upheld. The “connected everything” IoT potentially holds rich data sources to impose those new types of taxes.

## **The intensified connectedness of global citizens and organizations**

As global citizens are becoming more and more connected, they expect to receive a different service level from governmental organizations than they did in the past. Positive experiences travel fast and born innovators in the form of BigTech companies have raised the bar for all other organizations in both private and public domains. As a result, there is an evident push by citizens for tax agencies to explore more omni-channels ways of interaction. After all, if other organizations can make it easy for them to do business, why can’t tax agencies support them with the same servicing standards? Citizens want their tax agencies to be available for them anytime, anywhere while being dealt with personally and quickly across every channel they prefer to choose.

Comparable needs can be found when examining corporations and other public organizations. We see more and more organizations “opening up” by selectively sharing their data and services with a greater audience. Driven by regulations (e.g. PSD2), or simply driven by citizens’ needs. It is worthwhile for tax agencies to investigate the possibilities and limitations in this field

as well. Currently, it can be cumbersome for citizens to gather their personal data from governmental organizations, simply to deliver it to another, resulting in a negative servicing experience. Being able to automatically share required information with other (semi) public organizations and private companies can enable tax agencies to reduce overhead and bureaucracy while contributing to the overall customer experience.

### Increased life expectancy

A world's demography is influenced by an ageing population when the percentage of old-age population is larger, and is increasingly becoming greater, than the younger population. An ageing population will therefore lead to an unbalance in the ratio of productive and non-productive inhabitants. This affects countries in a variety of manners – economic growth decreases, inhabitants are required to pay increased amount of their salary to support the non-productive share of the population and government spending rises to meet the increased demands for healthcare and retirement programs. It is clear to see that this development exerts pressure on the potential tax revenues raised by countries.

Contra-measures such as raising the labor taxes may harm competitiveness, job creation and economic growth. What can be done? Shifting from direct labor taxes to indirect taxes (such as VAT) could be a solution to tackle the decreasing tax base. As a result of an aging population, tax agencies will have to face the fact that valuable employees - the “Baby Boomers”- will retire. This will put pressure on the tax agencies to find new well skilled IT employees in time and to maintain the appropriate level of knowledge within the organization.

## Economic trends

### The “gig”- economy or “platform-economy”

The “gig”- or “platform economy” explains a free-market system in which people hold temporary or part-time jobs and in which companies prefer hiring freelancers rather than employing full-time employees. For organizations, this saves all kinds of overhead costs, while individuals have the freedom to easily switch employers and can benefit from all the cheaper services organizations have to offer. Transitions towards gig-economies can

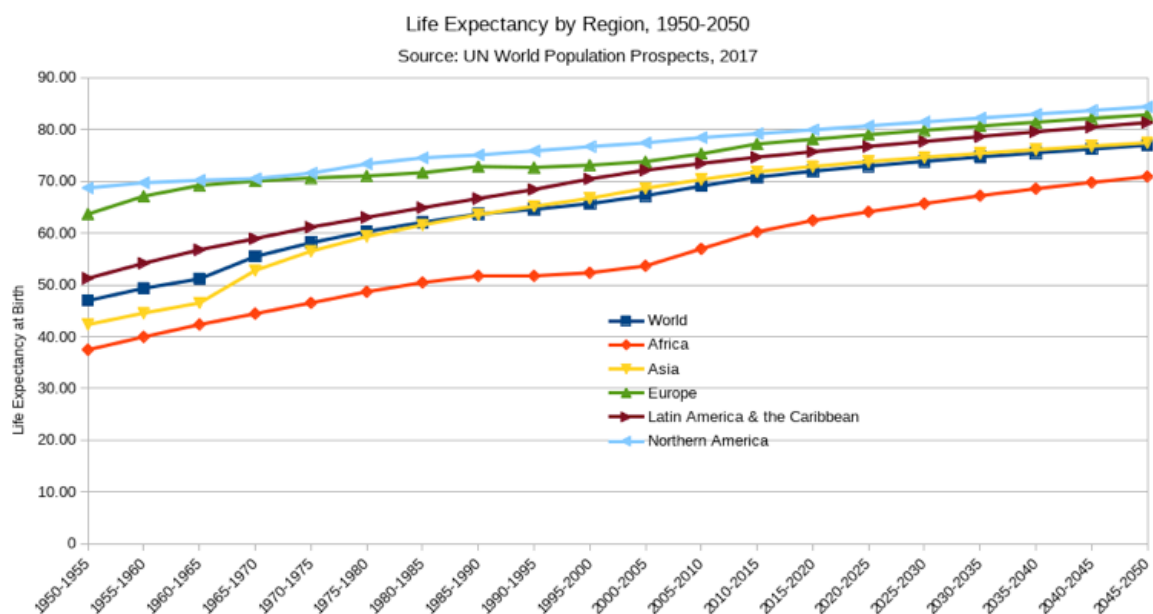


Figure 2: The (potential) rise of the average life expectancy from 1950 - 2050.

to several challenges with regards to the taxation of these freelancers as opposed to full-time employees.

The complications rise from the types of income one can distinguish when looking at a gig economy worker. Freelancers usually serve more than one organization to make an income, which leads to multiple sources of income that need to be correctly entered in the systems of tax agencies. Abuse or confusion resulting from this situation could potentially lead to lost Tax Agency revenue. A challenge lies ahead for tax agencies to work together with individuals and platforms to make visible the share of income generated by the gig-economy and to improve the ease of sharing personal finance to enable compliant behavior.

### Cryptocurrencies on the rise

A trend increasingly receiving more attention by national governments is the growing popularity of cryptocurrencies. The market capitalization of the 100 largest cryptocurrencies can be estimated at around \$250 billion in early 2019 and this number is expected to grow even further – especially when looking at recent developments like the introduction of Facebook’s Libra coin. As a result of this increasing popularity, tax agencies are forced to investigate if, and how, cryptocurrencies

should be taxed. Currently, we can find different countries treating cryptocurrencies in a different matter. Some countries do not tax the possession, nor sale, of cryptocurrencies at all, while others have introduced capital gains taxes or income taxes to tax one’s virtual assets.

## Political trend

### Tax legislation as vehicle to do politics

On a global scale we see a volatile political landscape, both within and between countries. Parliaments generally have fewer sitting days than in earlier days, potentially allowing for more changes in a nation’s legislations and regulations. In addition, we see an increase in treaties across nations, surpassing national sovereignty, requiring reforms from the nations affected. As mentioned, this trend puts a pressure on tax agencies to implement new legislations in an increased pace. This may disallow them to focus on innovation and development work on legacy systems. In particular for nations within the European Union we see this in the form of the emerging call to action against tax evasion and evasion facilitative countries, so called tax havens. Nations are requested to give up on **disrupting tax facilities and shift their focus to**

## How the Gig Economy Works

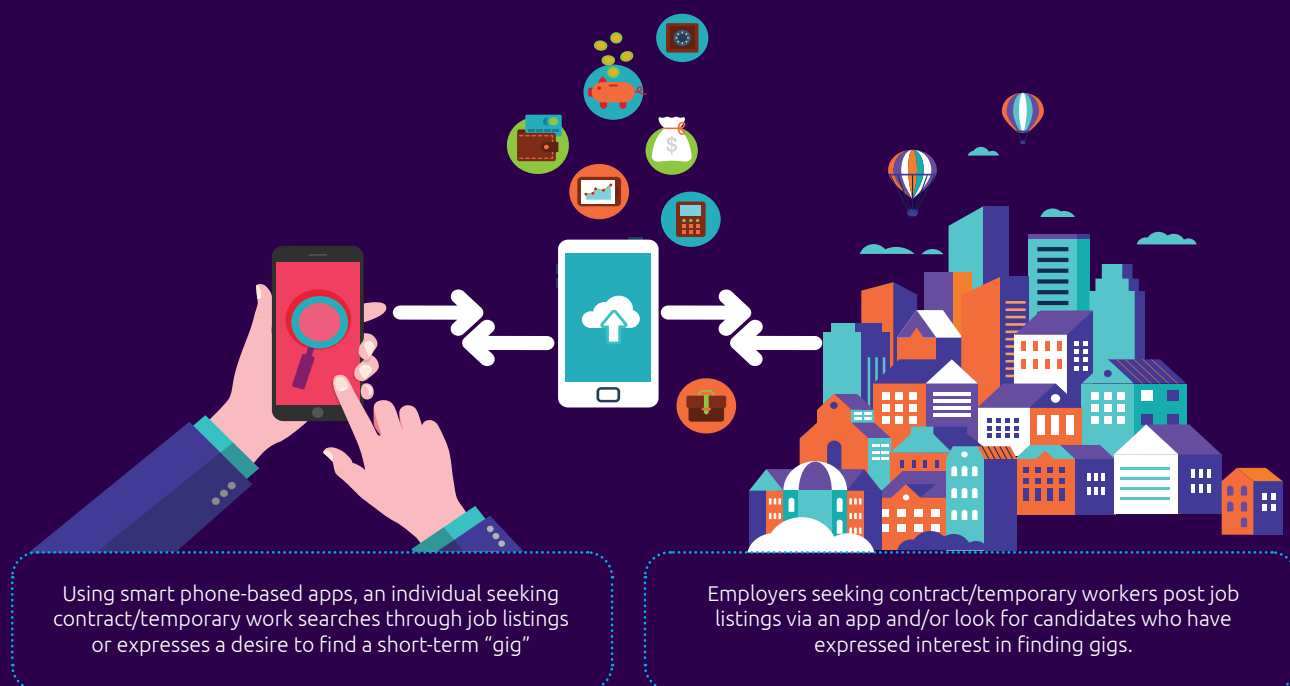


Figure 3: A short description of the gig-economy.

comply with international agreements. Recent revelations like the “Panama leaks” contribute to an international trend of almost zero tolerance for tax evaders. Developments like these, however logical, impact agencies’ agility, calling for them to better organize their flexibility and adaptivity internally to be able to manage these political disruptions properly.

## Legal trends

### Privacy regulations

The increased globalization and digitization make it easier for anyone to gather and share (personal) data, for both legitimate and non-legitimate purposes. This emphasizes another type of topic tax agencies need to be aware of and act upon, namely: security and privacy. The increased public awareness and understanding of the use and misuse of data has created a base for governments to rethink their policies regarding citizens’ data rights. One of the results was the introduction of the General Data Protection Regulation (GDPR) in the European Union which regulates the usage of personal data by organizations and poses significant fines for those breaking the rules. These types of regulations had, and will continue to have, an impact on the way of working of agencies across Europe as agencies had to re-assess the way they had been executing their operations for years in order to be compliant.

### The role of identity in a digital world

Another aspect of security and privacy in the tax domain is identity management. All agencies have, and are required to have, processes in place to make sure that the person at the other end is in fact the person who they say they are. Although this might seem as an obvious statement, the complexity of verifying one’s identity is increasing. Merely asking for pre-defined personal questions might not suffice

anymore in the near future, with examples of (digital) identity fraud and theft being numerous. But also, how do tax agencies make sure that user’s verification happens securely and safe?

### Ethical considerations

This brings us to the last topic in global legal trends, namely: the ethical considerations of using data. While all sorts of data is widely available, there are various ethical considerations that need to be taken into account when establishing future policy and technologies. Examples of (disproportionate) usage of data by governments that sparked the public debate are numerous and will likely become an even greater center of attention in times to come. A question tax agencies will face is, for example: “Where does the legitimate collection of data stop, and where does privacy infringement begin? A challenge for a well thought-through approach to tax agencies’ policies lies ahead.

## Conclusion and key take-aways

To summarize, we find a variety of global trends to put pressure on the way of working of tax agencies. Social, economic, political and legal developments require tax agencies to critically re-evaluate their current operations and their future movements. Given the trends described above, we distilled the most prominent challenges for tax agencies to consider when developing future policy:

### Changing citizens in the digital age

It is undeniable that citizens’ behavior is changing. As mentioned before, citizens want tax agencies to be available for them anytime and anywhere and want to deal with tax agencies as quickly and seamlessly as possible on the channel they decide to use. In addition, they want to have access to their personal data and would ideally want to have it integrated in all other services provided by



governments to avoid unnecessary touchpoints. However, taken into consideration the security and privacy of their data.

### **The platform economy is on the rise**

Companies move towards becoming platforms instead of standalone service providers, integrating their ecosystem in their current business models. Results of this development can be seen in the fact that the biggest taxi company in the world (Uber) does not own its own cars, while one of the largest hospitality companies (AirBnB) does not own any accommodations. We see corporates more than often being accommodative service providers than actual providers of products. A consequence we observe is the rise of freelancers and self-employed hires (often operating cross-border) which makes it more difficult to visualize the actual earnings of this sector making it complex for tax agencies to rely on income-based tax. Next to these developments, in the coming years autonomous driving and autonomous manned drones will be introduced, pushed by leading car manufacturers, but also companies like Uber and Airbus. Airbus for example launched a feasibility

study to demonstrate an urban system of vertical take-off and landing vehicles in Paris at the 2024 Olympic Games. It can be expected that based on these developments sharing of vehicles will become more popular than owning, which will have huge impact on taxation of mobility. tax agencies therefore are advised to explore different means of taxation (such as consumption-based taxation) to which technology will be a significant enabler.

### **Security and privacy by design**

While we observe a tendency for organizations to innovate to keep up with their tech-competitors, security and privacy should play an integral role in any type of innovation discussion. tax agencies will have to assess their strategy in collecting and storing (personal) data. In addition, in terms of servicing innovation, agencies should evaluate where an enhanced customer experience stops and where privacy infringement begins. Furthermore, the widespread digitalization has made it easier for criminals to get involved in identity theft and fraud – something that tax agencies should definitely focus on in years to come.



### 3 TRENDS IN TAX LOOKING INSIDE OUT IN:

## Interviewing Tax Authority executives

In the course of our survey we interviewed tax agencies executives around the globe. We sent them a questionnaire in advance and conducted semi structured identically set up interviews with all of them. From these interviews we derived trends that tax agencies are dealing with around the globe, and challenges that are similar to a large group of tax agencies. Finally, we focused on those topics where technology can and will play a crucial role in dealing with those challenges.

### The speed of technological developments

When asked about their biggest challenges and concerns towards the near future, a number of Tax officials reply:



“Our biggest concern is how to keep up.”



The authorities' perspective on all these trends is a mixture of hope and fear. A significant number of Tax officials face the future with mixed feelings. On one hand technological developments like artificial intelligence (AI), the availability of data and increasing computing power, create in their opinion great possibilities to improve the tax agencies performance. On the other hand, the increase in customer demands, the speed of technological developments and increasing complexity of systems, an ageing workforce and the lack of agility of their own organization, raise great challenges to keep up with society.

## The need for speed in the Taxation process

Over the last decades tax agencies have used technology more and more to make tax compliance easier and paying taxes faster. Global research shows that the average time to comply has fallen by 84 hours since 2014 (source: World bank Group – paying taxes 2019). Intelligent – real time or near real time tax accounting systems, pre-populated tax returns and easy to use online tax portals are used to improve compliance and reduce the overall number of payments to tax

administrations. North America and Europe are regions with the most efficient post-filing processes and can be regarded as the easiest economies to pay taxes. Central Asia and Eastern Europe as well as Asia Pacific countries show great progress over the last decades in the reduction of the average time to comply both due to tax reforms and the use of technology such as electronic payments systems and online filing.

## The lack of agility and the law of the inhibiting lead

A number of tax agencies that are already using advanced technologies have continued to improve their systems and have obtained great progress in making compliant tax behavior easier by increasing speed and reducing error. Over the last decades, they signal an increasing burden of maintaining their legacy IT landscape. Those agencies are often the early adopters of IT systems for their large-scale transaction processes shortly after World War II and have massively implemented IT systems for all of their business processes in the 70's and 80's. Some

of these systems are still running and are become an increasing burden of maintenance consuming a large part of their IT budget. Transformation- or replacement of these systems proves to be a complex exercise (from an organizational point of view) and is often postponed or sheered because of the possible negative effects – in case of failure - on the direct tax cash flow for the state. With that the old IT landscape becomes a log jam for the organizations agility to implement tax reforms.

A tax official from a large western economy stated avowedly:



“We have a huge challenge to get rid of our legacy IT-systems in order to become more agile.”

## The need to digitalize taxation

The use of the word “legacy” is often used to refer to a combination of old IT systems or an entire stack of older IT systems. A tax official in one of the largest European economies added to this that his organization is not only suffering from a legacy of IT systems but also of the inheritance of massively computerized paper-based processes. When entering the digital era, in an attempt to fulfill the presumed taxpayer desires to serve them as much as possible via the online channel, numerous paper-based processes were automated. In a lot of cases this meant no more than the automation of a form which

was to be filled and returned electronically and was then processed by the tax agency in no different way than the former paper form which was inserted into the “silo”-transaction system. No real digitalization was part of this automation and no real benefits such as straight through processing, real time risk assessment, business rules comparison or cross system data checks were applied or possible. To summarize, the official said: “And then there’s this other legacy to get rid of: the legacy of the computerization of paper-based processes”.



“We have digitized most of the tax agency’s processes over the last decade. Now it’s time to digitalize taxation.”



In our practice we see quite a lot of tax agencies struggling with this problem. On the one hand there is the need to become more agile to keep up with society's pace to implement changes in taxation or the way taxes are levied and collected. On the other hand, the tax agencies current IT and processes landscape demands for a thorough renewal or rebuild to obtain the necessary agility to keep up with politician's and taxpayer's demands. In a number of cases this puzzle almost paralyzes the IT investment agenda and decision making of the organization in question. We see best in class tax agencies follow a crystal clear multi annual Roadmap towards the modernization of their IT and processes landscape and manage the, sometimes painful transition with rigor and determination.

We see a number of tax agencies, who follow a less tight road to modernization, struggling between maintaining their "old" IT systems – which still bring in a lot of yield day by day – and renewal of these systems. In some cases, this leads to a detrimental shift in the ratio between IT budget spent on maintenance and IT spent on renewal.

An interesting trend we see is the use of Robotic Process Automation (RPA) to help diminish the problems resulting from - legacy - technology. An example: A problem that a lot of tax agencies face is a systems and processes landscape that is built up around silos. Each type of tax uses its own system and process. The result of this is that a lot of taxpayers' data are also stored in separate systems. When a taxpayer calls the tax agency's customer contact center with a service request involving more than one type of tax, the tax employee must query each system separately to obtain an overview of all the taxpayer's data. This is a very time-consuming process while the taxpayer is waiting for an answer. This situation can be improved dramatically by using robotics. An intelligent script can gather all necessary taxpayer data from every required system at the start of the conversation by entering customer ID or number and can then present a full client dashboard to the tax employee within seconds. Combining this solution with other technologies like smart contact center software with learning functions, can further improve and speed up correct service and answering to the taxpayer. Experiences show a dramatic improvement in service levels and decrease in costs, thus freeing up scarce human resources for other tasks within the organization.

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## The need for experienced tax inspectors

tax agencies scream for skilled staff and resources to develop, maintain and run their IT and business technology, especially in the area of data science. Resources in these domains are scarce. At the same time skilled tax inspectors are also still needed to analyze data and to define the “business rules” algorithms are composed of or fed with. A

lot of tax agencies, especially those with an ageing workforce, fear a knowledge drain in the fiscal domain once the baby boomers start retiring over the next years. Practically all tax agencies put massive effort in training tax officers while at the same time retaining their experienced staff.



“We are doing everything we can to mitigate the knowledge shortage as a result of the predicted outflow of skilled workers”

a number of tax administration officials from Western European and North American agencies said. These countries face a rapidly ageing workforce resulting from their massive growth in the 60's and the massive hiring of staff to fulfill large scale administrative and investigative processes. The average age of the skilled government employee in a lot of western countries is over 55 years and, in some cases, up to 30% of the staff is up for retirement within the next 5 to 10 years resulting in a huge drain of tax expertise and experience.

Although a lot of former manually processed administrative work and pre-audit risk investigation can be supported by the good use of process automation and AI, experienced tax professionals will still very much be needed to analyze data and to assess nonstandard tax matters and to rule on appeals.

The use of technology like RPA as illustrated before can free up scarce human resources from repetitive manually executed administrative tasks like querying systems for taxpayers data but also the effective use of data and advanced analytics can free up time of the experienced tax inspector.

# The fight against Fraud – the need for Intelligence



“We are always one step behind the professional fraudsters. The trick is not to get more than 1 step behind.”

In the first chapter of this report we stated that, in essence, a tax agency’s compliance strategy consists of two pillars: a thrive to make being compliant with tax laws very smooth and easy and being noncompliant very unattractive. The chance of being caught and punished must be high.

Practically every tax official we interviewed for this trends research stated that this is their top of mind concern and one of the main drivers to do everything within their power to keep up with technological developments.

In the digital era, fraud and evasion are digitalized too and fraudsters are extremely motivated and skilled in using the possibilities of the latest technologies and the opportunities and loop

holes the tax systems offer, to take advantage for themselves at the cost of society. In the digital-by-default era a great number of government services can be accessed in fully digitalized interaction using only an electronic identity and password to apply for a benefit, allowance or refund. Skilled fraudsters know how to by-pass all standard in-process controls and thresholds to successfully obtain allowances or refunds. In case of later detection, the fraudsters have disappeared (for example in the case of Missing Trader fraud with VAT refunds) or have used stolen ID’s. In some cases, ingenious constructions are designed by professional fraudsters such as fictitious employment fraud by using feigned employee relationships.

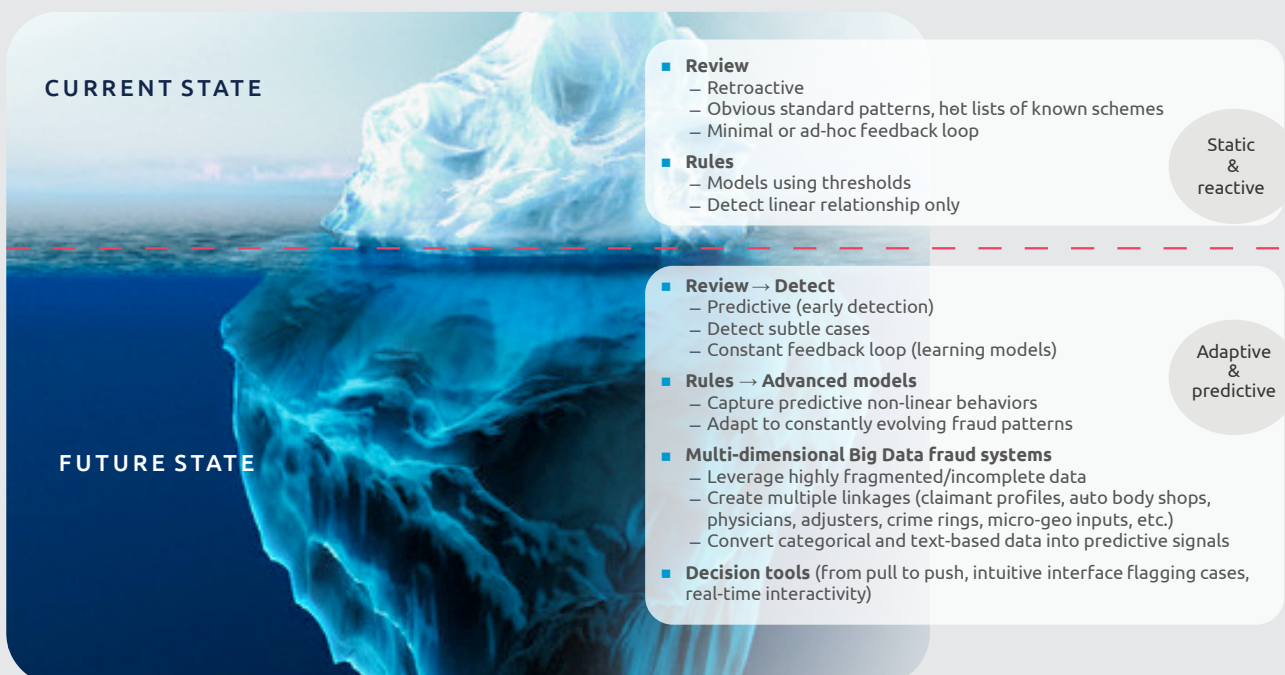


Figure 4: Current versus most advanced fraud detection systems.



Tax agencies will also have to operate in a digital world with increased risks for fraud and error. Where risk management was traditionally seen as a specialized capability, focusing on threats which were already transacted and driving corrective actions tax agencies will need to move from “checking” to “risk based” analytics and move from “downstream” risk assessment to upstream risk assessment to timely detect fraud and error. This means risking using advanced analytics to link multiple data sets and generate a risk score and an analytics-based compliance strategy. This means the Tax agency will need to think data, analytics and digital. The graph above shows illustrates that current state fraud detection systems mainly hit the tip of the iceberg.

A lot of tax agencies seek help from companies like ours in implementing anti-fraud solutions.

Now the good news is: an awful lot is possible. Advanced analytical methods combined with excellent software suites and sufficient computing power can give tax agencies very efficient and effective means of detecting non-compliant behavior and implementing early warning systems for yield risks and fraud. The bad news is, there is no one size fits all – off the shelf simple solution to cover all non-compliant tax payers behavior. You have to know what you are looking for and line up fiscal expertise with process and data expertise and – yes – technological know-how to make it work. Think big and start small and scale up gradually. To really implement data – or better: intelligence – driven compliance into the heart of the tax agencies Operating Model requires a strategic approach and a clear vision and roadmap of the path to maturity in combating fraud in the digital era.

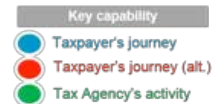
# Personalization and segmentation of services through the use of Big Data

Tax agencies are rapidly shifting to adopt data, analytics and digital by leveraging new data sources and sophisticated modelling tools and data mining to improve targeting of high-risk cases, detection of fraud and retrieval of debt. At the same time the availability of data and increased modelling tools create more and better possibilities to improve the customer service end of the tax agencies

compliance strategy via segmentation and personalization of services.

The next graph shows examples of the way tax payers can be “serviced” in the digital era, tailoring the tax agencies approach to the behavior that can be observed in the customer interaction processes.

## Real time risking & process escalation capability



### Real-time risking and service tailoring will enable more segmented approach to compliance in the upstream process

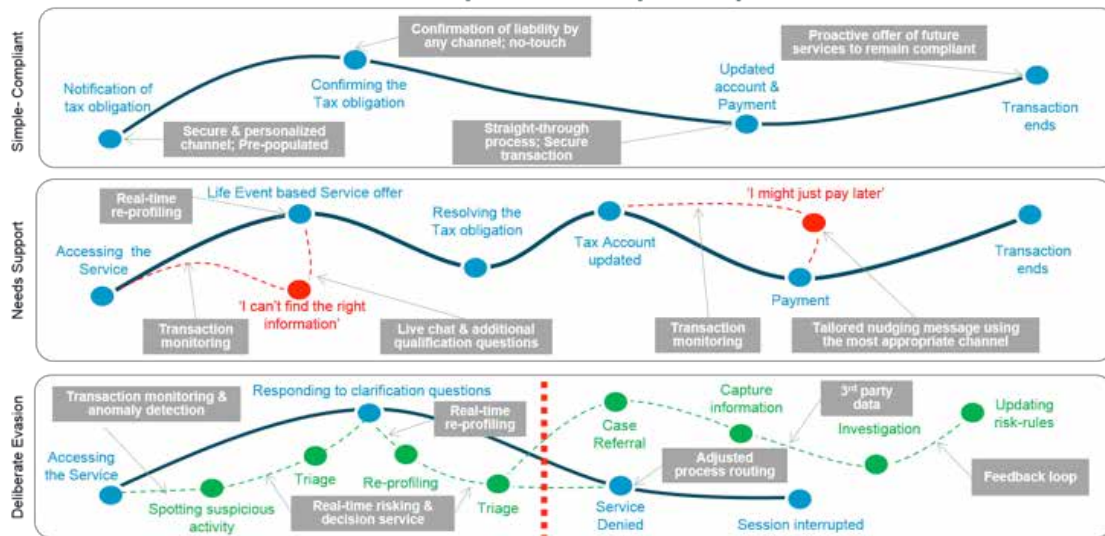


Figure 5: An impression of real time risking used to improve compliance management by tax agencies.

Tax agencies are modelling their service concepts to the way services and goods are provided in other fields of the platform economy. Services need to be available anytime, anywhere and as soon as possible in a personalized way via dedicated digital

accounts. Virtual agents support taxpayers in filling out their tax returns. Techniques like pop-up messages and nudging are used to guide the taxpayer through his “customer journey”.

## The limits of data science

Tax agencies operate by definition in a heavily regulated environment, which puts specific constraints on tax agencies, especially when it comes to the ethics of AI. Both within tax agencies, as well as in the wider context, we see an increase of attention with respect to the ethics of AI. The number of articles in the media questioning the ethics of AI is increasing annually (trend), and focusses on a

number of topics: transparency, auditability, bias and human impact.

The use of the great amounts of available data in the digital era also imposes major legal and even moral duties on government parties using them. Aspects such as the proportionate use of data, protection of security of data and privacy aspects are publicly debated and subject to further legislation.



“A bad data scientist will let the data speak the truth; a good data scientist will listen to the data and speak truly.”

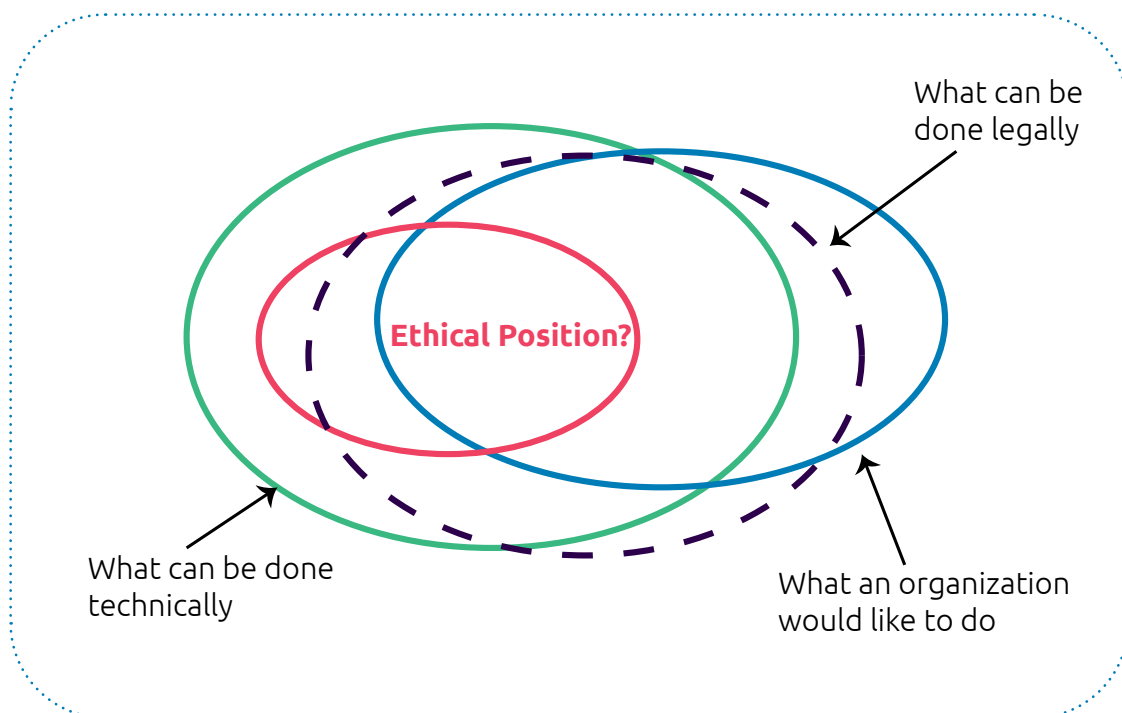


Figure 6: An illustration of the ethical impediments when using AI.





**Hans Timmermans, Director of Data Foundations & Analytics, Tax Agency**

“With around 25,000 employees, the Belastingdienst, the Dutch tax and customs administration, is the largest administration department in the Netherlands. Its task is to ensure that citizens and companies pay the right amount, and that everyone is also refunded what he or she is entitled to. This applies not only to taxes, but also to the payment of allowances.”

“Data flow optimization is working on a step-by-step improvement program. In a few years time the systems will be flexible enough to process massive data flows smoothly. At the same time, innovation is incorporated and fully engaged with implementations of Artificial Intelligence through “transformational analytics” that will drastically change business processes.”

## The pursuit of as little as possible customer interaction

In order to stimulate compliant tax payer behavior tax agencies have used technology to speed up their processes resulting in a much faster settlement of tax returns and in general a smoother customer interaction. Where 2 decades ago, a final assessment of a tax return within 2 months was considered as “fast”, the expectations of tax payers have changed in the digital era and improved computing power and the use of data mining and real time risk assessment have brought the expectation of a “timely response” back to “within a couple of weeks or even days”. A lot of tax agencies have succeeded in bringing back their time intervals for processing tax returns and applications for allowance accordingly.

Pre-population of tax returns and self-service portals have at the same time improved the ease to comply with obligations towards the Tax Agency considerably. Fall out and disruptions in the tax agencies large scale processes have been reduced with the use of AI and robotics.

With the increase of speed and the use of data and analytics it is possible for a lot of tax agencies to cut out the need of “preliminary” tax assessments and refunds or allowances.

Some countries are urging for changes in tax legislation that prescribes the issue of preliminary settlements.

A next step to reduce the interaction between taxpayers and tax administrations is sought by many countries in a process of “silent admittance”. If a final tax assessment is according to preliminary assessments or equals already paid withholding taxes on for example wages, why send a final assessment? A lot of tax payers could be serviced best by interacting as little as possible with them and only in case of deviations from earlier settlement or a change in circumstances. “Don’t send me messages with information that I already have or upon which no further action by me is required could be the paradigm here. Many tax agencies are already shifting fast to digital by default communication via “My Taxes” or “My Government” portals.

Payments and refunds are processed fully electronically, and some tax agencies are studying the possibilities of a running account with taxpayers to settle all payments in and out. A Tax Authority executive from one of the European countries stated:



“Most people want to have as little as possible interaction with the tax agency.”

But again: transparency about how the Tax Administration uses data is crucial for the trust between tax agencies and taxpayers. Differences in the way governments and citizens value the way their Government collects and uses personal data can be observed. In one

of the former East-European countries where government has a very clear and modern view of how Government should operate in the digital world and has implemented “the most advanced digital society in the world”, a leading government executive simply stated:



“I think citizens are willing to share their data with us because they are just like me basically lazy.”

## Conclusions and take-aways

Based on our interviews and client engagements we see a couple of dominant trends.

The first one is to transform the tax agency into a more agile organization that will be able to keep up with the speed of the digital era, meeting customer demands in terms of speed and personalization and meeting changes in taxation and tax reforms. A lot of tax agencies will have to unleash themselves from the IT and processes legacy landscape that still runs their current business. Making tax truly digital could be the metaphor for this transition.

The second dominant trend is the development towards an intelligence driven operating model for the tax agency. Although most tax agencies struggle with really transforming their operating model and putting data and analytics at the heart of their operation, it is

clear that all of them are on a path towards an organization that is data driven and analytics enabled in order to keep up with the digital society. Shaping the digital strategy on which the organization’s way from present to future is plotted however, proves to be complex to a lot of them and shows slow progress and decision making in a number of cases.

A third, but less dominant trend we observe is the growing use of automation (intelligent automation) to improve operational excellence and customer service. Speed of transaction and even customer interaction processes can be increased, and error can be reduced by automating repetitive tasks. Next to the improved results of the tax agencies performance this also leads to the possible freeing up of scarce Human Intelligence that is needed for other tasks within the tax agency.





## 4 New digital technologies create opportunities for tax agencies

Challenges on the way to the horizon require political, administrative and technological choices. This chapter describes several emerging technological developments that may even be regarded as established, but which may be of value particularly for the challenges and characteristics within the tax domain. We look at this from a perspective of technical possibilities that we believe are relevant for the field of taxation and pay less attention to completeness and possible consequences for legislation and policy choices.

# Technology assessment

Below you will find a selection of technologies varying from developments in the field of the IoT, cognitive computing (AI, machine learning and deep learning), to Blockchain, virtual reality and quantum computing. These technologies all potentially impact tax agencies. In this report, we assess the weight of their relevance to tax agencies by means of the maturity stages below:

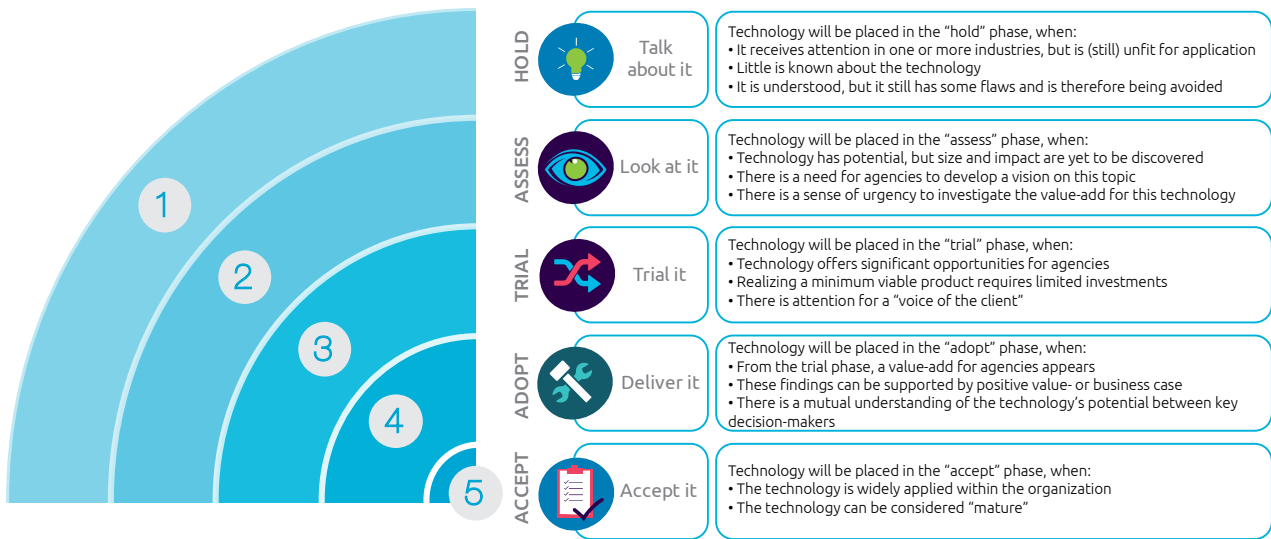


Figure 7: Assessment of the relevance of new digital technologies for Trends in tax.



## Internet of Things

Definition	Relevance for taxation - TRIAL
<p>The Internet of Things (IoT) is one of the most impactful trends today. We are at the cusp of large-scale industrialization of Internet of Things initiatives that will achieve business objectives. The information technology is revolutionizing products into intelligent, connected devices. The products solely composed of mechanical and electrical parts, today have transformed into complex systems with the combination of sensors, microprocessors, software and connectivity in myriad ways. These new connected products are reshaping the industry boundaries and ushering in a new era of competition. IoT and connected products will drive the next generation of technology and productivity growth for companies, their customers and the global economy. As such, every organization will need to evaluate the product-as-a-service model to leverage the landscape of IoT and connected products.</p>	<p>The IoT can enable tax agencies to obtain tax payers' data in an easier and quicker way, leading to more detailed and accurate data as a foundation for an increased digitalization of their work. As an example, the IoT can be leveraged when taxing consumption. Information regarding the revenue associated with the consumption of goods and services can then be processed real-time, ensuring easier auditing or verification of the declared income, revenue or profit base.</p> <p>The IoT might also allow agencies to have more direct and personalized interactions with citizens because the increased usage of mobile devices and applications that can be reached via IoT.</p>
Prospects	Challenges
<p>McKinsey Global Institute research supports that around 30 billion objects will be connected to the IoT by 2020 and the impact of the IoT on the global economy might be as high as \$6.2 trillion by 2025.</p> <p>Examples of the application of IoT by tax agencies can already be found in the Philippines and Indonesia, where the IoT is used to improve field operations and to identify tax leakages.</p>	<ul style="list-style-type: none"> <li>• Have uniformed open standards</li> <li>• Solve security and privacy issues</li> <li>• Solve legal regulatory and right issues</li> </ul>

## Cognitive Computing (AI, Machine Learning, Deep Learning)

Definition	Relevance for taxation - TRIAL
<p>AI is technology that appears to emulate human performance typically by learning, coming to its own conclusions, appearing to understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance (also known as cognitive computing) or replacing people on execution of nonroutine tasks. Applications include autonomous vehicles, automatic speech recognition and generation and detecting novel concepts and abstractions (useful for detecting potential new risks and aiding humans quickly understand very large bodies of ever-changing information).</p>	<p>AI can be able to perform tasks that are usually done by humans for example process text documents (unstructured data), find patterns, constantly learn from coming data, draw insights, do predictive analysis, prevent fraud and for sure calculate tax amounts with required information. AI can also be able to process human languages and provide services to citizens. It would empower employees to deliver new, higher value services to taxpayers and giving insights on the current status.</p> <p>With AI, more simplified and personalized services can be provided to increase satisfaction rate of tax payers. Using AI for auditing and error &amp; fraud detection can help tax agencies increase efficiency, increase revenue and cut costs.</p> <p>Tax agencies can benefit from increased computing power to speed up their transaction processes in combination with the use of AI and advanced analytics to detect non-compliant behavior.</p>

Prospects	Challenges
<p>PwC found that AI could add as much as \$15.7 trillion to the global economy by 2030. According to Nasdaq GlobeNewswire, annual worldwide AI revenue will grow from \$643.7 million in 2016 to \$38.8 billion by 2025, and Reuters Analysts forecast the global AI market to grow at a CAGR of 50.51% during the period 2017-2021.</p> <p>Based on the research by McKinsey Global Institute, AI investment is growing fast, dominated by digital giants such as Google and Baidu.</p>	<ul style="list-style-type: none"> <li>• Computing power should be in place to support AI. AI – specifically the machine learning and deep learning techniques which show the most promise, require a huge number of calculations to be made very quickly which means lots of processing power (Marr, 2017).</li> <li>• Make the technology more mature, for example have generalized AI which is capable of carrying tasks given every combination of input value.</li> <li>• Make citizens adapt and adopt due to security and privacy concerns.</li> <li>• Have enough well-trained staff with required skills (Marr, 2017).</li> </ul>

### Chatbot's, VPA's and Personal Assistants

Definition	Relevance for taxation - ADOPT
<p>Customers nowadays want to have simpler means to interact with businesses and get faster response to a question or complaint. This behaviour is similar across all customer focused industries where trust is determined by the quality and speed of the provided feedback. Chatbots offer a new automated channel for conversation with the customer. One single channel, for instance Facebook Messenger, supports the interaction with multiple businesses and government agencies.</p> <p>The promise of chatbots is enormous. Customers and businesses will expect intelligent conversations from day one with interactions in different languages, across many channels and with self-learning capabilities. In addition, chatbots are also expected to tap into the potential of conversational assistance by including similar voice and speech recognition capabilities as is being used in popular home assistants like Google Home, Amazon's Alexa and Apple's Siri.</p>	<p>Government organizations can increasingly be reached through various digital channels. In addition, the number of searches executed without a screen, thus based on voice recognition, will likely continue to grow. Speech technology-based applications, such as Apple (Siri), Google (Google Now), Amazon (Alexa) and Microsoft (Cortana), will function as an intelligent intermediary between users and services offered via websites or App's. Web sites also expand with chatbots that automatically provide targeted help to customers or visitors to the site.</p> <p>Tax agencies can improve customer service by offering a more personalized and tailored approach to its users via chatbots and personal assistants.</p>
Prospects	Challenges
<p>The application of chatbots that automatically provide tailored assistance to taxpayers via its digital support channels is growing. Using advanced machine learning, these "bots" become increasingly smart and are therefore able to answer more complex questions and to anticipate questions that have not yet been asked.</p> <p>In addition, the number of searches done without a screen based on voice recognition is growing, up to a 30% share in 2020.</p>	<ul style="list-style-type: none"> <li>• More complex forms of interaction that go beyond requests are difficult.</li> <li>• Safeguarding privacy as personal information is often required to answer questions.</li> <li>• Dependence on access to data for the quality of service.</li> <li>• Identification, authentication and authorization of persons.</li> </ul>



## Big Data & Analytics

Definition	Relevance for taxation - ADOPT
<p>Big Data is the term used for datasets that are so large or complex that conventional applications usually cannot deal with them. The high volume, the high speed of availability and the high degree of variation in data require cost-effective and new innovative forms of information processing aimed at providing insight, supporting decision-making and automation of processes.</p>	<p>Data Driven Compliance. Tax agencies are leveraging new data sources and more sophisticated modelling tools and data mining to improve targeting of high-risk cases, detection of fraud and retrieval of debt. Crime and fraudulent behavior in the digital era can be countered by making good use of the available technologies of the digital era.</p> <p>Using Intelligence to improve customer experience. Segmentation and personalization to improve customer experience by tailoring services to taxpayers' requirements. All of these require the integration of many different data sources.</p>
Prospects	Challenges
<p>Big Data applications can create disruptive effects in the way organizations work through through the identification of trends that cannot otherwise be discovered, and that offer new insights and improve decision making. Many organizations are currently struggling to realize real benefits, but there will be growth in the coming years in which the market for suppliers of big data solutions in 2025 will reach 100 billion euros.</p>	<ul style="list-style-type: none"> <li>• The value that the analysis and insights yield is to a large extent determined by the quality of the available data.</li> <li>• Synchronization over different datasets can be difficult and determines the quality of the analysis.</li> <li>• The choice which (analytical) tooling can best be used for which need can be difficult.</li> </ul>

## Blockchain

Definition	Relevance for taxation – ASSESS
<p>Blockchain is a distributed, autonomous general ledger system. Transactions are logged in a network of multiple computers, secured via cryptographic security. This enables a decentralized registration of transactions in the general ledger. It therefore makes it impossible to make changes to the registered transactions afterwards. Transactions based on a blockchain make transaction management simpler because no intermediary is needed that regulates the central authorization or arbitration concerning transactions. This role of "Trusted Third Party" is now included in the model on which the blockchain is based. The expectation is that many intermediaries will eventually become redundant.</p>	<p>Blockchain changes the IT paradigm for processing transactions and has the potential to create entirely new models for managing appointments / decisions based on transaction processing. The ability to base this on a decentralized and distributed network of computers or even in the cloud does not require major investments in central and expensive infrastructure and storage facilities.</p> <p>Tax agencies are amongst the government bodies that hold the largest amount of personal data. Blockchain technology offers a huge potential in securing and safeguarding these data making them protected against unauthorized use or modification.</p>
Prospects	Challenges
<p>The prediction is that through the use of Blockchain networks many intermediaries can become superfluous. Many parties (including governments) are already seeing the added value of this technology in fields of safe cadastral registration and other applications of smart contracts. Blockchain is still in its infancy and the market of providers is limited and is characterized by start-ups exploring new applications.</p>	<ul style="list-style-type: none"> <li>• The market understands Blockchain and its application possibilities insufficiently.</li> <li>• Large-scale deployment of Blockchain has a major impact on existing processes.</li> <li>• Lack of standards, robust platforms and interoperability mechanisms make the technology immature.</li> </ul>



## Augmented Reality/Virtual Reality

### Definition

Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects. It is this “real world” element that differentiates AR from virtual reality. AR integrates and adds value to the user’s interaction with the real world, versus a simulation.

Virtual reality (VR) provides a computer-generated 3D environment that surrounds a user and responds to that individual’s actions in a natural way, usually through immersive head-mounted displays and head tracking. Gloves providing hand tracking and haptic (touch sensitive) feedback may be used as well. Room-based systems provide a 3D experience for multiple participants; however, they are more limited in their interaction capabilities.

### Prospects

According to Goldman Sachs, VR/AR have the potential to become the next big computing platform following PC and smartphone. They can reshape existing ways of doing things-from buying a new home to interacting with a doctor or watching a concert.

It is estimated by Goldman Sachs that augmented reality and virtual reality HMD market has the potential of reach over \$100bn annually by 2025 (Bellini, 2016).

The current technology lacks maturity, but as its sophistication deepens, its adoption rate will accelerate at a modest pace through 2020 (Panetta, 2017).

### Relevance for taxation - HOLD

Immersive experience provided by AR/VR as the next big computing platform can be used for communication/interactions with citizens, data gathering & sharing and training etc. from the perspective of tax agencies. For example, customs authorities could use AR/VR for inspecting goods and training purposes.

Although we see some potential in these technologies, we find insufficient evidence to consider this technology as being very relevant for tax agencies at this point in time.

### Challenges

- Have critical technologies ready which include 4D Printing, Augmented Reality (AR), Computer-Brain Interface, Connected Home, Human Augmentation, Nanotube Electronics, Virtual Reality (VR) and Volumetric Displays (Gartner, 2017).
- The content and use cases should be compelling and have must-have quality (Wiltz, 2017).
- Improve user experience, solve health concerns and comfort issues. VR has been known to have display issues that cause effects such as irritation, nausea, and other problems (Bordvik, 2016).

## Biometric authentication

Definition	Relevance for taxation – TRIAL
<p>Biometric authentication methods use biometric characteristics or traits to verify users' claimed identities when users access endpoint devices, networks, networked applications or web applications. Across a wide range of use cases, any biometric authentication method may be used in one-to-one comparison mode (when the user enters a user ID), or one-to-many search mode (when the user simply presents his or her biometric characteristic, with no explicit claim of identity, and the system determines his or her user ID from a range of candidates).</p>	<p>Biometric authentication can be used to verify the identity of tax payers when interacting with tax agencies via digital channels. It is generally acknowledged that without any form of biometric identification, organizations and individuals are highly vulnerable to identity theft or wrongful identification and authentication.</p> <p>Biometric authentication will also enhance convenience and comfort for citizens</p>
Prospects	Challenges
<p>A recent report from ABI Research forecast that global revenues for biometric banking technology alone will top \$4 billion by 2021.</p> <p>Although fingerprint biometric technology is still the most preferred modality, face recognition, voice recognition, palm vein, and finger vein biometric technologies have high growth opportunities in the short and mid-term future</p>	<ul style="list-style-type: none"> <li>• Challenges regarding security and privacy of biometric data</li> <li>• Challenges from biometric technologies to ensure the accuracy</li> </ul>

## Intelligent Automation

Definition	Relevance for taxation - ADOPT
<p>(Intelligent) automation is the application of technology, under the governance of business logic and structured inputs, aimed at automating business processes that were previously done manually. RPA scenarios can range from a very simple copy-paste exercise, to the implementation of thousands of bots to enable more efficient ways of working.</p>	<p>(intelligent) automation is one of those technologies with a high relevance and impact for tax agencies. Automation initiatives can significantly reduce processing costs and allows agencies to reduce operational risk by improving the accuracy of tedious, repetitive and standardized work previously done by humans. In addition, the efficiency of tax agencies can be improved as robots continue their operations without required stops.</p>
Prospects	Challenges
<p>Forrester predicts that the RPA market will reach approximately 3 billion dollars by 2021 spurring the implementation of RPA in a wide variety of sectors. In addition, a wider adoption of this, and adjacent technologies will follow, as developments in the field of AI will continue to grow.</p>	<ul style="list-style-type: none"> <li>• Ownership of IT solutions</li> <li>• Security and privacy considerations</li> <li>• Short term solution as opposed to structural/strategic solutions</li> <li>• Resistance to change from employees</li> </ul>

## Quantum computing

Definition	Relevance for taxation - ASSESS
<p>A quantum computer uses atomic quantum status to effect computation. Data is held in qubits (quantum bits), which have the ability to hold all possible states simultaneously. This property, known as “superposition” gives quantum computers the ability to operate exponentially faster than conventional computers. Data held in qubits is affected by data held in other qubits, even when physically separated. This effect is known as entanglement. Achieving both superpositioning and entanglement will allow a quantum computer to increase computational power up to complexity that cannot be achieved by conventional computers and use less power by doing so.</p>	<p>Quantum computers will entail faster computing power that can process immense datasets and integrations of a number of these sets. Enhanced with artificial intelligence, the enlarged computing power of quantum computers can capture patterns or anomalies in datasets way quicker than conventional computers can. This will greatly benefit a tax agency’s fraud detection and will increase the pace at which the recurring large amount of calculations can be executed. Aside from the positive impacts, quantum computers also pose a serious threat to a tax agency’s cyber security. Whenever quantum computers are established, our current cryptographic structures will become breakable making current systems vulnerable to be hacked by outsiders. It is therefore relevant for tax agencies to already anticipate and evaluate the impact of this technology on their organizations.</p>
Prospects	Challenges
<p>According to Market Research Media, the quantum computing market is projected to surpass \$5 Billion through 2020.</p> <p>Despite technology advances the quantum computing market is still fledgling. The governments are the major driving force behind investments in quantum computing R&amp;D, fiercely competing for what is perceived as the most promising technology of the 21st century.</p>	<ul style="list-style-type: none"> <li>- Security and privacy implications to conventional cryptography</li> <li>- Complexity of implementation</li> </ul>

## Edge computing

Definition	Relevance for taxation - HOLD
<p>Edge and fog computing concepts have been developed to respond to the cheer increase of data bandwidth required by end devices and has been fueled by the explosion of IoT (Internet of Things) which in turn has increased the need to process the generated data much closer to the source in real time. In other words, edge and fog computing push the cloud (read data center) closer to the requester to minimize latency, minimize cost and increase quality.</p> <p>For example, a Boeing 787 generates 40 TB per hour of flight, but just half a TB of this is ultimately transmitted to a data center for analysis and storage. Similarly, a large retail store might collect approximately 10 GB of data per hour, but just 1 GB of that is transmitted to a data center. As it is not sensible, nor possible to install a full data center either on a plane or within a store, edge or fog computing steps in to validate and pre-process this data either within a local network (fog) or a gateway device (edge).</p>	<p>In edge computing, data storage and computing are put at the proximity of data sources for example base stations, routers and switches. The edge design patterns can be used in infrastructure architectures particularly in Internet-of-things domain which would allow real-time response and processing for IoT devices. It’s a complementary concept to the cloud with centralized structure.</p> <p>We see potential to evaluate the applications of edge computing in case of a more widespread adoption of IoT amongst tax agencies (e.g. when implementing consumption-type taxation). However, we do not see a short-term value for tax agencies.</p>
Prospects	Challenges
<p>According to Transparency Market Research’s report, the global edge computing market is likely to clock 10. 7% CAGR for the forecast period between 2017 and 2022. At this pace, the market’s estimated valuation of US\$8,024.5 million in 2017 will become US\$13,313.7 million by the end of 2022.</p>	<ul style="list-style-type: none"> <li>• Challenges regarding security and privacy. It is fairly easy for cyber criminals to take control of devices at the network edge and obtain sensitive data (Cranford, 2017).</li> <li>• Technical challenges regarding networking, storage, compute, programming language, and management.</li> </ul>

## API economy

Definition	Relevance for taxation - TRIAL
An application programming interface (API) provides standardized, open access to an application service or data set; it is decoupled from the actual user interface of the application. APIs provide the building blocks for (outside) developers to compose and enrich their application leveraging multiple data sources. API economy refers to the management of an organization's APIs.	The adoption of APIs enables a wide array of opportunities for government organizations to open their systems so that third party software providers can use and integrate the data provided by tax agencies. As an example, this data can be used by tax advisors to develop customer friendly applications for assisting citizens in filling their tax return forms.
Prospects	Challenges
We currently see numerous organizations in both public as private sector experimenting with API developer portals. Whereas in some sectors this is mainly driven by regulatory demands, we see a growing trend in other organizations to also set foot in the open data space. Although it might appear there is no immediate business case for governmental organizations, in the long run we expect the development of more citizen-friendly applications to also contribute to more accurate data inputs and thus, a decrease in overhead costs.	<ul style="list-style-type: none"> <li>• Security and privacy. Without adequate security and privacy measures in place, an open data platform might just as well be a gateway to an organization's deepest secrets.</li> <li>• Complexity. Developing a seamless API gateway is complex, costly and time-consuming. Multiple systems need to be integrated, resulting in a number of challenges developers need to cope with.</li> </ul>

## 5G

Definition	Relevance for taxation - HOLD
5G is the fifth generation of cellular networks which is scheduled for deployment for basically every major telecommunications provider in the developed world. The new radio technology and network architecture will provide a step-change improvement over 4G in, amongst others: speed, latency and density. 5Gs speed and capacity will address the exponential growth in mobile data traffic. It is likely to enhance customer experience in a number of ways and will support innovations such as mobile cloud gaming, augmented reality (AR) and virtual reality (VR).	At this moment in time we do not see a direct applicability of 5G use cases for tax agencies. However, looking somewhat further ahead in time we believe that 5G can play a role in the real-time distribution of data from consumer to tax agency. For example in case of a pay-per-use model in which consumers are charged based on their usage of a specific asset (e.g. cumulative amount of kilometers driven with a car or the real-time speed of a car).
Prospects	Challenges
Research by Ericsson predicts that by 2024, 5G networks will carry 35% of global mobile data traffic. In addition, it is expected that there will be 1.9 billion 5G subscriptions for mobile broadband by the end of 2024.	<ul style="list-style-type: none"> <li>- Costs; expensive hardware</li> <li>- Coverage</li> <li>- Complexity</li> </ul>



## 5 Looking forward & final remarks

### Becoming more agile

The first dominant trend we see today is the transformation of tax agencies into a more agile organization that will be able to keep up with the speed of the digital era, meeting customer demands in terms of speed and personalization and meeting upcoming changes in taxation and tax reforms. A lot of tax agencies will have to unleash themselves from the IT and processes legacy landscape that still runs their current business. Making tax truly digital could be the metaphor for this transition.

## Data & Analytics at the heart of the organization

The second dominant trend is the development towards an intelligence driven operating model for the tax agency. Although most tax agencies struggle with really transforming their operating model and putting data and analytics at the heart of their operation, it is clear that all of them are on a path towards an organization that is data driven and analytics enabled in order to keep up with the digital society. Shaping the digital strategy on which the organization's way from present to future is plotted however, proves to be complex to a lot of them and shows slow progress and decision making in a number of cases. Nevertheless, tax agencies are rapidly shifting to adopt data, analytics and digital by leveraging

new data sources and sophisticated modelling tools and data mining to improve targeting of high-risk cases, detection of fraud and retrieval of debt. At the same time the availability of data and increased modelling tools create more and better possibilities to improve customer service as part of the tax agencies compliance strategy via segmentation and personalization of services.

We see over the last decade - but with increasing acceleration over the last 5 years - the development of the appropriate operating model for the tax agencies analytics program. With this transformation the greatest challenge is not to use new available technologies such as algorithms to detect risks, but to develop, build and run an organizational model that allows analytics to become embedded in the tax authorities day to day operation.

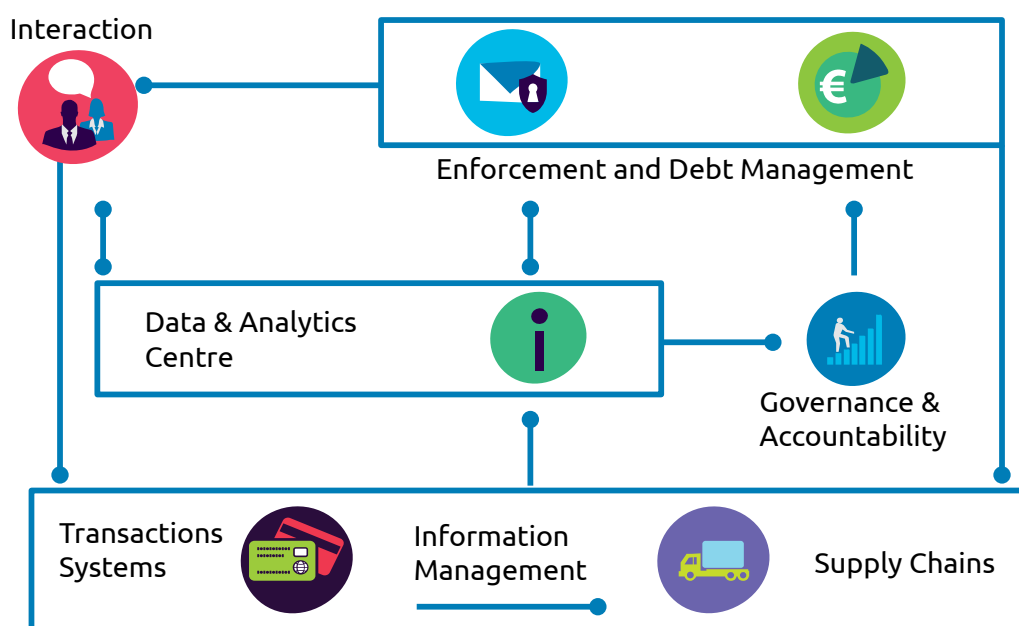


Figure 8: Simplified Data & Analytics centered target operating model of a tax agencies.

There are many factors influencing the development and implementation of such an organizational model. One of the main complications is that organizations find it hard to integrate the data from various source systems in one holistic view of the customer along his journey through the tax agency. In addition to that, new technological developments demand a new “digital” skillset meaning tax agencies need the specific skills and expertise of data scientists and analysts, IT architects, developers and customer journey experts to achieve their goals. However, these types of resources are often short in supply and costly to attract and maintain.

## Accountable Integrity

The use of the massively available big data in the digital era also imposes major legal and even moral duties on government parties using them. Aspects such as the proportionate use of data, protection of security of data and privacy aspects are publicly debated and subject to further legislation. People want tax agencies to be of non-disputed Integrity. Between tax authorities and taxpayers.

Politicians want tax agencies to be accountable for their decision making in the use of data. The solution to this accountability may lie again in the intelligence function that is at the heart of the digital operating model of modern tax agencies.

## Robotics and Intelligent Automation

A third, but less dominant trend we observe is the growing use of automation (robotics and intelligent automation) to improve operational excellence and customer service. Speed of transaction and even customer

interaction processes can be increased, and error can be reduced by automating repetitive tasks. Next to the improved results of the tax agencies performance this also leads to the possible freeing up of scarce human intelligence that is needed for other tasks within the tax agency.

Industry research has shown that automation can drive 25-50% cost savings by automating data intensive, repetitive tasks, and by improving the accuracy and efficiency of process execution. In addition, virtual workers can be deployed 24/7 reducing latency and driving higher levels of productivity.

When looking at tax agencies across the globe, we see similar opportunities regarding RPA. High frequent intensive manual processes which involve repetitive handlings are perfectly suitable for RPA solutions. For example, customers interaction processes where a customer service agent no need to access certain data related to the citizen, data entry and extraction processes between several system interfacing or simply automating an end-to-end process where manual disruption is involved within ERP system process. It is all possible by using RPA technology. A real-life example which we observed at a tax agencies is a process relating to wage supplements where we see information flows such as data entry, data adjustment and data output which is manually done by an employee within different interfaces. This type of process is often highly time consuming and low value adding for an organization. RPA allows one to automate this type of process by predefining a set of business rules and eventually configuring a robot to follow the predefined business rule to execute the process identical to the way how an employee will do.





## The use of blockchain by tax agencies

According to a WEF survey, governments will collect tax for the first time via Blockchain in 2023. Leading countries are Finland and Estonia, where tax agencies are currently implementing Blockchain technologies into their businesses. The UK is also advanced in developing a whole government approach to Blockchain, including the area of taxation. The question is not if Blockchain will change the tax system, but how fast and how deeply this will happen. Potential impact of Blockchain can be expected in all three pillars of the taxation operation model.

Blockchain has the potential to simplify and automate tax collection. The technology can be used for verifying, appraising, approving and auditing the information provided by citizens, thus driving efficiency and accuracy. Automation of calculation for taxation can become more efficient and time-saving, reducing costs and administrative burden on tax systems.

Blockchain can be used to track and trace documentations such as invoices and receipts, thereby preventing citizen and organizations from providing false information. Moreover, Blockchain can be used to view transactions in real time, making it easier for tax agencies to detect fraud and errors.



## IoT – What about it?

IoT will continue to impact our daily lives. More and more companies change their business model from selling products, to selling a pay-per-use service. Changes like these can be applicable to taxation, as well. For instance, there are several pilots in the United States where car drivers are charged per mile instead of paying gas taxes. In the future, there might even be individualized tax rates based on usage. When companies buy tangible assets -such as equipment,

machines and vehicles – given that they have been equipped to become smart objects - depreciation could be calculated by use and place of the object. In this example tax agencies become part of a bigger IoT solution. In addition, big data – measured by IoT devices – enables tax agencies to analyse tax payer's behaviour. Based on these, a better (personalized) experience can be delivered. The customer experience can be increased by means of convenience. An example can be found in Singapore, where international shoppers can now

receive a VAT-tax return at the airport within minutes via smart tax booths. To improve experiences even more, a complete picture of each individual or company can be achieved by combining data from different IoT devices and other information sources on one platform. Data can also be collected through devices installed by tax agencies. However, taxation processes often exist of (digital) documentation, there are not many physical objects which could be connected to obtain data. Herein lies a big opportunity for tax agencies to become part of an existing ecosystem. The service offered by authorities should be beneficial for an individual or company to increase their willingness to share data. Besides allowing agencies to have more direct and instant interactions with tax payers, services can be improved by the obtained insights.

## Changes in the tax agency's organizational model

All the above leads to the further evolution of the digital organizational model that provides maximum "Public Value" by the tax agency. An according strategy and underlying business operating model must substantiate this.

Public value will be derived from a government organization (the tax agency) that operates day to day with integrity, respect, professionalism and accountability

The operating model must have an outcome that is (from a tax payer viewpoint):

- Customer centric
- Simple
- Integrated
- Proportionate
- Cost efficient

## Final remarks

Tax agencies are leveraging new data sources and more sophisticated modelling tools and data mining to improve targeting of high-risk cases, detection of fraud and retrieval of debt. Crime and fraudulent behaviour in the digital era can be successfully countered by making good use of the available technologies of the digital era.

Personalization and segmentation of tax payers using big data and sophisticated modelling tools and techniques leads to a more tailored approach of tax payers based on their (previous) behaviour, needs and potential risk profiles.

The use of the massively available big data in the digital era also imposes major legal and even moral duties on government bodies using them. Aspects such as the proportionate use of data, protection of security of data and privacy aspects are publicly debated and subject to further legislation.

People want tax agencies to be of non-disputed integrity and to be accountable for that. This leads to a further evolution of the digital organizational model that provides maximum "Public Value" by the Tax Agency. Accountability and integrity will be key elements in the Public Value equation.

In the near future we expect to see the common use by government agencies of for example distributed ledger technologies ("Blockchain"), biometric authentication, and the IoT to fight evasion and fraud, speed up transaction and interaction processes, improve tax payers customer service and secure the tax agency against cyberthreats and identity theft.



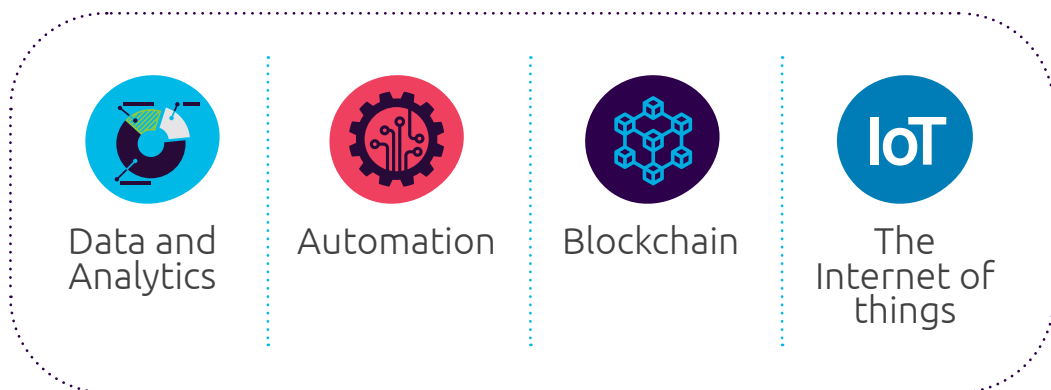


# Appendix

## Highlighting 4 enabling technologies for tax agencies

In this annex we zoom in on four technological capabilities that, based on our interviews, are most relevant for tax agencies in their day to day operations.

The four technological capabilities are:



### The sections are structured in the following way:

- An introduction of the technology
- The potential value for tax agencies
- Real use cases
- Trends, developments and challenges



# Data and Analytics – from experimentation to implementation

## Introducing Data and Analytics

Big Data is the term used for datasets that are so large or complex that conventional applications usually cannot deal with them. The high volume, the high speed of availability and the high degree of variation in data require cost-effective and new innovative forms of information processing aimed at providing insight, supporting decision-making and automation of processes.

## Data and Analytics – potential value for tax agencies

It is easy to understand how data and analytics can contribute to the most important for tax agencies (increase of speed, reduction of error, improved customer experience and better accountability):

- **Operational excellence:** “increase of speed” and “reduction of error” are goals that belong to this category. Data and analytics (or rather the insights) have contributed to improving operational excellence for decades if not for centuries. But the last few years showed an enormous increase of available analytics methods especially in the area of AI with promising results.
- **Customer experience:** the same is more or less true for this category. However, in this case it is the abundance of all sorts of data that boosts the opportunities for improvement: transaction data, customer data, click behaviour, data from social media etc. Again, we see many new applications with promising results.
- **Better accountability:** this has always been an important task for data and analytics although we may not recognize it as such. But using data and producing relevant insights (through descriptive analytics) about the tax agencies operations and performance can be seen as just another instance of data and analytics.

Although it is very clear that big data and analytics have a huge potential for adding business value, this does not mean that organizations are able to turn this big promise into real benefits. One of the biggest challenges for many organizations is to make big data and analytics really work: to get beyond the point of promising experiments that are, however, not implemented for various reasons.

The big question for tax agencies is, how do you implement big data and analytics in such a way that they continuously and sustainably contribute to the aforementioned goals.

## Data and Analytics – real use cases

It is very understandable that we first turn to technology when people look for solutions that match the goals above. In the case of data and analytics this means that we will look for a specific analytics method that fits our purpose. In other words: our first reaction is to take a technological perspective. This is necessary to achieve a working solution. And the ability to find the right analytics method or to develop a new variation is a key competence in any data science environment.

But however brilliant the data science competence is, it cannot guarantee that the innovation will be implemented into operations. Research by Gartner in 2018 showed that less than half of data science experiments lead to successful implementations.

To overcome this hurdle a different approach must be taken: adding a business perspective, next to the technological perspective. Does this mean that technology is less relevant in data science? Of course not. Technology plays a pivotal role in the success of data science as we will see later on in this paragraph when we discuss DataOps/AnalyticsOps as an emerging trend.

In our view two implementation views must be taken into account:

**1. Individual use case implementation:** which steps are needed to successfully implement results from data and analytics experiments into your operations (e.g. a predictive model for fraud detection)?

**2. Structural operating model implementation:** this is more on a meta-level: which capabilities must be in place in order to perform the above (i.e. individual use case implementation) as a structural process, not in an ad-hoc fashion?

In the following section we will give real-life examples of these two views.

## **Individual use case: combating VAT carousel fraud using data & analytics**

An example of various European tax authorities using data and analytics is combatting tax fraud, specifically in the area of VAT fraud and missing trader fraud. Countries that have implemented data and analytics solutions to combat this type of fraud are the UK, Netherlands and Belgium. Missing trader fraud is an area where data and analytics can make a huge impact, because the total amount of VAT loss across the EU in 2016 is estimated by the European commission at 147.1 billion euros. This VAT gap is the result of noncompliance, fraud, avoidance and bankruptcies. Missing trader fraud, also known as Missing Trader Intra-Community (MTIC) fraud, is a type of fraud where VAT rules on cross-border transactions in the EU are misused and it is theft of VAT from the government. This type of crime is hard to detect by hand, because complex international fraud rings are constructed to conduct and conceal this type of fraud. Usually the fraud is detected after the fact when the tax losses are already a fact. With the use of advanced analytics, like network analytics and deep learning, these type of fraud rings can be detected when they emerge based on detected behaviour that might lead to fraud. Taking appropriate action by tax agencies means that fraud can be prevented, instead of detected after the fact. This also means tax agencies really need to put data and analytics at the center of their business and drive decision-making based on the insights generated from analytics. This a fundamental change in the tax operating model. It does not only require a technology perspective, but very much a business perspective.

## **Structural new operating model: Estonia**

A good example of a tax agency that really puts data and analytics in the heart of their business decision making is Estonia. Since the 00's the government has been developing a digital strategy and one of the cornerstones of their strategy is the "only ask once" principle. This means the Estonian government will only ask citizens information once and the information is shared with all relevant government entities so that a citizen never has to enter the same information again. In Estonia VAT fraud is also a large problem with an estimated loss in tax revenue in 2013 of 220 million euros a year. In 2014 Estonia launched a new strategy to tackle VAT fraud. A big part of the

success of this strategy was first to focus on gathering higher quality taxpayer data. All transactions of a company with another partner company exceeding 1000 euros on a monthly basis have to be reported to the tax agency. On top of this analytics is applied to be able to detect gaps in the VAT declarations when they are matched to the transaction data. Although there were initial concerns mainly around privacy and administrative burden for companies, the systems proved to be a success with a major reduction in tax fraud. And this is only one of the examples where the Estonia government is putting data and analytics at the core of their tax strategy.

## **Data and Analytics - Trends, developments and challenges**

In this section we will focus on some important developments and trends in Data and Analytics that are relevant in the context of this new operating model that puts data & analytics at the core.

### **Analytics funnel approach being adopted as best practice by growing number of organizations**

Across the board we see a growing number of organizations adopting an analytics funnel approach to support and facilitate their big data and analytics initiatives. The analytic funnel approach represents a significant improvement in maturity: a few years ago, organizations were still struggling with isolated proof-of-concepts (PoCs). That approach carried the risk of throwing out the baby with the bathwater: when the isolated PoC failed the whole idea of big data and analytics was perceived to be a failure. But once organizations start to appreciate the hypothesis-driven nature of big data and analytics they switch to an analytics funnel approach.

### **Number of data labs is growing**

The move towards an analytics funnel approach often leads to the installation of a data lab. Again, this is a step towards higher maturity. Instead of conducting separate and isolated projects a data lab holds the capabilities to conduct use cases and at the same time gives the possibility to leverage best practices, lessons learned, re-usables etc. from previous use cases. However new challenges in the area of governance arise such as: who owns the data lab, and who controls the data lab backlog?



### **Data Governance Board representing all stakeholders**

To follow up on the previous topic: we see that some organizations are setting up a separate governance board that takes care of many data-related matters: not just data governance and data ownership but also control of the Analytics Funnel. All departments are represented in the Data Governance Board and it is headed by a Chief Data Officer.

### **Real business change is the big bottleneck**

Once a lab experiment has delivered a successful outcome (e.g. a fraud detection algorithm) it in some cases cannot and will not be implemented right away. There are several stumbling blocks that need to be overcome. Some of them are technical or functional. But the most serious ones are organizational and cultural. This means that business change capabilities must be aboard of your initiative to overcome these challenges. What we see is that some organizations start mobilizing these business change capabilities very early in the innovation funnel.

### **DataOps/AnalyticsOps emerging as best practice in deployment**

In the last couple of years, we see a trend emerging, that can best be described by Ben Lorica's quote, Chief Data Scientist at O'Reilly Media inc., already in 2013.

**“The next breakthrough in data analysis may not be in individual algorithms, but in the ability to rapidly combine, deploy, and maintain existing algorithms.”**

In the past few years, a traditional approach has been followed for the introduction of AI, that was seen as a fail-safe approach. Starting in a safe laboratory environment (Proof of Concept), models were tweaked until certain thresholds with respect to accuracy were being met. Though the tests were largely successful, it proved notoriously hard to productionalize these models, especially in case of real-time applications. To counter this growing problem, we see the emergence of DataOps or AnalyticsOps, as predicted by Ben Lorica, as a successful way



of implementing real-time decision support systems. It involves the creation of a Continuous Development / Continuous Integration pipelines, as we have seen also in e.g. front-end development (DevOPS). Essentially it means that you will be iterating on a model in the run-time environment. In these frameworks, Business will be involved as the party that has full authority on what goes into production, IT is the enabler as well as the safe-guard for the many regulatory compliance requirements as well as safety / security requirements.

Especially for higher-end AI based systems (e.g. decision support systems), the traditional approach is not usable, as the run-time environment will put a lot of additional requirements onto the initiative that are not present in laboratory conditions. Also, AI based systems require a constant feedback loop, which requires fast iterations which can only be achieved in a run-time environment. Finally, AI based applications have a short shelf life. At the moment an AI model goes into production, it is already starting to age, as the output has the possibility to change the behavior of the users, while the model was trained on "old" data. Hence, AI based applications are not a 1-time development effort but require a constant monitoring of model performance in run-time. Even if business requirements do not change, AI based systems will be updated regularly to keep the performance on par with expectations. With this final part of the solution, there is no further technical inhibitor for the successful implementation of AI based systems. It is thus expected, that in the next couple of years we see an acceleration of the application as well as adoption of AI based systems.

## **Ethics of AI becoming a significant factor**

Tax agencies operate by definition in a heavily regulated environment, which puts specific constraints on tax agencies, especially when it comes to the ethics of AI. Both within tax agencies, as well as in the wider context, we see an increase of attention with respect to the ethics of AI. The

number of articles in the media questioning the ethics of AI is increasing annually (trend), and focusses on a number of topics: transparency, auditability, bias and human impact.

- **Transparency:** It is important, especially as a Tax Agency, to be fully transparent with respect to the use of AI. When a person is interacting with an AI enabled product (e.g. chatbox), it should be perfectly clear to this person.

- **Auditability:** Due to the nature of tax agencies activities as well as its public function, everything a Tax Agency does requires auditability. Especially with the application of AI this can become troublesome, as the nature of AI products to some extent is its black box workings. However, the auditability requirement remains intact. I.e. if a decision of the Tax Agency, aided by any form of AI, leads to a legal case, the Tax Agency will be required to exactly reproduce and explain the results of the AI assistance. In practice this means that the same AI model, producing the same results, will have to be rerun. This remains the case even if the legal case unfolds years later than the initial decision. For AI this is a problem, as these results can only be exactly reproduced, if the same model is run on the same dataset. This requires correct version control as well as the storage of the trained artifact, separated for each individual updated to the model. For this, we see the emergence of Model Management frameworks, that enable the storing of both the model in code, as well as in artifacts of the trained model. Different tax agencies are experimenting on how to achieve this demand for auditability. DataOps or Analytics Ops (see section on DataOps) evolve around both the cd/ci pipeline, as well as a Model Management Framework.

- **Bias:** AI is not intelligent by nature (yet). This means that if bias is present in the training data, this bias will be visible in the produced results. This is an important aspect of the application of AI, especially when it involves or affects humans. Various cases are known where large initiatives were eventually shut down due to issues in relation to bias.



Especially when deploying self-learning systems, e.g. personal assistants, a continuous monitoring should be established to make sure the system remains within specific boundaries. This usually means that in the creation of these types of solutions, specific attention should be paid to the ability to monitor its development.

• **Human Impact:** AI is not in the state yet, to fully replace human beings, and this should currently not be the aim. Instead of replacing humans, it changed the role of humans, from operating at the lowest level of activities (the robot in humans), to monitoring of outcomes and potential bias. This can have an impact on overall fte, which leads to lowering operational cost, but is not aimed at replacing individual persons. Even if a Tax Agency might be inclined to not see ethical issues with the application of AI in certain business processes, its customers, partners and stakeholders might see this differently. We do see some examples of general AI, which does have the capability to fully replace human beings, however in general it is in lab conditions. It is not expected that in the next 5 years, general AI will be available for more than R&D.

### **Business commitment, not just involvement**

One outstanding success factor for analytics use cases is business commitment, not just business involvement. It has already become clear that experiments in the Data Lab will not become successful when business is not involved, no matter how brilliant the analytics are. So we see a development towards reaching out to the business and trying to engage them. This will surely help. But there is a difference between involvement and commitment. This plays out in the phase after the experiment: is business really willing to implement the results? Investing in business commitment early in the funnel will lead to a higher degree of successful implementations.

### **Business-driven, Design Thinking, Ideation**

Successful innovation with big data and analytics thrives on promising hypotheses that are fed into the analytics funnel. This takes place in the Ideation Phase. Design Thinking has become the favoured method to generate ideas in close relationship with business users. Design Thinking is an iterative



process in which we seek to understand the user, challenge assumptions, and redefine problems in an attempt to identify alternative strategies and solutions that might not be instantly apparent with our initial level of understanding. At the same time, Design Thinking provides a solution-based approach to solving problems. It is a way of thinking and working as well as a collection of hands-on methods.

Design Thinking revolves around a deep interest in developing an understanding of the people for whom we're designing the products or services. It helps us observe and develop empathy with the target user. Design Thinking helps us in the process of questioning: questioning the problem, questioning the assumptions, and questioning the implications. Design Thinking is extremely useful in tackling problems that are ill-defined or unknown, by re-framing the problem in human-centric ways, creating many ideas in brainstorming sessions, and adopting a hands-on approach in prototyping and testing. Design Thinking also involves ongoing experimentation: sketching, prototyping, testing, and trying out concepts and ideas.

## **AI is hot**

Nowadays AI is everywhere, at least in the media. Sometimes it seems as if AI will automatically solve all our problems. Which of course will not be the case. Though we believe it is good to understand what AI is, and what it is not, we will not burn our fingers in trying to choose a definition, as it most probably will not cover all aspects. However, as with every analytics method we know the following: its purpose is to deliver relevant insights, and the method should fit this purpose. So the same is true for every individual AI method (or technology). Of course, the understanding, mastering and handling of AI requires new capabilities. This is true at an operational level but also on a more strategic level or even ethical level. One question that is already being discussed is: how do we deal with the biases that are inherent to some of these AI methods, and are we (as a society) willing to accept the risks associated with it? How can we mitigate these risks while reaping the obvious benefits from AI?



## Automation – from basic- to cognitive automation

### Introducing automation

Governments and public institutions are transforming core operations to address significant industry disruptions from digital developments. Optimizing operations and improving efficiencies means more than just upgrading systems or eliminating and outsourcing processes—it means innovation and automation.

In automation we can distinguish different levels of maturity, as shown in the figure below. In this chapter we will first elaborate on RPA, which can add huge value for tax agencies, even though it is relatively simple. Then we will dive into more sophisticated ways to automate tax agency processes, where capabilities such as AI are used as input to automate our processes.

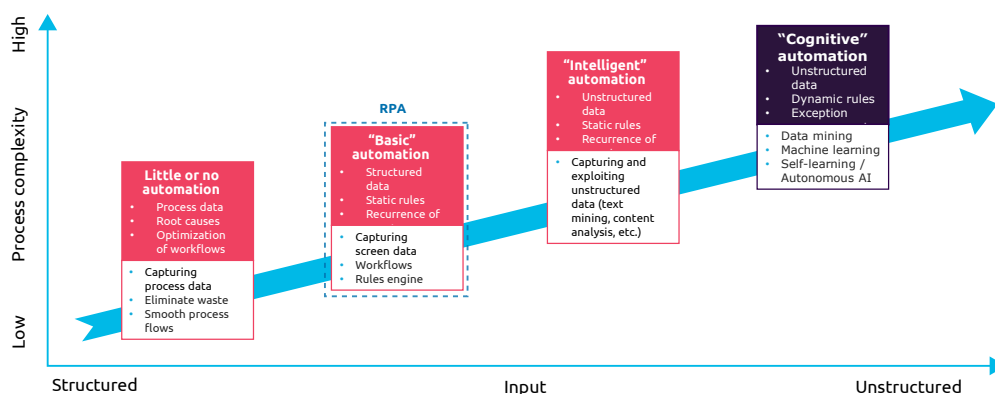


Figure 9: Different levels of automation.

## RPA – potential value for tax agencies

One way to innovate and automate is by using RPA to improve the speed and accuracy of core business processes. Depending on the complexity of business processes, institutions are enabling to use different levels of automation to enhance their overall business efficiency.

Industry research has shown that RPA can drive 25-50% cost savings by automating data intensive, repetitive tasks, and by

improving the accuracy and efficiency of process execution. RPA is a software-based approach, taking place at the user interface layer of applications. As such, its adoption can be realized quickly. As a virtual worker, RPA replicates user actions to reduce or eliminate human intervention in mundane, repetitive, and manually intensive processes. By automating these manual processes, public institutions can improve efficiency and accuracy. In addition, virtual workers can be deployed 24/7 reducing latency and driving higher levels of productivity.

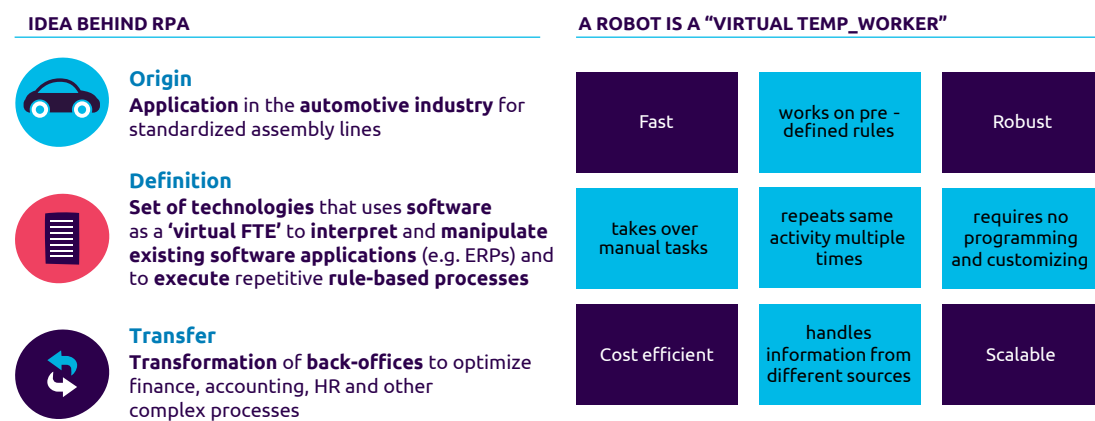


Figure 10: Background of RPA.



Figure 11: Core benefits which RPA can bring to organizations.

## RPA – Real use-case

HM Revenue & Customs (HMRC), the UK tax authority, is a leading example of using robotics to improve customer experience and job satisfaction. HMRC automated processes to give a better service to customers as part of their wider digital transformation. Staff identify time-consuming clerical tasks that can be automated to allow more focus and time spend on customer-facing aspects of their roles. Robotics solutions include dashboards that automatically open relevant case files for contact center advisers to answer customer queries more

quickly, and end-to-end processing of first-time employer registrations. RPA is delivered from HMRC's Automated Delivery Centre (ADC), which Capgemini helped set up and run. The ADC opened in April 2016 and delivered 14 industrialized projects in its first eight months and has a further 30 projects in flight or scheduled. Building on this success, HMRC is extending its robotics development capability to business teams to help them building their own automation solutions using ADC governance model.

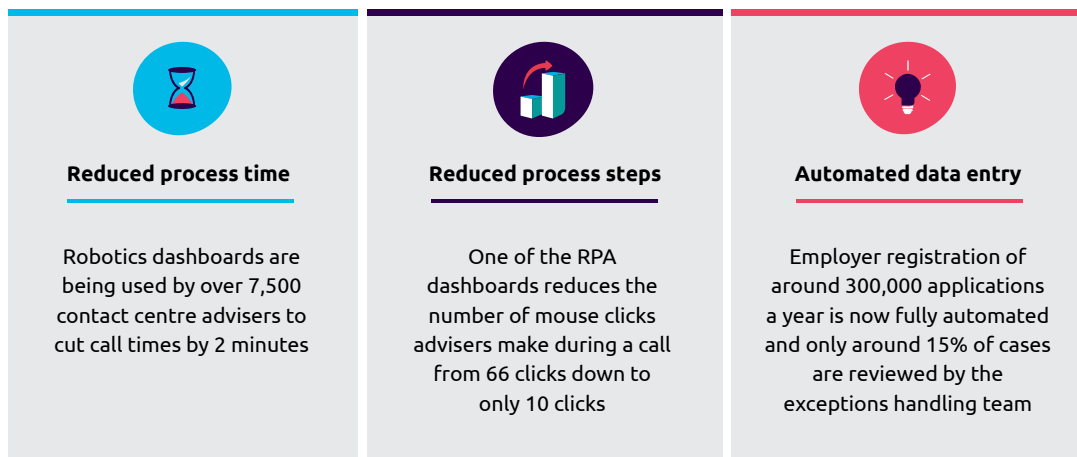


Figure 12: Benefits which RPA brings to HMRC.

## RPA – Trends, developments and challenges

When looking at tax agencies across the globe, we see similar opportunities regarding RPA. High frequent intensive manual processes which involve repetitive handlings are perfectly suitable for RPA solutions. For example, customers interaction processes where a customer service agent need to find a certain data related to the citizen, data entry and extraction processes between several system interfacing or simply automating an end-to-end process where manual disruption is involved within ERP system process, it is

all possible by using RPA technology. A real-life example which we observed with one of the Tax Agency is a process relating to wage supplements where we see information flows such as data entry, data adjustment and data output which is manually done by an employee within different interfaces. This type of process is often highly time consuming and low value adding for an organization. RPA allows one to automate this type of process by predefining a set of business rules and eventually configuring a robot to follow the predefined business rule to execute the process identical to the way how an employee will do.

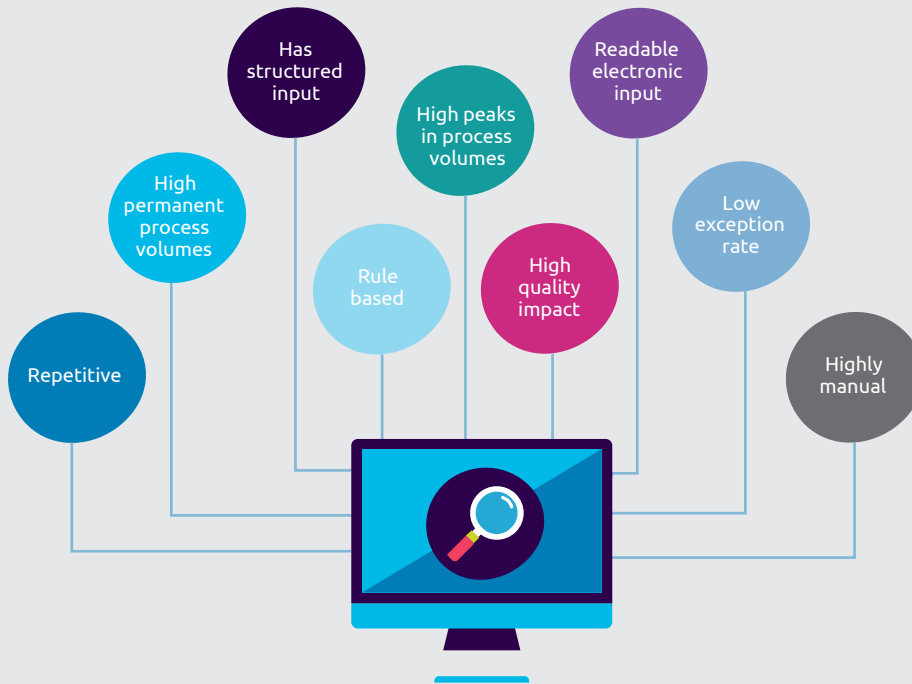


Figure 13: Criteria for process candidates.

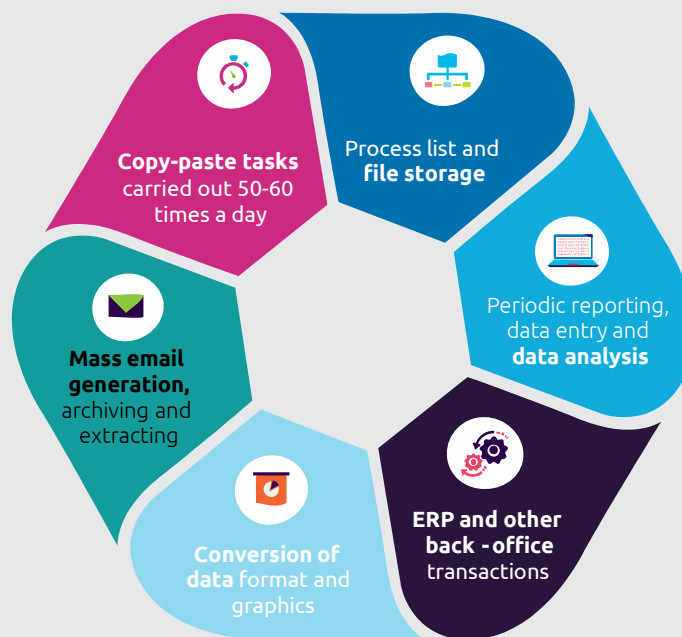


Figure 14: Types of business processes.

To sum up, we believe in the core benefits which RPA can bring to governments and public institutions based on its flexible and

highly adaptable nature and the ability to unlock value for a host of organizations in a wide range of areas.



## Intelligent automation

AI is a hot and trending topic and the perception is that many organizations and public institutions are looking at AI as a technology with immense potential. As Capgemini, we believe that AI will be the most debated, invested in, and disruptive business technology trend over the coming years. Insights from our own research institute and our interactions with clients show that companies are transitioning to

the age of the intelligent enterprise. The opportunities to use AI are numerous, from customer experience to operations, cyber security to risk orchestration. AI can transform or replace existing business processes or create new ones, driving down costs and delivering greater speed, agility and quality. It can handle far more complex processes and data structured which significantly increased innovation and automation potential in an organization.

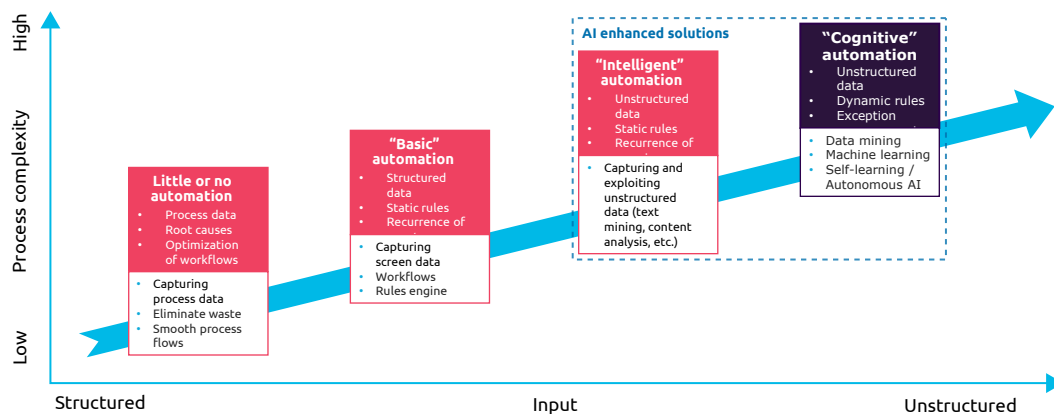


Figure 15: AI enhanced solutions.



## Intelligent automation – potential value and real use-cases

Though AI has use cases outside of intelligent automation, AI is one of the drivers of intelligent automation. When diving into the capabilities of AI, we will see a set of spectrums where AI can add value to an organizations business processes.

The different capabilities are divided into thinking, learning, supervising, listening & answering and recognizing, which are all related to human capabilities which a normal employee uses in daily work life. A virtual machine can eventually take over their tasks by using these capabilities to produce the same results.

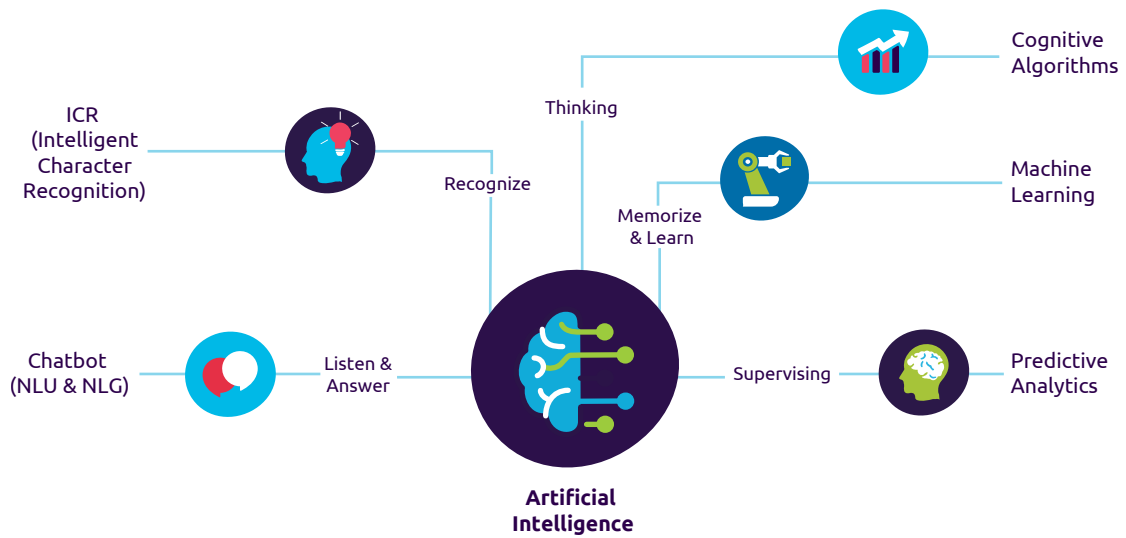


Figure 16: AI capabilities.

For example, Intelligent Character Recognition (ICR) which adds an intelligent dimension to an existing character recognition system and learns it how to extract document elements, despite

variations in layout, language and type. An ICR robot can classify data types and process the relevant data for hard-copy or digital documents such as tax applications forms, vendor contracts or citizen requests.

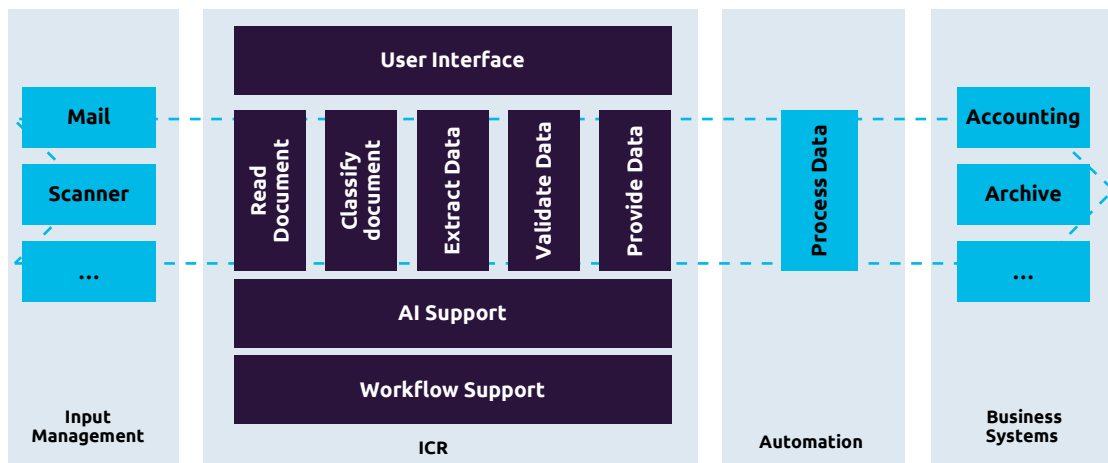


Figure 17: Example ICR workflow.

Another often used AI capability is natural language generation and understanding, which is often incorporated in the development of a chatbot. Organizations often use a chatbot to replace customer service functions for frequently asked questions or basic information requests. This can either be internal customer service for employee such as IT Helpdesk or HR Helpdesk, to provide an employee with relevant answers regarding leaves, personal data adjustment or network account issues, or it can be used for external customer service such as answering frequently asked questions regarding regulation or tax

policies. The main benefit of a chatbot is to enhance the processing time of customer service requests while leaving complex and less common question to a service agent. Recently, Capgemini has created a chatbot for a Dutch customer, to easily record requests received from citizens on online platforms such as Facebook, in case they would like to report minor finding or accidents. It is also possible to incorporate a bot within a certain dial in service number to answer questions from customers over the phone, which is highly adaptable for internal or external helpdesk functions

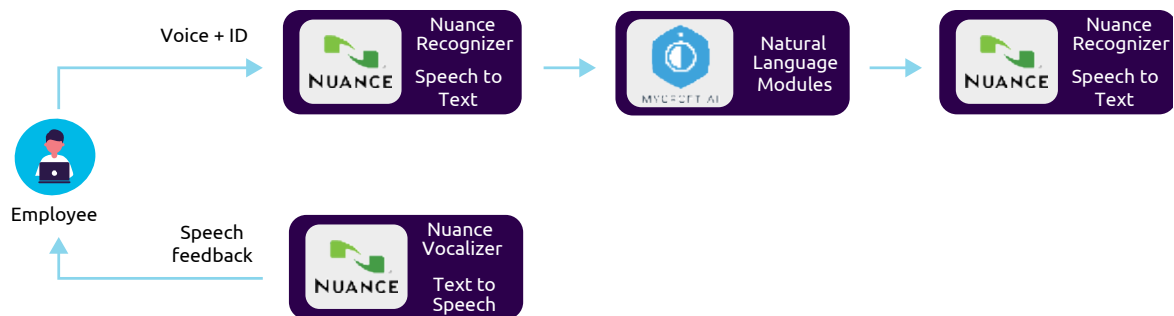


Figure 18: Example of a voicebot workflow using vendor software from Nuance and Microsoft.

## Intelligent automation – Trends, developments and challenges

When looking at tax agencies across the globe, we will see that AI technology provides many possibilities to support the authorities to innovate and automate. An interesting use case to mention is the end-to-end business intelligence project which Capgemini implemented for an Indian Sales Tax Department, which is a major revenue collecting body for the government and has constantly been focusing on reducing tax evasion and associated revenue leakages. By automating the process of building predictive models and integrating advanced data analytics and reporting tools, Capgemini successfully helped the department in optimizing the Identification of fraudulent claims and expanded its taxpayer

base. Besides advance analytical we also see other opportunities to use AI to increase business efficiency. For example, by using Chats and Voice bot solutions to process queries of citizens which are nowadays often manually processed by customer service agencies. Or to use ICR technology to process application of citizens or company tax refunds which are seen as highly time-consuming tasks when doing it manually.

To sum up, intelligent automation is driven by the many distinct capabilities that AI brings, which can eliminate repetitive work and allows tax agencies to spend more time on real value adding activities and deliver the opportunity to enhance operations by using new insights created by AI.



# Blockchain – a search for the best applications

## Introducing Blockchain

Since Satoshi Nakamoto released the bitcoin as a “purely peer-to-peer version of electronic cash” in 2008, Blockchain – the underlying technology of bitcoin – has developed into one of the most groundbreaking technologies that could potentially revolutionize the way we conduct payments, store data and perform transactions. According to the World Economic Forum (WEF) Blockchain is the foundational platform of the fourth industrial revolution and WEF expects that 10% of global GDP will be stored on Blockchain by 2027. The rise of Blockchain has attracted investors to pour nearly \$1.8 billion into the Blockchain market in the first half of 2018 alone. Whereas the financial sector is expected to adopt Blockchain technologies first, governments worldwide are increasingly exploring the potential implications of Blockchain technologies for government processes and civic services.

Blockchain is a complete and unchangeable history of transaction on a digital database, which can be used and shared within a decentralized, publicly accessible network. Blockchain is a type of Distributed Ledger Technology (DLT) in which all nodes are equal, and no central administrator exists. The decentralized nature of the Blockchain eliminates the need for trust towards a single administrator. According to Bank of England, a Blockchain is “a technology that allows people who don’t know each other to trust a shared record of events.” Blockchain transactions contain a strict verification process to create a new transaction record. When a node in the network makes a transaction, the whole network is informed and validates this transaction. When the transaction is validated,

a new block will be added into the chain. This new block is – like all blocks – encrypted with transaction details and can be traced back to the original block. Due to this encryption, altering information is theoretically impossible. The strict verification process highly increases transparency, traceability and security of transactions.

Many government organizations are following, studying or using the underlying technology of the Blockchain. Most prominent is the use of Blockchain by Estonia in creating its Digital Society. Since 2012, Blockchain has been in production use in Estonia’s data registries, such as the national health, judicial, legislative, security and commercial code systems, with plans to extend its use to other spheres such as personal medicine, cybersecurity and data embassies.

## Blockchain - potential specific value for tax agencies

According to a WEF survey, governments will collect tax for the first time via Blockchain in 2023. Leading countries are Finland and Estonia, where tax agencies are currently implementing Blockchain technologies into their businesses. The UK is also advanced in developing a whole government approach to Blockchain, including the area of taxation. The question is not if Blockchain will change the tax system, but how fast and how deeply this will happen. Potential impact of Blockchain can be expected in all three pillars of the taxation operation model.

### 1. Operational excellence

Blockchain has the potential to simplify and automate tax collection. The technology can



be used for verifying, appraising, approving and auditing the information provided by citizens, thus driving efficiency and accuracy. Automation of calculation for taxation can become more efficient and time-saving, reducing costs and administrative burden on tax systems. Furthermore, Blockchain technology may create new possibilities to capture and share information between multiple stakeholders using a common technical platform with identical and synchronized data. Updates of information in the network, are updated for every stakeholder at the same time, providing real-time and synchronized data to all stakeholders.

## **2. Compliance strategy**

Blockchain can be used to track and trace documentations such as invoices and receipts, thereby preventing citizen and organizations from providing false information. Moreover, Blockchain can be used to view transactions in real time, making it easier for Tax Authorities to detect fraud and errors. Avoidance strategies become much more difficult as Blockchain allows governments to follow transactions across jurisdictions and borders. Furthermore, due to the encryption that makes altering of information impossible without permission, Blockchain highly increases security and decreases manipulation. The strict verification process of transactions and the transparent character of Blockchain makes fraud less likely and easier to detect. A Blockchain based tax invoicing system to fight against fraud and corruption is already implemented in China in June 2018 .

## **3. Customer experience**

Due to the decentralized character of the Blockchain network, customers don't have to rely on a single administrator or a powerful third party. Rather, all nodes – e.g. governments, tax authorities, customers – are equal in the network. The transparent and equal character of the network fosters trust between customers and tax authorities. Customers have more control over their identities and keeping sensitive information anonymous.

## **Blockchain – potential future use-cases**

### **Value Added Tax (VAT), payrolling and Transfer Pricing**

Blockchain applied to VAT theoretically enables removal of a business acting as an intermediary agent collecting taxes on government's behalf and allows taxes to be withheld and transferred automatically, using smart contracts. If transactions were recorded on a distributed ledger and paid through a smart contract that calculated the correct VAT, the tax due could be split from the payment as it is made by the customer and be sent directly to government, resulting in significant reduction of transaction costs and reducing the risk for fraud.

Other examples of the possible use of Blockchain technology by Tax Authorities include payrolling and Transfer pricing. References to literature about these topics are listed in the Literature appendix in this report.

## **Blockchain - Trends, developments and challenges**

Blockchain is 80% about business process changes, and 20% about technology implementation . Changing the current tax-system into a fully Blockchain-enabled tax system, therefore, takes time. Besides time, the initial costs of implementing Blockchain technologies are significant. Changes in legal systems and tax policies are needed and laws on intellectual property and legal identity need to be adapted. From a technological perspective, challenges regarding security and scalability will have to be overcome. Although encryption creates superior safety, absolute protection of data against cyber-attacks, hacking and corruption is not guaranteed. Privacy and protection of personal data are challenging in a Blockchain network where transactions can be seen throughout the whole network. Furthermore, new technologies need to provide solutions to overcome the current scalability issue of Blockchain.



# IoT– connecting the physical to the digital world

## Introducing the Internet of Things (IoT)

IoT refers to “the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data”. Devices such as cars, home appliances and even people can all be connected through IoT via inexpensive processors and wireless networks. This enables the devices to communicate without human involvement and brings the digital and physical

world together . Cisco predicts that machine-to-machine connections will account for more than half of the estimated 27 billion devices and make up five percent of global IP traffic by 2021 .

The IoT is an umbrella term for a broad range of underlying technologies and services, which depend on the use cases and in turn are part of a broader technology ecosystem which includes related technologies such as:

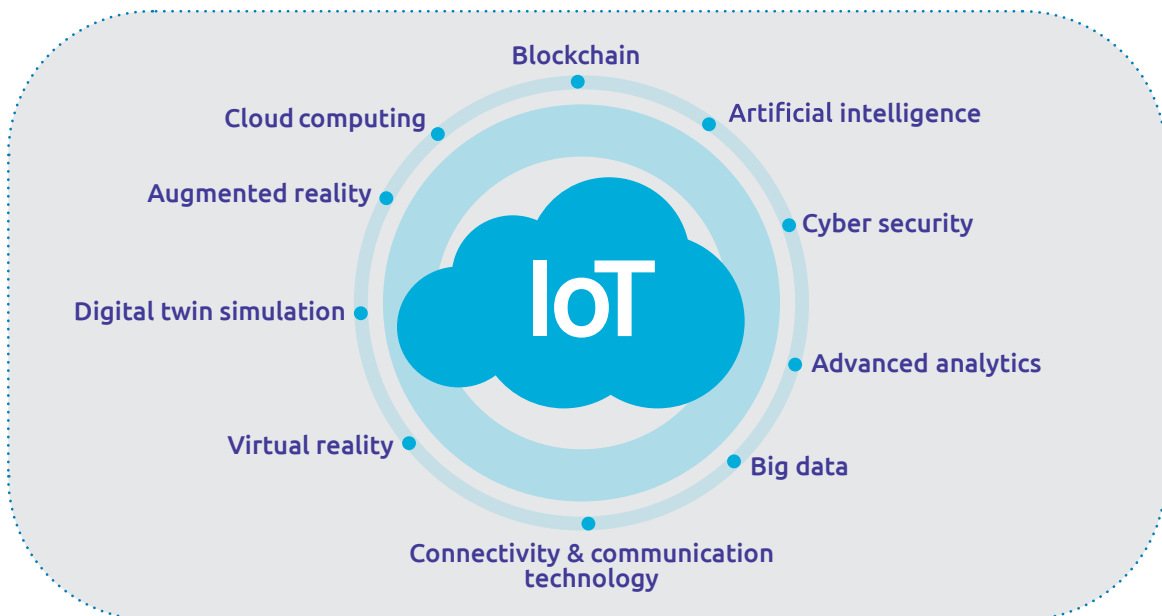


Figure 19: Visualization of the “IoT-Umbrella.”

The key characteristics of IoT are communication and interaction of connected devices and technologies. This generates new kinds of data and the possibility to offer new products and services. IoT generates large amounts of (real-time) data from sensors attached to physical objects, which are connected to an (cloud based) IoT platform. The latter collects data via different devices, integrates it and applies analytics to identify valuable information. This information

can be used to identify patterns, make recommendations and discover and prevent potential difficulties. This enables companies to learn from the behavior and usage, react on this, or even transform business processes. IoT capabilities are fundamental for the creation of a digital business. Other technologies strengthen IoT. For example, Blockchain can record details of transactions between IoT devices. In addition, AI will help to make sense of the data measured by connected IoT devices .

## IoT – potential value for tax agencies

Taxes are usually the main source of revenue for a modern state and the most important instrument for financing its territory. Due to the financial impact on all citizens and the complex tax legislation, taxes and other levies are an ongoing political and social issue. Additionally, governments lose billions every year due to tax evasion. Thus, it is in the best interest of tax authorities to simplify the taxation process and increase the equity across all entities or individuals that are subject to taxation. As a prerequisite, authorities must enhance their tax data measuring capabilities and improve the management of tax transactions. The question is how?

The answer may lie within IoT. Up until recently, IoT innovations have found their greatest application within the private sector. Two examples of industries that have been applying the IoT and thereby transforming their business model, are the banking and insurance sector. For instance, Progressive, a US car insurer, introduced its usage-based insurance (UBI) telematics program allowing them to monitor customers' driving behavior. Through a dongle and machine learning, the insurer can assess how a driver behaves on each trip. As a result, the insurer can more accurately determine the prices, while the approach also rewards safer drivers with reduced premiums.

### 1: Compliance Strategy

As smart products and digital services become more relevant than ever, corporations may no longer be the sole beneficiary IoT. Over the past four years a few tax agencies started to apply IoT to improve their performance and services. At the core stand efficiency, cost saving and speed. The goal for tax agencies is to plug tax leakages (due to evasion, fraud and avoidance) and substantially decrease errors. Such initiatives are ultimately mutually beneficial for both, the authorities (internal)

and the tax payers (external) as IoT positively effects compliance. Being compliant with tax laws should be smooth and easy, without errors and ought to be fostered by operational excellence. Building on that, IoT can play a major role in detecting fraud. With IoT, products can be easily tracked and traced. As a result, taxation of certain goods can be controlled within and across borders. Apart from potentially controlling the flow of goods, tax agencies also can use automatic license plate recognition cameras for motor vehicle tax control. In the future, the obtained images may also be used to control whether a vehicle is used for private or business purposes.

### 2: Operational Excellence

IoT delivers data that has been previously inaccessible or took large effort to collect. Such (big) data can now be stored in databases and can be applied to improve machine learning to predict and uncover suspicious behavior, gain and apply information in real time. Tools to obtain certain data are (e.g.) sensors, ID tags or the usage of drones. Erie Insurance uses the latter for object inspections in the event of damage. The benefits range from speeding up claims procedures and investigating damage to a clearer picture of potential fraud. This approach may also be valuable to the taxation and assessment of properties. Verification of property size, usage, cultivation and development could be done within a fraction of the time. Gathered data can then be matched with previously provided information at the local registry of deeds and be verified much easier and more accurately than ever before. Detecting any kind of anomalies and correcting mistakes or malicious intend can now be done remotely. Also, this approach would increase areal coverage extensively. A government in Asia implemented the use of drones to catch fraudulent practices who underreported the size of their plantations, already in 2015. The approach showed results already as an oil palm



planter had to pay a large amount of taxes due to the drone implementation. Such example illustrates how IoT technologies that have been previously been applied in the private sector can also find application by the tax agencies.

### **3: Customer Experience**

IoT is and will continue to be present in daily life. One of the effects of implementing IoT is the change in business models - from selling products, to selling a pay-per-use.

Changes like these can be applicable to taxation, as well. For instance, there are several pilots in the United States where car drivers are charged per mile instead of paying gas taxes. In the future, there might even be individualized tax rates based on usage. When companies buy tangible assets -such as equipment, machines and vehicles – given that they have been equipped to become smart objects - depreciation could be calculated by use and place of the object. In this example tax authorities become part



of a bigger IoT solution. In addition, big data – measured by IoT devices – enables tax authorities to analyse tax payer’s behavior. Based on these, a better (personalized) experience can be delivered. The customer experience can be increased by means of convenience. An example can be found in Singapore, where international shoppers can now receive a VAT-tax return at the airport within minutes via smart tax booths. To improve experiences even more, a complete picture of each individual or company can be achieved by combining data from different IoT devices and other information sources on one platform. Data can also be collected through devices installed by tax agencies. However, taxation processes often exist of (digital) documentation, there are not many physical objects which could be connected to obtain data. Herein lies a big opportunity for tax agencies to become part of an existing ecosystem. The service offered by authorities should be beneficial for an individual or company to increase their willingness to share data. Allowing agencies to have more direct and instant interactions with tax payers, services can be improved by the obtained insights.

## **IoT – real use cases**

### **A. Use case - Enhancing tax field operations with the IoT**

In 2016, the Philippine’s Bureau of Internal Revenue (BIR) equipped their field officers with mobile devices which significantly improved field operations and streamlined the process of ad hoc vendor inspections at the market place. The officers are now able to scan customs specific stamps on items such as cigarette packs. Collected

data is stored, down- and uploaded to the central database called, Mobile Revenue Collection Officers System (MRCOS), and matched with existing data in real time. As a result, field officers may now uncover (e.g.) fake or unregistered goods and take appropriate measures on site. In addition, the devices are geo location enabled and optimize the route field officers take, thus improving time efficiency. The goal is to extend the stamp system onto other goods, as well. Initiatives include fuel pumps, automatic vending machines and carpark systems to gain real-time retail data .

### **B. Use case - Enhancing container inspections of customs with the IoT**

Another application of IoT in the field of taxation can be found in the Netherlands. Up until now, the process of selecting a container for inspection (by customs) has been costly and time-consuming. Therefore, Dutch tax agencies and Port of Rotterdam introduced remote scanning as a solution which is faster, more efficient and safer. In the “Rijksinspectie terminal” (RIT), inspection agencies are located close to the container terminals. They use remote scanning, meaning all containers are scanned at the terminal. The scans are then analyzed and, if necessary, the container is commissioned for further inspection via a (smart) planning system. This results in significant time savings due to short distances to the container terminals and usage of real time data. In addition, the Port of Rotterdam and tax agencies are working on a container exchange route, where the containers will be moved from A to B without using any documents. Since Rotterdam is the outer

border of the EU, after fast customs clearance and release from Dutch tax agencies, goods can be transported to the rest of Europe .

Even though a few tax agencies started to implement some IoT initiatives, the application of such technologies remains at a minimum. Many countries only recently started to develop a digital transformation strategy. The German government, for example, announced in October 2018 that they plan to extend ELSTER, the electronic tax declaration system . Additionally, to the slow pace of digitization within the public sector another obvious reason is cost and time. Deployment of digital initiatives is often time consuming as systems must be conceptualized, implemented and connected. An undertaking that takes substantial amounts of funds – funds that come from taxes.

## **IoT - Trends, developments and challenges**

### **A. Uniform data and data exchange**

The utilization of IoT paves the way for tax agencies to streamline, ease and improve taxation processes by collecting real time data from “dumb objects”, which was previously intangible or time consuming to gather. However, being able to obtain data comes with the challenge of analyzing and making sense of the information gained. Specifically, databases require uniform data formatting for AI to detect anomalies, learn to map the information and improve accuracy. While obtaining

uniform data for one data base is already a challenge, the complexity is increased when exchanging data across different data bases and even countries. However, here lies the major potential for cross-border collaboration of tax agencies.

### **B. Cybersecurity**

While speaking of data collecting and sharing, one key challenge must not be neglected – cyber security. Consumers are increasingly concerned about the way personal information is collected and shared by the usage of IoT . Companies are spending more and more on IoT security since IoT devices (in taxation) will collect a large amount of sensitive data and share such data via broad networks. Therefore, device encryption is imperative for individuals’ and organizations’ privacy to prevent hacks of public systems . Thus, in taxation this is of great importance for tax agencies and tax payers alike.

Finally, one should keep in mind that IoT has already irreversibly started to influence today’s (business) world. Business models have changed and herein lies a major opportunity for tax agencies. By becoming part of an IoT ecosystem, tax authorities can monitor integrated data to plug tax leakages and simplify the taxation process. It is imperative for governments to keep up with trends and transformations, especially in the digital world, to not fall behind. Being part of the digital transformation enables one to understand, monitor and evidently plug tax leakages.



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## List of interviewees

Name	Title	Country
Mr. Egon Veermae	Former Director General	Estonia
Mr. Jan Zetterdahl	Chief Information Officer	Sweden
Mr. Krebs	Innovator, think-tank and program manager	Germany
Mr. Konig	Vice President and in this role in charge of the IT	Germany
Mr. Schuller	Head of Department Organisation	Germany
Mr. Robert Bauer	Human Capital Management	Germany
Mr. Roy Wallace	Head of Delivery MTDfB	United Kingdom
Mr. Michael Udell	Senior Economist	United States
Mr. Michiel van Hauten	Former Director Innovation & Strategy	Netherlands
Mr. Hans Timmermans	Director Datafoundations & Analytics	Netherlands
Kurian Kallaraka	Account executive tax agency	Dubai / Georgia
Shinichi Tonomura	Account executive tax agency	Singapore
Xavier Moy	Account executive tax agency	France
Stefan B Holm	Account executive tax agency	Sweden
Haakon Brandtzaag	Account executive tax agency	Norway
David Harper	Account executive tax agency	Australia / New Zealand
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## About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of almost 220,000 team members in more than 40 countries. The Group reported 2019 global revenues of EUR 14.1 billion.

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