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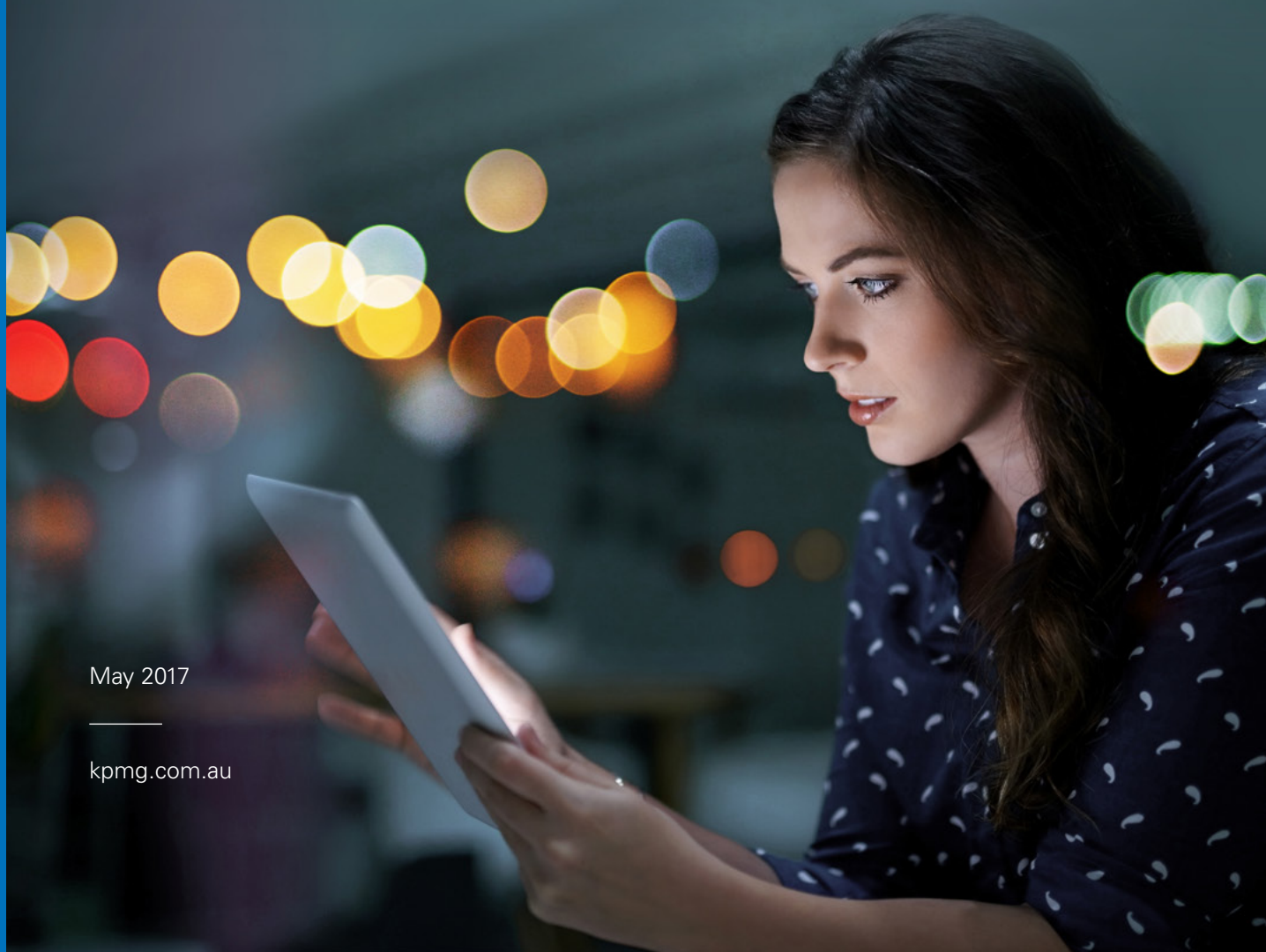
Technology in Tax

Embracing the now & thinking the future



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Executive summary

The practice of Tax is now being impacted by the Third Industrial Revolution, the Digital Revolution. Tax is grappling with the technology of robotics and automation. This is driven by new ways of dealing with data to unlock value.

Tax will also see dramatic change in the Fourth Industrial Revolution. This will be a confluence of multiple technologies, but in particular Artificial Intelligence or Machine Learning, which has the potential to impact tax writing and structuring, as well as meeting compliance obligations in a more efficient manner.

The difference between the Third and Fourth Industrial Revolutions is largely scale, speed and scope as robotics, the Internet of Things, autonomous vehicles, nanotechnology and 3-D printing come to the fore. But it is also grounded in Artificial Intelligence. This is self-learning of the machine, where a computer absorbs from repeated exposure to huge quantities of data. Tax is ripe for this experiential change.

It seems likely that the Fourth Industrial Revolution will change nearly everything. There will be a wave of destruction, accompanied by creation. The balance between the creation of new jobs, occupations and industries, and the destruction of the old is hard to predict, as is the timing of any substitution. But many are suggesting that we could face significant global dislocation.

Not only will our business models require substantial reconsideration as we search for new sources of value, but our personal lives will be dramatically impacted. One's identity as a tax professional will be significantly altered.

This publication seeks to prompt thoughts rather than provide answers on the future. It does so against a backdrop of the suite of technology products that KPMG has on offer in the here and now.

We wish you well in thinking through this critical topic.

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What this is about

This publication is about the practice of Tax, with a capital T, now and in the future, viewed through the lens of dramatically changing technology. It is intended to stimulate, cajole and offer multiple perspectives. It is not intended to provide answers or certainties.

Underlying these thoughts is the view that we have recently seen the Third Industrial Revolution, often known as the Digital revolution, and we are now about to see a Fourth. This is the language of Klaus Schwab, Founder and Executive Chairman of the World Economic Forum which famously meets in Davos every year. In 2016 Dr Schwab released a book titled *The Fourth Industrial Revolution* to prompt discussion at the Swiss gathering.

The term is derived from the Hannover Fair in 2011, where the German Government released a White Paper titled *Industrie 4.0*. It seems like a big call. One can imagine Oscar Wilde saying that it is the height of ill-manners to start a fourth revolution before the third one has finished.

To be sure, they do meld into one another and dividing history into distinct periods is always fraught with difficulty. What can be said with a reasonable degree of confidence is that the Fourth Industrial Revolution will bring dramatic change to all areas of business and society. It is not a question of whether a business will be disrupted. It is when and how.

One of the difficulties in thinking about the Fourth Industrial Revolution is that we continue to feel the winds of the Third. In the Tax world many aspects of the Digital revolution are still being embraced. These can give rise to considerable benefits now. Indeed they provide the best pathways to future technologies, rather than technologies to be 'leap-frogged'.

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Getting to where we are now

The word 'technology' was given its modern usage in 1706. Here a distinction was drawn between theory on the one hand, which was the world of science and knowledge and 'know-how' on the other. Whilst Aristotle used the term, combining techne meaning art or craft, with logos meaning systematic study, he did so to refer to the study of grammar or rhetoric.

The First Industrial Revolution is commonly dated from 1760 to 1840. This is rise of mechanical power, the demise of muscle power, and the beginning of widespread work in factories. The steam engine is an iconic symbol of this period.

At the end of this period, around the 1850s, a new relationship developed between science and technology.

Prior to that time, science was concerned with truth and technology concerned with efficiency, but then science, through its theory, began to drive technology. Technology became grounded in scientific laws rather than craft-based procedures.

This led to the Second Industrial Revolution which is commonly dated from the 1870s to the First World War. This saw the massive expansion of the use of electricity, petroleum and steel.

The Third Industrial Revolution is a more contentious space in terms of timing, but clearly refers to the digital revolution and at its broadest would span from the 1970s with the rise of mainframe computers, through personal computers in the 1980s to the rise of the internet in 1990s, to smart phones in the mid-2000s.

In the 2010s, we have seen another turn – a bit like the one in the 1850s – this concerns the role of data. When data storage was expensive, the focus was on clever algorithms to deal with little data. As data became cheaper, indeed super-cheap, then the focus changed from using simpler algorithms to deal with massive data. Indeed the data can drive the outcome. Speaking metaphorically, rather than finding an algorithm that will define a horse, and distinguish it from a cow, the algorithm can look at millions of images of horses and cows and thus draw its own delineation from the learning experience. This difference is profound and is one of the factors that will lead to the Fourth Industrial Revolution.

The Third Industrial Revolution

The Third Industrial Revolution is about digitisation. The essence of digitisation is reducing something to numbers, commonly the binary 0 & 1. This is to be contrasted with analogue. The essence of analogue is analogy. The hands of an expensive watch are not time, but an analogous measure of time. The power of digitisation, defining things in binary terms, has been huge, particularly when accompanied by Moore's Law. Gordon Moore postulated in 1965 that the number of transistors in a dense integrated circuit doubles every year. In 1975 he revised this to every two years (although this is often quoted as every 18 months). This prediction – remarkable as it is because it is exponential growth – has largely held to 2017. It has enabled our pocket super computers or smart phones, which surprisingly only date from 2007.

A key feature of the Third Industrial Revolution is the Internet. The Internet, at its essence, is simply a protocol for different computers to talk to one another. Such a relatively simple concept produces immense power which is truly the essence of a global revolution.

The ability for a large number of computers to talk with one another has produced the platform effect which has become an essential feature of modern communication, value creation and hyper-successful business models. There is not a linear provision of value from supplier to consumer. Rather, the consumer, through for example, book reviews on a book purchasing website, provides a significant portion of value in the supply chain. The Internet has given rise to different concepts of ownership and sharing, which has translated to the physical world forms such as car-sharing.

The Fourth Industrial Revolution

One might envisage the Fourth Industrial Revolution as simply an extension of the Third. The argument against this is that the speed, size and scope of change is such that it becomes qualitatively different. Technologies will be used in novel ways. The interaction of the physical world with the digitised world will be significantly different.

Technologies that we have now – implantable technologies, driverless vehicles, internet connected clothing and household appliances, smart cities, 3-D printing and manufacturing – will reach tipping points. This will change the day-to-day lives of many, but not all, of us.

What makes the concept of the Fourth Industrial Revolution different from the Third is largely Artificial Intelligence. The concept of Artificial Intelligence is used in a variety of ways. Its first use is generally attributed to John McCarthy in the 1950s, who talked about making a machine behave in such a way that would be called intelligent if a human were so behaving. This is similar to an imitation game proposed by Alan Turing.

Turing developed two games, one based on gender and the other based on machine thinking. An interrogator, who does not know whether he or she is speaking to a computer or a person, asks questions. The computer can lie according to its strategy, but a person must be truthful. The Turing test is passed if the computer can deceive the interrogator. The test must be executed many times. No computer has ever passed the test (although a University of Reading competition in 2014 claimed that a programme had passed with a 33 percent success rate). Imagine questions such as 'what does it feel like to experience summer rain when you are in love?'

There is, however, a slightly different way in which Artificial Intelligence is used which is closer to the concept of Machine Learning. This concept is more akin to self-programming based on substantial data, usually from other machines. That is, the machine learns itself through repeated exposures to data. Commonly this will be machines learning from other machines and not within a machine itself. This tends to be black-box architecture, because the billions of connections which produce the right answer cannot be 'reverse engineered'.

The classic Artificial Intelligence program is IBM's Watson. Watson, named after IBM's first CEO and not Dr John Hamish Watson, friend of Sherlock Holmes, is a computer system capable of understanding and answering questions in natural language. In 2011 it beat previous winners of the quiz show Jeopardy! In 2013 it was used to assist in determining the optimum treatment for lung cancer patients, a capacity which is now employed frequently by doctors.

Watson learns from data. Uses may include processing insurance claims with a high level of accuracy on likely insurance fraud. In the tax world it could be used to distinguish between an expense which constitutes a deductible repair and one that is a non-deductible improvement by 'learning' how to draw the distinction and applying that to specific data. There are a wide number of potential application of machine learning from

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programs or approaches utilising Watson techniques.

Above we have mentioned to tipping points. The World Economic Forum published a report in September 2015 outlining 21 potential tipping points, identified by surveying 800 executives and experts from the information and communications sector on whether they believed a specific tipping point would have been reached by 2025. A selection is provided in the adjacent table.

Tipping points expected to occur by 2021 selected from WEF Report	%
90 percent of people having unlimited and free (advertising supported) storage	91.0
The first robotic pharmacist in the US	86.5
The first implantable mobile phone available commercially	81.7
30 percent of corporate audits performed by AI	75.4
Tax collected for the first time by a Government via a blockchain	73.1
The first AI machine on a corporate board of directors	45.2

Source: Deep Shift, World Economic Forum, September 2015

There are two other concepts worth mentioning here which are sometimes used in discussion of the Fourth Industrial Revolution but may be beyond it.

The first is Artificial General Intelligence which takes the acronym AGI and is an extension of AI. The concept here is to create computer systems or robotics that can do anything a human can do. We are a long way from this.

The second is the notion of 4D. This is an extension of 3D technology – printing and bio-printing – into a fourth dimension which is one of 'adaption'. This raises an interesting discussion on the distinction between software and what is becoming known as 'wetware' – living tissue. It has been asserted that a critical distinction between a living cell and a silicon chip is that the cell can autonomously and adaptively modify itself in response to various circumstances whereas a chip cannot. The machine, on this view, comprises a set of fixed parts that can change their position in relation to each other but cannot change their own form. In this sense, it is asserted that cells have 'intentionality', whereas a chip does not.

Tax in an IoT World

The 'Internet of Things' heralds a fundamental societal shift that embeds the internet in everything we do. Smart Cities of the future may feature road systems without traffic lights, intelligent street lighting and smart garbage collection. The appliances in our smart homes will all contain sensors connected to each other and us.

The opportunities from this new technology might have some surprising tax consequences, which will be back of mind for most tech developers. The classification of revenue into goods, services, royalties, digital services or telecommunications can have different tax effects in different locations. When your lawn mower measures the height of your grass, lets itself out of the garage and mows your lawn while you're at work, has the lawn mower manufacturer shifted into the realm of a providing a garden service? Similarly, when your fridge monitors its own contents, logs onto supermarket online shopping and orders next week's groceries for home delivery, the line between product and service becomes blurred.

The classification of revenue can alter its tax treatment, both across borders, and across tax types. Businesses would be foolish to ignore such future tax implications that may have a serious effect on the bottom line. The tax position needs to be evaluated up front, before the technological and business structures are cemented in place.

Techno-cynicism, techno-optimism and techno-pessimism

Techno-cynicism is likely to be most prevalent amongst professionals, such as lawyers, accountants and tax advisors, on the basis that such professions adopt a questioning mode of thinking and are particularly careful about hype. The benefit of such wariness is not to be dismissed lightly. Some of this wariness emanates from a lack of knowledge. As Carl Sagan has said "we live in a society exquisitely dependent on science and technology, in which hardly anyone knows about science and technology."

There is also a sense that technology is exogenous or beyond our control. Philosopher Martin Heidegger gives weight to this view with his assertion that in its essence, technology is something that man does not control. Jerry Mander has said all technologies should be assumed guilty unless proven innocent. And there is Douglas Adams: we are stuck with technology when all we really want is stuff that works.[1]

Potentially this techo-cynicism is a dangerous manner of thinking as it may constitute a denial of the future and engender an abdication of the ability to shape our future.

Techno-optimism, at its core, is a belief that technology has improved our lives to date and while the Third and Fourth Industrial Revolutions may cause economic and social dislocation as the First and Second Industrial Revolutions have done, ultimately the Luddites were wrong. There is also a sense that technology can act as a saviour – a bit like Q providing James Bond with a new gadget at the beginning of a 007 film which we know will be used at the appropriate time.

Industrial revolutions by their nature involve destruction and creation at largely the same time. Techno-optimism is the belief that the creation happens quickly enough to cause minimal damage from the destruction. This is dealt with further below.

Techno-pessimism is prevalent. On one level there is a concern about what technology can do. There is the image of a dystopian world of atom bombs, a deterministic world of environmental destruction and a cautionary narrative of Mary Shelley's Frankenstein. Philosopher Nick Bostrom from Oxford University has warned that if machine intelligence were to exceed human intelligence we could lose our position as the dominant life form on earth.[2] Stephen Hawking has said that the development of full artificial intelligence could spell the end of the human race.[3]

There is a stream of debate on whether one can program a machine to think ethically or so as not to dominate man. Some see natural limits to machine dominance based on the assertion that intelligence of mankind is grounded in the fact that we suffer, have regrets and that our own thoughts fundamentally matter to us. Some argue there cannot be real intelligence without concern for our own existence. A machine can reflect the complexity of the real world, but it does not have a connection with it, in the sense, that ultimately, with a machine no one is home.[4]

1 New Philosopher, volume 11, pp. 74 & 75 for the above quotes from Sagan, Heidegger, Mander and Adams

2 Bostrom, *Superintelligence*, OUP, 2014

3 Interview on BBC, 2 December 2014

4 Jerry Kaplan, *Defining Artificial Intelligence*, 2016

Destruction, creation and substitution

As noted above, an industrial revolution involves the duality of destruction through disruption, and creation. What is most difficult about the Fourth Industrial Revolution is that the rate of change will be faster than in any previous revolution. A high rate of change gives limited time for people to adapt, to develop new skills or to locate to different places. If one considers driverless taxis, trucks, delivery vans and drones, the potential dislocation to vast numbers of semi-skilled male workers is substantial. It raises questions as to whether we have the leadership skills and political infrastructure to deal with this.

Age will play a role here as many older workers will not be attuned to adaption. However they will live in a time when, with the advent of longer lives, many will not be able to afford to retire.

There are also likely to be different implications for men and women. While the logistics industry is likely to be substantially disrupted impacting many men, changes in the retail sector are likely to impact women disproportionately. On the other hand many positions involving compassion and empathy, particularly in health and aged care, may favour female employment.

A new world is likely to favour complex thinking rather than deep technical knowledge. This will almost certainly impact Tax. Technical expertise thought purely as knowledge will be diminished.

In recent times we have seen greater specialisation in Tax. Compliance has been streamlined and continues to become more efficient. This will form a sound foundation for even greater specialisation through the use of clever algorithms to calculate tax liabilities. Some of this may be mechanistic, such as a thin capitalisation calculation. Some may use artificial intelligence to discern between, for example, a deductible repair and a non-deductible improvement as mentioned above.

The Fourth Industrial Revolution will not only impact compliance, but also legal research, drawing on massive data involving similar problems and on letter writing for structural advice. Indeed one can imagine a computer considering the optimal tax structure for an investment in the future.

If there has been a trend in Tax for offshoring, that trend may be reversed with ‘re-shoring’. In a technological environment, generally involving low marginal costs, the cost of employment becomes a diminished factor in determining where activities are carried out.

One risk which will impact all is that the dynamics of the Fourth Industrial Revolution may be one where the ‘winner takes all’. This results in immense pressure to ‘get it right’.

There is another dimension related to destruction and creation. Currently the world is experiencing a ‘productivity paradox’. That is, the Third Industrial Revolution has not produced high productivity and growth as one might expect. There is no clear answer as to why, although one can make a number of observations.

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Observations

1. Firstly, traditional ways of measuring productivity may not capture the full value of a service. If one has a phone application to call a taxi, the cost of that application may be free or close to free, whereas the value contributed may be significant.
2. Secondly, the success of the Third Industrial Revolution has generated a significant amount of cash for a substantial number of businesses. These cash holdings have not found a productive home. Whether this will occur over time is another question. Others have pointed to the fact that we may be experiencing the waning of the Third Industrial Revolution, accounting for low productivity growth.
3. Thirdly, a concern that is commonly raised is the potential for greater inequality arising from a Fourth Industrial Revolution. The source of the inequality is the loss of jobs before new ones are created. Also the nature of the businesses that are able to extract value from disruption are usually areas where that value is in cost-savings rather than new products. Thomas Piketty has argued that inequality rises over the long term if the rate of growth of the economy generally is lower than the return on capital. He believes that given demographics and other factors we can expect this to be the norm for the 21st Century. Not all agree with this analysis. One interesting issue concerns the level of inequality that occurs in a rapidly growing developing country. Is this a short term phenomena that arises because of the large number of rapidly growing businesses that will be disrupted later in a transition phase or is it a more permanent feature?

Business drivers and the tax function

Tax is experiencing a dramatic change in the way things are done. This is very much the experience of now, but it will be greater in the future. Chief Tax Officers are looking for automated solutions for greater efficiency, reliability and to provide superior insights. Cost may also be a factor.

In seeking these benefits, sharing much more data with advisors is key. New relationships are developing between advisor and client grounded in trust and a different form of partnership. There is a drive to collaboration. While the concept of an operating model is moving to a digital model in the general business environment, so it is in Tax.

Tax has traditionally been a look-back phenomena. Increasingly it is dealt with in real time. This is partially due to the increasing role of revenue administrations in dealing with reviews in real time and partially because Tax is being viewed in a new way: not merely as a compliance function, but as an area that can contribute to a deeper understanding of the business.

In both the Third and Fourth Industrial Revolutions, data is the key to business value. In the adjacent pyramid an increasing portion of the Confidence, Intelligence and Optimisation sub-triangles will be performed automatically. Not all. There is still a significant role for judgement. That role has been enhanced given the complexity of dealing with a greater number of stakeholders and the reputational risk involved in tax moving into the domain of corporate social responsibility.

Data will play a greater role in Tax. This will raise concerns about cybersecurity and transparency. We have seen a substantial drive to greater Revenue Administration transparency with Country-by-Country reporting, and public transparency with various mandatory and voluntary disclosure regimes.

It is inevitable that we will see large scale cybercrime on taxation in the future. This is a question of minimising the risks involved through an appropriate cost-benefit analysis. The risks cannot be eliminated.

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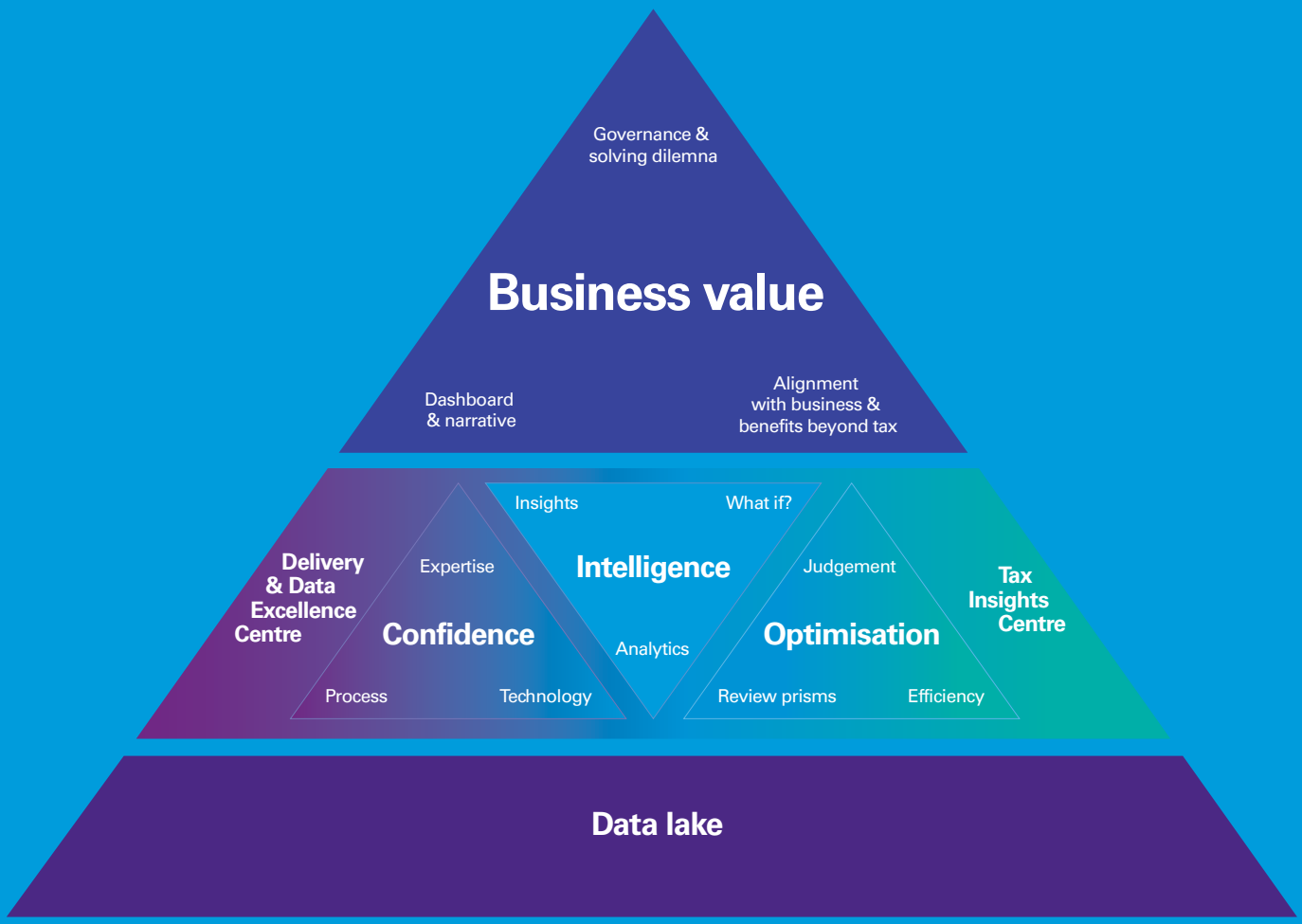
Tax path to greater business value



Tax and Blockchain

Blockchain is the technology underlying the digital currency, Bitcoin. Introduced only in 2008, the technology was first described (although the term 'blockchain' was not used) in a white paper by the pseudonymous writer/s Satoshi Nakamoto. The paper proposed a *'peer-to-peer network using proof-of-work to record a public history of transactions that quickly becomes computationally impractical for an attacker to change if honest nodes control a majority of CPU power'*.

The potential of Blockchain technology is real-time, immutable, decentralised, trusted and transparent transactions – exactly the sort of characteristics that are becoming ever more important in the global tax system. The international push for tax transparency and inclusive action against tax avoidance has created uncertainty around international tax positions, and resulted in major compliance burdens on bigger businesses. Blockchain has the potential to simplify and accelerate transparency compliance, tax audits, and decision making. It may also be the key to facilitating collaboration between business, tax authorities, and professional advisors.

However, Blockchain also introduces a new twist on two age-old tax issues – **where** did the transaction take place, and **who** is the taxpayer? Blockchain transactions are verified and recorded across thousands of decentralized, international computers. This makes it difficult to determine where a transaction is concluded, and allows for anonymous transacting. Although this is no different to the anonymity afforded by the cash economy, it may require government involvement to create private centralised Blockchains.

The tax professional

It is interesting to postulate how the Tax Professional will change in the Fourth Industrial Revolution. The tax return preparation process is being seriously disrupted now.

Broader tax professional are also likely to experience significant winds of change. They are more likely to be free agents, possibly assisting companies on an as needs basis depending on the specific skills required. They may become part of the human cloud. Will this give rise to greater freedom and greater stress? Possibly. Work-life integration, as opposed to work-life balance, may change from this perspective. We may feel differently about what it is to be an individual and what we feel is purposeful.

As technical experience will be drawn upon in a different way, many tax professionals may experience a broader set of work opportunities within a specific business. Professionals may rotate through the Tax Department in a different way from the past as complex thinking becomes more important and technical knowledge less so. Boundaries between functions will start to break down. Corporate services will become less siloed. This will be the case not only within corporates, but for advisors, where advice is not functionally based, but multi-functional. The focus will be on the broader problem, rather than the siloed expertise.

This will also lead to a changing sense of what constitutes the tax community. The future may see less rigidity between the revenue administration, Treasury policy officials, business and advisors. This will be exacerbated by globalisation and break-down in functional strictures.

What companies need to do

The taxation path to the Fourth Industrial Revolution is a complex one. The primary issue is awareness. Thinking about what an organisation faces in the future, including the when and the how. Grasping the magnitude of the change. Thinking beyond the marginal actions.

Then technological developments need to align with workforce strategies. This alignment may be hampered by resource constraints and short-term profitability goals. Indeed the definition of skill in tax is in a state of flux.

Investment may be key. Some will wait in the hope that they may leap-frog the current technology. But this may lead to being left behind.

Ultimately, as with any business dealing, the future for Tax is all about capturing value. One thing that is often missed is how valuable rich tax analytics can be for understanding the broader business. There are many windows to a business and Tax is a unique and valuable one.

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