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Experimentalism and the Fourth Industrial Revolution

November 2022

Open Data Institute

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About

This policy report has been produced by the Open Data Institute, and published on 8 November 2022, as part of our international project Experimentalism and the Fourth Industrial Revolution, led by Dr Mahlet ("Milly") Zimeta. The report's lead authors were Lucas Stiglich and Matt Davies, with additional contributions throughout the course of the project from Adjoa Anyimadu, David Warrell and Dr Jeni Tennison.

The wider project team included Di Leighton, Emily Sinclair, Julie King and Prushoth ("Prush") Ratnatheepan. We are also grateful to Neil Mortimer (Institute for Diplomacy and Governance, Loughborough University London) and Dr Stefaan G. Verhulst (GovLab, NYU) for feedback on an earlier draft of this report.

If you want to share feedback by email or would like to get in touch, contact the policy team on policy@theodi.org

This report is published as a document open for readers' comments and contributions. To share feedback in the comments, highlight the relevant piece of text and click the 'Add a comment' icon on the right-hand side of the page.

How can it be improved? We welcome suggestions from the community in the comments.

Team foreword

Experimentalism by name, experimentalist by nature: for this report Foreword, we've invited the project team to share their observations, reflections and highlights from our kaleidoscopic project.

Dr Mahlet (Milly') Zimeta,
Head of Public Policy and Project Lead

Narratives are an important part of this project and I was really interested in being able to explore – and challenge – some dominant narratives around my relationship, as a Black African woman philosopher, to digital technologies.

I actually owe my career in data and digital technology to a digital technology. When I left academic philosophy a few years ago, I signed up to LinkedIn to submit an online job application to an education company. But as soon as I completed my profile the algorithm started recommending research and strategy jobs at Google. At that time, I didn't own a laptop or a smartphone, and my home PC had a floppy disk drive and no WiFi antennae: so I wasn't the most obvious candidate for a technology career. But the algorithm's analysis side-stepped these features and opened up life-changing possibilities for me. How else could data and digital tech be used by disenfranchised communities as tools for social, economic and political expression and transformation, on our own terms, and as leaders in our own right? This is what I've enjoyed exploring through the Ursula Le Guin and Octavia Butler workstreams of our project.

I still use my retro PC, though – and I'm still, at heart, a philosopher. Friedrich Nietzsche in *The Birth of Tragedy from the Spirit of Music* (1872) warns that modernity in Europe will lead to a misguided faith in a 'technoscientific utopia', where we mistake information for wisdom, and where we erroneously place our hopes on science and technology to save us from the harmful consequences of our human nature. And so when we find ourselves discussing the possibilities of new data availability and Fourth Industrial Revolution, I think it's important to remember that information is not wisdom, and that 'utopia', in Ancient Greek, means both 'a good place' and 'nowhere'. 'Sometimes what you have is not a *data* problem,' Professor Ganna Pogrebna from the Alan Turing Institute says in one of our roundtables, 'sometimes what you have is a *decision* problem'; I've loved exploring this with policy-makers through our Isaac Asimov workstream.

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Lucas Stiglich, Senior Policy Associate (Visiting Researcher) and Lead Author

I believe that there's a need to be careful about what we take for granted as 'progress' during the Fourth Industrial Revolution. We know from history that industrial revolutions do more than just transform production: they also transform how the lives of people are organised. Karl Polanyi argued that during the first industrial revolution, labour started being treated as a commodity so as to keep production going under a market logic. As he points out, however, labour is actually 'the technical term used for human beings'.

Reorganising production under a new economic logic will inevitably impact societies and people's lives. But these impacts are unlikely to be equal or uniform for everyone. The first industrial revolution looked different for industrialists than it did for workers operating the new machinery in factories. At an international level, global processes of marketisation of the first industrial revolution led to different economic realities, as colonial and post-colonial territories remained largely sites for value extraction while European countries accumulated wealth.

Since data and information are core elements of the Fourth Industrial Revolution, it's important to pay attention to how different forms of knowledge or rationalities are favoured, in these economic transformations, while others are left out. For these reasons, I've valued how the Octavia Butler workstream of our project enabled us to centre diverse ways of understanding the world. I believe this should serve as a starting point to imagine how we can ensure to keep diverse global voices present in the design of a human future that is more equitable, fair and inclusive.

Matt Davies, Senior Policy Advisor and Lead Author

Nothing's new under the sun - or so the cliché goes. I think some things under the sun probably *are* new, but I suspect that they're fewer in number and more difficult to recognise than is often suggested.

This is especially true in public policy, and in digital technology – two fields in which the hype cycle reigns supreme. Working at the intersection of both, I believe in cultivating a healthy degree of scepticism towards injunctions to 'make it new'. Too often, 'new' is taken to imply not only that a policy or idea is of recent origin, but also that it is good – or if it isn't quite good, then it is at least inevitable, so there is no point trying to resist it. Calls for 'modernisation' have frequently served as a fig leaf for ideas that are not new at all, probably not good, and which could certainly be resisted.

Innovation can however be powerfully attractive in a world so clearly broken – riven with social, political, economic and ecological crises that seem intractable to traditional modes and methods of policymaking.

It's therefore incumbent on those of us with an interest in policy for data and digital technologies to exercise good judgement, balancing our justified scepticism with openness to new ideas.

It has been a privilege, through this project, to explore how this balance can be struck. We've sought to ask questions which I believe are valuable and provocative: what is genuinely novel about the present moment? When might new and experimental approaches be needed? And, to quote V. I. Lenin by way of Cambridge philosopher Raymond Geuss: *who whom*, or rather who is experimenting and on whom? We don't presume to have all the answers – or indeed any of the answers – but I hope you find our report stimulating nonetheless.

Adjoa Anyimadu, Senior Policy Associate

Building a representative community of practice has been a core ambition of this project – bringing together practitioners who may not have had previous opportunities to connect in order to create not only new conversations but also new practical opportunities for experimentation.

As we emphasised in the Ursula Le Guin workstream, marginalised communities can offer insights that benefit all – and in this spirit the disability rights slogan: 'nothing about us without us', was foundational to how we considered the best ways to identify and ensure the inclusion of vital stakeholders in existing and prospective data experimentation. But within both the Ursula Le Guin and Octavia Butler workstreams, the multi-faceted role of diaspora communities did not easily fit into established conceptions of marginalisation and the policy influence that minority groups can hold.

Delineating the space that diaspora communities occupy as stakeholders in data policy in the Global South and North was an interesting challenge, as we tussled with what Georgetown University's Professor Olúfẹ́mi O. Táíwò refers to as 'elite capture', whereby data policy practitioners from diaspora communities (who can be positioned as marginalised minority groups within the Global North) were often drawn from elite networks within their home countries. Understanding this hybrid role encouraged us to critically consider our modes of engagement, and how far we should seek to work within the traditional international development frameworks that are often dominated by elite voices, especially considering that our focus on jobs, skills and supply chains inevitably overlapped with the objectives of established international development policies.

I hope that one result of our considerations of these nuances will be wider appreciation for the value that diaspora communities can bring through their redistribution of experience-based knowledge across transnational networks of data practice, and by adding diversity to critical perspectives of new data and associated technologies.

David Warrell, Policy Associate (Visiting Researcher)

What is a policymaker to do when faced with a definite problem that has unknown, and perhaps unknowable, parameters? To me, that was the central question that this project sought to address. The answer, I thought (with my scientific background), was being experimental. Immediately, I was faced with the question of whether we can apply scientific principles to policy. Expecting not to see a difference - a null hypothesis - is at the very heart of science. As Karl Popper said, 'Insofar as a scientific statement speaks about reality, it must be falsifiable; and insofar as it is not falsifiable, it does not speak about reality.' *Looking for what isn't true* is necessary to avoid fooling ourselves into *seeing what isn't real*.

But policymakers can't make policies expecting there to be a null hypothesis: in traditional modes of policy-making, 'failure' is considered a disastrous outcome. Conversely, if a policy intervention has a chance of yielding benefits, then *not* implementing it elsewhere (in the name of experimental rigour) might draw criticism, particularly if the intervention ends up succeeding for some.

The question of whether we *should* use experimentation in policy is equally important. In our Ursula Le Guin workstream I was interested - although upon reflection not surprised - to learn from Dr Aaron Franks from the First Nations Information Governance Centre (FNIGC) that disenfranchised groups are often overrepresented in certain datasets where they have been surveilled against their will.

This adds important nuance to ongoing debates: representation *in data* can be too little (potentially causing skewed answers) or too great (potentially signalling skewed questions): both are a form of injustice.

Experimentation needs rethinking if we're going to apply it to data policy and practice, both from a perspective of feasibility and of equity. I'm proud of my small part in that reimagining.

This report is open for readers' comments and contributions

Dr Jeni Tennison OBE, Vice-President and Chief Strategy Advisor (until December 2021)

There's a lot that we still don't know about how to make data work for everyone. That's partly because data is a new field, and partly because how data works is so dependent on context: on what data you're talking about, what you're using it for, and who else is in the mix. Building knowledge requires us to experiment, but it also requires us to work in the open so that others can benefit from that experimentation.

In summer 2020 the UK data community was preparing for the publication of the UK's first National Data Strategy (NDS). This was an opportunity to bring together some of the lessons that the data community had learned over many years. I created a trio of reflective essays on data policy and published the working drafts online as open documents, inviting public commentary and discussion. I wanted to draw on collective intelligence and community co-creation, and while I had planned to create final versions of the essays that incorporated the feedback in a polished way, it soon became clear that the layers of comments, and comments on comments over time, were themselves valuable. (You can read the essays and comments here: Data to support policy-making, The future of data protection in the UK, and Data for the wider economy.) We adapted this approach for our exploration of the unknown in Experimentalism and the Fourth Industrial Revolution.

'Openness is a skill,' Rudi Bormann from the Open Government Partnership says in one of our project roundtables. It's a practice that doesn't only build knowledge but also builds relationships. Working in the open means sometimes you might fail in the open - but that is the nature of experimentation, and it's only failure if you don't learn from it. By experimenting and working openly we learn together and build a community that is more than the sum of its parts.

Executive Summary

The world is now in the midst of what is often called a 'Fourth Industrial Revolution': the era of widespread automation of industry, made possible by the greater availability of data and innovations in the use of that data (such as new digital technologies such as AI). As with previous industrial revolutions, the Fourth Industrial Revolution holds the potential to fundamentally alter methods of production, revolutionising our ways of working and shaping how we relate to each other in local and global contexts.

This poses a challenge for traditional policy-making approaches. The rapid change engendered by the Fourth Industrial Revolution has created, and is continuing to create, social and economic situations that are both novel and challenging. Policy action is necessary in these circumstances yet beset by uncertainty due to the lack of clear precedents and the risk of unforeseen consequences cascading at scale and pace.

This report explores how policy-makers can respond to these conditions, asking what new approaches might be necessary.

In **Chapter 1**, we argue that the Fourth Industrial Revolution differs from earlier industrial revolutions because of the changed and central role of data within the production process. We set out three contrasting 'data futures', and suggest that navigating these futures will allow us to deliver the benefits of the Fourth Industrial Revolution while minimising the harms.

In **Chapter 2**, we look at the tools available to us for managing these data futures, which we term 'data policy' and 'data practice'. We define data practice as the wide range of activities that yield value from data, and data policy as the public policy decisions which create the conditions for these practices. We argue that the centrality of data to the Fourth Industrial Revolution has increased the significance of data policy, while also putting new pressures on it that will require it to move beyond its current dependence on older policy traditions.

In **Chapter 3**, we discuss these pressures, arguing that the Fourth Industrial Revolution creates rapid, complex feedback loops which can be difficult to manage using the conventional techniques drawn on by data policy. We ask what kinds of new adaptive capacities data policy-makers will need to develop in order to more effectively manage these feedback loops and steer us to a future in which data works for everyone.

In **Chapter 4**, we explore the genesis of this project in early 2021 in response to both the role of data and digital technologies in global experimentation around the Covid-19 pandemic; and also in response to evidence gaps as countries were starting to draft and publish their first national data and AI strategies. We outline the project's methodology of working in partnership with 18 international organisations to convene three parallel workstream communities. Each of these workstreams was named after science fiction writers as a means of recognising science fiction as the genre of political utopia and dystopia, and reflecting the speculative aspects of the Fourth Industrial Revolution. The Isaac Asimov workstream focussed on opportunities for experimentation and innovation in the post-Brexit UK; the Ursula Le Guin workstream focussed on disenfranchised communities in the Global North as data and digital pioneers; and the Octavia Butler workstream focussed on the Global South as data and digital pioneers.

In **Chapter 5** we provide a synthesis of key themes and observations that emerged across the three sequential Parts of the project. These parts reflected the three sequential stages of traditional policy-making: agenda setting and problem definition; solution design and implementation; and evaluation. In Part 1 we examined the new parameters of data policy and practice: new sources of data, new kinds of analysis, and new societal expectations. In Part 2 we examined practical opportunities for innovation and experimentation in data policy and practice: in sector ecosystems and market transformation, in local ecosystems and community transformation, and in governance and accountability. In Part 3 we examined policy needs and opportunities around innovation and experimentation in monitoring, evaluation and learning.

The **Annexe** provides a reference overview of each of the roundtables that were convened as part of this project, along with multimedia resources and information on the event partners for each of the nine roundtables. The roundtable notes have been published as 'living documents' and we welcome and encourage reader comments on them, as part of a community of practice.

Introduction: The Fourth Industrial Revolution

In Europe and in the USA, the Industrial Revolution unfolded over the course of the eighteenth and nineteenth centuries. The large scale mechanisation of industry left massive transformations of society and economy in its wake.

The world is now in the midst of what is often called a 'Fourth Industrial Revolution': the era of widespread automation of industry, made possible by the greater availability of data and innovations in the use of that data (such as new digital technologies such as AI). While date ranges vary, it is typically held to refer to a period starting in the 2010s and continuing today.

As with previous industrial revolutions, the Fourth Industrial Revolution holds the potential to fundamentally alter methods of production, revolutionising our ways of working and shaping how we relate to each other in local and global contexts.

This poses a challenge for traditional policy-making approaches. The rapid change engendered by the Fourth Industrial Revolution has created, and is continuing to create, social and economic situations that are both novel and challenging. These range from the threat to conventional notions of authenticity posed by AI applications such as deepfakes and sophisticated large language models to the tensions between workers' rights and consumer surplus fomented by the gig economy.

Policy action is necessary in these circumstances yet beset by uncertainty due to the lack of clear precedents and the risk of unforeseen consequences cascading at scale and pace, mediated by digital technologies that might not conform to national borders.

This report explores how policy-makers can respond to these conditions, asking what new approaches might be necessary to govern the Fourth Industrial Revolution effectively and deliver a future in which data works for everyone.

Chapter 1: Data and the Fourth Industrial Revolution

The Fourth Industrial Revolution holds the potential to fundamentally alter methods of production, revolutionising our ways of working and shaping how we relate to each other in local and global contexts. This chapter expands on that premise, asking what precisely is novel about the Fourth Industrial Revolution and exploring the effects it is having on the production process.

1.1: Defining the Fourth Industrial Revolution

The term 'Fourth Industrial Revolution' was popularized in a 2016 book by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum:

> **'Mindful of the various definitions and academic arguments used to describe the first three industrial revolutions, I believe that today we are at the beginning of a fourth industrial revolution. It began at the turn of this century and builds on the digital revolution. It is characterized by a much more ubiquitous and mobile internet, by smaller and more powerful sensors that have become cheaper, and by artificial intelligence and machine learning.'**[1]

In practical terms, these technological changes are leading to widespread automation across global societies and economies. Processes such as 'smart manufacturing' are transforming the production of goods; more personalised and efficient services are being provided; and smart devices allow for the use of monitoring and analytics even in domestic and personal settings.

The Fourth Industrial Revolution is not the only term used to describe this era:

- Scholars Brynjolfsson and McAfee have referred to it as the 'Second Machine Age';[2]
- British investor and writer Azeem Azhar has coined the phrase 'the Exponential Age';[3]

[1] Klaus Schwab (2017),) The Fourth Industrial Revolution

[2] Erik Brynjolfsson and Andrew McAfee (2014), The Second Machine Age

[3] Azeem Azhar, Exponential View

- A new project by the Joseph Rowntree Foundation led by writer James Plunkett talks about digital capitalism.[4]

It appears to be the most widespread, however, gauging by Google Search rankings and search results in the titles of peer-reviewed academic papers.

1.2: The Fourth Industrial Revolution in historical context

In Schwab's telling, the Fourth Industrial Revolution builds on previous industrial revolutions. When trying to understand the Fourth Industrial Revolution, then, it could be helpful to ask what features it has in common with the industrial revolutions that came before it.

The period that we now call the First Industrial Revolution spanned from about 1760 to around 1840, starting in Great Britain and spreading to continental Europe and the United States. It was triggered by the construction of railroads and the invention of the steam engine, which allowed production to be organised in new ways. The onset of mechanical production meant land, labour and capital could be more efficiently exploited, enabling enormous productivity gains. This, in turn, produced economic growth – which some economists suggest did not happen at all prior to the onset of the First Industrial Revolution.[5]

The First Industrial Revolution was followed in the late 19th and early twentieth centuries by the Second Industrial Revolution, which started in the United Kingdom and its dominions, the United States, the countries of continental Europe and Japan – the countries that we now call the Global North. Fostered by the advent of electricity, the Second Industrial Revolution enabled the development of the moving assembly line. This made mass production possible, allowing the use of unskilled labour to produce cheap products with standardised parts.

The Third Industrial Revolution or the 'digital revolution' spanned from the 1960s to the 2000s, again led by the Global North. The development of mainframe, and subsequently personal, computing in the 1960s, 70s and 80s, and the popularisation of the World Wide Web in the 1990s, accelerated processes such as globalisation.

[4] James Plunkett (2022), Social justice in a digital age

[5] Bank of England (2019) How has growth changed over time?

Previous industrial revolutions have therefore been characterised by three features:

- New technological developments;
- Increased productivity and economic expansion, made possible by the revolutionisation of the production process using these new technologies;
- Unpredictable social, political and cultural consequences as a result of this economic expansion.

Some of these characteristics are present in the current era: as Schwab points out, we are witnessing new technological developments in the form of 'more ubiquitous and mobile internet', 'smaller and more powerful sensors' and 'artificial intelligence and machine learning'.[6]

It is also certainly true that these developments are changing the way we work and produce goods, with unpredictable social, political and cultural outcomes. It is far from clear, however, that the changes associated with the Fourth Industrial Revolution are producing sustained or measurable increases in productivity and economic expansion, however. Many of the economies of the Global North have experienced stagnation in levels of productivity, even as the uptake of technologies associated with the Fourth Industrial Revolution has continued apace – a conundrum referred to by economists as the 'productivity paradox', and sometimes also associated with the Third Industrial Revolution.[7]

Another issue we may want to consider is the pattern so far of industrial revolutions to intensify inequality and exploitation. The developments we associate with previous industrial revolutions were predominantly driven by elite groups in the Global North in the pursuit of wealth and power. They produced severe – and often unacknowledged – negative impacts on the Global South and marginalised communities in the Global North.

For example, while we often talk about the First Industrial Revolution as a phenomenon that originated in Great Britain, it was facilitated by imports of raw materials from British colonies across the world. Historians have argued that industrialisation in Britain in turn fuelled further imperialist expansion and the atrocities which came with it.[8] In Britain itself, contemporary observers such as Friedrich Engels expressed horror at the conditions endured by the poor and uneducated under industrial capitalism.[9] We can see this pattern at work in subsequent Industrial Revolutions, too: consider how the Second Industrial Revolution coincided with America's 'gilded age', now a byword for soaring inequality, and or the manner in which the globalisation facilitated by the Third Industrial Revolution delivered cheap goods through the exploitation of the Global South's working poor.

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[6] Klaus Schwab (2017),) The Fourth Industrial Revolution

[7] McKinsey (2018), Is the Solow Paradox back?

[8] JR Ward (1994), The Industrial Revolution and British Imperialism, 1750-1850

[9] Frederich Engels (1845), Conditions of the Working-Class in England Index

There are, of course, many ways in which the industrial revolutions of the past delivered benefits for marginalised communities. The standard of living enjoyed by the majority in the Global North today, and increasing numbers in the Global South, has been facilitated by the technological progress delivered by previous generations. New markets, products and services have been created addressing the specific needs and interests of minority groups.

However, the extent to which economic growth during the First Industrial Revolution delivered improvements in the standard of living for the majority of the population, even in the 'imperial core' of the Global North, has been questioned – and similar arguments are made in the context of today's economy.[10] In many cases, wider access to the goods and services delivered by new technologies had to be contested and fought for.

Many from marginalised, minoritised or otherwise oppressed groups have also questioned the desirability of access to the fruits of economic growth. Activists from the disabled people's movement and queer communities have for instance highlighted the ways in which the increased standardisation of processes in the pursuit of mechanical efficiency and economic expansion can lead to the further marginalisation of minority bodies and identities by creating products, services and opportunities narrowly tailored to normative ideals of how human beings should look and behave.

Thinking about the developments of today in these terms allows us to compare and contrast the transformations we see today with the changes wrought by these previous industrial revolutions, and learn lessons from how they were governed.

1.3: The role of data in previous industrial revolutions

Data is central to the Fourth Industrial Revolution, but data isn't new – it played a role in each of the three previous industrial revolutions. We can illustrate how this has been the case with recourse to the ODI's data value chain, which sets out three stages in the creation of value from data:

- Data is **stewarded** – collected, maintained, and shared;
- Information is then **created** from that data – in the form of products and services, analyses and insights, or stories and visualisations;
- **Decisions** are then made on the basis of that information – along with information from other sources, experience and understanding.

[10] Eric Hobsbawm (1963), The Standard of Living during the Industrial Revolution: A Discussion

We can see this process at play in rudimentary forms even in the pre-digital era. In the nineteenth century an industrialist might have:

- Stewarded (non-digital) data in the form of company records, such as data concerning basic business performance measures such as profit, loss and revenue;
- Created information from that data about the viability of their enterprises;
- Decided whether and where to allocate capital based on this analysis.

The availability of data and the sophistication of the information created from it has increased with each subsequent Industrial Revolution. Technological change has facilitated improved record-keeping, allowing greater amounts of data to be collected, maintained and shared at the stewardship stage. Modern technologies also allow for more sophisticated analysis of recorded data at the insight-creation stage, and better communication (in terms of geographic reach and speed) of such analyses and resulting decisions at the final decision-making stage.

The transformation in data availability and data use cases between the Third Industrial Revolution (1960s-1990s) and the Fourth Industrial Revolution (2010s-present) can be considered the most pronounced, however. This is because of three major technological developments that have taken place since the 1990s, distinguishing the Fourth Industrial Revolution from the Third[11].

Firstly, internet penetration is much higher than in the 1990s. Large numbers globally have come online for the first time: at the turn of the millenium, only 7% of the world was online, but this figure is now nearly 60%.[12] Speed, bandwidth and mobility of internet connections has also increased, with 36% of the population in high income countries now benefiting from access to broadband internet and 51% globally accessing the mobile internet.[13]

With the majority now connected, and many in the Global North enjoying near-instantaneous communication, data is continuously collected – both deliberately, and as a byproduct of service delivery – as individuals use online services. This data, as well as data from other sources, can also be transferred from place to place much more easily and quickly over the internet than ever before.

[11] The writer James Plunkett has, for instance, has described developments associated with the Third and Fourth Industrial Revolutions as 'undermining the keystone assumptions of Standard Economics' and necessitating new policy-making approaches. See: The competition regime in 2050. Would we die from shock if we saw it? (2022)

[12] Max Roser, Hannah Ritchie and Esteban Ortiz-Ospina (Our World In Data, 2015), Internet

[13] GSM Association (2021), The State of Mobile Internet Connectivity 2021

Secondly, physical sensors are smaller, more powerful and more commercially viable than they were in the 1990s. An example of this is webcams: in the 1990s, streaming video from a camera to a computer was a novelty, whereas the vast majority of computers and mobile phones now have webcams built in.[14]

This means that data from physical environments is collected across a much wider variety of industrial, commercial and domestic settings.

Thirdly and finally, the increased availability of data as a consequence of these two factors, combined with the emergence of cheaper and faster computers, has enabled the development of machine learning. Defined by the Royal Society as 'a technology that allows computers to learn directly from examples and experience in the form of data', machine learning has a wide variety of applications ranging from the identification of objects to the automation of tasks.[15]

Many of the products and services used every day by people across the world use machine learning: from virtual personal assistants such as Siri and Google Assistant to content recommendation systems such as those used by online stores such as Amazon and Rakuten, or social media platforms such as Instagram and TikTok.

1.4: The role of data in the Fourth Industrial Revolution

The combined effect of these developments has been to significantly increase the collection and availability of data while creating new uses for that data. This has transformed each stage of the data value chain, explored in more detail below.

i) Data stewardship in the Fourth Industrial Revolution

Data is far more abundant, transforming data stewardship.

In previous eras, data stewardship was primarily the concern of what we might call 'traditional' data institutions (such as national statistics offices, company registers and other large bureaucracies). Today nearly every organisation has some role in the collection, maintenance and sharing of data, from small businesses maintaining records of transaction data to large conglomerates publishing data on their environmental records.

[14] Craig Hale (TechRadar, 2022), The evolution of the webcam over the years

[15] The Royal Society (2017), Artificial intelligence

ii) Information creation in the Fourth Industrial Revolution

Advanced techniques such as machine learning mean that more sophisticated insights can be created from data.

This means that in addition to the new availability of data, we can do new things with the data we already have – unlocking new value from older datasets. An example of this might be the use of machine learning to transcribe and search historical archives, and identify the handwriting of notable figures.[16]

Machine learning allows insights to be created from large datasets relatively quickly by relatively small organisations, where previously such insights were the preserve of large bureaucracies such as governments and corporations.

iii) Decision-making in the Fourth Industrial Revolution

The technical and social nature of the decisions made on the basis of these insights is different, introducing new domains into the fields of data policy and practice.

The relationship between the three stages of the chain is also different in the Fourth Industrial Revolution. Decisions made on the basis of data-led insights can be fed back into the production process more rapidly than before due to the instantaneous communication and real-time monitoring enabled by faster internet speeds and ubiquitous sensors. This, in turn, allows further new data to be gathered. One example of this is Google's efforts to reduce the energy usage of cooling systems for their data centres: data is collected by sensors across the data centre, used to train machine learning models to predict future temperatures, which is then used to control the cooling systems.[17]

Data is therefore more central to business models and to the creation of value in different sectors than it was in previous industrial revolutions, and increasingly recognised as a factor of production in its own right, distinct from labour, capital and land.[18]

1.5: Data futures and the Fourth Industrial Revolution

If previous industrial revolutions can be understood as the deployment of new technologies to more intensively exploit labour, capital and land, it might be useful to think of the Fourth Industrial Revolution as the deployment of new technologies

[16] Fintan Burke (EU Horizon, 2020), Machine learning and big data are unlocking Europe's archives

[17] See DeepMind (2016) DeepMind AI Reduces Google Data Centre Cooling Bill by 40%

[18] See Lillian Li (2021) Abridged: Data as a factor of production

to more intensively exploit data – which in turn enables the exploitation of labour, capital and land to be further revolutionised.

As a result, in the Fourth Industrial Revolution the data value chain is more central to value creation across the economy as a whole. Entire sectors are transformed through the stewardship of data, the creation of information from that data and decisions made on the basis of that information.[19]

At the ODI, we want those taking part in this process to act in ways that lead to the best social and economic outcomes for everyone. In our theory of change, we call this goal the farmland.[20] We contrast this positive data future against two negative alternatives.

Firstly, a data hoarding future where organisations restrict access to data, using inappropriate business or funding models for data that distort competition and limit the value that we, as a society, get from data. We call this the oil field.

This could result in a world where the benefits of the Fourth Industrial Revolution – for example, in terms of cheaper, more sustainable and more personalised goods and services – are unevenly available, exacerbating existing economic and global inequalities.

Secondly, a data fearing future where unaddressed fears arising from legitimate concerns – such as who has access to data and how it might be used – prevent us from realising its full benefits. We call this the wasteland.

This could result in a world where the benefits of the Fourth Industrial Revolution do not materialise at all, resulting in missed opportunities for social benefit including around the Sustainable Development Goals.

Thinking about data futures in these terms helps us to balance what Dr Claire Craig refers to as the 'asymmetry' of benefits and disbenefits presented by new technologies:

> **'Regulators of new technologies often operate in an asymmetry in which the benefits of a future good are likely to accrue to people who do not yet know that they risk missing them. At the same time, the disbenefits are often visible and will affect existing identifiable stakeholder groups. So in some cases a regulator may feel they are more likely to be penalised for letting a bad thing happen than for neglecting to enable a new form of good.'**[21]

[19] Stian Westlake and Jonathan Haskel (2017) have highlighted the rise of what they call the 'intangible economy' Capitalism without Capital | Princeton University Press

[20] Singaporean policy-maker Aaron Maniam (2017) has argued that data has certain qualities that mark it out as a new kind of 'generative good', requiring new approaches to resource management. From Scarcity to Generativity: New Approaches to Governing Resources

[21] See Claire Craig (2019) How Does Government Listen to Scientists?

This report is open for readers' comments and contributions

By considering what to do in terms of three contrasting futures – the oil field, the wasteland and the farmland – we can attempt to account not only for the potential disbenefits of data use but also the missed benefits of data underuse. Navigating between these different futures will be key to delivering on the promise of the Fourth Industrial Revolution, while minimising the harms.

Chapter 2: New frontiers in data policy and data practice

We have established that the Fourth Industrial Revolution creates novel social and economic situations due to the changed and changing role of data in the production process, and argued that delivering the benefits of the Fourth Industrial Revolution will require us to navigate between different data futures.

This chapter explores the role of data policy in doing this. We argue that data policy is an increasingly important discipline for shaping data ecosystems and the data practices that take place within them, but that it remains overly reliant on longer-established fields such as science policy and industrial policy.

2.1: Data practice, data ecosystems and data policy

The centrality of data to the Fourth Industrial Revolution has raised the prominence of what we might call data practice. We use this term to refer to the wide domain of activities associated with generating value from data, as laid out in the ODI's data skills framework.

Data skills are often considered to be a technical domain, centering on practices associated with data engineering and analysis. We think, however, that data practice is more holistic than this, bridging the 'two cultures' of science and humanities described by CP Snow.[22] Our data skills framework also includes strategic non-technical activities such as service design, privacy management and community-building which help to unlock the full value of data.

Data practices take place within what we call data ecosystems. A data ecosystem is the people, communities, and organisations that are stewarding data, creating things from it, deciding what to do based on it, influencing any of those activities, or are affected by any of those activities. Data ecosystems are underpinned by data infrastructure, which is made up of data assets, standards, technologies, policies and the organisations that steward and contribute to them.

[22] Snow, Charles Percy, and Baron Snow. *The two cultures and the scientific revolution*. Vol. 960. Cambridge: Cambridge University Press, 1959.

As a consequence of the growing significance of data practice, data ecosystems and data infrastructure across the economy, data policy is growing as an emerging discipline. We use the term data policy to refer to the public policy decisions that create and influence data ecosystems and thereby shape the conditions in which data practice takes place.

Data policy is distinct from data *for* policy: that is, the use of data practices to improve policy-making through the creation of insights which allow policy-makers to make better decisions. This is sometimes called 'data to support policy-making' or 'policy/data interactions'.[23] The two are, however, related: data practices can be used to inform data policy, and it is possible that higher levels of data literacy among policy-makers could support better data policy.

Data policy can include legislation, such as the UK government's forthcoming Data Protection and Digital Information Bill or the European Commission's Data Governance Act. It can include regulatory action such as the UK Competition and Market Authority's mandate underpinning the Open Banking Scheme. It can also include other less formal powers that governments and other public bodies can exercise, as laid out in the 'Government as a System' toolkit produced by the UK Cabinet Office's Policy Lab. This includes, for instance, providing information, guidance and frameworks, as well as trying to influence ecosystems through funding competitions and challenge prizes.

Data policy, like other types of public policy, is typically made by governments and other public bodies such as regulators. Many other types of organisation, however, have an interest in data policy: from private companies, professional and industry bodies and non-governmental organisations (NGOs) to trade unions, consumer groups and campaigning organisations. Often these organisations will try to influence data policy-making through lobbying and advocacy efforts aimed at legislators, civil servants and other parts of the public sector, but they also possess various formal and informal powers that can be used to directly influence data ecosystems.

An example of how non-public bodies such as corporations directly create public policy (as opposed to lobbying or influencing policy by other means) might be the establishment by industry bodies of voluntary codes of conduct which members are bound to adhere to, or the use of certification schemes and other types of assurance practices to shape professional norms within a sector.

We believe that these types of non-government policy-making might, in fact, be more prevalent in data policy than in other areas. Data practice is a rapidly developing field, and new applications for data can emerge and throw up unprecedented consequences at a faster rate than policy-makers can keep up with given current levels of public sector resourcing and data literacy. The dynamics of the job market are also likely to mean that the most advanced knowledge of data and data use cases might not sit with the public sector.

[23] See, for example, Jeni Tennison (2020) 'Data to support policy-making'

It's certainly true that this has historically been the case: as Hou, Lunsford, Sides and Jones argue, 'the policy world has generally lagged behind business in its use of data and data methods'.[24]

In addition to this, the data economy is highly consolidated, with a small number of – predominantly US-based – technology firms dominating data-rich sectors such as online advertising, e-commerce and cloud hosting. These firms enjoy significant power to set standards and shape markets, to a degree which many consider controversial and which regulators in different jurisdictions are attempting to rein in.

At the ODI, we believe that it is important that people and communities can participate in data policy-making. Typically, government entities are likely to provide the most appropriate vehicles for this in a democratic society. It is impossible to deny, however, the role that non-government entities currently play in shaping policy for global data ecosystems. By defining data policy in a broader sense than simply 'government policy for data', we are not making the claim that private and third sector entities *ought* to be making policy, but simply acknowledging that they *already are*.

2.2: Data policy questions and the mixed heritage of data policy

Data policy-makers are concerned with what the data ecosystem as a whole ought to look like, and how to avoid the pitfalls of either data-fearing or data-hoarding futures.

There are a number of questions that data policy-makers might choose to focus on – such as the below, inspired by the ODI's manifesto:

- **Infrastructure**: how can sectors and societies best invest in and protect the vital data infrastructure that they rely on?
- **Capability**: how can opportunities be created for everyone to understand data use, and to develop data literacy, data science skills, or experience using data to help solve their problems?
- **Innovation**: how can data inspire and fuel innovation by enabling businesses, startups, governments, individuals and communities to create products and services for economic growth and productivity?
- **Equity**: how can access to data and information promote fair competition and informed markets, and empower people as consumers, creators and citizens?

[24] Data & Policy: A new venue to study and explore policy–data interaction

- **Ethics**: what kinds of choices by people and organisations around data collection and use are ethical?
- **Engagement**: how can people, communities, and organisations collaborate around how data is used and accessed to solve their problems?

To answer questions such as these, data policy often draws on knowledge and approaches first developed in the context of cognate policy domains. These include science policy, industrial policy and innovation policy – as well as seemingly unrelated areas where appropriate methods such as public engagement and citizens' juries are more typical. However, lessons from these fields are not always applicable, and these domains are themselves rarely simple.

For example, data policy concerned with how to support and improve data stewardship practice has taken on lessons from wider policy debates around the management of common resources. Both the ODI and the Ada Lovelace Institute have explored the adaptation of Elinor Ostrom's commons management principles to the stewardship of data.[25]

Data policy is also informed and influenced by developments in data practice. The novelty of the practices which data policy seeks to support and govern means that the available evidence base is often limited and engaging with it can require specific data skills. This has implications for participation in data policy, and therefore for the question of who has the power and legitimacy to shape data ecosystems – exacerbating the tendency illustrated above for private and third sector actors to play an outsized role in data policy compared to in other sectors.

Data practice itself, as a relatively young discipline, also draws on more established fields. For example, those parts of data practice which centre on the stewardship phase of the data value chain – such as data standardisation, and elements of data risk management – are influenced by information management and library science. Others, particularly those focussed on interacting with and creating information from data (the 'insight' stage) – draw on practice from 'hard' sciences and engineering, including mathematical and computing skills overlap with AI.

[25] See The Ada Lovelace Institute (2021) Participatory data stewardship

2.3: Traditional policy-making, rationalism and incrementalism

The influence of more established cognate disciplines on data policy has implications for the way in which data policy is made.

Policy-making typically proceeds in a relatively linear fashion: an economic or societal need is identified, a policy intervention is designed, it is implemented, and then once a sufficient amount of time has passed it is evaluated.[26] The design of future interventions is informed by the outcome of this evaluation, and over time the evidence base for the effectiveness of different policy approaches grows.

This might be a lengthy and considered process with clear stages and following a trajectory designed in detail at the outset, or it might be a more rapid and agile process that develops in an iterative and overlapping way. We can crudely characterise these two schools of thought as rationalist and incrementalist respectively:[27]

- According to the **rationalist approach**, a decision-maker might draw on extensive evidence as part of an initial development phase. This development stage will be lengthy and considered. An implementation phase will proceed once this stage has finished, with analysis then following. Development, implementation and analysis are here discrete phases happening in succession.

- An **incrementalist approach** might instead draw on less evidence, but at more frequent intervals. Development might be more rapid, overlapping with the implementation stage, which then may overlap with the analysis stages. Development, implementation and analysis are still separate phases but they may run concurrently or in quicker succession.

In reality, of course, most policy-making processes will not exactly reflect either the rationalist or incrementalist theories: they are ideal types, rather than prescriptive models for how policy-making really works. It is nonetheless the case however that established approaches to policy-making are linear, with discrete phases for policy development, implementation and evaluation that operate in sequence.

These linear processes can be termed 'traditional' or 'legacy policy-making' – and there are good reasons to think that the conditions created by data practice in the Fourth Industrial Revolution create pressures which legacy policy-making may not be equipped to respond to. In the next chapter, we discuss these pressures and suggest that it might be time for data policy to 'come of age', developing its own tools and adaptive capacities in order to navigate between contrasting data futures.

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[26] Marijin Janssen and Natalie Helbig (2018), Innovating and changing the policy-cycle: Policy-makers be prepared!

[27] Charles E Lindblom (1959 The Science of 'Muddling Through'

Chapter 3: Experimentalism and data policy

In Chapter 2, we outlined how data policy is the discipline which creates, governs and influences data ecosystems. The centrality of data to the Fourth Industrial Revolution has increased the significance of data policy as the means by which we can navigate between different data futures. It has also put pressure on data policy – producing situations which the legacy approaches to policy-making on which data policy depends may not be best equipped to manage.

In this chapter, we discuss whether it might be time for data policy to 'come of age', developing its own tools and adaptive capacities in order to navigate between contrasting data futures.

3.1: Challenges for traditional policy-making

It can be tempting, as policy-makers working on data and digital technologies, to assume that the phenomena we are attempting to manage are wholly without precedent, and that new responses are warranted as a result. At the ODI we think it is important to also recognise that existing approaches and evidence-bases can often be repurposed for the twenty-first century, whether that's the use of centuries-old legal structures such as co-operatives to steward data or the use of tax incentives to support investment in data infrastructure. We also believe that technological fixes might not be a substitute for critical activities such as building institutions and communities.

This is why – as discussed in the previous chapters – we think that exploring the history of previous industrial revolutions can help us to navigate this one, and that data policy needs to draw on insights from related policy fields with longer histories.

We think, however, that the developments associated with the Fourth Industrial Revolution *might be* fundamentally changing the conditions under which data practice takes place, that existing approaches to public policy *might* therefore now be approaching obsolescence, and that data policy-makers *might* need to develop new tools and adaptive capacities as a result. These are the claims we have aimed to explore with the Experimentalism and the Fourth Industrial Revolution project. The remainder of this chapter will lay them out in further detail.

In Chapter 1 of this report we suggested that the developments associated with the Fourth Industrial Revolution have transformed each of the three stages of the data value chain. We think it might also be the case that the *relationship* between the three stages of the chain is different in the Fourth Industrial Revolution, with more rapid and intensive feedback loops across the stewarding, creating, and deciding stages. This has a number of implications for data practice in the conditions of the Fourth Industrial Revolution.

The first of these implications is **rapidity of action**: the instantaneous communication and real-time monitoring enabled by faster internet speeds and ubiquitous sensors allow decisions made on the basis of data-led insights can be fed back into the production process more rapidly than before. This, in turn, allows further new data to be gathered, creating novel and unpredictable feedback loops. These can create large-scale impacts very quickly, as well as new strategic opportunities for policy-makers such as the option of widespread, rapid digitally-facilitated consultation.

The second implication is **granularity of evidence**. The relative novelty of emerging data practices means that when evidence is available, it might be uneven in quality or highly contextual. This can be a problem for traditional approaches to policy and risk management, which depend on the presence of historical bodies of evidence that are applicable across domains and geographic areas. Conversely, new granularity and nuanced contextuality in new data sources can also be an opportunity for policy-makers to design or implement interventions with new precision, potentially creating better outcomes and at greater efficiencies.

The third is **non-linearity of impacts**. Interactions between different stages of the data value chain mean that impacts will not necessarily be linear or proportionate. For example, a small mistake at the data stewardship stage could lead to a significant impact at subsequent creating stages, which could then cascade into even greater impacts on the decision making stage and subsequent data collection. Conversely, a large-scale impact might be effectively managed by adjustments at the data stewardship stage, such as the adoption of participatory approaches to add legitimacy.

3.2: Experiments and experimentalism

The umbrella term we have chosen for policy-making approaches that adaptively reflect and respond to these three characteristics – rapidity, granularity, and non-linearity – is *experimentalism*.

Experimentalism should be distinguished from an 'experiment' in the formal sense, which refers to a test taking place under controlled conditions to examine the validity of a hypothesis. The use of experiments to develop and refine policies and practices is now fairly common: experiments, in different forms, are employed routinely by Governments, businesses, civil society organisations and other actors across the world as a way of informing their decision-making processes.

Prior to the 1980s, experiments in public policy were rare outside of narrow domains such as health policy, but since then interest has grown significantly and experimental methods are increasingly used to provide evidence across a wide variety of domains within social and economic policy.[28]

In the UK context, the first of a network of What Works Centres was introduced in 2014 to corral experimental evidence for new policies, while experimental techniques also form part of the methodology of the influential Behavioural Insights Unit.

To engage in experimentalism, then, isn't the same as just experimenting – if it was, we would all be experimentalists. The Alliance For Useful Evidence, in a 2015 report, makes a distinction between 'static evidence-based policy' which draws on evidence from experiments as part of the design and evaluation phases of policy-making, and more dynamic experimental approaches which integrate some of the characteristics of experiments into the policy-making process. We might therefore consider the following broad definition:

> **'Experimentalism is an approach to policy-making which is oriented towards iterative practices as a means of constant adaptation to changing circumstances.'**

Understood in this sense, experimentalism differs from both rationalism and incrementalism in its use of evidence, although it is closer to the latter. In experimentalism, the distinction between development, implementation and analysis is blurred: the three stages will run in parallel to enable constant adaptation and iteration. One recent example of this in the UK context was the development of Covid-19 vaccine. Effective vaccines were approved with unprecedented speed by the MHRA regulator by running some testing and approval processes in parallel instead of in sequence.[29]

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[28] See Jon Baron (2018), A Brief History of Evidence-Based Policy

[29] Elisabeth Mahase (BMJ 2020), Vaccinating the UK: how the covid vaccine was approved, and other questions answered

We might therefore consider experimentalism a variation on what David Halpern, CEO of the Behavioural Insights Team, has called 'radical incrementalism'[30]:

> **'Radical incrementalism' is the idea that dramatic improvements can be achieved, and are more likely to be achieved, by systematically testing small variations in everything we do, rather than through dramatic leaps into the dark. For example, the dramatic wins of the British cycling team at the last Olympics are widely attributed to the systematic testing by the team of many variations of the bike design and training schedules. Many of these led to small improvements, but when combined created a winning team. […] Applying similar 'radical incrementalism' to public sector policy and practice, from how we design our websites, to the endless details in jobcentres to business support schemes, we can be pretty confident that each of these incremental improvements can lead to an overall performance that is utterly transformed in its cost-effectiveness and overall impact.'**

We believe that 'experimentalist governance' is an area where this sort of radial incrementalism is already at work on a large scale. Experimentalist governance refers to a governance system in which sectoral, local or sub-national governmental units are allowed a high degree of autonomy in pursuing agreed policy ends. This autonomy is accompanied by high standards of accountability and reporting, allowing for policies to be compared and more effective policies developed.[31]

A system of experimentalist governance, in other words, is one in which experimentalist tendencies emerge as a functional property of the governance system. A wide variety of countries and supranational entities – including the United States, the European Union and the People's Republic of China – have been described as exhibiting characteristics of experimentalist governance.[32]

These indications of the viability and utility of experimentalist approaches set a helpful groundwork for considering the possible role of experimentalism in data policy and practice in response to the needs and opportunities around the Fourth Industrial Revolution.

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[30] See David Halpern (2015), What works? The rise of 'experimental' government. - Civil Service Quarterly

[31] Charles F Sabel and Jonathan Zeitlin (2008) Learning from Difference: The New Architecture of Experimentalist Governance in the EU; Huanming Wang, Bin Chen and Joop Koppenjan (2021) A refined experimentalist governance approach to incremental policy change: the case of process-tracing China's central government infrastructure PPP policies between 1988 and 2017

[32] Wenguang Zhang, Ji Lu and Hongping Lian (2021) Experimentalist governance in China: The National Innovation System, 2003–2018

3.3: The future of data policy

Experimentalism, as a way of working adaptively in response to changing and complex situations, is attractive in the context of the uncertain conditions created by the Fourth Industrial Revolution for data policy. If embraced by data policy-makers, it could represent a way for data policy to 'come of age': stepping out from the shadow (and the methodologies) of more established policy disciplines to develop its own tools.

It could also be a way in which data policy influences other policy traditions. For example, we are currently seeing the development of rapid public engagement activities such as vTaiwan that use digital technologies to explore the legitimacy of data and AI use cases and chart a course for regulatory action. This could establish new models for consultation, creating new capacities for policy-makers in domains beyond data policy.

The final chapter of this report – Chapter 5 – discusses in further detail what these new capacities might look like, as explored in nine international roundtables held over the course of this project.

Chapter 4: Putting it into practice

4.1: Why now?

The Experimentalism and the Fourth Industrial Revolution project was initiated and developed in a context in which the UK Government was seeking input for multiple policy documents in the data space: the UK's first National Data Strategy (2020), the UK's first National AI Strategy (2021), and the UK's first post-Brexit Data Protection reform (2021).

Around the world, countries had only recently started to develop national data and AI strategies. However, evidence about what makes a data or AI strategy or data protection framework more successful than an alternative approach was not yet readily available.

As mentioned in Chapter 3, the Fourth Industrial Revolution has introduced novel conditions that make data practice and data policy more complex. The wide availability of real-time data flows informing decisions call for rapidity of action in fields that can create large-scale impacts very quickly. At the same time, however, the evidence available to evaluate the impact of different decisions, when available, is granular, and may be uneven in quality or highly contextual and therefore non generalisable. Finally, the dimension of the downstream impacts of actions at different stages of the data value chain, from stewarding to decision making, are uncertain and can be considered non-linear or disproportionate.

This necessitates a broader shift in approach to data policy and practice, both for developing these new national data and AI strategies but also beyond them. The changes brought by the Fourth Industrial Revolution might necessitate what we termed in Chapter 3 'experimentalism': anticipatory or adaptive approaches to data policy that allow us to assess and understand rapidly changing phenomena as they emerge.

During 2020 and 2021, the scale of experimentation happening in the health policy space was significant because of the emergence of Covid-19, the first global pandemic of the twenty-first century. However, we considered that the project needed to focus on long-range strategic discussions about the future, whereas in the health domain the urgency of the pandemic called for rapid action. We also recognised that widespread experiences of experimentalism in pandemic response, and the role of data and digital technologies in these, was likely to create longer-term policy questions and needs about longer-term experimentalism beyond the health domain. Consequently, for our project we chose to treat the

health domain as being out of scope. We instead focussed on jobs, skills and sustainable supply chains as the key elements of industrial revolutions outlined in Chapter 1 of this report.

4.2: Our methodology

Between Spring 2021 and Summer 2022, the ODI partnered with 18 organisations from civil society, government and academia to convene high-level and multidisciplinary experts for international policy roundtables. The roundtables explored how data policy-makers and other decision-makers using data for public good can work in more innovative and experimental ways to adapt to the fast-moving challenges and opportunities around new data availability and associated digital technologies.

i) Shaped by dialogue

The roundtable format was chosen over other research methods because of the possibilities it provided for facilitating inclusive international discussions among high level experts from a range of disciplines. We wanted to create the conditions for people from different professional and political backgrounds, and from different sectors, to learn from each other and form peer communities of practice. Although other methods such as interviews or workshops could have been used to gather insights from experts, we believed that the roundtable format, which allows both for expert presentations and group discussions, provided a collaborative opportunity to shape new perspectives in an emerging field such as data policy in the context of the Fourth Industrial Revolution.

For each roundtable, we partnered with both an academic or research institution, and with a civil society or public sector organisation: this was to create a balance between expertise or perspectives from both theoretical exploration and from applied data practice (see Annexe for partner list).

Although roundtable meetings took place under the Chatham House rule, which enables candid discussion by giving participants anonymity, with speakers' consent we also published in the public domain an audio-library of their presentation 'Provocations' so that these aspects of the roundtable themes and topics were available to a wider audience (see Annexe for audio-libraries).

ii) Working in the open

We chose to run the project in an adaptive and experimental way, collaborating with roundtable speakers in developing their material and prompts for community discussion; seeking invitees' recommendations for subject resource guides; and then publishing summary notes of the discussions as open documents for reader comments

to enable ongoing collaboration, co-creation, and communities of practice (see Annexe for roundtables notes and resource guides). This allowed us to learn both about the issues being discussed and about the methodology as the project progressed, and to iterate aspects of the project and of the method in every new roundtable edition. Thus, the project took an experimental approach to research while at the same time catalysing an international community of peers by working collaboratively across borders and sectors. In total, around 250 practitioners, policy-makers, scholars and activists participated.

iii) International in scope

The challenges associated with the Fourth Industrial Revolution, as well as emerging data ecosystems, are interconnected beyond local communities and local and international boundaries. As with past Industrial Revolutions, the transformations brought by the Fourth Industrial Revolution in Europe or North America might look different than those in the Africa, Latin America or Asia. However, decisions about how it unfolds have impacts across regional boundaries, as data ecosystems that underpin global economies are highly interconnected and interdependent. Similarly, within large territories, different communities are affected differently by it, and have different insights and views about the challenges and opportunities associated with how the Fourth Industrial Revolution should be confronted.

Given this interconnectedness, anything that may risk loss of trust in data ecosystems in one or more communities or territories can end up having effects that spread across all of them. Trust is essential for societies to realise the economic potential of data ecosystems in the context of the Fourth Industrial Revolution. A 2021 report written by Frontier Economics for the ODI found that loss of trust can have a negative economic impact by making actors less likely to share data.[33] This could lead to what in Chapter 1, building on the ODI's theory of change, we call a data fearing future, in which unaddressed fears arising from legitimate concerns prevents societies from realising the full benefits of data.[34]

iv) Equity at the core

Mindful, then, of the ODI mission of building an open, trustworthy data ecosystem that can benefit all members of society,[35] the project was structured around three parallel workstreams to ensure collaboration within and across different sectors, communities and regions. It aimed to explore leadership and innovation opportunities for and by different communities while trying to avoid reinforcing existing inequalities.

[33] The ODI & Frontier Economics (2021) 'The economic impact of trust in data ecosystems'

[34] The ODI (n.d.) 'Our theory of change'

[35] The ODI (n.d.) 'Our mission and values'

Taking into account inequality, and particularly structural inequality, in policy discussions is always important, but it is particularly so in the context of experimentalism. Experimentation, as a concept, can take different connotations under different contexts and for different populations. While some groups of people may associate the term with progress and innovation, it can also have negative connotations for oppressed populations who throughout history have been subjected to experimentation and exploitation by others, as discussed in Chapter 1 of this report. That is the case, for example, for many people from minoritised and marginalised communities in Europe and North America, and people from post-colonial territories in the Global South.

4.3: Parallel narratives and parallel communities

As noted by Dr Claire Craig, narratives have the capacity to shape imagination and to shape what research questions are asked and thus what new evidence or ideas are developed. In particular, narratives can be a powerful tool to understand more about long term consequences of new technological developments and thus inform decisions made today, since 'decisions, and debates about their possible consequences, require the creation of options imagined to take place in the future'.[36]

Science fiction is one form of narrative fiction that has served as a way of reflecting on the future, and supported communities in imagining different futures for themselves. As Frederic Jameson argues in *Archaeologies of the Future*, science fiction is the genre of political utopia and dystopia, and it can reveal a culture's political hopes and fears for its future.[37]

We decided to name the three workstreams of this project after three science fiction writers: Isaac Asimov, feminist author Ursula Le Guin and Afro-futurist author Octavia Butler. We did this to pay tribute to the importance of narrative, and narrative fiction in particular, in framing discussions about technological developments and the possible futures they may bring. We also intended to encourage playfulness and speculation by drawing on the sci-fi aspects of the Fourth Industrial Revolution in public imagination.

i) Isaac Asimov workstream

The Isaac Asimov workstream focussed on opportunities for experimentation and innovation in the post-Brexit UK context, in which changes to data regulation are currently being debated.

[36] Claire Craig (2019). 'How Does Government Listen to Scientists?'

[37] Fredric Jameson (2005). 'Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions'

These changes are taking place in the context of an ongoing transformation of the UK's political landscape as well as its international position. The decision to leave the EU, which became effective in the beginning of 2021, means that the UK is no longer bound by European regulations on data protection and governance. This could allow the UK develop a strategic alternative to the dominant data and tech policy paradigms championed by the EU, the USA and China respectively, which could in turn open up new options for the international community.

At the same time, the UK economy is currently undergoing important transformations as it gradually moves away from its industrial base and needs to find new sources of productivity growth. In that context, successive Governments have been keen to invest in data and digital technologies as sources of growth for the future.

ii) Ursula Le Guin workstream

The Ursula Le Guin workstream focussed on data policy and practice among communities in North America and in Europe that have been traditionally minoritised, marginalised or that face ongoing structural disadvantages or under-representation.

The terms 'structural disadvantage' and 'structural under-representation' refer to institutionalised disadvantages that certain social groups may face. The first encompasses disadvantages like having less access to resources or to opportunities, while the second refers to the under-representation of certain social groups in positions of power due to societal inequities. We understand marginalised communities as communities of people who experience discrimination and social, political and economic forms of exclusion, and therefore face structural disadvantages.[38]

Minoritised peoples are those that are discriminated against, excluded or oppressed by dominant social groups on the account of having specific cultural, physical, social, religious, ethnic or racial characteristics. 'Minoritised' is used instead of 'minority' to acknowledge that individuals are minoritised as a consequence of social processes of power and domination, rather than just as a consequence of being part of statistical minorities.[39] [40]

It's important to note that minoritised communities need not be statistical minorities. For example, women account for around half of the population in any given country, but face structural disadvantages because of social dynamics. Additionally, identities are multi-facted and some of those in minoritised or marginalised groups may not necessarily *experience* oppression if there are other factors that prevent them from facing structural disadvantages in their society, such as family wealth, for example.

[38] See the Glossary of Essential Health Equity Terms

[39] The Law Society (2022) 'A guide to race and ethnicity terminology and language'

[40] See The ODI (2021) 'Le Guin's data identities'

Data policy and practice in their current forms risk reinforcing structural segregation and disadvantages experienced historically by marginalised communities. On one hand, the under-representation of marginalised and minoritised communities in data has led to data gaps that mean those communities are poorly served by decisions made from that data, or digital technologies developed from it. However, at the same time these communities have in many cases been over-surveilled for political reasons, while being less involved in governance decisions about any data collected. Widening access to data about them may therefore subject them to scrutiny that they do not have the agency to reject. This means that calls for 'inclusion' or 'participation' in the data economy or in data policy need to take into account that representation in data does not equal power or control, and that inclusion in data can be harmful when not accompanied by inclusion in decision-making about that data.[41]

We also did not want to reinforce the dominant narrative that positions these minoritised, marginalised and structurally disadvantaged communities as confronting a deficit of skills or resources. The emphasis of this workstream was instead on centering their own ways of knowing, and acknowledging their role as pioneers and as a potential emergent force for renegotiating the social contract under the Fourth Industrial Revolution.

We recognise that structurally disadvantaged communities hold unique insights that can help to identify tensions and contradictions in the systems in which they operate. Our approach was intended to highlight this, and how such communities can develop original thinking beyond currently hegemonic social and conceptual constraints. We also wanted to explore the ways in which these communities can be powerful transnational forces for change, as seen in the global influence of the Black Lives Matter movement in 2020.

iii) Octavia Butler workstream

The Octavia Butler workstream explored opportunities for experimentation and innovation in data policy and practice for international development and the Global South. In the Global South, data ecosystems cross international borders and span global regions with differing industrial and technological infrastructures, and which follow different development models.

While certain infrastructures and technologies in the Global South may be considered to be underdeveloped in comparison to those in Europe and North America, this may represent an opportunity to develop those countries in ways that respond to the particular challenges and needs they face in the Fourth Industrial Revolution. With this workstream, we therefore aimed to explore ways in which the Global South may be innovating or pioneering new approaches to data policy and practice.

[41] See Peter Polack (2021). 'False positivism'

It is worth noting that our choice of the term 'Global South' was not straightforward. Other terms or categories used frequently in the international policy space to refer to countries outside of the 'developed' world or 'the west' include 'low-and middle-income countries', 'developing countries' and 'the global majority'. These predominantly refer to current socioeconomic conditions or geographical locations. We preferred the term 'Global South' because it denotes a common historical, political and epistemological position which is shared by the regions it refers to, and underlines that European and American approaches to knowledge production should not be considered as a neutral default.

The term 'Global South' is associated usually with opening up imaginaries that do not necessarily conform to western or dominant logics of exchange or of development.[42] The use of this category can therefore help us to avoid positioning countries in a linear hierarchy of 'development', as is the case with categories based on level of income, and instead recognises the role of history in the positions currently occupied in the global economy by certain regions of the world. At the same time, it leaves open the possibility that these regions can develop in multiple ways that need not resemble currently dominant developmentalist logics.

The term is not free of controversy, as was noted by many participants in the roundtable sessions. It risks conflating the histories and experiences of a group of very heterogeneous countries and regions by collapsing them into a single category, limiting its use for discussing policy in fine-grained terms. However, participants also noted that countries that have been under colonial rule in the past may experience common challenges: as such, the category 'Global South' can serve to highlight international structural inequalities and build networks of solidarity and collaboration.[43] This is key in particular context of data policy, as there's evidence that points to the importance of international and national commercial interests in influencing data governance policies in Global South countries[44].

Because of this, South-South collaboration may offer a path to counterbalance asymmetric power dynamics, and allow countries to develop their data ecosystems and economies in a more autonomous way: this was our purpose in convening the Octavia Butler workstream and community.

[42] Mohan J Dutta and Mahuya Pal (2020). 'Theorizing from the Global South: Dismantling, Resisting, and Transforming Communication Theory'

[43] See The ODI (2022). 'Octavia and data games'

[44] Jacqueline Hicks (2021). 'A 'data realm' for the Global South? Evidence from Indonesia'

4.4: The policy cycle in three Parts

As well as being organised around three parallel workstreams, the project was organised into three consecutive Parts, which focused on the three different stages of traditional policy-making discussed in Chapter 2 of this report.

As a starting point to structure the different phases of the project, we used the GovLab's phases of the policy-making cycle: **agenda setting** and problem definition; solution design and **implementation**; and **evaluation**. At the same time we acknowledge how data in the Fourth Industrial Revolution can inform and transform the policy cycle: by enabling better analyses of situations, incorporating predictive capabilities into the design process, facilitating knowledge creation during the implementation and iteration, and enabling novel forms of assessment. With that framework, we structured the project around three parts: Part 1 was concerned roughly with the agenda setting and problem definition stages of policy, Part 2 focussed on the design and implementation of practical solutions or initiatives, and Part 3 emphasised the evaluation and assessment of policies.[45]

Part 1 aimed to establish foundations for our exploration of experimentalism throughout the remaining Parts of the project, focusing on aspects that are crucial in the initial agenda setting phase of the policy-making cycle. This part of the project was structured around three aspects of data policy or practice where a significant parameter for public services and policy-makers is changing: new data sources, new analytical methods and digital technologies, and new societal expectations. In the Part 1 roundtables, we discussed what is new about the Fourth Industrial Revolution, about data policy and data practice in these conditions, and established some initial framing questions that would guide the subsequent Parts of the project:

- Why should data policy and practice embrace experimentalism? When should we experiment?
- What might be the role of experimentation when we are in fast-changing or uncertain parameters, when the stakes for (in)action are high or when resources are scarce?
- How should we experiment?
- How can cross-sector collaboration play a role in the experimental process?

[45] See Stefaan Verhulst (2017) 'Better data for Better Policy: Opportunities and Challenges'

Part 2 shifted our attention to the implementation phase of the policy-making cycle, by looking at practical opportunities for experimentation and innovation in data policy and practice. This part of the project considered three areas of opportunity for experimentation and innovation in data ecosystems: transforming communities and local data ecosystems, transforming markets and sector data ecosystems, and transforming accountability around data and digital technologies such as AI. During the roundtables, experts, policy-makers, activists and practitioners from varied backgrounds shared examples of experimentation and innovation from their own professional experiences, and discussed associated challenges and opportunities.

Part 3 of the project focussed on innovation and experimentation in the evaluation stage of the policy-making cycle. The roundtables in this project discussed opportunities to change approaches to valuation, evaluation, and evidence in the context of the Fourth Industrial Revolution. The metrics and methods we use to monitor, evaluate and assess the impact of policy ultimately shape policy decisions and outcomes. Instead of framing these topics as purely technical fields, the Part 3 roundtables highlighted the social and political dimensions of monitoring and evaluation.

Chapter 5: Our findings

This chapter presents a synthesis of key themes and observations that emerged across the project's three parallel workstream communities and the three sequential Parts of the project. For more detail on specific insights on particular topics or from the perspective of particular workstream communities, please explore this report **Annexe** which includes a reference overview of each of the roundtables that were convened as part of this project, along with further information on the event partners and multimedia resources.

5.1: Part 1 - New parameters in data policy and practice

Part 1 of the project, convened between June 2021 and September 2021, aimed to explore how the parameters for data policy and practice are changing as a consequence of the greater availability of data and innovations in the use of that data. For instance, it looked at how indigenous peoples and minoritised migrant communities are leveraging new techniques for data collection to address their own social concerns. Examples of this included Afrozensus in Germany, an initiative of German people of African descent that for the first time recorded and measured the realities of black, African and Afrodiaposic people in Germany[46]; and the British Columbia First Nations' Data Governance Initiative, under which First Nations Governments in Canada are aiming to assert sovereignty over the data about them.[47] The discussions also covered practical examples of new analytical techniques being leveraged, such as the use of georeferenced data and non-traditional data sources to combat human trafficking and modern slavery,[48] as has been the case in Brazil through the SmartLab Platform.[49]

[46] See Afrozensus, Germany

[47] See British Columbia First Nations' Data Governance Initiative (BCFNDGI), Canada

[48] See OSCE & Tech Against Trafficking (2020) 'Leveraging innovation to fight trafficking in human beings: A comprehensive analysis of technology tools'

[49] See Iniciativa SmartLab, Brazil

At the same time, the criteria by which we select good practices for data, and good outcomes to be achieved from the use of data are also being transformed. Societal expectations around what can be achieved and what is or is not desirable evolve over time alongside technological and data transformations, but also vary across different regions, cultures and social groups. The project began to be developed in the early days of the Covid-19 pandemic, which put new pressures on the social contract. In many countries private sector organisations had to step in to provide emergency services typically offered by the government; the relationship between government, citizens and the private sector was challenged; and the limits of what is considered acceptable for each of these actors to do in emergency situations was put into question.

The key topics and insights that emerged across the roundtable discussions in Part 1 were:

- **The importance of building trust and improving data literacy for public and private sectors to be able to unlock the value of new data sources.** While new and alternative data sources hold great potential, it's important for countries to develop the right skills to be able to leverage them effectively. Similarly, building trust and developing trustworthy practices for data stewardship and use are also central to unlocking the value of data.

- **The role incentives play in ensuring data is collected and shared for the benefit of society.** Although new technologies have opened up the possibility of collecting and processing huge amounts of data from multiple sources, the right incentives for all the possible positive use-cases are not always in place. Governments should keep in mind incentives when designing and implementing policies and regulations to ensure new data sources are put to their best uses, and that data is shared across ecosystems.

- **Cultural contexts and the rationales for collecting and stewarding data influence what uses are considered acceptable for it.** In the Le Guin roundtable, there was a lively discussion on community data governance. It was noted that certain communities have put in place their own ways of collecting data about themselves for social purposes, and steward sensitive data that could potentially be valuable for other actors, but could also cause collective harm.

- **The importance of balancing representation in datasets with participation in governance.** Marginalised and minoritised communities, who tend to have less agency in and influence over government decisions, tend to be over-represented in official datasets because of histories of surveillance, or because of requirements set by government and welfare programmes. Policy-making should ensure that representation in such datasets is accompanied by mechanisms to ensure participation and oversight by those represented.

- **New data sources also create new challenges and costs associated with collecting and processing data from multiple sources, distributed along multiple regions or countries.** Creating information from data collected by different actors, across different geographical regions and timeframes, and in many cases originally collected for different purposes, presents challenges related to interoperability, interpretation and assurance. While in theory new data sources should help us to make better-informed decisions, these challenges create uncertainty about the quality and accuracy of the information that is created from that data and therefore about the decisions that can or can't be made on its basis. This is made evident, for example, in the challenges companies currently face when using supply-chain data to improve their ESG disclosures, as this requires integrating and interpreting data collected by multiple actors, across different regions and jurisdictions, with different levels of granularity and frequency, among others.

- **The importance of having 'robust hypotheses' and a proper understanding of the context in order to develop useful analyses of new or alternative data sources, rather than overestimating the role of data.** Building on the previous insight, understanding the local contexts and having clear frameworks for assessing decisions that are to be informed by data is key for data-driven policy. While optimistic accounts of the possibilities that data offers may lead some to adopt solutionist approaches that position technology as offering answers to policy problems, roundtable participants noted that data is just one aspect of many that should inform policy-decisions.

5.2: Part 2 - Practical opportunities for experimentation and innovation

Part 1 of the project generated some key questions for exploration, such as:

- Why should we experiment?
- When should we experiment?
- How should we experiment?

These questions served as the starting point for Part 2 of the project, which was convened between October 2021 and March 2022 and focussed on practical opportunities and use cases for experimentation and innovation in data policy and practice during the Fourth Industrial Revolution.

Part 2 was structured around three key areas of opportunity for experimentation and innovation in data ecosystems: transforming communities and local data ecosystems, transforming markets and sector ecosystems, and transforming accountability around data and digital technologies such as AI.

Practical examples discussed in Part 2 included the role of data by trade unions in collective bargaining to transform wealth distribution[50]; the collaborative development of open and experimental infrastructures; and the challenges and opportunities presented by digital technologies for low and middle income countries.[51]

The key insights that emerged across the roundtable discussions in Part 2 were:

- **Experimentation as a mechanism to generate new data and insights for multiple stakeholders.** Beyond being a means to make policy more adaptive, experimentalism was also discussed in roundtables as a mechanism for learning. Given the lack of existing data on the potential impact of new data sources and new technologies, it is by running multiple experiments that policy-makers and practitioners can gather the right information to make decisions at a larger scale.

- **Reframing data to better capture its economic complexity.** Current dominant framings of data as an economic resource tend to obscure certain key characteristics about it, such as its non-scarcity and non-rivalry, and position it as an economic resource available for extraction. One of the alternative framings that resonated with participants of roundtables was that of thinking of data as a generative good rather than as a scarce resource subject to accumulation. Discussions during the Le Guin and Octavia roundtables also

[50] See Unions21 (2022) 'Using data to build strong unions'

[51] See Digital Public Goods Alliance (2021) '2021 Digital Public Goods Alliance Report'

explored the multiplicity of approaches to data collection and governance emerging from different communities and cultures around the world, in opposition to universalising or euro-centric narratives about data. During the Octavia Butler roundtable, the South American social philosophy of *buen vivir*, which proposes a community-centric, ecologically-balanced, and culturally-sensitive approach, was presented as alternative way to understand and frame data in public discourse and policy, in order to drive more equitable and sustainable outcomes. In the Le Guin roundtable, indigenous approaches to data governance that favour community-centric participatory data collection and stewardship were presented as alternatives to those favoured by private or state-based stewards.

- **Collective bargaining, data rights and workers' data.** In the same way that understandings of data as an economic good were contested, the roundtables raised questions about who should be entitled to the economic benefits of data use, the fairest ways of distributing this, and who should control these decisions. In particular, there were discussions about the role of workers in producing valuable data, and about whether we should consider workers' data as a distinct data category that should be subject to specific safeguards and regulations in the same way as other sensitive categories of data about people, such as health data or financial data. In the Le Guin roundtable, the role of trade unions in rethinking what collective bargaining can achieve in the context of digital technologies was discussed. Novel approaches to collective bargaining that take into account data use and the value that can be created from workers' data were discussed as having the potential to advance redistribution efforts. In the Octavia Butler workstream, the importance of relying on cheap labour in business models that hinge on data collection and processing was emphasised.

- **Going beyond 'privacy' and 'data protection' to focus on data governance.** The roundtables surfaced a tension between two commonly-held aims of data policy-makers. On the one hand, the desire to protect individual agency and limit the extraction of value from data by big tech corporations for narrow commercial benefit that dominate data protection debates. On the other, the need to maximise data-sharing so that it can help to tackle grand societal challenges. Current approaches to data protection based on individual consumer rights might be insufficient to realise the potential collective of data, as well as to tackle collective harms. Participants highlighted the need to emphasise the relational, collective and social nature of data use, and adopt data governance practices that take these collective qualities into account.

- **Reimagining communities and learning from 'outsider' status.** Both the Ursula Le Guin and the Octavia Butler roundtable discussions highlighted the potential for communities to form bonds through the recognition that they share 'outsider' status. This can help counter existing vulnerabilities and inequalities. It can also help to reframe the development and deployment of new technologies among these communities as a matter of entitlement and full participation in society, rather than as a charitable act on the part of tech corporations or policy-makers.

- **Digital infrastructure and public goods.** Open source approaches to building digital infrastructure and digital public goods present huge potential for countries, especially those that face stronger resource constraints. However, 'infrastructures' are traditionally thought of as closed systems owned by one entity, whether public or private, whereas open source goods can be perceived as lacking ownership, and as weaker or less secure as a result. It was argued that with clear governance structures, digital public goods are secure and offer other benefits such as transparency about governance.

- **Openness as a skill.** A common critique of open source and open data approaches is that enabling greater openness doesn't necessarily lead directly to more socially beneficial uses of resources. Opening up data or software does not mean that all communities will have equitable access to it; nor that all communities may benefit equally from increased transparency. Moreover, there is often a risk that openness is leveraged mostly for commercial interests rather than socially beneficial purposes. To counteract this, openness should be understood as a skill that requires policymakers to effectively navigate challenges around equity and inclusion.

- **Rentier innovation and the role of states.** In the Octavia Butler roundtable, there was a discussion about how different kinds of innovation may be more or less desirable from a policy perspective. The concept of 'rentier innovation' was introduced to describe activities that are framed by big tech companies as innovation but which reinforce monopoly power instead of creating new value. This aim not only drives the development of new digital technologies, products and services, but may also become central to visions of development around data and digital infrastructure in the Global South. This may justify states taking a more active role in developing digital infrastructure, so as to prevent continued rentier innovation by private companies.

5.3: Part 3 - Innovation and experimentation in monitoring, evaluation and learning

Monitoring, evaluation and learning (MEL) shapes what gets done and what doesn't. Being able to measure or model the possible impacts and consequences of data policy and data practice is central to strategy, decision-making and accountability. In this context, decisions around how policies are measured and optimised provides opportunities for a transformative re-imagining of what the Fourth Industrial Revolution could be.

Part 3 of the project, convened during June and July 2022, looked at the evaluation and assessment phase of the policy-making cycle. The discussions in Part 3 explored how data and digital technologies are creating opportunities for innovation and experimentation in evaluation evaluation, and transforming the nature and criteria of evidence.

The key insights that emerged across roundtable discussions in Part 3 included:

- **Benchmarking innovation and looking backwards to look forward.** We often lack the right metrics or even the right vocabularies to express what the possible futures might be. In these cases, it can help to use history as a resource: for example, by learning from the short and long term effects of prior industrial revolutions or technological changes.

- **Future-proofing policy.** Policy solutions that arise from MEL are inherently limited by the fact that measuring a phenomenon changes it. One suggested solution to this problem was for us to hold different expectations of policy, and to understand that solutions may only be applicable in highly specific contexts or for fixed periods of time. Participants acknowledged that the experiences of minoritised communities can offer examples of how to navigate this uncertainty.

- **Monitoring, evaluation and learning for whom?** The methods and metrics we use as part of MEL can have a significant effect on policy outcomes. Although MEL is often presented as scientific and objective, it is intrinsically political, with certain measurements and models of evaluation serving some purposes more than others. Any metric will have its limits, testing some things but not others: for example, Gross Domestic Product (GDP) is used as a measure of national levels of production, but it doesn't tell us about national inequalities, or national happiness or well-being.

- **Development logics.** Interactions between new technologies and development outcomes are typically nuanced and complex. In order to channel tech towards achieving the right developmental outcomes it's necessary first to question the underlying development logics that any technological deployment builds on.

- **Narratives, value systems and AI imports.** We should not assume that the motivations and objectives for developing new technologies and policies are universal. Instead, frameworks for assessing the impact of new technologies and evaluating data and digital policies need to be grounded in local contexts and local values. Narratives and value systems that are associated with new technologies developed in specific countries tend to be 'exported' along with those technologies once they are deployed in completely different geographical contexts or within different communities. However, the motivations for adopting technologies may vary across different contexts, and so can the governance structures and value systems with which they interact. Frameworks for evaluating the impact of new technologies, such as AI, need to take into account the varying motivations behind their development or adoption, as well as local priorities, governance structures and value systems.

- **Emergent learning and systemic monitoring.** New approaches to evaluation, such as that of emergent learning, consider the importance of monitoring for change and sustainability at a system level, instead of narrowly focussing on the success metrics of particular projects or initiatives. Under these approaches, relationships and networks are considered key mechanisms for building local capacity and for effecting system-level change in an adaptive way.

- **Absence of evidence about impact of AI.** Although there are high expectations about the impact AI is having or may have across the global economy, robust evidence of this is scarce. While many tech companies publish their research in independent, peer-reviewed journals, and publicly test their models, there is no legal requirement for evidence to be gathered or published on AI solutions that are brought to market. Therefore, AI-based solutions that are marketed and sold to third parties may not have the expected impact. In that sense, the current state of AI can be compared to the pharmaceutical industry before the onset of widespread testing and regulation in the early twentieth century, when claims could be made about the efficacy of a drug without evidence being provided.

5.4: Reflections

What the discussions facilitated under this project ultimately confirmed was the ongoing need for experimentalism in policy to contend with the challenges and opportunities created by the Fourth Industrial Revolution. However, we are still at the beginning of a long-term process of learning. As more countries start developing and implementing their own AI and data strategies, new evidence will be created and new lessons will be learned.

Our findings have highlighted that the Fourth Industrial Revolution places unique pressures on data policymakers and requires them to develop a unique set of skills and capacities. In a context where constant adaptation is the norm, those involved in data policy will have to become comfortable with navigating uncertainty on a continual basis.

As argued earlier in the report, developing these skills and capacities could represent a way for data policy to 'come of age': stepping out from the shadow (and the methodologies) of more established policy disciplines. Done properly, this will allow policymakers to avert the harms represented by data-fearing and data-hoarding futures and deliver on the promise of the Fourth Industrial Revolution – a world where data works for everyone.

Annexe: Roundtable partners, summary notes and multimedia resources

This Annexe provides a reference overview of each of the roundtables that were convened as part of this project, along with multimedia resources and further information on the event partners.

The roundtable summary notes are a distillation of the high-level themes and observations that emerged in discussion, and do not necessarily represent the views of the ODI or the event partners. The roundtable notes have been published as 'living documents' and we welcome and encourage reader comments on them, as part of a community of practice.

Part 1: New parameters in data policy and practice

	Isaac Asimov workstream	Ursula Le Guin workstream	Octavia Butler workstream
Partners	Office for National Statistics (ONS) and the Behavioural Data Science Group at the Alan Turing Institute	The Leverhulme Centre for the Future of Intelligence (CFI) at the University of Cambridge and the Center for Responsible AI at NYU	The Future of Sustainable Data Alliance (FoSDA) and Delta 8.7
Outputs	Roundtable note, audio library and resource guide	Roundtable note, audio library and resource guide	Roundtable note, audio library and resource guide

Part 2: Practical opportunities for experimentation and innovation

	Isaac Asimov workstream	Ursula Le Guin workstream	Octavia Butler workstream
Partners	The GovLab and the Open Government Partnership (OGP) Local	Data & Society and the Science Policy Research Unit (SPRU) at the University of Sussex	Digital Public Goods Alliance (DPGA) and the Institute for Humanities in Africa (HUMA) at the University of Cape Town
Outputs	**Roundtable note, audio library and resource guide**	**Roundtable note, audio library and resource guide**	**Roundtable note, audio library and resource guide**

Part 3: Innovation and experimentation in monitoring, evaluation and learning

¶	Isaac Asimov workstream	Ursula Le Guin workstream	Octavia Butler workstream
Partners	The Innovation Growth Lab (IGL) by Nesta and the Policy Institute at King's College London	Latinx In AI and the Good Systems grand challenge at the University of Texas at Austin	The Centre for Intellectual Property and Information Technology Law (CIPIT) at Strathmore University and the network Tierra Común
Outputs	**Roundtable note, audio library and resource guide**	**Roundtable note, audio library and resource guide**	**Roundtable note, audio library and resource guide**