EMBRACING INNOVATION IN GOVERNMENT

Global Trends 2019

FEBRUARY 2019

WORLD GOVERNMENT SUMMIT

OECD
BETTER POLICIES FOR BETTER LIVES

The Observatory of Public Sector Innovation collects and analyses examples and shared experiences of public sector innovation **to provide practical advice to countries on how to make innovation work.**

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OPSI   Observatory of
Public Sector Innovation

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HIGHLIGHTS

Governments and their partners are undergoing transformations to overcome unprecedented challenges and seize vast opportunities

The world is in the midst of an unprecedented technological revolution that is transforming economies, governments and societies in complex and unpredictable ways.

This process is fundamentally changing how people live, interact and work, which inevitably affects their relationship with government and requires a transformation in the design and delivery of public policies and services. The volume and complexity of challenges are growing rapidly, and governments are locked in a game of catch-up, with citizen trust and business confidence in the balance. At the same time, in many ways the world has never been better. Poverty and hunger rates are at an all-time low, countries are uniting in extraordinary ways to achieve global goals, people are living longer than ever, and education and literacy rates are at record highs. Governments are integral to these successes and will play a central role in achieving the goals of tomorrow, by building on what has been accomplished and working to tackle emerging challenges. Governments at the edge of innovation are pioneers in this context, using fantastic, novel solutions to harness today's opportunities for the collective good.

A partnership to catalyse innovation

The OECD Observatory for Public Sector Innovation (OPSI) serves as a global forum for public sector innovation, helping governments to understand, test and embed new ways of doing things through the application of fresh insights, knowledge, tools and connections. For the third consecutive year,[1] OPSI and the United Arab Emirates (UAE) Mohammed Bin Rashid Centre for Government Innovation (MBRCGI), which serves to stimulate and enrich the culture of innovation within government, have partnered to conduct a global review on the ways in which governments and their partners are innovating, and the steps they are taking to transform ad hoc and sporadic innovation into routine practice integrated into systems worldwide. The purpose of this review, conducted as part of the Middle East and North Africa (MENA)-OECD Governance Programme, is to identify how governments respond to the enormous challenges of today's complex world and to highlight recent trends and examples in public sector innovation.

As with previous editions, this review is published in conjunction with the World Government Summit,[2] which brings together over 4 000 participants from more than 150 countries to discuss innovative ways to solve the challenges facing humanity. One of the features of the event is Edge of Government,[3] a series of interactive exhibits that bring innovations to life. These exhibits include three of the case studies presented in this review, specifically: Carrot Rewards, Finding Places, and Recyclables as transportation fare.

OPSI and the MBRCGI have spent much of the last year conducting research, holding a global Call for Innovations crowdsourcing exercise to surface key innovation examples,[4] and meeting with innovation teams from around the world. This work has fuelled the content of this report, which surfaces three key trends in public sector innovation, as discussed in the pages that follow.

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1   See https://oecd-opsi.org/projects/innovation-trends for information and reports related to the work conducted under this partnership in the previous two years.
2   See www.worldgovernmentsummit.org.
3   See https://edge.worldgovernmentsummit.org.
4   See https://oecd-opsi.org/call-for-innovations-2018.

Tools and resources for innovators

Over the last year, OPSI and the MBRCGI have placed increased emphasis on providing not only useful research on innovation trends, but also practical tools, resources and models that public sector innovators can use to help achieve their goals. All of these items are discussed in depth in the Introduction section of this review.

Case Study Platform

OPSI has developed a new Case Study Platform where innovations can be collected and shared to help disseminate good ideas.[5] Any public sector innovator may submit innovations to the platform. Cases received from the Call for Innovations from this year and previous years are being added regularly.

Toolkit Navigator

A plethora of free innovation toolkits, playbooks and guides exist to help people identify, develop and practice necessary skills and apply new approaches to reach desired outcomes. However, it can be difficult to know where to start or which approach is suitable for each unique context. The OPSI Toolkit Navigator[6] provides support for getting started by orienting users around a vast collection of innovation toolkits and helping to find the ones best suited to their situation and needs.

Innovation Facets Model

A great deal of confusion remains as to the exact nature of innovation in the public sector, which actions may be better than others, and how governments can position and structure themselves to bring forth and execute new and creative ideas. OPSI believes that governments should aim to achieve consensus around the fact that innovation is multi-faceted, and that successfully leveraging the power of innovation requires a portfolio approach that allows them to understand, foster and manage its different facets. Through its work with countries all over the world, OPSI has identified *four primary facets* to public sector innovation, and has developed a model to help governments achieve a portfolio approach.
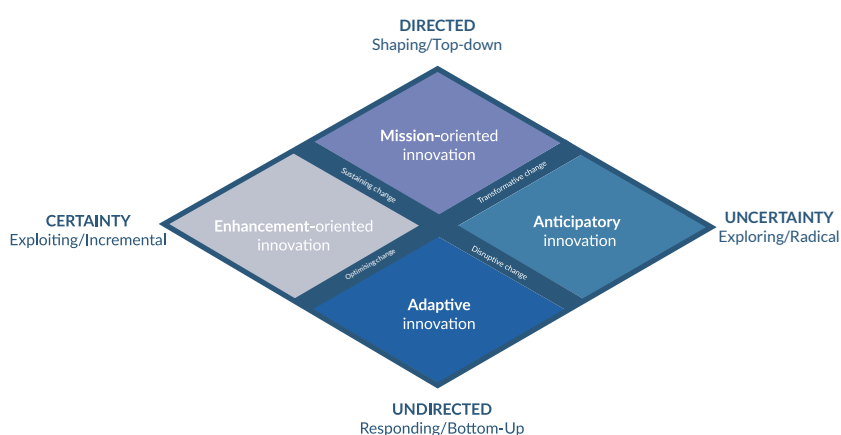
Hands-on Workshop

While the OPSI Innovation Facets Model helps to explain public sector innovation, governments also need to know how to put theory into practice, so as to make sense of and orient their own portfolios of innovation activity. OPSI, with the support of MBRCGI, has developed a workshop to help governments build a shared understanding of innovation in their organisations, analyse their innovation activities, uncover how different innovation activities are supported (or not), evaluate their innovation portfolio balance, and develop a roadmap of actions that sustain, reorient or develop new activities or innovation investments.[8]

5   The OPSI case study platform is located at https://oecd-opsi.org/innovations.

6   The OPSI Toolkit Navigator is located at https://oecd-opsi.org/toolkit-navigator.

7   The workshop materials and facilitation plan can be downloaded at https://oecd-opsi.org/facets-workshop.

HIGHLIGHTS:
INVISIBLE TO VISIBLE

Many recent government efforts have focused on making government more transparent to the public, a process that fosters trust and fuels innovation. Visibility is also important from the perspective of government.

The insights and perspectives of citizens and residents are often invisible to the individuals in government who make decisions that affect them. Governments also face challenges in perceiving different scenarios and envisioning the various paths towards positive future outcomes. Only once visible can they become tangible and thus meaningfully engaged with. Governments are innovating to make these invisible factors visible. By leveraging newly visible elements, they are equipped to make better decisions that affect their people, and to nudge citizens and residents to make better decisions as well.

CASE STUDIES: INVISIBLE TO VISIBLE

Carrot Rewards – Canada

Carrot Rewards is an app that combines gamification and behavioural insights to help governments understand the motivations and perspectives of their constituents, and nudge them to make better decisions on a variety of issues, such as healthy living and environmental sustainability. Canadians use the app to take quizzes and track goals, and in doing so are rewarded with points that they can use for loyalty rewards programmes. Launched as an innovative public-private partnership, Carrot Rewards has become one of the most popular wellness apps in Canada.

Finding Places – Hamburg, Germany

Finding Places is an innovative engagement initiative that has brought residents together to identify locations to provide housing for a growing number of refugees in the city. It combines optically tagged colour-coded LEGO bricks, augmented reality, touch feedback and geographical simulation algorithms to create a hands-on experience that allows users to collectively propose housing sites by placing tangible LEGO bricks at different sites along a model map.

Zika Mozzie Seeker – Australia

Countries around the world have experienced outbreaks of the Zika virus, which can lead to devastating birth defects when contracted by pregnant women. Zika is carried by mosquitoes that can be difficult to detect. To identify invasions of Zika mosquitoes early, the Queensland Government launched Zika Mozzie Seeker, which transforms traditional disease monitoring efforts by empowering thousands of "citizen scientists" to deploy mosquito traps, which serve as an early warning system for Zika mosquitos.

SEVERAL THEMES HAVE BEEN OBSERVED IN THIS AREA

Governments are using behavioural insights and gamification to unlock perspectives and reinforce positive change.

Immersive technology is enabling governments to surface new ideas and inputs.

Citizen science has matured, activating individuals as agents for change.

Countries are using positive deviance to reveal positive outliers.

KEY RECOMMENDATIONS

01 When possible, identify and adapt existing tools and resources to further the mission.

02 Ensure decisions frameworks consider diverse views.

03 Make room for ground-up and co-created solutions.

HIGHLIGHTS: OPENING DOORS

Traditionally, the complexity and opaqueness of government has served to limit citizen participation and minimise public value for underserved and at-risk populations.

Only those with the means or knowledge to navigate this environment have been able to maximise the value of government. However, new technologies, open data and the emergence of new business models in the private sector are creating space for government to explore a range of possibilities. Such mission-oriented and adaptive innovations seek to explore ways to open doors for everyone to access the public value of government, while also embracing the major shifts occurring in people's everyday lives.

CASE STUDIES: OPENING DOORS

SEVERAL THEMES HAVE BEEN OBSERVED IN THIS AREA

Governments are enabling the circular economy as currency.

Countries and cities are deriving public value from the platform economy.

New emphasis is being placed on improving access to justice.

KEY RECOMMENDATIONS

01 Explore the intersectionality between sustainability and economic catalysts.

02 Remain vigilant for unintended consequences.

**03** Enhance government adaptability to citizen needs to improve access to justice.

Sharing economy for government spaces – Amsterdam, Netherlands

The city of Amsterdam piloted a scheme to permit civil society organisations to access under-utilised offices in government buildings, introducing the potential for Airbnb-type space-sharing in city buildings. Over a period of eight months, a municipal building opened city rooms for use, providing a proof of concept that sharing government resources was a feasible way to meet public needs. The city hopes to expand the concept beyond renting rooms to municipal vehicles and tools.

Recyclables as transportation fare – Surabaya, Indonesia

Surabaya has launched Suroboyo Bus, a new rapid transit initiative that allows city residents to pay for bus fare with recyclable bottles. Commuters can bring plastic bottles directly to public buses or exchange them for bus tickets at recycling centres and drop boxes around the city. The initiative encourages improved recycling habits and helps to open doors to public transportation for those with less financial means.
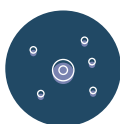
Transportation as a Benefit (TaaB) – South Bend, Indiana, United States

In South Bend, reliable transportation is the primary barrier to stable employment. To address this, the city developed TaaB, a city-sponsored pilot that uses a network of independent transportation providers such as Uber and Waze Carpool to meet the needs of employees and the employers that have adopted the programme. The initiatives assists employees by ensuring they have access to work, and by opening doors to new employment opportunities. It helps employers through increased employee productivity and reduced turnover.

Clear My Record – California, United States

Created by Code for America, Clear My Record is an automated process that clears the criminal records of individuals for infractions that were once illegal but have since been legalised. It applies an open-source algorithm to review records, determine eligibility and produce clearance paperwork for the courts. Clear My Record has benefited thousands of individuals with criminal records, opening doors to aspects of society and the economy that are difficult to access with a record, such as getting a job.

HIGHLIGHTS:
MACHINE-READABLE WORLD

The world is increasingly being translated into bits and bytes which can be read by machines and fed into algorithms that serve as the basis for an ever-growing number of decisions and services.

Governments are recognising the innovative potential of machine-readable data and are developing innovative projects that have the potential to reconceive one of the most foundational roles of government – creating laws that impact the daily lives of citizens and businesses. Governments are also seeking to digitise human characteristics, senses and surroundings to deliver innovative services. This growing wealth of machine-readable content also serves as fuel for a new generation of innovations that use emerging technologies such as artificial intelligence and blockchain.

CASE STUDIES: MACHINE-READABLE WORLD

Better Rules, better outcomes through machine-consumable laws – New Zealand

A core role of government is to establish laws that govern society. However, little has been done to update processes to facilitate this practice. In New Zealand, the government has created Better Rules, a pilot that is rewriting laws with machine-consumable code to ensure that the implementation of laws matches their intent. This project also makes it possible to develop real-time feedback loops between legislative design and implementation, allowing for better design of laws up front and agile refinement of laws over time.

Machine learning for land-mapping – Queensland, Australia

The Queensland Government has adopted machine learning to automatically map and classify land use features in satellite imagery. Identifying different land uses (e.g. agriculture or housing) is crucial for conserving biodiversity, natural disaster monitoring, and biosecurity disease outbreak readiness and response. It can also be useful in providing a near real-time analysis of potential crops impacted during large disasters such as tropical cyclones and floods.

Counterfeit medicine detection using blockchain and AI – Mongolia

Counterfeit drugs constitute the world's largest fraud market, and present major challenges to the economy and people's lives, including billions of dollars lost and hundreds of thousands of deaths every year. In Mongolia, where up to 40% of all medicines are fake, the government has partnered with the private sector to explore the use of blockchain and AI to track each batch of medicine along every step of the supply chain, right up to collection by the customer, in order to catch and eliminate counterfeits.

SEVERAL THEMES HAVE BEEN OBSERVED IN THIS AREA

Open data efforts are making public knowledge machine readable.

Countries are rewriting the rulebook with code.

Experiments are underway to digitise humans and our surroundings.

Governments are seeing enormous potential in emerging tech, but risks and adverse effects need to be anticipated.

KEY RECOMMENDATIONS

01 **Support multi-disciplinarity.**

02 **Ensure algorithms are transparent.**

03 **Build ethics into the design and implementation of initiatives.**

INTRODUCTION

The need for and the potential of innovation has never been greater

The world is in the midst of an unprecedented technological revolution. Changes are underway on a vast scale with digitalisation transforming economies, governments and societies in complex, interrelated and often unpredictable ways.

These changes are fundamentally altering how people live, interact and work. This process inevitably affects the relationship between governments and their constituents, and requires a transformation in the design and delivery of public services. The volume and complexity of threats and challenges are also growing rapidly, and governments are locked in a game of catch-up, with citizen trust and business confidence in the balance.

Unfortunately, government policies and practices have not kept up with the speed of change in economies and societies. Recent years have seen an erosion of trust in public institutions with the emergence of major challenges related to climate change, high levels of migration, rising financial inequalities and slow progress for gender equality. The profound impact of digital transformation in the private sector has not been mirrored by comparable changes in policy making or government-citizen interaction.

The pace of these challenges will continue to accelerate. Digitalisation brings disruption and overthrows assumptions about how things work. The OECD estimates that 9% of jobs in member countries are at high risk of being automated, and that automation will radically change the tasks that need to be performed in an additional 25% of jobs (Arntz, Gregory and Zierahn, 2016). There is concern that job generation in the high-skilled end of the labour market will go hand-in-hand with job losses at the low-skilled end, with potentially significant impacts on inclusiveness and equality.

Negativity bias: The notion that things that are more negative in nature have a greater effect on people than things that are neutral or positive.

Source: http://assets.csom.umn.edu/assets/71516.pdf.

Despite all the complexities and complications of today's challenges, in many ways the world has never been better. The 24-hour media cycle and the endless barrage of tweets, which focus overwhelmingly on negative events and uncertainties, can reinforce negativity bias and lead people to overlook a number of significant positive trends. Although income inequality remains a major challenge, poverty rates are at their lowest recorded levels, with 10% of the global population living below the poverty level (World Bank, 2018). While 10% is still too high, more than 1 billion people have been brought out of poverty since 1995 (see Figure 1).

The world is also facing other challenges on a massive scale, but countries have responded by taking unprecedented collective action to work towards overcoming them. With the adoption of Agenda 2030 and the Sustainable Development Goals (SDGs), every nation committed to meeting a set of universal, integrated and transformational goals and targets designed to tackle issues such as poverty, hunger, education, inequality, justice and well-being. This united agenda is helping to break down silos at an international level, and is pushing countries and cities to innovate in order to achieve the most ambitious, diverse and universal initiative in the history of humankind.

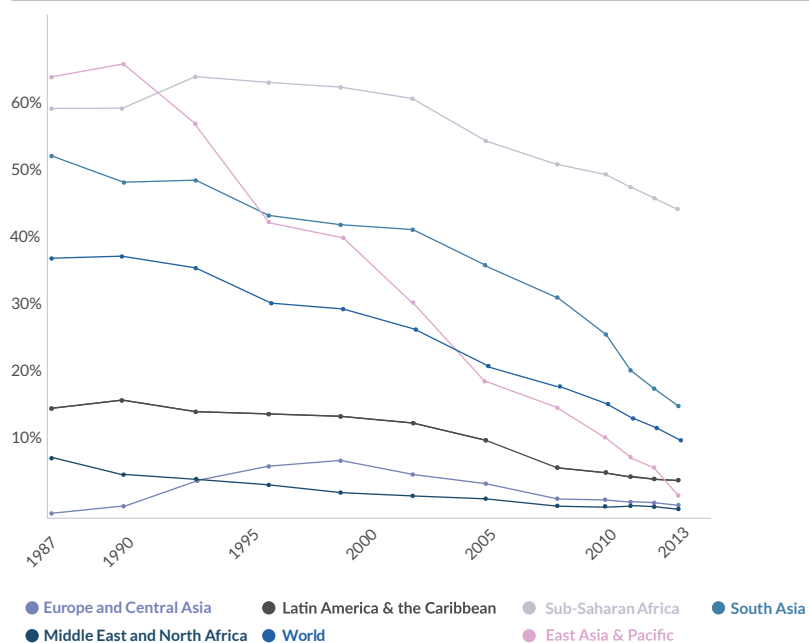The world is also building the foundation for major progress in tackling climate change. The Paris Agreement saw 195 countries adopt a legally binding and universal global climate agreement, a global first.[9] While obstacles have arisen along the way, such as climbing carbon emissions and the stated intent of the United States to pull out of the deal,[10] the world is coming together in incredible ways to combat what is perhaps the biggest challenge humanity has faced. Most recently, these countries have agreed on a "playbook" for implementing the agreement.[11]

Progress has also been made in other key areas. Hunger rates have fallen significantly (Von Grebmer et al., 2017), as have instances of child labour (ILO, 2017). In most countries, infant mortality has plummeted[12] and people are living longer than ever (Roser, 2018). Worldwide literacy and educational attainment are also at their highest levels (Roser and Ortiz-Ospina, 2018b).

Figure 1: Share of population living in extreme poverty

Legend:
- Europe and Central Asia
- Middle East and North Africa
- Latin America & the Caribbean
- World
- Sub-Saharan Africa
- East Asia & Pacific
- South Asia

Source: Roser and Esteban Ortiz-Ospina, 2018a.

Governments are integral players in every one of these successes, and will be essential actors in achieving the successes of tomorrow. They therefore need to make sure they understand and stay apprised of developments, and play their essential role in ensuring a level playing field, creating and keeping markets open and fair, and safeguarding the public interest. The challenges associated with an interconnected and increasingly borderless world also present incredible opportunities to build a better future. The pace of the global transformation will only accelerate, and governments need to adapt by simultaneously addressing the challenges while seizing the associated potential provided by opportunities.

Such opportunities include the ability to use digital technologies as enablers to deliver more timely, proactive and inclusive public services – and to develop platforms for others to build upon. They also allow for collaborative and innovative approaches that are conducive to greater trust in public institutions. Such opportunities enable progress to correct previous wrongs, such as injustice and inequality. In many respects, new technologies will allow their governments and their people to code towards a better future.

Governments are clearly adapting, but progress is often ad hoc rather than reliable, reactive rather than deliberate, and sporadic rather than systemic. Despite a generally forward trend, the public sector has not yet taken the next step: a commitment to ensure that innovation is a consistent and reliable resource that can be used to give governments the options they need and choices that can deliver better outcomes and greater impacts. However, some at the edge of government innovation are taking this step and are using fantastic, novel solutions to harness today's opportunities for the collective good. This review of global innovation trends identifies governments and their partners in industry and civil society who are leading the way.

9   See https://ec.europa.eu/clima/policies/international/negotiations/paris_en.

10 See www.theguardian.com/environment/2018/dec/05/brutal-news-global-carbon-emissions-jump-to-all-time-high-in-2018.

11 See www.npr.org/2018/12/16/677252474/countries-adopt-playbook-to-implement-paris-climate-agreement.

12 See https://data.unicef.org/topic/child-survival/under-five-mortality.

A partnership to catalyse innovation

Since 2014, the Observatory for Public Sector Innovation (OPSI) has served as a global forum for public sector innovation.[13]

In a time of increasing complexity, rapidly changing demands and considerable fiscal pressures, governments need to understand, test and embed new ways of doing things. OPSI works with governments to understand and encourage new approaches to address society's complex problems by empowering public servants with new insights, knowledge, tools and connections to help them explore new possibilities. OPSI values curiosity, the importance of understanding people's needs, a systems perspective and openness to new opportunities. Furthermore, first-hand experience of working in government means that its innovation specialists know that an innovative public sector makes better policy, builds constructive partnerships and delivers better outcomes.

OPSI works to meet the needs of countries and cities around the world, and seeks to empower public servants by working with them to:

» **Uncover emerging practices and identify what is next.** This involves identifying new practices at the leading edge of government, connecting those engaging in new ways of thinking and acting, and considering what these new approaches mean for the public sector.

» **Explore how to turn the new into the normal.** This includes studying innovation in different public sector contexts and investigating potential frameworks and methods to unleash creativity and innovation and ways to connect them with the day-to-day work of public servants.

» **Provide trusted advice on how to foster innovation.** This entails sharing guidance and resources about the ways in which governments can support innovation to obtain better outcomes for their people.

For the third consecutive year,[14] OPSI and the United Arab Emirates (UAE) Mohammed Bin Rashid Centre for Government Innovation (MBRCGI)[15] have partnered to conduct a global review on the ways in which governments and their partners are innovating, and the steps they are taking to transform ad hoc and sporadic innovation into routine practice integrated throughout systems around the world. The purpose of this review, conducted as part of the Middle East and North Africa (MENA)-OECD Governance Programme, is to identify how governments respond to the enormous challenges of today's complex world and to highlight recent trends and examples in public sector innovation.

The previous two reports found that governments:

» have created a growing number of innovation divisions and labs to support change, as well as tools and methodologies to address specific public sector challenges and engage with citizens

» are experimenting with emerging technologies to rapidly redefine the ways in which they provide services to citizens and residents

» are rethinking their back-office functions (e.g. procurement and human resources) as opportunities to spark transformation from the inside out

» are building specific projects and apps as cross-government and cross-sector foundations for innovation upon which new innovations can be built

» are starting to take an integrated systems approach to public sector transformation instead of viewing government as a series of discrete entities

» are working to build a more inclusive society that ensures the well-being of all people, often in relationship to the SDGs.

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13 OPSI is part of the OECD Directorate for Public Governance (GOV). See www.oecd.org/gov.

14 See https://oecd-opsi.org/projects/innovation-trends for information and reports related to the work conducted under this partnership in the previous two years.

15 See www.mbrcgi.gov.ae.

As with previous editions, this review is published in conjunction with the World Government Summit,[16] the largest annual gathering in the world focused on shaping the future of governments through innovation. The Summit brings together over 4 000 participants from more than 150 countries to discuss innovative ways to solve the challenges facing humanity. One of the features of the event is Edge of Government,[17] a series of interactive exhibits that bring innovations to life. These exhibits include three of the case studies presented in this review, specifically: Carrot Rewards, Finding Places, and Recyclables as transportation fare.

OPSI and the MBRCGI have spent much of the last year conducting research and meeting with innovation teams from around the world. Their work fuelled the content of this report (see Figure 2) and includes teams who submitted cases to OPSI and the MBRCGI's Call for Innovations crowdsourcing exercise.[18]

Figure 2: Two tracks for surfacing trends and cases

280 cases from Call for Innovations

542 innovations considered from 84 countries

262 cases from extensive research

In evaluating the 542 innovations surfaced through these two tracks, OPSI identified three key trends in public sector innovation that represent the latest thinking and actions of governments and government partners around the world (see Figure 3), which build upon the trends identified in the previous two annual reports.

OPSI and MBRCGI applaud these trends and all the innovation efforts uncovered in the process of surfacing them. Innovation is a fast-moving, iterative field. The evolutionary findings of these reviews show that governments are learning, growing and adapting to the increasingly complex challenges they face, and are devising creative new solutions to tackle them. By identifying and sharing these trends and examples, and by serving as a global forum for connecting ideas and innovators around the world, OPSI and MBRCGI hope to inspire action, embed successes, reduce the impact of failure and speed up the transformative process of innovation to deliver value for citizens at new levels.

16 See www.worldgovernmentsummit.org.

17 See https://edge.worldgovernmentsummit.org.

18 See https://oecd-opsi.org/call-for-innovations-2018.

FIGURE 3: THREE GLOBAL TRENDS IN PUBLIC SECTOR INNOVATION

INVISIBLE TO VISIBLE

The insights and perspectives of individuals can be invisible to those in government responsible for making decisions that affect them. Likewise, governments face challenges in perceiving different present-day scenarios and envisioning future paths. Governments are innovating to make these factors visible, thereby strengthening their ability to make good decisions, and to nudge others to do the same.

OPENING DOORS

Complexity and opaqueness in government limits participation and the ability to serve citizens and residents. This leaves only those with the means and knowledge able to navigate the system. To address this situation, governments are using innovative technologies and business models to open doors that enable everyone to access the public value of government, as well as the broader economy and society.

MACHINE-READABLE WORLD

Governments are translating the world into bits and bytes that can be read by machines and fed into algorithms that serve as the basis for a growing number of decisions and services. In so doing, they are re-imagining some of the most fundamental roles of government and building foundations for emerging technologies.

Tools and resources for innovators

Although only ten innovations are covered in depth in this year's review, OPSI has developed a new Case Study Platform where innovations can be collected and shared to help disseminate and replicate good ideas (see Figure 4).[19]

Any public sector innovator may submit innovations to the platform. Cases received from the Call for Innovations from this year and previous years are being added regularly.

In addition to the Case Study Platform, OPSI has launched the OPSI Toolkit Navigator (see Figure 5).[20] Toolkits are a great way to share innovative methods and practices. A plethora of free innovation toolkits, playbooks and guides exist to help people identify, develop and practice necessary skills and apply new ways of reaching an outcome. However, it can be difficult to know where to start or which one is suitable for one's unique context. The OPSI Toolkit Navigator provides support for getting started by orienting users around a vast collection of innovation toolkits to find the ones best suited to their situation and needs.

The Case Study Platform and Toolkit Navigator are linked, and connected to OPSI's growing innovation community. For example, it is possible to locate an interesting case study that was submitted through the OPSI and MBRCGI Call for Innovations process, identify the toolkits that were used in the development of that innovation, and reach out directly to the specific innovators who worked on the project.
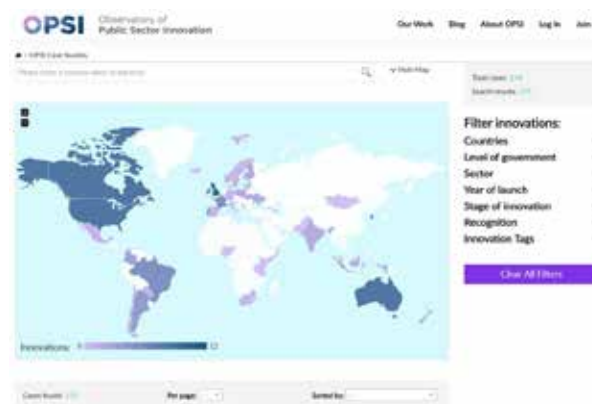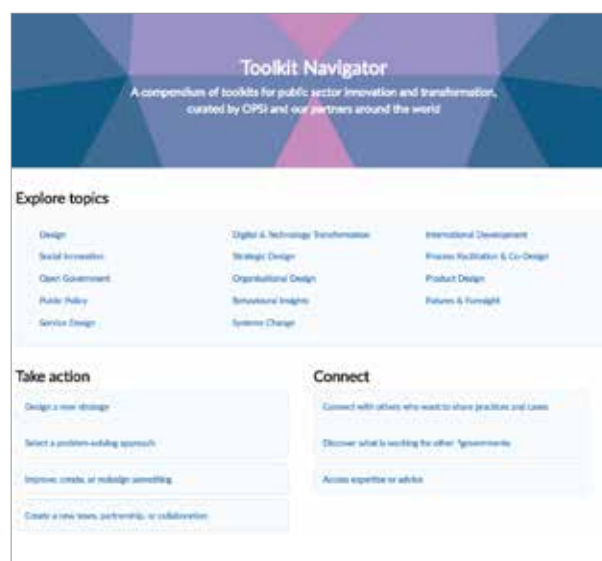
Figure 4: Case Study Platform

Figure 5: OPSI Toolkit Navigator

19 The OPSI case study platform is located at https://oecd-opsi.org/innovations.

20 The OPSI Toolkit Navigator is located at https://oecd-opsi.org/toolkit-navigator.

An emerging innovation model

As OPSI and the MBRCGI have observed, many governments and their partners in civil society and industry are taking bold steps to innovate.

In spite of this, a great deal of confusion remains as to the exact nature of innovation in the public sector, which actions may be better than others, and how governments can position and structure themselves to bring forth and execute new and creative ideas.

This confusion presents a problem if public sector innovation is going to become a more routine activity in governments. Having a shared understanding of innovation and a common vocabulary matters, as governments are focusing more on taking systems-wide approaches to transformation across and within their countries and even across national borders. Without some degree of consensus about the nature of innovation, there will be a misalignment of belief, intent and action, which is likely to make the difficult task of introducing and applying novel approaches even more challenging.

Devising an approach to building consensus around public sector innovation is no easy task. Innovation can mean many things and can take the form of many different types of actions. Innovation can be small and incremental or rapid and radical. It can be strategically and rigorously designed, or may take the form of an educated guess or a loose experiment.

It may not be possible, therefore, to rally consensus around one definition of innovation. Rather, OPSI believes that governments should aim to achieve consensus around the fact that innovation is *multi-faceted*, and that successfully leveraging the power of innovation requires a portfolio approach that allows them to understand, foster and manage its different facets. In today's complex and often turbulent political and economic settings, pursuing or relying on any one single option, whether innovative or not, is highly risky.

Through its work with countries all over the world, ranging from topic-specific workshops to large-scale studies of public innovation systems for entire countries (e.g. Brazil and Canada), OPSI has identified four primary facets to public sector innovation (see Figure 6).

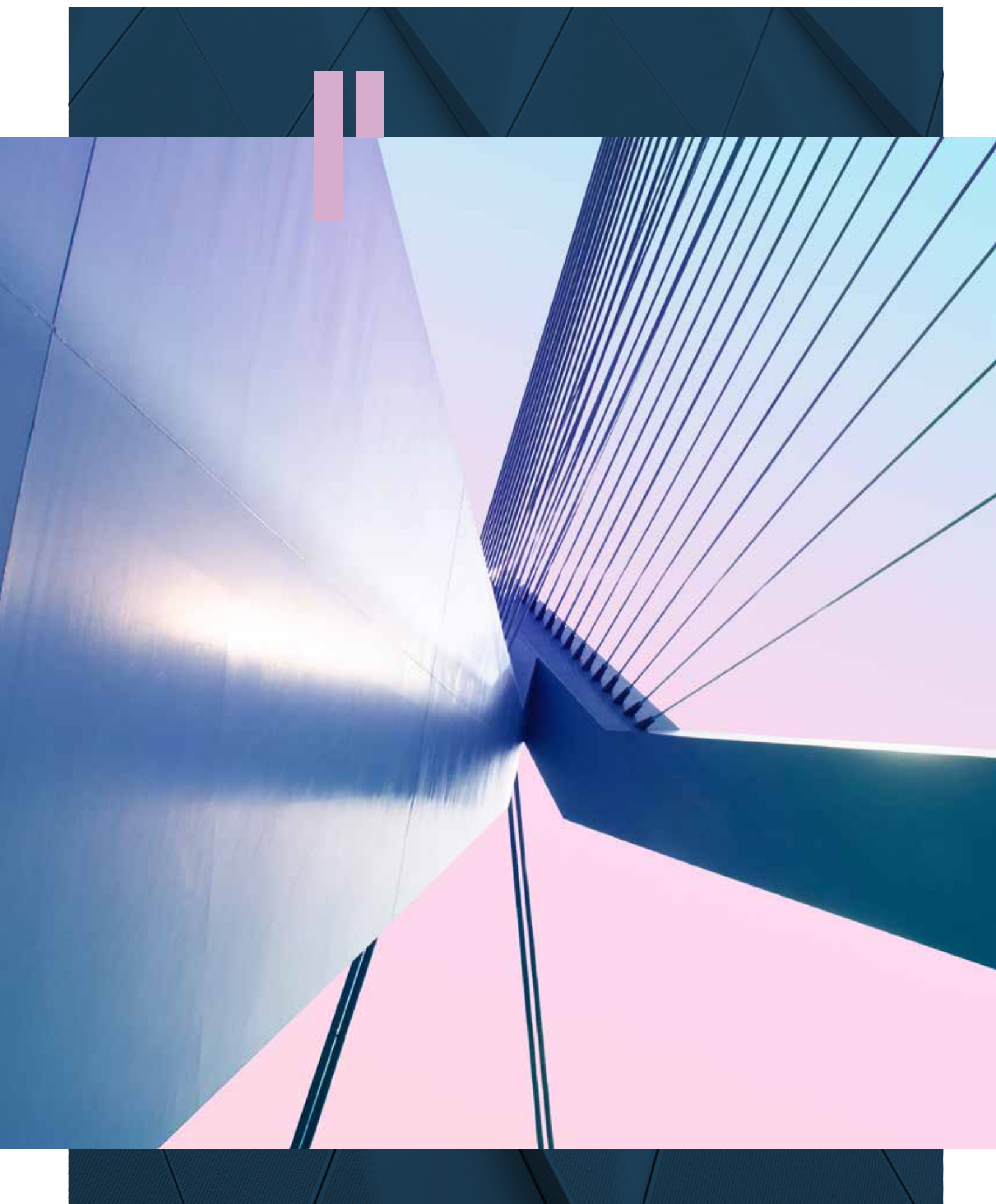**Figure 6:** The OPSI Innovation Facets Model
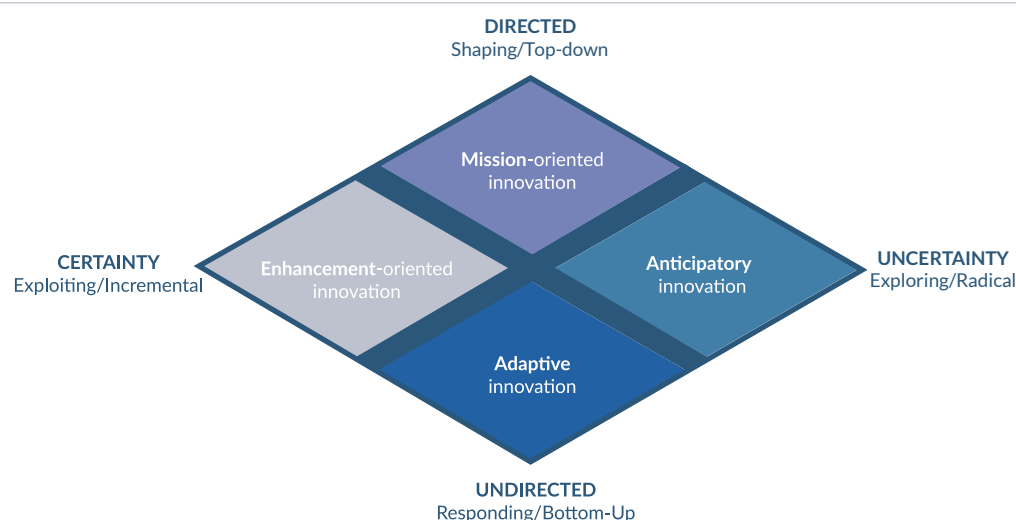
See https://oecd-opsi.org/projects/innovation-facets/ for more information on the OPSI Innovation Facets Model

» **Mission-oriented innovation:** This facet involves a clear outcome or overarching objective towards which innovation is oriented. A clear direction has been defined, even if the specifics of how it will be achieved may be uncertain. One historic example of such innovation was the race to reach the moon. There was a clear objective determined from the most senior levels downwards. This provided an overarching driving force that guided the relevant ecosystem players as they reoriented systems together to achieve the goal.

» **Enhancement-oriented innovation:** This facet focuses on upgrading practices, achieving efficiencies and better results, and building on existing structures, rather than challenging the status quo. Enhancement-oriented innovation generally utilises existing knowledge and seeks to exploit previous innovations. Such forms of innovation can build on existing processes and programmes to achieve greater efficiency, effectiveness and impact. One example of such innovation could be the use of behavioural insights to improve the response or compliance rates for on-time payments. This innovation is neither revolutionary nor disruptive, and does not involve rethinking the fundamental system or measures of value. Traditionally, most governments have focused their innovation efforts here.

» **Adaptive innovation:** This facet involves playing with, testing and trying new approaches in order to respond to a changing operating environment. The purpose to innovate may in this case be the discovery process itself, driven by new knowledge or the changing environment. When the environment changes, perhaps due to the introduction of innovation by others (e.g. a new technology, business model or new practices), it can be necessary to respond with innovation that helps adapt to the change. An example of such innovation is the use of social media by government organisations to interact with citizens, initially through bottom-up initiatives. Sometimes this type of innovation challenges the status quo and existing missions, which can create internal tension.

» **Anticipatory innovation:** This facet entails exploring and engaging with emergent issues that might shape future priorities and future commitments. It has the potential to subvert existing paradigms. Very new ideas generally do not cohabit well with existing reporting structures, processes and workflows, as the specific details of how the idea will work in practice still need to be teased out. Anticipatory innovation therefore generally needs to be sheltered from core business and have its own autonomy, or the pressures of tangible existing priorities are likely to cannibalise necessary resources. One example of this facet of innovation is government funding of exploratory work into artificial intelligence (AI) and its potential impacts on service delivery and social values.

This report aims to connect aspects of the identified innovation trends and cases with the OPSI Innovation Facets Model, in order to demonstrate how different actions represent various facets, which can come together in a portfolio approach to systems-wide innovative transformation of the public sector.

INNOVATION MODEL : 4 FACETS

Available now: Hands-on workshop for innovators

The workshop materials and facilitation plan can be downloaded at https://oecd-opsi.org/facets-workshop

Overview and intended outcomes

The OPSI Innovation Facets Model provides a valuable, empirically developed way to explain public sector innovation. However, governments also need to know how to put theory into practice, in order to make sense of and orient their own portfolios of innovation activity. OPSI, with the support of MBRCGI, has developed a workshop for governments to use to build a shared understanding of innovation in their organisations, analyse their innovation activities, uncover how different innovation activities are supported (or not), evaluate their innovation portfolio balance, and develop a roadmap of actions that sustain, reorient or develop new activities or innovation investments.

Who it is for

The workshop was developed with government administrations and leading civil servants in mind, working either in a central strategic capacity or in an individual ministry, department or unit with shared objectives. It can be modified to support between 1 to 100 participants who might work together on a daily basis or may be meeting for the first time. It is oriented towards the national government level, but may also be used in conjunction with sub-national and local governments. Civil society groups are encouraged to participate, although the emphasis for taking action is placed on governments.

What it includes

» **Module 1: Making sense of innovation (1.5 hours):** This module involves building an individual and shared understanding of public sector innovation by using the Innovation Facets Model as a framing tool. Participants will make sense of the different types of innovation activities in governments, as well as identifying which types of systems, capabilities, organisational structures and cultures tend to support each facet.

» **Module 2: Mapping an innovation activity portfolio (1.5 hours)**:** In this module, participants assess a hypothetical mix of innovation projects and activities to build a portfolio, using the Innovation Facets Model to contextualise the activities as well as reframe and guide discussions. Participants then add their own projects to the mix to map their own innovation activity portfolios.

» **Module 3: Reorienting an innovation portfolio and building a roadmap (2-3 hours)**:** In this module, participants evaluate their innovation portfolios using a set of prompts to guide the exploration and testing of their activities and the organisational preconditions, capacities, dependencies and structures that support them. Participants then develop a roadmap of actions based on the need to sustain, reorient or diversify their innovation activities and investments.

**Experienced process facilitator required

TREND 01:
INVISIBLE TO VISIBLE

👁 01

> *Many government efforts in recent years have focused on making government more transparent to the public, and to opening up government resources such as data. These actions can foster trust, promote accountability, and unlock economic development and fuel innovation in all sectors. However, visibility is also important from the perspective of government.*

Standard practices can render the insights, perspectives, and opinions of individual citizens and residents invisible to those in government who are responsible for making decisions that affect them. Likewise, governments can face challenges in perceiving different scenarios and envisioning the various paths to positive future outcomes. Only once visible can these insights, perspectives and opinions become tangible and meaningfully engaged with. Governments are now taking innovative steps to make these invisible factors visible. By leveraging these newly visible elements, they are better equipped to make better decisions that affect their people, and to nudge citizens and residents to make better decisions as well.

Governments are using behavioural insights and gamification to unlock perspectives and reinforce positive change

Behavioural insights (BI) (see Box 1) represent a prime example of enhancement-oriented innovation (see Figure 7).[21] By helping governments see and understand the behaviours and decisions of their people, BI helps governments make decisions on complex challenges facing policy makers, including inclusion, sustainability, and social outcomes at all levels of government and across economies and different contexts (OECD, 2017a). Moving beyond the disruption phase, governments have been using BI to inform policy and service design for several years now. The United Kingdom established the Behavioural Insights Team (BIT), also known as the Nudge Unit, about nine years ago to implement behavioural economics and psychology in government programmes, making them more efficient and effective.[22] During this time, BI methods have expanded to many other governments and governmental partners around the world. According to the latest OECD data, there are now about 200 institutions around the world applying behavioural insights to public policy (see Figure 8).[23]

Box 1: Behavioural insights
Lessons derived from the behavioural and social sciences, including decision making, psychology, cognitive science, neuroscience, organisational and group behaviour, are being applied by governments with the aim of making public policies work better.

Source: OECD (2017a).

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21 In the Introduction to this report, OPSI presented its new Innovation Facets Model. Throughout this report, there will be references to the four different "facets" of public sector innovation: Enhancement-oriented innovation, Mission-oriented innovation, Adaptive innovation and Anticipatory innovation. Governments will be most successful in their innovation efforts if they take a portfolio approach to their investments and efforts. OPSI is working to help governments build such an approach, including by providing innovators with a hands-on work that they can adapt and apply to their own contexts. This workshop is discussed in the Introduction and online at https://oecd-opsi.org/facets-workshop.

22 See www.gov.uk/government/organisations/behavioural-insights-team.

23 See https://oe.cd/BImap for a global map of institutions, compiled by the OECD BI team (https://oe.cd/Nudge).

TREND 01: INVISIBLE TO VISIBLE

Figure 7: Overview of behavioural insights

Source: https://oe.cd/Nudge.
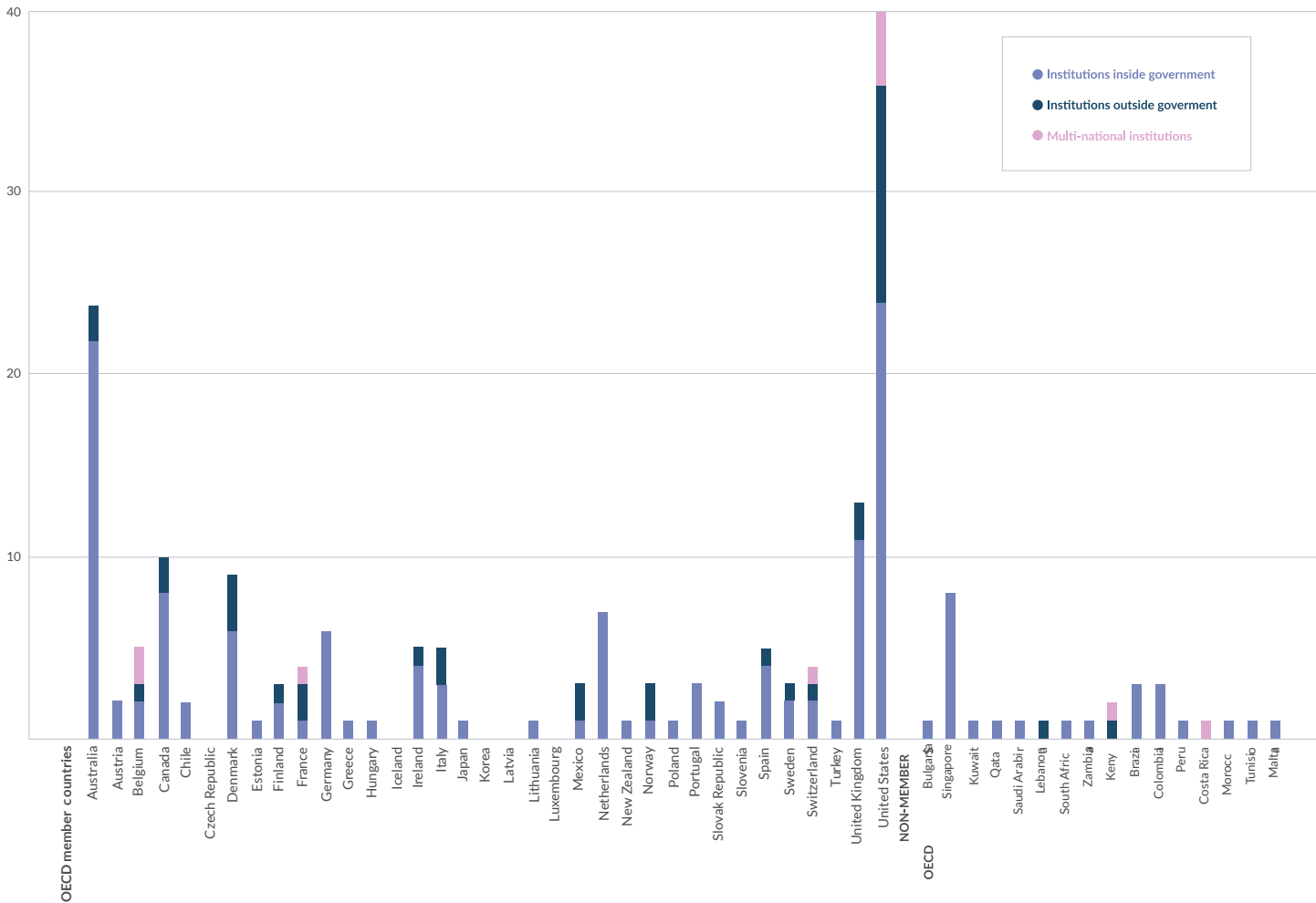
The use of BI in governments has matured significantly. While not quite mainstream, more than many other innovative methods, governments have had a great deal of success in embedding BI as a trusted and reliable way to affect change.

The OECD's Regulatory Policy team is supporting these efforts through the development of the Behavioural Insights Toolkit and Ethical Guidelines. Referred to as BASIC (**B**ehaviour, **A**nalysis, **S**trategies, **I**ntervention and **C**hange), the toolkit provides an overarching framework for applying BI to public policy from the beginning to the end of the policy cycle. It guides users through the application of BI to policy, and includes a wealth of best practices and proofs of concepts for anyone interesting in applying BI in real-world situations. BASIC recently underwent a public consultation phase to obtain input from global stakeholders, with the latest version available on the OPSI Toolkit Navigator.[24]

Figure 8: Institutions applying BI to public policy

Source: https://oe.cd/BImap

● Institutions inside government

● Institutions outside goverment

● Multi-national institutions

24 OECD's overall BI work, including the latest version of BASIC, can be found at https://oe.cd/Nudge

A recent OECD forum of BI experts from around the world found that, "behaviour change is a puzzle that requires policymakers to think about the traditional methods for applying policy and consider what behavioural drivers may be present, and how BI can improve the effectiveness of policies" (OECD, 2018a). However, these drivers may not always be visible. To solve this puzzle, governments need good, reliable data to inform potential policy interventions, as well as a way to communicate and test these interventions with target populations. A common approach is to analyse existing administrative data and communicate with citizens via a letter or other forms of messaging (e.g. targeted messaging in a utility bill encouraging energy reduction), in order to try to "nudge" positive behaviour change. Methods such as randomised control trials help to illuminate whether the nudges had any effect. But what if good data are not already available? Are there more engaging, dynamic ways to interact with individuals?

To answer these questions, governments have begun to push boundaries and further innovate around the application of BI. This has been done by combining BI with other innovative mediums, such as gamification, in order to better uncover often-hidden the perspectives and needs of citizens and residents and accelerate and amplify its impact.

A key example of this merging of innovative approaches is Carrot Rewards, a public-private partnership between multiple levels of the Government of Canada and the private sector company Carrot Insights. Carrot Rewards is a phone app that enables the government to actively conduct quizzes and polls of users to uncover valuable insights. Armed with this knowledge, the government can also nudge users to make better decisions by providing them with points-based rewards, which can be redeemed for items such as gift cards and flights. Carrot Rewards started by rewarding healthy choices, such as walking a certain number of steps per day, and has rapidly expanded to a more holistic vision of healthy living. A full case study on Carrot Rewards is presented later in this section.

In some instances, private sector business are moving ahead without government and are leading the way in devising integrated techniques that bring together BI and gamification to solve social challenges. For example, in most countries citizens are not saving enough money for unforeseen challenges or for their future more broadly, such as saving for retirement. Demographic trends can exacerbate these challenges, such as the coupling of aging populations approaching retirement age with the fact that people are living longer lives. In what the World Economic Forum has referred to as a "global pension timebomb",[25] the world's largest retirement systems and the systems of countries with the highest populations,[26] are expected to have shortfalls in retirement savings of USD 400 trillion by 2050, a figure five times as large as the global economy (WEF, 2017) (see Figure 9). This scenario could trigger catastrophic consequences by "imperilling the incomes of future generations and setting the industrialised world up for the biggest pension crisis in history".[27] Lack of savings can be particularly acute among certain demographics. For example, a recent report by the non-partisan National Institute on Retirement Security (NIRS) found that two-thirds of working American millennials have no retirement savings, with only 5% saving enough (Brown, 2018).

Figure 9: The pension gap (USD trillions, 2015)

● **2015 gap**

● **2050 gap**

● **Annual growth of gap (2015-2050)**
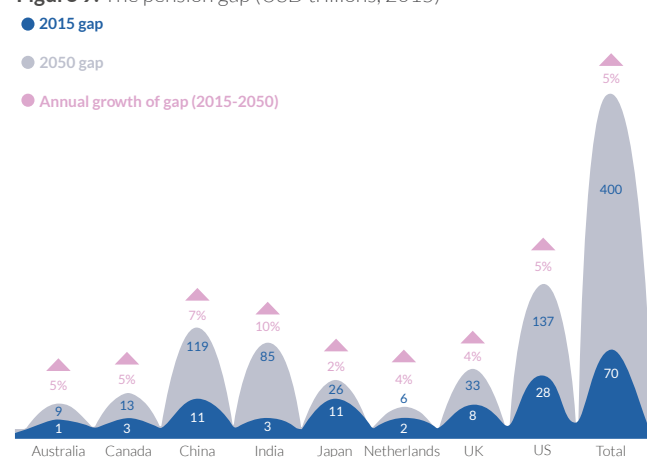
Source: WEF, 2017.

To help address this savings gap, California-based start-up Blast[28] – consisting of gamers, financial professionals and technologists – has created a "micro-savings" app of the same name that rewards players for playing games on their mobile devices. Users earn financial rewards for performing actions such as winning rounds of a game or trying a new game, and the earnings go to a bank account that earns higher interest than most typical savings accounts.[29] The benefit to users is financial savings, while the benefit to game companies is the ability to persuade potential new users to sample their games or to encourage re-use among existing players.[30] Although this example was developed by the private sector, it poses interesting questions and potential lessons that could be considered by government to solve pressing savings challenges.

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25 See https://www.weforum.org/press/2017/05/global-pension-timebomb-funding-gap-set-to-dwarf-world-gdp.

26 The largest systems are from the United States, United Kingdom, Japan, the Netherlands, Canada and Australia. The two systems with the highest population are China and India.

27 See https://www.weforum.org/press/2017/05/global-pension-timebomb-funding-gap-set-to-dwarf-world-gdp.

28 See https://blast.com.

29 See https://techcrunch.com/2018/07/17/acorns-co-founder-nabs-another-5-million-for-blast-a-startup-that-saves-while-you-game/?guccounter=1.

30 See www.gamesindustry.biz/articles/2018-03-12-blast-seeks-to-gamify-savings.

31 See http://globenewswire.com/news-release/2018/08/02/1545983/0/en/CreditEase-Fintech-Fund-Co-Leads-Seed-Round-Investment-in-Blast-A-Mobile-App-That-Merges-Fintech-and-Gaming.html.

"It is hard to save and difficult to change behaviours. But if you can attach a positive outcome to something that people are already doing and love, like gaming, you can change lives."

Shlomo Benartzi, Behavioural Economist, UCLA; Advisor, Blast[31]

While behavioural insights can yield significant results by making perspectives visible and facilitating nudges, governments need to think through the ethical considerations to help guide decisions around project design. In a recent OECD Behavioural Insights Survey, surprisingly few countries highlighted ethical concerns as a barrier to the use of BI (see Figure 10). This might be due to the fact that the respondents to the survey had mostly received support to implement BI by senior or political leadership. In gaining this support they might have already addressed a sufficient number of these issues to anticipate its possibility and to ensure that no ethical issues arise (OECD, 2017a). However, it could also mean that not enough attention is being paid to the subject. To ensure ethical application, it is important to implement a framework for acting on potential issues when they arise. The BASIC framework spells out ethical guidelines for considerations for BI initiatives (OECD, 2017b).

Figure 10: Type of opposition or criticism applying to BI

Total number of respondents = 60
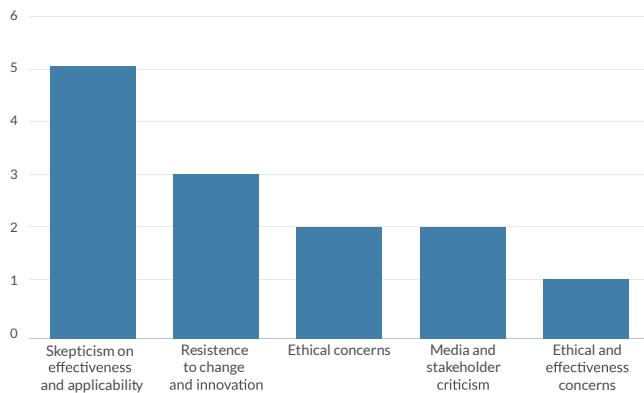
Source: OECD, 2017a.

Focusing on gamification specifically, OPSI has observed rapid growth in the development and use of "serious games" (see Box 2) to support governments and to make various options for courses of action visible. Governments have employed games before, but use of the technique for innovative approaches, such as systems thinking and futurism, has accelerated. As some innovation groups may be reaching workshop fatigue, perhaps teams have reached "peak post-it" – in reference to the sticky notes often used in innovation workshops – allowing methods such as games to pick up steam.

One notable example of this approach has been developed in an international context. The European Commission (EC)

Box 2: Serious games

"A game-based environment where the primary intention is not the entertainment of the player, but the attainment of some other objective which may be related to investigation or players' progress towards an objective of some real-world importance."

Source: Khosrow-Pour, 2015.

Joint Research Centre (JRC) has worked with experts in these types of games at the Hawaii Research Center for Future Studies[32] to create the Scenario Exploration System (SES) (see Figure 11).[33] SES helps to engage users in future-oriented systemic thinking by illuminating different considerations and scenarios that may not have previously been perceived and by working through simulations for the future (e.g. 2035 and 2050). Participants explore their long-term objectives against scenarios and consider various stakeholders. By creating a realistic journey towards the future, SES generates a safe space to uncover perspectives and thinking, with a view to simulating possible responses linked to issues of interest to the participants.[34]

Figure 11: Colleagues playing SES

Source: https://ec.europa.eu/jrc/en/image-gallery/scenario-exploration-system-ses.

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32 See www.futures.hawaii.edu.

33 For more information on the OPSI Toolkit Navigator, see https://oecd-opsi.org/toolkits/scenario-exploration-system-ses.

34 See https://blogs.ec.europa.eu/eupolicylab/scenario-exploration-system-ses.

SES is available under a Creative Commons licence, which allows anyone to freely use and modify the game, as long as they share the results of their adaptation under the same conditions (e.g. adaptations are not sold for commercial gain), and the originators receive attribution. Several versions of SES have been developed for different contexts, and in 2016 the Association of Professional Futurists awarded the system the Most Innovative Futures Work prize.[35] Other relevant serious games include:[36]

» **Impact: A Foresight Game**, developed by Policy Horizons Canada, teaches users how to think creatively about emerging technology and the future of society.

» The **Internet of Things (IoT) Service Kit**, developed by Futurice, brings domain experts out of their silos to co-create user-centric IoT experiences.

» The **Open Data Board Game**, developed by the Open Data Institute, is built around the creation of tools using data.

» The **Project Cycle Hackers' Kit**, developed by the United Nations Development Programme (UNDP), seeks to normalise innovation by embedding new practices in project management processes.
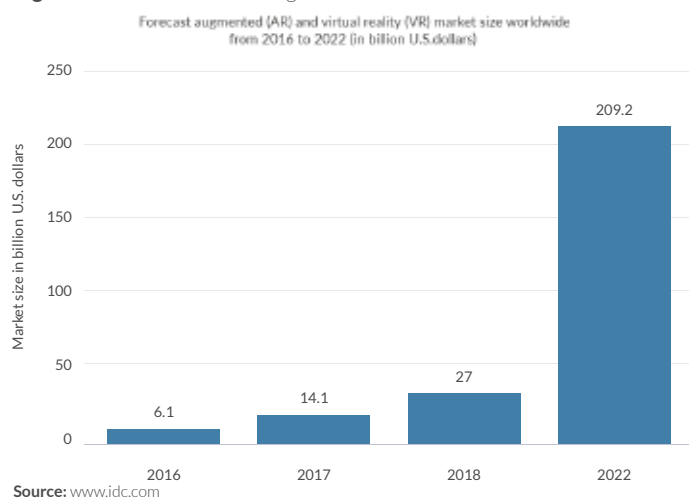
Want to play SES?

1. **Read the details and download the instructions and templates** on the OPSI Toolkit Navigator at https://oe.cd/ses.

2. **Watch the video tutorial** at https://youtu.be/kJNujoRpfVg.

3. **Decide which version you would like to play.** A number of versions are hosted on the Toolkit Navigator, including Sustainable Transitions, Food Safety and Nutrition Challenges, Migrations, New Technologies, Urban Sustainability, and Mobility.

4. **Exchange ideas with others on LinkedIn** at www.linkedin.com/groups/12089320.

Immersive technology is enabling governments to surface new ideas and inputs

The use of immersive technologies such as augmented reality (AR) and virtual reality (VR) has grown rapidly and is expected to soar in the coming years. Oculus VR, now owned by Facebook, launched the Oculus Rift headset in 2016, bringing the world the first fully immersive home VR product.[37] Apple and Google both launched developer kits in 2017 that enable Apple and Android devices to be used to run VR and AR apps. Not all applications of AR/VR use headsets and mobile devices, but these developments have accelerated the use of these technologies in areas such as gaming, travel, marketing, movies and education. It is estimated that over 1 billion people will be using the technology by 2020,[38] with a global market size of USD 209 billion by 2022 (see Figure 12).

Governments are also realising the potential of AR and VR for public good. Similar to gamification, governments and their partners are using the technologies as tools to bring previously invisible insights,

Figure 12: Forecasted AR/VR global market size 2016-22

Forecast augmented (AR) and virtual reality (VR) market size worldwide from 2016 to 2022 (in billion U.S. dollars)

Year	Market size
2016	6.1
2017	14.1
2018	27
2022	209.2

Source: www.idc.com

ideas and sometimes even people into focus, in order to take informed action and make better decisions.

Governments at the city level are leading the way. One example is Finding Places, a collaboration between the Massachusetts Institute of Technology (MIT) Media Lab and the city of Hamburg, Germany.

35 See https://blogs.ec.europa.eu/eupolicylab/jrc-ses-won-the-award-of-2016-most-innovative-futures-work.

36 For more details on these games, visit the OPSI Toolkit Navigator https://oe.cd/innovationgames.

37 See www.theverge.com/2016/3/28/11284590/oculus-rift-vr-review.

38 See https://www.newgenapps.com/blog/6-vr-and-ar-statistics-shaping-the-future-of-augmented-reality-with-data.

By using optically tagged LEGO bricks and AR, city leaders have worked with community members to help address challenges associated with accommodating major influx of refugees. This innovation is covered in an in-depth case study at the end of this trend section.

"What we're trying to do is think about how we can have a constant measurement of our citizens' needs and wants … and you can get that feedback long before those final development decisions are made."

Amelia Winger-Bearskin, Director, IDEA New Rochelle

In the United States, the New York City suburb of New Rochelle was recently named a 2018 Bloomberg Mayor's Challenge champion city[39] for its pioneering use of AR and VR to engage residents in plans for new buildings and public spaces in the city (see Figure 13).[40] Through this innovative project, residents can use AR apps on their smartphones to envision what a new park might look like, employ interactive software to design streets and use VR headsets to review different options for buildings and provide their opinions. City leaders had previously found that planning meetings were held too late in the process for resident input to make a difference, and that most planning meetings were attended by the same people, leaving the views and desires of others unseen and unheard. By providing an immersive experience, they believe that a broader variety of residents will be more likely to participate in planning efforts and to share their opinions and feedback, and that these opinions will be more actionable because they have been collected earlier.[41]

International organisations are also using immersive technology to surface public input for designing communities. The United Nations Human Settlements Programme (UN-Habitat) has partnered with the companies Microsoft and Mojang to develop Block by Block,[42] an innovative project that leverages the popular computer game *Minecraft* to simply and easily engage community members, such as children, the elderly, urban poor and refugees, who are not usually heard from when planning public spaces. *Minecraft* is a game where users within a virtual world are equipped with different kinds of 3D blocks to build new structures and bring their ideas to life. Block by Block uses this game as an entry point to give "neighbourhood residents the training, the tools, and the platform to participate and contribute their ideas, in a collaborative process that helps all participants expand their view."[43] To date, Block by Block has been used in more than 30 countries. In Kosovo, for example, it was it used to envision a new purpose for a derelict market that was left as a large, abandoned concrete space disliked by much of the community.[44] Citizens gathered and used Minecraft to design different options for how to use the space, agreeing collectively on a final design. This served as the basis for a new solution (see Figure 14).

Figure 13: Prototyping AR and VR solutions in New Rochelle   **Source:** https://medium.com/@BloombergCities/how-virtual-reality-is-helping-create-real-change-in-cities-a0e3736da97b

39 See https://mayorschallenge.bloomberg.org/ideas/new-rochelle.

40 Blog posts documenting New Rochelle's experiences experimenting with AR/VR and with the Mayor's Challenge can be found at https://medium.com/idea-new-rochelle.

41 See https://medium.com/@BloombergCities/how-virtual-reality-is-helping-create-real-change-in-cities-a0e3736da97b.

42 See www.blockbyblock.org.

43 See www.blockbyblock.org/about.

44 See www.blockbyblock.org/projects/kosovo.

Figure 14: Kosovo site before, and co-created Minecraft vision

Source: www.blockbyblock.org/projects/kosovo.

The hardware costs of using immersive technologies such as AR and VR have gone down significantly in the last few years. For example, the cost of high-quality VR headsets has dropped from thousands of USD to a few hundred. The cost of these systems and multimodal interfaces will continue to decrease, while their performance will improve. This trend provides governments with increasing opportunities to identify and collect ideas and feedback in new ways, thereby making visible the previously invisible opinions and thoughts of citizens.

45 See www.citizenscience.gov.

46 See www.environment.gov.scot/get-involved/submit-your-data/citizen-science-portal.

The key challenge to reaping the full benefits of AR and VR lies in the subject material itself. Creating specialised AR/VR experiences requires specialist knowledge, often from heterogeneous sources, and adaptation to context (i.e. individual experience, culture, existing skills and available time) (OECD, 2018d). While the hardware and technology grows cheaper and more accessible, using them in an optimal manner remains a challenge that governments will need to consider.

Citizen science has matured, activating individuals as agents for change

Citizen science and "do-it-yourself" science initiatives are growing in importance internationally and in the bioscience field. Citizen science describes a process whereby interested members of the public, often without specific scientific training, participate in the scientific process, addressing real-world problems by formulating research questions, conducting scientific experiments, collecting and analysing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems. Such processes tend to involve networks of people performing research-related tasks such as recording specific observations over time to reveal patterns and trends (OECD, 2013). Citizen science projects often feature the participation of non-professionals in crowdsourcing, mass-participation, and data collection and analysis. With citizen science, interested members of the public can uncover scientific findings and make new discoveries and solutions visible in new ways.

Government citizen science efforts are not all that new, and similar concepts go back decades. However, new innovative approaches have emerged recently, driven largely by the convening and co-ordinating power of digital platforms. Governments have launched a number of portals where those interested in becoming citizen scientists can access catalogues of government-supported citizen science projects, toolkits to assist practitioners with designing and maintaining projects, and forums and communities of citizen science practitioners and co-ordinators. Such portals include the following:

» In the United States, CitizenScience.gov was launched in 2016 to accelerate the use of crowdsourcing and citizen science across the US government (see Figure 15).[45]

» Scotland's Citizen Science Portal helps people participate in experiments and gather, share and view data on environmental issues.[46]

» Canada's Science at Work portal connects users with projects going on in their communities.[47]

» Sweden will be launching Arenas for Co-operation through Citizen Science (ARCS) in 2019 to help Swedish universities and colleges use civil society research in a responsible and sustainable way to interact with society.[48]

One example that bridges citizen science with the topic of gamification[49] is Phylo.[50] Phylo was created by the McGill Centre for Bioinformatics, part of McGill University, a public research university in Montreal, Canada. Players on Phylo help to align DNA sequences to develop better algorithms for research.

Another example featured as a case study later in this section is Australia's Zika Mozzie Seeker, which serves to illustrate the increasing maturity and innovative potential of well-designed and executed citizen science initiatives. With this project, the government of Queensland, an area of Australia vulnerable to invasion by the types of mosquitoes that carry the Zika virus, has engaged thousands of citizen scientists to deploy mosquito traps in their yard. These are then sent to labs for DNA testing to provide an early warning system in the event that Zika mosquitoes invade the area. This process gives the government new insights into these difficult-to-find mosquitos.

In a further example, the National Aeronautics and Space Administration (NASA) in the United States initiated a global citizen science effort in March 2018 to crowdsource landslide data.[51] Landslides cause billions of dollars in infrastructural damage and thousands of deaths every year worldwide. They affect nearly all countries, but are difficult to both predict and often detect. NASA's Landslide Reporter allows citizen scientists to submit landslides they witness in person or online to a publicly accessible global database. The initiative helps to help advance global knowledge of when and where landslides happen. This enhanced visibility helps support decisions that can save lives and property.[52]

When done well, citizen science efforts help governments to perceive things that were previously invisible to them. While these approaches are powerful, they are not leveraged in all areas, and many governments do not have policy frameworks in place that make it easy or even possible to engage in citizen science. Science policy will need to recognise and embrace more fully the contributions of citizens in the research and science processes. Citizen participation can be contributory (through the collection and provision of evidence) or collaborative (through mentoring and volunteer activities). Citizen-science activities can also help raise awareness of efforts such as SDG challenges in local communities and facilitate the behavioural changes necessary to implement social or technological innovations (OECD, 2018d).

47 See http://science.gc.ca/eic/site/063.nsf/eng/h_97169.html.

48 See https://medborgarforskning.se.

49 To find other projects that merge citizen science and gamification, see https://citizensciencegames.com/games.

50 See https://phylo.cs.mcgill.ca.

51 See https://landslides.nasa.gov.

52 See https://pmm.nasa.gov/landslides/index.html.

Figure 15: Components of CitizenScience.Gov   **Source:** citizenscience.gov.

catalog

Explore Projects

This searchable database provides a government-wide listing of citizen science and crowdsourcing projects designed to improve cross-agency collaboration, reveal opportunities for new high-impact projects, and make it easier for volunteers to find out about projects they can join.

Read more

community

Join Us

There are two primary groups within the federal government working collaboratively to advance the use of these tools, namely the Federal Community of Practice on Crowdsourcing and Citizen Science (CCS) and the Agency Citizen Science and Crowdsourcing Coordinators.

Read more

toolkit

Plan Your Projects

The Toolkit provides five basic process steps for planning, designing and carrying out a crowdsourcing or citizen science project to help federal employees use crowdsourcing and citizen science to advance the missions of their agencies.

Read more

Countries are using positive deviance to reveal successful outliers

OPSI has observed the growing use of positive deviance to reveal unique characteristics and outliers that improve circumstances for an individual or group, which have the potential to help others if the same circumstances occur for them (see Box 3). Positive deviance brings out positive behaviours that already exist but that are not obvious or part of the mainstream. It is also notable for its growth as an innovative tool in international development contexts (Albanna and Heeks, 2018).

Sometimes the solution to a problem already exists, but may not be well known or used widely. Coming from the development community, the concept of positive deviance offers an approach whereby government works proactively with community outliers who behave in ways different from the rest of the community, ways that mean they do not experience a problem affecting other members of the community (see Figure 16). Examples include improving child nutrition and reducing infant mortality (Pascale, Sternin and Sternin, 2016). This approach is intensive and requires active engagement with the community to help uncover the outliers and to socialise the positive behaviours and gain social acceptance for them.

Box 3: Positive Deviance
"Positive deviance (PD) is founded on the premise that at least one person in a community, working with the same resources as everybody else, has already licked the problem that confounds others. This individual is an outlier in the statistical sense – an exception, someone whose outcome deviates in a positive way from the norm. In most cases this person does not know he or she is doing anything unusual. Yet once the unique solution is discovered and understood, it can be adopted by the wider community and transform many lives."

Source: Pascale, Sternin and Sternin, 2016: 17.

Figure 16: Steps in the positive deviance process   **Source:** UNDP Pakistan. www.pk.undp.org/content/pakistan/en/home/blog/2018/-_positive-deviants-in-pakistan---their-strategies-for-success--.html

Through the Call for Innovations, OPSI identified an innovative pilot programme in Pakistan, led by UNDP, which serves as an excellent example of this approach.[53] UNDP wanted to identify and understand the strategies women outliers or "positive deviants" used in remote and deeply conservative areas, which have minimal technology coverage, to successfully join the workforce, become educated and serve their communities.

Pakistan's Federally Administered Tribal Areas (FATA) refers to a remote mountainous region in western Pakistan, bordering Afghanistan. Due to decades of conflict and weak governance, poverty is pervasive and livelihood opportunities are limited. In FATA, the cultural system attaches great importance to the concept of male honour. The female literacy rate is about 7%, and very few women are allowed to engage in work or public life outside the home, with the exception of a rare few women who are outliers in that they attend school or work in places such as hospitals and schools. As a result, UNDP Pakistan projects in FATA struggled to find ways to include women. In order to better de-

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53 See https://oe.cd/undppositivedeviance for the Call for Innovation submission on the OPSI case study platform, and www.pk.undp.org/content/pakistan/en/home/blog1/2018/3/7/Self-belief-personal-motivation-and-family-support-drives-women-s-engagement-in-Pakistan-s-Tribal-Areas.html for a series of UNDP blogs on the pilot.

sign a locally relevant programme and empower women in FATA, UNDP decided to first gain an understanding of women in the area by investigating these restrictions and those that managed to obtain employment. Their hypothesis was, "if we could understand these few women outliers' strategies to overcome resistance of their families and communities, we could design a more effective and sustainable women empowerment programme using locally accepted behaviour change strategies."[54]

Using bottom-up positive deviance methods, the UNDP team worked with partners in the communities to identify these outliers, "women who have pushed the boundaries of traditional thinking in terms of their participation in public life".[55] Through the partners, they held community discussions to obtain views about what sets these women apart, and also interviewed the outlier women themselves. The interviews sought to identify the main barriers to their engagement in public life, and their successful strategies to overcome them.[56] Through this, the UNDP team was able to identify a number of successful strategies which they are now exploring to see whether they can be applied to other women (see Figure 18).

The pilot was the first use of positive deviance to understand how to develop a women's empowerment initiative. It has provided the UNDP with a solid evidence base from which they can test and scale-up interventions in support of women's engagement in public life. This innovation not only aims to benefit the

women and their communities, but also to aid UNDP in finding more inclusive and impactful ways of designing programming for very hard-to-reach groups.

A number of other examples exists of using positive deviance for good, including improving enrolment rates as schools in Lebanon, eliminating violence against women in Moldova and reducing crime recidivism rates in the United States.[57]

Figure 18: Top five findings and successful strategies   **Source:** UNDP Pakistan.
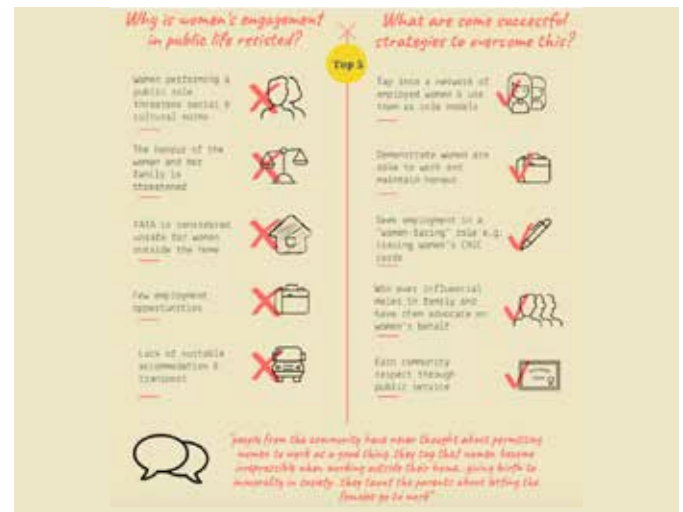
Figure 17: Women in the FATA region

Source: http://www.pk.undp.org/content/pakistan/en/home/blog/2018/-_positive-deviants-in-pakistan---their-strategies-for-success--.html

54 See https://oecd-opsi.org/innovations/positive-deviance-pilot-strategies-for-enhancing-womens-public-participation-in-pakistans-federally-administered-tribal-areas-fata.

55 See www.pk.undp.org/content/pakistan/en/home/blog1/2018/1/15/Necessity-is-the-mother-of-invention-tradition-women-in-public-life-and-the-space-for-innovation-.html.

56 See www.pk.undp.org/content/pakistan/en/home/blog/2018/-_positive-deviants-in-pakistan---their-strategies-for-success--.html.

57 See https://positivedeviance.org for resources and case studies related to positive deviance.

Recommendations

Innovative governments are making great strides in illuminating and raising up important views, characteristics and scenarios that were previously hidden, and providing conduits and frameworks to tap human potential for contributions in ways not possible before. Aspirations such as citizen engagement and promoting positive behaviours and decisions among the public are not new. However, the methods for doing so and the scale at which this can be done creates a tremendous amount of potential, but also raise questions regarding how to pursue these approaches effectively and appropriately. Governments should continue fostering innovative approaches to understanding their people's views and perspectives, and should consider how to do this in ways that work within their own contexts. The good news is that forward-thinking governments and organisations have already undertaken a significant amount of work to lead the way, and created resources to help others.

» **When possible, identify and adapt existing tools and resources to further the mission.** A wealth of tools, games, templates and other resources have already been developed to help governments innovate in this area. The new OPSI Toolkit Navigator[58] categorises hundreds of these by topic (e.g. Behavioural Insights, Process Facilitation & Co-Design) and by the actions that innovators seek to perform (e.g. select a problem-solving approach; or improve, create or redesign something). They cover many areas through the innovation lifecycle, from generating ideas to implementing and evaluating projects. Many of these are available under Creative Commons and other open licenses that allow for re-use and adaptation.

» **Ensure decisions frameworks consider diverse views.** Making public perspectives and opinions visible in innovative ways is a noble goal. However, governments should seek to ensure that they shine their spotlight on diverse groups and seek broad opinions, even from likely detractors and critics. Otherwise, they risk hearing biased views and taking biased actions.

» **Make room for ground-up and co-created solutions.** During interviews with innovation teams in the development of this report, innovators told OPSI that it is better to begin an engagement and a scenario-exploring project early, and with an open mind, rather than simply seeking feedback on an already-baked solution. They also emphasised that it is better to seek ground-up, community-led solutions, rather than putting in place overly formal and rigid top-down interaction protocols and questionnaires. Simply seeding interesting discussions and sitting back to listen can be a powerful approach, or placing final decision-making power in the hands of those who will be affected.

58 See https://oecd-opsi.org/toolkit-navigator.

TREND 01: INVISIBLE TO VISIBLE

01

Carrot Rewards, Canada

Carrot Rewards is an innovative application that combines gamification and behavioural insights to allow governments to better understand the motivations and perspectives of their constituents, and nudge them to make better decisions on a variety of issues, such as healthy living and environmental sustainability. Canadians use the app to take quizzes and track goals, and in doing so are rewarded with points that they can use for various loyalty rewards programmes. Launched as an innovative public-private partnership between the Government of Canada and the private sector company Carrot Insights, Carrot Rewards has become one of the most popular wellness apps in Canada and is eyeing international expansion.

The problem

As with other countries, healthcare costs in Canada have increased at an unsustainable rate. A significant proportion of this increase is related to the increasing prevalence of chronic conditions among Canadians. Regular physical activity has undisputed health benefits. Moderate intensity physical activity, such as brisk walking, reduces the risk of many chronic, non-communicable diseases – including cardiovascular disease, cancer, chronic respiratory disease and diabetes. However, most Canadians fail to follow the recommended activity guidelines. It is widely accepted that

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Canada

preventative healthcare methods and behavioural change among citizens and residents must be adopted.

In addition to seeking ways to promote physical activity among the public, in order to promote healthy living, Canada is also searching for innovative ways to address other complex challenges such as mitigating climate change and realising a low carbon future. Governments need to find ways to better encourage citizens to take action to reduce individual and collective carbon footprints.

For example, a 2015 evaluation of Natural Resources Canada's Office of Energy Efficiency (OEE) recommended that the Office improve its ability to communicate and demonstrate the value of its energy efficiency tools and services, such as ENERGY STAR[59] and EnerGuide.[60] Traditionally, the OEE has relied on the marketing efforts of stakeholders and partners, and communication tools such as websites and social media accounts, to raise awareness of energy efficiency among Canadians. A more targeted and interactive approach was needed to further raise awareness and also to learn from citizen perspectives and experiences with energy in the home and on the road.

Governments cannot achieve these and other priorities without support from individual Canadians. To obtain this, governments need better insights into the behaviour and activities of their people, and the ability to more proactively promote and influence goal-oriented actions.

An innovative solution

Although these two problems are not obviously related, the Government of Canada is experimenting to see whether they can be addressed by using the same approach. The underlying objective is essentially the same: to gain a better understanding of the perspectives and experiences of Canadians, in order to find new ways to influence them to make better decisions.

To this end, the Government of Canada and the Government of British Columbia entered into an innovative public-private partnership with the private sector company Carrot Insights to develop the Carrot Rewards app (see Figure 19). As described on its website, "Carrot Rewards is an AI-driven public engagement platform that leverages behavioural economics and nudge theory to motivate Canadians to make better everyday lifestyle choices. Carrot Rewards harnesses the power of the most popular consumer loyalty programs in Canada to maximise its appeal and user engagement".[61] By making positive lifestyle decisions, users earn points from popular loyalty rewards providers for items such as flights and gift cards from retailers and restaurants.

Canada is particularly well-suited to this type of innovative programme. About 90% of Canadians subscribe to at least one loyalty programme membership, and the average household has

about 13 memberships. Overall, Canadians have about 175 million memberships.[62] This is significantly higher than most other countries. For example, in the United States, only about 57% of people participate in such programmes.[63]

Figure 19: Carrot Rewards app for healthy living

Source: Carrot Rewards

This innovative approach was used initially to promote and reward healthy living. In this context, users gain points for engaging in healthy behaviours such as setting and achieving walking goals, and learning about their health and wellness (e.g. completing quizzes and surveys, reading blog content and viewing informational videos).

The Carrot Rewards app leverages behavioural science to ensure all features and education are theoretically driven. For example, the app includes several behaviour change techniques to help guide users along the behaviour change continuum. These include:

» **accessing public health resources** by directing users to informative tools like helplines and videos

» **shaping knowledge** by delivering micro-learning quizzes and surveys and measuring change over time

59 The ENERGY STAR initiative is a voluntary partnership between the Government of Canada and more than 1 500 organisations working to use Canadian natural resources more wisely through greater energy efficiency. See https://oecd-opsi.org/wp-content/uploads/2018/09/Phase-I_Case-Study_NRCan.pdf for additional details.

60 EnerGuide is the official mark of the Government of Canada for its energy performance rating and labelling programme for key consumer items-houses, light-duty vehicles, and certain energy-using products. See www.nrcan.gc.ca/energy/products/energuide/12523.

61 See www.carrotapp.com.

62 See www.theglobeandmail.com/globe-investor/personal-finance/household-finances/the-top-rewards-programs-canadians-are-using/article38318624.

63 See https://bit.ly/2ShOFic.

» **setting goals and making plans** by allowing users to create action plans, solve problems, identify barriers and set trackable health goals

» **enabling feedback and monitoring** by letting users monitor personal walking behaviour and receive immediate feedback on progress

» **promoting social support and comparison behaviour** by allowing users to connect with friends to issue challenges or collaborate to achieve a common goal (e.g. inviting friends to participate in Step Together Challenges)

» **setting external rewards** by engaging with external programmes to utilise the motivation of loyalty programmes.

The combination of behavioural science and insights allows the app to facilitate an environment where users can achieve and sustain behaviour change, and mostly importantly, incentivise positive change on a mass scale.

Importantly, in addition to making positive lifestyle choices, users are rewarded for interacting with certain pieces of content, such as surveys and quizzes on a wide range of relevant topics. The content delivered on the app has been expanded to include six diverse topics to suits everyone's lifestyle:

» **Your Body** consists of physical activity and healthy eating

» **Your Mind** consists of mental health and healthily relationships

» **Your Money** consists of money management and financial literacy

» **Your Future** consists of career planning and preventive health

» **Your Community** consists of local events and civic engagement

» **Your Planet** consists of reduction in carbon footprint and energy-efficient lifestyle choices.

This is the key aspect of Carrot Rewards that ties it into the theme of "Invisible to Visible". In the course of using the app and taking surveys and quizzes, citizens and residents provide the government with valuable insights into previously unknown behaviours and perspectives. These uncovered insights allow governments to proactively influence user behaviour, by nudging them towards better, more sustainable actions.

By embracing a more holistic vision for healthy living and wellness, other federal government departments like Natural Resources Canada's OEE can exploit the potential for better citizen engagement and action on priorities, such as advancing energy efficiency.

Megan Nobrega from Carrot Rewards speaking at the OPSI conference in November 2018, Paris

Source: https://oecd-opsi.org/wp-content/uploads/2019/01/Carrot-Rewards-Presentation.jpg

In 2016, the OEE worked with Carrot Rewards to design and launch a pilot to reach, inform and reward Canadians who demonstrate energy efficient behaviours, such as fuel-efficient driving or home energy efficiency upgrades. By leveraging in-app features and rewards, the OEE and Carrot Rewards have been able to engage users, and measure their awareness of energy efficiency topics and their interest in learning or doing more. This partnership and the programmes delivered in app have also helped highlight how users take action and make energy-smart decisions, such as searching for a home energy advisor in their area or completing an online eco-driving course.[64] In 2018, the OEE has worked with Carrot Rewards to design and launch randomised experiments that test different energy label designs and messages to understand how best to frame and inform energy efficiency action in the home.

Carrot Rewards also entered into a partnership with the Provincial Government of British Columbia to develop a novel Flu Campaign, which used mobile "push" notifications and geo-location technology to encourage vaccine uptake and awareness. Out of users in British Columbia, 38% (over 30 000 people) completed the Flu Campaign quiz, which increased their awareness of the flu vaccine. Among participating cities (over 21 000 people), 41% clicked on the in-app map to locate the nearest sponsored pharmacy. This enabled their smartphone's "location" feature, thus allowing the push notifications to be sent to them. Over the course of the four-week campaign, over 21 000 push notifications were sent to users when they were near

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64 For Natural Resources Canada's pilot results, see https://oecd-opsi.org/innovations/rewarding-energy-efficiency-getting-canadians-into-the-game.

a participating pharmacy encouraging them to get a flu shot. Approximately 5% more users reported receiving the influenza vaccine during the 2017 influenza season compared to the previous year, in part because of nudges from Carrot Rewards.

Novelty

Carrot Rewards is the world's first national wellness rewards platform. Similar tools, especially for health and wellness, have been developed and rolled out in various forms. However, these are typically targeted to closed populations, for example, employee wellness programmes and insurance products. Carrot Rewards is unique in two ways:

» It has direct access to a broad range of users through the ubiquity of mobile technology.

» It rewards users with popular loyalty rewards they *already* collect.

This makes the programme appealing to a broad range of users, particularly those who are not typically inclined to participate in these types of programmes.

Results and impact

Traditionally, governments raise awareness about a topic principally through advertising. The typical conversion rate for ads is 1%. With Carrot Rewards, the typical conversion rate is 40%. Importantly, while advertising is a one-way method of communication, Carrot opens the door to a two-way feedback loop, where governments can benefit from users' insights, which can then be used to promote positive behaviours among Canadians – all while the users are rewarded for their participation.

Carrot Rewards has become one of the most popular wellness apps in Canada, with over a million downloads and 500 000 monthly active users. Carrot has tracked over a trillion steps, and had over 20 million quizzes and surveys completed by users. Regarding energy sustainability, instructional videos for improving home energy usage have been viewed over 60 000 times, and users have submitted over 150 new ideas for achieving energy efficiency. In addition, 94% (27 702) of users have adopted better driving techniques for reduce fuel consumption, and 51% (17 298) have taken steps to improve energy efficiency in their home.

Carrot's results have been published in peer reviewed journals.[65] These show that the app has resulted in a 21% increase in physical activity among the participating lesser-active population[66] and a 5% uptake in influenza vaccinations during the 2017 influenza season compared to the previous year.[67]

Challenges and lessons learned

The unique nature of this public-private partnership initially made decision-making around features, partnering and evaluation a challenge. It was also difficult to know exactly how much information was required for reporting in order to measuring effectiveness, and which insights were most appropriate and impactful. The solution was to develop a robust evaluation framework and reporting process that was agile and tailored to the needs of all partners.

The support of the Public Health Agency of Canada and other project champions such as Natural Resources Canada OEE was a key ingredient for success. Future multi-sectoral partnerships may be more likely to flourish if a passionate and skilled champion is identified at the outset. Furthermore, the supportive environment for experimentation fostered by the Public Health Agency of Canada and Natural Resources Canada OEE allowed for the development and delivery of a largely untested real-world intervention, with real impact and real learnings that can be applied to future app iterations, or similar programmes.

Having a culture that supports experimentation, innovation, creativity and collaboration helps to ensure that motivations and values remain at the forefront of the initiative. A multi-disciplinary team consisting of individuals from many sectors, including business, academia, policy, health and technology, is also imperative for success, and encourages outside-the-box thinking to optimise available resources.

Replicability

The replicability of Carrot Rewards is already clear. As can be seen in this case study, the approach began with promoting wellness activities and has extended to rewarding energy efficiency. This momentum has continued to expand. The solution is now being used in several parts of Canada by various federal departments, jurisdictions, and private and non-profit organisations across a number of additional domains, such as consumer health, financial literacy and civic engagement.

The concepts behind Carrot Rewards are likely to be highly replicable in other areas and contexts. The Carrot team is currently planning to expand nationally in Canada and has been approached to test the platform in other countries.

65 See https://mhealth.jmir.org/2018/9/e178.

66 See https://mhealth.jmir.org/2017/5/e70.

67 See www.sciencedirect.com/science/article/pii/S0264410X18304870.
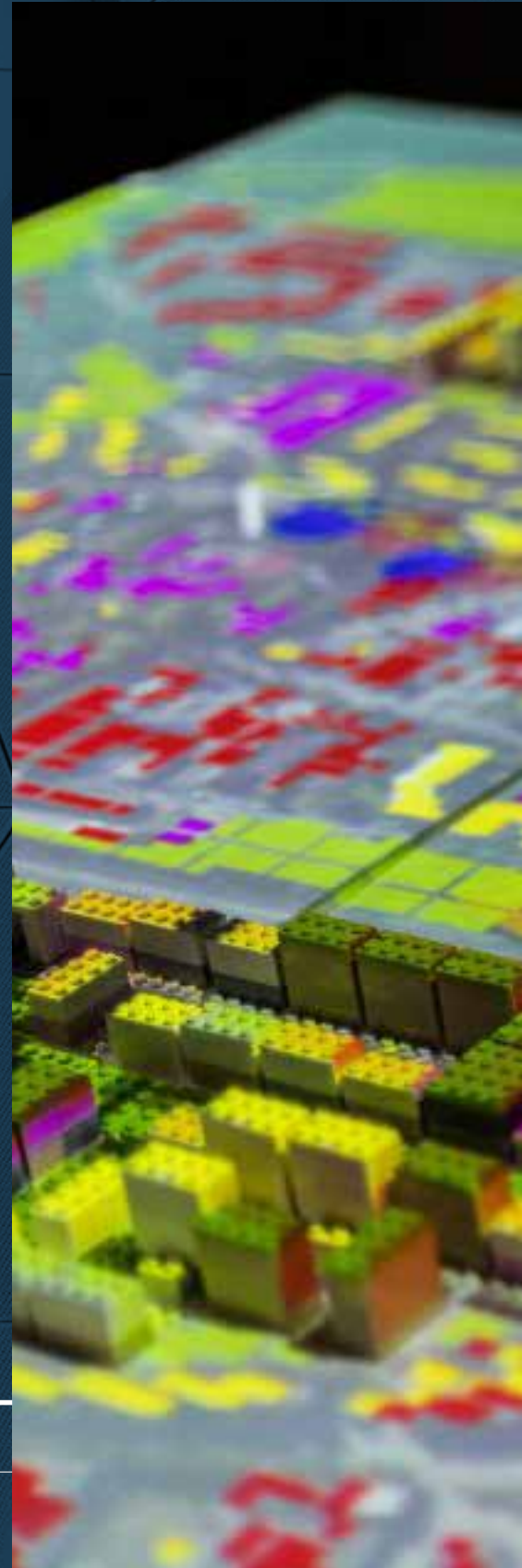
Finding Places

Finding Places is an innovative resident engagement initiative that has brought together the residents of Hamburg, Germany, to identify optimal locations to provide housing for a growing number of refugees in the city. It combines optically tagged colour-coded LEGO bricks, augmented reality, touch feedback and geographical simulation algorithms to create a hands-on experience that allows users to understand current land features and collectively propose housing sites by placing tangible LEGO bricks at different sites along a model map (see Figure 20). Through this immersive process, project partners from the Hamburg Mayor's Office, the Massachusetts Institute of Technology (MIT) Media Lab and the HafenCity University Hamburg (HCU) have brought residents' personal experiences and local knowledge into the government's decision-making process in new ways.

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Hamburg, Germany

Figure 20: Finding Places interactive display

Source: https://oecd-opsi.org/innovations/cityscope-findingplaces-hci-platform-for-public-participation-in-refugees-accommodation-process.

The problem

Migration is one of the signature challenges of the 21st century, with countries around the world experiencing massive rates of migration in recent years. For some individuals who seek new jobs or experiences in countries other than their own, migration is a choice. Others face more dire circumstances, with record numbers of people being forced from their homes due to conflict or violence and environmental factors such as climate change.

The number of humanitarian refugees arriving in OECD countries peaked in 2016, and governments continue to grapple with the resulting humanitarian crisis. During that year about 5 million people left their home countries to seek a better life, and OECD countries registered over 1.5 million new asylum requests. Germany alone accounted for nearly 200 000 of these requests, second only to the United States.[68] This influx of asylum seekers has posed major challenges for the central government, as well as cities throughout the country. Government systems and services were overloaded and solutions to assist these asylum seekers, while also helping communities effectively absorb them, were implemented in ad-hoc ways. The refugees were accommodated in tents, warehouses and gymnasiums, with hundreds of people living in confined spaces with little privacy, until a better solution could be found (Noyman et al., 2017) (see Figure 21).[69]

Within the City of Hamburg, Germany's second-largest city, facilities to accommodate refugees were concentrated in certain neighbourhoods, while others received little to no refugees at all. This had the unfortunate consequence of stimulating civil protest against refugees among those who already lived in these neighbourhoods (Noyman et al., 2017).

An innovative solution

Officials in Hamburg knew they needed to improve the conditions for refugees, and to facilitate a more equitable transition for existing community members. In early 2016, Hamburg's then-mayor Olaf Scholz (and now Federal Minister of Finance and Vice Chancellor of Germany) initiated a collaboration with the Massachusetts Institute of Technology (MIT) Media Lab and the HafenCity University Hamburg (HCU) to develop a participation process that would enable citizens to collectively engage in finding housing locations for a predicted influx of about 79 000 refugees (Noyman et al, 2017). As noted on the MIT Media Lab's blog,[70] the Mayor had three key criteria for this work:

» All districts in Hamburg should share an equal burden in terms of accommodating refugees.

» Consolidation of refugees into concentrated areas must be avoided.

» The process must be bottom-up to ensure that all decisions are community driven.

The resulting programme was Finding Places, an initiative devised with the goal of identifying ways to incorporate Hamburg residents' personal experiences and local knowledge into evaluating potential location refugee housing. The initiative produced proposals are designed to feed into the decision-making process for city government leaders.

Figure 21: Temporary housing in a Hamburg warehouse

Source: https://medium.com/mit-media-lab/shifting-priorities-finding-places-9ad3bdbe38b8

The core of the initiative is MIT's CityScope technology. This innovative "human-computer interaction" urban modelling and simulation platform uses a unique combination of optically tagged colour-coded LEGO bricks, augmented reality, touch feedback and geographical simulation algorithms to model scenarios for changes to urban environments.[71] CityScope allows users to interact with different simulations and scenarios, with the goal of "making complex urban questions accessible and tangible to various audiences."[72] While this sounds (and is) complicated, the individual components can be broken down to demonstrate how each piece contributes value to the process (see Figure 22):

» LEGO blocks serve as a hands-on representation of different aspects of refugee accommodations (e.g. buildings).

» An urban model displays maps at the scale of the city, neighbourhood or street.

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68 See http://www.oecd.org/newsroom/oecd-calls-on-countries-to-step-up-integration-efforts-for-migrants-and-refugees.htm.

69 See https://medium.com/mit-media-lab/shifting-priorities-finding-places-9ad3bdbe38b8.

70 See https://medium.com/mit-media-lab/shifting-priorities-finding-places-9ad3bdbe38b8.

71 Ibid

72 See https://oecd-opsi.org/innovations/cityscope-findingplaces-hci-platform-for-public-participation-in-refugees-accommodation-process.

» Sensors and cameras conduct real-time scanning of the LEGO block locations and movements.

» Geographic Information System (GIS) software integrated with data and analysis tools identify how interactions among participants (e.g. moving LEGO blocks) can have an impact on the city and its neighbourhoods.

» Display screens show in real-time how these interactions among participants play out, as informed by the GIS software and data and analysis tools.

When all these components come together, they provide users with contextualised information in easy-to-understand and easy-to-interact ways, which allows them to participate even if they have no technical expertise (Noyman et al., 2017).

In order to obtain the views of Hamburg residents, the innovation partners held a series of public engagement workshops using interactive CityScope technology. These enabled groups to assess various decisions regarding where and how to provide housing to refugees in the community.[73] Each workshop focused on one of the seven districts of Hamburg. Participants gathered around a large table upon which a map of a neighbourhood was projected, supplemented with other known geographic data, such as ownership records and land use information. Citizens then discussed various pieces of land and whether they could accommodate refugee housing. By placing different types of LEGO data blocks onto the neighbourhood map (e.g. one type of block represented housing for 50 people), participants could indicate locations where they believed refugee housing would work well. The participants could also submit comments explaining their reasoning for making certain decisions.[74] The results of their actions were projected on an adjacent district table map in real-time, allowing participants to see how placement of their LEGO blocks would affect the district. The overall effect on the city was projected on a large screen that was viewable by all participants.

Over a period of three months (May-July, 2016), the city and its project partners held 34 workshops with about 400 city residents. Through these workshops, Finding Places promoted resident engagement and direct discussions between experts and non-experts. All parties worked together towards the same goal of finding suitable housing locations. To try to raise participation and mitigate selection bias (see the Challenges section), the innovation team advertised the workshops via various media

Figure 22: Finding Places components and room setup

1. Station I: Hamburg city
2. Station II: District
3. Station III: Neighbourhood
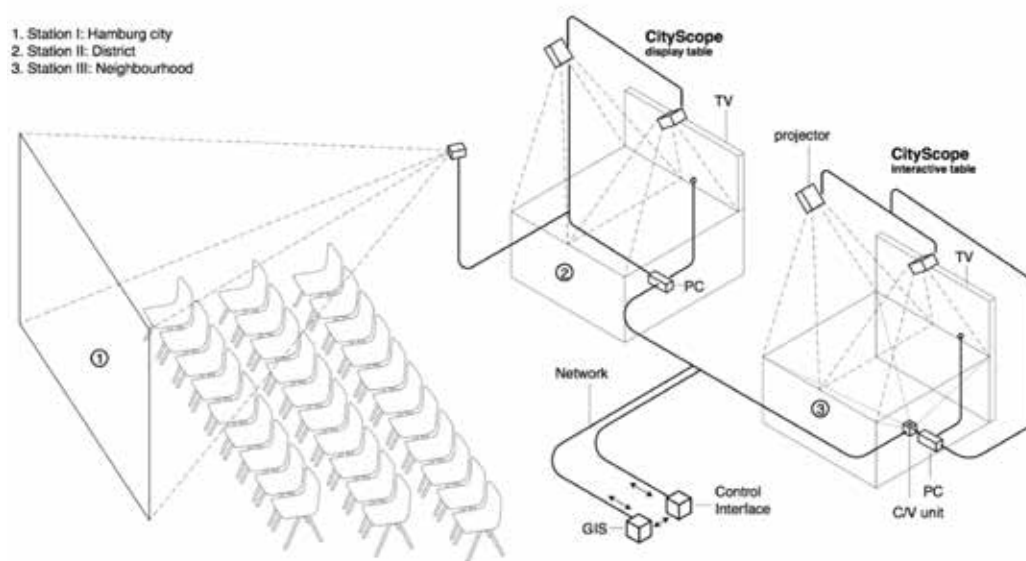
Source: Noyman et al., 2017.

outlets, and circulated about 40 000 brochures all over the city. In addition, interested individuals could easily register online. The Finding Places team reviewed registrants and invited 20 people per session. Each workshop concluded with participants providing their recommendations for housing locations to city urban planning staff, which were also published on the Finding Places website to ensure the transparency of the process.[75]

Novelty

MIT's CityScope technology had been used previously to assist city planning efforts, but never for a major public engagement initiative. Finding Places suggests a novel approach to public engagement in complex planning processes (see Figure 23). In typical urban planning methods, subject matter experts

73 To see videos of Finding Places workshops in action, see https://youtu.be/gKq5SVItlII and https://youtu.be/tyEZyYyZpyM.

74 See https://medium.com/la-fabrique-de-la-cit%C3%A9/finding-places-an-innovative-partnership-for-a-collaborative-effort-to-house-refugees-in-hamburg-20a953b06f1a.

75 See www.findingplaces.hamburg.

tend to dominate, and incorporation of public opinion is not always a key factor in decision-making processes. Even in cases where participation is ensured, the degree of interaction and the ability to explore design alternatives is limited. The novelty of Finding Places and its underlying CityScope technology lies in the accessibility, tangibility and simplicity of its approach for all types of users, while tackling complex and complicated issues. Unlike most traditional solutions, it enables significant substantive engagement and direct discussion among experts and non-experts, who may not typically use the same language.

Results and impact

Workshop participants identified 161 locations for refugee accommodations, representing housing for about 24 000 refugees if fully implemented. These locations were then evaluated by the city to determine whether they would be a good fit. Six are now being considered for development into refugee accommodations, with another ten being considered for additional development in the future.

The remaining 145 identified locations were determined infeasible for a number of reasons. For example, over 50% of the identified sites were public green spaces such as parks or nature conservation areas. The rest were generally sporting areas, parking lots, private property or were already set aside for future development. The thinking behind whether projects should move forward or not was published publicly on the Finding Places website.

While the number of feasible locations may seem low, those identified represent a number of optimal sites that may not have been previously considered. Due to the involvement of residents in their selection, the decisions to place houses in these areas may be viewed as more legitimate and better welcomed by existing residents than was the case with previous locations. According to the Finding Places team, the process has indeed helped to ease tensions and improve acceptance of migrant housing in the city (Noyman et al., 2017). Over time, Finding Places is serving to "plant the seeds for newcomers' long-term integration into Hamburg's existing communities."[76]

User perspective

Both stakeholders and participants rated Finding Places highly, stating that the initiative was a positive experience. Participants and city leaders found the process and the CityScope tool to be a helpful aid to real-time decision-making, while those involved in the workshops saw themselves as "partners in an 'eye-level'

dialogue with policy makers and the city administration, being able to supply planning authorities with relevant information based on their local knowledge."

Challenges and lessons learned

The key challenge for Finding Places was the tight schedule. The project needed to be implemented in just three months, however designing the CityScope technology, including creating new custom hardware and software solutions for the Hamburg context, required

76 See https://medium.com/mit-media-lab/shifting-priorities-finding-places-9ad3bdbe38b8.

Figure 23: Finding Places resident engagement session

time and testing. In addition, some challenges arose in terms of making the workshops accessible to the broadest possible range of residents. Due to the physical size of the CityScope equipment (e.g. cameras, computers, sensors, etc.), workshops had to be held at HCU. This reliance on a single location, though, may have reduced the number of potential participants, thus contributing to the risk of selection bias.

Although Finding Places is designed to bridge the gap between experts and non-experts, some challenges remained in terms of bringing non-experts up to speed on certain urban planning methods and concepts. In particular, non-expert participants experienced some difficulty in understanding the professional planning content. Participants were also unused to working with maps and satellite images, so orienting the projected images and assessing them adequately proved difficult. Most of these challenges are currently being addressed by the MIT team, which is designing new, open-source, mobile and easy-to-deploy CityScope platforms.

The Finding Places team cites a number of elements critical to their success in leveraging this platform:

» clear research questions (in this case, where to locate refugee housing)

» strong government support and collaboration with a local liaison (in this case, the Mayor's office and HCU)

» public recognition and support from professional stakeholders

» sufficient data and transparency about participants' roles.

Replicability

The Finding Places project concluded in 2017. However, the core issues of the refugee crisis and global migration remain a significant challenge for countries and communities around the world. The European Union and several research bodies have highlighted Finding Places as a viable path to sustainable planning for refugees in other areas. Beyond Hamburg, MIT and HCU have promoted the solutions devised for Finding Places for other European "arrival cities" that are facing similar challenges.

Zika Mozzie Seeker

In recent years, countries around the world have experienced outbreaks of the Zika virus. The virus can lead to devastating birth defects when contracted by pregnant women, and is carried by mosquitoes that can be difficult to detect. In order to address this threat and identify invasions of Zika mosquitoes as early as possible, Metro South Health (MSH) of the Queensland Government's Department of Health launched the Zika Mozzie Seeker (ZMS). This initiative transforms traditional disease monitoring efforts by empowering thousands of "citizen scientists" in Queensland, Australia, to deploy mosquito traps, which serve as an early warning system for detecting mosquitoes that can carry the Zika virus.

TREND 01
CASE STUDY

Australia

The problem

The Zika virus is generally spread by Zika mosquitoes, known as "Zika mozzies" in Australian slang. Determining how to monitor a covert mosquito species to prevent transmission of the Zika virus is a difficult task. The key to preventing outbreaks is to keep highly urbanised Zika mosquitoes separate from infected humans, an approach that has proven difficult in regions where the mosquitoes are endemic. In regions that are vulnerable to invasion, there is a risk that undetected invasions will result in the belated recognition of Zika outbreaks, with subsequent severe health impacts to the community and health authorities.

Zika mosquitoes are present in Queensland but are not yet found in the highly populated region of south-east Queensland, where about 70% of the population lives. However, the region is increasingly vulnerable to invasion along domestic and international freight pathways, and receives the majority of international travellers that may carry the infection. However, Zika mosquitoes are notoriously difficult to monitor because of their potential for extremely short flying distances. They lay their eggs in a wide variety of water-bearing containers (above, on and below grou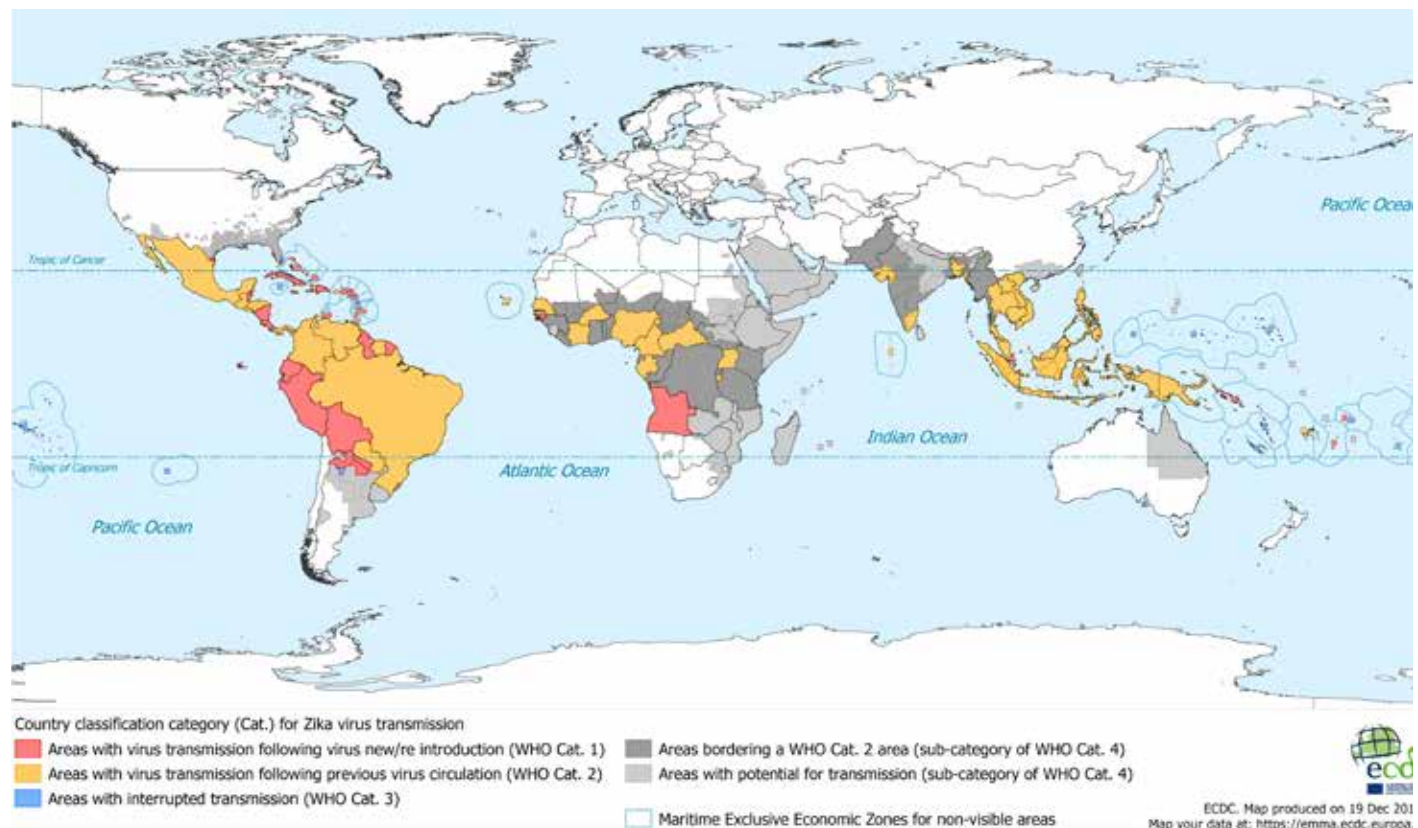nd) and adults fly less than 500 metres from those breeding sites. Both species are highly invasive and are typically transported as drought-resistant eggs in freight.

Zika symptoms may go unnoticed in adults or may be relatively minor (e.g. fever, skin rash, headache and muscle pain). However, rare cases of nervous system disorders (e.g. Guillain-Barre Syndrome) have also been reported.[77] If Zika mosquitoes are not suspected, Zika may not be considered when trying to diagnose symptoms. Thus, transmission may occur because undiagnosed cases are "invisible" to health authorities. Without detection, Zika outbreaks belatedly become visible due to the devastating birth defects that may develop when the virus is contracted by a pregnant woman. Collectively, these birth defects are referred to as Congenital Zika Syndrome, which is characterised most noticeably by microcephaly. Babies with microcephaly have a head that is smaller than expected and in some cases partially collapsed, with smaller brains that may not have developed properly.

As a result of these defects, babies infected with Zika struggle with sitting, eating and sleeping, and are prone to vision and

Figure 24: Zika transmission worldwide   **Source:** https://ecdc.europa.eu/en/publications-data/current-zika-transmission-worldwide.

Country classification category (Cat.) for Zika virus transmission

- Areas with virus transmission following virus new/re introduction (WHO Cat. 1)
- Areas with virus transmission following previous virus circulation (WHO Cat. 2)
- Areas with interrupted transmission (WHO Cat. 3)
- Areas bordering a WHO Cat. 2 area (sub-category of WHO Cat. 4)
- Areas with potential for transmission (sub-category of WHO Cat. 4)
- Maritime Exclusive Economic Zones for non-visible areas

ECDC. Map produced on 19 Dec 201
Map your data at: https://emma.ecdc.europa.

77 See www.health.gov.au/internet/main/publishing.nsf/Content/ohp-zika-factsheet-basics.htm.

hearing problems and seizures. As noted by the United States Centers for Disease Control and Prevention (CDC), "babies affected by Zika virus will continue to require specialised care from many types of healthcare providers and caregivers as they age."[78]

Since 2015, Zika outbreaks have been recorded in 84 countries, including the Americas and countries in the Asia-Pacific region including India,[79] Indonesia, Papua New Guinea Thailand (see Figure 24).[80] During 2015-16, Zika outbreaks prompted the World Health Organization (WHO) to declare a "Public Health Emergency of International Concern". Experts from the CDC have stated that vector control and national Zika surveillance systems to detect occurrences are vital to fighting Zika. Australian and international experts also warned that although Australia had not experienced cases of locally infected Zika, the country is at risk of an outbreak.[81]

Fears over Zika have eased over the last year, as major outbreaks have subsided. However, Zika remains a perpetual threat to parts of Australia. According to Dr Julie Mudd, Senior Lecturer at the College of Medicine and Dentistry at James Cook University, "Zika is still present in many countries. It remains a potential threat to north Queensland, now and into the future."[82]

The risk is that Zika disease notification will precede the detection of Zika mosquitoes in regions where mosquitoes are not established, but vulnerable to invasion. The longer the delay in detecting an invasion, the greater the risk of entrenched infestations and failure of eradication efforts. This delay may also result in more individuals suffering from the effects of the virus.

An innovative solution

In 2017, Metro South Health (MSH) of the Queensland Government's Department of Health launched Zika Mozzie Seeker (ZMS), one of Australia's first health-based citizen-science projects (see Box 4). The aim of ZMS is to enlist large numbers of citizen scientists to set Do-It-Yourself (DIY) urban mosquito egg traps to provide seasonal "early warning" networks for re-invasion by Zika mosquitoes. This species has not been found in south-east Queensland since the 1950s,[83] although robust monitoring is not available. The ZMS initiative is designed to align with WHO recommendations for the development of novel community-based Zika risk management measures and the Office of Chief Scientist Australia's aim to promote citizen science.

Box 4: Citizen science

In citizen science, the public participates voluntarily in the scientific process, addressing real-world problems in ways that may include formulating research questions, conducting scientific experiments, collecting and analysing data, interpreting results, making new discoveries, developing technologies and applications and solving complex problems.

Source: www.citizenscience.gov.

Sharing ownership for invasive mosquito surveillance between health authorities and communities can provide an efficient, flexible, scalable and sustainable solution. Such partnerships help to address the extreme difficulties experienced by health authorities in providing informative surveillance at the spatial-temporal resolution required for detecting invasive urban mosquitoes with very limited flight ranges.

Citizen scientists are recruited using a variety of media and strategies, including Facebook boost posts, that direct them to register online on the ZMS website.[84] MSH sends them, free of charge, an "egg collection kit" and a self-addressed return envelope. Registrants are invited to assemble and deploy an egg trap in their backyards for a few weeks (see Figure 25).[85] Structured communication through a series of prompts (SMS and emails) helps to synchronise each round of the trapping process. Participants complete the process by sending their eggs to MSH for egg counting and aggre-

78   See www.cdc.gov/zika/healtheffects/birth_defects.html.
79   See https://edition.cnn.com/2018/10/11/health/india-jaipur-zika-outbreak-intl/index.html.
80   See www.who.int/emergencies/zika-virus/en and www.health.gov.au/internet/main/publishing.nsf/Content/ohp-zika-factsheet-basics.htm.
81   See www.hospitalhealth.com.au/content/clinical-services/article/zika-still-a-threat-to-australia-400859439#axzz5Y9VALhhS.
82   Ibid
83   See https://metrosouth.health.qld.gov.au/zika-mozzie-seeker/frequently-asked-questions.
84   See https://metrosouth.health.qld.gov.au/zika-mozzie-seeker/register.
85   See https://metrosouth.health.qld.gov.au/file/3366/download?token=GfNnSQ20 for details on how the traps function.

Figure 25: Sample egg trap

Source: https://twitter.com/jacki_liddle/status/930255442466414592

gation into DNA testing cohorts for processing by Queensland Health's Forensic and Scientific Services Virology laboratory. The novel methodology for molecular screening – polymerase chain reaction (PCR) testing – uses highly sensitive DNA tests that can rapidly identify any testing PCR cohorts with signs of Zika mosquitoes (Montgomery et al., 2017). These tests can detect one Zika mosquito egg from among 5 000 traditional mosquito species. This allows eggs from many as 25 traps to be combined into each DNA testing batch. Previously, staff would spend hours individually examining eggs under a microscope.

A sophisticated, efficient, flexible and scalable ZMS Decision Support System has been developed by MSH to co-ordinate the data and information streams between each citizen scientist and MSH. These include registration details, egg data, email and SMS texting for reminders and the provision of individualised results for egg abundance, DNA diagnostics and thematic mapping outputs. The project emphasises two-way communication as the best form of community engagement. This includes return of results to each participant, responding to all SMS/email enquiries from citizen scientists, providing forums to accommodate volunteers and providing face-to face forums for feedback to improve the "user" experience.

Since mid-2016, MSH has partnered with nearly 3 000 citizen scientists in its communities, covering 1 million people (23% of Queenslanders) across 3 856 km², to monitor urban mosquitoes for invasions of Zika mosquitoes. The contribution of each participant is important, as the detection of Zika mosquitoes in south-east Queensland will trigger a comprehensive eradication protocol (Darbro et al., 2017). For each round of participation, MSH provides citizen scientists with a customised report (see Figure 26), and encourages them to submit photos on Twitter using the hashtag #zikamozzieseeker.[86] MSH also publishes a collective egg abundance "heatmap" on the ZMS website.

ZMS also seeks to mobilise community action through awareness and education, empowering individuals and communities to adopt preventative behaviours (e.g. tipping out water-bearing containers each week) to mitigate the risk of invasion before Zika outbreaks.

In 2019, the Department of Health plans to assess the feasibility of rolling out ZMS throughout the remainder of the southeast Queensland region. MSH is also developing partnerships to provide ZMS education opportunities in schools and complementary strategies to address geographic gaps in community participation.

Novelty

Zika Mozzie Seeker transforms traditional urban mosquito surveillance methods by linking citizen scientists to a world-first method of molecular screening. The ZMS system can co-ordinate large numbers of community members across broad geographic areas to collect and submit large volumes of mosquito egg samples for rapid screening of mosquito DNA.

Results and impact

Four synchronised rounds of trapping have been conducted since February 2017. Each round attracted an average 694 registrants on the ZMS website, with a total of nearly 3 000 registered citizen scientists. For each round, an average of 60% of participants successfully collected eggs in their traps and sent them to MSH for DNA testing. To date, ZMS has resulted in the testing of over 169 000 mosquito eggs with only 81 batch PCR DNA tests needed.[87]

Zika Mozzie Seeker sampling data also provide evidence to improve the confidence of health authorities and assure the participating community that their region is not widely infested with Zika mosquitoes. These citizen-science generated data also constitute important baseline data to assess the risk of infected travellers and can complement modest council programmes on at-risk pathways and federal programmes on first points of entry.

User perspective

Users participating in online feedback forums discussions hosted by the ZMS team appreciated the ability to contribute positively to science and public health, and believed that their work helped the community. They also saw ZMS as an example of the public sector taking a proactive stance on a serious issue.

Challenges and lessons learned

A defined pathway to guide the project through to commercialisation would have been helpful, according to the innovation team behind ZMS. Most project staff were part-time and competing priorities disrupted and delayed timelines and some communication efforts. To help mitigate this challenge, a clear vision and project plan were developed and enabled a small team of inspired individuals to focus on solving emerging issues and provide innovative outcomes. Governance by a multi-disciplinary project team that represented the various organisational stakeholders was key to the project's success.

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86 See https://twitter.com/hashtag/zikamozzieseeker.

87 See https://metrosouth.health.qld.gov.au/zika-mozzie-seeker/results for additional details on programme results.

To make ZMS work, a new resourcing model that supported partnerships between individual communities and the health authorities was necessary. Access to innovation funding to employ project staff was critical to success, and was provided by committees within Metro South Health and Queensland Health. Finally, the development of a ZMS website proved key to co-ordinating the delivery of information to the public.

The ZMS innovation team issued a few recommendations for others planning to engage in similar work:

» Do not be afraid to challenge the norm; look for opportunities to promote innovation within your organisation.

» Be prepared to collaborate with partners that have different areas of expertise.

» Be prepared to commit specialised community engagement staff to any project that requires liaising with the public and a range of organisational stakeholders. The engagement process should be structured and receptive to feedback.

» Repeatability of results is important to demonstrating project success, so build iterative components into the project plan.

Replicability

The objective of the ZMS project was to develop a blueprint for a citizen science platform for invasive mosquito surveillance that is efficient, flexible, scalable and sustainable. This blueprint can be adapted to detect Zika mosquitoes throughout Queensland, the rest of Australia and in other countries. The same concept may also be applied for other diseases and other types of insects. MSH is drafting a guide on how to deliver ZMS and leverage the decision support system.

ZMS is a powerful tool for engaging communities and confirming the absence of Zika mosquito species for countries and regions vulnerable to invasion but not yet affected by Zika outbreaks. Citizen science provides an ideal platform for conducting this surveillance, as the issue is one critical to the participant, and the tool provides reassurance that vectors are not present in the immediate domestic environment. However, it also provides baseline data for health authorities to ascertain the risk of exotic mosquito-borne disease transmission, and can detect an invasion early enough to implement a successful eradication programme.

Figure 26: Customised Zika Mozzie Seeker report
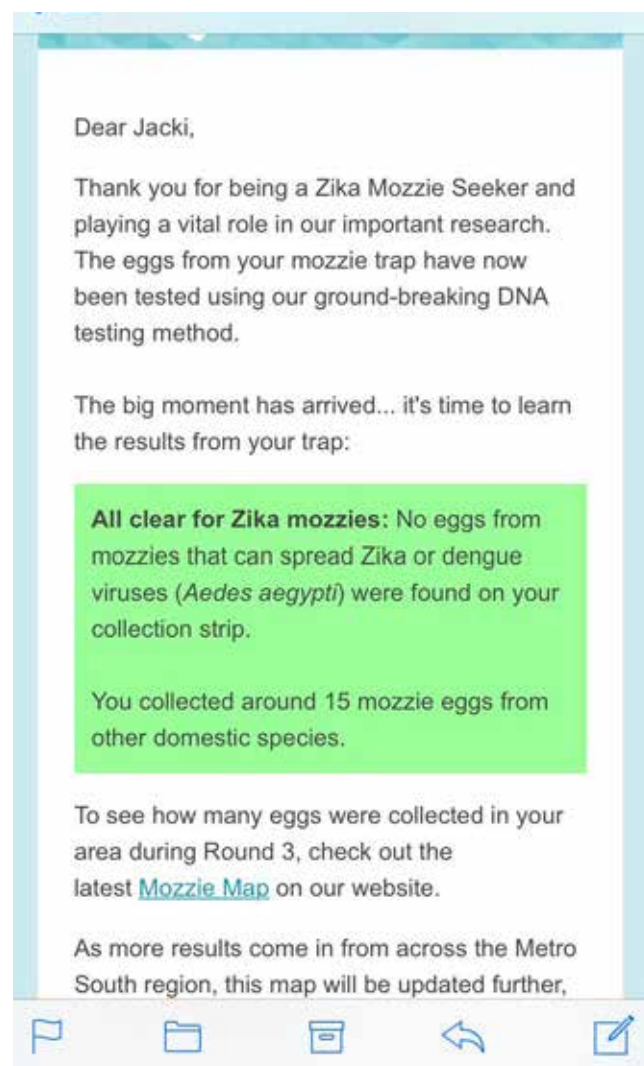
Source: https://twitter.com/jacki_liddle/status/942688416835104768

02

> *Governments are increasingly looking for ways to improve citizen participation in democracy, government benefits and the economy.*

Traditionally, the complexity and opaqueness of government has served to limit participation and minimise public value for underserved and at-risk populations. Only those with the means or knowledge to navigate this environment have been able to maximise the value of government. However, new technologies, open data and the emergence of new business models in the private sector are creating space for government to explore a range of possibilities. Such mission-oriented and adaptive innovations seek to explore ways to open doors for everyone to access the public value of government, while also embracing the major shifts occurring in people's everyday lives.

The circular economy as currency

One innovative manner in which governments increase access is by harnessing untapped elements of using the circular economy to create value for citizens. While the circular economy is not a new concept, the signing of the Paris Agreement on climate change in 2015 brought it to the fore, with governments and people worldwide seeking more sustainable solutions that limit the damage of climate change (see Box 5). Concepts based on sustainable design, upcycling, recycling, repairing, reusing and refurbishing are increasingly entering the public sphere in response to societal demand for alternatives to the production of new things.

In her recent book, *Doughnut Economics*, economist Kate Raworth argues that humanity is living outside its means, and that to ensure long-term sustainability, every country needs to participate in a more sustainable economy. Raworth's model connects the social foundations of society with the ecological ceiling. In so doing, it reframes economic growth

Box 5: Circular economy

The circular economy is an economic concept that advocates the continual rebuilding or regeneration of the health of the system. It represents an alternative to the traditional linear economic model in which actors use and then dispose of items.

Focusing on a circular economy that limits waste should enable governments to create a more sustainable and environmentally friendly economy. While this may require a change in behaviour, the quality of life of consumers will likely improve or at least remain the same. However, this approach may require a shift in business models for companies.

In 2012, *Towards the Circular Economy: Economic and business rationale for an accelerated transition*, commissioned by the Ellen MacArthur Foundation and McKinsey & Company, made the case for the circular economy across the European Union, with billions of potential savings in net materials.

Source: Ellen MacArthur Foundation, 2013
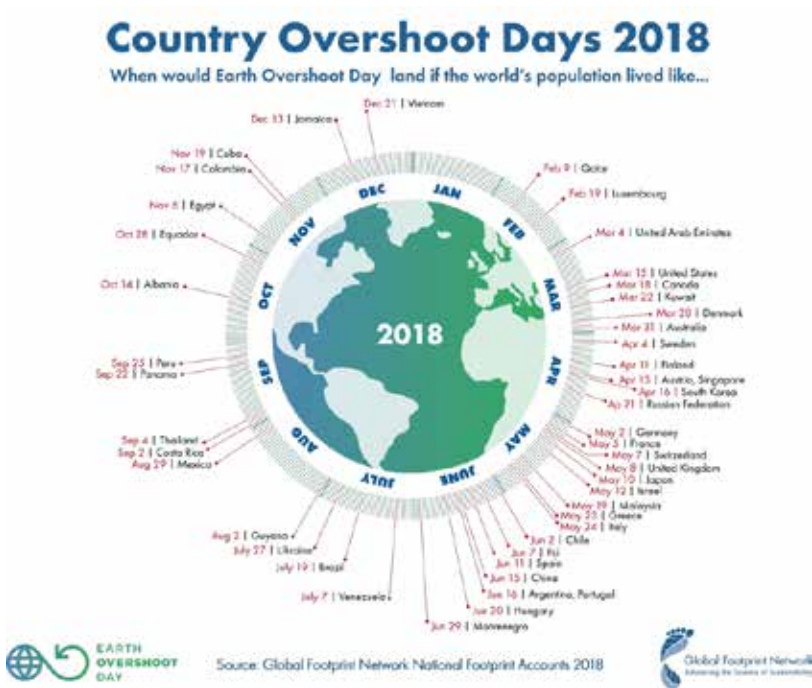
TREND 02: OPENING DOORS

Figure 27: Doughnut economics and sustainability

Source: www.kateraworth.com/doughnut.

Figure 28: Comparing sustainability of resource use by country

Source: www.overshootday.org.

and development and links the social and economic challenges facing the world to the environment (see Figure 27).

Indeed, humanity has collectively used more from nature than the planet can renew per year since the early 1970s (Global Footprint Network).[88] The day in which this happens is now referred to as "Earth Overshoot Day." In 2018, Earth Overshoot Day arrived on 1 August, the earliest date since tracking began in 1968. Figure 28 shows "Earth Overshoot Day" by individual states, if everyone in the world consumed energy like an average person living in the country in question.

Many governments are taking a multi-pronged approach to improving sustainability that includes a combination of policy, sustainable design of goods and services, and tax incentives. For instance, Ireland has created four Climate Action Regional Offices as Centres of Excellence to ensure a co-ordinated response and to assist with the roll out of national and regional policies at the local level. The public sector is also starting to combine sustainability and economic incentives in creative and new ways.

By assigning an economic value to sustainable products and activities, governments are finding innovative ways to create new opportunities, incentives and paths for society, in order to benefit from government action while also stimulating society to contribute to the circular economy. In so doing, governments are turning participation in the circular economy into its own currency – an approach which, in turn, helps to create new ways to access the economy and government benefits for poor, venerable and at-risk populations.

One of the easiest ways for governments to encourage individuals to participate in the circular economy is through recycling. While recycling is available in most countries, participation has remained uneven across OECD member countries.

As many interventions are proving ineffective, governments, NGOs and even private industry are incentivising recycling in new ways. These strategies link recycling to economic and societal benefits for members of society, and in this way create new opportunities for individuals.

One interesting example that may have implications for the public sector is the monetisation of recycling by companies in the private sector. In Indonesia, an app called GRINGGO[89] (originally named CashforTrash) was developed to help connect people with waste management companies. Residents could select "plastic, paper or electronics", and once they were ready to sell their waste, generate a map of nearby locations for pick-up or drop-off, and the estimated value of their recycled goods. GRINGGO thus creates a model for incentivising recycling while also profiting from the process (see Figure 30).

Figure 30: GRINGGO – how it works

1. You sell garbage
2. We harvest the recyclables
3. We sell the recyclables to factories and processors for recycling
4. We share the profits with you

Adapted from source: https://gringgo.co/end-ocean-plastic-now

Aside from cash incentives, other countries and local governments are incentivising recycling through other rewards. For example, in various cities in Brazil and Mexico, where healthy food is often expensive and unaffordable for impoverished populations, governments are using recycling and proper waste disposal as a currency to obtain vegetables. In Mexico City, the city created a barter market,[90] the Mercado de Trueque, where people swap recyclables for fresh vegetables. People can also buy vouchers for seeds so they can grow their own food at home. Each year the market distributes over 3 tonnes of agricultural products in exchange for recycled goods. In Brazil, many cities have started similar schemes inspired by the Mexico City model.

One of the case studies presented later in this chapter explores the intersection between the circular economy and increased access to public transportation for at-risk populations in Surabaya, Indonesia. A 2015 Harvard Study found that access to transportation is the single biggest factor in improving the chances of escaping poverty and avoiding homelessness (Chetty and Hendren, 2015). By linking incentives to recycle with efforts to help the impoverished population access more consistent transportation, Surabaya provides an innovative solution to recycling by making recycling itself a currency.

A different and unique approach to participation in the circular economy is taking place in Ljubljana, Slovenia, where the government is adopting a new and sustainable solution to tackling invasive alien plant species (IAPS). What started four years ago as a government programme offering to collect uprooted IAPS for free, has now evolved into an exploration of ways to use IAPS as an economic catalyst.[91]

IAPS displace local vegetation, destroy agricultural land and cause billions of euros in annual damage to the economy. In Europe, the most prevalent IAPS is Japanese knotweed. In 2016, Ljubljana began looking at more sustainable ways to reuse the plant that could benefit the city. The city collected 1 520 kg of Japanese knotweed and transformed it into 415 kg of paper. This paper was used to create over 1 600 bags that were used by businesses and environmental protection publications.

At the end of 2017, Ljubljana transformed the project into APPLAUSE, an ambitious programme that aims to use IAPS as a resource for new business models. APPLAUSE expands the list of IAPS and explores new potential uses including materials for emerging industries (e.g. 3D printing), wood products, food and dyes. By evolving the city's approach to IAPS, Ljubljana is finding new solutions to protecting the ecosystem, incentivising citizens to become part of the solution and turning a potential ecological issue into an economic advantage for the city.

Figure 31: List of uses for processed invasive plants

Paper products

Input materials for the industries of the future

Wood products

Invasive alien plant species as a food source

Dyes and hybrid coatings

Extracts for controlling of plant harmful organisms
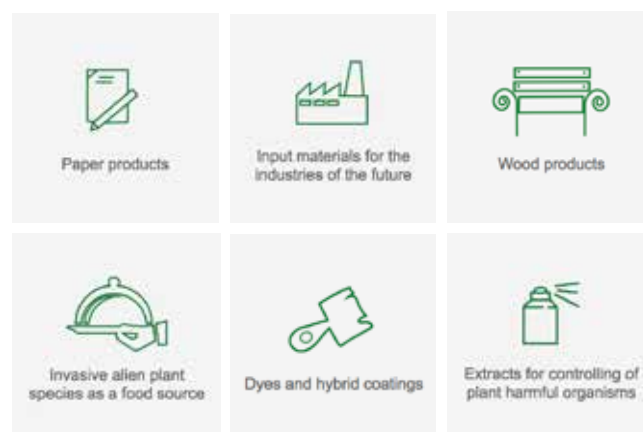
Source: www.ljubljana.si/en/applause.

89 See https://gringgo.co/end-ocean-plastic-now.

90 See http://data.sedema.cdmx.gob.mx/mercadodetrueque.

91 See https://oecd-opsi.org/innovations/processing-of-invasive-alien-plant-species-into-new-useful-products.

Deriving public value from the platform economy

The sharing economy, in which communities and individuals work together and share goods and services, is not new. Over the past decade, private industry has created a business model around the idea of the sharing economy that has exploded in size, scale and popularity. New platforms centre around matching individuals' needs to those who have supply and wish to monetise underused resources (see Box 6). This model opens new doors for individuals to earn additional income, creating greater economic alternatives. The explosion of businesses using this model is due in part to the willingness of populations around the world to share their own assets for monetary gain and to use other people's under-utilised assets (see Figure 32).

Box 6: What is the difference between the sharing economy and the platform economy?

The terms "sharing economy" and "platform economy" are frequently confused. As no unified definition exists for either term, they are often used interchangeably, but should be distinguished.

The sharing economy focuses primarily on peer-to-peer transactions of goods and services that have economic impact. In the sharing economy, economic impact does not necessarily involve a monetary exchange. For example, many cities encourage carpooling which increases access to reliable transportation, reduces traffic congestion and lowers greenhouse gas emissions.
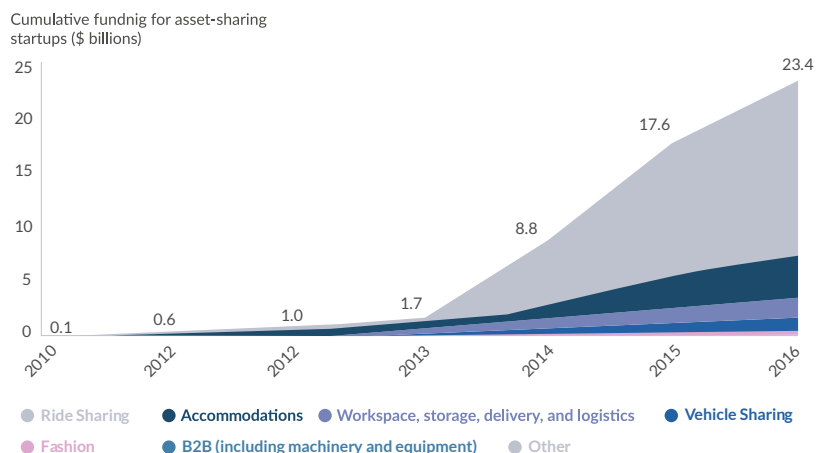
In the platform economy, there is an implied monetary exchange for the goods and services, and these micro-transactions occur through an online platform that takes a percentage of the monetary exchange. With this model, the platforms provide a hub in which an individual can be both the consumer and provider. The platform receives compensation for providing the opportunity, but the responsibility and liability generally still falls on the individuals involved in the transaction.

While the size of the platform economy is difficult to assess in terms of economic impact (e.g. measured in terms of GDP), the number of companies being created, the amount of venture capital funding, and the diversity in goods and services shared on platforms continues to increase (see Figure 33).

The exponential growth of sharing platforms is a controversial topic. While it has created new opportunities to increase individuals' wealth, national and sub-national governments are still grappling with how to regulate the platform economy, whose emergence has disrupted transportation, housing, fashion and other markets. As the adverse effects of the platform economy become clearer and more acute, governments are trying to find the balance between creating space for innovation and protecting vulnerable populations that could be

Figure 32: The rise in acceptability of the sharing economy

- Willing to share own assets
- Willing to share from others
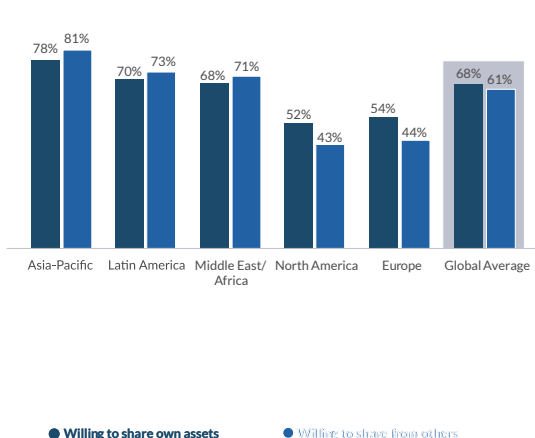
Source: www.statista.com/chart/2323/the-rise-of-the-sharing-economy.

Figure 33: Sharing economy start-ups have received more than USD 23 billion in venture capital

Cumulative fundnig for asset-sharing startups ($ billions)

- Ride Sharing
- Accommodations
- Workspace, storage, delivery, and logistics
- Vehicle Sharing
- Fashion
- B2B (including machinery and equipment)
- Other

Source: Wallenstein and Shelat, 2017.

harmed. For example, many popular tourist destinations, such as Amsterdam and Paris, are now in the second or third iteration of attempts to regulate Airbnb, the popular temporary housing accommodation platform (see Figure 34).

Figure 34: Cities creating restrictions for Airbnb

Source: www.telegraph.co.uk/travel/news/where-is-airbnb-banned-illegal.

The immediate reaction of governments to new business models is to focus on regulation. However, as a model becomes more entrenched and accepted by society, governments increasingly use adaptive innovative techniques to explore how the platform economy can improve their public value. Individuals working in the public sector often engage with the platform economy in their personal lives, and are inspired to use the model to improve the efficiency, effectiveness and public value of government.

While the notion of "government as a platform" has been theorised for some time, governments are starting to experiment and test different models for turning theory into action. One of the studies in this chapter explores the case of the city of Amsterdam, which drew inspiration from Kirklees in West Yorkshire, United Kingdom, to explore different models for improving public value. The city of Amsterdam conducted a pilot programme to find ways for non-governmental organisations (NGOs) to access under-utilised government space. Kirklees Council, on the other hand, created a platform called Comoodle,[92] which instead of exploiting government's under-utilised assets, allows citizens to volunteer their under-utilised goods and services to NGOs focused on social impact. In both of these examples, governments are adopting private sector models to create new opportunities and open doors for NGOs that are working to improve society

but may not currently be operating effectively due to inadequate funds for space, goods or services.

Governments are also partnering with non-profit organisations to provide platforms to resolve community issues. For example, the city of Toronto created a four-month HomeShare Pilot, which places students with older adults who would like to provide a space for student living.[93] This project increases the pool of affordable housing for students – an issue in Toronto – and helps older adults by providing student support with household activities. The project has been shown in other locations to create unique bonds between individuals who likely would not have connected without the programme.

As governments learn and experiment with creating their own platforms, some governments are conducting experiments by partnering with private industry platforms to solve local and national issues. The city of South Bend, Indiana, located in the Midwest of the United States, has partnered with ride-sharing apps to provide consistent transportation, where scaling and expanding public transportation proved ineffective and costly. This example, detailed in a study later in this chapter, offers an interesting case for less dense cities where distance and less urban populations create public transportation challenges.

Another example of partnership is taking place in Singapore, where the government is conducting a trial using Facebook to create a digital platform that opens up new possibilities for agencies to "borrow" civil servants with relevant and needed skillsets. A first attempt to build an internal version of this platform failed due to lack of adoption, however civil servants have quickly adopted the new Facebook platform as most employees already use the social media site in some capacity. The programme, entitled #ShareYourSkills, is hosted on Workplace, Facebook's professional offering on its social network, and aims to meet the changing needs and demands of the public sector, including:[94]

» younger employees' desire for non-linear career paths and new experiences

» increasing transparency in the need for emergent skills

» a reduction in e-mails by listing job and skills announcements on the platform

» the creation of a two-way rating system that allows both sides to "rate the experience".

As the platform economy further seeps into the public sector, new opportunities to provide increased access, connections and value will become available.

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92 See https://oecd-opsi.org/innovations/comoodle-a-collaborative-platform.

93 See www.rgptoronto.ca/older-adults-sharing-homes-with-students-learn-more-on-july-19.

94 See https://govinsider.asia/innovation/exclusive-why-this-unit-brought-facebook-into-singapores-government.

Improving access to justice

The United Nation's Sustainable Development Goals (SDGs) represent a global call to action in key areas, including access to justice and a strong rule of law (SDG 16.3), both of which are framed as core objectives for states to achieve by 2030.[95] The OECD's Framework for measuring public services to citizens, presented in *Government at a Glance 2015*, includes a focus on the judicial system and measures indicators across three dimensions: access, responsiveness and quality (see Table 1).

95 See https://sustainabledevelopment.un.org/sdg16.

A useful lens through which to explore these three core dimensions is that of an asylum seeker. *Access* from this perspective would depend on the ability to participate in legal systems, including the ability to communicate the asylum request in a language understood by all parties involved. *Responsiveness* would refer to an asylum claim being processed within a reasonable period of time, as opposed to a long backlog that prevents claims from being heard. *Quality* would relate to rates of acceptance and rejection of asylum claims.

Table 1: OECD Framework for measuring public services to citizens   **Source:** OECD (2015b).

Figure 35: Citizen confidence in the judicial system and the courts, 2007 and 2016   **Source:** Gallup World Poll (database).
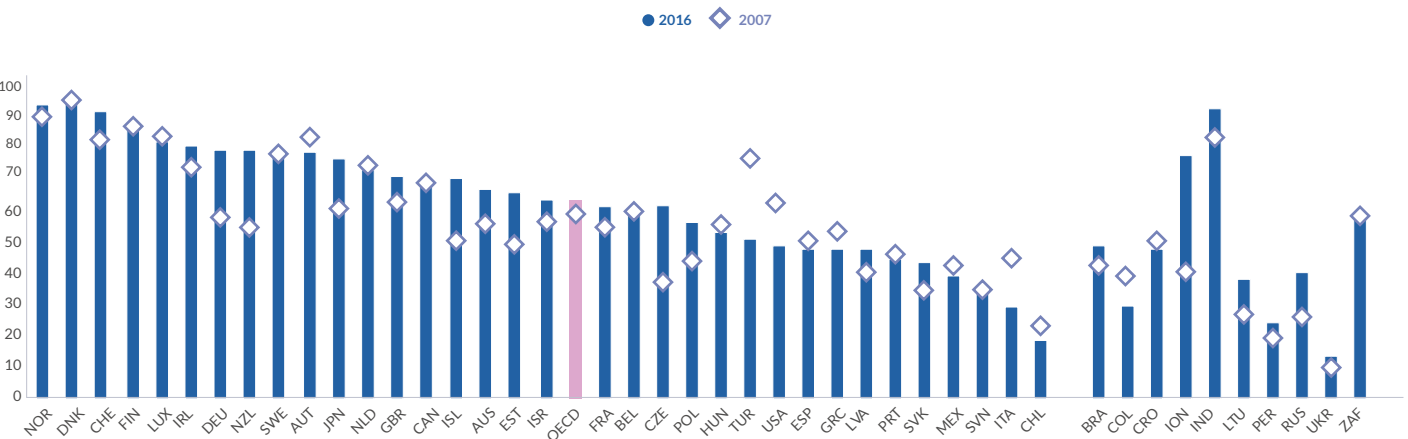
If all asylum claims are systematically rejected, or if there are significant discrepancies between approval rates depending upon where the courts are located in a country, then the system is not effectively administering justice.

Judicial systems across the world are being challenged to ensure fair access and treatment for all, but citizens' perceptions of these legal systems vary significantly across OECD countries, and have changed dramatically over the past decade – both for better and for worse.

While governments have strong incentives to increase access to justice, implementation has been uneven. Article 6 of the European Convention on Human Rights (ECHR) elucidates a fundamental, international principle of the separation of powers: court systems must be impartial and independent from the executive branch. While this principle constitutes a foundation of modern judicial systems, it has also served to isolate these units from many innovative initiatives and trends taking place in the executive and legislative branches of governments. While these other arms of government have undertaken enormous steps to transform themselves from classical, hierarchical 19th-century models into reactive, forward-thinking examples of governance, judicial systems may not have kept pace with these advances. As such, procedures in judicial systems still feel opaque to most citizens (see Figure 36).

Figure 36: Percentage of people who feel highly informed about legal procedures (2013)
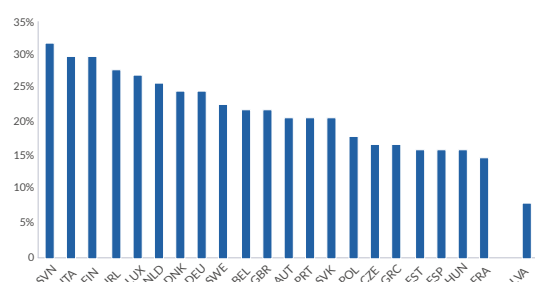
Source: OECD, 2015c.

Figure 37: Key barriers to justice
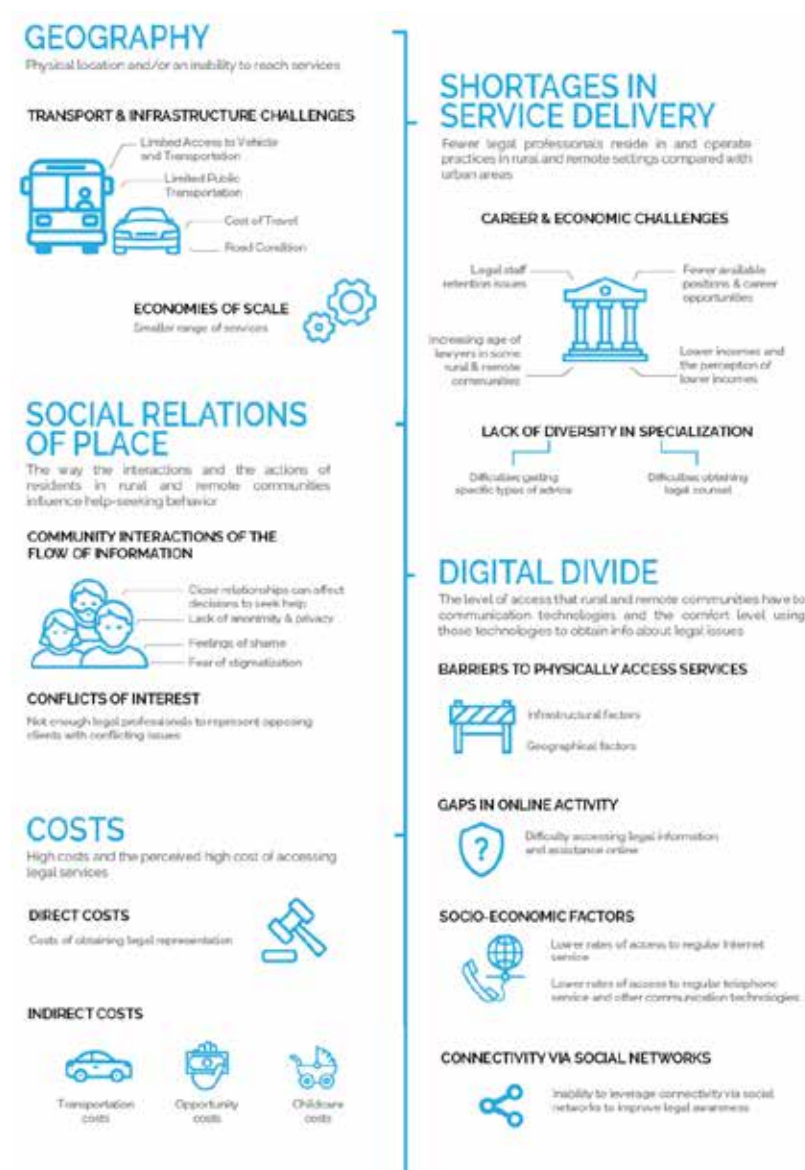
Source: OECD and Open Society Foundations, 2016.

According to the OECD, access to justice is crucial because:[96]

» it acts as a determinant in inclusive growth, citizen well-being and sound public administration

» it influences economic performance as well as business, trade and the investment climate

» it relates directly to trust in government.

By focusing on improving access to justice, governments have the ability to create new opportunities for economic growth, wellbeing and equality across society. The OECD has helped to identify key barriers related to access to justice (see Figure 37).

Access to justice has re-emerged as a focal point in the effort to ensure that everyone is able to utilise and access judicial systems, regardless of their situation. In this context, a number of new practices and solutions are being tested.

In Sierra Leone, extended or unlawful pre-trial detention was shown to damage the prosperity and health of prisoners and their families (Open Society Foundations, 2013). However, an Oxford University study found that a programme placing paralegals in prisons to provide free legal services reduced the numbers of prisoners held on remand by 20% and increased the percentage gaining access to bail by 13% (OECD and Open Society Foundations, 2016).

Another recent trend is the development of citizen assemblies to increase the access of citizens to government policy and legislation. In Ireland, such an assembly consists of 99 non-elected members of the public – representing a broad cross-section of society in terms of gender, age, social class and regional spread – which can make recommendations to the Irish Parliament. In total, the Assembly has produced four reports on five topics, including 77 recommendations spanning constitutional, legislative and policy proposals. This deliberative democracy, which places citizens at the heart of important legal and policy issues with the benefit of expert advice, reduces bureaucracy and opens up paths for citizens to engage with government in new ways.[97] With greater levels of participation, more members of society can access and participate in the justice system.

The Indian state of Bihar has instituted the right to public grievance redress.[98] The adoption of the Citizen's Charter and Right of Public Services legislation had previously improved service delivery, but public grievances still went relatively unaddressed. In order to confront this issue, the Government of Bihar decided to create a radically new system that would grant legal rights for grievance redress to all 100 million citizens. The system would introduce a one-stop solution for citizens, a new inde-

pendent authority to judge cases based on evidence provided by the public authority and complainants, and a focus on actual redress. This new system incorporated 44 government departments with 478 schemes plans and services. It also included an ICT system to ensure transparency and tracking, a 60-day time limit on administering cases, and guidance for public authorities on how to handle redress.

As transparency of information is a critical theme in most justice-oriented innovations, it also provides an opportunity for civil society to play a role. A case study later in this chapter on Code for America, a civil society organisation in the United States, shows how access to data can open doors to engaging broader civil society in improving access to justice.

96 See www.oecd.org/gov/access-to-justice.htm.

97 Read more about the Assembly on the OPSI case study platform https://oecd-opsi.org/innovations/the-irish-citizens-assembly.

98 See http://lokshikayat.bihar.gov.in/DefaultEn.aspx.

Recommendations

Governments are stepping up to solve the complex problems they are facing through creative and adaptive solutions. The most innovative governments are using these opportunities to open doors to improve citizen participation in government, provide opportunity to at-risk populations, and improve the economy. It is understood that complex problems are not bespoke, and now governments are creating solutions in the same manner – looking for opportunities to improve multiple societal problems through a holistic approach. This method creates new challenges – both internally and externally. Internally, governments will need to ensure they are prepared to operate outside of current silos so that creative solutions can continue to emerge. Externally, governments must continue to monitor and search for unintended consequences, especially when adopting private sector solutions. Governments are moving in the right direction, and early adopters are paving the way and are creating models that can be applied to various contexts and problems.

» **Explore the intersectionality between sustainability and economic catalysts.** Economic and environmental sustainability are often seen as diametrical opposites of economic growth. Governments should not only look to improve sustainability, but also use the opportunity to create a solution that improves the lives of citizens through various policies and services that incentivise and reward behaviour. As governments combat challenges such as climate change and nudge society to make more sustainable choices, they are also connecting these innovative solutions with economic catalysts. These economic catalysts create new opportunities for at-risk populations. This process can also spur entrepreneurship and innovation and become an inclusive solution that engages the public sector, civil society, private sector and citizens.

» **Remain vigilant for unintended consequences.** Government adoption of platforms to improve public value and create new opportunities is not a surprising trend. It follows the same pattern as government's embrace of social media following widespread adoption by the private sector and citizens. However, as the negative effects of the platform economy become better understood, government should remain vigilant and work to prevent similar consequences on from affecting their own platforms. Such risks could include unintentionally harming private markets, reputational risk from partnering with the wrong platforms, and decisions regarding the platform's scale and scope. While many of these consequences may be unavoidable, government should design solutions with these concerns in mind and stay nimble, so as to be able to pivot or adjust as the market evolves.

» **Enhance government adaptability to citizen needs to improve access to justice**. Court systems must constantly seek out new ways to explore what is possible, simplify procedures and reduce burdens on citizens to access or understand court systems. But access to justice requires a system approach that extends beyond just process streamlining, IT, data and transparency. As society becomes increasingly complex, justice cannot reduce barriers or improve access without a more comprehensive and inclusive problem-solving approach. Governments must understand that justice relates to how all parties, including the most vulnerable members of society, engage with the system and are able to obtain effective access to justice.

02

Sharing economy for government spaces

The city of Amsterdam ran a pilot scheme to permit civil society organisations to access under-utilised offices in government buildings, introducing the potential for Airbnb-type space-sharing in city buildings. The city's Technology Office launched the initiative after observing that many offices go unused, even though the city had to pay for sunk costs such as heating, electricity and security. Over a period of eight months, a municipal building opened city rooms for use, providing a proof of concept that sharing government resources was a feasible way to meet public needs. Through this innovative project, the City of Amsterdam has participated in the sharing economy, and hopes to expand the concept beyond renting rooms to municipal vehicles and tools.

TREND 02
CASE STUDY

Amsterdam, Netherlands

The problem

The city of Amsterdam struggles with space. The general density of the city centre, combined with the lack of lack of high-rise buildings and relatively high costs of renting in the city, makes finding space a challenge for civil society organisations. The cost of renting a small meeting room in Amsterdam for a couple of hours, without any amenities such as coffee or Wi-Fi, starts at EUR 200-250. The more space and amenities desired, the greater the cost.

Simultaneously, numerous government buildings go unused and could easily meet the demand and needs of civil society organisations. Project lead Nanette Schippers informed OPSI that, "At the times of day when associations are having meetings, such as nights and weekends, many rooms in government buildings go completely unused. Schools are a great example of buildings with part-time use. It's a missed opportunity for other parties to use these spaces."

"There is not a lot of space, but there is a lot of underused space."

Nanette Schippers, Economic Affairs, Amsterdam

Another critical element is that the city of Amsterdam's relationship with the "sharing economy" has changed dramatically, impacting significantly the lived experience of residents and visitors. As a hyper-popular destination for Airbnb, with 25 000 rentals, Amsterdam has recently started enforcing strict regulations to encourage respect for the cultural and historical integrity of neighbourhoods. In 2018, the municipality of Amsterdam limited Airbnb rentals to just 60 days per calendar year, a figure which halved to 30 days as of January 2019.[99] The nature of sharing economies and platform economies is evolving rapidly, and local governments must be responsive to the needs of their communities in a manner that promotes local interests without handicapping potential local economic growth.

An innovative solution

In 2018, the Chief Technology Office launched a three-month pilot project that opened up rooms in government buildings for sharing with civil society organisations. The Amsterdam municipal leadership was already highly engaged with the complex political questions surrounding the sharing economy and wanted to find new ways to better serve citizen interests. After obtaining project approval, the first critical decision for the Chief Technology Office was to determine which specific governmental build-

Figure 38: The Amsterdam Chief Technology Office designing the room-sharing initiative

Source: City of Amsterdam.

ing was most appropriate for an initial pilot test. Ultimately, they settled on their own. "Being in a municipal building, it was fairly easily accessible and not connected to any other departments – which was easier for us to handle", said Ms. Schippers.

For the Chief Technology Office, it was essential to select organisations with a social mission – not simply to open up office space for use by for-profit firms. The first major participant in this initiative was the association Hack Your Future,[100] which teaches software coding to refugees to help them become software developers. The association made use of four meeting rooms for their lessons. Due to the success of this collaboration, the pilot project was extended from three months to eight months. Eventually, the pilot wound down due to a lack of adequate resources to ensure continued success on the part of the city of Amsterdam's facilities department. However, the Chief Technology Office is evaluating options to re-launch and expand the pilot in the near future, taking into account the lessons learned from the initial trial.

The project drew on several sources for its inspiration, including the participation of Ms. Nanette Schippers in the Sharing Cities Summits,[101] where she learned about public sector innovators
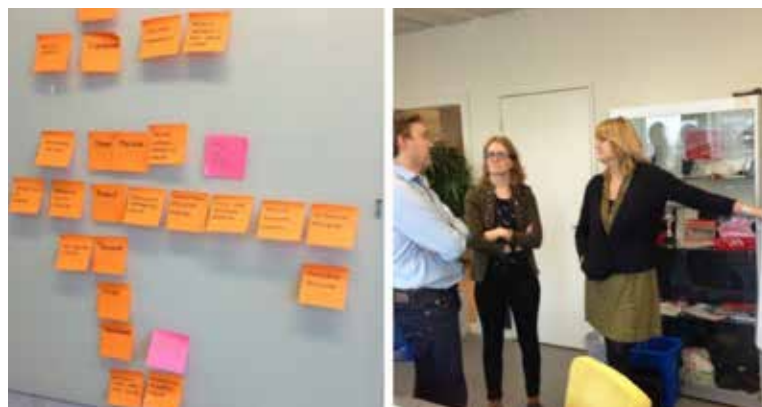
99   See www.dutchnews.nl/news/2018/01/amsterdam-slashes-airbnb-rental-period-from-60-to-30-days.

100 See www.hackyourfuture.net.

101 See https://sharingcitiesalliance.com.

Figure 39: A user journey mapping exercise helped understand how participants would interact with facilities

Source: City of Amsterdam.

such as Comoodle (see Box 7), a recent winner of the Bloomberg Mayoral Challenge.[102] Ms. Schippers participation in a Design Thinking workshop run by THNK,[103] furthermore reinforced her forward-leaning mentality, encouraging her to look for occasions to innovate within her own team's workstream. Once the team settled on this particular project, they implemented a "user journey" mapping exercise to understand how the participants would interact with the facilities (see Figure 39). This preparation was crucial in ensuring the seamless operation of the pilot.

Sharing unused rooms in a government building is an example of adaptive innovation, as the solution is based on the principle of the sharing economy, applied to the local context. The project is scheduled to resume soon: "The intention to scale is still there", Ms. Schippers explained. "In March 2018, we had city elections and since June a new coalition. This project is very compatible with their vision." The next iteration of the project plans to expand the use of unoccupied rooms and scale it to include the use of municipal cars and tools.

Novelty

Government adoption of the sharing economy approach is relatively recent, and redefines how resources can best add value to the public. This reframing is highly user/citizen-centric, as it complements services already provided by the municipality, while finding new ways to help civil society organisations prosper.

Results and impact

The most immediate impact of the pilot was increased access to a municipal building that Amsterdam residents would not ordinarily enter. The participants benefited from the space, saving hundreds of euros per week while working to improve the conditions of their clients, some of the city's most vulnerable residents. A corollary of this programme has been the positive impact it has had on trust in the government. Direct evidence of government interest in the well-being of residents, without reciprocation, has improved the relationship between the public and government.

This novel approach to sharing public goods could have potential far-reaching impacts well beyond sharing spaces. Taking into consideration the resources spread across national and subnational governments worldwide, it could redefine the role of government as a steward of public goods.

102 See https://mayorschallenge.bloomberg.org/ideas/comoodle.

103 See www.thnk.org.

Box 7: Comoodle

Comoodle was developed to create a local sharing economy in Kirklees, United Kingdom. The web-based platform promotes collaboration and helps local communities access and share under-used resources. "Our goal is to get local governments to share their stuff, skills and spaces", Duggs Carré, Comoodle Programme Leader explained. "That has been a mixed success in many ways. It quickly became clear we were unlikely to make spaces available for free because of the disruption that causes in the market place with other paying users being upset, other lenders of space losing income and us losing income too. So the platform has been changed to allow charging."

Comoodle has also adapted its model, transitioning from a sharing-economy to a platform-based initiative. "In early 2017, we as a team managed over 300 council assets and we were directly involved in 80% of the requests where stuff was lent to groups. But we have now reversed that to make this work more sustainable – we have handed over most of the resources to 'community custodians' and now only manage about 20% of the stock", Duggs explained. Comoodle thus had to transition from being a sharer of content to becoming a platform where others could share their content, in order to adapt to demand.

Source: OECD interview with Comoodle.

User perspective

Gijs Corstens, the Managing Director of Hack Your Future, explained to OPSI the difficulty they encountered in finding a suitable meeting space. "We generally offer our lessons on Sundays, and most places are closed on Sundays. Four or five meeting rooms are hard to come by. Using commercial spaces is expensive, generally costing us EUR 700-800 total every Sunday, which is a lot for us as a non-profit."

A core element of the experience was Hack Your Future's interaction with the government. Gijs was impressed by the professionalism of the civil servants involved and their passion for bringing the project to life. His team also had to confront the realities of a partnership with government, which involved a different set of challenges than partnering with the private sector. "Government is still top-down, with parties having to receive approval from multiple layers of hierarchy", Gijs explained. There were more rules and regulations to contend with, and these extra steps delayed the start of the programme. In terms of room for improvement, Gijs would like to see governments grant greater liberty to frontline staff. "There must be more room for error, experimentation and trust for the people you employ." In spite of these challenges, Gijs expressed his appreciation of the innovative initiative and his hope that Hack Your Future would once again be a willing participant in this programme.

Challenges and lessons learned

The main challenges for the Chief Technology Office were liability and logistical preparedness. They had to anticipate answers to numerous questions, such as who would get a key to the building, who would be responsible for cleaning up spillages, would the security guard need to pass by and with what frequency, and so on. While no issues emerged, the Chief Technology Office undertook scenario planning to map out situations in order to understand how they would theoretically be handled. They have since mapped out their own liabilities and potential worst-case scenarios for room lending, which will simplify tasks once the programme is restarted. This level of preparation represented a huge hurdle, and can now serve as a model for other public sector organisations attempting similar initiatives.

The Chief Technology Office also had to ensure that the project was in conformity with Dutch regulations governing public sector intervention in the private sphere. "We can't undertake any economic activities and can definitely not be unfair competition to commercial rent outs", Ms. Schippers explained. Participants were, however, asked to cover minimal operational costs including coffee and tea, opening buildings and cleaning. Gijs attested that the overall reduced cost enabled Hack Your Future to utilise these services.

Ms. Schippers' core takeaway was "just do it", thereby encouraging other innovators to take the plunge, and pursue forward-thinking and challenging projects. Numerous logistical questions arose and a variety of complications could have blocked the project, were it not for the perseverance of the team. However, the end result was worth it to those who were able to participate in the programme. A second lesson concerned patience. "Amsterdam is stubborn", Ms. Schippers said, echoing the sentiments of public sector innovators globally. "We came to learn that what sounds easy at the start (that we have meeting spaces underused) is never easy and simple. Developing projects to fruition takes a long time."

Replicability

This innovation is highly replicable – every government building likely has workspaces that go unused during the day, and are almost certainly available on nights and weekends, when civil society organisations would happily meet. However, implementation of this project by any government requires point persons to co-ordinate programme logistics, in order to ensure its successful implementation.

Recyclables as transportation fare

The Mayor of Surabaya, the second-largest city in Indonesia, has launched Suroboyo Bus, a new rapid transit initiative that allows city residents to pay for bus fare with recyclable bottles. Commuters can bring plastic bottles directly to public buses or exchange them for bus tickets at recycling centres and drop boxes around the city. Not only does the initiative encourage improved recycling habits, it also helps to provide greater access to public transportation for those with less financial means. City officials also hope that the initiative will increase the use of public transportation in order to reduce the number of vehicles on the congested streets of Surabaya.

TREND 02
CASE STUDY

Surabaya, Indonesia

Figure 40: City residents paying for bus fare with recyclable bottles

Source: https://www.straitstimes.com/asia/se-asia/used-plastic-water-bottles-a-ticket-to-bus-ride
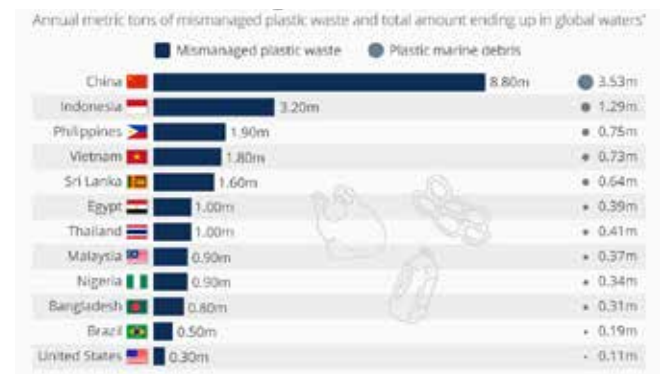
The problem

Indonesia produces nearly 190 million tonnes of plastic waste each year, yet it has a recycling rate of only 2%, with urban areas reaching up to 7.5%, which still rates low compared with large cities in most other countries.[104] Indonesia is the world's second-largest contributor to plastic pollution in oceans, sitting behind only China in global rankings (see Figure 41). In addition, four of its rivers are among the most polluted in the world, including the Citarum River, which ranks as the worst (see Figure 42).[105] This level of pollution causes a number of problems for the world's fourth-largest country. For example, one study shows that the majority of fish caught in parts of Indonesia contain plastic, with contamination found in up to 85% of species in some cases.[106] In addition to helping reduce plastic waste, Suroboyo Bus also has the potential to reduce road congestion. The streets of Surabaya are highly congested with traffic, and 75% of all vehicles on the road are private. Programmes such as Suroboyo Bus benefit the city through fewer traffic jams and congestion, and the world through less pollution and plastic waste in the oceans.

Economically, Indonesia, like many countries, has experienced growing inequalities in the last few years. Recent research has shown that the gap between the rich and the poor has grown fastest here than in all of Southeast Asia, with just four individuals holding as much wealth as the poorest 100 million Indonesians (Oxfam, 2017). The country's currency has also struggled, with the rupiah recently falling to its lowest value in 20 years.[107] In the light of these economic challenges, the government could do much to improve conditions for residents in Indonesia, including providing an alternative means of paying for daily needs such as transportation.

Figure 41: Countries polluting the oceans the most

Source: www.statista.com/chart/12211/the-countries-polluting-the-oceans-the-most.

Figure 42: Pollution in Indonesia's Citarum River

Source: TIMUR MATAHARI/AFP/Getty Images.

An innovative solution

To help improve its environmental standing, the country has pledged up to USD 1 billion per year to reduce significantly the amount of plastics and other waste products from Indonesia that pollute the oceans, seeking to achieve a 70% reduction in ocean waste by 2025.[108] At the local level, the city of Surabaya has set an ambitious target of becoming free of plastic waste by 2020. To help achieve this goal, Mayor Tri "Risma" Rismaharini launched Suroboyo Bus in April 2018, a programme that allows city residents to pay their bus fare using recyclable bottles. Commuters can exchange their bottles directly on city buses, or take them to recycling centres and drop boxes located at different sites

around the city, such as Purabaya bus station, the most active bus station in Indonesia. A two-hour bus costs a rider ten plastic cups, three 1.5 litre bottles or five 600 ml bottles.[109] Each bus is capable of collecting up to 250 kg of plastic bottles per day, representing about 7.5 tonnes of plastic waste each month that might otherwise end up in landfills or the ocean.

104 http://global-recycling.info/archives/1638.

105 https://thediplomat.com/2018/04/indonesias-citarum-the-worlds-most-polluted-river.

106 See www.bbc.com/news/science-environment-43913597.

107 See https://thediplomat.com/2018/09/how-badly-is-indonesias-economy-really-doing.

108 See https://www.theguardian.com/environment/the-coral-triangle/2017/mar/02/indonesia-pledges-us1-billion-a-year-to-curb-ocean-waste.

109 See www.blogcertified.com/2018/12/10/trade-recyclable-water-bottles-for-public-transportation.

Figure 43: Suroboyo Bus launch day with promotional mascots

Source: http://surabaya.go.id/id/berita/47051/modal-sampah-bisa-keliling-kota

Special buses have been deployed for this initiative. The city started with eight new, green, disabled-accessible Mercedes-Benz buses. Each of these buses cost more than three times the price of buses in the traditional fleet, and are much more modern and comfortable. In fact, these buses only accept fare earned through the recycling programme and do not take cash payments, which further incentivises participation in the programme. As a result of the success of the programme, the city added an additional 12 buses in order to expand coverage and increase the frequency of pick-ups.

Recently, the city also launched *GoBis*, an app that can monitor the locations of Suroboyo buses in real-time to help commuters navigate bus routes and pick-up times.[110]

It should be noted that the initiative is not designed to be profitable. City representatives are careful to state that the goal is to promote recycling, and not cost savings. "We know the used bottles and cups we pay as fares wouldn't cover the cost to run the service. The city clearly loses money, but gains when the people's mindset about waste is changed, when people no longer litter", said Erik Kurniawan from Bank Rakyat Indonesia.[111]

Novelty

The project has created an opportunity for Surabaya residents to participate perhaps for the first time in recycling, by incentivising them with better access to public transportation. Not only does this approach improve use of the bus system thereby decreasing the use of cars which are often paralysed in dense Surabaya traffic, it also reduces landfill waste and promotes a circular economy.

Results and impact

In its first three months of operation, Suroboyo Bus collected and recycled 12 tonnes of plastic bottles.[112] Although more recent figures have not been

published, this amount has likely increased, as the city has more than doubled the number of buses in operation.

User perspective

The public response to the initiative has been very enthusiastic. Passengers participating in the programme come from diverse backgrounds and economic statuses. The city has received generally positive feedback from residents. Some have stated:

"Everyone here knows these bottles are equal to bus tickets. I am not embarrassed. In fact, what I do – and many others as well – is what has made Surabaya famous abroad." – Ari Fatah[113]

"Garbage, like plastic bottles, piles up in my neighbourhood, so I brought it here so the environment is not only cleaner but also to help ease the workload of garbage collectors." – Linda Rahmawati[114]

"We can reduce trash so it doesn't pile up at home because we can just bring them in and make good use of it. It is a win-win situation." – Sulastri

Figure 44: Unloading bus recyclables

Source: www.instagram.com/suroboyobus

Replicability

Surabaya has been contacted by numerous governments who are interested in undertaking similar initiatives. Opportunities exist for every city and country to reduce waste through enhanced recycling efforts. There is also room for most municipalities to provide enhanced access to transportation options for their citizens and residents. A similar initiative emerged in October 2018 in Istanbul, Turkey,[115] which enabled citizens to pay their metro and bus fares with plastic bottles and aluminium cans, by using reverse vending machines located at metro stations and schools.

110 See https://www.thejakartapost.com/life/2018/12/29/surabaya-develops-gobis-application-to-monitor-suroboyo-bus.html.

111 See www.star2.com/living/2018/12/11/plastic-waste-recycled.

112 Ibid

113 Ibid

114 See www.reuters.com/article/us-indonesia-environment-plastics-bus/plastic-to-ride-indonesians-swap-bottles-for-bus-tickets-idUSKCN1MX1OD.

115 See www.nytimes.com/2018/10/17/world/europe/istanbul-vending-machines-recycling-subway.html.

Transportation as a Benefit

In South Bend, Indiana, reliable transportation is the primary barrier to stable employment for shift workers. To address this issue, the city of South Bend implemented an integrated network of on-demand transportation options leveraging existing technology to provide Transportation as a Benefit (TaaB).[116] Transportation as a Benefit is a city-sponsored pilot that uses a network of independent transportation providers such as Uber and Waze Carpool to meet the needs of employees and the employers that have adopted the programme. The initiatives helps employees by ensuring they have access to work, and by opening doors to new employment opportunities. The approach results in increased employee productivity and cost savings for employers due to reduced turnover, incentivising them to fund the programme over the long term.

116 See https://oecd-opsi.org/innovations/transportation-as-a-benefit-taab-program.

South Bend, Indiana, United States

TREND 02 CASE STUDY

Figure 45: Young participant in South Bend's "Best. Commute. Ever." cookout. To promote the greater publicity around South Bend's innovation, the city hosted the event to raise awareness regarding alternative means of transportation to work.

Source: https://mayorschallenge.bloomberg.org/ideas/south-bend.

The problem

According to the Mayor of South Bend, Pete Buttigieg, the current size of the city (population 100 000) is sufficiently large to experience many problems usually associated with larger cities (e.g. systemic homelessness, food deserts, etc.), but critically, is small enough to permit experimentation. South Bend, like several other Midwest cities that comprise the American "Rust Belt", was impacted significantly by the loss of major automotive industries in the 1960s, resulting in a lack of well-paid jobs that persists to this day. Approximately 27% of the city's residents live in poverty.[117]

One particular problem that Mayor Pete (as he is known) set out to solve is the city's problematic transportation situation (see Figure 46). In South Bend, reliable transportation is the primary barrier to stable employment for shift workers, contributing to annual turnover upwards of 55%. Turnover costs approximately USD 3 000 per employee and has cascading socio-economic impacts.

The problem of reliable transportation is a consequence in part of the city's layout. South Bend is characterised by large urban sprawl, with residents often living at a distance from work, necessitating travel either by car or city bus (see Figure 47). Because South Bend is a mid-sized city with a low density of residents, the municipal bus system is not always a practical choice, with only 3% of the population opting to use the network, according to the Mayor's office. This in turn decreases interest in the bus system, forcing it to operate on a hub-and-spoke model in which all buses are routed in and out of the central downtown station. This further reduces the practicality of buses as a means of traveling to work. As a result, 89% residents of South Bend use a car to commute. These limited options are not always reliable, and thus can negatively impact attendance at work.

An innovative solution

In 2018, the South Bend Department of Innovation & Technology partnered with four employers (including South Bend's two largest employers) and one vocational training school to test ridesharing solutions. It offered transportation assistance via ridesharing applications to over 500 shift workers in food service, housekeeping, maintenance and home medical care. To conclude the pilot phase, the Department facilitated a co-creation workshop with managers, directors and HR staff from partners, inviting them to share their experiences, concerns and ideas for the programme.

The city's solution, Transportation as a Benefit (TaaB), connects shift workers with the most appropriate and reliable transportation service through an integrated network of on-demand providers. As a result, employers benefit from reduced turnover and increased employee productivity. Furthermore, quantifying these savings will incentivise them to fund the programme over the long term.

The city tested out nine different iterations of the pilot phase, comparing the efficacy of different methods. The first iteration used Uber prepaid gift cards, then moved over to the Uber for Business platform. The latter platform allowed the Department to use real-time data to understand how participants were utilising the service. The city also tested an approach whereby em-

Figure 46: Mayor Pete Buttigieg speaking at the OPSI Conference in November 2018, in Paris

Source: OPSI.

ployees contributed a portion of the cost to see whether this approach better incentivised participants. Eventually, they settled on a model that provided free rides to 500 shift workers using a variety of application platforms.

The underlying concept of TaaB, also known as Mobility as a Benefit, is to reconceive employees' needs for reliable transport as a work benefit offered as part of an employer's benefits package. This approach is especially pertinent when work sites are located on the outskirts of cities. Employers absorb the cost of finding reliable transportation, which provides mutual benefits in terms of improved transportation outcomes and more reliable workforce attendance. TaaB can furthermore reduce traffic congestion, by encouraging carpooling which puts fewer cars on the road.

In 2018, South Bend was recognised as a Champion City of the Bloomberg Mayor's Challenge, and obtained a grant of USD 1 million to help realise and implement the project (see Figure 48). The grant covers the cost of the rideshares and finances the project's three-year second phase, which foresees a gradual

117 See https://datausa.io/profile/geo/south-bend-in.

transition from employers paying 10% of the ride cost in year one, to 30% in year two and 70% in year three.[118]

The four employer partners from the pilot phase have committed to providing financial and operational support moving forward. As the city transitions from reliance on grant funding towards employer contributions, it plans on refining the cost structure of the programme and continuing to explore cost-sharing between employers and employees to deliver the benefit as efficiently as possible. The TaaB programme will also increase take-home pay by preventing attendance-related job loss and allowing employees to work previously inaccessible shifts. Employers will benefit from reduced turnover and increased employee productivity, leading to cost savings and greater workforce capacity.

In the second phase of the programme, the South Bend Department of Innovation & Technology will integrate data from transportation and human resource (HR) platforms to demonstrate the financial impact of the programme for employers. To avoid publicising sensitive data, they will continue to work with a mission-aligned non-profit partner to collect and anonymise ride and HR data. They will also collaborate with a local tech company to build a customer service platform and an integrated data management system. A cost-benefit analysis of turnover and productivity will enable their team to quantify savings, and based on data-driven results and strong support from community partners, the Department anticipates that employers will be incentivised to become the programme's primary funders, thereby ensuring long-term sustainability.

Novelty

The South Bend Department of Innovation & Technology adopted a new approach to tackling the complex problem of insufficient means of transportation, using grant money to experiment with different approaches to providing transportation. Under the leadership of Mayor Pete, this mission-oriented innovation sets out to create a South Bend without transportation issues for workers. It has provided space for frontline staff to experiment and take risks without knowing what form the final result would take. Although the pilot was developed by public sector actors, uniquely it was designed with a view to eventual adoption and continuation by employers in the private sector.

Genevieve Miller, the Project Manager, noted two alternative methods attempted by other governments at the local and national level. One method which South Bend avoided was

Figure 47: Complex transportation issues in the city of South Bend

Low density urban development

Buses run every 30 mins in a hub and spoke model

78% of South Bend residents drive alone

Low-income residents **spend twice the national average** on transportation & South Bend employers experience annual **turnover upwards of 55%**

Source: City of South Bend.

subsidising public transportation. "The only available public transportation is buses, but due to the limited bus schedules (with no buses past 6 pm or on Sundays), for part-time and shift workers, the bus hours could not meet their needs. Currently, in South Bend, the cost of bus passes is subsidised at USD 1, which is already an artificially low cost." Another conventional approach is providing shuttle services to employees. However, there is a "high administrative burden associated with that solution, and a lot of scheduling involved." Furthermore, "superimposing the schedules of the workers makes for a higher level of administrative burden", she explained. These efforts have proven inefficient and unsustainable due to reliance on public subsidies and high operational costs.

The chosen solution does not require costly capital assets, and instead leverages on-demand, data-driven established transportation providers to lower the cost of delivery and increase ridership. By pooling the demand of participating employers, the TaaB programme achieves economies of scale to distribute overhead costs and the risk of under-utilisation.

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118 See https://oecd-opsi.org/wp-content/uploads/2018/09/TaaB-Budget_South-Bend.pdf.

Results and impact

As a result of the programme, employees have been able to work more hours, and employers have experienced a significant reduction in absenteeism and late arrivals, leading to benefits including increased scheduling flexibility and decreased overtime costs. Employees with access to ridesharing were 8 percentage points less likely to be absent, 1.2 percentage points less likely to be late, and worked an average of one additional hour per shift, according to the Mayor's office. Increased scheduling flexibility led to dozens of additional shifts worked, greater take-home pay, decreased overtime costs and increased client satisfaction.

User perspective

Pilot programme participants unanimously reported that the programme made it easier to get to work and reduced the stress of their commute, and 83% were able to work more hours.[119] All respondents stated that they would be interested in participating again, and 92% said that they would participate even if they were responsible for cost sharing at USD 2 per ride, an option that would allow both the employee and the employer to invest in TaaB.

Challenges and lessons learned

Initially, the Department of Innovation & Technology thought that Uber could provide a comprehensive transportation solution. However, some employees faced barriers to using the platform including a lack of smartphones, low tech-literacy and discomfort riding with strangers. This informed the Department's shift to incorporate additional transportation providers into an integrated transportation solution, including Waze Carpool, Limebike bikesharing and shuttle services.

The Department initially thought that the pilot phase would not require significant time investment on the part of frontline managers, but the city's most successful tests involved substantial time commitments and assistance in recruiting participants. During phase two, which will last the three years, the city will dedicate two full-time staff members to communicate expectations and provide additional administrative support to participating employers.

The success of TaaB will also depend on the willingness and ability of employers to share data, and the ability to leverage multiple on-demand transportation services. The city will ensure that these needs are met by establishing strong relationships with employers and a local service-oriented tech

119 Ibid

company commissioned to build an integrated transportation platform. It will also provide additional administrative support and sign formal data-sharing agreements with employers.

In terms of lessons learned, the South Bend Chief Innovation Officer, Santiago Garces, offers the following advice: "Start small. Consider which transportation barrier you as a municipality are best positioned to solve. After you identify this barrier, co-create and test with the target population to refine your solution. Only once you have a solution that works well for this group should you move on to other transportation barriers." He also found it essential to remain humble when defining the

problem: "it is important to have a strong initial idea, but equally important to adapt based on feedback from those who are closest to the problem. Residents experiencing transportation barriers are the experts in understanding their own unique challenges."

Figure 48: Banner decorated by South Bend residents at the "Best. Commute. Ever." cookout

Source: https://oecd-opsi.org/innovations/transportation-as-a-benefit-taab-program.

Replicability

This innovation has not yet been replicated elsewhere, although the problem of transportation as a barrier to stable employment is shared by countless cities around the world. Baltimore, Detroit and San Francisco have all identified transportation as a barrier for low-income shift work populations, and have reached out to South Bend to learn from the results of the pilot phase.

Clear My Record

Clear My Record is an automated process that clears the criminal records of individuals for infractions that were once illegal but have since been legalised.[120] A 2016 Californian voter initiative legalised possession of small amounts of marijuana, effectively downgrading previous related criminal convictions. Created by Code for America in collaboration with the California District Attorney Offices, Clear My Record applies an open-source algorithm to review records, determine eligibility and produce clearance paperwork for the courts. It shifts the burden of record clearance from individuals by enabling the government to clear records on a large scale. Tens of millions of Americans are eligible to clear their criminal record, but due to the complicated, costly and time-consuming nature of the old process, only a small fraction had been able to do so. Since its launch, Clear My Record has benefited thousands of individuals with criminal records, opening doors for them to participate in aspects of society and the economy that were difficult to access with a record, such as getting a job or obtaining financial aid to attend school (see Figure 49).

120 See https://oecd-opsi.org/innovations/clear-my-record.

TREND 02
CASE STUDY

California, United States

Figure 49: A Clear My Record user applying for a misdemeanour downgrade

Source: Code for America, https://oecd-opsi.org/innovations/clear-my-record
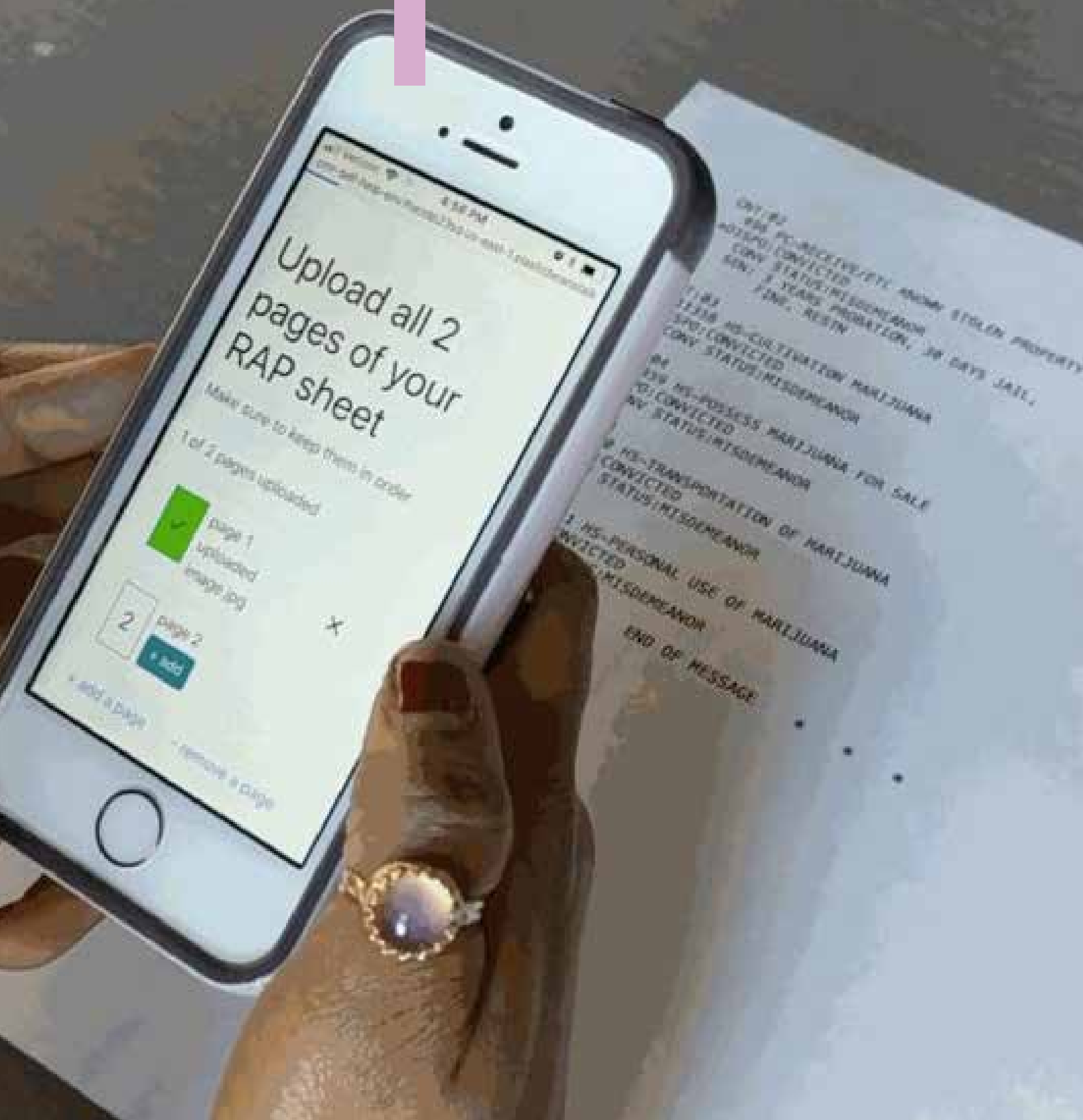
The problem

One in three adults (70 million people) have a criminal record in the United States.[121] Because of changes in laws, many of these individuals qualify to reduce their conviction from a felony to a misdemeanour, or even to eliminate it entirely from their record. In California, there are up to 5 million residents are eligible to reduce or dismiss their criminal convictions.[122] However, many individuals do not clear their criminal records for a number of reasons, including uncertainty about how to proceed, inability to afford a lawyer's assistance, or lack of time and resources to navigate the complicated process.

In 2016, Californians voted in favour of Proposition 64, which legalised possession of small amounts of marijuana. Those previously convicted under California state law for possession of marijuana became eligible to expunge the crime from their record (see Box 8). However, to date, only 8% of Californians who qualify to clear their record have managed to navigate the arduous process of petitioning (Interview, Code for America).

There are serious consequences to having a criminal record. In California alone, there are 4 800 opportunities or services that individuals cannot access if they possess a criminal record. These obstacles affect every area of life, and make it difficult, if not impossible, to find and keep a job, obtain a professional license, apply for public benefits, secure housing, or obtain a student or small business loan (see Figure 50). According to the Center for American Progress, nine out of ten potential employers systematically run a criminal background check.[123] This impacts the economy by shutting tens of millions of people with criminal records out of the labour market, resulting in the loss of as many as 1.9 million workers and costing the US economy up to USD 87 billion each year in lost GDP. Furthermore, having a prior felony prevents certain individuals from being able to vote. Over 200 000 Californians either in prison or on parole are ineligible to vote.[124]

Figure 50: Challenges that criminal records have posed for Clear My Record users
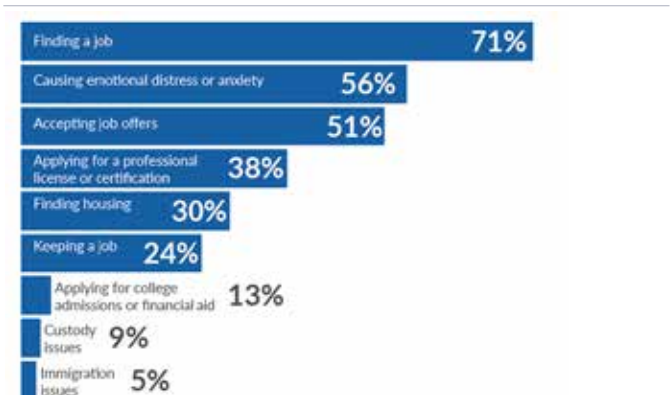
Source: Code for America.

Box 8: Expungement
Expungement is the act of clearing a criminal record retroactively, as if it never existed. Californian penal code stipulates that when a conviction results from a law that has been struck down, individuals with criminal convictions can apply to "expunge" or clear their record. Procedurally, the individual must make a petition to a judge requesting to vacate the conviction and dismiss the case. In place of the former plea of "guilty" or "no contest," the individual is considered to have entered a plea of "not guilty," and the case is then dismissed. Thereafter, the Californian Department of Justice criminal record and the FBI record no longer reflect the conviction, and the individual is able to indicate on all job applications (excepting governmental posts) that they have never had a criminal conviction.

Source: California Penal Code, § 1203.4; https://legaldictionary.net/expungement.

An innovative solution

In 2016, the civic tech non-profit Code for America launched the "Clear My Record" programme as an individual service for people seeking record clearance. Between 2016 and 2018, instead of having to physically attend a legal clinic at the Public Defender's Office, individuals who wanted to clear their criminal records in San Francisco could start the process by taking eight minutes to fill out an online form on their phone.

In 2018, Code for America determined that, in spite of this service, the burden of record clearance still fell on individuals rather than the government, and that this had to change. Even when individuals submitted clearance paperwork, local governments were not equipped to process these applications in a timely manner. To achieve record clearance at scale, Code for America began developing a second iteration of the programme in May 2018, entitled Clear My Record (Automatic). Code for America partnered with several Californian county District Attorney offices, who granted permission for Code for America to access the data of individuals with criminal records. As a result, Code for America will be able to apply its algorithm

121 See www.nelp.org/campaign/ensuring-fair-chance-to-work.

122 See https://oecd-opsi.org/wp-content/uploads/2018/09/2018-Justice-Fundraiser-deck-scrolling-.pdf

123 See www.americanprogress.org/press/release/2018/11/15/461053/release-cap-25-partners-launch-national-bipartisan-clean-slate-initiative-automate-clearing-criminal-records.

124 See https://felonvoting.procon.org/view.resource.php?resourceID=000287.

and generate a list of individuals who qualify for expungement of their criminal record. The algorithm has been designed in conjunction with District Attorney offices and distinguishes between conditions where automatic rules may be applied versus complicating factors that necessitate individual review (i.e. if the offence occurred within the context of a more significant crime being committed.)

The District Attorney's office then has the authority to automatically clear the record of those who qualify. San Francisco County District Attorney George Gascón has been a crucial partner in the shift towards an automatic clearance model. Gascón is interested in proactively clearing convictions eligible under state law, not only in the pursuit of improved access to justice, but also as a much more efficient alternative to increased government staffing.

"A lot of people don't even know they qualify, and I don't think it's the right thing to do to make people pay lawyers' fees and jump through a bunch of hoops to get something they should be getting anyway."
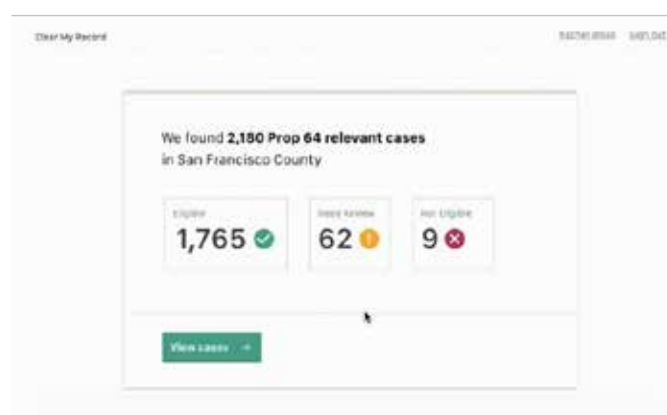
San Francisco County District Attorney George Gascón

The core technology reads a criminal record, then maps the record data to applicable record clearance laws through an open-source and transparent algorithm. It then automatically completes the

Figure 51: Overview of the Clear My Record process

Source: https://oecd-opsi.org/innovations/clear-my-record.
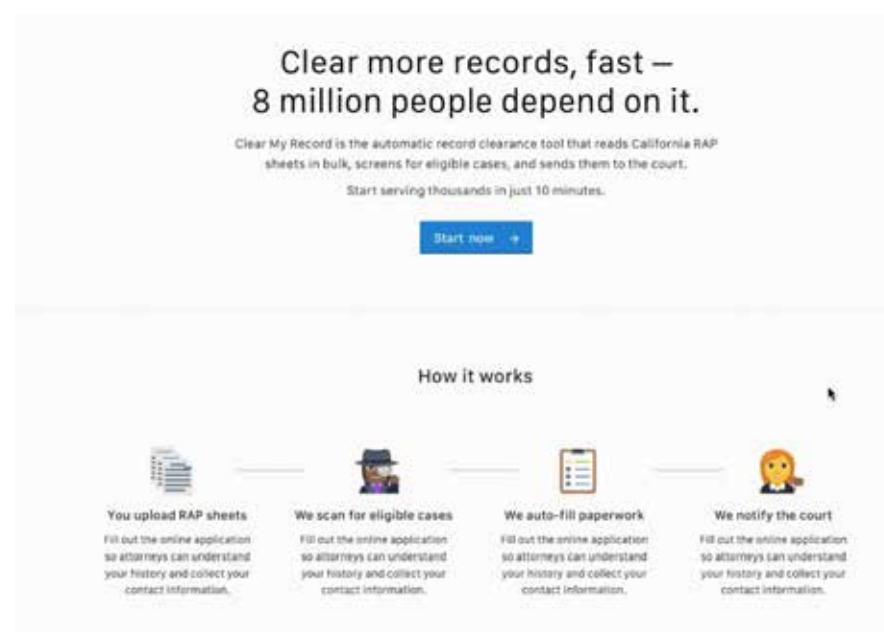
Figure 52: Automatic scanning of records

Source: https://oecd-opsi.org/innovations/clear-my-record

appropriate forms to be filed with the court (see Figure 51). The technology can currently process 100 records in under 5 minutes. This means that an attorney can review records, determine eligibility and prepare motions to be filed with court for 1 000 people in under an hour (see Figure 52).

However, in spite of this rapidity, judges still lack the capacity to individually process 1 000 dismissals in under an hour, which inevitably increases judicial backlogs. The burden of clearing the record falls either on the individual or on Clear My Record actors such as Code for America and participating District Attorney offices, instead of the government. Code for America has stated that its eventual goal is for governments to streamline and automate this process with greater efficiency via legislation that automatically expunges or reduces convictions that qualify. Such legislation would decrease or eliminate the high transaction cost of downgrading convictions.

Novelty

When Code for America launched the first version of Clear My Record, it functioned as a tool to make it easier for people with criminal records to connect with a lawyer to apply for record clearance. Through this service, their team gained an in-depth understanding of bottlenecks in a process that put the burden of record clearance on each individual. This caused them to ask two game-changing questions: "What if an individual didn't have to apply to clear their record in the first place? What if our goal was to clear ALL eligible records instead of

just a few thousand a year?" To help people at scale, Code for America pivoted its approach and rethought their process to fundamentally change the experience with the justice system. The Clear My Record collaboration with County District Attorneys represents a new model that can be scaled across the United States and function as a blueprint for automatic record clearance in all jurisdictions.

Opening Doors // Results and impact

CLEAR MY RECORD

VS

PARALEGAL OR ATTORNEY

The tool consistently processes
100 CRIMINAL RECORDS IN UNDER FIVE MINUTES

20-30 MINUTES
to review one record

or even voting. The following several testimonies were given by individuals who are currently benefitting or have benefited from the Clear My Record programme:

"Now that I've cleared my record, I have a second chance. I can go out with confidence. I can finally walk with my head up high."

"I'm applying to clear my record because I've done my time, I've paid my fees, I've gone to court and complied with everything I need to do, but now it's like I'm being punished for the rest of my life for my first and only offense. I want to move on with my life and make an honest living, and give back to my community. But it feels like I don't deserve a second chance, after all of my hard work, I deserve it."

"Thank you so much for this help. It has been somewhat of a struggle finding a job with a criminal background. However, I am looking and applying every day for employment. All this mess began when I was homeless and began stealing food and it seems like things just snowballed. I am working hard to get back on track."

Results and impact

The Clear My Record pilot project, in partnership with the San Francisco District Attorney's office, has facilitated a state-level process to provide county jurisdictions with bulk access to criminal record data, which will allow the tool to operate fully at scale. At present, Clear My Record has processed over 3 500 records. The tool consistently processes 100 criminal records in under five minutes, compared to the 20-30 minutes it takes for a paralegal or attorney to review a single record. Through the partnership with San Francisco, they are now on track to challenge over 7 000 convictions in 6 months (compared to only 6 200 petitions filed via traditional means with the court in the 16 months since the passage of Proposition 64 in California).

User perspective

Clear My Record enables the District Attorney's offices to review more records and generate more motions with its limited resources. The intended beneficiaries are tens of millions of people across the country with criminal records for actions that are now considered legal, as automatic record clearance removes significant barriers to work, education, health, housing and more. These individuals gain a second lease on life, as the act of expunging their records lifts barriers to employment

Challenges and lessons learned

The greatest challenge Code for America has faced since launching its pilot in May has been obtaining access to criminal records on a significant scale. In order to access these records, District Attorneys must first be willing to open up their data. A representative of Code for America must then go to the District Attorney's offices (dispersed across counties in California) to apply algorithms to the data, rather than accessing the data centrally via a secure, cloud-based database. This limits the feasibility of scaling up Clear My Record. Were Code for America able to obtain access to bulk criminal records in a manner that protects the confidentiality of the individual's identity, their work would accelerate rapidly.

Privacy remains another concern. Individuals may not want their criminal records to be reviewed for potential downgrading by third parties such as Code for America. District Attorney offices have the obligation to ensure the protection of these private records, and are thus naturally cautious with regard to sharing the private data of criminal records. This also prevents Clear My Record from scaling up.

A final challenge is that while open source technology builds trust and reduces cost, many governments lack the know-how to adapt the technology. This means that Code for America's

presence is required for implementation, however its capacity remains relatively small compared with demand.

Regarding lessons learned, S.T. Mayer, Chief Program Officer at Code for America, explains that "it is important to invest time in building trust with your stakeholder in the design, technology and application of the innovation. We have also found that it is important to understand the political landscape such that you are able to identify unique opportunities to leverage technology to affect larger policy change. Our deployment of user-centred design methodology in building the initial service ensured that we had proximity to those most impacted by criminal records." Through its delivery of this service, Code for America gained key insights into the experience of finding lawyers to help file record clearance paperwork with the court. Those insights led their team to acknowledge the need for a better way, inspiring the programme's re-orientation towards automating misdemeanour downgrading.

Replicability

Code for America's vision is to create a blueprint for automatic record clearance of all eligible criminal records, first in California and then across the country. By transparently explaining how the technology works and enabling local governments to more easily act in the interests of residents in a quick and inexpensive way, they are setting a strong example for how government can work for the people who need it most, helping to break the cycle of poverty and incarceration for millions.

The automatic clearance model has gained traction – in June 2018, the state of Pennsylvania passed the Clean Slate Act to enable the automatic downgrading or clearing of eligible criminal records. In November 2018, Code for America became a partner of the Clean Slate Campaign, a nationwide initiative to deliver the algorithmic tool directly to governments in California and across the country.

Source: https://medium.com/code-for-america/reshaping-the-criminal-justice-system-at-scale-404e73185438

This campaign aims to leverage the technology and insights from the California County District Attorney partnerships to shape broad, bipartisan policy reforms to ensure automatic record clearance laws become a reality in every state. Code for America's mid-term goal is to help clear 250 000 eligible convictions by mid-2019.

OPSI speculates that such a technology may have even broader potential applications beyond criminal records. For instance, the European Union's General Data Protection Regulation (GDPR) enshrines individuals' "right to be forgotten", on the basis of which they can request that internet companies such as Google erase all information about them.[125] Perhaps such an automated processes and algorithms like those used by Clear My Record could be applied to implement this and other rules, thereby expanding the scope of its impact beyond criminal records.

125 See https://gdpr-info.eu/issues/right-to-be-forgotten.

TREND 03:
MACHINE-READABLE WORLD

03
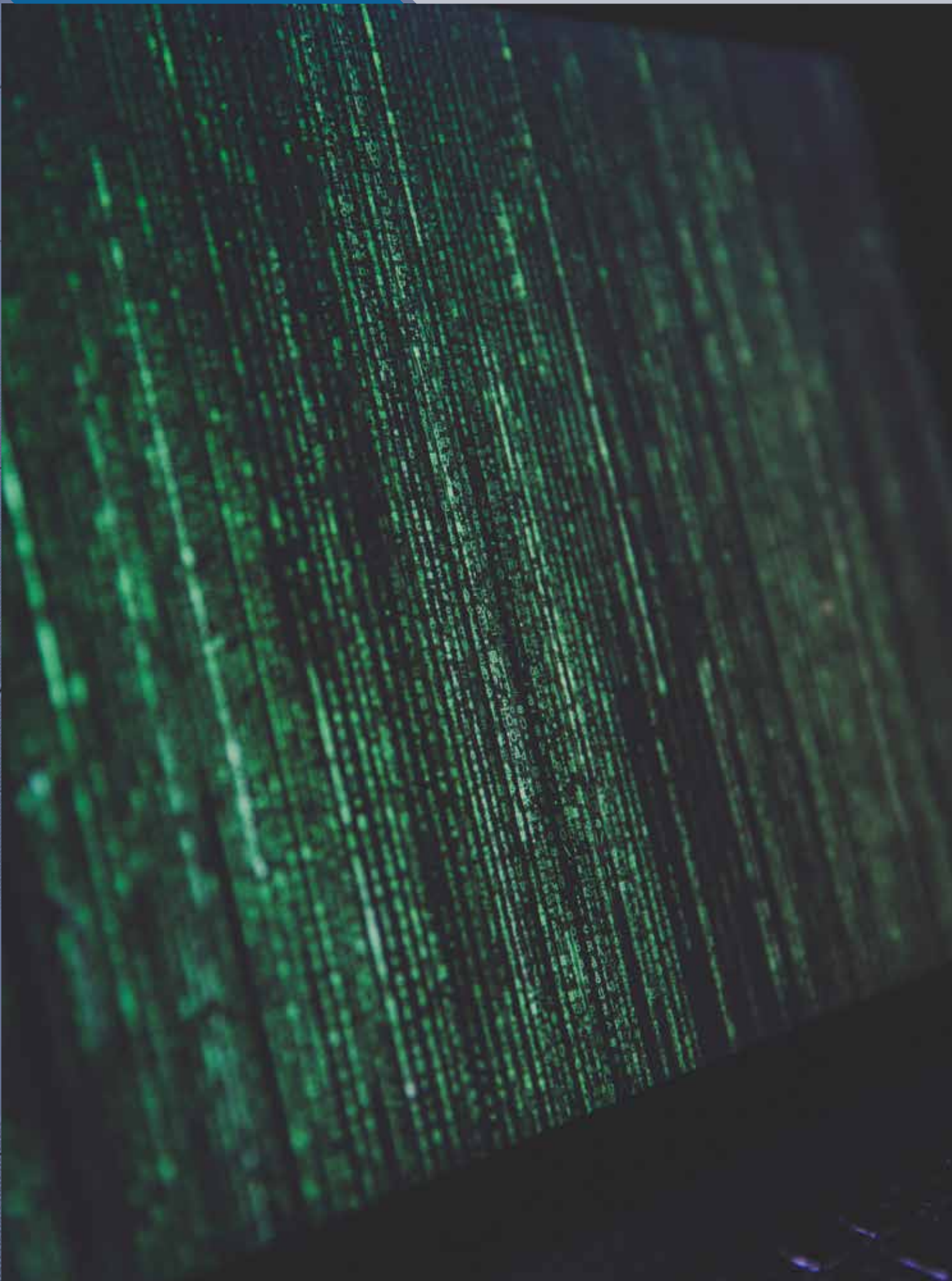
> *The world today is increasingly being translated into bits and bytes which can be read by machines and fed into algorithms that serve as the basis for an ever-growing number of decisions and services.*

In recent years, governments have started to discover the power of machine readability, with energy devoted to building open government data programmes that help to fuel innovations both within government and in the broader economy. They are now setting their aims even higher by developing innovative new projects that have the potential to completely reconceive one of the most foundational roles of government – creating laws and other rules that impact the daily lives of citizens and businesses. Governments are also seeking to digitise human characteristics, senses and surroundings to deliver innovative services and interventions. This growing wealth of machine-readable content serves as fuel for a new generation of innovations that use emerging technologies such as artificial intelligence and blockchain. While these advances show tremendous potential, they can also pose major risks and raise significant ethical questions. Governments should seek to understand and experiment with these technologies, but should do so in an informed and ethical way.

Open data efforts are making public knowledge machine readable

Open government data (OGD) are by definition a matter of innovation-related policy (OECD, 2016). They can increase the openness, transparency and accountability of government activities, and thus boost public trust in governments. At the same time, by allowing others to convert government data into information and knowledge, OGD has the potential to enable a wide range of commercial and social services across society. Reuse of a wide range of public sector data by a broad range of actors is a key condition for creating economic and social value, and is necessary to stimulate creativity and innovation. OGD also allows citizens to become not just passive consumers of public sector content and services, but also active contributors and designers in their own right – empowered to make more informed decisions to enhance the quality of their lives (OECD, 2017c).

Governments have put significant time and energy into improving their OGD efforts. OGD can be seen as a form of mission-oriented innovation, as senior-level leadership is often needed to drive ambition towards an articulated goal. This is the case because opening up data is not easy and often requires fundamental process and technological changes within governments. In addition, it can be hard to perceive the value of OGD from within government, as the effects, at least initially, tend to manifest in other sectors. These factors necessitate senior-level support, with a mission focused on opening data as an asset.

Recent growth in this area is working especially to ensure that outputs are machine-readable (see Box 9). In the early days of the OGD movement, governments would publish all sorts of file types that,

Box 9: Machine readable
Information or data presented in a structured format that can be processed by a computer without (or with minimal) human intervention and without loss of semantic meaning. Digital formats are not automatically machine readable (e.g. text documents in PDF or DOC formats are not machine readable).

Source: OECD (2016).

TREND 03: MACHINE-READABLE WORLD

while open, were not able to be consumed by machines for analytics or to power services through Application Programming Interfaces (APIs). The most notorious example of this not-so-open data is PDFs.

The latest OECD data on OGD indicate that issuing OGD in machine-readable formats is now one of the top priorities in national OGD strategies, second only to ensuring that data are published under an open license. The OECD also found that countries are providing most of their datasets in machine-readable formats (OECD, 2018b). Machine readability is a major factor in data accessibility and overall OGD efforts, as measured by the OECD OURdata Index (see Figure 53).

OGD also functions as an important starting point for building AI services and algorithms, discussed later in this chapter. As AI is increasingly being used to improve service delivery and users' experience, open data provides evidence on user behaviour and preferences in order to fuel citizen-driven design. Hence, increasing availability of large amounts of data provided in open formats, which can be accessed and reused, enables the design of innovative citizen experiences driven by citizen needs (OECD, 2018b).

While OGD initiatives are not as novel now as they were just a few years ago, in many cases they have provided governments with an initial taste of the transformative nature of machine-readable content, and the ways in which it allows for more seamless interoperability of data, as well as the ability to build things from and on top of OGD in new and unexpected ways. OGD has improved how government resources are used and information is managed, resulting in new ecosystems both inside and outside government. It has also unlocked economic opportunities for new business models and companies.[126] Just as machine-readable OGD has resulted in new ecosystems and businesses, governments are now seeing how machine-readability can catalyse potential in other areas.

Figure 53: OECD open, useful and reusable data (OURdata) Index, 2017   **Source:** OECD (2018b).
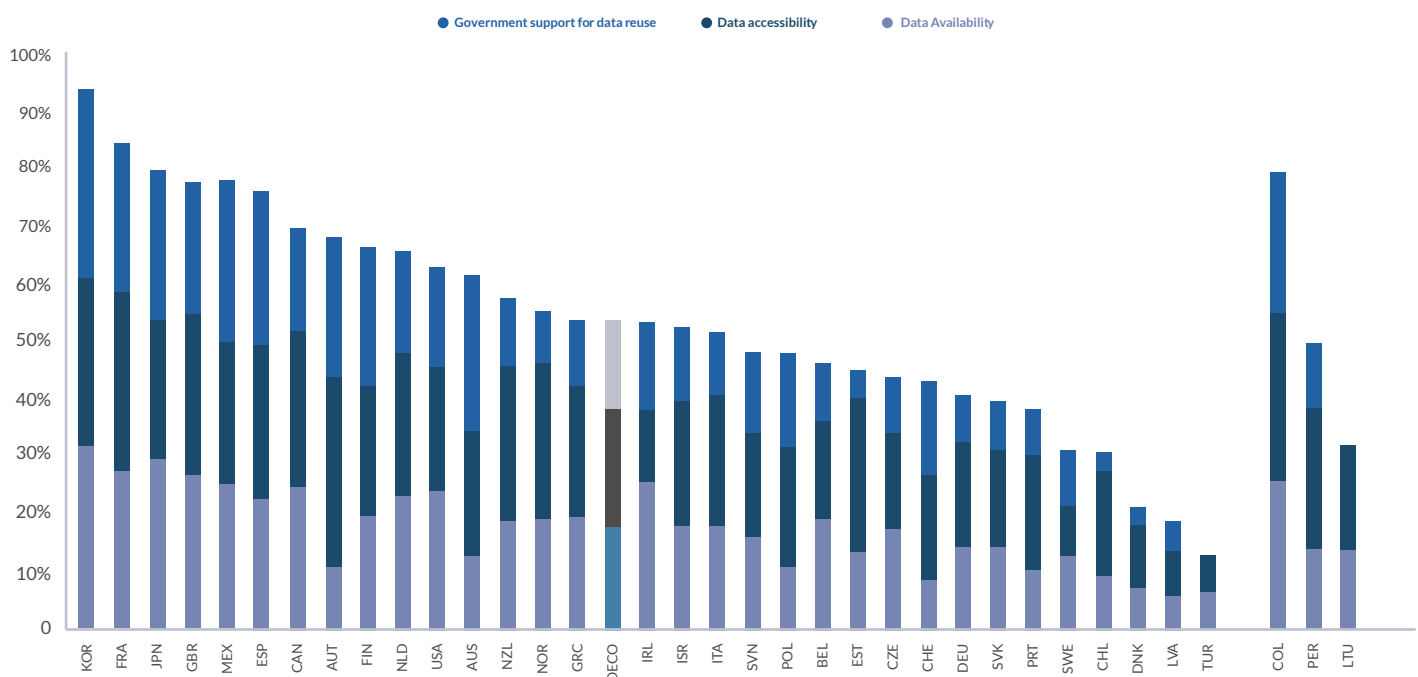
● **Government support for data reuse**   ● **Data accessibility**   ● **Data Availability**

Countries are rewriting the rulebook with code

The ways in which governments develop laws, policies and other types of rules have remained largely the same for decades, or even centuries. Recently, technology has disrupted and transformed much of the surrounding world, yet with the possible exception of facilitating slightly more citizen input, the ways in which the rulebooks that govern everyday life for governments, citizens and business are written have remained largely unaffected. However, a number of emerging innovative practices indicate a major shift in the near future.

OPSI has observed a significant increase in government focus on transforming how these rules are designed, published and refined by making them machine readable. While somewhat technical in nature, this type of innovation potentially has the power to build a new foundation for evidence-based, citizen-driven laws and policies. Such rules could be prototyped and experimented with before being finalised. Real-time feedback from information systems could also lead to iterative and agile refinement of policies over time, rather than waiting decades to update outdated rules. In some ways, this could simply be classified as enhancement-oriented innovation in the OPSI Innovation Facets Model. However, this could also be considered a form of anticipatory innovation, as some governments are experimenting with the potential for changing the role of laws, and the ways in which they can bring about broader transformation (e.g. advancing AI).

Perhaps the most compelling example of this trend is Better Rules, a pilot initiative from the Government of New Zealand. The government's cross-agency Service Innovation Lab,[127] which represents an innovation in its own right, observed that laws were difficult for members of the public to understand, and noted that they required interpretation by lawyers and others, in order to implement them. This need for interpretation often resulted in inconsistent implementation in different areas, which in some cases did not match the intent of the laws. To address these challenges, and to reconceive the ways in which laws are designed and implemented, they launched Better Rules as an experiment in developing legislation as machine-consumable code. Better Rules also has the potential to enable real-time scenario testing of potential policy options and feedback during implementation. An in-depth case study on Better Rules is included at the end of this section.

"Legislation-as-code is the most transformative idea we got from the 2018 D5 Summit."[128]

Siim Sikkut, Chief Information Officer (CIO),
Government of Estonia

In another example, in this case focusing on government-wide technology policies, the United States Office of the Federal Chief Information Officer (OFCIO) launched Project Cruft (see Box 10 for a definition of "cruft") to cross-analyse requirements within all existing policies, in order to identify targets for rescission and revision to reduce burden, particularly in cases where requirements are duplicative, outdated or impede innovation. The backbone of the initiative is a Policy Schema,[129] which represents government technology policy in a machine-readable format. The schema creates new possibilities for automatically parsing policy and linking it with other related rules. It can also inform the policy drafting process, helping OFCIO to craft more carefully structured and targeted policies.[130]

The power of machine-readable rules can also be demonstrated at the city level. In 2018, Washington, DC took the innovative step of publishing all of its laws on GitHub[131] in open, machine-readable form, as the *authoritative source* of its legal code (Tauberer, 2018). GitHub is a software development platform which enables people to collaboratively code and interact with one other.[132] By using the platform's "issues" feature, residents and city officials can engage in transparent, two-way discussions about city laws. Meanwhile, the "pull request" feature gives users the ability to make proposed edits for consideration by city officials. The use of these features demonstrates the potential transformational impact of modern approaches on drafting and improving upon laws. In one example, Washington,

Box 10: Cruft

Anything that is left over, redundant and getting in the way. It is used particularly for defective, superseded, useless, superfluous or dysfunctional elements in computer software.

Source: www.techopedia.com/definition/15410/cruft

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127 See webtoolkit.govt.nz/blog/tag/service-innovation-lab for Service Innovation Lab blog posts, and https://oe.cd/ServiceInnovationLab for a case on the OPSI Case Study Platform.
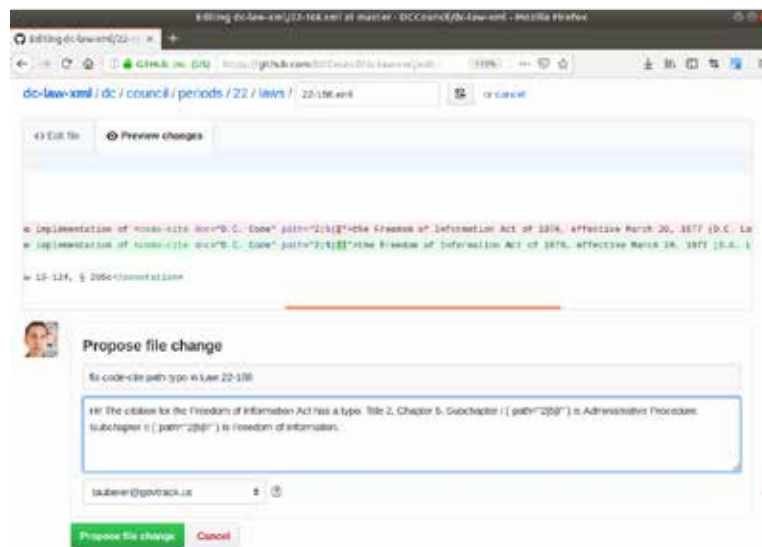
128 The Digital 9 (D9) – formerly the D5 – is a network of the world's most advanced digital nations with the shared goal of harnessing digital technology and new ways of working to improve citizens' lives. See https://oecd-opsi.org/wp-content/uploads/2018/09/2018-Justice-Fundraiser-deck-scrolling-.pdf.
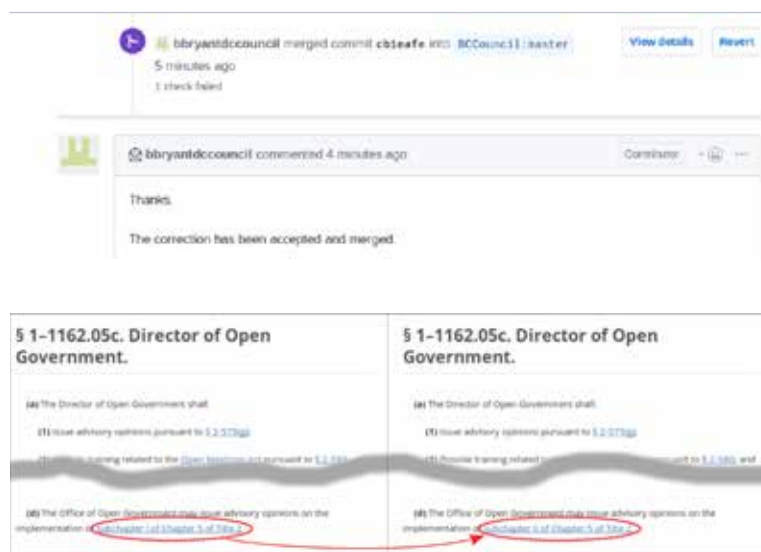
129 See https://policy.cio.gov/policy-schema.

130 Ibid

131 See https://code.dccouncil.us/dc/council/code.

132 See https://github.com.

Figure 54: Pull request proposing change to DC law

Source: https://arstechnica.com/tech-policy/2018/11/how-i-changed-the-law-with-a-github-pull-request.

Figure 55: Pull request merged by DC city council staff

Source: https://arstechnica.com/tech-policy/2018/11/how-i-changed-the-law-with-a-github-pull-request.

DC resident Joshua Tauberer noticed a mistake in a law and opened a pull request to fix it (see Figure 54). This was reviewed and "merged" into the law by DC council staff with the click of a button (see Figure 55). While the change amounted to a minor correction, this example demonstrates how such innovative law-making can empower citizens and residents. As Mr Tauberer notes on his blog post, "GitHub's pull-request feature isn't going to replace public hearings, expert testimony, negotiations between stakeholders, votes by elected representatives, etc.—and it shouldn't" (ibid). However, it can make codifying laws faster, easier and more accessible, while unlocking tremendous potential for the public to become more engaged with the law.

These examples represent just the beginning in terms of the potential for machine readability to impact how laws and policies are created and how they evolve in agile ways. From enabling two-way communication with the public and incorporating the views of resident, to creating the ability for continuous real-time feedback loops between policy and implementation, the benefits are significant, and the momentum to transform this relatively untouched area of government is growing.

Experiments are underway to digitise humans and our surroundings

Innovative and sometimes controversial efforts are underway in many countries to make human characteristics and decisions machine readable, enabling them to be analysed by automated decision algorithms, along with an individual's surroundings and senses. In the last few years, new types of data inputs have become available, leading to the emergence of the concept of "data scores" (see Box 11).

The concept itself is not that new. Perhaps the most classic example is credit scores. In the United States, for instance, every citizen has a three-digit score that aims to predict how likely they are to pay back debts on time. Data from thousands of creditors and banks around the country feed into

scoring models that calculate this number based on factors including the amount of unpaid debt and bill-paying history, among others. Companies use the credit scores to make decisions such as whether to offer a mortgage, credit card or auto loan, and to determine what interest rate the customer receives.[133] Such screenings exist in various forms in countries around the world and date back decades.

Box 11: Data scores

"The advent of data-driven scores that combine data from a variety of sources as a way to categorise citizens, allocate services and predict behaviour."

Source: Dencik et al., 2018.

The world is now witnessing rapid growth in innovative applications of a variety of types of human scoring, essentially using the exponential growth of increasingly granular data to build machine-readable profiles of individuals. The most innovative, yet extreme and ethically questionable is China's "social credit" system, in which China is working to rank all citizens by 2020 based on their behaviours. The rankings would then be used to punish or reward citizens, and the methodology for calculating rankings is secret. Under the philosophy that "keeping trust is glorious and breaking trust is disgraceful",[134] the system is already being piloted. Score reductions can result from actions such as posting fake news, buying too many video games, smoking where it is forbidden and poor driving. Those with low scores are already being punished. For instance, 9 million people have been banned from buying domestic flight tickets. Some parents with low scores have been denied admissions for their children to attend the best schools, citizens have had their internet speed throttled and others have been added to a blacklist of bad citizens.[135]

The potential also exists to use data scores to deliver less extreme, innovative public services. The United Kingdom, in particular, has been looking at this approach to better serve citizens and residents, especially at the local level. For example, Hackney County is working with private sector partners to develop the "Early Help Profile System" (EHPS), "a predictive risk model which brings together data from multiple agencies to identify children who are most at risk", in order to better target services and prioritise scarce resources. Data are only shared about people who are already involved in the child protection system (Dencik et al., 2018).

Such profiling is also being used for good at the national level. Faced with high rates of refugees seeking better conditions, Switzerland is piloting the use of data-driven refugee profiles, analysed by algorithms, to place refugees in areas where they will have the best chance of achieving positive integration outcomes, including employment. Refugees face tough conditions when entering a new country, and often lack resources, live in overcrowded housing and are unfamiliar with the local language. After three to five years, employment rates are still low, resulting in a drain on the government which provides refugees with assistance benefits. To help address this situation, researchers developed an "algorithm [that] uses a combination of supervised machine learning and optimal matching to discover and leverage synergies between refugee characteristics and resettlement sites", based on data from 30 000 previous refugees. The algorithm is believed to increase employment outcomes by 40-70% on average compared to the status quo (Bansak et al., 2018). The Swiss government is now piloting this algorithm to conduct a scientific test, with a view to improving refugee outcomes.[136]

Such profiles and algorithms raise a number of ethical questions for governments. However, these types of approaches have existed in the private sector for a number of years, with detrimental effects only now coming to light. As the technology and capabilities of these types of algorithms are only going to become more advanced, governments will need to understand how these approaches work and be able to consider the underlying ethics, in order to determine if and how they can be used to improve public services – as well as understand and react to their use in other sectors.

However, government efforts to make data machine readable are not restricted to human profiles; people's surroundings and senses are also being converted to code for analysis by algorithms. For example, in Australia, the Government of Queensland is using machine-learning algorithms to map and classify land use features, in order to plan the usage of natural resources and agricultural production, and monitor disease vectors, among other things. By using technology to make land features machine readable, governments and scientists can make much faster decisions about how to use land, much earlier than was previously possible. With traditional manual methods, mapping land use for the whole state takes years, but the same process only takes six weeks with new technology. An in-depth case study on this example is found at the end of the chapter.

Another example of land features being made machine readable for algorithmic analysis is found in the United Kingdom. The

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133 See www.consumerfinance.gov/ask-cfpb/what-is-a-credit-score-en-315.

134 See https://chinacopyrightandmedia.wordpress.com/2014/06/14/planning-outline-for-the-construction-of-a-social-credit-system-2014-2020.

135 See https://medium.com/code-for-america/reshaping-the-criminal-justice-system-at-scale-404e73185438.

136 See https://apolitical.co/solution_article/switzerlands-new-algorithm-could-get-up-to-30-more-refugees-into-work.

Rights Lab[137] launched Slavery from Space[138] to end modern-day slavery, using machine-learning algorithms that study high-resolution satellite data to make a credible estimate of the number of brick kilns across the "Brick Belt", which runs across South Asia. Slavery is highly prevalent in brick kiln industries, and by connecting the enhancement-oriented facet with a mission-oriented innovation project, the initiative helps to calculate the scale of modern slavery in the region. Prior to this work, the full scale of brick kilns and, by proxy, slavery, was unknown, making action from the appropriate agencies difficult. This innovation provides data to help NGOs and governments fight modern slavery (Boyd et al., 2018). Using this technology, the Rights Lab team estimates that a third of slavery may be detectable from space.[139]

Another interesting case was identified in the city of Louisville, Kentucky, in the United States through the OECD's Call for Innovations.[140] To counter a recent spike in homicides, the city has placed gunshot-detection sensors around the city, which listen for the sound of gunshots. Once heard, the sensors convert the sound into data which triggers an emergency response. Instead of deploying police officers to the scene, who often arrive after the 10-minute window crucial to stabilising injuries, the city plans to automatically deploy surveillance drones, which can reach the scene within 90 seconds. The drones will transmit video to the emergency response centre in real time, allowing personnel to rapidly identify injured persons, dispatch emergency medical personnel, and assist with first responder situational awareness and safety until officers arrive.

Governments are seeing enormous potential in emerging tech, but risks and adverse effects need to be anticipated

As governments progressively make more components of everyday life machine readable, they effectively create the fuel that feeds emerging technologies.

Every bit of data generated is a building block that can, for instance, feed into decision-making algorithms or execute automated workflows on blockchain smart contracts.

With regard to the public sector, the question of whether governments should be experimenting with emerging technologies may be controversial. On the one hand, emerging technologies by nature are less proven than common solutions, and thus carry a greater risk of failure. One could argue that governments should take a "wait and see" approach, and let the private sector ascertain which applications of emerging tech work well and which do not, instead of pursuing risky ventures with public funds. On the other hand, researchers such as Professor Mariana Mazzucato[141] argue that government has a critical role to play in funding early-stage research and experiments, and that its work in this area has functioned as a catalyst in the technology revolution and in other transformations apparent today (Mazzucato, 2013).

Currently, governments are pursuing both courses of action. They are often the predominant funders of research that is fundamental for developing an understanding of transformative technology (e.g. the Internet, GPS), but when it comes to anticipating the full effects that technology produces in the process of being mainstreamed, they adopt the "hazard approach" – only engaging when the adverse effects of technologies become apparent. This only happens when technologies have been widely adopted and validated by the private sector and society at large. However, by this point, technologies are disrupting the

137 https://rightsandjustice.nottingham.ac.uk.

138 https://oecd-opsi.org/innovations/slavery-from-space.

139 Ibid.

140 https://oecd-opsi.org/innovations/air-incident-response-public-safety-using-autonomous-drones-in-urban-environments.

141 Miriana Mazzucato is a Professor in the Economics of Innovation and Public Value at University College London (UCL), and Director of UCL's Institute for Innovation and Public Purpose. For more information, see https://marianamazzucato.com.

current system of practise or values that public sector needs to uphold and it is very difficult to change the underlying technology itself. In essence, the public sector often makes uncertain investments by putting significant funding into research, but disengages when the private sector uses the fruits of the research to develop solutions for the market.

It could be argued that governments should become more directly involved in this activity, but in a manner that mitigates risks and upholds public values (e.g. through experimentation and small pilot programmes), as long as those approach do not hinder innovation or experimentation with the new technology in the private sector. Professor Mazzucato's research in this area proposes to link socially aware "missions" – such as making the ocean plastic free and switching to carbon neutral cities – with private sector developments that can stimulate private sector engagement in new areas and allow the public to gain more from its investments. Such missions would see governments integrally involved in nurturing the development of innovative work, rather than simply providing funding and taking a back seat.

Governments are continuing to catalyse innovation through funding research and development efforts for emerging technologies. Recent data show that the number of venture capital (VC) deals and the total amounts invested for emerging tech from public and mixed funds has grown exponentially in recent years (see Figure 56). In addition, while there are arguments on both sides, OPSI has observed a rapid increase in governmental efforts to understand and engage with emerging technologies, in order to use them to develop government programmes and services.

A key example of continued heavy funding of research by government is artificial intelligence (AI) (see Box 12). In Europe,

the European Commission (EC) has called for the public and private sector to increase investments in AI by at least EUR 20 million by the end of 2020, and has sought to kick-start efforts by devoting EUR 1.5 billion in research funding, plus an additional EUR 2.5 billion from public-private partnerships.[142] China is also trying to position itself as a world leader in AI, pledging billions of euros in public research funding for domestic projects in the hope of catalysing a Chinese AI market of EUR 130 billion by 2030 (European Commission, 2018). Similar public research and development funding is being strategically provided in countries around the world (New, 2018).

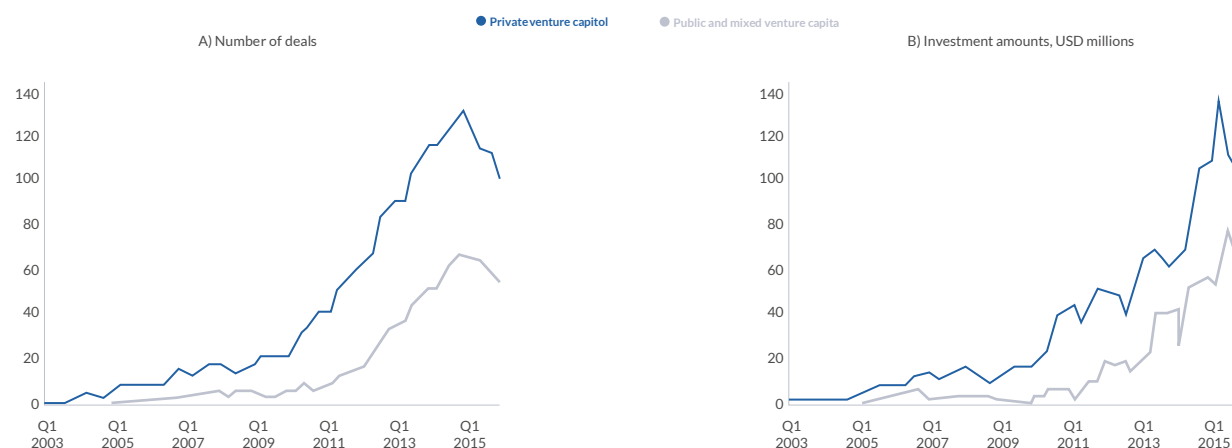### Box 12: Artificial intelligence (AI)
A device or program with independent reasoning power. The test for intelligence is widely accepted to be that devised by Alan Turing: *If a conversation with the device cannot be differentiated from a similar conversation with a human being then the device can be called intelligent.*

Source: Dencik et al., 2018.

Governments have not always taken a passive role in AI efforts, and have recently begun actively developing their own AI initiatives, typically in partnership with the private sector. By experimenting with AI and exploring the ways in which it may change the public sector, society and the economy, gov-

142 See http://europa.eu/rapid/press-release_IP-18-3362_en.htm.

Figure 56: Investments in emerging tech

● **Private venture capitol**   ● Public and mixed venture capita

A) Number of deals   B) Investment amounts, USD millions

Note: The emerging technologies covered in the charts consist of drones, virtual reality, artificial intelligence, apps, 3D printing, blockchain and cloud computing.
Source: Breschi et al. (forthcoming), based on Crunchbase data (www.crunchbase.com).

ernments are engaging in anticipatory innovation. This process is occurring at all levels of government.

At the national level, Finland launched the Aurora National Artificial Intelligence Programme[143] in 2018 as part of its Age of AI vision (see Box 13). "The aim of Aurora is to accelerate the transitioning of public administration into the age of artificial intelligence in a secure, ethical manner. The idea behind Aurora is to make it possible for citizens to access the wide range of services available from service providers into seamless, smoothly functioning entities when dealing with various life events."[144] So far, Aurora is much more hands-on and service-based than most country strategies, which tend to focus more on R&D funding. For instance, one Aurora-based service being piloted is an AI bot to help citizens find and retain employment. It includes a predictive algorithm to alert citizens who are at risk of job automation, and help them find ways to update their skills or locate new opportunities elsewhere. Finland is not alone in this venture. To date, Aurora has brought together about 40 government entities and private companies to develop its strategy and AI services approach.[145]

> **Box 13: Finland's "Age of AI" key actions**
>
> 1. Enhance the competitiveness of companies through the use of artificial intelligence
> 2. Utilise data in all sectors
> 3. Speed up and simplify the adoption of artificial intelligence
> 4. Ensure top-level expertise and attract top experts
> 5. Make bold decisions and investments
> 6. Build the world's best public services
> 7. Establish new co-operation models
> 8. Make Finland a trendsetter in the age of artificial intelligence.
>
> **Source:** Finland Ministry of Economic Affairs and Employment, 2017.

At the local level, a number of cities in China are using AI as the foundation for building smart cities. For example, the city of Hangzhou, which has a metropolitan population of about 6 million,[146] recently launched the Hangzhou "City Brain" project in conjunction with tech company Alibaba. The initiative uses hundreds of cameras around the city to collect real-time data on road can traffic conditions. These machine-readable data are then centralised and fed into to an "AI hub" which makes decisions affecting traffic lights at 128 city intersections. The system does not simply monitor and adjust traffic based on vehicle volume; it can also make more strategic decisions, such as identifying and clearing paths for ambulances on emergency calls, reducing their travel time by 50%.[147]

Government activities in the areas of emerging tech and anticipatory innovation are not just restricted to AI; another hot topic of interest is blockchain. In recent years, blockchain technology has evolved from a niche subject to become one of the biggest tech disruption buzzwords. However, confusion persists about the subject, with a lack of clear understanding about the nature of blockchains, and their potential impact on the public sector and their limitations (Berryhill, Bourgery and Hanson, 2018). While this report can only touch on some of the discussions and trends related to blockchain, OPSI recently published *Blockchains Unchained: Blockchain technology and its use in the public sector*[148] as a guide to equip public servants with the knowledge necessary to understand blockchain architecture, the implications it could have on government services, and the opportunities and challenges governments may face as a result. The detailed report describes blockchain in depth and includes technical characteristics.

Blockchain technology was created in 2008 as a by-product of bitcoin, which was itself developed by an unknown individual under the pseudonym Satoshi Nakamoto.[149] The technology is still in its infancy, and governments are investing significant amounts in research and experimentation to explore its potential. EC spending on blockchain will amount to EUR 340 million by 2020,[150] and the US Department of Homeland Security has given USD 2.25 million to fund related R&D among start-ups.[151]

143 See https://vm.fi/en/auroraai-en.
144 See https://valtioneuvosto.fi/en/article/-/asset_publisher/10623/viranomaispalvelut-tekoalyaikaan-esiselvitys-kansallisesta-tekoalyohjelma-aurorasta.
145 See https://apolitical.co/solution_article/finland-is-building-a-robot-that-will-help-you-get-a-job.
146 See http://worldpopulationreview.com/countries/china-population/cities.
147 See https://govinsider.asia/security/five-chinese-smart-cities-leading-way/?ct=t(GI_AllSub450.1_COPY_01)&mc_cid=073b3e6689&mc_eid=12918788e4.
148 See https://oe.cd/blockchain.
149 See https://bitcoin.org/bitcoin.pdf.
150 See www.openaccessgovernment.org/european-union-boosts-blockchain-research-funding/42315.
151 See www.coindesk.com/us-government-awards-2-25-million-blockchain-research-projects.

Governments are also taking steps to develop blockchain strategies in the public sector, as well taking a hands-on approach to the development of public sector blockchain projects. At least 47 countries around the world have launched or are currently planning a total of over 200 blockchain-related initiatives (see Figure 57).

One example of a government engaging in innovative blockchain initiatives, which also incorporate elements of AI, is Mongolia's Counterfeit Medicine Detection pilot. This example, presented as a case study later in this chapter, aligns well with the "mission-driven" aspect of the OPSI Innovation Facets Model. In Mongolia, up to 40% of medicines distributed are fake, resulting in untreated illnesses and numerous deaths each year. The proposed solution uses blockchain technology to digitise and record every step of a medicine's journey in the supply chain, from manufacturer to customer distribution, in a transparent machine-readable ledger designed to track and trace drugs. When combined with AI, this system can identify and dispose of counterfeit medicines, and draw conclusions about how the medicines entered the supply chain in order to mitigate future problems. Mongolia hopes that this solution will help resolve the issue and ensure that consumers receive the life-savings drugs they need.

In another example of experimentation with blockchain for the public good, the Mayor's Office of Austin, Texas in the United States, realised that the city's 7 000 homeless people experienced frequent difficulties in accessing services such as healthcare and employment, as well as housing, due to a lack of personal identification and vital documents, which were often lost or stolen. The city is now working to improve access to services through the use of blockchain technology, by providing these residents with a unique identifier, and the ability to save and access their personal records in machine-readable form at any time, thereby enabling access to critical city services.[152] The city received a USD 100 000 grant from the Bloomberg Mayor's Challenge for development and testing.[153]

As noted earlier, innovative government efforts with emerging technologies are exciting and have great potential, but are not without controversy or risk. These risks and the potentially adverse effects that might occur with poorly designed projects based on emerging technology need to be anticipated and mitigated. In the case of blockchain, recent research indicates a shift from the initial phase characterised by eager optimism and overinflated expectations, to the secondary phase termed the "trough of disillusionment" (see Figure 58). This process is playing out on a real-product basis. A recent project by investigative journalists at ICTworks selected 43 blockchain use examples based on internet searches, press releases and statements with purported successes and major results, and investigated each one. Their findings produced zero evidence of results, impacts, lessons learned or insights.[154]

Controversies and risks related to blockchain can be especially acute when the focus is vulnerable and marginalised populations. For instance, Austin might face questions as to whether new technolo-

152 See http://projects.austintexas.io/projects/mayors-blockchain-challenge/about/overview.

153 See https://www.ethnews.com/austin-texas-to-develop-blockchain-based-id-for-homeless-with-bloomberg-grant.

154 See www.ictworks.org/blockchain-impact-failure.

Figure 57: Blockchain initiatives in the public sector

gies should be tested on the city's most vulnerable residents. Such questions need to be anticipated and considered up front, because once a blockchain goes live, it is very difficult to change. As a result, the design phase for blockchain development is critical.

To help civil servants determine whether blockchain might be a good solution for them, and encourage them to consider critical privacy and ethical considerations up front, the Beeck Center for Social Innovation at Georgetown University has developed and published *The Blockchain Ethical Design Framework for Social Impact.*[155] As a first step, the framework encourages readers to consider whether blockchain is a viable option for their needs, or whether a more traditional technology might be a better fit (see Figure 59). This approach can help mitigate risks inherent with emerging technologies when a proven and likely less expensive, solution already exists.

Once a user determines that blockchain is a viable solution, the framework walks them through the ethical considerations – a critical component of mitigating potential adverse effects. As described in the executive summary, "technology is never neutral; it affects people in both helpful and harmful ways. Values are always embedded in the technology, even when not overtly recognizable."[156] In order to integrate values and ethics into the blockchain technology design and implementation process, the frameworks helps to identify key ethical questions that should be addressed, and provides a framework to approach blockchain usage (see Figure 60). Although the framework is geared to blockchain, its general principles are broadly applicable to other emerging technologies, including AI.

Figure 58: Gartner Hype Cycle for emerging technologies, 2018
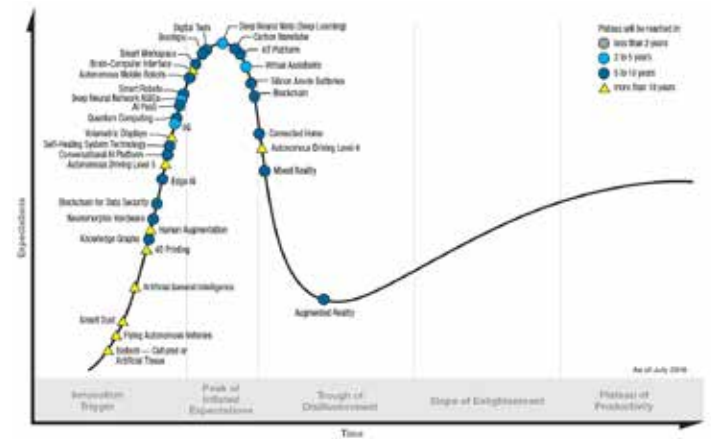
Source: www.gartner.com/smarterwithgartner.

Figure 60: Blockchain ethical design framework

Source: http://beeckcenter.georgetown.edu/blockchain-ethical-design-framework-social-impact

Figure 59: Is blockchain a viable technology option?

Source: http://beeckcenter.georgetown.edu/blockchain-ethical-design-framework-social-impact

155 See http://beeckcenter.georgetown.edu/blockchain-ethical-design-framework-social-impact.
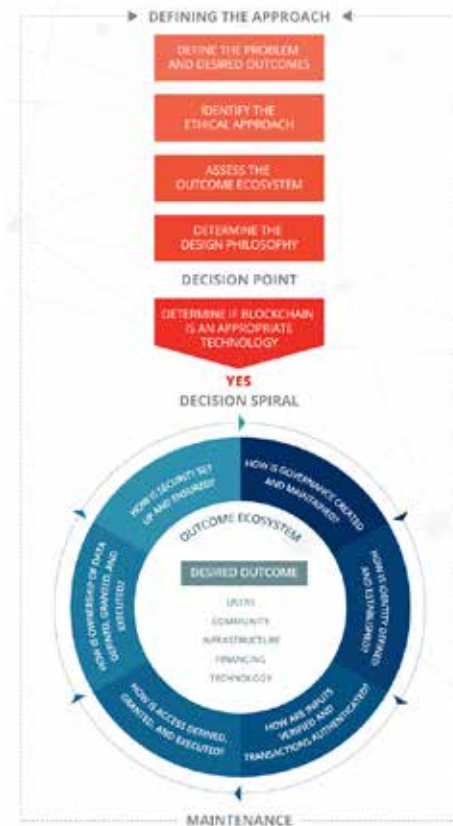
156 Ibid.

Recommendations

Governments are learning quickly and creating and transforming the world around them into machine-readable form, unlocking the potential for a sweeping range of innovative possibilities. The machine-readable code and data produced through these initiatives can fuel public innovation with emerging technologies. Understanding these technologies and all the considerations that surround them can be dizzying, but it is important for public sector innovators and governments at large to build relevant awareness and capacities. Beyond their potential (or not) to help address public sector challenges, such capacities are important because these technologies are here to stay. At some point, governments involvement will become imperative, as is currently the case with Facebook, Google and other companies whose business models centre on personal data. When that time comes, knowledgeable governments will be more prepared to respond.

» **Support multi-disciplinarity.** During meetings for the development of this report, innovation teams repeatedly cited one key factor as critical to success: building a multi-disciplinary team comprising representatives from different parts of government with a variety of skills and expertise. At the outset of any innovation project, governments should convene a group consisting of the skilled individuals necessary to make the project a success. Such individuals could include policy analysts and advisors, field experts, user-experience designers, software developers and attorneys.

» **Ensure algorithms are transparent.** Algorithms for projects related to machine readability and emerging technology are becoming ubiquitous. Where they provide decisions or guidance, it is crucial that the public view them as legitimate. Transparency helps to secure this legitimacy, as individuals and groups can analyse the algorithms and hold government accountable for their soundness and lack of bias. Governments should also include documentation on underlying assumptions and details on the data that feed into the algorithms.

» **Build ethics into the design and implementation of initiatives.** The last two years have witnessed tremendous upheaval in terms of the treatment of personal data by some of the world largest private sector companies. Ethics lies at the centre of these controversies. As can be seen from recent challenges affecting large private sector companies built upon private data, ethical considerations need to be built into each step of the design and implementation process, or serious problems can arise. The public sector is held to an even higher standard. Significant risk accompanies efforts to pursue emerging tech projects due to the unproven nature of the technology. Governments must therefore mitigate future risk by including ethical protocols and frameworks into their projects.

03

Better Rules, better outcomes through machine-consumable laws

One of the most foundational roles of government is to establish laws and other rules by which society is governed. Despite the importance of this role, little has been done to update the underlying processes and to leverage modern technologies to make them better. In New Zealand, the government has created Better Rules, an innovative pilot project that is rewriting the rulebook with machine-consumable code to help ensure that the implementation of laws better matches their original intent. The project also makes it possible to develop real-time feedback loops between legislative design and implementation processes, allowing for better design of laws up front, and agile refinement of laws over time. Looking ahead, the concept of law-as-code has the potential to fuel decision-making algorithms, AI applications and immersive virtual reality experiences.

TREND 03
CASE STUDY

New Zealand

The problem

Governments carry out their day-to-day work and interact with residents and businesses based on evolving sets of rules. These range from laws put in place by legislators and policies developed by government decision-makers, to business rules that structure individual programmes and the logic rules programmed into the software used to implement government services. These rules form the basis of nearly all government actions, behaviours and decisions, and require a significant amount of energy to ensure compliance by individuals and business, as well as government oversight and enforcement. These rules have a significant impact on the lives of the public and the ability of business and other organisations to achieve their mission, however the associated development and implementation processes still reflect paper-based environments almost obsolete in many other domains. This results in missed opportunities such as difficulties in aligning policy-making with delivery through digital channels, as well as a number of challenges.

The process whereby these rules are designed and implemented can be difficult for most members of the public to understand. Many government rules can also be difficult to understand and navigate. Furthermore, not all rules are easily accessible and some are not publicly available. This hinders people from understanding their rights, obligations and entitlements, and how government decision-making affects them. On occasion, the effort required to understand and follow rules is disproportionate to the benefit of compliance. Complexity and ambiguity around rules also tends to restrict understanding to people with a high level of education and training, such as lawyers.

The complexity and ambiguity of rules necessitates interpretation, which can result in inaccurate and/or inconsistent implementation of laws and policies, causing a mismatch between policy intent and implementation. This is especially true of foundational rules, such as laws. In the words of the Better Rules team, once a law is enacted, the current model positions "lawyers as modems" who, along with other types of advisors and analysts, are necessary to interpret and translate the law into operational policies and business rules, which are then translated by others into a variety of information systems, among others. These interpretations require human judgment and have the potential to skew the original intent of the law through misinterpretation and errors. Such interpretations are then operationalised, by coding

Figure 61: Current state: Translation gap in policy production and consumption
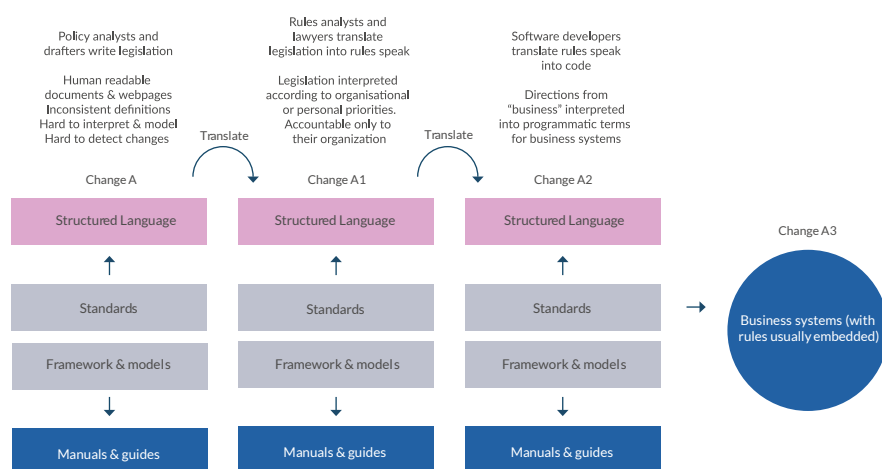
Source: www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html

workflows, decision models and calculations into software (see Figure 61). The decisions rendered by such systems have the potential to impact the lives of millions of people.

Over time, the factors and assumptions underlying the implementation of laws and policies can be lost, rendering it impossible to trace the formative decisions and thinking. For example, many governments use decades-old legacy information systems to process critical services, such as social benefits payments. These systems can be opaque, and the individuals who understand why and how the systems conduct calculations and reach decisions on who receives benefits may no longer be available. In addition, every time a law or major policy changes, the software needs to be manually updated by replacing the hard-coded values with new values. In such situations, it is unclear who should interpret any grey areas and make decisions regarding how the information systems and software should implement the law.

Another issue is that once laws and policies are implemented, a significant period of time is necessary to understand their results and impact. It takes even longer to make corrections and other adjustments. The linear feedback loops of traditional policy and development systems make rapid, iterative evaluation and revisions of rules impossible.

Finally, the traditional approach represents a missed opportunity to build alignment between policy-making, drafting and service delivery through digital channels, including through emerging technologies such as AI.

An innovative solution

The Government of New Zealand's cross-agency Service Innovation Lab initially launched "Better Rules" as an experiment to test machine-consumable laws, and as a potential solution to the challenges discussed above. As an alternative to human interpretation of laws whose intent is locked up in text on paper and PDFs, the team sought instead to develop law in the form of software code which could be consumed by computers and immediately understood, with a view to implementing the exact requirements of a law in a consistent manner (see Box 14). Under the traditional model, legal teams in different government agencies and

Goal

"We started with our future state in mind, which was to have human and machine consumable versions of rules for effective and efficient delivery of services".

Source: Better Rules Discovery Report.

businesses individually interpret the law, resulting in many potentially different approaches to implementation. Law-as-code, on the other hand, provides a single precise, clear and authoritative source of truth. This helps to eliminate ambiguity and inconsistencies, and better ensure that implementation of a law matches its original intent. It also makes it easier to understand and trace how laws are implemented.

Box 14: Machine-consumable

Machine consumable, for the purpose of this work, means having particular types of rules available in a code or code-like form that software can understand and interact with, such as a calculation, the eligibility criteria for a benefit or automated financial reporting obligations for compliance. It goes beyond "machine-readable" (e.g. XML), as machine-readable laws are typically not machine actionable – calculations cannot be made from them.

Source: www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html.

Box 15: Discovery sprint

A discovery sprint is a necessarily constrained exploration of key ideas or concepts. The intent is to understand the problem and opportunity without investing too much effort too soon.

Source: www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html.

Better Rules was launched initially in February 2018 as an informal, exploratory process that took the form of a three-week "discovery sprint" (see Box 15). The discovery sprint team conceived of a multi-agency and

Figure 62: Future state: no translation gap
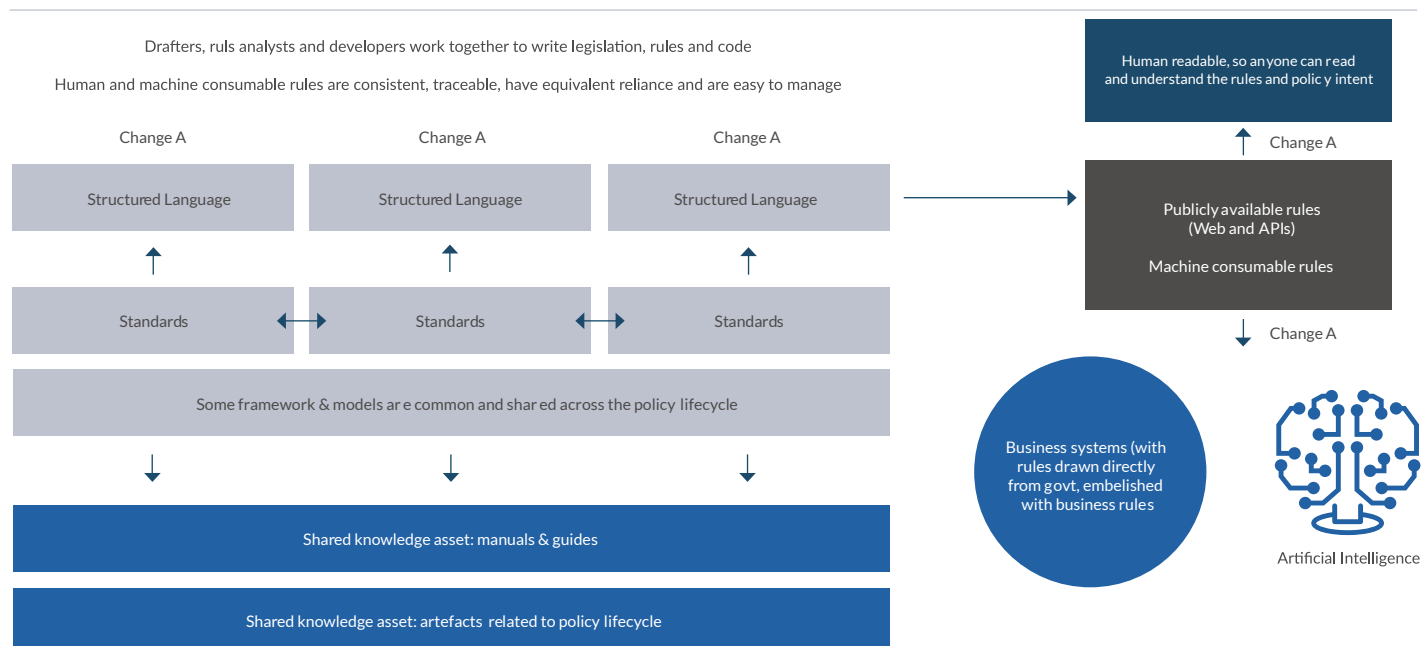
Source: www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html

multi-disciplinary approach to co-design authoritative and reusable machine-consumable laws in conjunction with equivalent human-readable versions (see Figure 62). Together, these versions would better enable government offices, businesses and individuals to understand the law and how it affects them.

Service Innovation Lab brought together a team consisting of representatives of different branches of government, ministries and the private sector,[161] including legislative drafters, policy advisors, service designers, rules analysts and software coders. Using a design-led and agile approach, the team initially focused on gaining a full understanding of the challenges with the current model, and the opportunities that machine-consumable laws presented (see Figure 63). The teams then worked on two real-world use cases to test the concept of developing machine-consumable rules in parallel to human-readable legislation (see Table 2).

Table 2: Two pilot use-cases

Rates Rebate Act[162]	Holidays Act[163]
Enacted in 1973	Enacted in 2003
Intends to lower the burden of home ownership for those on low incomes by reducing the taxes on their home	Provisions include annual holiday entitlements for workers in New Zealand
Under-subscribed	Intends to guarantee workers a predictable four calendar weeks of paid leave each year
Produces complicated interactions between ratepayers and central and local governments	Confusion in implementation around what constitutes a "week", how to calculate balances, and how much to deduct from a balance when leave is requested.
Recent amendment added even more complexity	This results in challenges for employees, employers, and those who design payroll and accounting software.

The discovery sprint team created concept models that broke down the individual steps of the Act, defined key terms, and articulated the interactions between various concepts and individuals. They then developed decision models that mapped out the logic behind decisions, such as eligibility and entitlement criteria. Next, each team generated three key versions of the legislation:

1. Human readable legislation

2. Pseudocode (i.e. detailed logic behind decisions written in plain English, which helps to craft actual software code)

3. Software code.

Crucially, these products were constructed in parallel using an interdisciplinary team. This process allows people who otherwise

use different languages to come together and shape a common approach and draw on their respective strengths and knowledge. It also enables everyone involved to acquire a mutual understanding of how the draft legislation would impact end users, which can help shape and improve the design. Taken together, the created products enable both humans and machines to consume an authoritative source of the law and understand how decisions should be made and how they affect benefits, without the need for expert interpretation. Critically, they also provide the necessary building blocks to fuel the software algorithms used to implement digital services. By using open source software application OpenFisca,[164] the Better

161 Specifically, the multi-disciplinary team comprised representatives from the Inland Revenue (IR), the Ministry of Business, Innovation and Employment (MBIE), the Parliamentary Counsel Office (PCO) and a private sector software company.

162 See www.legislation.govt.nz/act/public/1973/0005/latest/whole.html for full text of the Act, and www.digital.govt.nz/blog/labplus-rates-rebates-discovery-report for the Rates Rebates Discovery Report.

163 See www.legislation.govt.nz/act/public/2003/0129/36.0/DLM236387.html for the full text of the Act.

164 OpenFisca is an open source computational law engine. See https://openfisca.org for the software website, and www.digital.govt.nz/blog/turning-the-rules-of-government-into-code-using-openfisca for instructions from the Better Rules team and their partners on how to turn the rules of government into code using OpenFisca.

Figure 63: Brainstorming approaches to the discovery sprint

Source: Better Rules Team.

Rules team was able to create a functional proof-of-concept to demonstrate the feasibility of this approach.[165] Such use cases of legislation as code have proven the value of this approach, particularly to support integrated service delivery for eligibility calculations, as well as clarification of rights and obligations, and compliance purposes.

The initial discovery sprint was seen as a success, and in July 2018 the Service Innovation Lab and the Better-for-Business programme agreed to co-lead further development of this initiative. Together, these co-leads represent a voluntary coalition of 16 government agencies responsible for a large number of regulatory frameworks, and providing the majority of government services to citizens and businesses. The breadth of areas they cover also represents tremendous potential for expanding the Better Rules principles and approaches to additional domains.

Beyond helping to ensure that implementation of laws matches their intent, Better Rules can be leveraged for a number of other benefits. Machine-consumable rules have the power to transform the process of designing and drafting rules. As more laws become machine consumable, advisors and decision makers will be able to run through various scenarios and test how a potential change in the law could ripple across a system and affect government programmes and end users. This offers the possibility to experiment with policy options on new scales, whereas the traditional approach tends to rely on a "wait and see" approach, enacting new rules and then seeing whether they work. Further downstream, this approach could also enable new forms of monitoring of implementation. Instead of conducting after-the-fact impact assessments months or years after enactment of a new rule, mechanisms could be put in place that allow governments to collect real-time data to inform evaluations of compliance and impact.

Additionally, automated systems that use the machine-consumable rules will be able to provide continuous feedback about the effects of implementation. This will enable governments to understand in real time how the law may affect individuals and businesses on the receiving end. Once the benefits

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165 See code at https://github.com/ebuckley/legislation_as_code/blob/master/rates_rebate_as_plain_old_python.ipynb

of the front-end design process are combined with downstream implementation, Better Rules can potentially establish a constant real-time feedback loop between decision makers and the public. In the future this may enable lawmakers to make improvements to laws in a more agile manner.

Major potential also exists for third-party users to build products and services that use machine-readable rules. Providing laws and other rules as code enables software, artificial intelligence, blockchain and internet of things (IoT) applications to become primary consumers of government rules. This can lead to new business models and products that support new economic development in New Zealand. For example, machine-readable laws could result in new RegTech, FinTech and legal tech applications. On the civil society end, machine-consumable rules could produce new methods and tools for monitoring and evaluating the transparency and accountability of government. By providing the public with the same tools that are used by government, the public sector effectively lowers the barriers of entry to public discourse.

Providing laws and other rules as code is not without its limitations. First off, not all rules are suitable for machine readability. The Better Rules team has identified the features of rules that are most valuable in this regard (see Box 16). In addition, even though Better Rules is designed to minimise human interpretation for some types of rules, such interpretation is immensely valuable for other types of rules. For example, justice issues may not be suitable, as interpretation of the law on a case-by-case basis is important for ensuring due process and equitable treatment of citizens. If taken too far, there is also a risk of de-politicising important debates, as machines become more capable of proposing courses of action. This has the potential to undermine democratic values and the role of government. In many cases, lengthy political debate and the need for interpretation are features, not bugs.

Box 16: Features of legislation that make them suitable for machine readability

» They involve a calculation

» They involve a process that requires factual information to determine application, eligibility, entitlements or coverage

» They prescribe a process that is used repeatedly

» They prescribe a compliance process or obligation (e.g. regulations that set out 14 different steps that must take place before raw milk can be certified as being fit for human consumption)

» They prescribe a process or system that can be delivered digitally.

Source: Better Rules Discovery Report

In addition, the benefits of machine-readable rules only accrue as long as the rules and decisions are freely available as open source formats. If the rules are not open source, there may be significant democratic risks, according to the Better rules team. Without transparency in rules and decision algorithms, there is the potential for wrong decisions to be made faster. Decision algorithms that have embedded biases could be identified through a transparent process, but would be hidden if the algorithms are not open source. Legislation is arguably the most important data asset from government. By making all aspects of it open source, governments can foster trust through transparency and allow a wider community – both public and private – to participate in delivering services of value.

Going forward, the Better Rules team intends to further test the approach on end-to-end design and implementation of a piece of legislation. To accelerate their work and amplify their impact, in September 2018 the Better Rules team launched a global online discussion forum[166] to help shape a common vision and set of actions. The team will be working to link up global interests through the online forum, which will help them to harness the collective work and intelligence of communities and countries to better understand the challenges and opportunities for machine-readable laws.

Considering that machine-readable data fuel both traditional software applications and newly emerging technologies, it is logical to anticipate potential future uses and impacts that are not completely clear today. For example, instead of lawmakers using real-time feedback available through Better Rules to rapidly improve upon laws, can artificial intelligence (AI) applications be programmed with evolutionary algorithms to autonomously identify how laws should be changed? Can virtual reality (VR) be used to help decision makers visualise synaptic journeys of rule-change scenarios and their impacts on citizens and residents? Can VR scenario experiences and decisions made in a VR environment generate proposed legislation? These are questions that raise fascinating prospects for the future, and are actively being explored by the Better Rules team.

Novelty

Other efforts have looked at optimising the policy or drafting process, and trying to develop code from existing legislation. Better Rules brings the two professions together as part of a multidisciplinary team to co-design both human and machine-consumable legislation.

Additional novel aspects to the case included bringing together a multidisciplinary coalition representing different areas and branches of government as part of the policy-making and development process, thereby bridging the gap between the world of policy and the world of code.

Results and impact

Since the initial discovery sprint the Better Rules approach has attracted a lot of interest. For example, the Inland Revenue Department has used the front-end design approach for the research and development of Tax Incentive legislation.

As the initiative expands, a number of benefits are expected to accrue. These include:[167]

» faster and better delivery of policy intent through integrated policy and service design

» reduced risk from misinterpretation of rules

» communication of rule changes simultaneously for all systems relying on those rules

» early error correction, modelling and testing of outcomes

» better cross-system rules management

» accountability of public and private implementation and decision-making

» incorporation of third parties as part of a government services ecosystem.

User perspective

Better Rules has demonstrated significant transformation potential, but it is still in its infancy. In order to explore the ideas and practice of making legislation machine readable that can be reused and integrated across domains, the Service Innovation Lab partnered with Legal Hackers NZ[168] to hold a series of "Better Rules Hack"[169] hackathons in May through July 2018. Participants from the hackathons included some of the earliest users of Better Rules, who were able to develop functional prototypes that demonstrate the power of law as code. As discussed on the Better Rules project lead Nadia Webster's blog,[170] these users found that Better Rules enables:

» digital service delivery that works for people by hiding the complexity of multiple rule sets and giving them greater certainty about their eligibility or obligations

» greater opportunities for democratic participation in the development and improvement of legislation

» improvement in the logic and consistency within and across different rule sets.

"If we want to move beyond our silos, then we need to create a way to search for what's common, a solid base from which to re-imagine who we want to become."

Brigette Metzler, Better Rules Hack participant[171]

167 See www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html.

168 See https://legalhackers.nz.

169 See https://legalhackers.nz/betterruleshack.

170 See www.digital.govt.nz/blog/better-rules-hack-wellington for coverage of one of the hackathons, including highlights, user findings and videos on the functional prototypes created at the event.

171 See www.digital.govt.nz/blog/legislation-as-code-modelling-in-real-time.

Challenges and lessons learned

The biggest challenge facing Better Rules was to balance the interests of the different groups and professions necessary to make this innovation a success. The value proposition for each group was different, but the overall aim was the same: to enable better services for citizens and businesses. The concept was more easily understood by people in the service delivery and software development industry because they identified with the problems that citizens and businesses encounter in interacting with government. Policy drafters and lawyers, on the other hand, might have perceived the initiative as eroding their profession. While the team had support from senior executives in the policy and drafting professions, it was important to ensure that everybody obtained value from the process. The co-leads worked to bring others on board by holding open meetings each week, where anyone in government interested in the topic could come together to learn about pilot progress and findings. The Better Rules team believes that this process was vital in facilitating broad adoption and support. They also initially targeted non-controversial low-hanging fruit for their initial uses cases to minimise the chance of push-back.

A critical element of success for the Better Rules team was bringing together an interdisciplinary team from across government as well as the private sector. By incorporating advisors who design and draft legislation, lawyers who interpret it, programme staff who implement it and software coders, the team was able to obtain a complete understanding of the journey of a piece of legislation, as well as the user journey for those that the legislation impacts. According to the Better Rules team, understanding the full journey had profound impact on their ability to build common approaches through real collaboration. Having everyone in the same room also created opportunities for greater clarity and consensus regarding the team's objectives.

The Better Rules team believes that for this initiative to work, it was critical to make the full stack of rules visible (from the law through to the individual rules programmed into software calculations and decision models). A potential challenge is reluctance on the part of some government programmes to have rules relevant to their lines of work become machine consumable. As laws become machine consumable, government offices will need to open up and adapt their information systems and software to become more transparent. This has the potential to shine a light on how decisions have been made in the past. It may also highlight the arbitrary nature of how some rules have been programmed, and show that different offices are interpreting laws in different, perhaps incorrect ways. Additionally, it could reveal that legacy systems have been calculating benefits in different and perhaps incorrect ways.

Replicability

Within the New Zealand context, the structures put in place by bringing together a cross-government, interdisciplinary team will assist with replicating the Better Rules concept in other areas of the country's government. However, the potential for replicability is much greater. The underlying premise of Better Rules can be replicated in almost any other government, and at all levels of government.

Over 130 individuals from 20 countries are currently participating in the Better Rules online forum. Many of these people are seeking to replicate Better Rules in their own context, in order to realise the potential benefits of increased pace and quality of rules development and ease of service integration, innovation and change management based on single-source, transparent, machine-readable rules.

Machine learning for land-mapping

The Queensland Government Department of Environment and Science has adopted machine learning to automatically map and classify land use features in satellite imagery. Identifying different land uses (e.g. agriculture or housing) is crucial for conserving biodiversity, natural disaster monitoring, and biosecurity disease outbreak readiness and response. It can also be useful in providing a near real-time analysis of potential crops impacted during large disasters such as tropical cyclones and floods.

The Department undertook the mapping of banana plantations as their proof of concept. This demonstrated that their machine-learning approach has an accuracy rate of 97%. This rate is extremely efficient compared to current methods of mapping compilation, and essentially automates work that otherwise takes skilled scientists years to complete. Using this technology, the Queensland Government can accurately map and classify the land use, and thus provide critical, up-to-date information on demand.[172]

172 See https://oecd-opsi.org/innovations/potential-for-mapping-the-worlds-land-resources-using-satellites-and-artificial-intelligence-an-australian-case-study-in-land-use.

TREND 03 CASE STUDY

Queensland, Australia

Figure 64: A map of Queensland produced by the Queensland Land Use Mapping Program

Source: https://qgsp.maps.arcgis.com/apps/Cascade/index.html?appid=ede05699466e46c69dc0290489548ae0.

The problem

The state of Queensland covers 1.7 million square kilometres, an area seven times the size of Great Britain and two-and-a-half times the size of Texas. This large geographical area presents a particular challenge in terms of reacting quickly to crises such as floods, tropical storms or wildfires. Home to two UNESCO World Heritage Sites – the Wet Tropics rainforest and the Great Barrier Reef – Queensland is rich in different flora and fauna, including several endangered species. In light of the substantial losses provoked by natural disasters, the Queensland government needs to be responsive and possess a working knowledge of how the land is used. Over the last 20 years, the Department has relied on the Queensland Land Use Mapping Program (QLUMP) to map and assess land-use patterns and changes throughout Queensland (see Figure 64).[174] The main methodology of QLUMP requires manual interpretation of imagery and hand-digitising to map on screen and classify land use features. The process is both time and resource intensive.

An innovative solution

The Department Environment and Science used existing land use mapping of banana plantations to test the capability of computer vision to map land use features as a proof of concept. Computer vision refers to the engineering of computers to mimic human vision in order to be able to read and understand images. The Department trained the computer to map banana plantations in a basin in north Queensland and used the model to predict

the presence of banana plantations in another basin. The results were very encouraging, with an overall mapping accuracy that correctly reflected the actual use of land as seen in the satellite images.

Machine learning as a sub-discipline of artificial intelligence has progressed in recent years, due to enhanced computing power, with the result that methods of computer vision and deep learning in image analysis and classification approaches are now viable. Machine-learning algorithms enable computers to train on data inputs and use statistical analysis to output values that fall within a specific range. Using this approach, machine learning facilitates the building of models from existing land use data to predict the land uses of a new image.

With a trained model that recognises and distinguishes types of plants, the Department can go beyond banana plantation mapping to mapping other types of land uses that can contribute to improving response times to critical events, such as natural disasters and biosecurity incidents. For example, Queensland is threatened episodically by tropical cyclones, and the viability of the local banana industry was recently shown to be endangered by the detection of a highly damaging fungus disease, Panama Tropical Race 4 (TR4) (Brown, McCarthy and McKillop, 2015). TR4 represents a significant threat, having previously devastated the neighbouring Northern Territory banana industry in the 1990s.

Future work will expand this method to other land use classes in an attempt to fully or semi-automate land use mapping in Queensland. One person using the manual method took approximately six weeks to map all land uses in a basin, including banana plantations. Running the trained model on the same area to map banana plantations took a matter of minutes. With a fully trained model consisting of all land uses, the
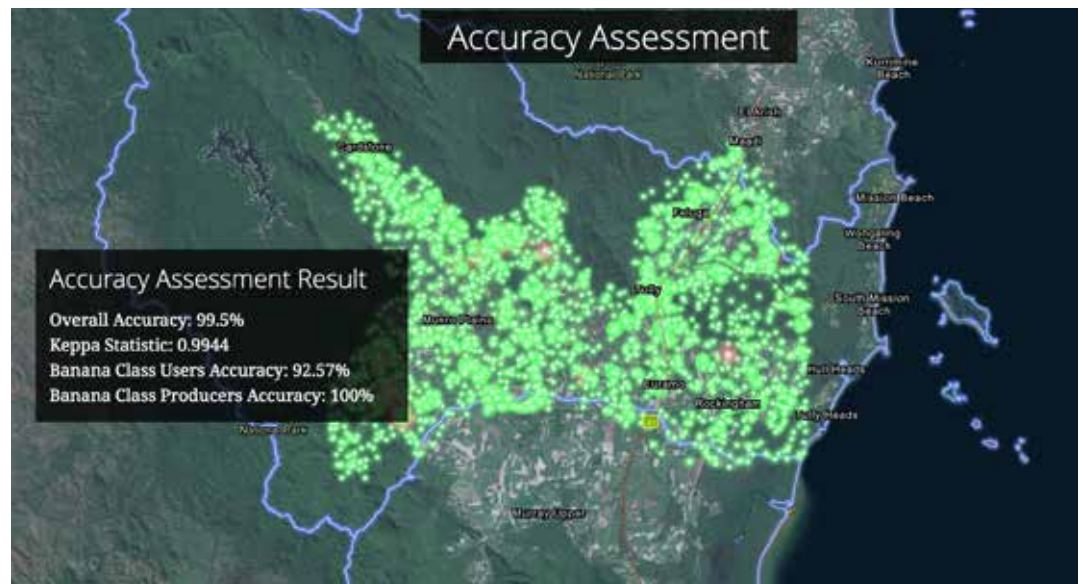
Figure 65: Map demonstrating the accuracy of the prediction model

Note: Green indicates a correct assessment and red indicates erroneous predictions.

Source: https://qgsp.maps.arcgis.com/apps/Cascade/index.html?appid=ede-05699466e46c69dc0290489548ae0.

174 www.qld.gov.au/environment/land/management/mapping/state-wide-monitoring/qlump.

Department estimates it could reduce the state-wide mapping of land use from 30 years to less than a year.

Novelty

Traditional methods for land use identification involve manually reviewing satellite images and tracing boundary lines onto the image to indicate differing uses. The previous generation of land use mapping, known as remote sensing classification, uses the colours (spectral bands) of individual image pixels or dots to identify features. The main problem is that different features can have similar colours, such as banana plantations and rainforests, or even grasslands, all of which are green. Up until now, this limitation has restricted the utility of computers. In interpreting land use, individuals also take into account the context of the whole image, for example, that banana plants are planted in rows, near roads and packing sheds, and have a distinct leaf texture.

The new approach to machine learning and "computer vision" enables the computer to learn about all the components that make up a banana plantation, not just colour. Traditional approaches are also resource-intensive, while one of the benefits of computer vision is the capacity to process big data, which is increasingly being acquired at ever greater spatial and temporal resolutions, to produce extremely timely land use information.

Results and impact

Use of the automated assessment technology produced an assessment of banana and non-banana plantations that was 97% accurate, well above the 80% threshold set by the Department. Further training of the model using additional data will likely resolve some of these issues and further increase accuracy (see Figure 65).

The Department of Environment and Sciences anticipates expanding the methodology to other land use classes to create a fully or semi-automated land use map of Queensland.

User perspective

The primary beneficiary of this new technology is farmers. Queensland has a significant agricultural sector – 94% of the national production of bananas comes from Queensland, in addition to other produce such as sugarcane. In 2006 and 2011, two cyclones (Larry and Yasi) wiped out the banana industry, increasing the cost of bananas five-fold for consumers. Following the natural disaster, the government disbursed relief packages depending on the size of the farm, with farmers getting approximately AUD 30 000 if over 90% of their crop was wiped out. The Department of Environment and Science had no way to verify which farms were damaged, and sent drivers to different regions of Queensland to assess the damage. The new technology enables the government to know which farmers are entitled to post-disaster damage relief in an instantaneous manner, and to eliminate potentially fraudulent claims, thus ensuring that the correct farmers receive the maximum amount to which they are entitled.

Other Queensland governmental departments associated with biosecurity and natural disaster responses have requested and will receive updated mapping of banana plantations and other land uses such as sugar cane mapping. The Queensland Government now has the capacity to rapidly update the mapping of banana plantations to ensure that departments concerned with biosecurity response possess the most accurate information available.

Challenges and lessons learned

The biggest challenge to the Department was the lack of literature on application of this technology. Machine learning for land-mapping is a new area of science, and very little research had been conducted on the subject. Managing the expectations of colleagues and other interested parties also presented a challenge. The methods involved require both training and training data, however some colleagues held expectations that the technology would be able to map anything and everything automatically.

Securing ongoing funding to continue this research and to operationalise and integrate the methods into the existing land use mapping programme has proven challenging. Although the technology represents cutting-edge science and is producing encouraging results, the current economic environment has restricted the available resources to continue this work.

Replicability

These methods have been replicated to map other landscape attributes including sugar cane plantations and woody vegetation. Computer vision has the capability to greatly improve the efficiency of compiling mapping to support large-area landscape management and monitoring programmes, especially in support of natural resource management and monitoring by government and non-government bodies and aid organisations. It is anticipated that these methods could be used to map other features using satellite imagery and aerial photography. Examples include fire scars, woody vegetation change detection and monitoring of mining and coal seam gas well infrastructure.

This technology also has significant applications outside of studying land use. For example, the programme could be utilised in war-torn zones in Syria to categorise buildings as intact or bombarded based on satellite imagery. This information could help peace-keeping forces know about the status of damaged neighbourhoods in real time.

Counterfeit medicine detection using blockchain and AI

Counterfeit drugs constitute the world's largest fraud market, and present major challenges to the economy and people's lives, including potentially hundreds of billions of dollars lost, and hundreds of thousands of deaths every year. In Mongolia, where up to 40% of all medicines are fake, the government has partnered with the private sector to explore the use of blockchain and AI to track each batch of medicine along every step of the supply chain, right up to collection by the customer. A feasibility study has been completed and a pilot is now underway. Although the initiative is still in the early stages, the concept has demonstrated tremendous potential and, if successful, could be replicated worldwide.

TREND 03
CASE STUDY

Mongolia

Figure 66: Memorandum of Understanding signing ceremony

Source: https://oecd-opsi.org/innovations/counterfeit-medicine-detection-using-blockchain-and-ai.

The problem

Tracking, tracing and organising pharmaceutical supply chains represents a complex and costly challenge which spans the manufacturer to the end user. As the world's largest fraud market (Behner, n.d), counterfeit drugs pose a major problem around the world, especially in developing countries. They account for USD 75-200 billion in spending per year, with up to half of all drugs sold in low-income nations (United States International Trade Administration, 2016). According to the World Health Organization (WHO), the failure rate of these products in low and middle-income countries is approximately 10.5%, leading to estimated spending of USD 30.5 billion on substandard or falsified medications (WHO, 2017). The ramifications are not only financial, as counterfeit drugs put consumers' lives at risk. For instance, an estimated 120 000 die annually due to reliance on fake anti-malaria drugs alone (Wall, 2016).

The issue of counterfeit medicine is an especially serious one in Mongolia, where it is estimated that up to 40% of pharmaceutical drugs are counterfeit. Many anti-drug programmes in the country focus on illegal drugs such as heroin and cocaine, leaving fewer resources to combat counterfeit versions of legal drugs, even though the effects can be just as devastating.[175]

In addition, the pharmaceutical industry has a wide network of stakeholders, resulting in a highly complex and inefficient supply chain system that is difficult to monitor (Tseng et al., 2018). The fragmented nature of the industry's trading partners also renders it more difficult to track a product effectively from its origin to final distribution, let alone in an openly transparent manner (Guenther, Pierson and Modi, 2018). In order to ensure that individuals reliant on life-saving medications are properly treated, and to bolster consumer faith in the authenticity of medicines, it is necessary to introduce a consistent, reliable way of validating the medicine supply chain from the point of creation to the point of distribution.

An innovative solution

In February 2018, the Government of Mongolia and the Specialized Inspection Agency of Tuv Province partnered with London-based company FarmaTrust to launch the Mongolian Medicine Verification Program (MMVP), a partnership effected to address the challenge of counterfeit drugs in Mongolia (see Figure 66). The partners have conducted a feasibility study and

launched a pilot programme to use blockchain and AI to reliably track medicines throughout the entire supply chain – from manufacturers and warehouses, through shipping and logistics companies, to hospitals and pharmacies, and eventually all the way to the consumer, with the aim of detecting and eliminating counterfeit drugs.[176]

The feasibility study completed in November 2018 explored a nationwide system of implementation and uncovered many innovative ideas that will be tested during the pilot. The study examined questions including the size of the supply chain and associated challenges (e.g. mapping supply chain touch points at customs, pharmacies and hospitals) and data needs. The proposed technological solution has been fully developed and is functioning,[177] and will deployed as soon as the initiative moves into the pilot phase. In order to demonstrate the practical applications of the innovation, the pilot will cover all drugs in one of the 18 provinces. It is being rolled out in three phases:

1. The Mongolian government will set up the necessary regulations to make MMVP work, including developing medicine serialisation and anti-counterfeit regulations, and mandating a national verification system, as discussed below.

2. Manufacturers will be shown and trained to use the verification system.

3. Distributors and retailers – such as pharmacies and hospitals – will be trained in the verification system, which will allow consumers to verify their medicines at the point of distribution.

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175 See www.youtube.com/watch?v=bskkionz0WI.

176 See www.youtube.com/watch?v=p0teXjW-pTs.

177 See https://pr.blonde20.com/farmatrust-feasibility-study.

178 The MMVO was inspired by the European Medicines Verification Organisation (EMVO). For more information, see https://emvo-medicines.eu.

179 See www.youtube.com/watch?v=bskkionz0WI.

To help achieve this programme, the Government of Mongolia and FarmaTrust are setting up the Mongolia Medicine Verification Organisation (MMVO),[178] which will have responsibility for advancing the MMVP and protecting the Mongolian pharmaceutical supply chain from the entry of counterfeit medicines. The MMVO will also implement the Mongolia Medicine Verification System, which will establish the structure for tracking medicines from their origin to end of the supply chain.

The MMVS consists of four key areas of focus:

1. **Serialisation**. Pharmaceutical manufacturers will place QR codes or other unique identifiers on each packet of pharmaceutical drugs.[179] These identifiers serve as "e-fingerprints" that can be tracked across suppliers and recorded on an immutable blockchain ledger.

2. **Safety features.** Manufacturers will use tamper-evident seals to protect consumers from counterfeit medicines.

3. **Verification**. Once a packet of drugs is entered into the system at the manufacturer, distributors are responsible for scanning and verifying the packet at each step of the supply chain, all the way to the consumer, who also scans the packet to verify its authenticity. Random inspections will also be conducted to ensure consumer protection.

4. **Compliance reporting.** Once a medicine is dispensed, it will trigger automated compliance reporting on the journey of the medicine through the supply chain.

Each of the supply chain scans produces data which are registered on an immutable blockchain ledger, helping to ensure reliable tracking of the packet.[180] Analytics and AI help to ensure that the medicines are transported appropriately through the supply chain – from manufacturers and warehouses, via shipping and logistics companies, to hospitals and pharmacies, and eventually to the consumer.[181]

These technologies are operationalised through two separate mobile applications used for tracking and verifying medications:[182]

» **FT App** allows stakeholders at all touch points along the supply chain (e.g. government inspection agency officials, pharmaceutical industry staff, whole sellers, distributors and retailers) to

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180 Ibid.
181 See www.youtube.com/watch?v=p0teXjW-pTs.
182 See www.youtube.com/watch?v=Eu-Y7ouSNYM.
183 See www.youtube.com/watch?v=p0teXjW-pTs.

Figure 67: Demo consumer confidence app **Source:** Government of Mongolia

scan the label of drugs. This embeds records in an immutable blockchain ensuring the entire history is tracked and transparently verified. With each scan, the application lets the users know whether the drugs are genuine or counterfeit.[183] Falsified packages are discarded.

» **Consumer Confidence App** enables consumers to scan medicine codes to check whether the drugs are genuine or counterfeit (see Figure 67).

Because the system is based on blockchain, counterfeiting is difficult. If someone tried to duplicate a QR code or insert a fictitious QR code into the supply chain, the system would identify the intrusion and raise an alert before the products were able to reach consumers. In the event of duplicates, both packets of drugs (both the legitimate drugs and the counterfeit drugs) would be rejected. Armed with an immutable record of every contact point through which the drugs had passed, investigators could determine where the breakdown had occurred that allowed the counterfeit drugs to enter the supply chain. Such investigations would work to ascertain how the counterfeit drugs entered the supply chain, who might have been involved and what preventative measures could be taken going forward.[184]

This tracking system offers additional benefits beyond helping individuals ensure that their medicines are legitimate. Once packets of pharmaceuticals are scanned and the drugs enter the supply chain, the system's AI algorithms can learn a significant amount about their journey, including the different routes taken. Such information was not necessarily known before, due to the inherent complexity of the system. Armed with this knowledge, AI algorithms can be programmed to locate the most efficient routes to market, and generate predictive insights about which medicines will be needed when and where.

Box 18: Smart contracts

Smart contracts are self-executing contracts (or workflows) that have the terms of agreement between the parties directly written into lines of software code. With smart contracts, "if/then" software programs self-execute when a specific trigger occurs.

Source: ACT-IAC (2017).

They can also help ensure that drugs do not expire on shelves, and are instead routed to those in need. While many of these positive outcomes benefit the pharmaceutical companies, positive effects also accrue to consumers. A more efficient supply chain can prevent price distortions through more efficient distribution of medicines, and better allocation of drugs before they reach their expiration date can result in greater availability of drugs on the market.[185]

Blockchain also unlocks the potential to reduce the complexity of the system and make it more efficient and effective. The use of Smart Contracts creates the potential for automated payments and regulatory reporting, as well as automated auditing functions (see Box 18). These processes can be useful for governments and companies alike.[186]

Novelty

The Counterfeit Medicine Detection initiative in Mongolia is the first blockchain track and trace project in the pharmaceutical industry, according to FarmaTrust.[187]

Results and impact

The programme is still in its early stages and the new software solution has just been rolled out. It is therefore too soon to show demonstrable results or impacts. However, programme leads expect the solution to transform the pharmaceutical industry in Mongolia, save thousands of lives by eliminating counterfeit drugs and contribute to the growth of Mongolia's economy.

Challenges and lessons learned

The biggest challenge, which emerged during the feasibility study, was to ensure collaboration among all supply chain partners in Mongolia, as well as amongst external partners that manage drugs imported into the country. An additional challenge in the case of imported medicines was to ensure compliance from drug manufacturers with the new Mongolian regulations and their agreement to upload their data to the new track and trace system.

Replicability

The issue of counterfeit drugs is one of global importance, affecting in particular low and middle-income countries. If proven, this approach and technology could help ease a problem that results in a significant number of deaths every year. Project leaders believe that this initiative can "act as a case study for other governmental bodies around the world, particularly those in countries where the regulatory environment is unclear and they lack technology infrastructure."[188]

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184 See www.youtube.com/watch?v=bskkionz0WI.

185 See www.youtube.com/watch?v=p0teXjW-pTs.

186 See www.youtube.com/watch?v=bskkionz0WI.

187 See https://pr.blonde20.com/farmatrust-feasibility-study.

188 Ibid.

Conclusion

This review on public sector innovation comes at a paradoxical time. Technology, globalisation and economic turbulence are making modern challenges more complicated and complex than ever before. Conversely, the world in many ways has never been more prosperous and peaceful, with incredible opportunities available to people, often quite literally, in the palm of their hands. Governments and their partners in industry and civil society must navigate this terrain and strike a precarious balance, in order to address challenges while seizing opportunities. This is not an easy task. Through this lens, the current global context is as exhilarating as it is daunting, as energising as it is exhausting.

Unfortunately, there are no clear-cut solutions or even reliable precedents for the current set of circumstances. However, some governments and partners are stepping up and taking risks to experiment with bold, creative and innovative ideas and solutions. In forging new paths, these innovators may create the kind of approaches from which others can learn, adapting new ideas and models to their own unique contexts. In particular, as discussed in this review, these approaches include:

» leveraging new methods, tools and technologies to transform the **invisible to visible**, allowing governments to see and understand insights, perspectives, opinions and possibilities that have previously remained hidden, allowing them to become more effective and make better decisions

» rethinking the traditional role of government and **opening doors** to new economic services and opportunities, as well as providing access to justice and society for marginalised populations

» building a **machine-readable world** comprised of bits and bytes that mirror the physical world in digital form, thereby unlocking public information for mass electronic consumption, reimaging foundational government practices and fuelling the next generation of innovation through emerging technology.

These trends in government innovation highlight novel opportunities and forecast new possible futures. If these trends are able to proliferate and spread their influence to the fullest extent, the future looks very promising. Governments will make use of a broad gamut of solutions – ranging from the analogue to the fully virtual – in order to understand, empathise and engage with their people, make fully informed decisions and help lift up the underserved. They will finally realise the vision of government as a platform, sharing taxpayer-funded spaces and resources for the common good and enabling others to and make new solutions built on top of government foundations. Governments will also generate and act on results and feedback instantly, automatically and transparently, so that the structures and frameworks that guide everyday life will evolve as needed. The OECD Observatory for Public Sector Innovation (OPSI) and the United Arab Emirates (UAE) Mohammed Bin Rashid Centre for Government Innovation (MBRCGI) explore these trends and share these case studies to show innovators worldwide what tomorrow could be like, connecting them through inspiration and common endeavour. Only by shining a light on and actively sharing these important ideas and actions can such a future become possible.

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The MBRCGI works to stimulate and enrich the culture of innovation within governments through the development of an integrated innovation framework. The goal is for innovation to become one of the key pillars of the UAE government in line with the vision of H.H. Sheikh Mohammed Bin Rashid AlMaktoum, UAE Vice President, Prime Minister and Ruler of Dubai, which aims to develop government operations and enhance the UAE's competitiveness.

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The mission of the OECD is to promote policies that will improve the economic and social well-being of people around the world. This review has been developed through the OECD's Public Governance Directorate (GOV), which works to help governments implement strategic, evidence-based and innovative policies to strengthen public governance and respond effectively to economic, social and environmental challenges.

WORLD GOVERNMENT SUMMIT

The MBRCGI sponsored this review in conjunction with the World Government Summit, which is dedicated to shaping the future of government worldwide. Each year, it sets the agenda for the next generation of governments with a focus on harnessing innovation and technology to solve universal challenges facing humanity. It serves as a platform for knowledge exchange, leadership, networking and analysis.

OPSI Observatory of Public Sector Innovation

As a part of GOV, the Observatory of Public Sector Innovation (OPSI) collects and analyses examples of government innovation to provide research and practical advice on how to make innovation work, and serves as a global forum for the exchange of innovative ideas. OPSI led the development of this review.

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