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Use of New Technologies in Regulatory Delivery – Summary Note and Case Studies

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Acknowledgements

List of Abbreviations

AI	Artificial Intelligence
B2B	Business-to-business
B2C	Business-to-Consumer
B4B	Better for Business (Government of New Zealand)
BEWG	Business Environment Working Group
CFR	Community of Federal Regulators (Canada)
CIO	Chief Information Officer
DCED	Donor Committee for Enterprise Development
G2B	Government to Business
G2C	Government to Consumer
G2G	Government to Government
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GNU	Free Unix Style Operating System
IoT	Internet of Things
ML	Machine learning
NAICS	North American Industrial Classification System
OECD	Organization for Economic Cooperation and Development
OpenVAS	Open Vulnerability Assessment System
Prism Institute	Public Risk Management Institute
RACQ	Royal Automobile Club of Queensland
RIK	Estonian Centre of Registers and Information Systems
ULB	Urban Local Bodies (Andhra Pradesh, India)
UQ	University of Queensland
US CFR	United States Code of Federal Regulations

1. Executive Summary

There is growing evidence to suggest that the technological advancements of the 21st century have had profound implications for governments, including many benefits but also heightened complexity and challenges. Specifically, while digital technologies have already disrupted the Business-to-Business (B2B) and Business-to-Customer (B2C) spaces, policy makers alike are yet to understand the underlying benefits, opportunities and challenges in the Government-to-Business (G2B) domain. Being a smarter government requires a more forward-thinking approach to the use and integration of information, technology, and innovation in the activities of governing and delivering services (Ramon Gil-Garcia, 2014).

Rulemaking is generally understood as the process by which regulations are created and promulgated by governments and/or authorities with the powers to make regulations. Regulatory Delivery, on the other hand, is defined as the way that regulatory agencies operate in practice to achieve the intended outcomes of regulations (Russell and Hodges, 2019). Rulemaking and Regulatory Delivery are the two key components of a regulatory system that help render statutory decisions and deliver services provided to citizens and businesses by governmental agencies and/or independent regulators. With digital technologies such as Artificial Intelligence (AI) transforming businesses and societies, regulatory delivery needs to evolve as well especially through the adoption of such technologies to make a balance between burden reduction and protection of public and consumer interest in the new digital era (OECD, 2019). AI-enabled solutions, for example, can not only help regulated parties such as businesses demonstrate compliance, it can assist regulators in allocating resources efficiently and obtaining results that demonstrate meaningful outcomes. They enable smarter regulatory oversight activities such as risk-based targeting by providing information and knowledge that would allow for proactive actions and response.

This study, commissioned by GIZ and World Bank Group on behalf of the Business Environment Working Group of the Donor Committee for Enterprise Development (DCED) contributes new knowledge including progress being made in the G2B applications of emerging technologies and that builds on more recent studies by organizations including The World Bank Group[1], Prism Institute[2], and the OECD[3]. Specifically, this study contributes new knowledge to answering the following questions:

1. How are innovative technologies influencing regulatory rule-making and regulatory delivery models?

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[1] Internet of Things – The New Government to Business Platform

[2] Risk Based Regulatory Delivery – Review and Toolkit of Modern Practices

[3] The Regulatory Future of Emerging Technologies –   A Scoping Paper on Gaps and Opportunities

2. What are the prerequisites regulators have put in place to apply these technologies?
3. How can these technologies support achieving investment climate reform objectives?
4. What are the risks in the use of the technologies and how are they mitigated?

A combination of an initial analysis of over 50 emerging practices in the use of artificial intelligence and other emerging technologies across the different stages of rulemaking and regulatory delivery across 5 continents, and a detailed analysis across six jurisdictions (Australia, USA, Estonia, New Zealand, India and Canada), led to the findings which are summarized later in the Conclusions section. The case studies also provide valuable information supporting the design of a basic maturity model that can be used by practitioners, particularly in developing countries, to guide the implementation, monitoring and benchmarking of these technology applications in rulemaking and regulatory delivery activities. The maturity model, while being a new contribution to literature in this area, should be considered as a work in progress that can be enhanced continually based on evolutions in technology and their applications across the regulatory processes.

2. Introduction to Case Studies

This Note provides highlights of a study on the use of artificial intelligence and other emerging technologies across the different stages of rulemaking and regulatory delivery by analyzing their application across jurisdictions including Australia, USA, Estonia, New Zealand, India and Canada.

The typical stages of a regulatory lifecycle consist of the following at a minimum:
- Development of regulations or rulemaking;
- Regulatory management including regulatory delivery; and
- Monitoring and Feedback.

The typical processes representing best practices that support these various stages of a regulatory lifecycle (OECD 2010), can be captured under the categories illustrated in Figure 1.0 below.

Figure 1. Regulatory Processes (Source: Authors)
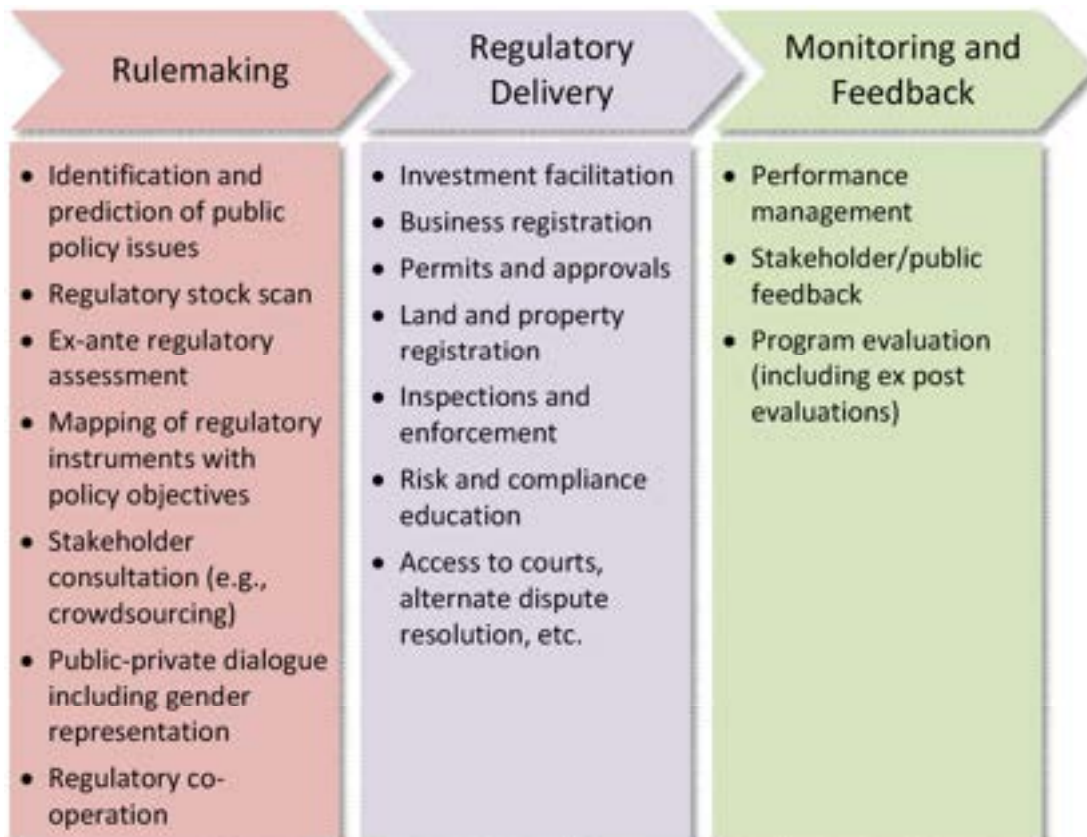
AI, the use of algorithms, and the growing uptake of open data, as well as social media enable regulators to collect timely information, conduct analysis and engage with stakeholders when developing coherent policies. Digital technologies can also replace or complement traditional compliance enforcement methods and support policy evaluation. These technologies described in Figure 2.0 below can help in collecting, aggregating and analyzing large volumes of data (Hu et al, 2014) to facilitate faster, more accurate and more reliable means of executing activities designed across the various stages of life cycle.

Figure 2. Technology Applications for Regulatory Delivery (Source: Authors)
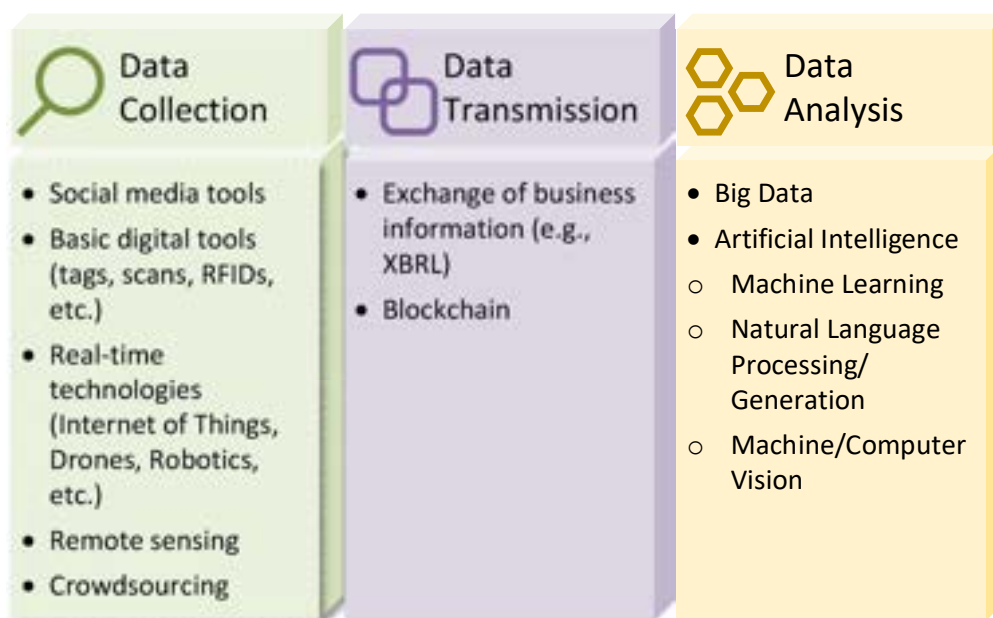
Over 60 cases spanning across Americas, Asia, Europe and Australia were initially identified that covered technology applications across the different stages of lifecycle. These cases (see Annex B) largely represented applications that:

- Targeted Service delivery with "Registrations" (Businesses, Licensing, Land Titles etc.), "Access to Services" and 'Surveillance and inspections";
- Used Artificial intelligence, machine learning and/or natural language processing as the most preferred means; and
- Also covered real-time technology (IoT, remote sensing etc.), social media and crowdsourcing tools, and blockchain technology across the regulatory cycle.

Based on this initial information, six of these cases were selected for further analysis. The intent behind this approach was to learn from the developments of advanced jurisdictions with a potential to be replicated to developing environments (such as, transitional economies, and fragile, conflicted

and volatile areas). The detailed analysis was conducted using a combination of questionnaires, telephone interviews and documentary research. The questionnaire itself was designed based on an initial maturity model framework that was subsequently validated through the case studies. The six case studies are shown in Figure 3.0 below.

Table 1. Summary of Selected Case Studies

Country	Participating Jurisdiction	Level of Government	Regulatory Process	Emerging Technologies	Development Level
Australia	Queensland Department of Transport and Main Roads	State	Identification of Public Policy Issues	Crowdsourcing	In Production
USA/Canada	Multiple	Federal (US), and Provincial (Ontario, Canada)	Regulatory Stock Scan	Machine Learning	In Production
Estonia	Ministry of Justice	National	Business Registration	Artificial Intelligence	Pilot
New Zealand	Ministry of Business Innovation and Employment	Central	Compliance Education	Artificial Intelligence	Pilot
India	Government of Andhra Pradesh	State	Land and Property Registration	Remote Sensing, Internet of Things, Artificial Intelligence	In Production
Canada	Technical Safety BC	Provincial (British Columbia)	Risk based Inspections	Machine Learning	In Production

3. Description of Maturity Model

A basic maturity model using generally described principles[4], was developed to help determine the priority of specific elements required to implement emerging technologies designed for specific regulatory processes. In addition to establishing the priorities, the model is also intended to help map the maturity levels for each of these steps in order to monitor progress. For the purposes of this study, the maturity model was more used to determine the relevance and applicability of the categories and less so to characterize the maturity levels for the selected case studies.

The maturity model was initially developed using four main model categories, Policy Considerations, Institutional Arrangements, Technology Implementation, and Operating Model and Sustainability (Figure 4.0).

Figure 3. Illustration of Maturity Model

Model Category	Maturity level 1 Initial (Concept)	Maturity level 2 Piloted	Maturity level 3 Partially Scaled, Implemented and Standardized	Maturity level 4 Fully Scaled, Implemented and Standardized	Maturity level 5 Optimized with Continuous Improvement
I. Policy Considerations					
II. Institutional Arrangements		The categories and individual elements within each category are described below			
III. Technology Implementation					
IV. Operating Model and Sustainability					

As part of this study, professional judgement was used to assign maturity levels against each category across the case studies. Follow up research is required to further analyze and identify the parameters that would better define the maturity levels.

3.1 Description of Categories

Policy Considerations

This model category examines the relevance of and priority of any legal and policy considerations that are essential prerequisites to support the application of emerging technologies across

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[4] https://en.wikipedia.org/wiki/Maturity_model

regulatory processes. The considerations apply to broad based government policies, specific laws and regulations that may apply to the governance, use and application of data, and other planning considerations. Specifically, the elements addressed under this category include:

- Regulations (performance-based and not prescriptive, focused on an outcome and risk management) that allow the use of AI and other emerging technologies in rule-making and regulatory delivery;
- Policies for using emerging technologies for rule-making and regulatory delivery;
- Specific laws/policies that regulate the collection, ownership, sharing, use, privacy, quality and security of data;
- Standards developed, adopted and/or used for the use of emerging technologies (e.g., interoperability framework);
- Processes for stakeholder consultation and citizen engagement before the use of emerging technologies;
- Gender equity considerations as part of applying emerging technologies (including eliminating gender bias, Leaving no one behind, and any other discrimination); and
- Rules/Policies for using sandboxes for pilot testing.

Institutional Arrangements

Institutions embarking on a journey of implementing emerging technologies are required to put in place arrangements that support the successful implementation of such initiatives. These arrangements range from establishing strategies and plans, appropriate institutional and organizational structures (e.g., inspection coordination bodies), necessary resources and capacity, and private-academic partnerships. Specific elements covered under this category include:

- Organizational structure including a senior role responsible for the use of innovation/risk management/emerging technologies;
- Research programs/partnerships (e.g., academic) to facilitate the development and use of emerging technologies;
- Recruitment, staffing and training programs and practices, and job descriptions that recognize the use of emerging technologies;
- Private companies/Start-ups to be partners in piloting and implementation (including innovative procurement procedures);
- Procedures to pilot test the use of emerging technologies before implementation; and
- Methods for measurement of outcomes and indicators to evaluate the effectiveness of the emerging technologies as an alternative to traditional approaches.

Technology Implementation

The feasibility, ease, reliability and effectiveness of the implementation of AI and other technologies are dependent on some key emerging best practices that reflect both software and hardware

elements including hosting environments and other infrastructure aspects. Some of the elements that help address these expectations under this category include:

- Use of cloud-based technology infrastructure to implement the emerging technologies;
- Interoperability across the regulatory lifecycle (from business entry, over the operation, to exit, implementing "Once Only" principle);
- Infrastructure built to international standards and best practices;
- Specific resources and staffing to manage and maintain the technology infrastructure;
- Marketplace options for implementing the AI and other emerging technologies;
- Platforms that support "Open Data";
- Partnerships with private sector to provide data using emerging technologies for demonstrating compliance, and for risk management; and
- Feedback mechanisms for regulated businesses and the public on the technology applications and services provided.

Operating Models and Sustainability

One of the key challenges and gaps identified in previous studies on topic involve the most effective and appropriate operating business models that not only help initial infrastructure costs but also demonstrate long term sustainability (e.g., ongoing operation and maintenance). Sustainability of such models require a top-down commitment and alignment with government priorities and pathways for active public-private sector dialogue schemes. Specifically, the following elements are necessary for long-term sustainability:

- Alignment of the use of data generated by emerging technologies driven with the broad objectives of the government typically through government mandates and policy directives;
- Availability of long-term strategy and sustainable business models;
- Shared cost of implementation and operation across stakeholders (for e.g., subsidised by the government);
- Incentives for private sector participation (e.g., lower inspections costs, insurance reduction) in emerging technologies;
- Mechanisms to measure the benefits of the implementation (measured against expected outcomes and indicators); and
- Alternative/contingency plans.

4. Conclusions

An initial assessment of over 50 case studies covering 21 countries/jurisdictions in Asia, Americas, Australia and Europe suggests that a wide range of innovative technologies are being used to enhance the quality of service delivery across regulatory life-cycles. More than 60% of these case studies have been successfully implemented and the rest are in pilot/proof of concept stages. A detailed review of six of the 50 case studies using a basic maturity model framework examined the pre-requisites that regulators had to put in place to apply these technologies across four distinct categories including policy considerations, institutional arrangements, technology implementation and operating models and sustainability.

During the review of the six specific case studies, it became obvious that not all the categories and/or specific questions apply to all the individual cases and would therefore need to be tailored to specific elements of the regulatory life cycle and the technologies under consideration. In addition, responses to some of the questions were also dependent on the level of maturity (i.e., status of the implementation) of the technologies thereby limiting the ability to determine their relative importance. The framework also introduced a maturity assessment approach that would help determine the levels at which jurisdictions are and/or need to be to successfully implement the technology solutions. However, as the applications were either in the pilot/proof of concept or early stages of implementation the study was unable to clearly identify the parameters that define the maturity levels and may be covered as part of a future study.

Nonetheless, the case studies reveal some key findings that help provide broad based guidance to developing and transitional economies as they evaluate the relevance and applicability of emerging technologies as part of their investment climate reform. They include:

- Recognition that the collection and use of data is the most fundamental element in the transformation of regulatory processes, because:
    - **Artificial Intelligence and associated applications** (Machine Learning, Natural Language Processing), which are increasingly being used across several regulatory processes, require a range of data sources.
    - Regulators are beginning to recognize the **need for timely, reliable data** using innovative data gathering (e.g., Internet of Things, Remote Sensing) and data aggregation/transmission (blockchain) technologies as key to supporting AI based applications.
- Technology can significantly enhance the scope of regulatory inspections and enforcement by providing valuable data on compliance and risk and therefore making **performance or risk-based regulations** a critical pre-requisite.

- **Regulatory alternatives** (e.g., Self or Co-regulations, Regulatory Co-operation) help in designing timely technology-based responses to disruptive business models **coordinating across multiple agencies and departments, data sharing, or creating automated responses** to regulatory queries spanning across multiple regulatory domains. Examples include global supply chains, online marketplace platforms etc.
- The establishment of **regulation for data collection** helps to not only transparently define the data needs of government but also to mandate its collection, sharing and use. Creating unique identifiers for core data elements creates the opportunity to map and link several government to business services including regulatory delivery.
- Distinct regulatory policies and guidelines are imperative to address issues surrounding **data privacy, prevention of discrimination and biased algorithms, and ethical considerations.**
- **Sandbox environments are a useful means** to **test a range of aspects** including policy development, technology relevance and feasibility, interoperability, costs, and business models.
- The presence of a **senior leadership role** with responsibility for research, development, coordination, and implementation of emerging technologies is seen as vital to the success of their deployment. An **internal team of experts and/or the use of outsourced services** of expertise have both been used to build and maintain capacity and skills within an organization.
- **Partnerships with academic and/or research institutions** have benefited agencies on multiple fronts including access to the most modern and innovative solutions, continuity of support and availability of short-term resources such as internships and lower costs for expertise compared to obtaining prohibitively expensive resources.
- **Cloud based solutions built using open source codes** appear to be the most common, cost effective and standardized means of applying technologies such as AI and ML. These also ensure that the availability of suppliers and experts in the marketplace are adequate and that issues such as interoperability are addressed.
- While most governments are moving towards **"open data"** it is yet unclear if this is always the most appropriate approach particularly if the data is being sourced from external parties such as the private or the regulated sector. Misuse of data (e.g., for enforcement purposes), protection of proprietary information etc. have been raised as risks.
- Increasingly, regulatory agencies are **recruiting data scientists and analysts** to form the backbone of any implementation of such technologies and
- Procurement processes are **ensuring that training modules are an essential component** of any packages provided to regulators from external suppliers.
- In most cases, **governments continue to bear the costs of the research, development and implementation of emerging technologies**. Previous research (World Bank, 2017) suggests that such approaches are unsustainable and subject to several political and administrative

risks and that incentives/subsidies should be created for the private sector to participate in and share the burden.

- The most feasible and sustainable models would involve the **active participation of the private sector** and **for governments to contribute by establishing innovation friendly policies, procurement processes and schemes**.

In addition to addressing the study questions responses to which can be continually updated based on new information, two important contributions have been made through this study:

1. Primarily, it adds to existing literature, the creation of a matrix that maps a taxonomy structure that represents regulatory processes against the different technology applications that are available for data collection, transmission and analysis. This structure was found useful in identifying and building the case studies and will provide a valuable input for regulatory agencies who look to identify similar applications.
2. Secondarily, it has helped in establishing the case and the methodology for a permanent solution to monitor and expand the case studies. Ideally structured in the form of a database, this would provide developing and transitional economies not only with real example applications but also identify resources and expertise that may be required for regulatory transformation activities.

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Annex A: Detailed Review of Selected Case Studies[5]

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[5] The information provided in these case studies were largely gathered through the interviews conducted with experts and officials representing the respective jurisdictions and documents provided by them. These experts have been identified in the Acknowledgements section of this report. These experts and officials have reviewed and approved the content of their respective case studies. Where appropriate and available, public citations to referred documents have been included.

A1: Australia Case study

Background

Representing the rule making aspect of the regulatory cycle, this study was focused on examining the use of technology for consultation of a range of public policy options. Commissioning a study or report on policy aspects such as development of regulations can be expensive and time consuming. The case involves the use of an innovative crowdsourcing tool to address these challenges while examining a range of policy options to address the emergence of disruptive business models (e.g., Uber) in the transport sector.

In response to the emergence of Uber and other personalized transport schemes, the Queensland Government established a taskforce to identify how best the government can meet public interest by identifying opportunities that enable improved access for customers and industry; lifting regulatory and commercial barriers to improve cost effectiveness for industry, customers and government, resulting in greater choice; and ensuring safety quality is upheld. The review (involving 140 stakeholders including RACQ, Taxi Council Queensland, Uber and UQ Business School) began in October 2015 and concluded in July 2016 (State of Queensland, 2016).

In the first phase of the project, the Taskforce used Mindhive, an innovative crowdsourcing tool, to engage with the expertise available, who they believed could assist in providing feedback to the questions they posed. They encouraged operators, consumers and observers from other jurisdictions to engage in this open and transparent process, to ensure a workable solution can be presented to government. Specifically. the Taskforce released a Green Paper for consultation designed to capture the key elements of the personalised transport industry in Queensland and generate dialogue about what the future might look like. To help illustrate different approaches and how individual reforms could work together, the taskforce identified four scenarios and posed some questions about the scenarios and other ideas in the tool.

Based on feedback received, and in the second phase of the review, they chose to further use the tool to seek expertise on the economic and impact analysis prepared for the review. The crowdsourcing tool was further used to engage expertise, analysis and thought leadership from their existing stakeholders and the general public following which a final report with recommendations was presented in the form of a white paper to the Queensland Government.

The Whitepaper led to the Queensland Government developing a new "Personalised Transport Reform Framework" which involved the removal of 80 pieces of regulation to drive innovation and improve customer service standards.

The Framework helps:
- strengthen safety standards;
- provide passengers with greater choice and flexibility;
- drive innovation and improve passenger service standards by reducing red tape; and
- ensure accountability and clearly defined obligations.

The Department of Transport and Main Roads (TMR), which is the implementing agency is currently in Stage 3 of implementation as shown below.

Figure 4. Implementation of crowdsourcing in rulemaking

The tool also helped to bring together people from across their large department and develop consistent thinking and leadership on the digital disruption. As a result, the TMR was able to successfully implement the framework that lifted commercial barriers to improve cost effectiveness for industry, customers and government and provided greater choice and safety for consumers.

Policy Considerations

Crowdsourcing tools can accelerate consultations and create social capital. While it is not currently formally recognized as a tool for stakeholder consultation by the Australian government, it has become standard practice to adopt the tool. **Given the tight deadlines provided by ministers and government mandates, the alternatives to such crowdsourcing tools appear limited** for governments to enable collaborative platforms to generate policy solutions to emerging complex public policy issues.

Such tools as are required to be built to meet with all current data related regulations in Australia with all necessary data privacy provisions are in place. The site itself **has been constructed to banking standards, with encrypted databases and daily penetration testing**. OpenVAS is used to ensure this standard is maintained. While currently not implemented, the platform is capable of integrating algorithms that reflect gender equity considerations as part of its operability.

Institutional Arrangements

Built on a collaborative contributor model, Mindhive has an international research community of academics from a wide range of backgrounds. It is also populated with leading thinkers from industry and the public sector. Institutions such as governments and regulatory agencies can be members through an annual membership model and access the site for specific projects including consultations on regulations etc.

Mindhive also **offers an academy which involves a series of courses that teaches individuals to bring crowdsourcing into their department**, faculty, or organisation and how to plan, build, and execute a crowdsourcing project.

Technology Implementation

The tool is a **cloud-based solution** and is developed using OpenVAS, a software framework of several services and tools offering vulnerability scanning and vulnerability management**. All OpenVAS products are free software, and most components are licensed under the GNU General Public License.**

Conversations, issues and topics are separated from one another. Access to each discussion is determined by the host organisation. The organisation can determine the level of visibility of each individual topic or issue. A topic or issue can be private - visible only to a small group of individually selected experts. Or, it can be public- visible. Organisations are also able to promote their issue through social media and invite external parties to register to Mindhive so as to elicit their contribution. All versions of the document and all discussion will be archived on mindhive.org. Projects will archive automatically allowing the organisation to refer back to a project once complete. The course and method of publication of the final report will be decided by the organisation that proposed the topic - the final report is the property of the organisation.

Operating/Business Models and Sustainability

The tool is available for universities, not-for-profits, governments and other organizations on an annual membership fee basis.

Given the nature of the platform that provides a significant advantage to government and industry by enabling direct access and engagement with evidence-based research, as well as expertise on complex issues. It is currently widely used by federal and state governments in Australia particularly in reviewing new and emerging public policy issues.

A2: USA Case Study

Background

A key aspect of rule-making and regulatory modernization involves taking a stock scan of existing regulations to identify their relevance, adequacy and impact on the economy amongst other factors. Traditional approaches to undertaking such exercises pose several challenges and are fraught with risks of inaccuracy. The number of regulations, amounts of texts within these regulations, overlapping across multiple sectors and in some cases covering different levels of government are some examples of challenges.

State, federal and local governments in the US produce enormous amounts of policy text, including the text of laws, regulations, trade agreements, treaties, court decisions, and even public speeches. As an example, it would take the average person over three years to read the entire US Code of Federal Regulations (CFR), which contains more than 100 million words and counting. The sheer size and complexity of policy documents make it nearly impossible to tackle "big picture" issues, such as the cumulative effects of federal and state regulation.

RegData was developed as a Machine Learning based tool to quantify regulations for governments and agencies (Mclaughlin, Sherouse 2018). This tool is both a methodology and a database that quantifies regulations by industry, by regulatory agency, and over time. Developed by the Mercatus Center, George Mason University, Arlington, USA and originally launched in 2012, it involves developing custom-made computer programs to perform text analytics and apply machine learning algorithms designed to quantify several features of regulation which include metrics on the volume, restrictiveness, and relevance of federal regulations to different sectors and industries. These are then released publicly at http://quantgov.org/data. Such data can then be used by agencies to address policy directions such as red tape reduction, regulatory consolidation etc.

RegData relies on machine learning algorithms to map federal regulations to the sectors and industries, as defined by the North American Industry Classification System (NAICS), that are affected by those regulations. NAICS classifications commonly are used in a wide variety of economic datasets, permitting users to merge RegData with other governmental information sources that may reflect the results or the causes of regulatory policies. The primary metrics in RegData are restrictions and industry relevance. Restrictions is a cardinal proxy for the number of regulatory restrictions contained in regulatory texts, devised by counting specific words and phrases, such as "shall" or "must," that typically are used in legal language to create binding obligations or prohibitions. The database also includes a secondary measure of volume—the total word counts—as an alternative measure of the volume of regulations over time.

RegData has been used by 7 States in the US that announced red tape reductions, the federal government of Canada and several provincial governments in Canada including Ontario.

In 2017, Missouri policymakers launched a regulatory reform initiative after consulting with Mercatus scholars about how to operate a holistic regulatory reform process. This initiative heavily cited Mercatus research and RegData restriction counts, which found that the state's regulations contained over 113,000 restrictions. The Governor's Office froze most rulemaking for a short time and implemented a review process for every rule in the Code of State Regulations. This process required each agency to evaluate their rules according to six criteria and to solicit public feedback.

Figure 5. RegData: Regulatory Restrictions by Agency and Industry

Policy Considerations

While none of the jurisdictions currently using the approach have formally recognized the use of RegData tool as means to achieving their regulatory stock taking objectives, they have established targets around counts that are based on the application of the tools. Ontario, for example, has communicated internally to all the departments that the specific targets will be informed using the RegData tool. The Government of Ontario, Canada, currently uses the count feature of regulations to support the achievement of two government targets: 25% reduction in the count, measuring the cost savings to business of that change. **In order to ensure standardization, consistency in arriving at red tape reduction targets and for benchmarking against other jurisdictions, agencies are encouraged to use the tool through internal government policies.**

Institutional/Organizational Arrangements

Ontario has established a core team within the Cabinet Office to implement and facilitate the use of the tool across various departments and agencies. The tool is implemented in Ontario and other jurisdictions in partnership with George Mason University who have developed and maintain the tool. The nature of the tool (open source) and **partnership approach with the university provides the governments the flexibility and ongoing support in the implementation and monitoring of the technology in the future.**

Institutional arrangements should be set up to avoid the potential for misusing the solution. Examples may include establishing individual departmental budgets based on counts of mandatory requirements. Other risks include use of alternate wording in regulations for restrictions (the tool is currently limited to searching for terms such as "may" and "shall") to game the system.

Technology Implementation

The tool is a **cloud-based solution and is developed using an open source code** and in accordance with open source standards and is therefore easily accessible and customizable, if necessary, by jurisdictions and for private marketplace providers.

The basic data is outputted in the form of csv files. Training is minimal for undertaking regulatory stock counts. However, some amount of training is required for estimating industry relevance and other customizations. The tool is dependent on the structure of the regulations and its linkage with specific departments and agencies and the lack of appropriate structure may pose challenges in applying the tool.

The pre-requisites for the tool include: 1) structure to be standardized, 2) regulations must be in English, 3) documents must be in electronic format that is machine readable (pdf as pictures are harder than pdfs as machine readable), 4) accessibility.

Operating/Business Models and Sustainability

The tool is currently available for government agencies for free and therefore a major incentive for jurisdictions to use the same. The costs for the tool are currently subsidised through a not-for-profit venture set up at George Mason University and the limitations of wider use of the tool would be the availability of resources and time from the Mercatus Centre.

The Centre is currently working on another project wherein regulators output their products in machine readable format. In such a scenario all regulations if developed using standard typology, would make RegData irrelevant.

A3: Estonia Case Study

Background

One stop shops and centralized intelligence systems are becoming an important component of the regulatory landscape in successful economies. The ability for businesses to seamlessly search for and register their operations, identify applicable laws and regulations and transact efficiently with governments is becoming an essential part of modern regulatory service delivery.

Estonia has been at the forefront of instituting digital technologies into government and throughout its society. The latest wave in the development and use of Artificial Intelligence (AI) received a strong pitch in Estonia, with the adoption of the AI strategy and preparation of a legal framework around its use. The AI initiative in Estonia is called "Kratt," according to a magical creature in Estonian mythology brought to life from hay or household objects making terrible things happen if not being taken care of.

The work to understand AI in Estonia started by establishing the self-driving vehicles task force. Soon it became clear that the scope was too limited for a far-reaching implication of AI. In 2016 the work started within a task force under the Ministry of Economic Affairs and Communications and the Government Office to solve the problem of accountability in the machine and deep-learning algorithms, as they do not follow 'if-then' type of logic, which makes them legally hard to define. For example, in the event of an accident, even the creators of the algorithm cannot determine where the mistake exactly occurred.

The encouragement and support to introduce AI augmented solutions comes from the highest political levels in Estonia. Several AI-based projects have been started at government agencies. For example, manual inspections are no longer done to check if farms on government subsidies have cut their hay fields each summer. Satellite images taken by the European Space Agency are fed into the deep-learning algorithm which determines whether the field is cut or not. Two weeks before the deadline the system notifies farmers with a link to satellite images. The system saved $755,000 in its first year because inspectors made fewer site visits.

This case study explored activities of the Estonian Centre of Registers and Information Systems (RIK) in the use of AI to automate business registration-related processes. RIK is established under the Ministry of Justice, to implement and manage an innovative environment for integrated e-Business Register, e-Land Register, the information system of courts and other systems in the justice domain. Recent pilots involve the AI company name selection process, AI enabled translations of company-related court rulings, AI chatbots to improve the customer service, and the Smart Services for companies to integrate a complete service delivery value chain. The pilot on the AI for business name

selection is in the mature stage of development, ready to be introduced in the real-world production environment.

Policy Considerations

With the development of the AI Act, Estonia is taking an innovative approach to allow the potential growth in AI over the longest possible timeframe. One of the goals is to attract investors by providing a simple, comprehensive guide to enable the broad use of AI systems. The approach decided is not sector specific, given a cross-cutting nature of questions related to cybersecurity, enforcement, and ethics. The efforts are assisted with the use of a blockchain system which is intended to promote the data integrity and security.

The main legal means is awarding a legal personality to AI, which will be accompanied by the introduction of insurance regulations to cover the liability issues. The AI Act will also set boundaries for AI algorithms, by introducing the core ethical principles on which Estonia bases its information society. Due to the unpredictability of AI decision-making pathways, the challenge is the capability of the algorithms to implement such guidelines, as well as the accountability in case of violation. Nonetheless, recent example of introducing sharing economy business utilizing innovative technologies by Uber and Airbnb, eventually showed a need for legislative amendments in Estonia. Initially, Uber and Airbnb were allowed to operate without any legal changes. After the complaints of the traditional taxi operators, the government decided to level the playing field by requiring Uber service providers to get registered as businesses (either sole traders or companies), and by simplifying the licensing process for traditional taxis.

The Personal Data Protection Act prescribes the conditions and procedures for processing of personal data, the supervision procedure, and the liability for the violation. It applies to all data collection which involves personal data, except anonymized data sources. In the domain of business registry data, the Ministry of Justice issued a regulation on the amount of fees for issuing certain data. The government is actively supporting the Open Data concept, and concerning the Business Registry, the open data is available up to a certain limit, as RIK is financing the operation from related fees. Regarding information security, Estonia developed the Three-level IT Baseline Security System (ISKE). ISKE is compulsory for state and local government organizations who handle databases and registries. In Estonia there are no differences between the genders, for example the information about the gender is not even stored in the business registry.

Institutional Arrangements

RIK is a champion of innovation laboratory events, which involve brainstorming sessions called "Think-Tanks," and hackathons to develop software solutions to address particular challenge having

AI as one of the primary targets. Requests to improve business processes are going to the RIK innovation laboratory and are followed with two-three days hackathons to collect the ideas. The best three solutions receive an award (for example, 10,000 EUR for the first place, 5,000 for the second, and 3,000 for the third place).

The connection with academia is organized through joint projects, as well as by involving consultants working both in the academic and private sector. Also, representatives from academia are participating in the government AI Task Force that proposes AI development and projects. To prevent the risk of failure, new solutions are usually researched and tested in the academic environment, and once mature, the development is continued by the government through projects.

Job descriptions and recruitment processes organized by RIK are requesting knowledge of emerging technologies. For example, in one recent project, experience with blockchain was requested in the job description. Partnership with the private sector is significant in the development of government solutions. The private companies are participating in hackathons and the development of the pilots. The design of the AI for business name reservation is organized through a public-private partnership, and government financing will be used to implement the solution for a real-life production environment.

Needs of entrepreneurs and other stakeholders are assessed through feedbacks and from journals following and evaluating the business environment in Estonia. The feedback is received through checklists attached to online services at the end of the process, through the innovation events, and the call center for customer support. Occasionally questionnaires are sent to businesses requesting feedback, often without many inputs received. The impact of innovations in service delivery is continually evaluated and used to measure the success.

Technology Implementation

RIK selected to automate company name selection and validation with the use of AI (Figure 6). For this task, RIK used logistic regression machine learning algorithm commonly applied for classification tasks. The intention is to use this AI development as a pathway to a fully automated company registration which can be applied in some instances since the business name validation is one of the important tasks which traditional IT systems cannot automate because of many different rules that apply.

RIK implemented the chatbot to improve the customer service, as most of the questions are quite similar and could be answered automatically. Another pilot is the AI based translations of court rulings to provide foreigners' ability to understand the content of decisions related to their companies. In this project, RIK is testing the Neural Machine Translation (MT), which is the next generation of machine translation technology and produces more fluent translations than ever before.

The Smart Service for Companies initiative is a good example of a highly interoperable environment and the implementation of a point of single contact and "Once Only" principles. RIK is piloting the initiative by integrating the VAT registration and the registration of employees with business registration. Financing is requested to expand with additional services, and the next step is to add the information and enable online applications and processing of business licenses.

The Smart Service should help the entrepreneur to understand and navigate through a company life cycle by suggesting different actions, supporting grants and information from the government. This means that the AI/machine learning algorithm constantly "learns" what are the behavior patterns of the entrepreneur and presents helpful information at the right time.

The next stage is to enable AI to suggest different actions to the entrepreneur to lessen bureaucracy, such as filing annual reports, sending e-invoices, statistics reports, renewal applications and other similar actions. The plan is that the platform allows private companies to develop and add commercial applications, and let the AI choose the services relevant to entrepreneurs. The platform could also use economic indicators to predict the probability of

Step 1: Checking name availability and receiving percentage from AI – example of "Koka-Kola"

Step 2: Support to decision making in the back office

Step 3: Providing a reason for rejection used to train the AI

Figure 6. Estonia RIK – AI for Company Name Selection

recession in some area of activity (i.e., AI Company Life Expectancy) and suggest what entrepreneur could do to prevent a decrease in a profit.

RIK has its own cloud-based infrastructure, along with a government cloud that can be used as a hosting option by agencies. The use of hosting environment depends on a case by case basis, with high-level computing power essential for AI systems. In developments, RIK is applying IT service management standard according to ITIL, agile development (SCRUM), ISO standards, ISKE standard, and others. Policies in Estonia are allowing piloting and sandboxing, which is a common practice, even in a real-life environment if development is sufficiently mature. RIK has all the needed capabilities for any sandboxing, as all systems are managed internally with sufficient competences to organize the sandboxing.

RIK has considerable internal IT expertise, with 90% of IT experts in a staff of 250 employees. The staff turnover is 6-7% on average annually, which is not too high considering the developing market with many startups in the segment of AI and other emerging technologies. The government is encouraging the private sector to harness the innovative technologies with subsidies provided by the Estonian Investment Agency, in particular, robotics in the industry sector.

Operating Model and Sustainability

The broad objective of the government is to actively encourage the use of emerging technologies, especially AI, across the government and in the private sector. RIK has a three-year strategy, whose vision and operating goals are aligned with the higher-level business strategies of the Ministry and government.

The pilot implementation of AI for business name selection has met the expectations, which once implemented can allow an upscale to a fully automated business registration in some cases, without human interaction in the back office. The contingency and alternative option considered is to implement a rule-based decision algorithm, by introducing an initial set of rules and update based on decisions taken.

Initially, AI pilots to improve regulatory service delivery are often organized through a public-private partnership, with a project budget allocated by agencies in the next stage for wider implementation. Also, RIK has a certain level of flexibility as it can engage own staff to developments and use its budget. The developments are based on open source AI frameworks, which allows a sustainable business model and independence from external vendors.

A4: New Zealand Case Study

Background

In addition to seamlessly "registering" their activities and obtaining the necessary approvals for operations as demonstrated in the Estonia case study, businesses are also faced with the challenges of having to navigate through multiple sources for information on applicable laws and regulations and getting support on compliance.

Better for Business (B4B) is a strategic cross-agency programme focussed on making significant improvements to the business experience with government. Originating in 2012, B4B has grown to a collective of 10 New Zealand government agencies that collectively make up approximately 83% of the interactions a business would normally have with government. The programme objective is to make it easier and more seamless for businesses to deal with government.

Figure 7. New Zealand Better for Business (B4B) Programme

Initiatives are prioritised by leveraging B4B's long term business research and insights to identify and prioritise the pain points businesses experience when dealing with government. Customer-centric design approaches are then applied and, where appropriate, digital technologies are adopted to achieve better outcomes for businesses.

To improve government services, B4B specifically focuses on initiatives that improve the consistency of services and coordination between government agencies. B4B's research shows that improvements to these two dimensions of the customer experience have the highest overall correlation to business satisfaction with government.

One of the key pain points for business customers is the right information from the right government agency. Currently information is available from various sources including websites, guidelines, brochures and third party advisors and can run into tens of thousands of pages of information. For example, businesses that export honey from New Zealand are currently required to meet over 20 different regulatory requirements, and information about how to meet these requirements is currently available across several government websites.

Figure 8. Regulatory Requirements for Exporting Honey from New Zealand

Customs Exporting Requirements
Register for Official Organic Assurance
Honey Labelling Requirements
Register as an Exporter
Comply with the Food Act 2014
NZ Food Standards
Market Access Requirements
Overseas Market Access Requirements
Apply to MPI to read the OMARs
Apply for Beekeeper listing
Official Assurance
Free Sales Certificates (FSC)
Free Sales Advice Statements (FSAS).
Premises need to be approved
Registered and verified Risk Management
Verification Services to verify your RMP
Manage Tutin Contamination
Storage Requirements
Transport Requirements
Register for an E-Cert
Export Requirements

In response, B4B decided to examine the use of a "Digital Concierge" to support businesses and reduce the effort of searching for honey export information.

A proof of concept (POC) study was designed to primarily addressing the following questions:
1. Is a Digital Concierge able to point a customer to the correct information in the context of a (cross-agency) regulatory environment?
2. Would a business customer use a Digital Concierge? Are they happy to engage with a "machine" to understand regulatory requirements?

Under the aegis of B4B, agencies including the Ministry of Primary Industries (MPI), the New Zealand Customs Service, the Inland Revenue Department and the Ministry of Business, Innovation and Employment (MBIE) collaborated with a private sector partner who provided the tools and experience to enable experimentation, testing and learning. An off-the-shelf Conversational AI tool set was selected as part of this proof of concept study.

At the core of government services is regulation. The information exporters of honey need to understand is in published legislation and regulations, guidelines, websites, booklets, the knowledge of human experts and even in call centre logs. All this information needed to be reflected in an "Expert System" which transformed the existing unstructured information into structured information using a business rules approach.

With this approach applied to all this information the team was able to build an Expert System for honey exporting. In parallel, the cognitive part of the tool was also developed mainly using Natural Language Processing techniques. From a customer perspective, it all comes together through a simple interactive user interface.

Figure 9. "Tai" Digital assistant / Chatbot
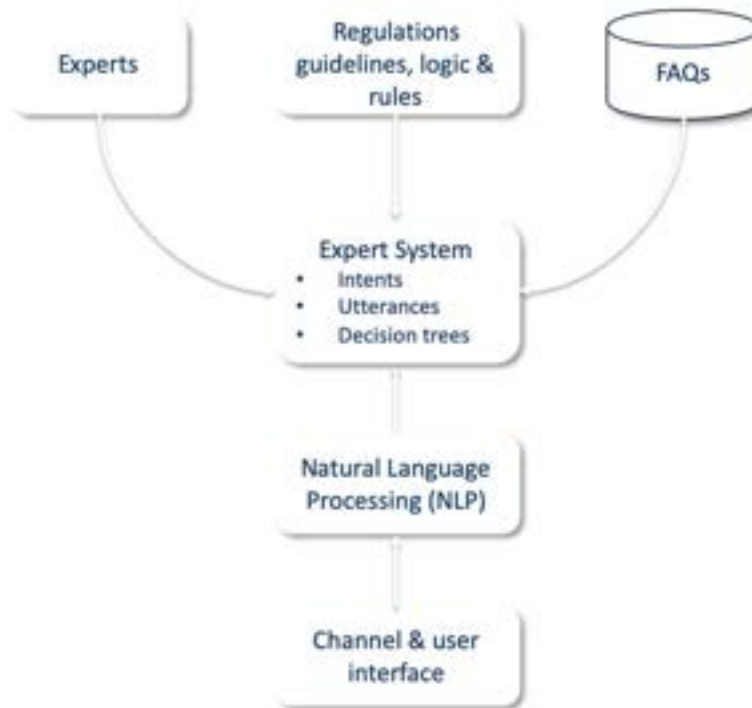
The result of the design work was a digital assistant called Tai – meaning friend or mate in New Zealand's indigenous Maori language. Tai was designed to be a gender neutral 25 year old, who is positive and encouraging with a focus on ensuring people are well informed. Tai's language and conversation style is friendly, with a calm and authoritative voice.

The POC was not only about testing the technology itself but how it could work in a government context. This included spending a lot of time on the profile and character of Tai to ensure the assistant was suitable for the audience. This also included Tai's "tone of voice".

The results from the trial showed that Tai was "faster than using Google search". Furthermore, "the responses through Tai were a lot more tailored than the Google search tests". The trial also found that participants trusted the information provided, and had no problems interacting with Tai since "the majority of participants had used a digital assistant before". Tai was built using Natural Language Processing (NLP), a subset of artificial intelligence that allows a computer to process and interact with human queries. It also uses Machine Learning (ML) to build up its store of knowledge.

Policy Considerations

- The Government of New Zealand has set expectations for good regulatory practice, including expectations for regulatory stewardship by government agencies. These expectations, among other things, cover responsibilities for good regulator practice. Regulatory agencies are expected to:
- **maintain a transparent compliance and enforcement strategy that is evidence-informed, risk-based, responsive, and proportionate to the risks or harms being managed**
- **provide accessible, timely information and support to help regulated parties understand and meet their regulatory obligations**
- **provide simple and straightforward ways to engage with regulated parties and hear and respond to their views**
- maintain and publish up-to-date information about their regulatory decision-making processes, including timelines and the information or principles that inform their regulatory decisions
- develop working relationships with other regulatory agencies within the same or related regulatory systems to share intelligence and co-ordinate activities to help manage regulatory gaps or overlaps, minimise the regulatory burden on regulated parties, and maximise the effective use of scarce regulator resources
- provide their frontline regulatory workforce with the necessary knowledge, skills, tools and support to be able to discharge their responsibilities with integrity, review and improve their professional practice, and report back on issues they may encounter in the course of their work
- contribute to wider regulator capability building initiatives within the state sector where there are common interests and benefits from collective action and leadership
- alert relevant Ministers and monitoring agencies to organisational capability or resourcing issues, or problems with legislation, that may be significantly compromising the agency's ability to discharge its responsibilities to a reasonable or expected standard, and
- at the time of the alert, provide advice on the nature of the resulting system performance risks and proposed or possible mitigating strategies.

The MBIE is responsible for the stewardship of 15 regulatory systems and has partial responsibility for one other. MBIE is also responsible for the development and maintenance of regulatory charters for these regulatory systems. A regulatory charter is a management tool designed to support a living regulatory system and reinforce its shared ownership for those with regulatory functions.

A regulatory charter:
- sets clear expectations for what the regime is intended to achieve
- describes the roles and functions of the various parts of the regulatory regime

- sets out how systems actors will work together to address the gaps, overlaps and uncertainties which inevitably arise in complex systems
- describes a regulatory regime for a public audience.

Institutional Arrangements

As noted earlier, B4B is a strategic cross-agency program that is focused on making significant improvements to the business experience with government.

The Better for Business (B4B) Research Monitor has been running since 2012 and is a biannual survey of 2,000 New Zealand businesses. The B4B Research Monitor gives a unique system-wide view of the business experience with government and provides insights into the world of government from the business' perspective. This allows B4B to identify and prioritise opportunities for improvement.

B4B is also implementing Business Connect, a cross-agency digital initiative, that brings multiple agency services together to make the experience of applying for, managing and renewing 'permissions to operate' (for example licenses, consents, permits, certifications, registrations) more seamless. Integrating the New Zealand Business Number (a unique number for every business in NZ), Business Connect enables businesses to provide information across all levels of government from one place.

A collaboration between multiple government agencies, the 'Better rules – better outcomes' initiative examines the way the regulation is developed to ensure it's more easily implemented as part of government's digital services for citizens and business. It's about re-imagining regulation as an open platform based on logic, decision models and rules – also known as 'legislation as code'.

Technology Implementation

In May 2018 the Digital Government Leadership Group commissioned the development of a Digital Government Strategy that will define the role of government in a networked world. As part of this strategy, initial work has been completed that has identified a number of emerging themes for digital government, including:

1. Collectively reimagine experiences
2. Uplift workforce skills and culture
3. Embrace new leadership models
4. Redesign system settings
5. Establish solid digital foundations

Specifically, under the theme of establishing solid digital foundations, the government expects to create the conditions and building blocks for open collaboration across society, economy and government including:

- Open digital infrastructure: Government needs to operate as a "platform" in which data, processes, and business rules are shared, open, and reusable. This requires safeguards to foster trust and confidence in government.
- Champion Ethics and Rights: Make transparency, openness, privacy, inclusion, and social licence central to what we all do, to encourage responsiveness.
- Enable transformational technologies: Some emerging technologies have the potential to fundamentally reshape the way government operates and the way services are delivered. Multi-stakeholder governance, from within and outside of government, allows us to be responsive to emerging technologies and address any negative consequences of disruption.

Operating Model and Sustainability

Given that the technologies are currently in pilot stages and that the government is setting the foundations to build technology applications, it is too early to describe any business models. However, as highlighted in some of the themes of its digital strategy, the government expects to build a partner-based ecosystem that builds value collaboration, partnerships, and leadership at all levels. Incentivise behaviours that champion openness, partnership and cross government collaboration. It recognizes that Digital' offers new ways of problem-solving that does not require large-scale capital investment. It is better suited to incremental investments that allows for fast course-correction. Multi-agency initiatives need a clear path to funding and ongoing operations. This investment approach enables prudent spend.

A5: India Case Study

Background

Governments and regulators are realizing the need for accurate and timely data for being able to deliver better services to businesses and citizens. Technology plays a vital role in the institutions' ability collect and utilize data efficiently and effectively. However, it is important to identify types of data required, the methods by which they are managed (collected, stored and used) and other aspects of data governance in a transparent manner.

The state of Andhra Pradesh in India has put in place a governance model that is responsive to the needs and aspiration of its people and that will enable the creation of a conducive and enabling policy environment to achieve vision outcomes (E&Y, 2016). The governance model for the state focused on an inclusive regulatory and policy framework, robust, accountable and transparent institutions that provide quality service delivery, the creation of sustainable partnerships and the creation of a vibrant civil society and that is based on the effective and smart use of data.

As part of its data governance model , the government has enacted the [Andhra Pradesh Core Digital Data Authority (Effective Delivery of e-Services) Act, 2017](#) that provides the framework for the government to collect core digital data [6]for the purpose of providing efficient, transparent, and convenient digital services to the citizens and business community of the state and for providing good governance. One key aspect of this regulation requires every core entity (person, property or thing) that provides core data shall have a unique identifier number. Several other regulations and policies with strong e-governance components were also formulated including public service delivery guarantee, technology policies (e.g., IoT, Cloud computing etc.) land management and urban development.

Municipal Administration and Urban Development (MA&UD) Department of the Government of Andhra Pradesh in India is entrusted with the responsibility of urban sector management including Urban Development. The department is responsible for administering and monitoring the activities and functions, and issue necessary directions and orders for better civic administration and sustainable urban development. Policies were enacted that included the introduction of biometric attendance system for all Urban Local Bodies (ULB) functionaries for accountability, E-office system with fully digitized file management system for increased transparency and quicker response and other e-governance elements. As a solution to the challenges of Good Governance in ULBs, the

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[6] Defined as the essential and minimal data about core entities and collected, transmitted, stored, maintained, secured and processed in digital form. Core entity is a physical or artificial juridicial person, property or thing (in households, land parcels and immovable properties), sensors and intelligence devices capturing and communicating information to central servers.

Urban Development Department, took up an "Enterprise Resource Planning (ERP) Model" which revolutionized the urban governance both from functionaries and citizens' point of view.

AP Municipal Development Framework Project sponsored by the World Bank was initiated to support the development of this ERP model which involved three phases. Phase I involved rolling out e-governance activities across 110 urban local bodies. An integrated centralized system involving a total of 18 modules were rolled out as shown in the figure below.

Figure 10. AP Integrated Centralized ERP System

These applications were rolled out on a centralized server (cloud) and made available to the urban bodies by creating a specific instance for each and provided centralized control to all urban bodies.

In Phase 2, GIS Mapping of entire landmass across ULBs was carried out with the use of Drones that fed data into AI algorithms and calculated SFI for all properties in the ULBs. The benefits of this system included addressing gaps in property tax which went up by 4 to 5 times, reduced corruption (lowering costs by owners by falsifying property areas etc.). A combination of drone data, GIS platform and AI helped measure the square footage/Floors and would calculate the property tax and look at backlogs etc.

In addition, the drone data provided valuable information on the condition of the roads, potholes, encroachments, levels and sources of pollution etc. GIS Maps had 100 layers which could be

switched on and off based on needs and modular applications. Each ULB could be covered over a period of 2 weeks using multiple drones.

In Phase 3, an automated building permit control system has been developed using an AI/ML application requiring no human intervention at all. Plans are approved by designated architects and submitted online. An AI interface would determine if the plans meet requirements upon which building construction permits would be sent via email within 30 minutes. Regulatory agencies can now monitor completed construction using drones without having to conduct physical inspections. The system is also connected to other core entities such as IoT sensors and AI based applications and is geared to be implemented in other areas including remote inspections etc.

Policy Considerations

Given a choice, many government agencies prefer to continue with manual mode of delivering services, despite the fact that e-Governance can bring about a sea change in the quality of service. This is basically on account of the fear of the unknown, vested interests in some cases and most commonly internal resistance. In response, the AP Government formulated several pieces of legislation and policies that **seek to mandate the delivery of all citizen/ business services electronically and in a timely manner**. Such mandating was expected to remove the initial hesitation and make all departments to design and implement e-Gov projects in a time-bound manner.

The [Information Technology Act, 2000](#) formulated by the Government of **India stipulates requirements around the collection, ownership, sharing, use, privacy, quality and security of data**. In addition, the AP government also established the **Core Digital Data Authority Act which has specific provisions applicable to data collected by the government** for delivering its services.

The e-governance application **is an open source code and follows the open source foundation**. Driven by interoperability standards, it connects with all aspects connected with GIS etc. IoT driven data are best fitted in this e-governance platform.

Extensive stakeholder consultations were organized through the use of townhall meetings. In addition, the system has a built-in complaint redressal mechanism to which the citizens and businesses can easily connect using mobile applications on their smart phones.

Institutional Arrangements

The ULBs have a **person responsible who is an IT point person** (CIO, IT Manager) and generally has a team of 3-4 people. In addition, each of the 18 modules has **a champion within government**. The maintenance of the various modules is **outsourced to local private companies using procurement guidelines developed by the World Bank**.

The project involved a large training/capacity building component of the project. Several rounds of training took place across various departments that included behavioral training and change management programs. Service level agreements compliant with the newly constituted Public Service Delivery Guarantee Act ensure that the appropriate measurement indicators are used to evaluate the performance of the system.

The government has established several **centres of excellence in partnership with universities and the private sector** to undertake research and development of such modules, provide the necessary education and learning to staff within departments and maintain knowledge hubs.

Technology Implementation

All the modules are housed on a 3rd party cloud data centre which ensures 99% availability of all applications. These modules are designed to meet with the government's broader objectives of real-time governance. They operate using **Command and Communication Centre** models with data input from CC cameras, drones, biometric augmented technology and virtual reality, machine learning technology, Internet of Things (IoT), etc, adopting the most advanced technology of international standards for governance.

Operating Model and Sustainability

The ULB e-governance modules form a key part of the government's Core Platform shown in the figure below (E&Y, 2016). This integrated core platform provides program level services, citizen related services rendered by each department, services internal to the department and provides API interface for applications external to the platform including use by the private sector. This introduces a single point of entry to government services and intends to deliver a technological foundation for digital transformation of G2C, G2B, G2G services, by enabling departments to streamline operations, deliver consistent service, and modernize operations without interruption. The core platform enables development of common applications which are agnostic of the department and relate to horizontal functions of the government. These common applications are built centrally and used in common by all the line departments, with appropriate configuration required by each department.

Figure 11. e-Government Core Platform (Source: E&Y, 2016)
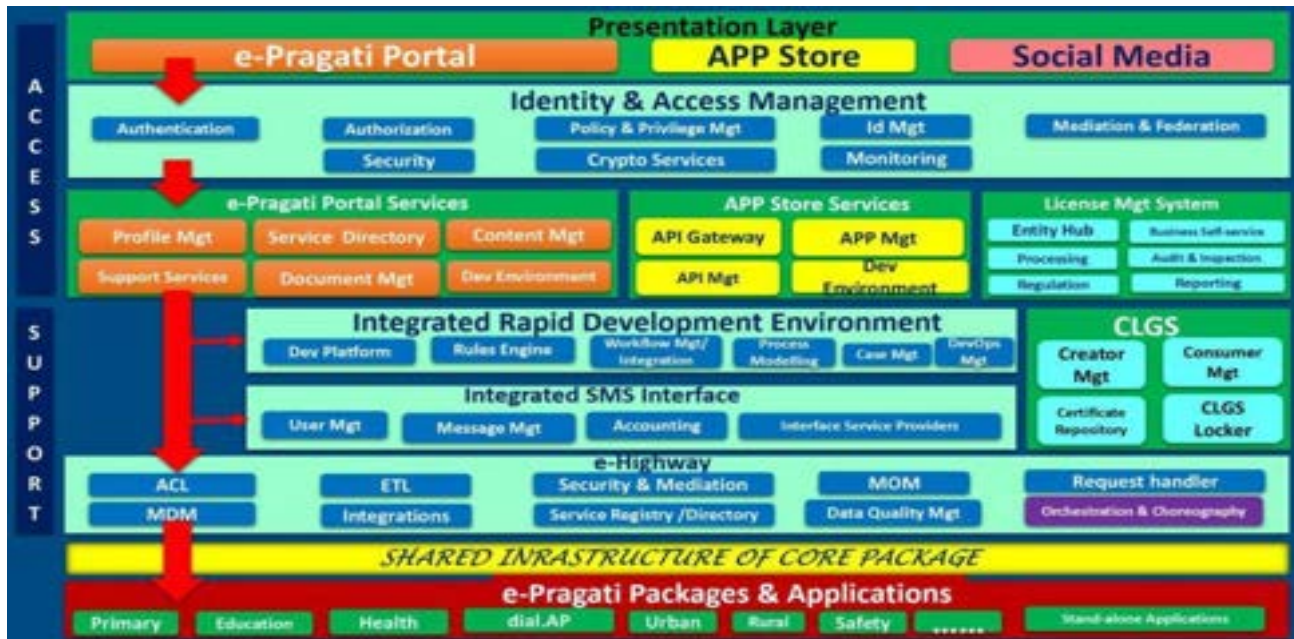
A6: Canada Case Study

Background

Risk based inspections and enforcement have been recognized as part of OECD's regulatory best practice principles (OECD, 2014). Risk based approaches are typically built using predictive models that are reliant on the availability and effective use of data. This case study examines the use of AI/ML tools to inform the prediction of inspection schedules and methods of enforcement.

Technical Safety BC (formerly BC Safety Authority) is a delegated administrative authority that oversees the safe installation and operation of technical systems and equipment across the province of British Columbia. In addition to issuing permits, licenses and certificates, they work with industry to reduce safety risks through assessment, education and outreach, enforcement, and research.

Technical Safety BC operates within a legislative and regulatory framework that includes:
- *Safety Authority Act*
- *Safety Standards Act* and Regulations
- *Railway Safety Act* and Regulations
- *Freedom of Information and Protection of Privacy Act*
- *Workers Compensation Act*
- *Ombudsperson Act*
- *Offence Act*

Key drivers to creating a dedicated organization for the delivery of regulatory oversight include the desire to increase the responsiveness to industry needs and simultaneously meet or exceed in the administration of regulatory requirements. Against this back-drop, Technical Safety BC has developed a risk-based approach and has set thresholds both for enterprise and public safety risks. Thresholds are made available in the public domain and the organization is currently in the process of developing a framework and engaging stakeholders on risk acceptability thresholds.

Technical Safety BC has introduced data analytics tools in two main areas:
- Risk based resource allocation using Machine Learning and statistical sampling plans
- Contractor performance for improving compliance and creating competition

Using a combination of data generated through inspections and investigation along with permits and declarations, machine learning is used to predict the risks associated with regulated assets in BC. The machine learning tools scan the information, analyze, predict the chance of finding medium, high or severe hazards (levels 3, 4, and 5 on a 5-point scale) and if the percentage is above a threshold, the tool prompts an inspection by a safety officer. The predictions made by the machine learning tools are verified empirically by safety officers. Safety officers are informed daily on

inspection priorities but significant changes to resource allocation done is more on annual basis (though that may change in the future). After having piloted it in a sector the model has been scaled across electrical and gas installations.

Technical Safety BC views the importance of connecting with the community of stakeholders such as contractors and making sure information is pushed out to these regulated organizations to help them be aware of their performance. An example of one such application involves the creation of a client safety profile. Contractors can get information on their profile, such as those employees who are taking permits and how well they do. Many contractors access the information and use it to communicate with their employees and staff. Data such as compliance performance of individual contractors in comparison to provincial averages, compliance rates or pass rates etc. are made available and are updated daily.

The game changer for introducing ML was hiring of statisticians. As opposed to sending an inspector multiple times, algorithms were designed to look at different decision-making options. A significant learning while testing is that ML based models require large amounts of data. There were several technical challenges to get the tools functional, and change management was a big factor. Gaining the trust and acceptance of safety officers with over 25 years of experience who challenged the accuracy of the machine learning tools as opposed to their expertise and experience was a major challenge. Transparency of the functioning of machine learning tools are not clear and a key success factor was balancing machine intelligence and human intelligence. In order to address change management issues, the data analytics team worked closely with operations including influencing them to take ownership of the program. The approach provides leeway to balance ML with local knowledge of the safety officer.

Technical Safety is examining the ethics around how to interact with the stakeholder community including what information should be made public. Legislation is limited in this domain. While Technical Safety BC has realized the benefits of meeting contractors and contractor associations more than in the past, they see the publicizing of information generated by such tools as impacting the relationships.

Policy Considerations

The **lack of prescription of inspection schedules and frequencies in the administered regulations** helps Technical Safety BC to implement risk-based inspection processes using innovative tools such as AI and ML. Technical Safety BC has developed **guidance documents into using innovation including what are the ethics around use of AI**.

Technical Safety BC adheres to current privacy legislations both at the provincial and federal levels. As the data that is fed into the ML tool is limited to information gathered by its safety officers, there

are no restrictions on its use. However, new guidelines would have to be established once external data is interfaced with the tool in the future. Consultations were largely focused around internal change management and, to the extent that external stakeholders were impacted, consultations took place to obtain their buy-in.

Pilots are seen as highly valuable and at the same time also quite disruptive to the organization. Technical Safety has consciously limited its pilot studies to approximately 2 months and aimed to collect as much information as possible including the expected and unexpected within the timeframe. The organization has found that the size and design of the pilots are adequate to scale up and put the tools into production.

Institutional Arrangements

The responsibility of overseeing the research, development and implementation of the AI based applications lies with the **Vice President, Risk and Analytics** who also manages a team of data analysts.

Technical Safety BC, in designing their pilots, **have found academic institutions to be great partners.** In addition to building future capacity by creating space for the students to work on innovative projects, they have found the total costs for executing pilots to be effective while engaging academic institutions.

Technical Safety BC is constantly reviewing and updating the ML algorithms based on independent validation of the data by inspectors and other new sources of information that it obtains and has reached an 85% accuracy level in terms of its prediction of risk-based schedules.

Technology Implementation

The biggest drawback and therefore cause for inefficiency is that the tool is currently on Technical Safety BC's own IT platform**.** However, they are working towards moving the tool on a cloud-based environment such as Amazon Web Services so that they can benefit from other ML applications that are available through such platforms.

Retraining of the model is less frequent than initially planned: the roll-out of an updated model to production happens approximately twice a year. The main reason for a lower frequency is that model changes always lead to changes within operations, and they want to avoid overloading our employees with changes.

The organization is also planning on hiring a new Chief Information Officer who will take over the responsibility of enhancing the identification and application of new and innovative tools that would further modernize their current regulatory delivery system.

Operating Model and Sustainability

The costs for the development and implementation are currently entirely borne by the organization and funded through its regulatory fee model. However, the organization is open to new and innovative ideas including creative incentives in the future for businesses to be able to provide real-time compliance data thereby reducing the number of inspections that may be required to be conducted. **However, the organization does not see this change happening in the immediate term and may require regulatory policy changes that are beyond the control of the institutions. Instead the organization is now focused on building its own capacity in delivering effective and efficient regulatory services for the foreseeable future.**

Annex B: Index: Original List of Case Studies

Figure 12 provides a geographical overview of the case studies for use of technology in regulatory life cycle have been identified in this paper. The map gives an insight on the countries where there appears to be a wider application of emerging technologies for rulemaking and/or regulatory delivery, (i.e., U.K., U.S.A., Canada etc.) relative to other countries identified in the study. While the actual number of case studies cannot be accurately verified, an independent study[7] suggests the relative distribution to be similar. In addition, there is anecdotal information suggesting case studies in China, however, the authors were unable to obtain any information in this regard.

Figure 12. Case Studies of Emerging Technology in Regulatory life cycle – Geographic view

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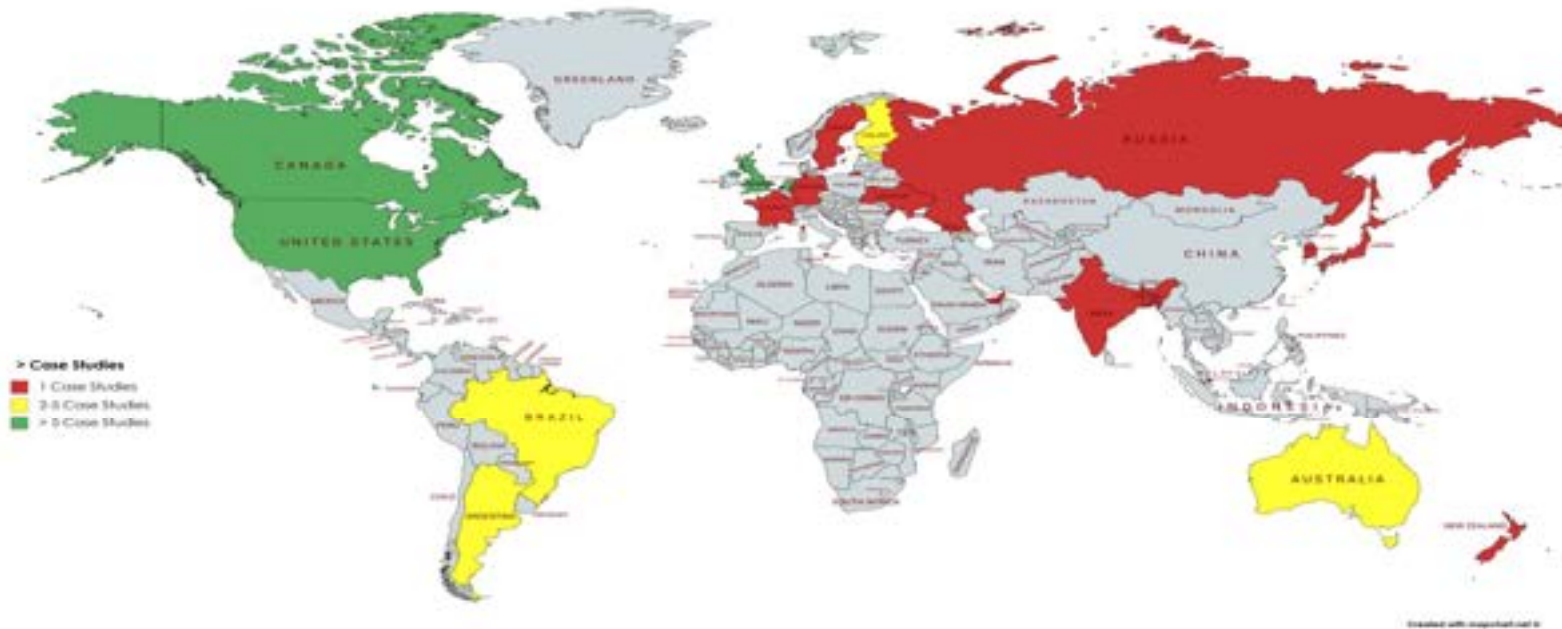
[7] Cambrian Group - Becoming a global leader in the cognitive era: A comparative study of national AI strategies

Table 2 below provides an index of the original list of over 50 case studies identified in this report across different countries shown in Figure 12. The table has been categorized across the broad stages of the regulatory cycle (i.e., Development of regulations or rulemaking, Regulatory delivery, and Monitoring and feedback) along with a brief description of the cases. Details regarding these case studies are included later in this Annex.

Table 2. Emerging Technologies in Regulatory life cycle- Case Studies

Countries	Regulatory Cycle		
	Rulemaking	*Regulatory Delivery*	*Monitoring and Feedback*
Argentina		1. Internet Domain Registrations 2. Blockchain for Compliance of Simplified Stock Companies	
Australia	3. Crowdsourcing Ridesharing Legislation (Queensland Australia) 4. Leveraging Public-Private Partnerships for Economic Insights (Australia Treasury and LinkedIn)	5. Remote Monitoring of Fisheries Sustainability (State of Queensland)	
Bangladesh		6. Internet of Things based Factory Inspections	
Brazil		7. Blockchain based Land Registry 8. Real Time Detection of Deforestation (DETER)	
Canada	9. RegData Tracker	10. Refugee Immigrant Screening	

Countries	Regulatory Cycle		
	Rulemaking	*Regulatory Delivery*	*Monitoring and Feedback*
		11. AI for 311 (City of Surrey) 12. Machine Learning Based Predictive Inspections of Installations (Technical Safety BC) 13. SMARTS Real-Time Trading Surveillance System (Investment Industry Regulatory Organization of Canada) 14. Online Dispute Resolution (British Columbia)	
Estonia		15. Automated Company Name Validation 16. Smart Service Platforms for Companies 17. AI Translation of Court Rulings	
EU	18. Franco-German-Luxembourgish Cooperation on Automated Connected Driving Legislation		
Finland	19. Crowdsourcing Legislation	20. Skype Inspections of Industrial Establishments (Finnish Chemicals and Safety Agency)	
Georgia		21. Blockchain Based Land Registry	
Global	22. www.healthmap.org		
India		23. Geotagging for Property Assessment and Compliance (State of Andhra Pradesh)	

Countries	Regulatory Cycle		
	Rulemaking	*Regulatory Delivery*	*Monitoring and Feedback*
Japan		24. AI Powered Chatbot for Services (Shibuya Ward)	
Malta		25. Licensing Relationship Management System (Malta Gaming Authority)	
Netherlands		26. Blockchain Based Ship Registry 27. Blockchain for New Schools Financing 28. Blockchain based International Waste Transport Permits 29. Blockchain based Personal Data Processing 30. AI based identification of financially vulnerable citizens 31. Blockchain based Port Logistics 32. Blockchain based Verification of Education Credentials 33. Blockchain based Pension Management 34. CAS/Predictive Policing 35. AI assisted Reporting of Criminal Offences 36. AI comparisons of intended verdicts with delivered verdicts	
New Zealand		37. Better for Business: AI Bot for Compliance Information	
Russia		38. Internet of Things Based Construction Site Inspections	

Countries	Regulatory Cycle		
	Rulemaking	*Regulatory Delivery*	*Monitoring and Feedback*
Singapore		39. Facebook based Chatbot for Information	40. Facebook based Chatbot for Information
South Korea		41. Bid Rigging Indicator Analysis System (Korea Fair Trade Commission)	
Sweden		42. Blockchain Based Land Registry	
Ukraine		43. Blockchain Based Land Registry	
United Arab Emirates		44. Blockchain Based Business Registry (City of Dubai)	
United Kingdom		45. Enhanced Registration for Food Establishments 46. Robotics for Process Automation (Her Majesty's Revenue and Customs) 47. Robo-Advice (Financial Conduct Authority) 48. Risk Based Inspections of Schools (OFSTED) 49. Gas Tag – RFID Tags for Monitoring Gas Engineers (Gas Safe Register) 50. Remote Monitoring of Food Establishments using IoT (City of Cambridge) 51. Traceability in Meat Supply Chain using Blockchain (Food Standards Agency	

Countries	Regulatory Cycle		
	Rulemaking	*Regulatory Delivery*	*Monitoring and Feedback*
USA	52. RegData Tracker 53. Government Crowdsourcing (www.challenge.gov)	54. Chatbot Based Business Assistance (City of Los Angeles) 55. AI Chatbot for Immigrant Services 56. Next Generation Compliance (EPA) 57. FireCast – Predictive Building Inspections (City of New York) 58. Nemesis – Twitter Powered AI Engine for Inspecting Food Locations (Southern Nevada Health District) 59. Air Sensor Toolbox (EPA) 60. Solar Powered Water Quality Sensors (New England EPA)	

Annex C: Short Description of Case Studies

This Annex provides descriptions of the originally identified list of case studies. These descriptions are categorized according to the specific elements within each stage of the regulatory cycle.

I. Development of Regulations

A. Issue Identification

1. Healthmap.org – Real-time monitoring and mapping of diseases and emerging public health threats
   - Jurisdiction – Various
   - Technology Type – Social Media, AI/ML
   - Description:
     - HealthMap, a team of researchers, epidemiologists and software developers at Boston Children's Hospital founded in 2006, is an established global leader in utilizing online informal sources for disease outbreak monitoring and real-time surveillance of emerging public health threats. The freely available Web site 'healthmap.org' and mobile app 'Outbreaks Near Me' deliver real-time intelligence on a broad range of emerging infectious diseases for a diverse audience including libraries, local health departments, governments, and international travelers. HealthMap brings together disparate data sources, including online news aggregators, eyewitness reports, expert-curated discussions and validated official reports, to achieve a unified and comprehensive view of the current global state of infectious diseases and their effect on human and animal health. Using emerging technologies including AI/ML the system monitors, organizes, integrates, filters, visualizes and disseminates online information about emerging diseases in nine languages, facilitating early detection of global public health threats.

2. Crowdsourcing Legislation
   - Jurisdiction – Finland
   - Technology Type – Crowdsourcing (Displays, Social Media etc.)
   - Description:
     - The Open Ministry (Avoin ministeriö) of Finland is about crowdsourcing legislation, deliberative and participatory democracy and citizens initiatives. It is a non-profit organization based in Helsinki, Finland.

Openministry.info helps citizens and NGO's with national citizens' initiatives, EU citizens initiatives and develop the online services for collaborating, sharing and signing the initiatives.

B. Regulatory Stock Scan

3. RegDataTracker(Quantgov.org) – Frequency, classification, modeling and clustering of legislation
   - Jurisdiction – US (Federal and States), Canada (Federal and Provinces)
   - Technology Type – AI/ML
   - Description:
     - Quantgov.org (USRegDataTracker) - The RegData Live Tracker allows researchers and other interested parties to visually assess the quantity of regulation in the Code of Federal Regulations (CFR) on a daily basis. The tracker runs on the QuantGov platform, which quantifies regulation by counting the number of regulatory restrictions in the CFR (the words shall, must, may not, prohibited, and required). The tracker can display other attributes of regulations that the QuantGov platform identifies or quantifies, such as the levels of regulation targeting specific industries or the quantities produced by regulatory agencies at different points in time. Furthermore, the tracker can display multiple industry or agency regulatory restriction counts at the same time.

C. Ex- Ante Regulatory Assessment

D. Selection of Instruments

E. Stakeholder Consultation

4. Challenge.gov – Government crowdsourcing
   - Jurisdiction – USA
   - Technology Type – Data and Visualization Tools
   - Description:

- o C.gov breaks down barriers to innovation by providing an open format for collaboration. The platform allows government representatives to communicate with citizen problem-solvers and features data and visualization tools that make it easy for agencies to track and report the success of their challenges.

5. Impact of digital disruption to traditional transport systems and regulatory models: Queensland Department of Transport and Main Roads
    - Jurisdiction – Government of Queensland, Australia
    - Technology Type – Crowdsourcing Platform (MindHive)
    - Description:
        - o Uber was growing in Queensland. Queensland's Department of Transport and Main Roads (TMR) used crowdsourcing to discuss the impact of digital disruption to traditional transport systems and regulation to develop consistent thinking and leadership on the digital disruption. As a result, the TMR lifted commercial barriers to improve cost effectiveness for industry, customers and government and provided greater choice and safety for consumers.

   F. Public-Private Dialogue including Gender Representation
6. Leveraging public-private partnerships using data analytics for economic insights – Australia Treasury and LinkedIn
    - Jurisdiction – Australia Government
    - Technology Type – AI/ML
    - Description:
        - o Governments around the world are looking to new data sources to gain previously undiscovered insights to deliver the best policy and service outcomes for the public. In October 2017, the Australian Treasury and LinkedIn embarked on a pilot project to gain a deeper understanding of Australia's labor markets. This public-private partnership presents a unique opportunity for the treasury to derive new data-driven insights about industry composition, employment trends, and job creation, which could potentially improve economic productivity and living standards for citizens.

G. Regulatory Co-operation and Co-ordination

7. Franco-German-Luxembourgish Cooperation on Automated and Connected Driving
   - Jurisdiction – Germany, France, Luxembourg
   - Technology Type – Data Collection, Transmission, and Analytics
   - Description:
     - objective of the initiative is to enhance cooperation between the countries in order to progress innovations in the spheres of electric mobility and automated and connected driving in three thematic areas including; 1)Continuous compatibility of automated driving perception functions, 2) Link between automation and connection, including Intelligent Transport Systems (ITS) and cross-border mobility services, and 3) Impact and effects of automated and connected driving

II.   Regulatory/Service Delivery

A. Business Registrations

8. Blockchain based Business Registry – City of Dubai
   - Jurisdiction – Dubai, UAE
   - Technology Type – Blockchain
   - Description:
     - Dubai has partnered with IBM to launch a Blockchain registry that will help businesses operate under its jurisdiction. The Dubai Blockchain Business Registry Project will also see involvement from Smart Dubai and Dubai Silicon Oasis Authority (DSOA), while the government input comes in the form of the Department of Economic Development (DED).The Registry will store registration information from companies, as well as keep track of changes, and thus will streamline the process of setting up and operating a business, roll out digital exchange of trade licenses and related documentation for all business activities, and ensure regulatory compliance across Dubai's business ecosystem.

9. Automated Company Name Validation – Estonia
   - Jurisdiction – Government of Estonia
   - Technology Type – AI/ML
   - Description:
     - name checking is one of the most complex tasks to automate because there are a lot of different rules that apply when you select a company name. Estonia uses a logistic regression machine learning algorithm that is used for classification tasks. This could be a pathway to fully automated company registration since name checking is one of the main tasks that traditional systems can't automate.

10. Enhanced Registrations for Food Establishments
    - Jurisdiction – UK Food Standards Agency

- Technology Type – AI
- Description:
    - A system of registration where businesses themselves will be able to update their information; FSA will be able to check whether a business owner is who they say they are; and will be able to track changes to food businesses; will help get better quality data about food businesses including a risk rating which will help Local Authorities prioritise and tailor their activities and give it a unified view of all food businesses in England, Wales and Northern Ireland. It will provide consumers with greater confidence in the way food businesses are established and regulated from the very start of their business life. Food businesses will benefit from an improved and streamlined process for registering, and access to a tailored support package designed to help them comply with food regulation.

11. Internet Domain Registrations – Argentina
- Jurisdiction – Government of Argentina
- Technology Type – AI
- Description:
    - AI is used to make decisions on allocating internet domain registrations for businesses and to resolve disputes regarding the issue of ownership of domains by "reading the written statements of an NLP and by comparing against previous resolutions and a query linked to Trademarks and Patents Registries.

  B. **Other Registrations (Tax, Land Titles etc.)**
12. Geotagging for Property Assessment and Compliance – India
- Jurisdiction – States of Andhra Pradesh and Tamilnadu, India
- Technology Type – Remote Sensing, Sensors, AI/ML
- Description:
    - Applied many innovative solutions based on emerging technologies across the 'governance life cycle' of city governments - from Master Town Plans to Revenue management, municipal assets including utility network

and engineering, expenditure regulations and results-based performance management of the city governments.

13. Blockchain based Land Registry – Sweden
   - Jurisdiction – Swedish Land-Ownership Registry
   - Technology Type – Blockchain
   - Description:
       - By July 2017, the Swedish land registry was using Blockchain to register land and properties on the Swedish Blockchain startup ChromaWay's private Blockchain network

14. Blockchain based Land Registry – Brazil
15. Blockchain based Land Registry – Ukraine
16. Blockchain based Land Registry - Georgia

   C. Regulatory Application Process Tracking
17. Licensee Relationship Management System – Malta Gaming Authority
   - Jurisdiction – Malta Gaming Authority
   - Technology Type – AI/ML
   - Description:
       - Developed in partnership with Microsoft, the Licensee Relationship Management System is a one-stop shop for licensing which empowers the gaming operators to electronically track the status of their applications and meet regulatory requirements more efficiently. This digitisation process provides a two-way communication between the Authority and its customers using an online portal.

18. Bid Rigging Indicator Analysis System – Korea
   - Jurisdiction: Korean Fair-Trade Commission
   - Technology Type – Blockchain, AI

- Description:
  - Drawing information directly from the Korean e-procurement system KONEPS, BRIAS looks to data elements including bidding price (as a ratio compared to reference price), the number of participants, and the competition method, and applies a formula that generates a potential bid-rigging score. If above a certain threshold, this then suggests the need to collect more information regarding the contract action. Based on this closer look, an investigation is opened in cases where it is warranted. BRIAS collects information from KONEPS on a daily basis, and each month the system is run on data collected from the previous month. The establishment of this kind of automated system for the detection of red flags in public procurement is a good practice implemented successfully in other countries such as Brazil.

19. Refugee Immigration Screening – Canada
- Jurisdiction: Immigration and Refugee Services, Canada
- Technology Type: AI/ML
- Description:
  - Canada has developed a system of "predictive analytics" using AI/ML to automate certain activities currently conducted by immigration officials and to support the evaluation of some immigrant and visitor applications for immigration decision-making and assessments, including in Humanitarian and Compassionate applications and Pre-Removal Risk Assessments.

  D. **Access to Market Information**
20. Chatbot based Business Assistance – City of Los Angeles
- Jurisdiction – City of Los Angeles
- Technology Type – AI
- Description:
  - The city of Los Angeles in cooperation with Microsoft developed a chatbot called Chip, which is an abbreviation of "City Hall Internet Personality". The city implemented the chatbot first to the Los Angeles Business Assistance Virtual Network (BAVN), to drive vendor engagement to find opportunities for business[s]. The Chip

was designed by two city developers in three days after receiving a training from Microsoft. It utilizes Microsoft Cortana platform, [Azure bot framework](#) and Azure cloud. Through an extensible platform and Application Program Interface (API) programming, the bot can connect to any data or back-end system.

E. Access to Services

21. Facebook based Chatbot for Information – Singapore
- Jurisdiction – Government of Singapore
- Technology Type – AI
- Description:
  - The Singapore government implemented a [Facebook-based chatbot](#) to help citizens and visitors get faster access to accurate and up-to-date information. The users can search for answers, government directory entries, events, news. This bot will be complementary to the official one-stop portal for government information to easily find answers to questions and search for the right person to talk to, to ask for help and provide feedback when citizens have something they need help with, or something to be reported, the feedback can be provided using the chatbot and will be automatically routed to the right department; to stay informed, the chatbot can push out regular news alerts and government announcements from the government information portal [gov.sg](#) to the subscribers, tailoring the news to their interests; and to help citizens find their representatives, to find the right ministry, organization, officer or service that a citizen needs, instead of having to navigate websites.

22. AI for 311 – City of Surrey
- Jurisdiction – City of Surrey, BC, Canada
- Technology Type – AI
- Description:
  - The city of Surrey, British Columbia, made their 311 call center services easier after they turned to artificial intelligence and implemented the mobile application called [My Surrey](#) and it is a mobile, cognitive computing application powered by [IBM Watson](#). As it continuously learns over time, with increased interactions the knowledge base will only grow. The System has been trained to understand questions for city services that include:

Animal Control, Parking Enforcement, Waste Collection Pickup, Bylaws, Fire Police Emergency Services, Transportation, Utilities, Cemetery, Mobile Apps, Building and Construction, Engineering Customer Services, Engineering Infrastructure, Property Taxes, Culture, Recreation, and Volunteering.

23. Smart Service Platform for Companies – Estonia
   - Jurisdiction – Government of Estonia
   - Technology Type – AI
   - Description:
     - Company life cycle – the company starts with an idea of starting a business and ends with the company exit. The government sees that they could help the entrepreneur to understand and navigate through the company life cycle by suggesting different actions, supporting grants and information from the government.

24. AI-Powered Chatbot for Services – Shibuya Ward
   - Jurisdiction: Shibuya Ward, Japan
   - Technology Type: AI
   - Description:
     - The Shibuya Ward of central Tokyo together with Microsoft developed AI-powered chatbot called Shibuya Mirai (Mirai means "future" in Japanese). It is modeled after a 7-year-old boy to help its population of 224,000 access local services, as well as to provide local officials with better insights into public opinion. It is available via the LINE messaging application and responds to the conversations in Japanese texts in real time and generates images.

25. AI Chatbot for Immigration Services – USA
   - Jurisdiction – US Immigration Services
   - Technology Type – AI
   - Description:

o The U.S. Citizenship and Immigration Services (USCIS) developed an intelligent virtual-assistant to answer questions on common immigration issues, to navigate the USCIS web site and to find searched information. The bot supports both English and Spanish and can simulate a real-word conversation to guide customers to information found on uscis.gov. Customers seeking online assistance with routine questions are able to engage with Emma by simply clicking on the "Ask a Question" link. Emma searches through the USCIS website to provide a brief answer and refers online customers to the most relevant information. If the online customers reach a point when their questions cannot be answered, the customer is offered the opportunity to open a chat session using the built-in chat client. Emma is integrated with a Live Chat feature to assist customers with both general and case-specific information.

26. Robotics for Process Automation – UK Her Majesty's Revenue and Customs (HMRC)
- Jurisdiction – UK Government (HMRC)
- Technology Type – Robotics
- Description:
  o Use of robotics solutions that reduce costs for HMRC. Solutions that automate and speed up repetitive processes include: Dashboards for contact centre advisers which give information and guidance straight to advisers' computer screens, using robotics to automatically open files from a number of different systems so they can answer customer questions quickly and accurately.

F. Compliance Education and Promotion
27. Robo-Advice – UK FCA Authorizations
- Jurisdiction – UK Financial Conduct Authority
- Technology Type – AI
- Description:
  o FCA's Advice Unit provides regulatory feedback to firms planning to offer automated advice to the mass market ('robo-advice'), as this could make suitable financial advice available to many more consumers. The unit's aim is to reduce the level of regulatory uncertainty for firms that want to operate in this relatively new market.

28. Next Generation Compliance – US EPA
- Jurisdiction – US Environmental Protection Agency
- Technology – AI
- Description:
    - The Compliance Assistance Centers offer easy access to plain-language materials and other resources on environmental compliance through websites targeted to industry and government sectors, virtual plant tours, telephone assistance, "ask the expert" (Chatbots), and email discussion groups

29. Better for Business: Government Trialling Artificial Intelligence – New Zealand

- Jurisdiction – Ministry of Business, Innovation and Employment (MBIE), Government of New Zealand
- Technology Type - AI
- Description:
    - Originating in 2012, Better for Business is a collective of 10 government agencies committed to making significant improvements to businesses experiences with government. In particular a focus on "across" government – coordination, consistency and seamless services. The agencies have committed to identify key pain points for businesses and use customer-centric design as well as digital technology to achieve better outcomes for businesses dealing with government and to enable businesses to operate more efficiently and effectively, and improve the productivity, income and well-being of New Zealanders. One of the pain points for customers is finding information. Currently information is on websites, guidelines, brochures from various sources and running into tens of thousands of pages of information. The Government trialed a conversational AI bot called Tai involving four different Government agencies co-ordinated to develop Tai: Ministry for Primary Industries (MPI), Customs New Zealand, IRD and MBIE. In its proof of concept trial, Tai focused on honey exporting wherein business users interacted with Tai using chat interface and natural language queries. The trial showed that Tai was "faster than using Google search". Furthermore, "the responses through Tai were a lot more tailored than the google search tests". The trial also found that participants trusted the information

provided, and had no problems using the app since "the majority of participants had used a digital assistant before". Tai was built using Natural Language Processing (NLP), a subset of artificial intelligence that allows a computer to process and interact with human queries. It also uses Machine Learning (ML) to build up its store of knowledge.

G. Business Licensing (Permitting)
30. Robotic Process Automation – UK Her Majesty Revenue and Customs (HMRC)
- Jurisdiction – UK Government (HMRC)
- Technology Type – Robotics
- Description:
    - Robotics is used in the employer registration process to validate data from online applications and provide a unique reference number to new employers so they can start employing staff for the first time. If problems with the application are detected, robotics assigns cases to an exceptions handling team. Around 85% of applications are processed automatically, and employers who register with HMRC to start paying staff receive confirmation three times faster than before. Automated services like employer registration reduce processing costs by around 80%.

H. Compliance Assurance: Regulatory Oversight including Inspections

31. FireCast – Predictive Building Inspections in New York
   - Jurisdiction – City of New York
   - Technology Type – Predictive Analytics
   - Description:
     - FireCast is a data-analytics algorithm used in the program, which is named the Risked-Based Inspection System; from it, fire chiefs can look at a list of buildings in their districts that are at highest risk of experiencing a fire that day and used over 7500 metrics across 17 city agency data streams to determine the fire risk of buildings on a real-time basis.

32. Remote Monitoring of Fisheries Sustainability – Fisheries Queensland
   - Jurisdiction – Fisheries Queensland, Australia
   - Technology Type – IoT Cameras
   - Description:
     - The agency is working with two innovative start-ups to develop cutting-edge systems which can track fishing activity and location, as well as use cameras, sensors and machine learning to automatically recognise the types and quantities of fish caught and discarded and eliminating the need for manual logbooks and physical inspections.

33. Skype Inspections – Finnish Chemicals and Safety Agency
   - Jurisdiction – TUKES, Finnish Chemicals and Safety Agency
   - Technology Type – Skype
   - Description:
     - In 2017-18, Tukes established a project with the main aim of foreseeing what inspection would look like in 10 or 20 years. Tukes tested different types of inspections such as consolidated inspections across a group of

companies (Concern inspection) and Skype inspections. The feedback both from operators and other authorities has been positive and encouraging. In the future, Tukes has plans to further digitize its Seveso inspections

34. IoT Based Construction Site Inspections – Russia
   • Jurisdiction – Russia
   • Technology Type – IoT
   • Description:
     o TBD

35. Factory Inspections – Bangladesh
   • Technology Type – IoT
   • Description:
     o TBD

36. Machine Learning based Scheduling of Inspections of Electrical/Gas Installations – BC Safety Authority
   • Jurisdiction – Technical Safety BC, British Columbia, Canada
   • Technology Type – Machine Learning
   • Description:
     o Using a combination of data generated through inspections and investigation along with permits and declarations, machine learning is used to predict the risks associated with regulated assets. The machine learning tools scan the information, analyze, predict the chance of finding medium, high or severe hazards and if the percentage is above a threshold, the tool prompts an inspection by a safety officer.

37. Nemesis – Twitter powered AI Engine to inspect food locations (Nemesis) - Southern Nevada Health District
   • Jurisdiction – Southern Nevada Health District
   • Technology Type – Social Media (Twitter), AI

- Description:
  - Nemesis employs geotagging and natural language processing to identify tweets reporting food poisoning, with human-guided machine learning and an automated language model. In an experiment conducted in Las Vegas, half of the inspections were allotted randomly, and the other half used the Nemesis-supported targeting. Adaptive inspections unveiled more irregularities, an average of nine versus six compared to randomly-assigned inspections.

38. Risk Based Inspection of Schools – OFSTED (UK)
- Jurisdiction - Office for Standards in Education, Children's Services and Skills (Ofsted) - UK
- Technology Type – ML
- Description:
  - Supervised machine learning engine risk-based inspection program to schedule inspection of schools

  I. **Compliance Assurance: Alternative Approaches (e.g., Self-Declarations, Automation, Third-Party, Citizen Engagement)**

39. Gas Tag – UK Gas Safe Register
- Jurisdiction – UK Gas Safe Register
- Technology Type – RFID Tags
- Description
  - The Gas Tag system is a third-party platform that grants private and social landlords access to a dashboard, which provides real-time updates on their properties gas safety compliance. The app, tailored for engineers ensures the highest quality of work is completed by the engineer with the correct competencies, in the correct location. The data is (can be?) made available real-time to the regulator to provide compliance assurance of both the engineer and the property.

40. Remote Monitoring of Food Establishments – City of Cambridge, UK
- Jurisdiction – City of Cambridge, UK
- Technology Type – IoT

- Description:
  - Data is collected via a third-party food safety management system at food establishments using cloud-connected sensors that assist environmental health officers in identifying businesses remotely to target their inspections more efficiently

41. Air Sensor Toolbox for Citizen Scientists, Researchers and Developers - US EPA
- Jurisdiction – US EPA
- Technology Type – IoT Sensors, GeoTagging, AI
- Description:
  - EPA has developed two new tools for the Agency's Air Sensor Toolbox that enable citizen scientists and others to more effectively collect and interpret air quality data in their communities using low-cost air sensors. The new tools which allows users to compare data from low-cost monitors to the data being collected by regulatory-grade air monitors. By comparing low-cost sensors with regulatory monitors that have undergone rigorous review and approval by the EPA, citizen scientists will gain a better understanding of the reliability of the data they collect.

42. Traceability in the Meat Supply Chain – UK Food Standards Agency
- Jurisdiction – UK Food Standards Agency
- Technology Type – Blockchain
- Description:
  - Recognizing that the data in the Food Business Operator system was much better quality and much more granular than FSA data, in early 2018 FSA has developed a proof of concept using blockchain which provided the results of the inspection not just to the last farmer but also to all of the other farmers that owned that animal. It uses the ear tag and information from the animal passport to collect the data. Meat Inspectors enter data about conditions into the Food Business Operator (FBO) system. These are batch uploaded to the blockchain by the vet once the data has been approved. The vet, FSA, FBO and farmer can access the data. FSA is starting to develop dashboards for data visualisation and once this is done are hopeful that the industry will adopt this (or a similar equivalent) system or systems. The system uses Linux Hyperledger as a fabric and because it was commissioned

through a government framework contract the code etc. will be available for others to copy / use. For traceability and to maximise value there is the possibility of having data on the blockchain about the animal from its birth through its life course.

43. Blockchain for Compliance of Simplified Stock Companies – Argentina
- Jurisdiction – Government of Argentina
- Technology Type – Blockchain
- Description:
  - Argentina uses Blockchain as a ledger to verify corporate legal compliance of the Simplified Stock Companies (a legal type of society). The minutes or accounting entries in the corporate book must be digitally signed and saved as a PDF document. A hash of that document is calculated, and that hash must be reported to the Companies Registry web page with each minute number and date. That hash is uploaded to a Blockchain which returns a digital receipt that allows checking the authenticity, date and correlation of all corporate books. This eliminates the need for retaining paper-based corporate records for this type of society. As the experience has been so good, this procedure is being extended to the rest of legal type of societies.

J. **Compliance Assurance: Market Surveillance**
44. Healthmap.org – Real-time monitoring and mapping of diseases and emerging public health threats (A1)

45. SMARTS Real-Time Trading Surveillance System – Investment Industry Regulatory Organization of Canada
- Jurisdiction – Canada
- Technology Type – Artificial Intelligence/ML
- Description:
  - The surveillance system generates real-time alerts for unusual trading activity across all Canadian equity marketplaces. Surveillance officers will investigate these alerts and if deemed necessary, they can intervene using trading halts and resumptions to ensure fair and orderly markets. The officers also manage the triggering of single-stock or market-wide circuit breakers.

K. Enforcement and Penalties

46. Solar-powered water quality real-time sensors – EPA New England Regional Laboratory
    - Jurisdiction – EPA New England, USA
    - Technology – IoT
    - Description:
        o EPA's New England Regional Laboratory employs solar-powered water quality sensors to measure a variety of pollutant parameters with the aim of identifying the need for further monitoring or targeting sources for enforcement action.

47. Real-Time System for Detection of Deforestation" (DETER) programme – IBAMA (Brazil)
    - Jurisdiction – Government of Brazil
    - Technology Type – Remote Sensing
    - Description:
        o In Brazil the enforcement agency (IBAMA) receives information at a high level of periodicity from satellite images. This high-level of periodicity allows IBAMA to distinguish between naturally-occurring cases of reduction in forest cover and those arising from human intervention.

L. Access to courts, alternate dispute resolution mechanisms

48. AI Translation of Court Rulings – Estonia
    - Jurisdiction – Estonia Ministry of Justice
    - Technology Type – AI
    - Description:
        o Business registry and Courts in Estonia work in the Estonian language. This makes it difficult for foreigners to understand the content of the rulings related to their companies. Neural Machine Translation (MT) which is the next generation of machine translation technology is being used for the purpose of translation of court rulings.

49. Online Dispute Resolution – British Columbia Civil Resolution Tribunal
- Jurisdiction – British Columbia, Canada
- Technology Type – AI
- Description:
  - The Civil Resolution Tribunal [CRT] is Canada's first AI powered online tribunal and, currently, the only ODR system in the world that is fully integrated into the justice system. The CRT allows the public to resolve small claims disputes fairly, quickly, and affordably.

III. Monitoring, Reporting and Feedback

A. Performance Measurement

B. Stakeholder/Public Feedback

50. Facebook based Chatbot for Information – Singapore
- Jurisdiction – Government of Singapore
- Technology Type – AI
- Description:
  - The Singapore government implemented a [Facebook-based chatbot](#) to help citizens and visitors get faster access to accurate and up-to-date information. The users can search for answers, government directory entries, events, news. This bot will be complementary to the official one-stop portal for government information to easily find answers to questions and search for the right person to talk to, to ask for help and provide feedback when citizens have something they need help with, or something to be reported, the feedback can be provided using the chatbot and will be automatically routed to the right department, to stay informed, the chatbot can push out regular news alerts and government announcements from the government information portal [gov.sg](#) to the subscribers, tailoring the news to their interests; and to help citizens find their representatives, to find the right ministry, organization, officer or service that a citizen needs, instead of having to navigate websites.

C. Program Evaluation (including Ex Post Evaluations)

Additional Cases from the Netherlands

Blockchain & the Law
Cases:

51. Ship registry
52. Compliance by design: Financing of new school (by Dutch Treasurer/Ministry of Finance)
53. International permits: International Waste Transport (ILT, Ministry of Infrastructure & Water Management)
54. Processing of personal data by administrative body in context of "Wet maatschappelijke ondersteuning" (with CAK)
55. Smart Contracts (more abstract case)

Algorithmic decision making & The Law (in Dutch, expected end of 2019)
56. Automated identification of financially vulnerable citizens in government processes

Dutch Blockchain Coalition (public private partnership)
57. Logistics (with Port of Rotterdam)
58. Verification of Educational certificates and diplomas (EU wide)
59. Pensions: efficiency and transparency (with Dutch Pension funds APG and PGGM)