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Cracking the code: Rulemaking for humans and machines

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OECD Working Papers on Public Governance

Cracking the Code

Rulemaking for humans and machines

Forward

Rules as Code (RaC) is an exciting concept that rethinks one of the core functions of governments: rulemaking. It proposes that governments create an official version of rules (e.g. laws and regulations) in a machine-consumable form, which allows rules to be understood and actioned by computer systems in a consistent way. The creation of a machine-consumable version of government rules would be integrated in the rulemaking process and complement the existing, human-readable form. RaC challenges the long-established processes of government rulemaking and could transform both policy making and public service delivery. It envisions and helps support a truly digital government, with rules created as a digital product and service, rather than having them incorporated into digital processes after the fact. It creates the conditions for a government that can be more agile, more responsive and more innovative in navigating and shaping an unpredictable operating environment, and makes it easier for those outside of government to understand their responsibilities and obligations.

The potential of RaC is significant. Governments create rules for people, businesses, other private actors and for the entities of government itself. They are foundational to our system of government and public administration. Yet, though much has been learnt and improved over time, our rules share a common characteristic: they are written in human-readable, natural languages. That is, they are not immediately consumable by machines (or indeed, by those untrained in legal language, structures, concepts and precedents). This can result in gaps between the intent of policy and how it is implemented. RaC seeks to minimise the risk of discord between policy and implementation, achieve better policy outcomes and create opportunities to improve the speed and consistency of service delivery.

Beyond the issues resulting from the human-consumable *form* of government rules, RaC addresses the reality that our world is increasingly digital and that, by extension, governments need to optimise their operations for this. Over time, the systems and processes that underpin the *production* of rules have remained largely immune to fundamental transformation; this has created a number of significant, interconnected and immediate problems. RaC challenges the status quo and, in promising to transform the process of government rulemaking, offers a new way to make the rules needed in today's world.

The third in a series of 'innovation primers' from the OECD Observatory of Public Sector Innovation, *Cracking the Code* is intended to help those working both within and outside of government to understand the potential (and the limitations and implications) of RaC. It aims to provide clear, understandable and practical advice to those considering how RaC could be applied in a public service context. By bringing together information and case studies from the global RaC community, it also seeks to provide actionable insights for those looking to implement their own RaC approaches. This primer is intended to make a complex and emerging topic understandable and to enable those inside the public sector and without – rule makers and rule takers both – to consider RaC and its applicability in their context.

Acknowledgements

This innovation primer was prepared by the Observatory of Public Sector Innovation (OPSI), in the Open and Innovative Government Division of the Public Governance Directorate (GOV) of the OECD. OPSI collects and analyses examples and shared experiences of public sector innovation to provide practical advice to countries on how to make innovation work.

This primer has been drafted by James Mohun and Alex Roberts of OPSI, under the coordination of Marco Daglio, Head of OPSI. Jamie Berryhill, Kent Aitken, Sam Nutt and Joshua Polchar of OPSI provided comments on draft versions. The primer has been aided by input and guidance from other parts of the OECD, most notably by Ben Welby in GOV's Digital Government and Data team, Miguel Amaral and Nikolai Malyshev of GOV's Regulatory Policy Division, Lawrence Pacewicz from the Directorate for Legal Affairs, Suguru Iwaya from the Directorate for Science, Technology and Innovation and Edwin Lau, Senior Counsellor, GOV.

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Executive Summary

Every year, people file taxes, claim government support payments and determine their eligibility for government services (e.g. state-based childcare or visas). Businesses apply to governments for operating licences or submit information to government entities that allows their compliance against regulations to be assessed. Government is subject to independent audits that verify its adherence to the rules that it itself has created to guide the use of its power. These rules – the rules made by government – affect all domains of our lives, from the personal to the professional. As such, the way these rules are created, made available, consumed, understood or misunderstood, and enforced is of significant interest to those seeking to improve the function and effectiveness of government. Governments have long refined and developed their rulemaking processes (for instance, as captured in the *OECD Recommendation on Regulatory Policy and Governance*) – but the digital revolution requires a transformational shift.

Rules as Code (RaC) aims to change government rulemaking. Fundamentally, RaC proposes to create a machine-consumable version of some types of government rules, to exist alongside the existing natural language counterpart. More than simply a technocratic solution, however, RaC represents a transformational shift in how governments create rules, and how third parties consume them. By integrating technology into rulemaking from the outset, it brings the policy development and implementation components of the current process closer together to better align intent and outcomes. In allowing third parties to consume an official version of machine-consumable government rules, it also promises the potential for quicker service delivery, a more consistent application of the rules and greater efficiencies for rule takers.

RaC would result in significant changes to the current way that rules are made by government. Typically, an idea or need for a rule emerges and rule makers (lawmakers, often informed by policy experts) design its intent and expected outcomes. This is transferred to drafting experts (commonly, lawyers) who interpret and formalise this intent into a rule-like form (often in the form of a law or regulation). The rules are adopted politically and then passed to government service design and delivery teams for implementation. Third parties affected by the rules, such as people, businesses or government itself, attempt to interpret the natural language versions of rules to assess their rights and responsibilities. These rules are then often translated into machine-consumable code on an entity-by-entity basis (e.g. to inform business rule systems) and used to enable activities including compliance or service delivery. While this is a simplified account, it highlights a number of challenges that attend the current state of rulemaking. For example, it can be linear and siloed (in that it is composed of a series of stages that each rely on specialists with a specific expertise) and considerations around implementation are often left until late in the process.

Why has RaC emerged? Rulemaking is a foundational, long-standing function of governments. Accordingly, the way governments create rules (and third parties consume them) is well established. Yet, governments now face a vastly different operating environment that has resulted in, or amplified, a number of pressures associated with current rulemaking. Firstly, the current system creates the need for repeated interpretation and translation, from natural language rules into the machine-consumable rules almost ubiquitously required for modern service delivery and compliance efforts. Secondly, it restricts the capacity of rule makers to deal with increasingly complex policy and regulatory challenges that bridge policy

domains and demand quick, effective public responses. Finally, the current system creates inefficiencies resulting from the manual translation of government rules into machine-consumable forms at the enterprise level.

RaC suggests that, if government were to assume the role of digital rule maker, it could create stronger alignment between rule intent and implementation. In offering the potential for greater *ex ante* modelling, RaC could better aid policy makers dealing with complex and cross-cutting issues. It also proposes to speed up public service delivery, as coded rules are made immediately applicable and consumable by relevant parties once a given rule is ratified. It could also drive a more consistent application of the rules, as third parties are enabled to consume an official version of machine-consumable rules directly from government. This may mean efficiencies for businesses, as well as lower regulatory compliance burdens. Providing machine-consumable rules as a public good could therefore help unlock economic benefits, improve public service delivery and enable more innovation.

RaC has strong potential, but remains an early stage concept with much to test. With only limited experimentation to date and no known large-scale approaches currently embedded in and across governments, understanding of the concept, its potential benefits and challenges remains limited. For example, there remain unresolved questions about the legal status of machine-consumable laws, how versions should be governed and how errors in the coded form of rules could be identified and corrected.

This primer has been developed to help inform governments' understanding and use of a RaC approach. It explores the RaC concept, the challenges facing current rulemaking and why a new approach is needed. It considers the potential benefits of such an approach, as well as the necessary considerations, and outlines potential scenarios that may characterise its development. It also contains a practical aspect, including a set of principles on which RaC initiatives can be based. Adopting the principles of: transparency, accountability, traceability, appropriateness and appealability, availability and interoperability, and security, should help ensure that RaC initiatives realise the value that they promise.

Following the success of early RaC initiatives, notably that of the New Zealand Government's Better Rules programme and France's efforts to 'transformer la loi en code informatique', global interest in RaC continues to grow rapidly. In Australia, Canada, France, Germany and Jersey (United Kingdom), public sector teams are experimenting with the concept and its potential application. It is hoped that this primer will help governments progress towards new and better rulemaking that helps people, businesses and governments prosper.

1. New rules (and rulemaking) needed for a new context

From New Zealand to France, innovators in the public and private sectors are exploring options to deliver what the Government of Estonia's Chief Information Officer Siim Sikkut (in Webster, 2018) described as 'the most transformative idea' of the 2018 Digital Nations Summit: Rules as Code (RaC). RaC (a term coined by the NZ Better Rules team, see Box 2.4) is the concept that governments need to create an official version of rules (e.g. legislation or regulation) that can be consumed by machines (namely, computers). To achieve this, governments must deliberately and explicitly rethink existing rulemaking processes to enable the creation of human and machine-consumable versions of rules. In so doing, RaC argues that governments can improve the effectiveness and efficiency of rulemaking processes, achieve better policy outcomes and transform public service delivery. This would be a digital leap forward for one of the oldest functions of government and could have far-reaching implications, not only for how government works, but also for government-citizen and government-business relations. As with any far-reaching idea, however, care will also need to be taken to ensure that the promise does not overshadow the necessary nuance and hard work required to make it succeed. This primer hopes to highlight the potential of RaC, while also outlining the different considerations and implications governments will need to bear in mind.

How hard is it to sell cabbage in the United Kingdom?

Why does the rulemaking process matter? The European Commission (EC) in the United Kingdom (UK) once published the now-archived Euromyths; a blog dedicated to rebutting myths about European Union (EU) rules and regulations (Publications Office of the European Union, 2019). One myth concerned a supposed European ban on 'curved bananas', another that EU data protection laws would prevent German children from sending Christmas wish-lists to Santa (Publications Office of the European Union, 2019). In most cases, the stories had little factual basis or had been heavily sensationalised by parts of the media. Yet, despite the often-humorous nature of such stories, the cursory dismissal of such myths belies important ideas about the nature of the rules imposed by governments or supranational organisations. The myths' subjects and existence, as well as the interest they generate in the media, also reveal important insights into how people and businesses perceive government rules.

In 2016, for example, a claim surfaced on Twitter and in the UK's Daily Mail lamenting EU regulations on the sale of cabbage. It suggested that:

> *'The Lord's Prayer is 66 words long. The Ten Commandments: 79 words. The Gettysburg address: 272 words. EU Regulations on the sale of cabbage? 26, 911 words.' (Butler 2016)*

The claim was quickly characterised as false or, at least, strongly exaggerated (Gray, 2016). The sale of cabbage was not governed by regulations running to 26 911 words. In fact, this particular allegory has a long pedigree, having been used by various actors throughout British and American political history to criticise the extent of government regulation. Yet, despite its potentially overstated nature, the myth's

existence and the public's reaction to its content nicely illustrates a number of common perceptions about government rules and regulations.[1] These include that rules are:

- pervasive, in that they relate to an extremely wide array of issues, their reach extending even to the types of cabbage that can be imported and eaten;
- immense, which makes it difficult and potentially costly to ensure compliance; and,
- complex, which makes them incomprehensible to laypersons and requires the interpretation of (costly) experts and technocrats (e.g. lawyers).

The regulation of cabbage thus helps illustrate how complex and pervasive government rules can be, as well as their potential to affect numerous aspects of the lives of people and businesses. Additionally, it hints at some of the problems connected to the design, development and enforcement of government rules i.e. that they are perceived or felt to be ubiquitous, burdensome, hard to understand and comply with effectively. The benefits of rules (e.g. food safety) can often be assumed, but the costs and difficulties caused by their existence may be far more noticeable. Therefore, the process of rulemaking matters, not only to ensure that the intent of rules is matched by the reality, but that the costs of implementation are proportionate to the benefits.

The problems facing government as rule maker

As identified in OPSI's (2019) Embracing Innovation in Government: Global Trends Report 2019,[2] making the rules that regulate society is a foundational role of governments. Contained in forms such as legislation, regulations and procedures, and embodied in society's structures and institutions, rules have long determined the contours of government operations, business activity and everyday life (see Box 1.1). From mandating speed limits to determining the size of tax rebates, from who gets to vote and how national leaders are chosen or selected, government rules are integral to societies and have material effects on people's lives and the functioning of society. In many cases, rules play a vital social role with respect to the public good; for example, government rules can help to enable the fair and effective operation of markets by protecting property rights and ensuring competition.

As government rulemaking has a long pedigree, many of these issues are not new. Considerable attention and thought has been directed to rulemaking, particularly in the form of regulation. For instance, the OECD Recommendation on Regulatory Policy and Governance (2012) articulates some of the key lessons that have been identified around effective regulation and rulemaking. What is new, however, are the dramatic shifts in the operating environment facing governments; a setting which has recut the context in which governments produce rules. The range of rules that exist (see Box 1.1) are being confronted by a milieu very different to the one in which they evolved.

[1] It has also been referenced in a key contribution to the field of 'computational law', which we recognise as a source of inspiration for this introduction (see: Genesereth, 2015).

[2] See https://trends.oecd-opsi.org/embracing-innovation-in-government-global-trends-2019.pdf

Box 1.1. Where are the rules?

The development of rules – to govern both private individuals and organisations, as well as public institutions themselves – is a long-standing role of governments. Further, it has become a function of considerable breadth and variety, illustrated both by the range of forms such rules can take, as well as the topics they cover. The following attempts to provide a general overview of the types of rules governments develop, bearing in mind that terminology, structure, and form varies significantly across countries.

Legislative branches of government adopt a wide body of rules. These are commonly referred to as **laws**, **legislation (primary)**, **acts**, or **statutes** and generally contain broad principles or higher-level requirements. Such rules may address any policy area and apply to private individuals or organisations, as well as to government itself. The highest form of law in a nation state is typically the **constitution**, which establishes the authority and parameters for governments and their power to make and change laws.

Executive branches of government and other public bodies also create a wide array of rules. These come in a variety of forms, often referred to, for example, as **legislation (secondary, subordinate, or delegated)**, **decrees**, **executive orders** or **memoranda**, **regulations**, **decisions**, **orders**, **policies**, **operational guidelines**, **instructions**, or **guidance**. Such rules tend to be more detailed and operational than those adopted by the legislative branch. They may address all areas of government policy and apply both to private individuals and organisations, as well as to government agencies or other public bodies. These rules could, for example, reside in operational guidelines that govern the provision of welfare support for citizens.

Beyond national governments, inter- or supra-governmental bodies also create a large variety of rules, both 'hard' and 'soft'. For example, European Union (EU) **regulations**, **directives** and **decisions**, International Labour Organisation (ILO) **conventions** and **recommendations**, World Health Organisation (WHO) **regulations**, or OECD **decisions**, **recommendations** and **declarations**.

Creating rules is not only the province of governmental bodies. Non-governmental organisations, such as the International Standards Organisation (ISO), develop **standards** that provide a 'formula that describes the best way of doing something'. Such non-governmental standards can apply across a wide range of domains from building quality to food safety to web accessibility. These can be local, national or international in scope. Governments often recognise specific, independent and accredited non-government organisations to aid in the creation, coordination and adoption of standards.

Source: International Organization for Standardization (2020), 'Standards', www.iso.org/standards.html.

How is the current context substantively different? Government rulemaking is being challenged on several fronts. The OECD (2019c) has noted a number of challenges in ensuring 'regulatory effectiveness in the era of digitalisation', highlighting how 'digital technologies also challenge deeply the way governments regulate'. Further, the OECD's latest Regulatory Policy Outlook (2018a: 17) noted that:

> *While good regulation is conducive to economic growth and well-being, inadequate regulation endangers both. But "regulating" is an increasingly daunting task. The overwhelming pace of technological change and the unprecedented interconnectedness of economies confront governments with uncertainty and complexity in terms of what and how to regulate. The validity of existing regulatory frameworks and, indeed, the capacity of governments to adapt to change are being questioned.*

As this illustrates, governments face difficult trade-offs in terms of the rules they create. Governments must not over regulate, nor can they merely abdicate the responsibility. Designing the 'right' regulatory response

takes time, while the pace and scale of emerging issues can demand rapid public reactions. Additionally, governments that successfully manage to implement new rules then have to ensure compliance, something far from guaranteed. For example, in 2019, Germany's National Regulatory Control Council (2019: 6) reported that 'more than half of companies in Germany report that they engage in the "autonomous reduction of bureaucracy", i.e., they only observe the regulatory requirements that they deem important and practicable.' It is unlikely that this represents the outcome lawmakers would have originally intended.

Despite these challenges, however, people continue to expect that governments will solve complex policy issues. In fact, over time, people and businesses have increased their expectations of government. This trend is particularly pronounced in terms of citizens' rising expectations of public service delivery, which, among other factors, has been driven upwards by the emergence of new information and communication technologies (ICTs). As the OECD (2016b) highlights:

> *'The Internet, social media, smartphones, and access to real-time information have not only made people's daily lives easier, but have changed citizens' expectations of how products and services are delivered. This shift affects not only the way citizens view and interact with businesses; it has also raised expectations in their interactions with government. People are demanding transparency, accountability, access to information and competent service delivery from their governments. They also expect policies and services to be tailored to their needs and address their concerns.'*

Yet, in a time when expectations are rising, the belief in government and its capacity to deliver against these is falling away. In 2016, the OECD's Trustlab reported that governments and parliaments were the least trusted institutions in the six OECD Member countries examined in the research (Murtin, 2018). In 2020, the Edelman Trust Barometer reiterated that people are largely sceptical of governments and their capacity to address contemporary challenges. While Edelman (2020: 17) reported increases in trust in 15 of 26 markets surveyed, governments remained distrusted in 17 economies overall. Further, a majority of people felt that the pace of technological change is too fast and that governments do not understand emerging technologies (61%). Perhaps most concerning for governments, though, is that they are seen as both less competent and more unethical than the media, NGOs and businesses (Edelman, 2020: 20).

These and many other documented pressures have contributed to a fundamental conundrum for governments. In a context of rising expectations and falling trust, governments are expected to act both quickly and carefully. They must ensure that societal expectations are met and embodied in the laws governing society and the economy, but also that this is done at the lowest necessary cost and minimal inconvenience. They need to respond and put in place appropriate rules, and yet must also allow room for change and learning, such as with new transformative technologies that may lead to unexpected outcomes (OECD, 2018a). It is thus clear that governments have to do better in responding to our era's most pressing policy challenges if they are to meet the growing expectations of their citizens and, most crucially, if they are to effectively execute their fundamental role as rule makers.

Governments can, and need to, do better

The forces noted above are placing governments and public sector rulemaking under pressure. Firstly, governments are expected to develop effective rules that impose the lowest necessary costs on people and businesses, generate positive outcomes (e.g. economic growth and positive societal outcomes) and remain cognisant of secondary effects on other, connected domains. Secondly, governments are expected to create these rules rapidly and implement them even faster. Thirdly, people and businesses expect that the rules (and rule changes) will be clearly communicated, open and accessible, and fairly enforced. Finally, they expect that the rules will be certain, but also adaptable to changing contexts or needs.

Around the world, public sector organisations are increasingly aware that existing ways of operating are no longer sufficient to manage the complexities of the modern world. Facing wicked, multi-faceted

challenges which proliferate and morph with increasing speed (not to mention sudden shocks or crises, such as the coronavirus (COVID-19) pandemic), there is growing acknowledgment that governments' current systems, infrastructures and ways of working are no longer delivering the level or standard of outcomes rightly expected by citizens and businesses (Hynes et al., 2020: 16). Typically, and understandably, most public attention is directed to the substance and quality of the rules created by the state. Less attention, however, is given to the administrative and bureaucratic dimensions of how rules are created, governed and implemented.

While new technologies and ways of working have often forced changes to the rules themselves (e.g. gig-economy platforms and employment law), the way rules are created, used and enforced by governments has remained largely immune to whole-scale transformation. The current process has largely failed to leverage modern technologies for improvement, even when opportunities to drive efficiencies, increase transparency and to establish greater alignment between policy and delivery exist. Among the key problems are concerns that the current process:

- is opaque, complex and hard for members of the public (and sometimes even those making the rules) to understand
- is often linear and siloed, which creates opportunities for misinterpretation of either the initial policy intent or of the rules themselves
- does not ensure that the rules created by governments can be implemented effectively, because of the limitations of government service delivery
- struggles to tailor rules or to make them fit for purpose and commensurate with their benefits
- generates rules that are numerous and interconnected (though without guaranteeing consistency between them), which increases the difficulty faced by people, businesses and governments seeking to comply with their requirements
- positions certain individuals (especially, lawyers and others whose roles require them to interpret the specifics of the rules) as 'modems', that is, the necessary interlocutors and intermediaries for interpreting the rules and translating them into other forms, such as operational business rules
- only creates a human-readable form of rules, requiring individuals, businesses and governments, to separately interpret, code and implement a machine-consumable version of the rules within individual systems
- often struggles to balance the need for certainty while also providing room for learning as new things are discovered (e.g. with emerging and transformative technologies)
- limits the scope for policy makers to model and test the impacts of changes to the rules *ex ante*, and to seek public input in the rule development process.

The result is that the current way that governments create and implement rules may be becoming increasingly ill suited, or perhaps even incapable, of responding to contemporary pressures.

Rules as Code: a deliberate, strategic and systemic response?

Governments have likely been grappling with the challenges of rulemaking and enforcement since the creation of the first rules. Even the Code of Hammurabi from the 18th Century BC, one of the first known codifications of a society's laws, illustrates the contextual and nuanced nature of law and rules, with punishments varying depending upon particular criteria. The problem associated with rules, as well as the need to do better, have been a long-standing feature of debate in many countries.

In response, red-tape reduction, administrative simplification, 'debureacratisation', regulatory impact assessments, and many other interventions have been created in an attempt to address these issues, to varying degrees of (sustained) success. While there have been new additions (e.g. regulatory sandboxes,

or the use of behavioural insights (OECD, 2018a)) and notable progress, much has been incremental or focused on enhancing existing operations rather than rethinking them. As discussed later, there have also been many efforts to reduce rules and/or simplify their implementation or interpretation, including through rules engines and other approaches. Yet the ongoing concern with the issues discussed here – as evidenced by governments returning repeatedly to simplification and streamlining of rules in their respective reform agendas (see OECD, 2019a; OECD, 2018b) – suggests that a continuation of the same approaches will likely continue to deliver the same frustrations. A new approach, which is deeper and more systemic, is now required to move past the recurrent concerns and limitations identified.

Any such approach should also be one that is respectful of the current context. If government is to be effective, then it must keep pace with the speed and direction of change happening around it. If this is accepted, then it is surely necessary that one of the most fundamental functions of government – rulemaking – does likewise. Accordingly, one can expect that such an approach will incorporate a high degree of digital transformation for, as has been noted, 'to become fully digital, governments need to adopt and use digital technologies and data as strategic components of their efforts to modernise the public sector' (OECD, 2019b).

Given the fundamental importance of rulemaking to governments and to effective governance, care must also be taken. Rulemaking is one of the primary expressions of the coercive power of the state and the restraints it puts upon itself. Rules are a core part of the contract between citizens and governments. Any approach therefore must be appreciative and respectful of the traditions, protocols, processes and safeguards that have evolved within and around the legal and associated rulemaking systems. There is a real risk for decisions to be made with the intent of optimising or improving what is, without regard to broader democratic and governance concerns. Any approach seeking to address the problems identified, even if it is about responding to citizen expectations, must pay careful attention to the path it is starting down. Technocratic fixes can easily and accidentally become the new default, bypassing due consideration as to whether they were right (appropriate and legitimate) as well as workable (feasible and effective).

Any wide-scale response to the challenges identified should thus be:

- deliberate – an explicit choice rather than an inevitable progression, so that it can be considered and its potential implications debated, rather than being an implicit and reactive response. This involves a conscious recognition of new realities, such as that machines are now consumers of government rules, and that this is something to design for.
- strategic – reflecting and integrating with wider shifts, trends and investments. Representing an acknowledgement that governments should provide what they are uniquely responsible for.
- systemic – an integrated and supported, rather than patchwork or partial response that does not recognise the fundamental significance and interconnectedness of rulemaking within the public sector and its administration.

RaC recommends itself as such a response. This primer helps to consider whether and to what degree that is the case.

About OPSI

The OECD Observatory of Public Sector Innovation (OPSI) works with governments and public servants to:

- Uncover emerging practices and identify what is next, by identifying new practices at the leading edge of government, connecting those engaging in new ways of thinking, and considering what new approaches mean for government.

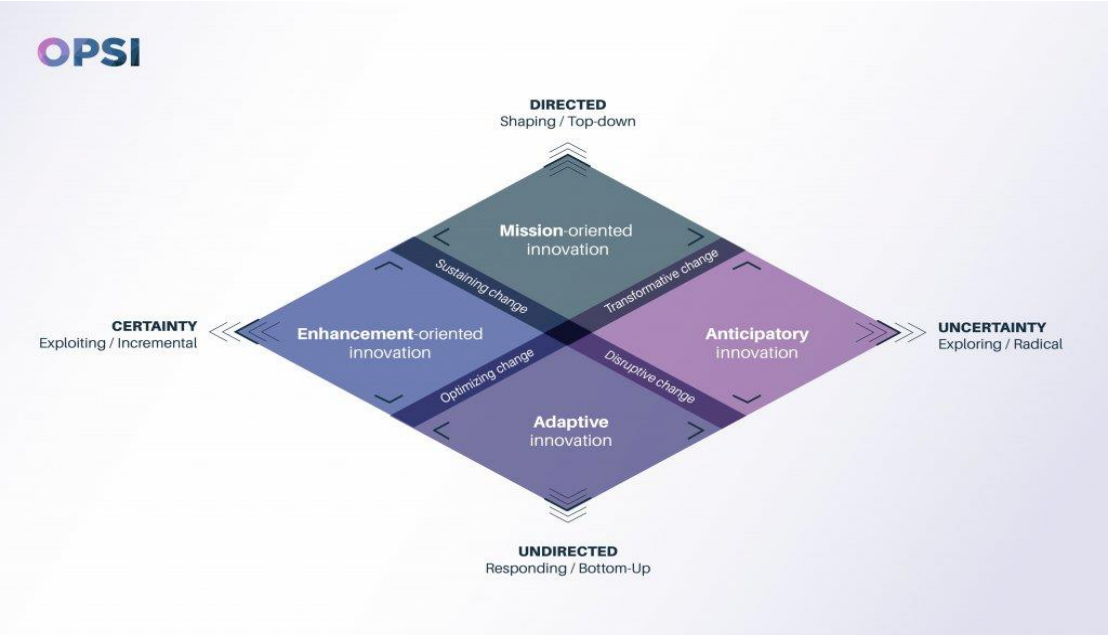
- Explore how to turn the new into the normal, by studying innovation in different public contexts and investigating methods to unleash creativity and incorporate it into the work of public servants.
- Provide trusted advice on how to foster innovation, by sharing guidance and resources about the ways in which governments can support innovation to obtain better outcomes.

Through its work with countries around the world, OPSI has learnt that innovation is not just one thing; it takes different forms all of which should be considered in the public sector. OPSI has identified four facets to public sector innovation (Figure 1.1):

- **Mission-oriented innovation** sets a clear outcome and overarching objective for achieving a specific mission.
- **Enhancement-oriented innovation** upgrades practices, achieves efficiencies and better results, and builds on existing structures.
- **Adaptive innovation** tests and tries new approaches in order to respond to a changing operating environment.
- **Anticipatory innovation** explores and engages with emergent issues that might shape future priorities and future commitments.

Through its innovation primer series OPSI seeks to provide clear, understandable and practical advice to those considering how new relevant approaches can be applied in a public service context.

Figure 1.1. Four Facets of Public Sector Innovation



Source: OPSI.

Paper outline

This primer is an introduction to RaC, which represents a new and innovative response to the challenges posed by the existing model of rule creation. It is designed to provide a simple, clear and understandable guide to the concept and its potential application. By defining what RaC is, the problems it could solve and the challenges associated with its use, the primer can assist those policy makers and civil servants wishing to develop or implement RaC initiatives. It highlights when RaC may be most useful, as well as those areas

where its utility may be more limited. The primer also details some challenges and potential implications that may arise from the use of a RaC approach. It gives some indication as to how governments could begin to consider these implications in their own specific contexts. As interest in this concept develops, this primer can serve as an introductory guide that aids governments considering how to implement RaC.

To this end, Chapter 2 asks: 'What is Rules as Code?' It discusses several of the nuances present in existing definitions, before highlighting the conceptualisation that positions RaC as a new approach to government rulemaking. This is followed by a discussion of what RaC is not.

Chapter 3 examines the current state of rulemaking and reveals how the status quo is creating a number of issues for governments, businesses and people. As a result, it argues that a new way of rulemaking is needed for governments to thrive in the contemporary era.

Subsequently, Chapter 4 makes the case for RaC, highlighting its potential benefits and exploring a number of use-cases that help demonstrate how it could improve government rulemaking and service delivery.

Chapter 5 focuses on how RaC is being approached around the world. Commencing with a discussion of the origins and influences that have shaped the concept, it then discusses existing strategic and operational initiatives that are testing ways to use, improve and implement RaC.

Chapter 6 acknowledges and discusses a range of considerations associated with the concept, as well as highlighting several areas and questions where further exploration may be needed.

Noting the potential role of path-dependencies, Chapter 7 sets out a range of future scenarios that outline how the conditions favouring the introduction of RaC may unfold over time and how this could affect other parts of government.

Chapter 8 ties the preceding discussions together with more practical advice and considerations for those individuals and teams considering implementing a RaC initiative in their own context.

Finally, Chapter 9 concludes the primer by providing final reflections on the RaC concept and how it has the potential to transform government rulemaking and service delivery.

2. What is Rules as Code?

RaC represents a fundamental change in the status quo of rulemaking, by integrating established and new technologies into the rule creation process in a deliberate fashion. While it involves the incorporation of technology into the rulemaking process, RaC does not simply aim to improve or enhance what already exists. Rather, RaC envisions a fundamental transformation of the rulemaking process itself and of the application, interpretation, review and revision of the rules it generates. Being a new concept, debate continues over the concept's precise definition and scope. Accordingly, while the following section does not seek to provide a conclusive definition of RaC, it does suggest a definition that best captures the focus of this primer and RaC in the public sector context. This is intended as a working definition.

Defining RaC in the public sector

Consensus around what RaC actually is, or may represent, is not yet settled. Relative to Gartner's (2020) Hype Cycle,[3] which illustrates the pattern of interest typically shown in a new innovation or approach, the RaC concept is still at the earliest stages of interest and adoption. Like many innovative approaches, it draws and builds upon considerable thought from a diverse and wide range of thinkers and practitioners. As a result, many terms have been used in connection with the RaC concept. Computational law, digital legislation, digital regulatory reporting, automated compliance and model driven regulation have all featured in the conversation. In France, for example, the idea has been expressed as 'transformer la loi en code informatique' or 'transforming law into computer code', while the Australian Federal Government established a *Digital Legislation* Working Group. Such terms have sometimes been employed interchangeably, which has created and exacerbated confusion about what RaC may or may not be. It should be noted that there is a long history of related efforts in the concept's broader domain, with a commensurately large amount of research and insights (see *Other preceding and related efforts*). At the same time, how RaC is conceptualised is changing rapidly as teams and individuals experiment with, and test, various approaches. Consequently, the following discussion should be regarded as trying to set some parameters without prescriptively defining every component, something that will only come as the concept is more widely explored and adopted in a public sector context.

Having noted these caveats, what is RaC? Firstly, if understood literally, RaC may be considered as an *output*. That is, a coded version of rules (for example, those contained in policy, legislation or regulation) that can be understood and used by a computer. This is a broad definition, which can act as an umbrella concept for a range of outputs. Here, Wong's (2020) 'seven levels of digitisation' is a useful means of understanding various RaC efforts in a 'hierarchy of levels' (see Box 2.1).

[3] See https://www.gartner.com/en/research/methodologies/gartner-hype-cycle

Box 2.1. RaC and Levels of Digitalisation

Noting that the debate over what RaC constitutes is ongoing and that discussions about RaC often involve stakeholders with different ideas about the concept, establishing a shared understanding can be difficult. To this end, Wong explores '7 levels of digitalisation' in terms of efforts to digitally transform legal rules. Presenting these as a 'hierarchy of levels', Wong (2020: 1) proposes that the hierarchy may be used to 'agree on a common vocabulary to facilitate discussion and planning'. In this rendering, the levels of RaC range from the lowest (digital first steps) to the highest form (universal adoption). The seven levels (not including sub-levels) are:

- Level Zero: Non-Digital
- Level One: Digital First Steps
- Level Two: Digital Applications and Products
- Level Three: Declarative Rules with Separate Rules Engines
- Level Four: About Ontologies
- Level Five: Natural Language Generation of "Digital Twins"
- Level Six: Tooling Automation
- Level Seven: Universal Adoption.

Source: Wong, M.W. (2020), "Rules as code – Seven levels of digitisation", Research Collection School of Law, https://ink.library.smu.edu.sg/sol_research/3093/.

This definition of RaC, i.e. as an output, can encompass, for example, business rules written in software code, such as those that firms use to comply with regulation governing their commercial activities. Indeed, many software companies already exist to take rules written in natural language and convert them into code for use as operational business rules by specific entities. Compliance with rules is a significant activity – in Australia, for instance, Deloitte (2014: 34) estimated that the 'combined cost of administering and complying with public and private sector bureaucracy' totalled $250 billion every year. Unsurprisingly then, there is a broad and significant industry focused on the creation and maintenance of, and compliance with, the coded business rules that help companies comply with government rules. While broader than just ensuring and enabling compliance, a look at the size of the 'RegTech' market is illuminating as to the economic significance of working with rules. In 2019, Grand View Research (2019) found that the 'global RegTech market size was valued at USD 2.87 billion in 2018' and has significant growth potential. Understood in this way, RaC as an output is not completely new and has been subject to significant and extensive examination, something that will be explored later in the primer.

There is a second and additional component of RaC, however, which is where the focus of this primer lies. This dimension has been opened up by the work of several public sector teams, often with private sector or academic involvement. Pioneered by the New Zealand Government, especially through the Better Rules work (see Box 2.4), RaC is increasingly seen as representing a strategic and deliberate *approach* to rulemaking, as well as an output. Taking de Sousa's definition from the Rules as Code Handbook (2019a), RaC can therefore be understood as:

> *'the process of drafting rules in legislation, regulation, and policy in machine-consumable languages (code) so they can be read and used by computers.'*

RaC, conceptualised in this way, is about changing when, how, by and for whom rules are made. It moves beyond enhancing existing workflows and processes, and requires deeper and deliberate examination of the rulemaking process. Currently, rules are made available in human-readable form; that is, they are

presented in natural language in the form of legislation, regulation or policy documents. End-users of rules, such as regulated entities or government agencies, take these rules and interpret them into 'machine-consumable' versions (see Box 2.2). That is, they take rules written in natural language and translate and reformulate them into code that can be used by the machines (i.e. computers) in a way that is relevant for their specific context and allows them to be enacted at scale (e.g. across the welfare system or ensuring compliance with taxation requirements). By contrast, RaC proposes that governments create an official and machine-consumable version of coded rules from the outset, which compliments and mirrors the natural language version, and which can be published and consumed by interested third parties. For Andrews (2020a), this would represent an acknowledgment that machines are now significant and important end-users of government rules.

Box 2.2. Machine-readable vs. machine-consumable rules

A RaC approach calls for the creation of machine-consumable rules. This condition allows rules to be actioned by machines (computer systems), rather than just being processed by them. The difference between these can be understood thusly:

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

Machine-consumable: In order for information, data or a rule to be machine-consumable, it needs to be 'available in a code or code-like form that software can understand and interact with, such as a calculation, the eligibility criteria for a benefit…or automated financial reporting obligations for compliance' (Digital.Govt.NZ, 2018).

Source: OPSI (2019), Embracing Innovation in Government: Global Trends Report 2019, https://trends.oecd-opsi.org/embracing-innovation-in-government-global-trends-2019.pdf; Digital.Govt.NZ (2018), Better Rules for Government Discovery Report, www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html.

To achieve this, early initiatives (see Box 2.4) have brought together key stakeholders from the existing rulemaking process to create machine-consumable versions of existing rules. A more complete (but less tested) RaC approach would see this process comprehensively restructured in order to bring forward the creation of machine-consumable versions to the initial drafting stage. This would see government become rule makers of both human and machine-consumable versions of the rules, simultaneously.

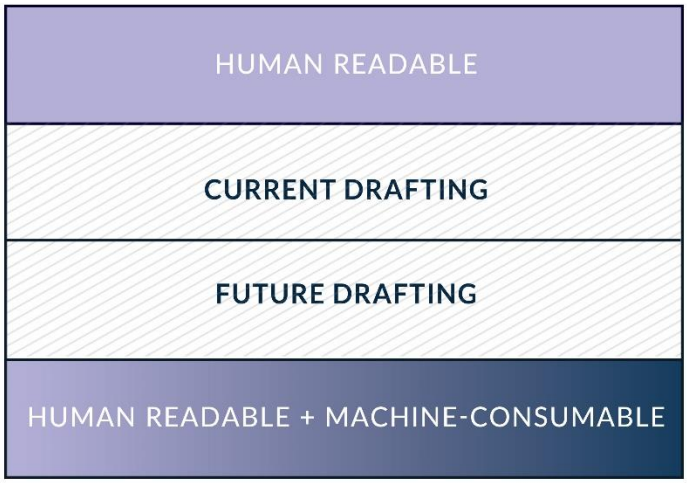
This shift would result in the development of an official machine-consumable version of government rules, produced by government in parallel to the creation of the natural language rules. This would allow third party consumption from the outset of rule creation and would avoid leaving the creation of machine-consumable versions to specific end-users. Further, by drafting the human and machine-consumable versions simultaneously, and allowing the drafting of each to influence the other, drafters and coders are more likely to be able to achieve 'isomorphism', that is, an effective 1-to-1 mapping between both versions.

Box 2.3. Which rules?

While efforts to create coded rules span several domains (e.g. law, commerce), this paper focuses on government rules. Within this category, a RaC approach is likely to be more suitable for certain rule types. Based on early efforts, RaC approaches appear to lend themselves to rules possessing certain characteristics. These include that they are more prescriptive, repeatable and valuable if codified (meaning they are used repeatedly or have significant impact for businesses and people). There is scepticism and debate about whether RaC can or should be used with rules requiring higher levels of human judgement. These issues are examined later in the paper, which explores the question of 'What rules should be coded?'

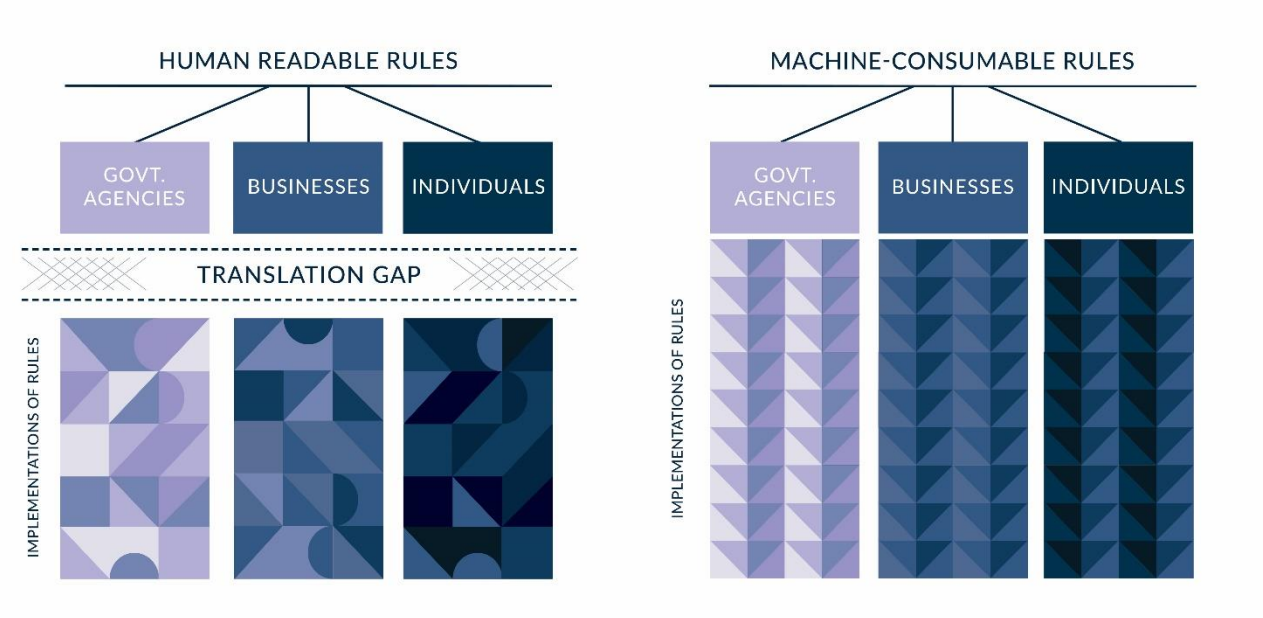
This version of RaC represents a significant departure from the existing rule creation processes and is set out in Figure 2.1. In order to be done effectively, it requires revisiting every step of the rulemaking process, conceiving of rules as a digital product and service from the outset, rather than as an expression and manifestation of policy intent that will then be enacted accordingly, including through digital means.

Figure 2.1. Current vs. future state, where RaC occurs from the outset of rule creation



RaC could also mean a new way of consuming rules. Currently, governments produce human-readable rules (e.g. those contained in laws) that are individually consumed and interpreted by people and businesses. Each regulated entity, for example, must translate laws into machine-consumable formats for use in often-proprietary business rule systems. A future state with RaC could see official, machine-consumable versions of these rules produced by governments, concurrently with the natural language versions, and exposed through mechanisms such as an API or a software library. This could allow businesses to consume machine-consumable versions directly from government, reducing the need for individual interpretation and translation. This is shown in Figure 2.2.

Figure 2.2. Consuming rules



Note: With only a natural language, human readable form of government rules, entities have to interpret and translate rules into coded forms (which can create inconsistencies or errors) multiple times. Figure 2.2 Shows how creating an official, machine-consumable version of rules could enable their more consistent consumption and use by government (and its agencies), business and people by minimising the translation gap.

This could have a range of impacts from necessitating an overhaul of the current rule creation process to making it easier for rules to be consumed (known and acted upon accordingly). Another major effect of making rules machine-consumable is that rules become easier to recognise and act upon for machines, *but also for humans*. This would likely be achieved indirectly, in that the coded version of the rules could inform tools (such as applications) that facilitate a better and more accessible understanding of government rules for individuals and businesses.

Formulating and recording rules in clear and precise language, which is unambiguous as possible, aids their effective and consistent implementation. It allows them to be known and shared, and supports standardisation in their application. The more explicitly rules are formulated, the less chance of rule takers interpreting them differently and reaching diverging understandings and expectations of what is allowed or not. While this is true for all rules, clarity, precision and consistency in application are particularly important for government rulemaking. Of course, sometimes there is value in having less detailed and precise laws that act as high-level signals, that is, as indications of what is desired or valued (or what is to be avoided) e.g. a law against hate speech. Here, the manner in which the rule is applied needs to take into account the specifics of different cases and evolve over time as the intent and details of the rule are solidified in light of the working reality. This element of the law and rulemaking cannot and should not be discounted – but it should also be recognised that, especially in a digital context, all rules *will* be implemented in some form and thus ultimately translated into precise and specific rules *anyway*.

As digital transformation unfolds, many rules become more and more embedded in digital systems and structures. For instance, rather than knowing the details of tax law, many will simply rely on digital systems when completing their tax return, accepting that it is likely in compliance with the rules because the system said so. In this way, humans will act in accordance with the rules embedded in digital infrastructure, even though the rules themselves may no longer be immediately apparent or visible (but with the knowledge that they are accessible and interrogable).

RaC, in effect, forces and demands that more government rules (and their interpretations) be made with greater clarity and precision. It requires that rules – if their implementation is going to be routine and digitally encoded in some way – be drafted in a manner that is explicit about their intent and interpretation, as machines are as yet unable to engage in a fully nuanced interpretation of ambiguity. RaC thus offers a structural driver for insisting that government rules are drafted with greater clarity, including as to identifying where nuance and interpretation are expected or not. In the absence of such a driver, and with the rulemaking process being done by different people in different contexts, it is unlikely that government rules will consistently be as unambiguous as is desirable.

By providing an official source of coded rules, it should also become possible to understand and track how those rules are embedded and used, making them visible and trackable. It would also likely lead to rules being more easily discoverable and decipherable. In these ways, RaC offers the potential to ensure rulemaking delivers benefits for humans and machines. An example of what this can look like in practice is provided in Box 2.4.

Box 2.4. Better Rules, New Zealand Government

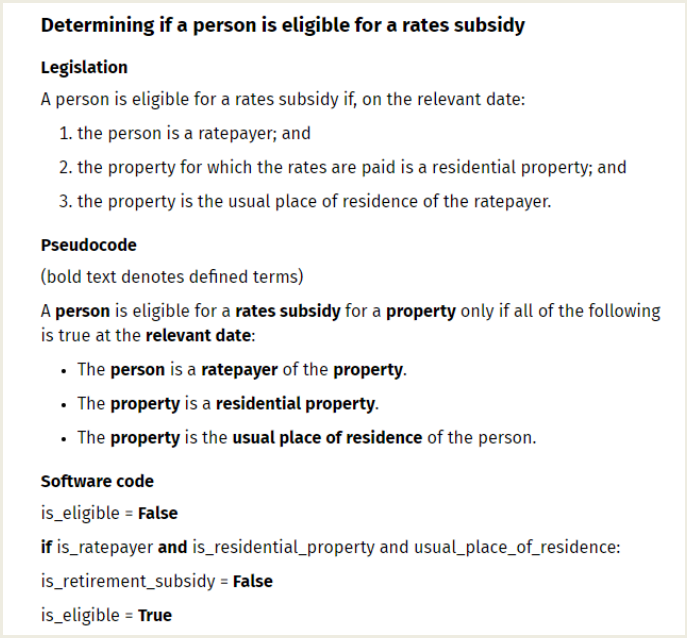
Better Rules is a New Zealand Government initiative, which has helped drive international interest in RaC. Covered in OPSI's *Global Trends Report 2019*, the Better Rules discovery has inspired similar initiatives elsewhere (e.g. in New South Wales (Australia) and Canada) as a number of jurisdictions (at the national, state and local levels) seek to test this approach for producing RaC. The Better Rules methodology emphasises the use of multidisciplinary teams and human centred design practices to produce machine-consumable code that helps ensure the implementation of rules better matches their original intent. As the Ministry of Business, Innovation and Employment explains, Better Rules is a 'methodology that enables us [the government] to produce logic expressed as a concept model, decision trees, and rule statements. Together these create a blueprint of the legislation… [which can be used] to write legislation in any language. For example, English words and software code.'

The initial Better Rules Discovery occurred over three weeks in 2018. Facilitated by the Service Innovation Lab (LabPlus) and Better for Business, the project brought together representatives from several NZ Government agencies. Highly multi-disciplinary, the team contained business rules specialists, business analysts, legislative drafters, service designers, policy specialists and software developers. Together they mapped the current state of policy development and implementation, before defining a future state 'which was to have human and machine-consumable versions of rules for effective and efficient delivery of services' (Digital.Govt.NZ, 2018). The discovery tested an approach the team thought capable of delivering this future state, by attempting to code two pieces of legislation: the Rates Rebate Act and the Holidays Act (Digital.Govt.NZ, 2018).

To create the coded rules, the team first formed a number of artefacts to create a basis of common understanding within the team. These included concept and decision models, which highlight relations between different concepts contained within the legislation as well as the logical flow of decisions that lead to an outcome. From these, the team generated 'rule statements that detail the logic of the rules in a human readable format, human readable legislation and software code' (Digital.Govt.NZ, 2018). Figure 2.3 shows these distinct forms in relation to a person's eligibility for a rates subsidy.

Following the Discovery phase, the findings and approach was implemented to develop rules as code for two use cases: '(1) to support a planning tool for parents, expectant parents and caregivers to assess what financial help is available; (2) a calculator to help low income ratepayers find out how much of a rebate they are entitled to and to step them through the application process' (OPSI, 2018). It also resulted in the establishment of a global forum dedicated to advancing ideas related to the Better Rules methodology and RaC more broadly.

Figure 2.3. Forms of rules, eligibility example



Determining if a person is eligible for a rates subsidy

Legislation

A person is eligible for a rates subsidy if, on the relevant date:

1. the person is a ratepayer; and
2. the property for which the rates are paid is a residential property; and
3. the property is the usual place of residence of the ratepayer.

Pseudocode

(bold text denotes defined terms)

A **person** is eligible for a **rates subsidy** for a **property** only if all of the following is true at the **relevant date**:

- The **person** is a **ratepayer** of the **property**.
- The **property** is a **residential property**.
- The **property** is the **usual place of residence** of the person.

Software code

is_eligible = **False**

if is_ratepayer **and** is_residential_property and usual_place_of_residence:

is_retirement_subsidy = **False**

is_eligible = **True**

Source: Digital.Govt.NZ, 2018

The Better Rules discovery demonstrated that the production of coded rules is technically feasible and provided one potential approach to achieve this. Its key findings included that while 'it is difficult to produce machine-consumable rules if the policy and legislation has not been developed with this outcome in mind', the multidisciplinary team is an effective way of creating RaC. Finally, the discovery resulted in the establishment of a Better Rules work stream within the Ministry of Business, Industry and Employment. Currently, the team is focused on two outcomes:

1. Supporting use cases that demonstrate the value in a government context (including on issues such as identity management and trade regulations); and,
2. Capability and capacity development (including through the moderation of the global Better Rules forum, explanatory videos and the ongoing development of a facilitated and online course).

Better Rules demonstrated how RaC could be instituted in government. It has played a central role in bringing greater attention to RaC, especially within government, and is acknowledged as having made a key contribution to the global discussion on the concept's importance and viability.

Source: OPSI (2019), Embracing Innovation in Government: Global Trends Report 2019, https://trends.oecd-opsi.org/embracing-innovation-in-government-global-trends-2019.pdf; Ministry of Business, Innovation and Employment (2020) "What better rules – better outcomes is all about", www.mbie.govt.nz/business-and-employment/business/support-for-business/better-for-business/better-rules-better-outcomes/what-better-rules-better-outcomes-is-all-about/; Digital.Govt.NZ (2018), Better Rules for Government Discovery Report, www.digital.govt.nz/dmsdocument/95-better-rules-for-government-discovery-report/html; OPSI, 2018, "Better rules, better outcomes", Observatory of Public Sector Innovation, https://oecd-opsi.org/innovations/better-rules-better-outcomes/.

Something different: RaC isn't…

As with any new concept, it is important to both understand what RaC is and what it is not. For instance, in assessing previous 'digital legislation' efforts, Andrews (2020a: 15) suggests that these are overwhelmingly 'structured content that would still require all interpretation, codifying and hardcoding efforts'. Further, she writes that while there were 'a few notable exceptions…many people don't understand the difference between a website and rules as code' (Andrews 2020a: 15). The following section accordingly seeks to clarify a number of things that RaC is not.

RaC is not only publishing existing rules in a digital format online

Some governments may make their legislation available online in PDF format, which is not machine-consumable nor always machine-readable. As noted in Box 2.2, machine-readable allows for computer understanding, whereas machine-consumable allows computers to understand the content and take actions based on that understanding. Some governments, such as the United Kingdom's and NZ's, have committed to make their legislation available online in an XML format, which is machine-readable. Yet, to date, no government has shifted to making their rules machine-consumable consistently or on a comprehensive scale. This is not always clear-cut and, again, Wong's (2020) classification is useful in this regard – RaC efforts can range in the extent to which they achieve digitalisation of the rules.

The use of tools that assume (exclusively) human readable formats

At present, there does not appear to be an end-to-end technology solution that can accurately and effectively convert human-readable rules into machine-consumable form without human involvement. While there are some products that attempt the automatic translation of human to machine-consumable forms, for example, through the use of semantic or natural language processing, the extent to which they are 'automatic' ostensibly remains limited. Beyond these limitations, many of these products assume that rules are created *only* in human-readable format. That is, they seek to take rules in a human-readable form (e.g. a piece of legislation written in a natural language) and apply their technology solution to translate it into a machine-consumable equivalent. In moving away from the need to create a machine-consumable version of rules from the outset, this may propagate the status quo in which rule makers do not consider machines as end users of rules (Andrews 2020a). Although more advanced capabilities may exist in the future, current RaC initiatives have tended to centre on the more deliberate and human-led creation of machine-consumable law. These processes have already revealed the value of interdisciplinary exchange between actors in the rulemaking process (e.g. between lawyers and coders) in generating mutual awareness of the other's functions. Improved technical capacity to translate human-readable rules into machine-consumable ones may eliminate (or, substantially minimise) the need for multidisciplinary cooperation and learning, thereby reducing the need for different types of experts to adjust their ways of working to improve the overall rule quality. This would not facilitate the improvement of the rules created in the first place or ensure that the initial rule makers consider machines as key consumers of the rules they create. This is not to say that such tools can or should not form some part of future RaC initiatives, merely that their use is unlikely to be sufficient in isolation.

RaC is not about replacing judges, the law or human discretion

Despite (or perhaps because) RaC remains a relatively early-stage proposal, its emergence has already elicited nervous responses from those very reasonably concerned about the potential misuse of machine-consumable rules. Early discussions about RaC have seen concerns raised that the idea 'is not just misguided and deaf to history, it's dangerous' (McIntyre 2019). In some accounts, even in those invoking the RaC concept (or something approximating it), it has been equated with the replacement of human discretion in rulemaking and enforcement. Equally, its mention has been quick to invoke related fears of

ubiquitous automation and straight through processing by governments. Certainly, there is the possibility that coded rules (i.e. those enabling automated decision making or straight through processing) could result in adverse outcomes for people.

While those in the existing RaC community are overwhelmingly not advocating for such uses, it would be remiss of governments not to anticipate these possibilities and seek to guard against them. Already, some national governments, such as the United Kingdom and Canada's,[4] as well as some international organisations, including the OECD,[5] have developed a range of principles and frameworks to guide the ethical use of data and algorithmic decision making. These are resources that could be usefully leveraged in the future. In addition, there are potential concerns that RaC could act to unintentionally 'lock-in' interpretations of rules, thereby leaving the law static rather than as something where the interpretation of original intent needs to change over time to reflect contemporary issues and understandings.

Of course, while it is correct to identify such concerns, it must be equally highlighted that these risks are not inherent to the RaC concept itself. Like other technologies or approaches, RaC is capable of enabling positive or negative outcomes. Many proponents of RaC have consistently argued that efforts should be limited to 'prescriptive rules that you want implemented clearly and consistently, like eligibility criteria, or calculations for taxation and benefits' (Andrews, 2020b). Further, among the stated goals of most RaC projects to date has been to encourage greater openness and transparency, while avoiding the use of (more) black boxes or arbitrary decision making. It should also be noted that activities such as automated processing can and are occurring now based on (privately) coded rules. If anything, a RaC approach (as described here) could make the use of coded rules more amenable to public scrutiny and independent audit (i.e. by publishing the rules openly). It could also make it easier to understand where rules are being interpreted in ways deemed harmful, undesirable or outdated, and thus easier to remedy them. In summary, the effects that RaC will deliver will depend largely on how it is implemented. Additional considerations for creating a trustworthy system and positive use cases for RaC are discussed later (see *Principles for a successful approach*).

RaC: A new approach

This chapter has explored different elements of RaC and offered a working definition that informs and sets the scope for this primer. RaC involves rethinking the processes underpinning government rulemaking to create an official and machine-consumable version of coded rules that can be used by third parties. It envisages that rules should be conceived of as digital products and services from the very outset of their creation. This chapter has also further specified that while a RaC approach can be used to code existing rules, achieving the full potential of the concept would involve the development of coded rules concurrently with a natural language version in the initial drafting stage. Finally, in line with this understanding, it has outlined a number of things that RaC is not. In the following chapter, the primer explores why RaC is needed and how the current state of government rulemaking is creating three related problems for governments.

[4] See www.gov.uk/government/publications/data-ethics-framework/data-ethics-framework; www.canada.ca/en/government/system/digital-government/digital-government-innovations/responsible-use-ai/algorithmic-impact-assessment.html

[5] See OECD Recommendation on Artificial Intelligence [OECD/LEGAL/0449]

3. Why RaC is needed

Given the macro-level pressures on government rulemaking discussed in Chapter 1, the following explores the current state of government rulemaking and the issues arising from it. Specifically, it highlights the three related problems of interpretation and translation, complexity and efficiency. It argues that these, in combination, have contributed to a growing need for change in the way government rulemaking occurs – a task for which RaC appears well suited.

Rulemaking: The current state

For the OECD (2019b: 211), public sector 'governance' refers to the 'exercise of political, economic and administrative authority'. This authority gives governments the power and ability to create and enforce rules. In turn, these rules, which are manifested in various forms including laws and regulations, shape the societies over which governments have jurisdiction. These rules not only govern the actions of people, businesses and societies, but also how governments themselves operate. This is a central and long-established aspect of democratic systems and is most explicitly linked to Magna Carta (1215). This document, issued by King John of England, placed constraints upon the governing executive and thus 'established for the first time the principle that everybody, including the king, was subject to the law' (Breay and Harrison, 2014). Crucially, the example of Magna Carta underlines that governments are not only creators of, but also subject to, rules. These rules are perhaps the most fundamental, in that they place limits on government and its ability to act, and help to reduce the risk that citizens will be subject to the arbitrary exercise of the coercive power of the state.

The nature of rules and laws has evolved over time, becoming more refined as legal systems have become more sophisticated. Moreover, at an ever-increasing pace, digital technologies are requiring widespread changes to the rules themselves (for example, the modification of aviation law to account for the use of drones). Governments have also been long engaged in deep, extensive examinations of what and how many rules to make. In the wake of crises, this trend typically becomes pronounced. Following the Global Financial Crisis of 2007-08, for example, many governments assessed to what extent the regulatory frameworks and compliance measures governing the financial sector were sufficient. Many countries have also made changes to the ways they make certain rules, for instance, through the introduction of regulatory impact statements into the law-making process. Yet, despite all these changes, the basic, most foundational methods by which governments design, create and implement rules have remained largely immune to comprehensive transformation.

The existing rules

Rules are part of a constellation of components that shape and govern society. For North (1991: 97), institutions are 'the humanly devised constraints that structure political, economic and social interaction'. They constitute 'informal constraints (sanctions, taboos, customs, traditions, and code of conduct) and formal rules (constitutions, laws, property rights)' (North, 1991: 97). In this way, rules can be both specific things but also embodied in structures and processes. A democratic government functions on the basis of rules – i.e. the non-arbitrary use of the state's coercive power. Formal rules particularly, such as those contained in constitutions, enable the state to govern for or on behalf of its people.

Government rules are present in almost all domains of life. People must comply with road rules when driving a vehicle, pay taxes according to certain criteria (for example, income earned and allowable exemptions) and have their relationships (e.g. child, spouse and parent) legally acknowledged or certified in accordance with specific laws. Rules also determine what people can receive by way of government support and assistance. For example, people may be eligible for social security or welfare if they become unemployed or are seriously injured. Failing to follow rules can result in penalties, while compliance can provide entitlements to public services and benefits. Having access to and understanding government rules is therefore crucially important.

Rules similarly affect businesses. As North (1991: 97) notes, institutions are central to economic activity because of their 'ability to create order and reduce uncertainty in exchange'. For example, businesses may start trading only after obtaining a licence that guarantees that they meet the requirements necessary to operate in a specific sector. Commercial activity is also subject to rules. Banks, for instance, can be required to hold certain levels of capital reserves to manage risk and exposure. The process of commercial exchange is further regulated; for example, businesses selling products and services must ensure compliance with consumer law. Primarily, it is the role of governments, including regulators and other public bodies, to develop the rules of business activity. Non-government actors, such as standards bodies, also have a role to play in helping to ensure baseline requirements are met in terms of key indicators (for example, health standards in food manufacturing). These can help ensure better outcomes for all those entities operating in an industry, but also underpin social benefits such as consumer confidence.

Governments are simultaneously administrators of, and subject to, rules. Once in force, government rules, for example those contained in legislation, need to be interpreted and implemented by non-elected members of the government, such as public servants. In such cases, governments may adopt operational guidelines that public servants must follow. An example would be operational guidelines for the application of eligibility criteria to determine if individuals can access state-funded grants or loans. Public sector leaders can also be required to comply with internal budgeting rules, created by government, for the purpose of administering and managing agencies. Rules can therefore be legal obligations or formalised accepted or expected practices.

As the ultimate form of rules in a nation, a constitution establishes the obligations, freedoms and powers of a government. One of these powers is the ability to create, modify and enforce rules. Typically, the rules created by governments are thought of as residing primarily in legislation. Indeed, while legislation often houses a significant portion of the rules created by government, many are also contained in regulation, policy documents and operating guidelines. While these and other instruments seek to set out precise and unambiguous rules, their implementation will often require interpretation or the exercise of discretion as to how a rule should be implemented in specific circumstances. In this regard, the application of rules by individual public servants can be affected by the depth of their knowledge and expertise, among other things. It can be further influenced by the degree to which the rules are established and enforced and the extent to which parameters and guidance are detailed and meaningful.

While not the focus of this primer, the judiciary and courts are another key actor in the creation, interpretation and enforcement of rules. Their role differs across countries depending on a range of factors, including the type of legal system in place (across OECD countries, civil law, common law and mixed systems predominate (see Box 3.1)). The judiciary and courts' role may be relevant when considering RaC for a number of reasons and the differences between them can matter because of their impacts on the nature, effect and operation of rules made by governments. The level of detail in various forms of government rules might vary from country to country, as may the extent to which the courts shape the rules after their adoption. Even in cases where the role of the courts in this regard is more limited or where government rules do not require the exercise of discretion (for example, in some instances of sentencing), courts will still play a crucial role in interpreting how and to which cases the rules apply, thereby shaping how government rules are implemented in practice. It is therefore important to consider the role of courts

when determining how and where RaC could be most effective. In this, rule makers should also consider the types of rules to which RaC is best suited (see *What rules should be coded?*).

Box 3.1. Common law, civil law and mixed legal systems

The nature of a country's legal system may affect the design, operation and the effectiveness of RaC initiatives. Typically, legal systems are based on either common or civil law, with some country systems being a mixture of the two. Common law systems generally rely more on precedent in the creation and development of law. By contrast, civil law systems generally represent 'a codified system of law', and prioritise the development of law through legislation. Mixed systems combine aspects of both types of system (e.g. in South Africa and Scotland (United Kingdom)). Table 3.1 illustrates some of the primary differences that often distinguish the two systems.

Table 3.1. Differences between common law and civil law systems

Feature	Common Law	Civil Law
Written constitution	Not always	Always
Judicial decisions	Binding	Not binding on 3rd parties; however, administrative and constitutional court decisions on laws and regulations binding on all
Writings of legal scholars	Little influence	Significant influence in some civil law jurisdictions
Freedom of contract	Extensive – only a few provisions implied by law into contractual relationships	More limited – a number of provisions implied by law into contractual relationship
Court system applicable to PPP projects	In most cases contractual relationship is subject to private law and courts that deal with these issues	Most PPP arrangements (e.g. concessions) are seen as relating to a public service and subject to public administrative law and administered by administrative courts

Source: Adapted from Public-Private-Partnerships Legal Resource Centre (2016), "Key features of Common Law or Civil Law systems", https://ppp.worldbank.org/public-private-partnership/legislation-regulation/framework-assessment/legal-systems/common-vs-civil-law.

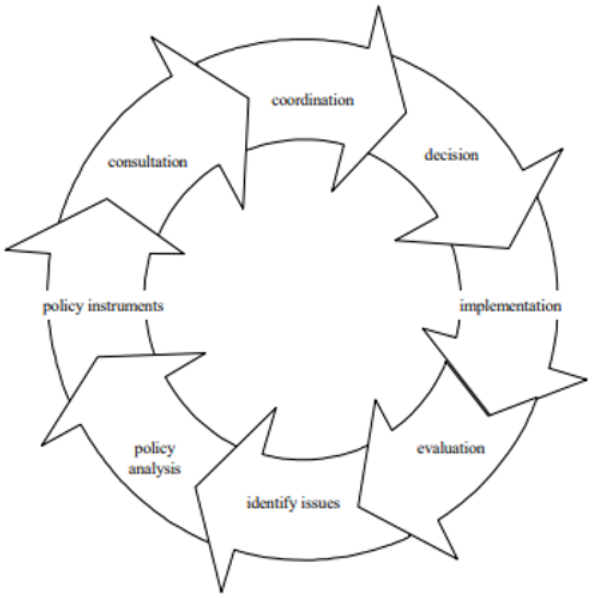
Anecdotal evidence suggests that RaC can be applied effectively across different legal systems, although the sample of attempts is limited. Discussions on this issue have revealed that some individuals involved in RaC projects have found relatively minor differences between common and civil law jurisdictions when coding rules. Conversely, it has been suggested that the degree to which politics influences the rulemaking process may complicate RaC efforts. For instance, RaC may be more possible where an apolitical public service oversees the drafting of rules, and thus leverages greater control over the rulemaking process as compared to other systems (e.g. those with elected legislators). However, this area requires additional investigation.

Source: Public-Private-Partnerships Legal Resource Centre (2016), "Key features of Common Law or Civil Law systems", https://ppp.worldbank.org/public-private-partnership/legislation-regulation/framework-assessment/legal-systems/common-vs-civil-law; OPSI Research Interviews 2019/2020.this line.!!>

How rules are made

Theoretically, rules can be understood as emerging from the policy process. Policy making is often understood as a linear process which moves from problem identification, to policy implementation and policy evaluation through a series of sequential stages (Jann and Wegrich, 2007). A common rendering is contained in the policy cycle (Figure 3.1), which presents a series of stages from agenda setting to policy evaluation. Here, various actors (e.g. politicians, civil servants, external advocacy groups) move progressively through the stages. This model has been criticised on both theoretical and empirical grounds (Jann and Wegrich, 2007: 43). Experience shows that the policy process is often non-linear and can be strongly influenced by the existing policy context and actors (Jann and Wegrich, 2007: 44-45).

Figure 3.1. The Australian Policy Cycle



Source: Bridgeman and Davis, 2000: 27

In reality, a number of additional factors can affect rule creation. Extra-political activities, such as framing or agenda setting, can influence the need for, and nature of, rules, as well as the extent to which they are

enforced. A contemporary example of this, which is being played out in a number of nations across the world, relates to the enforcement of laws relating to the use of marijuana. In the US and Australia, for instance, changes in governments have at times influenced the extent to which law enforcement agencies are expected to enforce rules and prosecute individuals for infringements such as possession and recreational use (see Lynch, 2018; Bright and Bartle, 2020). At the same time, however, several states have legalised marijuana, thereby creating a conflict between federal and state rule sets. This illustrates the contested nature of rulemaking processes, but also highlights how multiple sets of government rules (e.g. inter-jurisdictional or intra-jurisdictional) can interact and sometimes conflict. Rules, in this case, laws, may be clear, but their implementation can be uncertain or variable – will they be implemented, under what conditions and by whom? Such situations create areas where there is discretion as to whether a rule will be applied and, if it is, when and how that occurs. It should thus be remembered that rulemaking is not just a technocratic exercise – rules are a manifestation of power, and so is their interpretation and application.

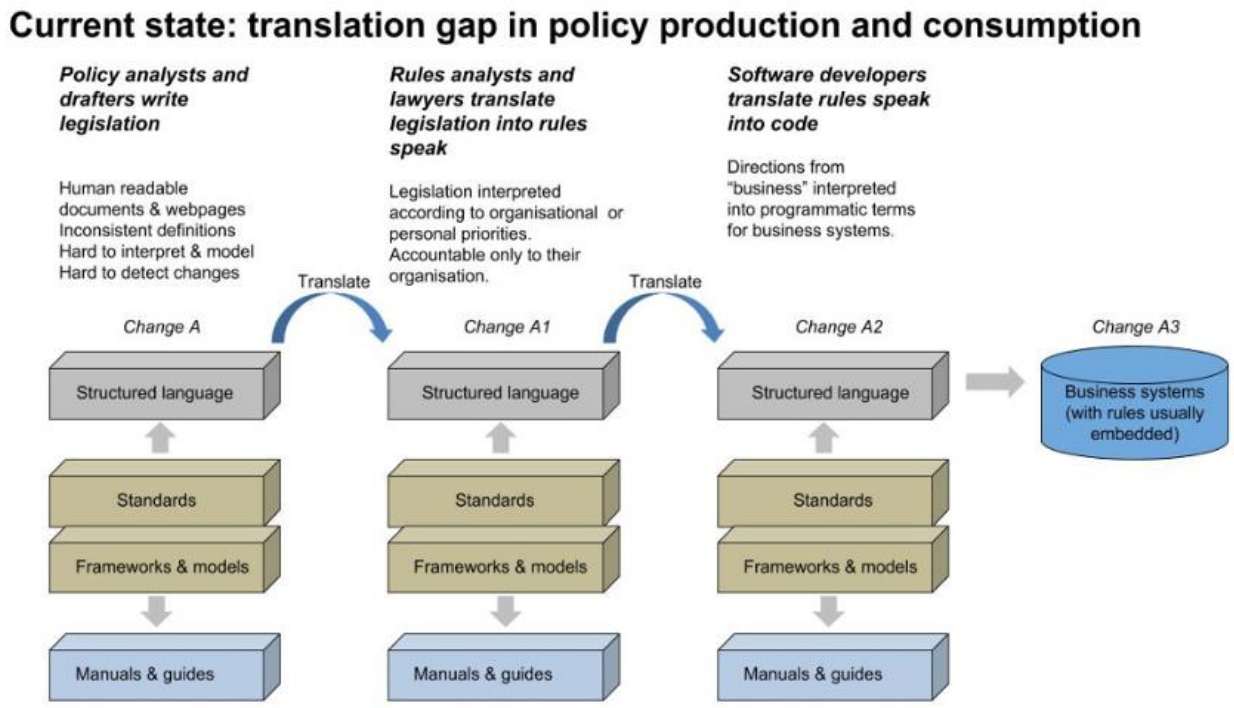
Beyond politicians, other actors also feature strongly in the rulemaking process, as opposed to the more limited role often afforded to them in the idealised model. Stakeholders, including lobby groups and advocacy coalitions, may attempt to shape rules through official and non-official channels. Theoretically, stakeholder and external consultation occurs prior to the rules formulation (e.g. through a public consultation process) and again after implementation (to gauge the effects of the rules). In practice, the development and form of rules is often subject to additional stakeholder influence throughout the entire process. This may be through lobbying or formal representations to Members of Parliament or political appointees. In some cases, the occurrence or influence of such activities may not be transparent to outside observers.

Yet, despite the apparent limitations of the theoretical model, the *functional process* required to move policy from development to implementation often accords with its basic tenets. NZ Government research on the 'policy intent' user journey reveals that an often linear, sequential and siloed process underpins the movement from policy development to implementation. They write that:

> *'The current approach is relatively linear as Policy Development iterates with Ministerial Decision making and then moves to Legislative Development, before throwing the set of rules over the fence for operational implementation by Service Design and Delivery. If the policy is Operational then it skips the Legislative Development stages and goes straight into implementation.' (Digital.Govt.NZ, 2018)*

Elements of the current state of rulemaking, those relating to how rules are translated and implemented once created, are shown in Figure 3.2. The processes and mechanisms governing the way rules are developed continues to reflect the analogue environment in which they were developed. The reliance on a system developed for a paper-based world creates significant inconsistencies, inefficiencies and challenges for contemporary rule makers and this has contributed to a situation where new rulemaking processes are needed (OPSI, 2019). The following section elaborates on the problems and challenges of the current system.

Figure 3.2. The 'translation gap' in current rulemaking



Source: Digital.Govt.NZ, 2018

Three related problems

The world is changing at an unprecedented rate, often in unexpected directions. The *Embracing Innovation in Government* global trends report of 2019 identified that 'digitalisation [is] transforming economies, governments and societies in complex, interrelated and often unpredictable ways' (OPSI, 2019: 13). Digitalisation has 'sped up' the world and made it increasingly connected. This has amplified the complexity of issues, as well as the complexity of responses needed to address them. As a result, governments have often struggled to prepare for, shape, adapt to and keep pace with this changed context. Likewise, the way governments create rules is under pressure and often falling behind what is now needed and expected. This is exacerbating old problems, while also creating new ones. Here, these problems can be understood as relating to three main areas:

- **Interpretation and translation of intent**: In requiring repeated interpretation multiple times and in multiple stages throughout rule creation and implementation, the current process risks misunderstanding. This can create a gap between policy intent and implementation, as well as uncertainty and costs for consumers of the rules. This is magnified when happening at speed, as the ability to compare a rule's intent with feedback about its in-practice implementation and its application to unanticipated contexts is hampered by ongoing, often irregular change.
- **Complexity**: The current process is not well equipped to handle the twin-challenge of growing complexity and fast-paced change, which characterises governments' operating environments. This can reduce the quality and timeliness of government rulemaking. This is amplified by the transboundary interconnectedness that comes with globalisation and digitisation, and which requires that effective rulemaking addresses local and international contexts (OECD, 2019c).
- **Efficiency**: Inefficiencies accrue in the current rule-creation process, especially in terms of the testing and revision of rule changes. By failing to provide an official set of government rules in

coded form, inefficiencies are created as individual consumers of rules are required to translate and code rules for individual systems. This too is exacerbated by speed and transboundary concerns, as consumers of rules may have to integrate multiple rule sets on an ongoing basis.

Interpretation and translation of intent

The current way of creating, distributing and consuming rules carries an inherent risk of discord between the original policy intent and the eventual effects of the policy. In the model outlined above, each stage of the policy-to-implementation process can occur almost independently from the others, with distinct groups of actors responsible for specific aspects. Policy professionals and subject matter experts, along with elected politicians, may cooperate to create an initial policy document. This is then communicated to legislative drafters, for example, via drafting instructions, who transform the policy into the form required by the parliament. If there are implications for people, the policy will also be passed to agencies responsible for implementation, who create operational guides and business rules.

Even in this simplified example, there are multiple opportunities for the misinterpretation of the original policy intent. This can be compounded by the absence of shared understanding between parties, who typically rely on profession-specific knowledge and ways of working. For instance, the vocabulary and lexicon used by lawyers will differ from that of policy analysts, and even more substantially from that of technologists. Additionally, this process sees 'discreet, static knowledge assets produced at each stage…[which are] inconsistently shared between stages, use domain specific language and are created for a paper based world' (Digital.Govt.NZ, 2018). The disintegrated nature of the process can thus result in misunderstanding and gaps between policy intent and implementation. This is suboptimal for the creators of policy, as well as for those who are subject to the policy's effects.

The current process also necessitates translation and makes certain actors crucial in the processes of rule-creation, implementation and use. As NZ's Better Rules team noted, once a law is enacted, the current model positions 'lawyers as modems' who, along with other types of advisors and analysts, are necessary to interpret and translate the law into operational policies and business rules (Andrews in OPSI, 2019: 106). Subsequently, these outputs are again expressed by others, including technologists, in a variety of information systems. This requires translation that, in turn, requires human judgment and therefore has the potential to skew the original intent of the rule through misunderstanding and errors. Such (mis)interpretations are often not explicit and may be operationalised, for example, by coding workflows, decision models and calculations into software. As Box 3.2 illustrates, this can affect very fundamental things, such as what is meant by half a year.

Box 3.2. From legislation to code

Waddington (2019: 46), Senior Legislative Drafter in the Government of Jersey, illustrates how the act of interpretation, from rules to code, can have significant impacts on how a policy is implemented. Examining the role of 'silences' in legislative drafting, he writes:

> *An example is work done in New South Wales on encoding a provision that said a grant was payable to parents of children aged four and a half to eighteen. A human knows, with reasonable confidence, what we mean by a child being aged four and a half. But a computer needs to be told exactly what to do…The first point is that this does not mean when exactly 4.5 years have passed since the moment the child was born (and regardless of international time differences). Half of a year is 182.5 days (unless a leap year). So half of a year, measured from the child's actual hour, minute and second of birth, would expire at a point 12 hours later in the relevant day (a child born at 07:00 on a given day, will have lived for exactly half a year at 19:00 on whatever is the day that is 182 days later).*

Waddington notes that while the expression '4 and a half' is quite clear to humans, conveying this seemingly simple concept to machines is more difficult. Further, he shows that how it is interpreted by those implementing the software could have material consequences. If age were to be measured to the minute, for example, this may exclude individuals who should have reasonably qualified for the grant. This is not to say that coding such expressions is impossible. Instead, it is to highlight the challenges posed by the interpretation and translation of rules. The point of RaC is not necessarily to eliminate this challenge or ambiguity, but instead to make it visible to both implementers and policy makers (who can decide if it is warranted or desirable). The current, linear sequence of rulemaking does not currently facilitate this and, as a result, issues such as these are not evident nor easily correctable until after the policy is implemented. Revealing these discrepancies, through RaC, may therefore help to realise outcomes that are closer to the original policy intent.

Source: Waddington, M. (2019), "Machine-consumable legislation: A legislative drafter's perspective – human v artificial intelligence", The Loophole, no. 2, www.calc.ngo/sites/default/files/loophole/Loophole%20-%202019-02%20%282019-06-24%29.pdf#page26.

The decisions rendered by such systems have the potential to influence people's lives and there is often little visibility about how the code was developed or how it can be traced back to the initial rule. Ultimately, the creation and enforcement of rules is always likely to rely on certain actors with specialised expertise. Yet, as noted in the OECD's Recommendation on Regulatory Policy and Governance, countries should seek to 'adhere to principles of open government, including transparency and participation in the regulatory process to ensure that regulation serves the public interest and is informed by the legitimate needs of those interested in and affected by regulation' (OECD, 2012: 4).

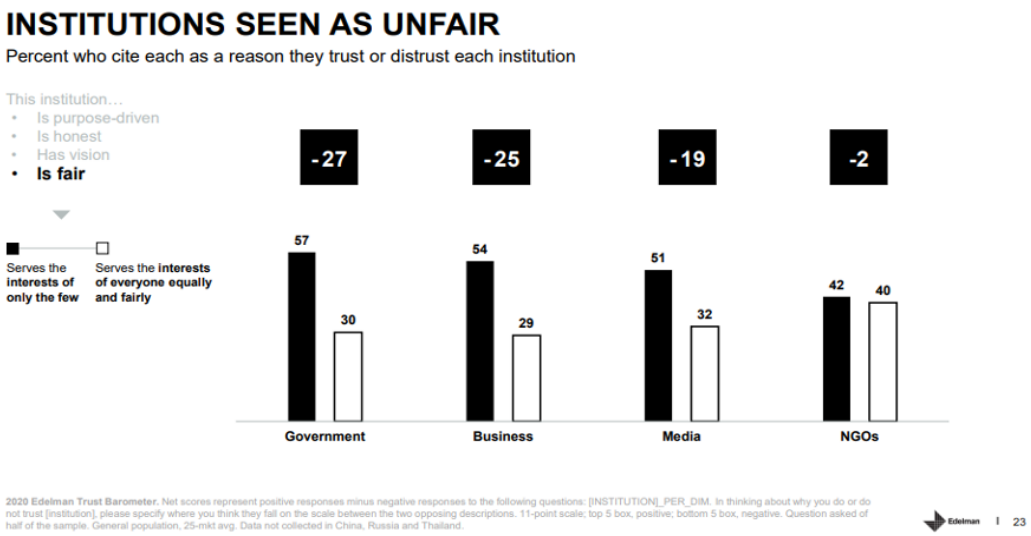
Complicating these issues is that the assumptions underlying the implementation and operationalisation of laws and policies into digital formats can be lost over time, rendering it impossible to trace the formative decisions and thinking (OPSI, 2019: 106). For example, many governments use decades-old legacy information systems to process critical services, such as social benefits payments. These systems can be opaque, and the individuals who understand why and how the systems conduct calculations and reach decisions may no longer be available to offer advice or insight. In addition, every time a law or major policy changes, the software needs to be manually updated. In such situations, it can be unclear who should interpret grey areas and make decisions about how the information system and software should implement the law. This is also highly inefficient, especially for the largest consumers of government rules (such as regulated entities).

Further, the process underpinning the design and implementation of rules can be difficult to understand for people. Many government rules are complex and intertwined with other pieces of legislation and policy.

This can make navigation of the rules hard and attempts to interpret one's standing in relation to them difficult. This also assumes that rules are easily accessible. Some are not publicly available and the extent to which a government publishes rules online varies significantly. In combination, these issues can hinder people from understanding their rights, obligations and entitlements, as well as how government decision making affects them. On occasion, the effort required to understand and follow rules may even be disproportionate to the benefits of compliance. The complexity and ambiguity around rules thus tends to restrict understanding to people with a high level of relevant education and training, which has its own implications for equality of access (OPSI, 2019: 106).

Lack of understanding about government rules and the absence of tools to navigate and interpret them is a problem that can directly affect the health of government. If laws or rules are not applied or upheld equally – because of access to legal expertise or because of other characteristics irrelevant to the law (such as race, sex, or wealth) – then the actions of government risk being seen as arbitrary, rather than as based on democratic principles. This is especially true in a context of declining trust in government. Salient in the Edelman research was the finding of record 'trust inequality', which reflects growing concerns about inequity and unfairness in incumbent systems (Edelman, 2020: 8). They find that a significant '57 percent of the general population say that government serves the interests of only the few, while 30 percent say that government serves the interests of everyone' (Edelman, 2020: 23) (see Figure 3.3). Even if the Edelman findings reflect perception more than reality, such beliefs can be immensely damaging to the social belief and confidence that underpins political systems.

Figure 3.3. Fairness perceptions of institutions including government



Source: Edelman 2020: 23

Trust in government, and faith in the collective good, will be undermined if citizens are unable to understand the rules by which their behaviour is judged or regulated. If citizens cannot know the rules of the game, they are unlikely to think of them as fair. Additionally, rules that remain unclear or inaccessible to the public may create inequalities between individuals, for example, in terms of relative access to government benefits or grants by different population segments. Finally, the absence of mechanisms to democratise access to, and understanding of, government rules may reinforce a view of government as opaque, elitist and self-serving. RaC is an opportunity to demonstrate that the rules are not arbitrary (or to reveal where in fact they are arbitrary). It also offers the ability to expose the processes informing rule creation and use, as well as to make rules more accessible and understandable through the creation of tools (e.g. applications or information services) based on machine-consumable versions. RaC could therefore be a

part of responses looking to arrest the fall of trust in government. (This is not inevitable, of course, as RaC could also add to it if poorly implemented, by entrenching rigidity or increasing compliance with unfair rules – much will remain dependent upon the application, as with the current system.)

Complexity

External forces, such as heightened interconnectivity and an accelerating pace of change, mean that governments are facing problems of increasing complexity. In fact, it seems clear that 'complexity is a core feature of most policy issues today' (OPSI 2017: 3). Exemplifying such challenges are the so-called 'wicked problems', which Stockdale-Otarola (2016) suggests are 'dynamic, poorly structured, persistent…difficult to define, highly intertwined with other social issues, and involving many actors'. These problems, typified by issues such as the Covid-19 pandemic, climate change and regulating online misinformation, cannot be solved with simple solutions. As OPSI's report, *Systems Approaches to Public Sector Change* noted:

> *'Governments are struggling with adapting their policy-making approaches to account for complex system dynamics when tackling public challenges. Traditionally, public policy makers have addressed social problems through discrete interventions layered on top of one the other, building on a "cause and effect" relationship. However, these interventions may shift consequences from one part of the system to another, or simply address symptoms while ignoring causes.' (OPSI 2017: 3)*

This problem is evident in the legislative and regulatory spheres. The European Systemic Risk Board's Advisory Scientific Committee nominates the world's growing interconnectedness as a primary driver of increased regulatory growth and complexity (Gai et al., 2019). Illustrating this point in relation to the financial services industry, they write that 'traditional financial markets have been transformed into a global and highly interconnected network of institutions and markets, with long intermediation chains, substantial specialisation of activities, new entrants and high-speed financial transactions' (Gai et al., 2019: 9). Similar forces are also evident in other policy domains, including everything from taxation to environmental regulation, and this has created additional difficulty and risk for people, businesses and governments needing to comply.

The challenge of responding to heightened complexity is accentuated by the increasing pace of change. The challenges of contemporary phenomena, such as the sharing economy, social media or cryptocurrencies, highlight the current difficulties associated with governments' efforts to regulate such fast moving and crosscutting areas. The ongoing and high profile challenge of designing a consistent and effective regulatory response to Uber, for example, has been thoroughly explored. Many countries have struggled in this regard, with many cities and jurisdictions failing to create new regulatory structures that adequately address the new dimensions of the emergent sharing economy (Henly, 2017). The World Economic Forum (2016: 6) has also noted that 'given the Fourth Industrial Revolution's extraordinarily fast technological and social change, relying only on government legislation and incentives to ensure the right outcomes is ill-advised. These are likely to be out of date or redundant by the time they are implemented'.

Governments have responded to this challenge in different ways, some with more success than others. Continuing with the example of Uber, the Government of Toronto used a systems-led, multi-stakeholder approach to design a 'user-centric vision and a sharing economy city strategy for Toronto' (OPSI, 2017: 108). While there remained 'winners and losers' from the process, it at least revealed some of the benefits of moving away from a '"black box" approach to policy making' and to one that is more systemic, cross-cutting and based on the consensus of multiple parties (OPSI, 2017: 117). This exemplifies the use of 'systems approaches', which are 'a set of processes, methods and practices that aim to effect systems change', and which have been nominated as one way of addressing policy complexity (OPSI, 2017: 9). It is increasingly clear that governments are starting to recognise the need for such thinking – the move to create seamless, connected government services and emphasis on the delivery of integrated policy advice suggests this. It has also created a demand for solutions, tools and techniques that not only help mitigate growing complexity but also enable its navigation.

For governments to respond to the dual challenges of complexity and rapid change, then, traditional policy processes and tools need to be updated for the digital age. The interdependent and interconnected nature of issues means that it is no longer sufficient to maintain siloed, linear and unidimensional approaches to complex policy problems. Further, the presumption of a structural separation of laws between different portfolios, policy domains or even single issues reduces the effectiveness of rules by failing to address the complexity generated by now ubiquitous interdependencies. Policy makers need better ways to model potential policy changes and view their impacts across other, connected policy domains. As the NZ team notes of the current policy process, 'it takes a long time to deliver impact or achieve the desired policy outcomes, and there is limited flexibility to change direction given new evidence or insights' (Digital.Govt.NZ, 2018). Improved modelability and simulatability is not only a potential means of increasing responsiveness, but also a necessary one. Giving policy makers the capacity and opportunity to better assess the potential implications of policy changes in other domains could result in more effective rules, with less unexpected or unintended consequences (see Box 4.6).

Efficiency

The current system of rule generation results in a number of inefficiencies in the production of rules by governments, but also in the consumption of rules by end-users and third parties. The linear, siloed nature of the incumbent process can create significant transaction costs as rules are created. Firstly, individual knowledge assets are individually generated by each group of actors. Policy experts create policy documents and drafting instructions, while legislative drafters create legislation, and those in service delivery agencies create implementation guides. This often occurs using domain-specific expertise, lexicons and definitions, which can result in inconsistencies across artefacts. If feedback is sought from stakeholders, this can occur sporadically across agencies (or at least divisions) and regularly requires additional clarification or follow up. This not only causes issues relating to interpretation, but also contributes to slowing overall responsiveness. As issues demand increasingly quick policy solutions and implementation, efforts to reduce duplication of work and confusion have strong utility.

Inefficiencies also accrue for businesses following the creation of new government rules. Every entity must dedicate resources to knowing how or if a new law will affect them, understanding those influences in its business context and manually updating its business rules and processes (which can involve significant IT changes) to ensure compliance. All of this must also be communicated internally. There is, for example, a significant part of the typical modern entity dedicated to the development, monitoring and maintenance of business rules. This is now a developed business capability and one that is correctly seen as vital in the current system. Teams are required to constantly scan for changes to rules influencing their businesses, understand what these mean in terms of operational requirements and update them accordingly in their individual systems. An enhanced capacity to automate or at least speed up the consumption and use of appropriate business rules may thus free up some business capacity for other, higher-value activities. This may represent potential productivity and efficiency gains for businesses.

This process typically also requires the intervention of those in the legal profession, who are required to interpret and advise on responsibilities for compliance. Precisely because government rules require interpretation before they can be applied in any specific circumstance, as well as because governments do not provide an official coded version of the rules they create, lawyers are required to perform this role in order to reduce the legal exposure of business for non-compliance. These costs are significant and quantifiable. In Australia alone, Deloitte Access Economics estimates that it costs $94 billion to administer and comply with Australian federal, state and local government rules (Deloitte, 2014: 4). In the UK, it has been estimated that the cost of regulation for firms in the financial industry is around 1% of total operating costs (Financial Conduct Authority et al., 2018: 5). Reducing these costs could reliably be expected to have benefits for the wider economy.

Of course, there can be no efficient industry or commercial activity without rules. Returning to North (1991), rules enable economies and markets to function. They are an essential part of ensuring trust, confidence, consumer and social good across commercial activities. What RaC has the potential to offer is the ability to reduce the transaction costs of administering and complying with rules by reducing uncertainty and the need for costly analysis and interpretation, as well as potential contradictions between and within rules.

New rulemaking needed

The problems outlined above are occurring now. These issues already have discernible and sometimes negative impacts for people, businesses and governments. Existing RaC initiatives have revealed inconsistencies between the intent of certain rules and the version of those rules implemented in software, as well as between the rules and the actual, realised outcomes when implemented. This can result in material and negative implications for those individuals subject to the rules (see Box 3.3).

Box 3.3. From intent to implementation: the real impacts

The implementation of a given policy will strongly influence its effectiveness, especially in terms of its realised outcomes. As Cerna (2013: 17) notes, 'passing policies does not guarantee success on the ground if policies are not implemented well.' Under the current system of government rulemaking, insufficient attention can be directed towards if and how policies can be realised within given implementation capabilities. If attention is given, it typically occurs late in the rulemaking process when it may be costly or time consuming to change or alter the rules. Further, because individual end-users must translate and interpret rules, in order to code them into their own systems for service delivery – mistakes can occur. This can have significant impacts on the lives of the people affected, as well as for the commercial or government entities involved. In 2020, for example, it was reported that the New Zealand Government Ministry of Social Development's Work and Income are facing a potentially 'costly class action lawsuit after it appears to have spent decades wrongly advising some benefit applicants that they cannot get support until their redundancy runs out' (Scanlon, 2020). Similarly, in France, it was reported that approximately 300 000 'autoentrepreneurs' may have had their retirement entitlements incorrectly reduced as a part of the state's pension reforms. As the court system upheld a challenge on the decision, the government may therefore be liable to pay significant compensation to those affected. In combination, these examples suggest that inconsistencies between rule intent and implementation can be costly, for both rule makers and rule takers alike.

Source: Cerna (2013), The Nature of Policy Change and Implementation: A Review of Different Theoretical Approaches, OECD Publishing, Paris, www.oecd.org/education/ceri/The%20Nature%20of%20Policy%20Change%20and%20Implementation.pdf; Scanlon (2020), "Costly legal action may await over mishandling of redundancy issue", https://www.rnz.co.nz/news/national/416320/costly-legal-action-may-await-over-mishandling-of-redundancy-issue; Fédération Nationale des Autoentrepreneurs & Microentrepreneurs, (2020), "LA CIPAV CONDAMNÉE PAR LA COUR DE CASSATION : LES AUTOENTREPRENEURS SATISFAITS", FNAE, www.federation-auto-entrepreneur.fr/actualites/cipav-condamnee-cour-cassation-autoentrepreneurs-satisfaits.

Thus, while it is true that government rulemaking processes have endured over time and, at present, they remain capable of creating rules, there are clear and obvious pressures being placed on incumbent systems. As has been detailed, these can be summarised as relating to three primary areas: interpretation and translation of intent, complexity and efficiency. These problems are interrelated and self-reinforcing. Furthermore, there is little to suggest that these challenges will abate. In fact, it seems more likely that they will continue to intensify. This poses significant challenges for governments and, in combination, suggests that new rulemaking processes are needed.

4. The case for RaC

As discussed in the previous chapter, a new approach is required for rulemaking. This does not mean, however, that RaC is the automatic answer. As a significant shift in thinking, RaC will challenge the existing structures and processes of government rulemaking. To date, RaC initiatives have been largely experimental and remain somewhat unproven at scale. It is therefore likely that innovators within public sectors seeking to test or implement such an approach will need to understand and make a case for RaC, rather than expecting it to happen by default. To this end, the following describes:

- the potential benefits that could be derived from the adoption of a RaC approach
- a number of use-cases which help demonstrate how RaC could improve government rulemaking and service delivery.

Benefits

What might the benefits be of accepting and integrating RaC as an approach? As described, governments are being challenged to respond to a number of interconnected and interdependent policy issues in an increasingly fluid and fast-paced environment. While not a panacea, the use and widespread uptake of RaC in a public sector context could improve governments' capacity to deal with these challenges. Table 4.1 summarises these advantages, with the following sections examining each in detail.

Table 4.1. Main potential benefits of RaC

Benefit	Description
Better policy outcomes and enhanced service delivery	By reducing the need for interpretation and translation of rules between their human-readable and machine-consumable forms, and by making these interpretations more visible and explicit, RaC could minimise the gap between policy intent and implementation. This could deliver better policy outcomes and enhance service delivery.
Greater transparency	By making the process of rule creation more transparent, for example, by exposing the coded rules, as well as any desired and actual changes to these, citizens and lawmakers could have greater visibility over how rules are made. The provision of a machine-consumable version of government rules could also facilitate greater transparency indirectly i.e. by enabling the creation of applications, tools and services that help people understand government obligations and entitlements. RaC could also encourage new forms of citizen engagement in the rulemaking process.
Disintermediation and agile government	RaC extends the trend towards disintermediation enabled by digital technologies into the domain of the law and, by extension, public administration. By making rules more accessible and comprehensible (for both humans and machines), users of rules will have less need to rely on (costly) experts (such as lawyers) to understand their rights and responsibilities.
Improved consistency and fairness	An official set of machine-consumable rules, made available to be consumed by third parties, is likely to increase the consistency of their application. This could improve fairness and confidence in the rules.
De-risking	The current system of rulemaking creates risk by having individuals hard code rules into multiple, distinct systems. Over time, this knowledge can be lost and the reasoning behind the original coding decisions can become opaque. This can create system risk for the entities, as well as for governments (e.g. because of noncompliance).
Interoperability and efficiency	Creating a set of shared and consumable rules could drive greater interoperability between all levels of government (and potentially even between nations). Additionally, the reduced need for manual translation of rules by individual actors, manual updating of rules and time between policy development and service delivery could deliver efficiency gains for governments and third parties alike.
Innovation	Opening up the rules of government for third party use and consumption could help encourage public innovation, not least in terms of supporting innovation in public service delivery.

Better policy outcomes and enhanced service delivery

The best policy is not a good policy at all if it fails to realise its stated objectives in practice. As the European Commission has written:

> *'Public policy-making presents a dilemma to public administration. On the one hand, governments should strive for "good policy" that satisfies societal needs and expectations, which suggests a rigorous process that involves planning and resources. On the other hand, the environment for policy is continually evolving, which forces decision-makers to be responsive to changing conditions and nimble in reacting to events' (European Commission, 2017: 6).*

To balance these tensions, it is incumbent upon policy makers to adopt reforms that improve the government's ability to respond to rapidly changing demands. The gap between identification of rapidly emerging issues and an appropriate set of responses must be reduced. A vital component of this will be ensuring that actions taken – the policy implementation – accurately meet government objectives and

citizen needs. This depends upon reducing the interpretation and translation gap that can emerge between policy intent and outcomes.

By reducing the number of opportunities for misinterpretation between the designers and implementers of policy, RaC can deliver policy outcomes more true to their original intent. This should mean better outcomes for people, businesses and governments themselves. An ability to 'push' updates to machine-consumable rules delivered via API is just one example of how RaC could help achieve this. By minimising the opportunity for misinterpretation, it will not only be easier to see if the rules are having the desired effect, but also if or where any implementation issues with those rules may lie. These are several of the objectives underpinning France's OpenFisca (see Box 4.1).

Box 4.1. OpenFisca

OpenFisca is a 'free, reusable, modular open source project… [which] allows modelling of legislation in code to improve the transparency of, and access to, the law'. Originally an initiative of the French Government's France Strategie, OpenFisca was developed in 2011 in order to allow better *ex ante* evaluation of tax and benefit reforms and public policy initiatives. Currently, OpenFisca is maintained through a collaboration between beta.gouv.fr, Etalab and the Agence Nationale de la Cohésion des Territoires (ANCT). Primarily focused on the domains of tax and social benefits, it allows for the development of applications that consume coded rules via a web API and the micro-simulation of potential public policy changes. In 2019, OpenFisca was the winner of the Joinup's (a collaborative platform of European Commission interoperability solutions) Sharing and Reuse award for 'most innovative open source software'.

Being open source, any individual can contribute to the development of the coded rules within OpenFisca. This is what is described as a 'shared rules infrastructure', which makes it contributive and therefore accessible to coders, but also to policy makers, legislators and interested individuals. This aligns with a number of the platform's key objectives, which include working to ensure that the law's complexity is not a source of privilege and that the law's creation is driven by an understanding of its (potential or realised) impact. Since its inception, the programme has continued to grow; in 2018, OpenFisca contained 3 963 coded French legislative elements and 730 contributions to the French legislation model were made. This highlights the important role of its community's collective intelligence, in that the platform's value grows in line with the efforts made by its members. It also reflects its connection to the Government as a Platform concept, which relies on the support of a 'contributive digital commons' to function effectively.

From an architectural standpoint, OpenFisca builds on two main components: the programming language Python and Numpy, an add-on to Python that allows high-performance numerical computing. Additionally, OpenFisca uses an embedded domain-specific language (EDSL) which augments the Python programming language with features specifically designed for RaC. These components are geared to representing the computational aspects of legislative texts, i.e. modelling in precise ways how one quantity (e.g. income tax due) depends on others (e.g. income or salaries). Once a particular set of legislative elements has been modelled, OpenFisca allows numerical outcomes for any set of variables to be computed with a given set of inputs. This computation interface is exposed as a standard Web API (using JSON for query and response payloads, following the OpenAPI specification) or as a set of Python Application Programming Interfaces (APIs) that allows the use of Jupyter notebooks or other visualization layers.

OpenFisca is used by the French Government's beta.gouv.fr, Etalab, the Direction de la Sécurité Sociale, the Sécurité sociale agricole, the Ministère de la Transition écologique et solidaire, the ANCT and the Assemblée nationale. It is also used by the cities of Paris, Rennes and Brest. The platform also has 'systems' for countries and cities including, but not limited to, NZ, Barcelona, Canada, Tunisia, Italy, Senegal, and New South Wales, Australia. It has a number of varied use cases, including LexImpact (see Box 4.6), Mes Aides and Mon Entreprise (see Box 4.2). OpenFisca has also been used by Klesia, a joint social protection group, who, under the leadership of La Federation Agirc-Arrco, has developed Ma Boussole Aidants, which seeks to aid those individuals caring for a family member in France. Ma Boussole Aidants is designed to connect carers with relevant supports and entitlements, which aid them to care for their loved ones. These examples suggest the relevance and utility of OpenFisca, but also of the broader RaC concept, across both public, private and not-for-profit sectors.

Source: OpenFisca (n.d. a), "Home", OpenFisca, https://fr.openfisca.org/; Joinup (n.d.), "Sharing and Reuse of IT solutions", https://joinup.ec.europa.eu/collection/sharing-and-reuse-it-solutions/sharing-reuse-awards-2019-results#oss-inno; OpenFisca (2018), Rapport d'activité 2018, https://drive.google.com/file/d/1SyI5ZJ2Vr_q4wwZ8LIxu4LR73JMTjk2H/view; Ma Boussole Aidants (n.d..), "Trouver des aides de proximité pour mon proche et moi", www.maboussoleaidants.fr/; OPSI Research Interviews 2019/20.

There is also the potential for enhancing the capacity of policy makers to simulate potential policy changes. This would mean being able to model what changes to rules might mean in practice, how those changes would intersect with other rules and to more easily identify where implementation issues might arise. This could also enable better engagement with stakeholders to understand their concerns and impacts.

Greater transparency

RaC has the potential to drive greater transparency in terms of the laws, rules and regulations of government. By making rules available in a way that is open, accessible and contestable, rather than in a 'black box', RaC may serve to enhance the transparency associated with the development and use of government rules. The provision of official, machine-consumable rules may also better facilitate the development of new or improved tools and services that assist individuals to understand their entitlements and obligations in relation to government rules. Some reforms are always likely to be resisted (even while others are welcomed or demanded). Ensuring rules are more visible could also encourage more objective public debate and help reform efforts attain a greater degree of legitimacy when implemented.

RaC may also facilitate, or at least allow for, greater citizen involvement in the policy making process. While it is unclear if any RaC initiative has successfully integrated opportunities for citizen and business feedback into the rules development process, some existing initiatives nonetheless provide insight into how this might work. As OPSI's (2019: 95) *Global Trends 2019* report highlighted, for a time Washington DC provided all of its laws in a machine-readable format on GitHub. Using the platform's features, citizens were able to investigate, interrogate and engage in a conversation with public officials about elements of the law (OPSI, 2019: 95-96). A similar approach could be used for the process of legislative amendments. Members of Parliaments, legislators and even lobbyists could make 'pull requests', where a request for an edit or change is submitted for consideration, which are then debated for inclusion in the final versions. These would be traceable and transparent, allowing the broader public to understand which actors are arguing for amendments, as well as the history of decision making relating to those particular rules. Such initiatives could help the public to become more engaged with the law, which represents a future opportunity to strengthen democratic engagement and participation (OPSI, 2019: 96).

Additionally, as more rules are coded and their intersections more explicitly identified, it could become easier to model and track the degree to which those rules are consistently applied and enforced. This level of transparency may complicate things (by making it more apparent where there are deficiencies or gaps),

but it may also assist in ensuring the impacts of rule sets are understood and tracked against the explicit (and implicit) intentions behind them.

Disintermediation and agile government

The law, regulations and associated rules and standards are an essential part of public administration and the workings of government. However, they can act as significant points of friction in the system, requiring expert analysis and negotiation to navigate. The question of 'Can we do this?' is often met by 'We need to get legal advice'. This means that the speed of the system and its ability to respond in agile ways can often become dependent upon the access to and the speed of expert counsel. This is particularly true in those areas dealing with new issues. Here, the application of rules is often uncertain, but the need for a timely response is strongly needed – for instance, when digital platforms intersected with the media ecosystem but were not classified as media companies.

Of course, even with RaC, there will always be legislative matters that require and necessitate careful legal analysis. Yet, the potential exists for RaC to disintermediate a range of matters that are relatively uncontroversial other than for the fact that they require legal guidance on their application and administration whenever there are (potential) changes. If RaC can help to reduce the transaction costs of understanding what is possible under existing laws, then there is potential to increase the speed at which government can consider options. Additionally, it could help to avoid situations of unintentionally overstepping or crossing legislative and regulatory boundaries, whether because of uncertainty, ambiguity or ignorance.

Just as the disintermediation of other parts of the economy has led to faster and more agile supply chains and product and service offerings, so too might disintermediation of parts of the legal process offer the opportunity for more nimble government. By reducing the need for lawyers, policy experts, software developers or government officials to interpret and translate laws, RaC could also enhance the ability of people, businesses and delivery partners to understand and navigate relevant government rules. Of course, RaC does not presume that the elimination of experts and intermediaries (such as lawyers) is possible, nor even preferable. Rather, it suggests a different role, where their expertise is redirected to those instances of the highest value. beta.gouv.fr observed that instead of eliminating the role of mediators, the availability of RaC tools to solve basic problems opens up more time for experts to solve more complex edge cases (Quiroga and Denoix, 2020). RaC could enable the largest possible number of individuals to understand (or at least be able to act upon) their rights and obligations, while freeing up resources (government or otherwise) to direct attention to more complex cases.

Improved consistency and administrative and legal fairness

Machine-consumable rules already exist today. They are created by almost every enterprise that is required to comply with government regulations or legislation. They are typically held in proprietary systems by individual entities and help enable each entity's function. Different outposts (overseas branches) within companies may have their own individual sets of coded rules. They are also created by the various branches of governments, often in ways that are not open, reusable or interoperable. By centralising and making open the rules of government, and allowing third parties to consume these from an official source, the need for interpretation (and therefore the risk of misinterpretation) is significantly reduced. It also assists in ensuring that changes are reflected in these systems in close to real time.

As Dzieduch (2019) writes, 'Providing API access to the current policy as a 'single source of truth', means those in the policy's 'ecosystem' are able to access the latest version at all times, rather than the laborious process of identifying and hard-coding new changes'. This should result in a more consistent application of the rules and greater understanding by people and businesses. It should also make it easier for actors to identify and assess situations where the application of existing rules is unequal or unfair.

De-risking and ensuring robustness of systems

Al-Ajlan (2015) writes that as societies have become more complex and specialised, private and public entities have needed to collect, collate, store and make accessible vast amounts of human knowledge. The creation of expert systems has been done from a desire to capture 'the knowledge of people who have particular expertise [so that it] can be stored before they retire [and to] lighten the load on specialists' (Al-Ajlan, 2015: 106). However, what happens when the expertise of those individuals who built the system is lost or retired? Business rules accrue over time and systems are layered with new rules as they accrue. This creates a reliance on sometimes just a small number of people who know why and how certain rules were created or added. Recently, the US State of New Jersey was required to make a public call for COBOL programmers capable of updating 40-year-old mainframes to cope with surging unemployment support applications resulting from COVID-19 (Leswing, 2020). By consuming official coded rules agencies could reduce the risk of over-reliance on certain individuals and IT systems. Further, drawing on the example above, the capacity for governments to offer official coded rules may also reduce regulatory failures due to misinterpreted or mis-implemented rules. In these ways, RaC can be seen as a mechanism for reducing the risks already present in the system.

Interoperability and efficiency

Ensuring interoperability of rules both within and outside of government is essential to realising some of the potential benefits of RaC. Within government, efficiencies and cost savings could potentially be realised, for example, by enabling rules to be consumed by multiple government departments. Yet, ensuring the interoperability of systems is likely to pose challenges. Governments are seeking to overcome issues associated with large and costly legacy systems. In many cases, it may be that integrating RaC-style rules into these systems is not feasible, possible or cost effective. Yet, as Chief Information Officers and Chief Technology Officers look to update or replace these systems, consideration of the potential benefits offered by consuming such rules should be considered.

Doing this may offer the opportunity to derive efficiencies through sharing and reuse. Assuming, for example, that RaC approaches are adopted by governments, this could progressively enable rule makers to identify the duplication of rules or conflicts between them. This may help reduce complexity but, more importantly, it could encourage reuse of existing rules. This capability would likely arise only as the RaC approach matures and is not without its own risks. This could create its own forms of complexity, such as when rule makers need to determine whether code could be reused across disparate domains. As approaches are instituted, the advantages will have to be weighed against the expected effort and return.

Additionally, the simultaneous design and creation of legislation and the rules could significantly decrease the time required for service implementation and delivery. By designing the rules concurrently, both parties can be sure that they meet operational requirements. To note, this does not mean that the intent or legislation should become subservient to operational requirements, which would place undemocratic and unsatisfactory restraints on the policy and/or legislative process. Instead, it is about creating the opportunity for upfront and shared dialogue that enables the policy to be implemented rapidly and in the way most true to its original intent. Determining the extent to which efficiency gains can be realised from this process at scale could be a focus of future research.

Innovation

RaC could enable individuals and businesses to re-use and innovate using public infrastructure. Successfully adopted, RaC could contribute to realising Government as a Platform (GaaP). As O'Reilly (2010) writes, with access to government information and data, 'citizens are empowered to spark the innovation that will result in an improved approach to governance'.

Making the rules of government available to other users has parallels with the open data movement. The OECD (n.d. b) reports that a 'great amount of innovation is happening across OECD and non-OECD countries as a result of the higher availability of open government data'. One reason for this is that governments are more readily accepting the idea of 'open innovation', which 'implies unleashing the power of non-institutional stakeholders such as the private sector, the academic sector, the non-profit sector, as well as the public in general, to accomplish more than what the government could do alone' (OECD, n.d. b). Drawing on an O'Reilly analogy, just as Apple created the framework to enable third-party app development, governments can provide the infrastructure and data to enable innovation through RaC.

However, the innovation that could be unlocked by RaC could be far broader than these utilitarian concerns. Drawing on OPSI's innovation facets model, RaC can be seen as a potentially transformative approach. For instance:

- **Enhancement-oriented innovation**: Digitisation has generated efficiencies in other domains, and so is also likely to in this area. It is likely to unlock potential innovation in terms of doing what rules already do – just more so and for less cost.
- **Mission-oriented innovation**: As noted, one of the benefits of RaC is likely to be a reduction in the gap between intent and delivery, which could be a vital support for large-scale missions where the risks of unintended consequences can be particularly pronounced. RaC could also provide faster feedback about the impacts of rules, allowing missions to be better informed and more adaptable. This would most commonly occur when governments have access to the data created by people interacting with the rules, for example, service metrics that reveal how easily (or not) individuals are able to access government programmes.
- **Adaptive innovation**: Often no matter how good the intent, the operational reality shows something different happening on the ground, meaning that service delivery often has to balance competing demands and find workarounds to adjust to the changing context. RaC offers the potential for greater clarity about what is and is not allowed, which could initially constrain adaptive innovation, but over time may actually accelerate it as previously implied or 'known' limits are clarified, reducing uncertainty. It may also be the case that RaC itself, the concept and its use, is a form of adaptive innovation.
- **Anticipatory innovation**: Governments are expected to respond quickly to high uncertainties, such as regulating disruptive technologies. RaC could allow for and encourage more experimental approaches, such as regulatory sandboxes, by making it easier to know the existing limits and the cumulative impact of the intersection of different rulesets. It could enable the testing of potential rules changes and the faster changing of rules through the updating of a central repository.

A variety of use cases

Official machine-consumable rules could serve a variety of purposes. Some current and potential use cases for RaC are illustrated below.

Tools and calculators to identify relevant benefits and concessions

Official and accessible machine-consumable rules can be integrated into online services. Through simple and easy-to-use interfaces, machine-consumable rules can be used as the basis for tools and calculators that help people or businesses access or use government services. These tools could be eligibility engines, which assess a person's eligibility for government services or payments, as well as calculators, which may assess questions including the amount of a government benefit a person receives or the amount of tax they should pay (see Box 4.2). By using an official version of coded rules to inform the tools, as opposed to creating tools based on individual rule sets, greater consistency of outcomes should result. Further, if

the official, coded rules of government are made available for public consumption and use, this should enable motivated individuals to create additional applications and information services. Another benefit of using rules maintained and made available by governments (for example, through APIs), rather than those hardcoded into individual systems, is that they can be automatically updated as the law changes. In this way, RaC can assist end-users to navigate, benefit from, and comply with government rules in a way that is understandable and useful, as well as current and accurate.

Box 4.2. Mes Aides and Mon Entreprise, French Government

An example of a front-end application based on machine-consumable rules is the French Government's Mes Aides. This service can assess a person's eligibility for 30 benefits in less than 7 minutes using coded taxation and social security rules. Built using the OpenFisca platform, which is an open source platform that allows rules to be written as code, individuals can better understand their eligibility for government entitlements. Similarly, beta.gouv.fr's Mon Entreprise website provides 'the resources necessary for developing your business'. Specifically, it offers a range of simulators designed to help owners understand and comply with the rules associated with running a business in France. For example, employers can estimate the total labour cost of a prospective hire using a simple calculator. Such tools, built on coded rules and integrated into online and user friendly government services, improve the access of people and businesses wanting to understand their rights and responsibilities. This is achieved without the need to consult or interpret the laws or regulations themselves and, in routine cases, without the need to acquire potentially expensive advice. As beta.gouv.fr also notes, tools like Mes Aides can help solve an issue that afflicts many governments, the lack of uptake of available social benefits due to the absence of information.

Source: mes droits sociaux.gouv.fr (n.d.), "ACCÉDEZ À VOS DROITS SOCIAUX EN UN SEUL CLIC", www.mesdroitssociaux.gouv.fr/dd1pnds-ria/index.html; OpenFisca (n.d. b), "Showcase", https://fr.openfisca.org/showcase/; mon-entreprise (2020), "L'assistant officiel du créateur d'entreprise", https://mon-entreprise.fr/; Guillet (2020), "Mes Aides dans les mains des experts", https://blog.beta.gouv.fr/general/2020/02/07/mes-aides-experts/.

A widespread coding of government rules, made available through a rules repository also creates an opportunity for third parties to develop applications that government rules. As beta.gouv.fr have asked: 'What prevents us from making an API guaranteed by the State, such as the API LegiFrance,[6] so that administrators, local governments and businesses can build even more services for users?' (Quiroga and Denoix, 2020). Governments are increasingly seeking to build integrated services that better correspond to natural patterns of behaviour and user needs. In some cases, this has led to the recognition that the government may not need to provide all aspects of the service. For example, the government may not need to create an additional information service if there already exists a similar, well-known and accurate service that is privately provided. Making government rules available for consumption and use could therefore improve the accuracy and quality of information offered through private initiatives.

[6] LegiFrance already provides a 'rules as data' API for consumption. See https://beta.legifrance.gouv.fr/contenu/pied-de-page/open-data-et-api

Box 4.3. ElectKB, Australasian Legal Information Institute

The Australasian Legal Information Institute (AustLII), which is a 'joint facility of the UTS and UNSW Faculties of Law' and an 'online free-access resource for Australian legal information', has produced the ElectKB tool. ElectKB can be used to assess an individual's eligibility to stand as a member of Australia's Federal Parliament, with specific respect to Section 44 of the Australian Constitution. ElectKB is built using AustLII's DataLex inferencing software, which 'allows the development of Internet-based applications combining knowledge-based inferencing, a limited form of example based inferencing, and automated document assembly' (Mowbray et al., 2019a: 11). DataLex is a web-based tool that can be used for RaC efforts (Greenleaf et al., 2020). DataLex (2019) requires 'the coding of knowledge-bases (KBs), and the development of expert text resources linked to those KBs and the dialogues they generate, so as to support decision making by users'. By drawing on coded information contained within the Commonwealth Electoral Act 1918 and the Australian Constitution, individuals can interrogate if they are eligible to nominate to be a Member of Parliament. This is achieved through the DataLex user interface which allows end-users to 'conduct a question-and-answer dialogue with the application in order to provide information ('facts') to it in order for the system to draw conclusions, and to conclude a user session by producing a report (and in some cases a document)' (Mowbray et al., 2019a: 6). DataLex 'aims to allow easier development, debugging and maintenance by domain experts (lawyers), without involvement by software experts or "knowledge engineers"' (Greenleaf et al., 2020: 5). Screenshots of the coded law behind ElectKB (Figure 4.1) and its chat-based user interface (Figure 4.2) are shown below.

Figure 4.1. Screenshot of ElectKB coded law

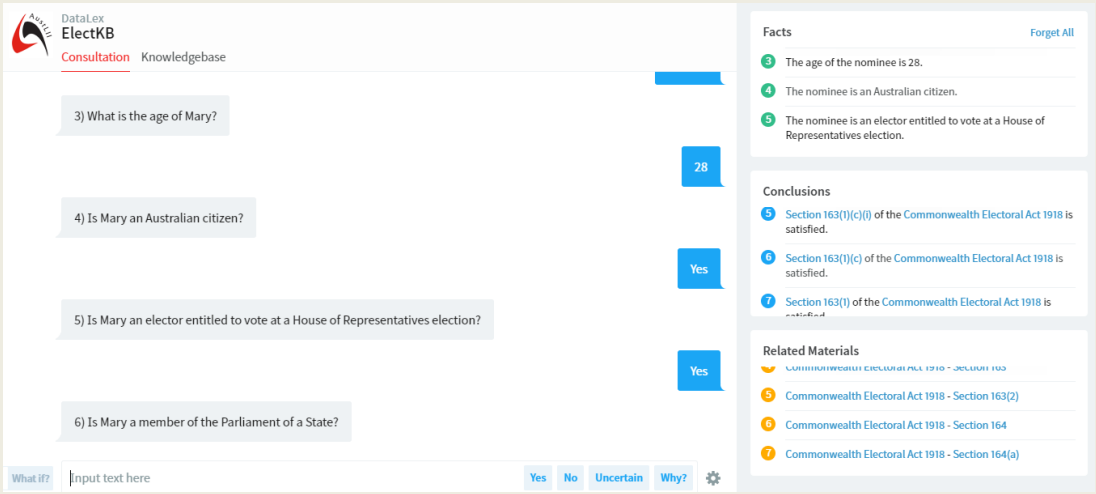
```
GOAL RULE Eligibility for Nomination to Federal Parliament PROVIDES

  the nominee is entitled to be nominated
      for election to federal parliament ONLY IF
    the nominee is entitled to be nominated
      under section 163 of the Commonwealth Electoral Act 1918 AND
    section 164 of the Commonwealth Electoral Act 1918 does not apply AND
    section 44 of the Constitution does not apply

/*
 *  Commonwealth Electoral Act 1918 Section 163 -- Qualifications for Nomination
 */
```

Source: AustLII Communities (2019), "Constitution Act, s44 consultation", http://austlii.community/wiki/DataLex/ElectKB.

Figure 4.2. Screenshot of ElectKB user interface



Source: DataLex ElectKB (n.d), http://beta.datalex.org/app/?rulebase=http%3A%2F%2Faustlii.community%2Ffoswiki%2FDataLex%2FElectKB

Source: AusLII, (n.d.) "About", AustLII, www.austlii.edu.au/about.html; Mowbray et al., (2019a), AustLII's DataLex Developer's Manual, http://www5.austlii.edu.au/au/journals/UNSWLRS/2019/65.pdf; Mowbray et al., (2019b), "Utilising AI in the legal assistance sector", https://pdfs.semanticscholar.org/d461/95270980a87c74f5ac45e4f1bffc5282af4d.pdf?_ga=2.244334789.1101175616.1578402412-372167066.1578402412.

Enhanced regulation

As the OECD's (2019d: 16) Better Regulation Practices Across the European Union report notes: 'The better regulation agendas of EU countries and of the European Union need constant attention – a 'set and forget' model does not work, just as it does not work for laws themselves. Countries need to strengthen their regulatory processes and the institutions involved'. Government regulation is under immense pressure to remain relevant and current in a rapidly changing environment. This is being particularly driven by digitalisation, which is providing both unprecedented opportunities for new regulatory approaches and technologies, but also critical challenges (OECD, 2019c). In just one instance of this, while governments were debating how to regulate the rise and proliferation of misinformation on Twitter and Facebook, TikTok became a platform of choice for young individuals. TikTok is 'the destination of short-form mobile videos' and has been traditionally used for the social sharing of music videos.[7] More recently, the platform has become a source of information on more 'serious' subjects including politics, health, history and current affairs (Mahan, 2020). Accordingly, it has also become a platform to spread misinformation. With some outliers,[8] governments and inter- and supranational bodies have largely failed to begin engaging with the platform, let alone to begin combatting the unique challenges it presents. This example suggests that, for government regulators, the pace of change is often too quick and the extent of its implications too large. In some instances, RaC may represent a response that helps to address these challenges. This could also apply to international cooperation on rulemaking (see Box 4.4).

[7] See www.tiktok.com/en/

[8] The World Health Organization has created a TikTok account to combat the misinformation threat related to COVID-19. See www.tiktok.com/@who

Box 4.4. Automating international trade rules

Rules that can be easily consumed by legal entities offer the potential for more effective and cost-effective regulation. While most rules modernization initiatives have highlighted domestic contexts and consumers – individuals within a nation state or local jurisdiction - there are also benefits for international policy delivery. Countries are connected across borders through the movement of goods, services and people. International actors face similar challenges to domestic individuals when it comes to knowing, understanding and complying with rules. As the OECD (2017a: 9) has highlighted, the costs of regulatory divergence can be significant and can result from 'rule-making processes working in isolation without consideration for the international environment'. It also notes that some of these trade costs may be 'avoidable without compromising the quality of regulatory protection', which creates possibilities for collaboration on the rules of finance, supply chain management, trade and customs (OECD 2017a: 9).

For example, a business seeking to export guitars from France could use a national government service (e.g. based on OpenFisca) to adhere to French commercial policies while their client imports guitars into three dozen countries using private trade compliance solutions (e.g. with Thompson Reuters services) or directly with national customs automation systems (e.g. single window) for each importing country. All parties require simultaneous, consistent and verifiable data about their obligations regarding *inter alia* licencing, tariffs and taxes. An 'Internet of Rules' (IoR) (Potvin et al. 2020) – a networked repository of executable commercial policies – could fulfil the necessary cross-platform function.

Currently, navigating trade compliance requires deep expertise not typically possessed by exporters and importers themselves, and enormous technical work to maintain automated systems as applications and internal data structures are updated. At present, businesses are required to acquire costly advice and intermediary services to comply with all relevant regulations and an average customs transaction may involve as many as 200 data elements and 30 parties (World Economic Forum, 2019). Extreme complexity, inefficiency and redundancy (multiple or no instances of the rules, each programmed in multiple languages and systems, testing, maintenance and documentation) creates an enormous, but unnecessary, drag on government revenue and fiscal policy objectives. However, reductions in relative cost and effort in trade compliance are possible with general-purpose methods and standards for rules that can function equivalently for any party, running any application.

Craig Atkinson (2018), a trade and development specialist with the United Nations, has pointed out that Micro, Small and Medium-sized Enterprises (MSMEs) particularly struggle in 'understanding and complying with international commercial rules and regulations'. At a national level, as well, countries seeking to promote development through cross border trade are finding that the proliferating number and complexity of cross-border regulations presents a major barrier. Creation of a shared, verifiable and semi-automated set of rules over the Internet would also help governments struggling to remain up-to-date with rapidly changing and increasingly interconnected rules.

Members of the not-for-profit Xalgorithms Foundation have designed an open source method and general-purpose online service that enables any organization or individual to publish, discover, fetch and prioritize rules in the form of JSON control tables. This is done in a simple tabular style that is readable by non-technical people and directly usable by computers for data filtering and transformation. Once any rule or reference table is expressed in this 'rules-as-data' form, it can be directly exchanged among, or embedded into, any application built in any programming language and either used natively or auto-transcribed into 'rules as code' form. This promises to create, in essence, an 'Internet of Rules'. The design is usable with both 'single window' and 'distributed' architectures for trade, commerce, logistics and value-chain administration and is compatible with a diversity of other use cases. Trade,

fiscal, and related statutes can include an attached 'schedule' with control table(s), or they can employ an 'incorporation by reference' clause to authoritative online sources where they are maintained.

Central to realising the benefits of this approach is interoperability. That is, it must be possible for various actors and enterprises, of any jurisdiction, to discover, access, inspect and run the rules. This use case further highlights the role for technical standards. Rapidly changing trade policies could be more easily published, maintained, used and tested via a common Internet methodology that works with all applications. Ensuring that this 'rules as data' method of expression is human-readable also helps to ensure validation of the integrity of automated taxes, exemptions, credits, and import/export duties.

In Atkinson's assessment, the development of an interoperable, accessible and consumable IoR could usher in a new era of trade or 'Trade 3.0' where 'the distinctive character…is that countries will be able to publish both natural language and digitally executable language versions of laws and regulations' (Atkinson, 2018). This has the potential to democratise access to international trade in ways that are specific and directly quantifiable. For example, governments would be able to 'see' real-time market responses to rule updates, ascertained from signal-generation or automated reporting in a rule (within all appropriate disclosure controls). This would also likely aid compliance with international requirements, for example, Article 1 of the World Trade Organisation's TFA which obliges countries to provide the 'regulatory trade information in an "easily accessible manner"' (Rodrigo et al., 2019). Already, this is being reflected in the form of governance structures, for example, through the establishment of 'National Trade Facilitation Committees'. As Atkinson notes: 'These multi-stakeholder bodies provide a public-private approach to addressing the TFA obligations. They are most relevant to computational approaches as they could support digitalization of trade procedures, single window deployment and transparency requirements (all could benefit from new forms of policy design and delivery).'

Source: Atkinson (2018), "Disruptive trade technologies will usher in the 'internet of rules'", https://blogs.lse.ac.uk/businessreview/2018/04/26/disruptive-trade-technologies-will-usher-in-the-internet-of-rules/; Potvin (2020), "An Introduction to 'Oughtomation'", https://xalgorithms.org/images/Xalgorithms_Lightpaper_2020-02-03_v1.03.pdf; Xalgorithms Foundation, (2020) "Global Reset", https://xalgorithms.org/global_reset; Rodrigo et al. (2019), "Digitally transforming Sudan's economy", https://trade4devnews.enhancedif.org/en/op-ed/digitally-transfort.cernaming-sudans-economy; OPSI Research Interviews 2019/2020.

As the OECD has noted, the onset of digitalisation will require governments to consider their approach to regulation (OECD, 2019c). Typically, regulatory reform distinguishes between changing regulatory approaches and the use of new, emerging technologies to achieve superior regulatory outcomes (OECD, 2018a: 28). This offers a strong opportunity for RaC which, as a new approach based on the use of emerging technologies (or new applications of existing ones), could help address both of these dimensions to some extent.

Automated decision making and AI-enablement

As Berryhill et al. (2019) have highlighted, the last several years have seen renewed interest in AI and its potential applications in government. The growing maturity of the field, improvement in technology and the democratisation of computers and programming are among the factors that have been nominated as factors driving this resurgence (Berryhill et al., 2019). It has been suggested that RaC could aid the use of automated decision making and rules-based AI in government, presupposing that avenues for appeal to human arbitrators exist. As de Sousa writes, 'coded rules could enable automated or semi-automated administrative decision making processes (for example, application forms and processing of applications' (Rules as Code Wiki, 2019). Certainly, the relative risks and benefits of such uses need to be rigorously considered. However, these uses should not be dismissed out of hand. Not only is automated or AI-enabled decision making likely to become more prominent in the future, but there are also some use cases where

it has already demonstrated its potential value (see Box 4.5). The exact connection between the burgeoning field of RaC and the growth of AI will therefore become clearer over time.

Box 4.5. Delegated decision making in Law, IP Australia

IP Australia is an Australian Government agency responsible for matters relating to intellectual property. This involves dealing with the legislation relating to trademarks, patents, designs and rights. As part of their ongoing digital transformation efforts, the agency sought to increase their use of automated systems underpinned by AI and machine learning. To facilitate this, IP Australia was required to reform their own agency's legislation in order to allow these technologies to be used legally. In 2018, Australia's Patents, Trade Marks and Design Acts were modernised to enable the automation of rules-based business processes to improve customer experience and organisational agility. Importantly, safeguards were also established and built-in to provide for review and appeal of automated decisions. The result was, according to IP Australia, a strong success. The use of artificial intelligence (AI) and machine learning (ML) technologies has 'resulted in higher-quality, more consistent and efficient decisions for customers'. This use case helpfully illustrates some of the benefits that may be derived by organisations using tools such as AI and machine learning to help enable automated or assisted processing. It also illustrates how governments can need to make changes beyond the technical sphere (e.g. to underlying legislation) to enable the use of new technologies and approaches.

Source: IP Australia.

Modelling and simulating policy changes

With heightened interconnectivity of laws and regulation, along with the availability of an ever-increasing amount of usable data, there is an opportunity to use RaC to inform modelling and simulation tools. Coded rules could enable testing of individual scenarios, to ensure the intent of the policy meets the likely outcomes given a person's circumstances, or broader impact scenario testing, where the machine-consumable rules are combined with data to assess the potential effects of changes. Such tools could be used to predict impacts on citizens, for example, as a result of changes to taxation law or welfare eligibility, before changes are implemented. In 2019, for example, the Institute des Politiques Publiques, a think-tank focused on public policy analysis, used a microsimulation model to analyse the potential effects of the 2019 French budget (Jelloul et al., 2019). For the IPP, the purpose of public policy evaluation is to measure a policy's impact (either while under consideration or post-implementation) in a variety of areas. The microsimulation model, TAXIPP 1.0, is based on the socio-fiscal legislation contained in OpenFisca (see Box 4.1) and government datasets, and can be used to 'estimate in advance the budgetary cost and redistributive effects of different reforms' (Jelloul et al., 2019: 4). This represents a significant departure from the status quo. Giving policy makers a greater ability to understand potential impact *ex ante* is likely to have significant implications for how and what policy is created. Another, related initiative that demonstrates this potential is explored in Box 4.6.

Box 4.6. LexImpact

RaC could help give lawmakers more of the information they need to design effective policies. France's LexImpact is 'an interface that allows you to quickly assess the impact of parametric income tax reforms' (LexImpact, n.d.) (Translated). LexImpact is built on the OpenFisca base (see Box 4.1) and has been designed in response to the absence of information available to parliamentarians considering changes to the law. As they note, decision makers do not currently have quick, accessible means of assessing the potential changes of a law before it is debated or even implemented. As a result, this means that mistakes or ill effects cannot be corrected until they have already been put in place. The LexImpact tool currently allows for the simulation of proposed changes to French income tax law and provides information on the potential financial implications on citizens. In the future, LexImpact is looking to expand its *ex ante* evaluation capability to include fiscal laws relating to local governments or enterprise taxation. As the scale of the laws and rules housed in a given repository grows, so too will the utility of tools such as these.

Source: LexImpact (n.d.), "Presentation du service et conditions dútilisation", https://leximpact.an.fr/presentation-et-cgu.

Summary

This chapter has outlined the case for RaC for those considering its implementation in a public sector context. It has outlined the potential benefits of a RaC approach and highlighted a number of use cases that illustrate how it may be practically employed by governments. In Chapter 5, greater attention is given to the approaches that have been used to develop and implement RaC.

5. RaC Approaches

The previous chapters have explored what RaC is, how it might address a clear need, as well as some of the potential benefits that it could bring. However, the benefits of any idea ultimately come down to its implementation. No matter how good an idea is in theory, the practice determines the results. Even then, however, implementation does not occur on a blank slate, as there have already been related activities. It is therefore also necessary to understand and appreciate what has gone before and what is occurring around it, as these things will shape how an idea is received, the options for implementing it and the extent to which it is likely to be adopted beyond pockets of advocacy.

This chapter therefore seeks to explore and identify:

- The origins of, and influences on, the concept – how does it fit within and align with the broader change agenda?
- Other preceding and related efforts – what has come before and alongside, and how have these related developments shaped the current state, and thus the options for RaC?
- Specific RaC approaches – what options are available for realising and implementing the concept?

Origins and influences: RaC as part of a broader transition to digital government

How can RaC be placed in the broader shifts and trends of public sector and economic reform agendas? Where does RaC fit as a concept and how does it, if at all, complement other existing concepts?

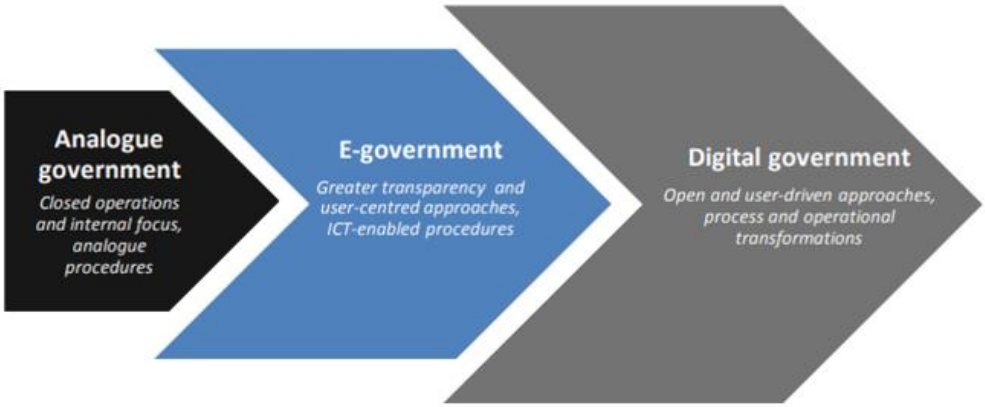
These questions matter for many reasons, not least because as a potentially bold and challenging approach, RaC will struggle to be accepted unless it is seen as part of, and located within, a broader transition – 'The more a new technology augments an existing system, the more likely it is to be accommodated' (Juma, 2016: 170). Despite its potential benefits, the extent of the shift envisaged by a comprehensive RaC approach could generate significant scepticism and even resistance, which might mean that other, less transformative approaches are pursued. If, however, it is seen within a broader context as an ongoing part of an existing process of (digital) transformation, then it becomes less a potential deviation and more another step on an existing journey.

Digital government

How can RaC be understood in the broader context? First, it is helpful to look at one of the major shifts occurring in government – the move to digital government.

As defined by the OECD's Recommendation on Digital Government Strategies (2014: 6), digital government is 'the use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value'. As Figure 5.1 shows, this represents a progression from analogue, to 'e-', to digital government. Digital government moves beyond online service provision and operational efficiency (OECD 2016c: 12). Instead, it represents a significant 'shift in culture within the public sector: from a use of technology to support better public sector operations to integrating strategic decisions on technologies in the shaping of overarching strategies and agendas for public sector reform and modernisation' (OECD 2016c: 5).

Figure 5.1. Progression towards the digital transformation of government



Source: OECD, 2019b

Digital transformation is a priority to some degree for most governments. While some jurisdictions, or parts thereof, have made significant progress in their transformation journeys, others feel progress has been slow or insufficient (OECD, 2019e; Dwyer, 2019). Further, while many public sector initiatives have successfully 'transformed' specific, individual websites, systems or services, less progress has been made in the holistic transformation of government itself (Andrews, 2019). Yet, it is this type of systemic transformation that will allow governments to thrive in contemporary operating contexts. To enable a systemic movement towards a new model of government, then, requires innovative and transformative approaches that reshape or even recreate core functions.

Digital government does not arrive like mana from heaven. It comes from ongoing efforts. In this sense, it is useful to appreciate some of the relevant reform agendas and paradigmatic shifts that have been involved in the move from analogue to digital government. For instance, RaC efforts have also been described as existing at the intersection of open government and GaaP, as well as open data.[9] The following explores some of these agendas, and how RaC builds upon each of them.

e-Government

Defined by the OECD (2003: 11) as 'the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government', e-Government can be seen as one of the first coherent and explicit policy movements emphasising the adoption and use of ICTs in the public sector. Public administrators saw potential in the ability of an e-Government approach to 'help improve efficiency in government and improve online access to information and service quality, enabling the delivery of services to citizens and businesses on their terms and at their convenience, rather than following the logic of internal government structures' (OECD, n.d. a). As implied by this definition, at least part of this movement involves transitioning from more manual, paper-based systems to those underpinned by the effective use of ICTs. A prominent example of this is the movement towards online government services, which replace analogue and in-person based systems. Interestingly, RaC initiatives can be seen somewhat similarly; although they do not seek to replace human-based systems, they do seek to better integrate and apply modern technologies into the rulemaking process. RaC also seeks to digitise the analogue. While this analysis is somewhat reductive, it demonstrates a key piece of the intellectual and material history of RaC by helping to reveal how the concept can be seen as an extension of several trends in public

[9] OPSI Research Interviews 2019

administration and policy making. This is especially true of those paradigms following e-Government, such as the Open Data movement, which aims to make public sector data more usable and accessible.

Open Data

The Open Government Data (OGD) movement is inherently connected to innovation and innovation policy (OECD, 2016a). A wave of reform has seen government data sets made open in the belief that, when shared in open formats, public sector data can be used as a means to spur new commercial and social innovation (e.g. by engaging actors such as the Govtech and Civictech communities), and to promote economic development. By allowing others to convert government data into information and knowledge, and integrate it as an input into their business models and value chains, OGD has the potential to enable the development of a wide range of commercial and social services across society. This gives individuals the ability to actively consume and use public sector content and services for their own pursuits and circumstances, thereby enabling them to optimise their interactions and relations with government (OPSI, 2019: 92). OGD can also help to increase and improve government accountability, integrity transparency and efficiency, thus boosting public trust in governments. This reinforces the case for applying open-by-default approaches in key areas such as public procurement and anti-corruption, and public service design and delivery (OECD, 2018c). Yet, opening up government data has often proven difficult, given it can require addressing cultural, organisational, technical and capacity-related gaps within governments (e.g. the creation of technical infrastructure to facilitate sharing of open data publicly). In addition, it can be hard to perceive the value of OGD from within government, as the benefits of opening up government data are often clearer for the data user than the data publisher. Initially, policy outcomes tend to manifest in, and benefit, other sectors before government itself.

A key part of OGD efforts has been work to ensure that government data outputs are machine-readable (OPSI, 2019: 92-94). In the early days of the OGD movement, governments would publish all sorts of file types that, while open, could not always be consumed by machines. Machine readability is a major factor in data accessibility and overall OGD efforts, as measured by the OECD OURdata Index (2020). Further, making OGD available in machine-readable formats is now a priority for a number of governments. In 2019, it was found that ‘in 29 of 32 OECD countries, central/federal governments require data to be available free, in machine-readable formats’ and ‘28 of 32 OECD countries require data to be available with an open licence’ (OECD, 2020: 24). Publishing data under an open licence implies the use of a standard, such as Creative Commons. For example, the CCO Public Domain Dedication indicates that a data set is available to be re-used without risking potential copyright infringement. Machine-readable data, which is published openly, can therefore be seen as a forerunner to RaC efforts.

OGD policies have provided governments with an initial taste of the transformative nature of machine-readable content (OPSI, 2019: 94). They have shown how it can improve the interoperability of data and how it can enable the ability to build things from, and on top of, OGD. To some extent, RaC extends the OGD movement in its attempt to provide an official, accessible and useful machine-consumable data. By providing an open, machine consumable set of rules, which can be combined with other open data sets, RaC can be seen as an extension of the OGD movement, converting some of the real but implicit nature of government into tangible, and thus observable, data.

Open Government

An additional agenda that informs and influences the context for RaC is that of open government. The OECD (2017b) defines open government as ‘a culture of governance based on innovative and sustainable public policies and practices inspired by the principles of transparency, accountability, and participation that fosters democracy and inclusive growth’. Open government has been identified as a means of reducing corruption, strengthening democratic systems of government and increasing citizen trust (OECD, 2017b). The desire to include citizens in the design and development of public services, as well as the

growing focus on user-centeredness in public service delivery are indicative of open government's influence. The pursuit of openness at the institutional level has also been translated by the emergence of technical tools to support this goal. Open government is therefore strongly connected to the concept of open data. While broader than digital government, open government has certainly drawn upon, and in turn shaped, digital tools and thinking, whether it be through access to data, the transparency enabled by the publishing of public information, or new opportunities for engagement with governments.

Open government and RaC approaches share a number of objectives: greater transparency, improved accountability, more extensive and meaningful citizen engagement in government. For the full potential of open government to be realised, some argue that new government infrastructure or even institutions are required. Tom Loosemore (2018), one of the founders of the UK's Government Digital Service (GDS), for example, has argued that 'if you want a natively digital nation…you actually need to be bold enough to create some new institutions; institutions that are of the internet, not on the internet'. Of course, RaC does not constitute an institution in and of itself. It could, however, represent a foundational component of a truly digital and open government. Provision 10 of the OECD Recommendation on Open Government (2017b) invites countries to explore the potential of moving towards an open state. In this context, RaC and other tools that foster technical openness of public decision making could represent a vehicle to mainstream open government principles into the heart of government processes and structures.

Digital Transformation

Over time, thinking on government transformation has developed from 'e-' to 'digital' government; a change that expanded ambitions for a more holistically digital public sector.

Digital transformation moves beyond the earlier steps of e-Government, focusing on integrating digital into the core thinking and activities of government. This can result in entirely new approaches, rather than simply digitising existing ones. Practically, the move to digital government through an explicit approach of 'digital transformation' can involve governments commencing or, more likely, scaling up efforts in terms the promotion and use of data, developing more coordinated and coherent uses of technology across jurisdictions and improving the implementation of digital government strategies (OECD, 2014). Indeed, many nations have made significant progress in their digital transformation journeys. According to the United Nation's prominent E-Government Survey 2018, there has been a 'persistent positive global trend towards higher levels of e-government development' (United Nations, 2018: xxv).

RaC can be seen as aligned with digital transformation, in that it envisages rules as digital instruments from the bottom-up, rather than as an add-on or an after-the-fact adjustment. If digital transformation is to succeed, then it will require the very basics of government to not just be digitised, but to be truly digital – built with digital technologies and mind-sets from the outset. RaC offers that possibility.

Equally, digital transformation is yet to realise its more comprehensive ambitions. This is not only true in countries that remain in the process of realising the more fundamental goals of e-Government, but also those countries that are more progressed in their transformation journeys and that have begun integrating digital technology and thinking into the core of government. That is, success in realising Loosemore's vision of a 'natively digital nation' has arguably been more limited. To counter this, then, a more ambitious vision which views 'government as a platform' may be required.

Government as a Platform

While not as solidly developed and implemented as the other conceptualisations of the intersection of digital and government, an influential idea that has helped influence and guide the efforts of some practitioners has been that of 'Government as a Platform'. O'Reilly considers that the emergence of GaaP is occurring from governments' realisation that 'the opportunities Web 2.0 technologies provide [can] not just help them get elected… [but also] help them do a better job' (O'Reilly in Lathrop and Ruma 2010).

While an ostensibly simple concept, it has been highlighted that the GaaP term has come to mean many things to many people (Pope 2019). Acknowledging this, Pope seeks to provide a working definition, which sees GaaP as:

> *'[Reorganising] the work of government around a network of shared APIs and components, open-standards and canonical datasets, so that civil servants, businesses and others can deliver radically better services to the public, more safely, efficiently, and accountably.' (Pope 2019)*

Understanding GaaP in this way requires a fundamental change in how government is viewed. It reframes governments as providers of public data and infrastructure, which can be used by others (i.e. the private sector and government itself) for individual purposes (Andrews, 2019). Like Apple's operating system, IoS, which allowed individuals to build mobile applications, as opposed to the company providing a single set of tightly controlled mobile applications, governments operating as a platform would provide the environment, tools and ability for individuals to innovate. Achieving this vision would require different operating models, institutions, capabilities and infrastructures.

Andrews has elaborated on the implications of a GaaP approach for service delivery in the Australian context, highlighting that there are four core aspects of a government service: content, data, transaction services and business rules (Andrews, 2019). Naturally, RaC affects the latter, as well as open data. The idea is that, if RaC is widely adopted, it could underpin the development of one 'building block' of GaaP. As Andrews (2019) writes, 'imagine an authoritative public API with the business logic of government available for consumption by everyone', that is, a mechanism to make the rules of government available to third parties. Accordingly, it has been proposed that RaC exists at some junction between open government and government as a platform and open data.[10]

A further step in an ongoing journey of transformation

Once viewed among these various shifts, RaC can be seen as part of the ongoing movement to digital government, fitting with, shaped by and in some ways a result of existing reform agendas. If considered against the identified characteristics for digital government (OECD, 2019f: 16), RaC is strongly aligned. For instance:

- **Data-driven public sector**: RaC makes one of the government's central data sets, its rules, available for public use and consumption, and allows for existing data to be used more effectively in rulemaking, for example, through enhanced *ex ante* modelling of policy effects.
- **Open by default**: machine-consumable versions of rules should be open to the public, for their consumption and use, as well as scrutiny and understanding (see *Principles for a successful approach*).
- **Government as a platform**: RaC remakes a core function of government, rulemaking, and exposes it as a public resource that enables collaboration and third-party value creation by people, businesses and other government entities.
- **Digital by design**: RaC represents a recognition that machines are a major consumer of government rules, and there is a need to design for their needs as well as for those of humans.
- **User-driven**: RaC can be used to better meet the needs of the public, by helping to improve citizen and businesses' understanding of their rights and responsibilities through public sector service delivery based on coded rules.
- **Proactive**: RaC should increase the speed of government service delivery and improve the responsiveness of the rulemaking process. It may also increase the government's ability to achieve

[10] OPSI Research Interviews 2019

transformative reform. If rules are digital and linked, changes can be more rapidly effected and enforced.

Other preceding and related efforts

While e-Government, open data and open government, digital transformation and GaaP have informed and influenced recent RaC efforts, there is also a long history of efforts to digitise rules – many of which precede the emergence of these other paradigms or reform efforts. Not all of the efforts detailed below conform to the conceptualisation of RaC adopted in this paper. Often, however, these initiatives share similar objectives or have engaged with common questions, for example, on technology-related issues. Therefore, these efforts have often revealed key learnings that those seeking to develop or implement a RaC approach can benefit from in their own contexts.

Legal

As technology has developed, significant consideration has been given to its potential effects on the law. Clearly, technology has resulted in significant changes to the substance of the law itself. One example is the emergence of the need for digital taxation as a response to the globalisation of digital firms. The OECD (2019g) has led work on this issue and published a proposal in 2019 to 'advance international negotiations to ensure large and highly profitable Multinational Enterprises, including digital companies, pay tax wherever they have significant consumer-facing activities and generate their profits'. However, technology has not only affected the content of the law. It has also exerted significant pressure on the processes underpinning the creation, administration and enforcement of laws. The availability of computerised screens in courtrooms, which allow for remote video conferencing and video evidence, is a simple example. The rise of computer-based assistance has also changed the nature of legal research. Not only can larger banks of evidence be searched, the roles of legal researchers have also changed and (in some cases) are being called into question. In an age of rampant speculation about the potential of AI, it has even been speculated that lawyers could soon be 'out of business' (Sahota, 2019). While this is hyperbolic and, indeed, unlikely, the impact of technology in the legal domain is nonetheless significant.

The legal system has taken stock of, and responded to, the changes wrought by technology. One response has been to examine the capacity of technology to 'computerise' the law. Computational law 'is that branch of legal informatics concerned with the mechanization of legal analysis (whether done by humans or machines)' (Genesereth, 2015). It aims to reduce the complexity of the law, while also improving its efficiency and comprehensibility. To achieve these goals, computational law systems 'dispense with traditional documents in favour of data structures that represent legal content in computable form; and, using this data, they are capable of conducting legal analysis entirely on their own, i.e. without the intervention of human experts' (Genesereth, 2015). This concept has been traced back to 'The First National Law and Electronics Conference' of 1960, an interdisciplinary gathering committed to understanding technology's potential to transform the electronic data retrieval process and its role in the administration of justice (de Sousa and Andrews, 2019). Both the thinking and technology employed has subsequently progressed from that conference. Prakken and Sartor (2015), for example, have reviewed the 'legal applications of logic', which they consider a 'rich test bed and important application field for logic-based AI research'. Otto and Antón (2007) have also surveyed the significant consideration and 'research efforts over the past 50 years in handling legal texts for systems development'.

A number of initiatives have also led the way in considering how the law can proactively evolve to harness and use technology to deliver better legal and judicial outcomes. One such initiative is Stanford's CodeX (2020) program, which brings 'researchers, lawyers, entrepreneurs and technologists [to] work side-by-side to advance the frontier of legal technology, bringing new levels of legal efficiency, transparency, and access to legal systems around the world'. There are also many commercially driven organisations

operating in this space. In 2018, Pivovarov (2019) reported that investment in the legaltech industry increased a mammoth 713% in 2018. While this primer is more focussed on RaC as it applies to government, the field of 'computational law' provides many illustrative comparisons and lessons.

Legislative Drafting and Public Administration

In a government-specific context, as opposed to the general practice of law, consideration of technology's impact on the law and legislation also has a long pedigree. Waddington (2019: 23) argues that the 'history of attempts to render statutes in computable forms goes back to Layman Allan's 1978 paper "Normalised Legal Drafting and the Query Method" [and]…a 1986 paper "The British Nationality Act as a logic program", which spawned several follow ups'. The former emphasised a form of drafting where 'the syntax that relates the constituent propositions is simplified and standardised' (Allan and Engholm, 1978: 380). This paper outlines similar aims to current RaC efforts, namely to facilitate understanding of the law and reduce ambiguity. It also highlights issues that contemporary efforts must continue to grapple with, namely those of logic and syntax. As is noted below, several contemporary RaC efforts are continuing in this tradition by examining the incumbent methods and processes of drafting legislation to ascertain opportunities for improved coherence with digital technologies (See Box 5.1).

Many governments also make their national legislation freely available in a digital format. Yet, across and within countries, the extent to which the rules of government are made available to citizens varies. In some countries, for example, the country's legislation is not available online in machine-readable formats (i.e. in scanned PDF documents that are not Optical Character Recognition (OCR) readable). Waddington (2019: 25) highlights that 'more recently we have seen coding used for a "naming of parts" approach'. This involves 'marking up' the legislation so that it is able to be searched and linked to other pieces of legislation.[11] The Finnish Ministry of Justice's Semantic Finlex (n.d.), for example, provides legislative information as linked data, which is machine-readable and made available through an API.[12] The UK publishes all legislation online via legislation.gov.uk and offers XML, HTML, RDF and Atom[13] formats. Extensible Markup Language (XML) is an example of a markup language, which is a 'standard text-encoding system consisting of a set of symbols inserted in a text document to control its structure, formatting, or the relationship among its parts' (Encyclopaedia Britannica, 2011). This makes legislation machine-readable and facilitates basic functions including content search (Waddington, 2019: 25). A known example of this is Akoma Ntoso (n.d. a) which 'defines a set of simple, technology-neutral electronic representations of parliamentary, legislative and judiciary documents for e-services in a worldwide context and provides an enabling framework for the effective exchange of "machine readable" parliamentary, legislative and judiciary documents such as legislation, debate record, minutes, judgements, etc.' The language has use cases for a number of country contexts across the world (Akoma Ntoso, n.d. b).

As a report from the Queensland Office of Parliamentary Counsel highlights, making legislation available, 'often in XML, has supported opportunities for recycling or repurposing of content aligned to open data initiatives, enhanced website functionality including searching and automation of some processes (e.g. automatic consolidation of amendments) (Talbot, 2020). Nonetheless, it also notes that in pursuing these changes 'the essential focus for most offices has been one of process improvement', rather than on the more radical transformation which may be required in the future (Talbot, 2020: 10). The more advanced instances of RaC extend beyond offering legislation in XML versions. They go further by creating a machine-consumable version of the legislation that 'captures the relevant rules embodied in that legislation' and enables machines to execute actions (Waddington 2019: 27).

[11] An example is the European Legislation Identifier. See https://eur-lex.europa.eu/eli-register/about.html

[12] Public Consultation 2020

[13] According to Wikipedia, Atom is a 'domain specific language in Haskell (programming language), for designing real-time embedded software'. See https://en.wikipedia.org/wiki/Atom_(programming_language)

Commercial approaches to making laws and rules easier to understand and comply with

A number of commercial applications seek to digitise government rules. Many companies rely on traditional business rules management systems (BRMS), which are software systems that help manage the interpretation and application of business rules. Companies such as InRule are well known and used in both private and public organisations.[14] InRule (2020) 'enables enterprises to automate decisions and business rules in applications without programming effort'. Of course, it is unsurprising that such tools are often used. As each entity is required to individually and manually create digital versions of rules with which they must comply, software solutions are required to help manage the ensuing complexity.[15] Being proprietary in nature, they do not typically make the laws of government available for consumption by multiple entities outside of an organisation. As a result, they often require individual teams to interpret and translate rules and this can limit re-use.[16]

Fintech and Regtech are other terms commonly associated with RaC. Fintech can be defined as 'innovative applications of digital technology for financial services' (OECD, 2018d: 3). In a similar way, Regtech seeks to employ new technologies to improve outcomes for both regulated entities and the regulators themselves. Many private companies are investigating and working towards solutions that resemble some of the goals sought by the RaC movement within government. One example is Apiax (2020), which aims to 'build powerful and flexible tools to master complex regulations digitally'.

Some companies are also working on solutions that ensure, for example, 'Compliance by design' at the code level. Compliance by design seeks to embed legal, regulatory, ethical principles directly into entities' software. Nonetheless, it should be noted that this remains possible only through the repeated act of interpretation and translation from the natural language version of government rules. As Andrews (2020a: 15) identifies 'most products in this space were interpretation engines that assume legislation is drafted only in human form'. A key problem with this is that the independent creation of distinct rule sets risks 'creating new translation mistakes, or of perpetuating existing mistakes if elements are copied' (Waddington, 2019: 24). Many of these solutions, then, do not appear to overcome the issues associated with the absence of a single provider of official, machine-consumable rules.

An alternative approach tested by some private sector companies centres on the use of 'model driven regulation'. This involves the creation of an open-source concept model that captures the targeted regulation. A concept model 'organizes the business vocabulary needed to communicate consistently and thoroughly about the know-how of a problem domain' (Ross, 2014). The information in the model is not, in and of itself, machine-consumable, but can be subsequently translated into a variety of programming languages. This approach has been tested in the Digital Regulatory Reporting project led by the Bank of England and the Financial Conduct Authority (see Box 5.3).

Overall, while such approaches may go some way to addressing the issue of replication of rule sets, there are legitimate questions as to how they might work when viewed from a whole-of-system level, where having numerous, presumably different, approaches may add to, rather than reduce, complexity. As conceived of here, RaC suggests that the actor best placed to provide a single and official source of rules is the government. This represents more than the development of a new technical approach or technocratic 'fix' to an existing problem. It represents a potentially paradigmatic shift in the way the governments design, implement and provide rules.

[14] See https://www.inrule.com/

[15] We use the term 'manually' here to convey the sense that this process is not (fully) automatic. That is, individuals and teams within an organisation must actively create, update, maintain and ensure compliance with rules.

[16] Of course, there may be examples of shared rules between teams/products internal to agencies, or even with agencies across government.

Rules as Code approaches

Having seen the related initiatives and endeavours that meet some of the same goals as RaC, but in different ways, what can be said about the options available for realising and implementing RaC in practice?

While current approaches to RaC mirror some aspects of the previous and related initiatives, they are decidedly different in others. There are also several approaches to RaC occurring around the world, which vary in terms of the emphasis placed on different aspects of the rulemaking process. While these differ in terms of maturity and scope, generally, it can be said that most initiatives are in their relative infancy. Table 5.1 summarises some of these initiatives, while the remainder of the section explores a number of these in detail.

Table 5.1. Examples of RaC initiatives

Initiative	Description
Better Rules, New Zealand, Service Innovation Lab and Better for Business	A three-week discovery sprint that developed and tested a multi-disciplinary approach to coding rules. Having helped spark other RaC efforts around the world, Better Rules is now a work stream within the Ministry of Business, Innovation and Employment. The Wellington City Council is also using RaC in the context of urban planning to help inform the city's new district plan.
RaC Initiatives, France	The French Government has a number of RaC-related initiatives. This includes the development of the open-source platform OpenFisca, LexImpact (which allows *ex ante* policy modelling) and a number of services based on coded rules (Mes Aides and Ma Boussoule).
Impulse Paper, Germany, German Competence Centre for Public IT	The German Competence Centre of Public IT has produced an impulse paper into how machine-consumable rules could be created and used within the German context.
Digital Regulatory Reporting, United Kingdom, Financial Conduct Authority and Bank of England	An ongoing program of work designed to explore how regulatory reporting mechanisms can be modernised and optimised. This is a collaboration between the Financial Conduct Authority, the Bank of England, as well as a number of commercial entities.

Accordingly, the following section outlines a number of options for RaC initiatives. These are non-exhaustive and it is likely that new approaches to RaC will emerge over time. As RaC is still relatively new in government, little can be said as to what 'should' be done, as much remains unsettled while significant learning is taking place. Nonetheless, this section does emphasise techniques and tools that appear to have generated positive outcomes to date.

Which approach should be used for RaC?

In recent years, a number of public sector jurisdictions have begun investigating the potential application of RaC approaches. A number of past and present initiatives have emerged to test and refine RaC approaches. Here, we classify these as strategic or practically focused, with initiatives in the latter category characterised by their generation of machine-consumable rules.

Strategic initiatives

Depending on the extent and style of implementation adopted, RaC initiatives could substantially change government operations. From policy making to regulatory compliance, RaC offers the potential to redefine the way government rules are created, consumed and enforced. A number of strategic initiatives are interrogating the potential implications of RaC. This involves exploring possible impacts not only for governments, but also for people and businesses.

One major area of investigation concerns how existing rulemaking processes may be reshaped to better accommodate the production of RaC. For example, some projects are examining how the legislative drafting process could better enable the development and delivery of RaC. Such initiatives have typically emphasised the importance of multidisciplinary perspectives in rulemaking and have often recommended that consideration of implementation implications occur earlier in the legislative process. These look 'upstream' in the rules development process to investigate issues including what rules should be coded and how to make legislation 'digital ready'. Several of the initiatives are being led by government actors, while others are being investigated by the academic sector. Of course, in some instances, these initiatives are combined with practical efforts to generate coded rules. A number of these initiatives are listed below:

- A team of researchers funded by the **New Zealand Law Foundation** (2019) will produce a public report exploring 'the legal, social, constitutional and democratic implications of converting, drafting and consuming legislation in machine-readable computer languages'. Among the primary areas of investigation is how to communicate the various ways that law and code interact and might be implemented for regulatory purposes, including how to preserve existing constitutional principles around the separation of powers. Its interim findings are expected in 2020.
- **Denmark** has developed principles designed to aid legislative drafters create rules that can be more easily converted into digital formats. Like other RaC initiatives, this is a response to the increasing complexity and difficulty associated with the use of government systems and services. These principles seek to make the legislation more usable in a digital world and, in so doing, better enable the digital delivery of government. More detail on this initiative is provided in Box 5.1.
- **Germany** - In 2019, the German Competence Centre for Public IT published an 'impulse paper' detailing how to realise machine-consumable law in a German context.[17] This follows another report, by the National Regulatory Control Council (2019), called *Content First, Legal Text Second*., which focussed on 'designing effective and practical legislation' for the modern German context.[18]
- The **Australian Federal Government** formed a Digital Legislation Working Group (DLWG) in 2019, which was established to develop and progress a RaC capability as a foundation for government service delivery. The DLWG has brought together a number of state and federal-level agencies, to work towards new approaches to the automation and management of legislation and rules. The group has met four times and has generated, among other things, a conceptual vision, a 'policy to delivery journey map' and the foundations of a requirements framework for digital legislation in a federal context.

[17] See www.oeffentliche-it.de/publikationen?doc=104099&title=Recht+Digital+-+Maschinenverst%C3%A4ndlich+und+automatisierbar

[18] See www.normenkontrollrat.bund.de/resource/blob/656764/1682184/2e44e89120eec431a536c747b8913646/2019-10-22-content-first-wording-second-data.pdf

Box 5.1. Principles for Digital Legislation, Denmark

While not producing coded rules, the Danish Government has sought to respond to the heightened complexity of case processing in the welfare system by creating a set of principles to aid the creation of digital-ready legislation. This aims to simplify 'legislation in order to promote automated digital case processing' (Agency for Digitalisation, n.d. a). This is being led by the Agency for Digitalisation who, in 2018, established a Secretariat to screen and assess alignment with a set of seven principles that enables drafters to create more digitally sound legislation.

The principles are:

1. Simple and clear rules
2. Digital communication
3. Possibility of automated case processing
4. Consistency across authorities – uniform concepts and reuse of data
5. Safe and secure data handling
6. Use of public infrastructure
7. Prevention of fraud and errors

Each principle provides a series of control questions, which assist practitioners to implement the principles when drafting legislation. For instance, when assessing the possibility for automated case processing, a control question asks if 'possibilities for using objective criteria are being explored' (Agency for Digitalisation, n.d. b). They note that 'complex legislation with several exceptions, vague terms or many procedural requirements may prevent an efficient and digital public administration' (Agency for Digitalisation, n.d. a).

These principles have been used to inform the development of new legislation relating to adult education and training, the storage and processing of passenger name record data, the control and sanction of the residence obligation, the promotion of day-care and correct tax payments in the sharing and platform economy. The Secretariat has provided 150 responses to specific legislative proposals since it became mandatory for Danish ministries 'to assess implementation impacts of the legislative proposal in the explanatory notes' (Agency for Digitalisation, n.d. c).

Denmark has reported international interest in following such an approach. For example, in November 2019, the Austrian Ministry for Digital and Economic Affairs hosted the Danish Agency for Digitalisation to share learnings from the Digital Ready Legislation project. Austria's 'Das Digitale Amt' project is exploring how to identify and remove legal barriers to digitalisation and was able to benefit from hearing about the Danish experience. In combination, these principles are helping Denmark's government modernise their legislation for the digital age. In so doing, they are helping ensure 'an easier every day for citizens, businesses and public employees while improving the effectiveness of the Danish public sector' (Agency for Digitalisation, n.d. a).

Source: Agency for Digitalisation (n.d. a), "Digital ready legislation", https://en.digst.dk/policy-and-strategy/digital-ready-legislation/; Agency for Digitalisation (n.d. b), "Seven principles for digital-ready legislation", https://en.digst.dk/policy-and-strategy/digital-ready-legislation/guidances-and-tools/seven-principles-for-digital-ready-legislation/; Agency for Digitalisation (n.d. c), "Public implementation impacts", https://en.digst.dk/policy-and-strategy/digital-ready-legislation/guidances-and-tools/public-implementation-impacts/; Agency for Digitalisation (2019), "International interest in digital-ready legislation", https://en.digst.dk/news/news-archive/2019/october/international-interest-in-digital-ready-legislation/.

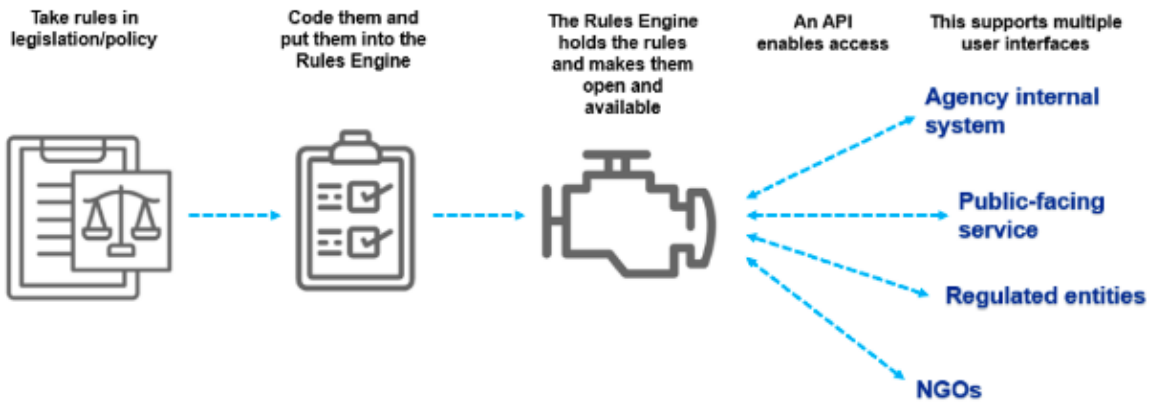
Practical/working-level efforts and activities

Other RaC initiatives have tested models and approaches for the production of coded rules. Of course, a number of these initiatives are also inherently strategic. They are helping to shape the vision for government systems based on machine-consumable rules. Additionally, these efforts may have significance over the longer-term as the approaches recommended and adopted now shape important path dependencies for governments. Accordingly, governments are rightly testing a range of approaches and technologies to implement a RaC programme. The following section explores a number of these.

Manual coding, multi-disciplinary team

This approach was popularised by the NZ Government's Better Rules work in 2018 (see Box 2.4). Other governments, such as the Government of Canada, have also trialled similar approaches (see: Box 5.2). This sees a team take existing rules, for example, those contained in legislation, and codify them into a set of machine-consumable rules. Once coded, the rules can be used for a variety of uses and by multiple actors. They can be made available via Application Programming Interfaces (APIs), which can be leveraged to inform tools such as eligibility calculators and business rules engines. In other cases, they can be consumed using smart contracts or blockchain, for example, to check compliance with regulations. Finally, they can be made available as standalone software libraries, which enable governments and researchers to use them as tools in public policy evaluation. These are presented to end users through a front-end display. This is shown in Figure 5.2.

Figure 5.2. Rule engine concept



Source: digital.nsw, 2019

Box 5.2. Rules as Code (RaC) Discovery Project, Government of Canada

In early 2020, the Government of Canada commenced a discovery focused on RaC. Led by the Community of Federal Regulators and the Canada School of Public Service, the intention of the project was to experience the RaC process and assess the extent to which its adoption could result in better rules. The team focused on coding existing rules, specifically Articles 12 and 13 of the Canada Labour Standards Regulations, as well as some aspects of the Canada Labour Code. These regulations relate specifically to the eligibility and calculation of vacation pay for employees. The team chose this use case because it had a narrow focus and was a prescriptive ruleset. Adopting a multidisciplinary approach, they held a number of RaC workshops that brought together lawyers, drafters, service designers, subject matter experts and developers to code the rules.

Over 8 weeks, the team undertook a multi-step process to move from human-readable rules to machine-consumable code. The process began with identifying key concepts and relationships in the regulations, before creating a concept model that provided a common point of reference throughout the coding process. Next, they created a decision tree by transforming the regulations into a series of 'yes or no' questions. This illustrated, for example, how different variables (e.g. the effects of medical leave) could influence vacation pay. After completing the models, the regulation was coded and a simple prototype was developed.

This process quickly proved its value. In one example, Scott McNaughton, Project Lead, Demonstration Projects at the Canada School of Public Service, recounted what occurred when one of the legislative drafters pulled him aside at the end of a RaC session:

> *He mentioned that the vacation pay regulations appeared simple on the surface but the gap between the regulations and service delivery is large. The example of medical leave illustrates this gap perfectly. The regulations say nothing about how an employee's vacation pay is impacted by taking a protected form of leave and yet it is an important part of the calculation. Rules as Code helps us prove, if nothing else, that there are gaps in the drafting of our rules. Unpacking our rules, logically thinking through concepts, relationships between concepts and the decisions that need to be made can uncover implementation gaps.*

This highlighted the capacity of the RaC approach to help close gaps between policy intent and implementation outcomes. It also suggested that RaC processes could help to improve the quality of rules (e.g. through real-time modelling of changes), support a more consistent interpretation and rapid deployment of the rules, reduce compliance costs and create new possibilities to improve service delivery. Perhaps as importantly, however, it also underscored the invaluable learning that can occur when different actors in the rulemaking process are brought together. This reinforced the value of the multidisciplinary team and suggested that the varied experience and backgrounds of those participating in the rulemaking process would be more likely to result in better rules.

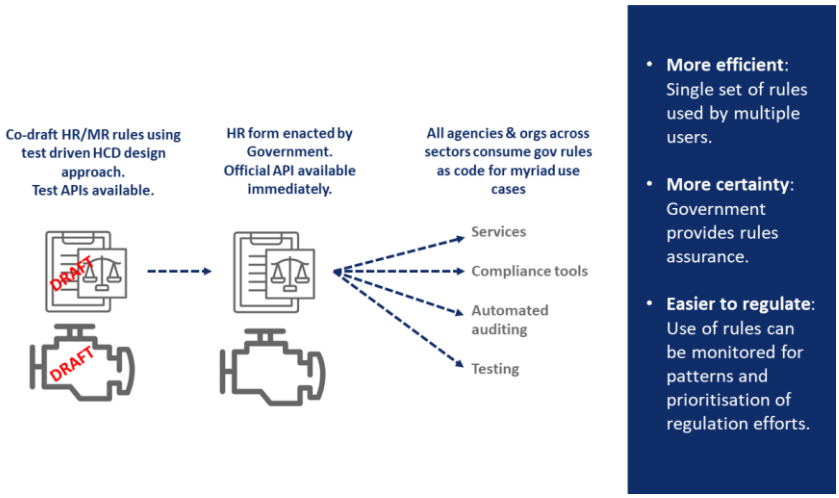
The team also worked in a consistently open and accessible way, which generated a number of positive outcomes. McNaughton provided regular updates on the discovery via his blog on Medium. The weekly sessions were made open to any interested party to observe, and this allowed others to see and understand the process. Demonstrating the value of this, Jason Morris, creator of the RaC technology platform Blawx, was able to 'follow along' with the project and to take a different approach to coding the same set of rules. Using the Flora-2 (ErgoLite) language and Oracle Policy Manager, he was able to create a tool that, using the coded rules, could generate answers to test scenarios and provide explanations for these. This not only demonstrated that there are a number of RaC approaches which remain to be tested, but also how making these efforts open and collaborative could expedite the process required to identify a 'best practice' approach.

The team has received a warm response from other agencies within the Government of Canada and will pursue further projects in 2021. As noted by McNaughton, these will give the team the opportunity to 'release the code as an API' and 'develop a coded version of the rule at the same time as the natural language version of the rule [is drafted]' (McNaughton, 2020d). This will likely involve trialling modifications to the drafting process, with the intention of identifying and correcting potential implementation gaps found in the rules in 'real time' rather than post-implementation. They also plan to test the RaC method on a different kind of rule set (i.e. internal policies or standards) and to contribute to the development of common standards, frameworks, and guidelines for the Government of Canada.

Source: McNaughton (2020a), "Week 46 – Rules as Code and other musings", https://medium.com/@mcnaughton.sa/week-46-rules-as-code-and-other-musings-123360522a93; McNaughton (2020b), "Week 47 – Lessons learned from regulatory AI projects part 1", https://medium.com/@mcnaughton.sa/week-47-lessons-learned-from-regulatory-ai-projects-part-1-7bb423defb8a; McNaughton (2020c), "Week 48 – Lessons learned from regulatory AI projects part 2", https://medium.com/@mcnaughton.sa/week-48-lessons-learned-from-regulatory-ai-projects-part-2-7cf71c30496d; McNaughton (2020d), "Week 52 – What a year of innovation has taught me part 2", https://medium.com/@mcnaughton.sa/week-52-what-a-year-of-innovation-has-taught-me-part-2-f7f677924296; McNaughton, S (2020e), "Week 55 – Adjusting to a new way of working", https://medium.com/@mcnaughton.sa/week-55-adjusting-to-a-new-way-of-; Morris, (2020a), "Playing along with Rules as Code: Part 6", https://medium.com/@jason_90344/playing-along-with-rules-as-code-part-6-5a30121a2a84.

In the model above, existing rules are coded retrospectively. Importantly, however, a RaC approach could also be used from the outset of rule creation itself. This involves creating human and machine-consumable rules concurrently.

Figure 5.3. RaC from the outset of rule creation



Source: Rules as Code Wiki, 2019

As Figure 5.3 shows, this form of RaC involves radically changing the way that legislative drafters, policy makers and service delivery experts create and implement rules. Importantly, it does not require that the existing human-readable forms of legislation and regulation be rendered redundant. Instead, it suggests that human and machine-consumable versions are created concurrently at the start of the rule-design and creation process. At the same time as the rules are agreed by the government, for example, after legislation is passed through Parliament, the human and machine versions are made available online. In the case of amendment, already coded rules are updated and these changes are automatically pushed to entities already consuming those rules. In this way, RaC of this type also changes how rules are consumed. A RaC approach adopted at the time of the rules' original creation could require a system-wide shift in the

operation of government. While, to date, there has been limited investigation and experimentation with this style of RaC, several public sector teams have indicated plans to test this approach in the near future.[19]

Semantic Technologies

The creation of machine-consumable rules could also be derived by using technology to automatically generate code from natural language text (e.g. published legislation). As Webster has written: 'What many legislative drafters would like to see is a magical tool that converts the logic straight into software code' (in Basu 2020). Indeed, there are several companies working towards the creation of a technology solution or platform capable of achieving this. Australia's Data61, of the CSIRO, has created 'Regulation as a Platform' (RaaP) which is 're-imagining regulation as an open platform, based on digital logic…that supports a future ecosystem of digital regulation and tools' (CSIRO's Data61, n.d.). As is explained below (see *Choice of technical solution*), Data61's Parse-IT is able to read, understand and convert 50-80% of the intent of existing legislation into 'pure maths logic', which is then verified by human experts (CSRIO's Data61, 2019: 31). Based on existing research, however, no existing tool has succeeded in *completely* and *automatically* deriving machine-consumable rules from natural language rules to a level of 1-to-1 accuracy. This is not to say, however, that this will not be possible in the future. The potential for technology development in this space is significant. As one of the Co-Founder of Legalese, Meng Weng Wong, has argued: 'Software could point out potential errors in laws and contracts. "What Word can do with red squiggly lines for spelling and grammar, future software can do for the semantics of legal obligations, deadlines and definitions"' (in Basu 2020). Webster, in her capacity as Innovation Lead for Wellington City Council, is also working on a proof of concept exploring how to create such a 'toolset' for drafters (Basu 2020).

Domain model based regulation

Another approach that has been trialled involves the government creating models of regulation and laws, which are then converted into software languages as required by third parties. The crucial difference is the provision of an official model of the rules, from which third parties can derive machine-consumable versions. The ostensible advantage of this is the promise of enhanced interoperability. By providing an open-source and technology agnostic model, third parties would be able to create machine-consumable versions in formats and coding languages that are compatible with their existing systems. One example of this is the International Swaps and Derivatives Association's (2018) Common Domain Model (CDM), which is 'a blueprint for how derivatives are traded and managed across the trade lifecycle'. It is a 'single, common digital representation of derivatives trade events… [that] will enhance consistency and facilitate interoperability across firms and platforms' (ISDA, 2018). This form of approach has been trialled by a team from the United Kingdom's Financial Conduct Authority and the Bank of England (see Box 5.3).

[19] Public Consultation and OPSI Research Interviews 2019/2020

Box 5.3. Digital Regulatory Reporting

Digital Regulatory Reporting (DRR) is an initiative led by the Financial Conduct Authority (FCA) and Bank of England (BoE) in collaboration with a number of financial firms. In response to the increasing difficulty of compliance with reporting requirements, the DRR project explored 'how we can use technology to link regulation, compliance procedures, and firms' policies and standards together with firms' transactional applications and databases' (FCA, 2020). They suggest that this 'opens up the possibility of a model driven and machine readable regulatory environment that could transform and fundamentally change how the financial services industry understands, interprets and reports regulatory information' (FCA, 2020).

Like other rule creation processes, the way regulatory reporting is currently conducted is increasingly unsuited to modern operating conditions. The volume of regulation has not only increased, but so too has the complexity of the information demanded by regulators. This is costly and high-risk for firms; failure to comply with the law can have significant implications. The current system is also manual and the role of interpretation features heavily, with individuals often being required to translate regulatory reporting instructions into forms consumable by entity-level systems. For regulators as well, the existence of late, incomplete or wrong data can hinder the execution of their roles and function.

The DRR project was created following a 'Techsprint' in 2016 and 2017 focused on 'Unlocking Regulatory Reporting'. Following the successful development of a proof of concept, which converted some regulatory reporting instructions into machine-consumable code, a longer 6-month pilot was agreed by the BoE and FCA. In Phase 1 of the pilot, the project team explored 'how to make reporting rules and instructions less reliant on human interpretation and implementation, and so improve the quality of regulatory data' (FCA et al., 2018: 7). This included developing 'a working prototype solution that demonstrates the end-to-end process for machine executable reporting', which was tested with two use cases relating to Loan to Income and Capital Equity Tier 1 Ratio compliance checks (FCA et al., 2018). The project also included other work streams that explored the impact of changing technology on other aspects of the reporting process, including on operating models, data and legal aspects.

The pilot tested two approaches for converting regulation into code: by 'setting parameters for regulatory content in a system' and by 'directly translating regulation into machine executable code' (FCA et al., 2018: 10). Regarding the latter, the regulation was coded in JavaScript, a general purpose programming (GPP) language, and 'executed as a smart contract on the DLT network' (FCA et al., 2018: 10). Describing the task of expressing the code in a GPP as 'very difficult', the team explored three further options, to: rewrite regulation in a Domain Specific Language, leverage semantic technologies to create machine-readable artefacts and to generate code using Natural Language Processing. Only the first of these was explored, and even then only in a limited way.

In 2019, Phase 2 of the DRR pilot commenced with the goal to 'determine whether continued investment in DRR is warranted and to identify any gaps that need closing before any potential implementation, while also exploring potential technical solutions for DRR' (FCA et al., 2019: 3). With respect to the latter objective, this involved completing a market survey to assess the availability of third party solutions. On this, the report notes that 'overall, the team did not find existing solutions that met all requirements for an optimal solution'. Accordingly, they examined the potential to create a custom solution.

This involved delivering two proof of concepts, both based on 'model-driven approaches'. The first of these was based on the use of semantic technologies and examined 'how to build the links between a model of a mortgage report and how that could then be converted to executable code'. This avenue, however, was frustrated by a lack of available and established supporting tools and applications.

Secondly, the team collaborated with International Swaps and Derivatives Association's Common Domain Model project for derivatives. This involved the creation of a common data model, shared between the regulator and firm, from which regulatory reports could be generated.

DRR reveals a number of important issues that require consideration in RaC efforts, including those that go beyond the development of a technical approach. Firstly, it highlights that 'there remains a degree of uncertainty over the best technical solution' as well as stressing the importance of data, its quality and its use. Further, it hints at the fact that, for a DRR-style system to be implemented, actors would need to make a number of non-technical changes. That is, DRR and RaC style projects are not only technological solutions, but represent a challenge to existing ways of operating.

Source: FCA 2020, "Digital Regulatory Reporting", www.fca.org.uk/innovation/regtech/digital-regulatory-reporting; FCA et al. (2018), "Digital Regulatory Reporting: Pilot phase 1 report", www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-1-report.pdf; Financial Conduct Authority (FCA) et al. 2019, "Digital Regulatory Reporting: Phase 2 viability assessment", www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-2-viability-assessment.pdf; OPSI Research Interviews 2019/2020.

Summary

This chapter has worked to place the idea of RaC into an intellectual and implementation context, to ensure that it is seen as a possible part of larger ongoing shifts, such as the shift to digital government, rather than an idea that has emerged in isolation. RaC can thus be seen as responding to and fitting with some deep underlying shifts affecting government. Consequently, RaC can also be located within a broad range of preceding and related efforts that have also occurred in response. Focusing on RaC efforts within government, the chapter highlighted a number of strategic and practical efforts in the space. Overall, it can be concluded the optimal model and approach to the production and use of coded rules remains unsettled. As has been suggested, however, the efforts of many individuals and entities, especially if shared with the broader RaC community, should rapidly accelerate progress towards a better sense of what works in the space.

Of course, regardless of the specific approach chosen, there are a number of considerations that attend the development and use of RaC in government. The following chapter examines a number of these and explores how those seeking to implement RaC can respond to them in a government context.

6. Considerations

A shift to an approach as new and potentially transformative as RaC will involve navigating a range of considerations, spanning both the conceptual and the practical. These cover areas that would benefit from additional research or experimentation, as well as some things that are only likely to emerge from the experiences and lessons that come from implementation (particularly at scale). Actors may also usefully draw insights from academic research in this and related areas (such as computational law) to help inform public sector initiatives and applications. This chapter outlines a number of possible challenges facing those considering RaC, which are summarised in Table 6.1.

Table 6.1. Potential considerations regarding RaC

Considerations	Description
New rules or old?	RaC initiatives must decide whether to code existing rules or, more ambitiously, to create new rules in both human readable and machine-consumable forms from the outset.
Technology choice	How to implement RaC from a technical standpoint, for example, the best language, standard or rules engine to use for RaC efforts is still strongly contested.
Sharing coded rules	A number of the potential benefits of RaC depend on third parties being able to consume and integrate an official version of coded government rules. Ensuring that rules are accessible and consumable is therefore a key issue, to which a number of solutions have been proposed.
Data	Strongly connected to the use of rules is data. Ensuring that mechanisms exist to pull and use data, for example, to test compliance against a rule set, is of central importance.
Scaling solutions	Most existing RaC initiatives have been experimental and have yet to be scaled. Achieving effective mechanisms and structures to scale RaC approaches will be required if governments are to adopt and embrace the approach.
Capability	The adoption of RaC approaches could result in a need for new, expanded and different capabilities for rulemaking. Further, it may generate demand for individuals possessing certain skill mixes, for example, legal and technical expertise; mixes which are relatively rare and already subject to growing demand.
Governance	Governing the rules will be a central issue as RaC becomes more widespread. Relevant questions may involve understanding who is best placed to undertake and lead RaC initiatives, as well as the structures and mechanisms required to support (and where necessary, constrain) this work.
Legal implications	Creating an official set of machine-consumable government rules raises a number of legal questions that must be carefully considered by governments.
Choice, not technocratic default	RaC could easily be seen as a technocratic matter of improvement, enhancing existing functions and responsibilities of government, rather than a strategic choice with ramifications for the operations of the state.

New or old rules?

There is a distinction to be made between the coding of existing rules and development of new rules with RaC as the default approach. Currently, recent initiatives have tended to favour the development and testing of RaC approaches with existing rules. As approaches mature, it is likely that RaC can be tested for its applicability to the creation of new laws. In 2020, the Government of Jersey's Legislative Drafting Office plans to develop 'analysis of legislation for logical structures, and our use of existing IT, before moving on to applying the Rules as Code approach to drafting a simulated legislative project, and then applying the results of that to the drafting of a real enactment'.[20] For some, as RaC approaches become more sophisticated and demonstrate their potential value, there may be a case for 'drawing a line in the sand' (Andrews, 2020a). That is, continuing to re-draft high-priority, high-value and existing legislation using a RaC approach, but focussing on implementing processes that enable all future legislation to be developed in human and machine-consumable forms from the outset. Pursuing initiatives with both types of rules is desirable, as this will help advance understanding of the potential and limitations of RaC. It is likely, however, that many of the decisions will come down to a) the scope for which RaC is considered appropriate and thus the demand for it, and b) the support and resources provided for this new approach, which will, at least initially, be more complicated than established processes even if it has the potential of substantial longer-term payoffs.

Technology choice

The technology required to enable and scale RaC is the subject of significant debate. This has generated a number of questions, which may need to be resolved in order to mature the RaC approach. The decisions made about a number of factors, for example, programming languages and data, will shape decisions and pathways around the technical solution(s), while also having flow-on effects for how RaC is supported from a process and implementation perspective. As systems are embedded, teams will also need to consider how they are maintained, secured and improved over time. The following discussions are intended to highlight some of the key questions and debates that exist, noting that the evolution of RaC will depend upon the interplay of several factors and cannot be predicted at this point. Acknowledging that this summary is not exhaustive, it focuses on some of the most salient issues relating to:

- Programming languages
- Data
- Choice of technical solution.

While these may not seem of strategic import to all, the history of large-scale government IT project implementations suggests that having an appreciation of at least some of the technical parameters and choices can be important, and is thus included here as an aid.

Programming languages

One of the primary issues relating to technology choice and RaC is the choice of programming language used to code the rules. A computer programme is 'a set of instructions that a computer follows to perform a task' (Gaddis, 2013: 1). Programmes, in turn, are written in programming languages that act as 'an interface between a computer and a human being, the programmer' (Morris, 2020b: 6). Like natural languages, such as English or French, high-level programming languages function on the basis of unique rules and structures. For example, the key words and syntax used in the COBOL programming language are not the same as those employed in Python (Gaddis, 2013). Unsurprisingly, these differences mean

[20] OPSI Research Interviews 2019/20

that certain programming languages are better suited to some tasks. Finding the optimal programming language, best aligned with the objectives of RaC, has thus been an early preoccupation of many interested in the space. Some of the key considerations that may need to be understood when considering the choice of programming language for RaC efforts are outlined below.

One of the primary divisions that can be drawn between programming languages is between two main 'paradigms': imperative and declarative. Imperative programming styles focus on how an action is to be achieved. IONOS (2020) notes that 'a program based on this paradigm is made up of a clearly-defined sequence of instructions to a computer'. Within this paradigm, languages can be further specified as belonging to sub-paradigms such as 'procedural programming' or 'object oriented programming'. Some common languages using imperative logic are C or Java. As the original form of programming, these types of languages are used extensively across the world.

By contrast, declarative programming languages (DPLs) describe the objective or goal, rather than specifying the means by which this can be achieved (McGinnis, 2016). To borrow an analogy, 'imperative languages provide recipes; declarative languages contribute photos of the finished meal' (IONOS, 2020). This type of language can be further categorised into sub-paradigms, such as logic and functional based languages. Some prominent examples of DPLs include SQL and HTML.

Imperative and declarative languages have their own strengths and weaknesses. For imperative languages, these are summarised in Figure 6.1. Morris (2020b) outlines the potential benefits that could be realised by using Declarative Logic Programming for computational law efforts. Among these, he singles out three for particular attention: translation rather than reformulation, increased efficiency and explainability (Morris, 2020b: 8-13). To elaborate, Morris argues that as declarative logic commonly mirrors the form in which the rules are drafted, this allows a simpler conversion of rules. This can allow for a stronger 1-to-1 relation between the written and coded rules, sometimes referred to as 'isomorphism', which can reduce the effort required to make changes across a rule set. Finally, Morris (2020b: 8-13) argues that the automatic generation of explanations for the rules created using these languages is technically feasible, potentially easier (when the feature is built into the tool) and more likely to result in something understandable for humans. Considering the principles around traceability and appealability, which relate to an actor's capacity to understand and (if necessary) challenge how decisions were made with coded rules, this may be of importance.

Figure 6.1. Advantages and disadvantages of imperative programming languages

Advantages	Disadvantages
Easy to read	Code quickly becomes very extensive and thus confusing
Relatively easy to learn	Higher risk of errors when editing
Conceptual model (solution path) is very easy for beginners to understand	System-oriented programming means that maintenance blocks application development
Characteristics of specific applications can be taken into account	Optimization and extension is more difficult

Source: IONOS, 2020

Another common distinction that can be drawn between languages is between general purpose and domain specific languages. As the name implies, general purpose programming languages (GPPs) can be applied broadly in a range of situations. General purpose programming languages include Java, C++ or Python and can be of both the imperative and declarative paradigm. To date, most RaC experimentation involving the manual translation of rules have employed a GPP (FCA et al., 2018: 11). The key advantages

of these languages include that they are well known and established in software development, learning may be easier and integration with other applications more possible. However, precisely because they are general, they may be of less utility when specific semantics or notations are required by an issue. This may therefore require the use of a more specific language.

Domain Specific Languages (DSLs) are languages designed and employed for a specific purpose (FCA et al., 2018). They cannot typically be used to solve issues beyond their defined purpose due to the different key words and semantics they employ (Cook, 2018). As these languages are naturally more limited in their potential application, the opportunity cost for developers learning them may be higher. Their specific nature can also make their integration and use in broader software systems more difficult. Equally, these potential challenges (for example, specificity) can simultaneously represent advantages. For example, DSLs may be naturally more suited to the specific nature of the problem being solved and therefore better able to address unique issues than their GPP counterparts.

Several organisations and individuals see the value in the use of DSLs efforts to code the rules of government, but also of the courts and legal systems. Legalese, a 'deep tech start-up' promising to apply the dictum that 'software is eating the world' to the legal industry, is developing a DSL called L4 to do 'for the modal u-calculus what functional languages do for the lambda calculus'.[21] Or, more simply, to create a domain-specific programming language for legal agreements and regulations that is 'specifically designed to capture the particularities of law, its semantics, deontics, and logic' (Legalese, 2020). This is deployed in their first Minimum Viable Product (MVP), which 'helps start-ups generate ALL the paperwork they need to close their ANGEL ROUNDS', without using lawyers.[22] Additionally, in France, a project team is working towards the creation of a programming language, called 'Catala', which has been expressly designed for RaC initiatives (see Box 6.1).

[21] See https://legalese.com/

[22] See https://legalese.com/

Box 6.1. Catala Language, French National Research Institute for Computer Science

In 2019, the French National Research Institute for Computer Science (Inria) has an initiative focused on developing a new coding language, one specific to the purpose of RaC: Catala. The language is based on the field of formal methods, which are used in safety-critical domains like avionics or nuclear power plants to ensure that software behaves as expected, given a precise and unambiguous description of the expected behaviour. Led by Denis Merigoux, from the Inria Prosecco group (https://prosecco.gforge.inria.fr/), and in collaboration with academics from the Paris Panthéon-Sorbonne University and the Northwestern Pritzker School of Law, Catala is designed to achieve semantic equivalence with the law itself (its fundamental source of truth).

Catala derives its uniqueness from its use of a style called literate programming, which sees each line of a legislative style text annotated with a snippet of code. This allows non-technical experts, such as policy makers and lawyers, to understand the representation of the code in relation to the legislation or rules. This allows Catala programmes to be more easily verified and validated. Catala also comprises a compiler, which is a mechanism that allows code to be translated into a range of programming languages, which improves interoperability. For example, the compiler can generate Javascript for web applications, SAS for economic models and COBOL for legacy environments. Crucially, the project team is working to ensure that the translated output can be guaranteed to behave in the same way as the original Catala programme. By using compilation, the code can be written once and be deployed everywhere; this avoids the need to manually write multiple versions of the code, which increases the chances of bugs. Catala remains an early stage project. In the future, the team is working on finalising the development of a compiler (e.g. for multiple languages including Javascript, Python etc.) and implementing a large-size body of legislation to demonstrate the tool's utility.

Source: OPSI Research Interviews 2019/2020.

Data

As the digital transformation of government continues, the amount, quality and use of data will increase in importance. Thatcher (2020) argues that data is one of two critical components in a truly 'digital enterprise'. As he notes, 'once tamed, data can be a source of great productivity and value creation' (Thatcher, 2020). Crucial here is that the data is 'tamed', meaning that the right data is captured and is made available in usable forms. High quality, accurate and standardised data is required for RaC efforts to succeed (FCA et al., 2018). This may be especially true for regulatory use cases, where the quality of the data will influence the utility of RaC solutions. This was an issue identified in the DRR work, which nominated the collection and use of data as a significant challenge for corporations, especially the largest ones (Bank of England, 2020). As their report stated: 'Currently some firms use multiple terms or identifiers to describe the same data. The metadata firms hold about their data was not designed to meet the needs of regulatory reporting. Firms often rely on subject matter experts or key individuals to understand the data they have' (FCA et al., 2019: 8). The method and approach chosen to code rules may require specific data, contained in the relevant and applicable formats or types. Ensuring consistency and quality may therefore require a range of efforts, including agreement on definitions, vocabulary and standards for data (see *Governance*).

Choice of technical solution

The considerations outlined above manifest themselves in an issue of significant debate within the RaC community: the choice of technical solution. How to achieve RaC aims, while avoiding concerns such as those associated with interoperability and vendor or platform lock-in, is a key question. As it currently

stands, there is ostensibly no single, end-to-end solution that has the desired or required functionality for RaC efforts. For example, a technology solution that enables the automatic conversion of human readable (natural language) text into machine-consumable code could potentially help alleviate concerns about the efficiency and scalability of manual coding efforts (see *Scalability*). As the FCA and BoE have noted, however, there 'is no obvious solution to efficiently convert regulatory instructions expressed in natural language into code' (FCA et al., 2018: 10).

Morris, from his scan of available technology options using declarative tools, has similarly concluded that 'there is no one product that "has it all"' (Morris, 2020b: 77). Accordingly, while this product may exist in the future, it is likely that a combination of tools may be required in the interim. RaC efforts will therefore benefit from the further testing and use of various tools. The market may be best placed to provide certain technologies or enhance existing capabilities to deliver this. Equally, governments may find it useful to test and develop products in-house (see Box 4.1).

A number of technical solutions and tools have been used in RaC efforts to date. The most suitable solution will depend on the method chosen for developing rules. The following is a non-exhaustive survey, which highlights some of these:

- **Excel**: The Government of Jersey's Legislative Drafting Office is using existing IT solutions to 'capture the rules embodied in our drafts, so as to demonstrate them to our policy officers as a means of ensuring we are both understanding them the same way'.[23] With a small team of legislative drafters who are closely connected to policy experts, they are approaching their RaC investigation from the perspective of the drafters. To this end, they have employed a simple technology solution involving QnA Markup Editor and Excel's logical formulae. Rather than focusing on tax and social security issues as many RaC initiatives have so far, they are investigating potential benefits for non-financial legislation (Waddington 2020). For example, one initiative focused its attention on Jersey's Charity Law. Firstly, they attempted to take the rules contained in legislation into formal logic before using Excel's IF, AND, OR, NO functions to capture these (Waddington 2020). This may represent a useful approach for teams looking to demonstrate value through short, low-intensity proof of concepts, before embarking on more intensive pilots involving the conversion of rules into machine-consumable code.
- **Oracle Policy Automation** (now, Oracle Intelligent Advisor): is a well-established, 'specialist application that is focused on modelling, automating, and optimizing the implementation of policy, legislation and complex business rules' (Oracle, 2017). It presents itself as 'an end-to-end solution for capturing, managing, and deploying complex legislation and other document based policies across channels and processes'. A suite of tools, Oracle Policy Modelling (OPM) allows for 'natural language based rule authoring in MS Word or MS Excel', which makes the ease of use somewhat easier than other options. Additionally, the tool is used widely in the private sector, especially by large companies with extensive regulatory compliance requirements. It has (at various times) also been used by governments to aid in the delivery of services and compliance with legislation (Oracle, 2010). The extent of its use means it has an advantage in being one the most known and understood solutions in this space. OPA is, however, a proprietary system and therefore requires that the software is purchased at an organisational or, perhaps, governmental level. For some actors this may be prohibitive; Morris notes that the cost of this system may place 'OPA well outside the range of the sorts of tools that can be easily adopted by most access to justice organisations unless it can be shown to have very significant productivity gains' (Morris, 2020b). While larger governments may be more able to make investments in such technologies, the value for money that could be derived from any proprietary option would need to outweigh that of an open-source alternative. Accordingly, while it is true that OPA allows for the production of rules as code (as an

[23] OPSI Research Interviews 2019/20

output), its associated costs and proprietary nature may restrict the extent to which the rules of government can be made open, re-useable and transparent.

- **Blawx**: is a technology platform developed specifically for RaC, which aims to combine 'the most powerful legal reasoning tools and the easiest interface to learn' in a single product. Blawx argues that 'the best programming languages for encoding rules are declarative logic programming languages, but most of them are too hard to learn and use'. As a solution to this, Blawx uses a visual programming style to inform the creation of coded rules. Drawing on the analogy of accountants and their use of excel, the creator of the platform, Jason Morris, hopes Blawx will similarly help policy SMEs code rules. In his assessment, this will help overcome the 'knowledge acquisition bottleneck' associated with many other RaC solutions (Morris, 2020c). Its use of visual programming language and declarative logic are presented as significant advantages for non-programmers. Blawx was also recently made open source in order to better guarantee the level of 'transparency and accountability' required by the public sector in RaC initiatives (Morris, 2020d). A roadmap outlining a number of additional features, including the capability to deal with additional data types and co-drafting features, is outlined on the website. Like other solutions, this suggests that the product will continue to mature.
- **Regulation as a Platform (RaaP)**: is a proof of concept project of the CSIRO's Data61, which 'aims to maximise the value of regulation, as the key data set of government' (CSIRO's Data61, n.d.). It is based upon Defeasible Deontic Logic, a logic developed by Data61 and researchers from the University of Bologna, and, more specifically, Data61's specific implementation of this logic, SPINdle.[24] This logic is employed as RaaP's underlying language and inference engine, on top of which is a rules editor and visualisation capabilities. SPINdle allows the system to 'handle obligations, permissions, and prohibitions, including the ability to reason with violations', as well as to identify norm violations and the consequences of these (CSIRO's Data61, 2020). Data61 also have engaged in a number of other efforts in this area. For example, SPINdle also underpins their 'Regorous' platform, which can be used to verify business processes against rules regulations in order to assess compliance.[25] Additionally, Data61 states that its 'Parse-IT' web-application 'takes existing legislation, reads its content and understands somewhere between 50-80 percent of its intent, and automatically translates it into pure maths logic' (CSRIO's Data61, 2019: 31). Policy experts are then employed to ensure the accuracy of the translation (CSRIO's Data61, 2019: 31). Returning to RaaP, Data61 partnered with PricewaterhouseCoopers (PwC) to create 'PaidRight', which helps businesses to manage their compliance with regulations relating to employee pay. This usefully illustrates the RaC concept in that it uses coded rules to improve understanding of a complex regulatory domain, while also offering potential efficiencies for businesses. RaaP has also been experimented with in RaC initiatives, for example, with the New South Wales Government of Australia. While certain elements of the Data 61's offering are open source (e.g. SPINdle is available under an LGPL licence),[26] it has been suggested that a potential limitation of the RaaP platform (as a whole) is that it is not 'open source software, and its availability [for commercial application] may change' (Morris, 2020b: 76).

As noted, this is *not* a comprehensive survey of all options available for RaC initiatives. The RaC Handbook also provides a list of other possible rules engines.[27] Further, it is likely that new offerings will continue to appear as the broader movement matures.

[24] OPSI Public Consultation 2020
[25] OPSI Public Consultation 2020
[26] OPSI Public Consultation 2020
[27] See https://github.com/Rules-as-Code-League/RaC-Handbook/wiki/5-Rules-engines-and-APIs

Interoperability

Assuring interoperability, between the coded rules created by governments and the third party consumers of those rules, will be important in realising the full value of RaC. If a technical solution is found and proven effective, there will likely be integration issues with existing infrastructure. Governments inevitably have large, expensive legacy systems that have been integrated into existing architectures over long periods. As early as 2003, the OECD identified how the existence and function of legacy systems can impede the realisation of e-Government and its objectives (OECD, 2003: 60-61). In 2019, the United States General Accountability Office published a report which estimated that 'the federal government's 10 legacy systems most in need of modernisation cost about $337 million a year to operate and maintain' (Kuldell, 2019). Legacy systems are therefore under increasing pressure, with governments increasingly keen to 'future proof' systems while also improving their resilience.

The new processes and technology requirements necessitated by the adoption of a RaC approach may result in expenses to integrate, upgrade or replace existing systems. It may increase staff costs for any new technology functions it creates, as well as the expertise required to manage the transition from new to old ways of working. At the same time, however, RaC could also represent an opportunity to reassess the long-term viability of established technology infrastructures and to move towards more modular, adaptable technical architecture. Overall, this suggests that further work will be required to assess the business case for RaC in specific contexts.

Scalability

Another issue that has been raised with regard to RaC is its potential to scale effectively. This issue can be seen in terms of available technology solutions. As noted, while the fully automatic conversion of rules to code is not currently possible, this could be something that increases the ability to achieve RaC at scale in the future (Greenleaf et al., 2020: 3). The issue can also be examined from a procedural perspective. Multidisciplinary teams can be costly and time consuming to assemble and this issue can be accentuated in organisations without existing experience using such team structures. The FCA and the BoE's Digital Regulatory Reporting project has also suggested that scaling solutions is a key issue. They note that 'the option commonly used today – human translation of regulation directly into machine executable code – is an expensive process at scale' (FCA et al., 2018: 12). Nonetheless, proponents have argued that by committing effort to establishing understanding across actors upstream, significant time and effort can be avoided at later stages. Indeed, the FCA itself states that 'the process may be significantly more efficient if it occurred all at once for all institutions, rather than separately at hundreds of institutions' (FCA et al., 2018: 12). This reinforces the argument that RaC may require a whole-of-system shift in order to maximise its potential benefits. To this end, some governments are already considering how RaC efforts might be scaled and what will be required to achieve this (see Box 6.2).

Box 6.2. New South Wales Government, Australia

In Australia, the state Government of New South Wales established a RaC program in 2018. The programme was initially focused on two outcomes: how to code rules from the outset of rule creation and ways to deal effectively with existing rules. Importantly, the teams also recognised the need to create the tools, capabilities and mechanisms required to empower others within government to undertake RaC. Rather than relying on a central entity to code all the relevant rules, the program set out to create the framework and technical tools required for individual teams and agencies to code rules specific to their operations. To this end, the program team (from the NSW Department of Customer Service) have developed the foundational components of a framework that will help to scale RaC efforts within NSW. Materially, the team has split the state's OpenFisca code into separate 'extensions', with each focusing on a separate piece of legislation and/or regulation. The intention is that these components are modular, flexible and can be reused by different government actors depending on the specific rules being coded. The program also includes the development of a web form builder, which is a standard website form that connects to the government's API, extracts the questions needed to populate the specific form and presents them to the front end user. The responses are automatically sent to the API and the response is presented back to the user in a meaningful way. This allows multiple agencies to create website components (i.e. eligibility engines) which all draw from a 'single source of truth'. Future plans include supporting agencies to code specific rule sets (for example, the Department of Planning, Industry and Environment and their Energy Savings Scheme rules), as well as the development of a rules explorer (similar to http://nz.openfisca.org/) that allows developers to examine all rules contained in the API. In combination, the team expects that the provision of a robust framework and consumable technical tools will aid the uptake and use of the RaC approach across government.

Source: de Sousa, (2019b), "Rules as Code – NSW joins the worldwide movement to make better rules", www.digital.nsw.gov.au/article/rules-code-nsw-joins-worldwide-movement-make-better-rules; see also https://github.com/Openfisca-NSW.

Additionally, the current technology options may not possess the capability required to support an effective application of RaC at scale. While some of the solutions outlined previously possess an enterprise level capability, this is likely to come at a high cost. Other platforms, including some open source platforms, are still maturing. As the DRR team noted in their Phase 1 discovery report, while the absence of a clear technical solution will not necessarily preclude the realisation of RaC projects, it may limit its application to certain areas (FCA et al., 2018). Several actors are developing and/or maturing a number of technology solutions. In March 2020, the Government of Singapore announced $15 million dollars in research funding for computational law, particularly focussed on the creation of the DSL, L4 (Low, 2020). Over time, then, it can be expected that the capability and scalability of technical solutions for RaC initiatives will improve.

Capability

A challenge will be finding public servants with the right capabilities for this work. It is likely that the adoption of a RaC approach could increase the need for policymakers and legislative drafters to adapt to changes in the rulemaking process. While it is not suggested that all legislative drafters would need to learn coding skills (or that technologists learn the law), developing a basic understanding and appreciation of these domains and the related skills may be of significant use. Further, in 2017, UK's National Audit Office's (2017) assessment of public sector capability revealed the need for significant increases in the number of digitally skilled public servants. In the Australian Independent Review of the APS (2019), it was reported that '58% of APS Agencies say they are under-skilled in the digital aspects of delivering for the Australian people' (Commonwealth of Australia, 2019: 24). This means that many governments are already struggling

to attract and retain staff with the necessary digital capabilities. A widespread adoption of a RaC could potentially create increased demand for individuals with both legal and coding experience.

RaC initiatives can also open up the opportunity for learning between individuals with different expertise, thereby facilitating knowledge transfer between siloed professions. Teams have reported significant benefits from lawyers seeing and understanding how laws are translated into code for implementation (and vice versa for coders) (see Box 5.2). Happily, there is already some evidence that different sectors are responding to the growing importance of digital skills. Suffolk University Law School's Institute on Legal Innovation and Technology, Ryerson Faculty of Law and Swansea University have all advertised for law professors with coding ability (Morris, 2019). In August, Singapore Management University (SMU) will begin an undergraduate course in Bachelor of Science (Law and Computing) (Low, 2020).

Governance

The scale and scope of RaC adoption will determine the type of governance structures required. Should multiple countries make efforts in this space, it is likely that governance bodies operating at the international level would also be beneficial.

Governing RaC

The increasing experimentation with and use of RaC raises several interesting and challenging questions relating to its governance:

- Which area of government should oversee RaC initiatives? Should this role fall to those entities currently responsible for rulemaking or will other entities, for example, those responsible for digital transformation, also be involved?
- Should RaC be produced via a centralised or decentralised model (for example, where all agencies are able to create and provide coded rules)? If the latter, how is the consistency between and quality of the rules to be assured?
- How will any interface with the judicial branch/area be managed? What oversight measures may be needed to monitor the reasonable and principled use of the approach?

As discussed below, several government actors could reasonably be involved in the creation of RaC (see *Who should be involved in the production and creation of RaC*). Due to the concept's multidisciplinary nature, however, there is not one individual entity or actor that necessarily recommends itself for the lead role in creation and oversight. This suggests that governments may need to create new governance mechanisms to oversee RaC efforts that are aligned with their own specific contexts. Further, if RaC efforts are industrialised and scaled, governments may need to consider how existing governance mechanisms (for example, those relating to the creation of policy or regulations) may need to change. As RaC matures, mechanisms and structures to support the maintenance of the coded versions will also be required.

In addition, the 'analogue' version of the legal system has evolved slowly and over time, though sometimes in rapid bursts, meaning that the institutional surroundings could also 'co-evolve' at pace. It is not yet clear what institutional settings a truly digital legal system might need, or what accountability or limiting constraints might be needed for it to work as desired. For instance, some public sectors have administrative appeal mechanisms by which people can challenge or ask for review of decisions, whereas RaC might negate the need for some forms of this by reducing ambiguity. Yet by automating *some* decision paths and generating efficiency gains in the implementation of some existing rule sets, new limiting or critical factors may reveal themselves, requiring additional intervention or attention or new forms of institutional support or control. These may reveal themselves over time or, potentially, be discovered at points of critical failure or scandal, such as when an unintended consequence is revealed. Governance should thus consider how to manage the learning at speed and scale that digital can bring.

Standards

Related to the issues of languages and data is that of standards. It is likely that the consistent and shared use of common standards could improve the utility of RaC efforts. McNaughton (2020a) has argued the absence of standards in government has allowed legacy systems to proliferate and empowered vendors to drive agendas. As he notes, there is a real risk that with RaC is that 'we could end up with a mess of different approaches, different use of logical reasoning, different vocabularies, different languages and platforms creating a mess for the people who might want to use our rules for their own applications' (McNaughton 2020a). Indeed, a situation where RaC increases complexity for users, as opposed to reducing it, would undermine its most central goals. While the early-stage nature of the concept means formal standards are unlikely in the short term, prioritising the use of open-source technologies and 'open' initiatives (which can be examined and scrutinised) could help mitigate this risk.[28]

It has also been suggested that borrowing vocabularies, such as the Semantics of Business Vocabulary and Rules (SBVR), could be of utility. SBVR is 'a vocabulary (or more accurately, a set of inter-related sub-vocabularies) that permits capture of semantics for the kinds of sentences commonly used to express business rules' (Ross, 2008). Ontologies and concept models are also regularly nominated as resources that would assist in the production of RaC. A shared or common ontology across, for example, all government departments within a country, would help simplify the complexity of legislation. Commonly, terms such as 'income', 'month' or 'year' have different meanings in various domains or pieces of legislation. This increases the difficulty of ascertaining the correct understanding within the legislation, but also with determining how it relates to other pieces of legislation. Yet, discussions with various Parliamentary Councils confirms that standardisation of vocabularies and ontologies is an intensely difficult task and one tried several times before. Noting this, a counter point can be made that the absence of agreed standards and agreed vocabularies should not prevent new and continuing RaC experimentation or efforts. In fact, it may also be that through dispersed and grassroots innovation that de facto standards emerge.[29] Nonetheless, early consideration of these issues in RaC efforts can help inform the eventual design of those tools which ensure greater consistency across digital rule sets.

The development and promulgation of frameworks, guides and standards about rule creation and data would better enable the growth and value of RaC. This could be achieved nationally, but there may also be scope for its consideration at a local, state, international or even supranational level. In this case, there may be a role for general standards organisations (such as the International Organisation for Standardisation) or more specific bodies (such as the WTO for cross border trade).

Legal implications

RaC invites consideration of a number of legal issues. In changing how laws are created, provided and enforced by government, the use of RaC could have significant impacts on people and businesses. Some of the questions that its use may generate include:

- If compliance by third parties is undertaken on the basis of the coded regulations delivered by government, but a mistake has been made in their drafting, is the government liable?
- How would the treatment of mistakes made in machine-readable legislation differ from mistakes made in human-consumable form?
- Is it appropriate to use coded rules to make decisions about all topics?
- Is the misuse of rules coded by government possible and, if so, what could be done to guard against it?

[28] Public Consultation 2020

[29] OPSI Research Interviews 2019/20

Concerns about the possibility of adverse outcomes from RaC have been raised by several actors. In the *IT Professionals Techblog*, Riversdale (2019) highlights his 'uncomfortableness' with RaC noting that his 'biggest issue is how #RulesAsCode is the seeming rush to atomise the law into rules that machines can then ingest'. Central to his concerns is the possibility that the concept will over-promise but under-deliver, drawing an analogy with the early promise of 'the cloud' in government (Riversdale, 2019). Additionally, he highlights the possibility of scope creep, whereby the 'competitive drive to deliver more and more benefits…move [governments] into unethical and law bending behaviour' (Riversdale, 2019). McIntyre (2020) has also raised a number of important considerations about RaC, questioning whether it is erroneously and mistakenly mirroring efforts of the French and the Napoleonic Code in the 19th Century. Specifically, he takes issue with the idea that legislation could be applied by machines and the possibility that the use of RaC could erode the vital role of the judiciary. As he writes:

> *'To allow machines to "interpret" legislation as code does not eliminate the role of values, but rather replaces the evolving values of the judiciary with the values of the programmer and reinforces bias towards past values choices. The "legislation-as-code" approach risks reinforcing a disingenuous conception of judges as mere dispute-resolvers and not as co-equal governors; the third arm of government' (McIntyre, 2020)*

This concern should not be ignored. Protecting the correct function of the law and the role of the judiciary as a vital pillar of the democratic system of government is of crucial importance. What it also exposes, however, is the need to clearly define the RaC concept and when it should be used: both goals of this primer. To reiterate, RaC (as understood here) does not aim to replace judges or legislators. Instead, its goal is to augment the rule-development process through the government's creation of a machine-consumable ruleset that mirrors its existing, human-readable counterpart. In this sense, RaC would be an improvement of a process that already exists, but with the potential for greater transparency and openness.

This currently happens, but it is not done well. Every business rule system designed and employed by businesses or government agencies has interpreted and coded aspects of the law.[30] RaC proposes to rethink this process and, in so doing, make these renderings more consistent, transparent and consumable by all people. Not only that, early efforts seem to suggest that in the development of legislation which supports service delivery, the experience of creating machine-consumable rules actually brings greater rigour to the drafting of the laws themselves. In other words, the rules created are better able to fulfil their intended function. In this sense, while RaC does aim for 'legislation [that] could be directly applied by machines', it more precisely seeks a *better* application of the law by machines. By assigning the responsibility for machine-consumable rule sets to government, the function and effectiveness of the laws created may therefore be enhanced, rather than eroded.

Of course, precautions should be taken and treated seriously, for there are several potential applications of RaC that could elicit potential legal concerns. Happily, governments and individual actors are increasingly aware of these issues. The Australian Law Reform Commission's (2019) *The Future of Law Reform: A Suggested Program of Work 2020-25* has proposed 'Automated decision making and administrative law' as a subject that could be considered. As mentioned above, the NZ Law Foundation also funded an initiative to investigate a range of ethical and legal questions. Such efforts are to be commended because, as RaC initiatives mature and grow in scale, governments will be rewarded for pre-emptive consideration of such issues and their potential implications. Equally, it is unlikely that all of these issues will be mitigated or reconciled prior to the introduction of RaC.

[30] OPSI Research Interviews 2019/20

Choice, not technocratic default

In and of itself, RaC should not be seen as a panacea for government rulemaking. There is a risk, however, that those within and outside of government will be attracted by the technocratic aspect of the concept and will accordingly view it as a natural progression or extension of the status quo. RaC should not be seen solely as a technocratic fix, a 'silver bullet' capable of opening up government, improving its responsiveness and the quality of its service delivery. If RaC results solely in the integration of technology into existing practices, without commensurate investment in examining and reforming the broader practice of government policy and rule creation, these benefits are far from assured. For this to be avoided, RaC must be thought of as a deliberate and strategic response to the challenges facing government. Further, its design and implementation must be carefully considered to ensure that the challenges it seeks to address are mitigated, rather than compounded.

Summary

The preceding chapters have explored the benefits of RaC, its trajectory and varied approaches, as well as the challenges and concerns that could accompany its implementation. Yet, as a fundamentally innovative approach, it is impossible to be certain how things will play out. Given the significance of rulemaking to government, a learning by doing approach suggests itself – preferably one that is agile, experimental and somewhat incremental in nature. However, even such a process can unintentionally create path dependencies from which there can be no adjustment without substantial difficulty. What, then, might implementers need to be on the lookout for? The following chapter uses some scenarios to help illustrate some of the considerations that might need to guide the practical implementation steps of RaC.

7. Future RaC Scenarios

The previous chapter highlights a number of challenges and questions that teams who choose to consider and implement RaC will be required to examine and solve. In reality, an emerging practice will lead to many unanticipated questions and challenges. Just as few could have imagined the vast and incredible opportunities made possible by the provision of the Apple or Android operating systems or Open Government Data, a wide scale adoption of RaC may result in other, currently unimagined possibilities. Equally, just as the rise of digital platforms brought sweeping changes and potential, they also brought significant disruption, for good and bad, to established systems, whether it be housing, transport or media. While these possibilities and ramifications cannot be predicted, it would be remiss not to consider different scenarios, to help expose and test assumptions about how the introduction (or not) of RaC might play out in practice. Accordingly, the following contains a number of **future states** that outline possible scenarios for the adoption of RaC within and across local, state and national jurisdictions, to help illustrate potential implications, challenges and considerations.

Using future scenarios to test assumptions

There is no way to predict exactly how (or even if) RaC will be implemented in any country context, let alone across multiple jurisdictions. Nonetheless, consideration of a range of hypothetical scenarios can be useful in teasing out system dynamics about how the public sector may engage with, respond to, or possibly resist RaC. These scenarios – a carrying forward of certain assumptions rather than static moments in time – provide a means of making those assumptions more explicit and thus more easily appreciated and challenged, as well as helping to highlight where there may be a need for reconsidering action in the 'now'.

The following outlines three potential scenarios to explore the possible use of RaC:

- The **'Zero Scenario'** explores how things might play out if the status quo continues along the existing defaults
- **Scenario One** explores what might happen if RaC is engaged with by governments in a partial manner
- **Scenario Two** explores how things might evolve with a wholesale adoption of RaC.

As a starting point for the scenarios, Box 7.1 provides a generalised overview of the current state of affairs when it comes to rulemaking across jurisdictions.

Box 7.1. A generalised overview of the current state of affairs

Laws and regulations generally fall under one or more of the following categories:

- they are drawn up as a by-product of the policy-making process (and thus are not always fully reflective of the policy intent, because they were drafted separately, disconnected from a deep understanding of the need, and/or have to deal with a policy intent that is not easily mapped into law or regulation)
- they provide an impetus or starting point for policy making (either because a law or regulation expresses the desired policy, and this then needs to be translated into policy and made actionable, or because judicial understanding of a law has challenged existing understandings and policy must adjust accordingly)
- they provide a constraint or parameter under which policy and service delivery must work (though the realities of implementation, side effects or consequences of the law may not have been anticipated, appreciated or understood during the drafting of the law or the political process may have created nuances or complications that are hard to reconcile with delivery or enforcement).

Additionally, in many jurisdictions, proposed regulations often have to undertake a regulatory impact analysis (RIA) process, detailing the potential implications, such as how it might affect certain stakeholders, whether it might impose particular costs, and what the expected benefits might be. In an interconnected system, it may be difficult for a RIA to fully appreciate the consequences of the law, as the 'users' (those affected or governed by the specifics) of the particular law may not be known until after the fact.

No one single actor generally has full visibility or oversight of the rulemaking process, from intent to delivery and impact, particularly as the interconnected nature of different policy domains means that a law or rule in one area may have tangible but unidentified or unappreciated consequences in another.

The subordinate rules and standards derived from laws, regulations and policies are embodied in myriad ways, often including technological systems such as ICT systems built to support and deliver services for citizens (e.g. supporting the taxation system). This occurs as an after effect, generally divorced from the rule creation or refinement process itself, which is determined by political and policy needs rather than service delivery and implementation realities.

Rules act as an enabler for many activities (either by setting the foundation for them explicitly, e.g. by saying 'this is allowed', or implicitly, e.g. by not saying 'this is not allowed') and a constraint (such as by limiting what is acceptable, e.g. by specifying parameters for emissions or waste). Both of these characteristics can drive innovation (limits requiring alternate solutions or approaches, and enablers creating the space for new types of activity).

Finally, rules are ubiquitous and prevalent but are not always necessarily visible or noticeable, having been embedded in decision making systems or rules engines that simply say or dictate what is or is not permissible. In other ways, rules can be highly obvious but also opaque, such as for people or businesses trying to navigate complex bureaucratic processes when they find their 'case' does not fit the usual workflows. In these cases, more comes down to discretion, as the uncertainties or limitations of what was foreseen or accounted for in the initial drafting or subsequent interpretation of the rules are revealed. In certain edge cases, the chances of a 'beneficial' result are determined more by a mix of the experience and attitude of those delivering the service, the aptitude, resources and influence available to the end-user, and some degree of serendipity or misfortune of circumstances, than by any intent that was both distilled and distorted into rules.

The Zero Scenario: Continuation of the current state

Building on the elements described in the generalised overview, the Zero Scenario assumes that many of the current defining features of the rulemaking process and context will continue, with RaC not seen as a major development, but more as one additional approach among others. The scenario carries the default settings forward, to explore what an effective continuation of the current state might mean in practice.

Box 7.2. The 'Zero' Scenario

Ongoing digitisation and digital transformation means that rules are further embodied in and through IT projects, including more and more manifestations of rules from sources including legislation and regulation.

Private actors start to code more rules on their own, such as platform companies having to deal with privacy restrictions and compliance requirements across different jurisdictions, offering compliance-as-a-service to other firms operating in multiple jurisdictions. Private companies in the Fin- and RegTech spaces offer more sophisticated solutions based on government rules coded after the fact. These help firms attain and maintain compliance in their activities without having to provide significant additional attention and effort.

As new technologies and developments occur, they in turn require new laws and new rules. Different jurisdictions either try to shape and limit what is allowed from the outset or take a more laissez faire approach of 'wait-and-see' before potentially grappling with any significant consequences after the fact. Some jurisdictions increasingly experiment with measures such as regulatory sandboxes or regulatory triage, in an attempt to allow learning in controlled ways for priority domains. There are continued complaints from some sectors that the legislative process is too slow or cumbersome for adequately enabling and/or controlling certain economic activities. Consequently, there is simultaneous pressure for further administrative streamlining and simplification, as well as calls for more effective regulation. Legislative processes continue to be used by some vested interests as a tool to try and limit competitors or upstarts (limiting the opportunity for new entrants), and by others as a means to dismantle unwanted resistance or interference (such as workforce unions or regulatory oversights).

Governments begin to introduce additional measures to increase trust in government, but increasing open and real-time data also serves to highlight and illustrate the differing extent to which existing laws are (consistently) enforced. This creates greater demand for initiatives that help the government to demonstrate transparency about how decisions are made, and openness about which rules are enforced and when and for whom. However, these transparency measures are not always believed, with accusations that the 'real truth' is being hidden or that the public are being misled.

The pace and direction of change continues to accelerate and fluctuate, contributing to a radically changing context, which complicates the design and delivery of government services. The gaps between intent and what is enshrined in rules are magnified in some areas as the original intent is translated into an operating context that is continually shifting. This exacerbates any underlying ambiguities or uncertainties. This is manageable for highly competent delivery agencies who have become expert in navigating these discrepancies, but leads to recurrent service delivery failures in those agencies that have neither the capability nor desire to grapple with such uncertainty. Service failures sometimes lead to scandals, increasing the demand for comprehensive reform, including calls for those agencies (or their functions) to be folded into the agencies that have managed to succeed.

A state of flux, where long term visions are hampered by rapidly changing delivery contexts, leads to calls for greater engagement in understanding the problems and drafting the appropriate responses, including rules. At the same time, the capacity for engagement, consultation and revision within the policy and drafting process is sometimes diminished because of the competing demands for responsiveness and action. This sometimes leads to unwanted and unproductive trade-offs, and a lack of faith in the legitimacy of the process and its results.

Some parts of the private sector see the potential benefits of coding rules for government agencies and sell proprietary solutions to individual agencies in order to help them enforce and comply with their own rules. Other agencies investigate partial RaC options on their own and apply them in particular use

cases, but are generally limited in getting buy-in or wider adoption given the incumbency of existing options. One or two jurisdictions make significant progress in embedding RaC, while others test and probe the concept, but this is generally led by 'technology' areas rather than by the policymaking functions. This means that RaC is often a solution in search of a customer, and is competing with an array of other 'solutions'. Some progress is made, but given this occurs as a technical shift rather than as a fundamental policy transformation, the basics of the rulemaking process remain relatively unaffected. Much of the work is done after the creation of the rules and retrofitted to them, rather than ensuring rules are digital from the very outset of their development.

The Internet of Things and the maturation of AI means laws, regulations, rules, and standards become increasingly part of the 'lived' experience and infrastructure of the world, rather than intangible abstracts or things that can be moderated or mediated by the judicial branch. Laws become manifest through digital platforms and automation that abide by laws strictly. This leads to tremendous advantages, including immense real-time data and feedback loops, as well as increased efficiencies and cost-savings. However, these digital systems are not able or designed to cope with ambiguity and provide real-time translation of intent into practice – e.g. the speed limit is X and the car is only allowed to travel up to a speed of X and thus the car will only be allowed travel up to the speed of X by real time monitoring and even enforcement with automated vehicles – making the law much more visible and sometimes intrusive. The law and other rules become hardcoded into human systems and structures, meaning that there is much less discretion or optionality around whether they are enforced or not. In the absence of a more cohesive framework for understanding or engaging with this shift, there is considerable disquiet about how this state of affairs has been arrived at without any apparent democratic debate or scrutiny.

The digital divide also becomes more pronounced, as digital capabilities become important to navigating automated rules. For some, compliance becomes harder, even though they may just be trying to survive or go about their lives. Perversely, compliance and enforcement becomes significantly easier.

Scenario Zero offers some considerations for the implementation of RaC:

- Some form of RaC might well start to happen even without a dedicated effort, coming as an extension of compliance-as-a-service from industry, as the private sector goes to the effort of interpreting and internalising rule sets for its own needs and commercial benefit, before selling this back to the public sector. Such an approach, while common enough in many parts of government IT, could be problematic in leading to a patchwork approach and vendor lock-in for something that should perhaps be a core part of the public sector's digital infrastructure. Care will need to be taken with private sector approaches to avoid lock-in with what is, after all, a public resource (rules).
- RaC could occur as a patchwork as differing experiments and initiatives are taken across differing government agencies, either within or across jurisdictions. While this will lead to significant experimentation and learning, it could also contribute to fragmentation and blunted momentum given differing levels of quality and success. Learning and sharing of experiences across governments will be crucial.
- RaC is one of an array of approaches that will attempt to address the underlying challenges facing government outlined earlier in the primer. While it may have particular advantages, it should not be assumed that these would be sufficient for it to 'win out' by default.

Scenario One: Partial adoption

This scenario envisages conditions favouring a partial adoption of RaC, meaning that a number jurisdictions (i.e. either within countries or even at the country level) test and implement RaC approaches for the production of machine-consumable rules.

Box 7.3. Scenario One

The demands for faster and better responses to the changing operating context mean that some governments announce full-scale trials of a RaC approach, to test whether such an approach would be successful in delivering better outcomes (and silencing or mitigating complaints that not enough is being done). This sees test cases in high-value and/or priority areas, such as welfare provision and business services (such as licensing and accreditations). RaC is led primarily from within the public administration, rather than at the political level.

This approach leads to initial high profile and successful examples, as the test cases chosen are deliberately ones with the highest chance of success and are those most suitable to the application of RaC. They are generally led and supported by enthusiastic skilled teams excited to work on a high profile initiative. The first instances deliver significant publicity and value, meaning there are soon a range of copycat initiatives, some of which spread into areas that are more nuanced or complicated, so that the translation of rules into code is harder. The growing interest also sparks more private sector interest, with vendors introducing options for this market. This leads to a rapid proliferation of different systems, contributing to significant complexity and transaction costs, with the different approaches not easily intersecting or interacting with each other. Some advocates begin to argue for an approach that is, if not standardised, based on shared principles and technologies. Some jurisdictions strongly reject the involvement of private sector operators from the outset, arguing that RaC should be understood solely as a public good, and actually start to reduce the market for vendor rules engines and equivalent platforms, creating compliance-as-a-service as part of the public infrastructure and service offerings. Other jurisdictions see the potential for private sector development and limit the ability of public sector organisations to 'compete' in this market to avoid the risk of crowding out firms.

While there are some successes, these are viewed by many as 'show ponies' rather than truly transformative, and the emergence of some high profile failures (including successful legal appeals against the interpretations encoded into rules in some cases) is taken as justification by some that RaC is merely a fad. The lack of political champions supporting RaC results in a mix of solutions. Some use RaC, others adopt alternative (often existing) approaches. This causes interoperability issues and some government agencies are 'captured' by specific vendors or solutions proponents, meaning their ability to explore alternatives is greatly diminished.

By contrast, some jurisdictions receive a moderate degree of political support and impetus and are thus able to slowly build up their competence and capabilities. These jurisdictions begin to set standards based on a collective, whole-of-system view, rather than those centred on individual organisational or functional perspectives. Over time, this provides a significant advantage as the concept demonstrates more long-lasting gains, leading to international recognition. However, the ongoing support for 'competing' approaches in different jurisdictions means international collaboration is difficult. This hampers efficiency and effectiveness for all of the approaches, leading to some frustration on all sides.

Scenario One illustrates some issues that might inform the implementation of RaC:

- As RaC begins to be taken seriously, it is probable initial efforts will focus on those where the circumstances are most appropriate or conducive for a RaC approach. These initial efforts will thus not be a good guide as to the limitations or to the critical dependencies needed for successful implementation, as they reflect only the most favourable use cases. Care should be taken in the early stages of RaC implementation to set realistic expectations, while also trying to build the case for why a transformative shift is needed.
- There will be potential resistance to RaC, particularly if there is not full and uniform leadership (political and organisational) support behind it. RaC could easily be seen either as an intrusion or

as an unnecessary complication by professionals who do not see the need for a significant shift from existing processes. If RaC is to spread, there will need to be efforts to engage all of those involved in the rulemaking process and to recognise that their support may not be automatic.

- There could be a proliferation of diverging RaC options and solutions, complicating the longer-term embedding of the approach. This may be able to be overcome in time with some form of over-arching technical solution – regardless, the extent of the governance overhead is likely to correspond to the extent to which there is a diverse range of options. A collaborative approach across jurisdictions, that considers interoperability from the outset, could avoid many problems later.

Scenario Two: Wholesale adoption

Scenario Two envisages a more widespread uptake of RaC across multiple jurisdictions and levels of government over time. It assumes conditions that mean RaC will be integrated into the current rulemaking process, with all rules fully embraced as needing to be conceived of as fully digital from the outset. This represents a broad embrace of the concept by the public sector, with commensurately more significant effects. Box 7.4 sets out this scenario in more detail.

Box 7.4. Scenario Two

RaC is accepted and welcomed as a concept with transformative potential for governments and society. Some political leaders see the opportunity for RaC to drive not only a clearer delivery of their intent, but also for it to be done faster and more efficiently. In some jurisdictions, new processes and structures are established to ensure that new and old rules are converted using RaC tools and techniques, soon creating an expectation from industry and other stakeholders for the same to be done in slower-to-move jurisdictions.

Some degree of formal international cooperation and collaboration occurs from the outset, and becomes more sophisticated over time, as different efforts to explore what works continue. At the same time some natural competition and differentiation emerges as various governments recognise the potential advantages of being a leader in RaC. These advantages are both local (e.g. greater businesses efficiencies, more effective compliance, reduced costs) but also global (e.g. soft power advantages from setting global standards and industry spill overs as the approach leads to economic advantages for businesses).

In this scenario, some solid successes occur alongside some notable failures (as new things that do not work as promised often stand out more than problems with the existing methods). Despite these developmental missteps, momentum is maintained as the successes are considered to have proved their worth, financially and otherwise. Industry and community advocacy groups begin to demand better and easier ways for businesses and citizens to understand their responsibilities and entitlements.

The technocratic logic underpinning this implementation of RaC (i.e. a belief that technical solutions can solve political questions) means that some begin to suggest that it is no bad thing for machines to decide a greater proportion of issues, with machines already being delegated to decide or approve a large component of routine things. After all, they say, if it is all appealable and transparent, then what is the problem? There are recurrent debates about the limits of RaC and its (reasonable) uses. Challenges to RaC based-rules and their uses occur in the court systems, ironically aided by the greater clarity enabled by RaC. In some cases this helps to highlight and demarcate the limits of RaC. In others, successes with RaC lead to inevitable overreach, where RaC is applied to areas and situations where it is not suited or where the trade-offs in doing so are extensive. At the same time, the growing implementation of RaC lays the groundwork to make it easier for machines to be seen as trustworthy, as evidence builds to show they are less biased, more consistent and less arbitrary than human decision makers in the application of rules.

As more rules are made machine-consumable, and thus become more easily embodied, trackable and enforceable, the arbitrary nature of many rules becomes more exposed, often leading to the abandonment of some rules where it becomes clear they were punitive or overly bureaucratic. In other cases, there is a ‘doubling down’ on rules, as belief in the signals they send is seen as more important than the particulars of their implementation. This contrast in approaches highlights the ideological and contested nature of rulemaking by the state. As the vague and convoluted becomes clear (“Those are the rules? I never realised”) it becomes easier for the assumptions and beliefs underlying differing sets of values to be exposed, requiring more active deliberation and engagement in attempt to reach democratic agreement.

The advancement of RaC allows for the implications of differing rule sets to be better modelled and simulated, providing significant insight into policy development and implementation. This information also makes it easier to contest different hypothetical policy proposals using evidence, enhancing and expanding democratic debate (though not always making that debate easier). This enables the claims of a government to be held to a higher standard, with modelling tools making claims more quantifiable

and, therefore, more open to scrutiny. Governments and oppositions demand the creation of protected instances of the coded rules to test potential policy options before presenting them to electorates (i.e. as is done in some countries with financial and fiscal modelling prior to elections).

Over time, some politicians begin to be frustrated by RaC as an approach. While many find it beneficial, in that the process of creating rules in a form suitable for RaC helps to ensure that rulemaking is more understandable, others find the necessary upfront investment and deliberation an unwelcome restraint. In some jurisdictions, RaC experiences rollback. In some this is short-lived, as industry complains about the return of associated inefficiencies; in others, populist leaders brook no interference with their ability to enshrine their ('the people's') will in rules, even if that intent is hard to decipher or translate into real outcomes.

Scenario Two suggests some possible considerations for the implementation of RaC:

- No matter the intent, there will be instances where RaC experiences overreach, either because the approach is used in contexts where factors that cannot be anticipated in advance are frequently important, or because the implementation fails to meet the level of ambition. Care should be taken to limit the potential overreach, particularly the more successful and supported RaC becomes.
- There may be some frustrations from the political side if RaC is perceived as involving *new* constraints on the leeway that politicians expect. While these constraints may or may not be different from those that already exist through the rulemaking process, their novelty will make them more noticeable. RaC, as an approach, will need political support and a favourable authorising environment, or risk being seen as an overreach or interference from the public sector.
- Both of these issues highlight the importance of a co-evolution of new governance and institutional forms to match RaC, just as occurred for the current rulemaking process. RaC, as an approach, cannot only focus on the technical side, attention will also need to be given to the broader system, including what checks and balances might need to exist for RaC.

Summary

There is no way to know if RaC will succeed as an approach or if it will be the dominant means of responding to the challenges outlined in this primer. The aim of this chapter is not to predict or prognosticate, but rather to expose and test different assumptions about how the future might play out. Such extrapolations of different starting points can help inform the implementation of RaC, thus giving it the best chances of success if or when jurisdictions decide to pursue it. The next chapter explores the questions of operationalising RaC in detail.

8. Operationalising RaC

This chapter provides some high-level considerations for how governments may choose to operationalise RaC. It considers:

- Who should be involved in the production and creation of RaC
- What rules should be coded
- Principles that could underpin a successful approach
- Practical steps that can be undertaken by actors in different parts of the rulemaking process.

It also provides a RaC checklist for those policy makers considering whether such an approach may be useful in their own specific contexts.

Who should be involved in the production and creation of RaC?

There are a range of actors, from the public and private sectors, who could play a role in producing RaC. Within governments, bodies responsible for legislative drafting, technology or transformation agencies and policy agencies could all lead RaC efforts. This may depend on whether efforts to produce machine-consumable rules are being driven mostly from a legislative or service delivery standpoint, as well as the nature of the RaC initiative. For example, efforts to design principles for legislative drafting that support ex-post efforts to develop RaC may be best led by entities responsible for drafting. However, noting the experience of the most mature RaC initiatives, it remains likely that more than one area of expertise will be required. An approach emphasising the use of a multidisciplinary team and the co-creation of human and machine-consumable rules appears most likely to deliver the innovative benefits promised by RaC. This being true, it may be that governments progressively consider joint ownership of RaC initiatives by several areas or agencies within government.

Additionally, the private sector could play some role in delivering RaC (as a coded output) or by collaborating with governments on platforms or tools. For example, the private sector may develop and deliver some of the technologies required for RaC. Indeed, there are already some commercial companies involved in RaC initiatives with governments. Additionally, private sector actors may themselves take up a role as the creators of RaC style rules in the absence of coordinated government efforts. Rule sets, for example, may be created by private sector entities, before being endorsed by government, either because it helps the private sector to have clarity or because it is a service that private sector firms could potentially offer. Providing they align with the stated principles, i.e. the rules are open, re-useable and transparent, this could be an option for accelerating the growth and maturity of RaC in government. Governments will need to be aware, however, of the potential trade-offs involved with private sector involvement. The risk of commercial lock-in, where one company holds proprietary access to the rules and can unfairly leverage a service or platform, is one such risk. Nonetheless, in the absence of government interventions in this space, it is likely that the market will inevitably generate its own solutions to help implement RaC initiatives. At this early stage, governments may still have an opportunity to shape the design, but also the minimum requirements and standards, of RaC efforts and solutions. However, failure to consolidate work already done may risk losing control of the conversation.

In summary, commercial actors are likely to be involved in shaping the development of RaC. Yet, the contours and impacts of this involvement remains unclear. How and when governments choose to engage

the private sector will create different opportunities and risks, which is an issue that has been explored in the previous chapter (see *Future RaC Scenarios*).

What rules should be coded?

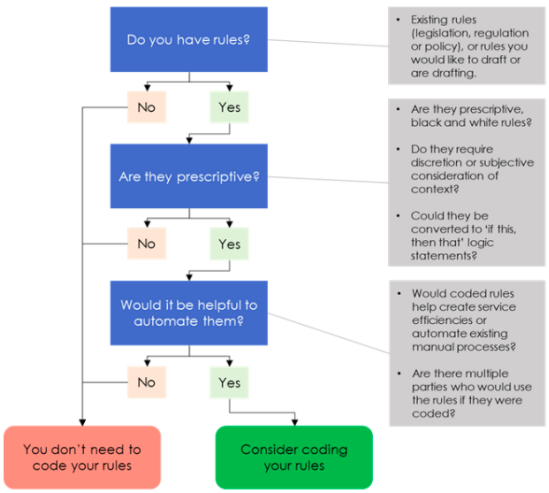
Existing experimentation suggests that rules with certain characteristics are more suitable for a RaC approach, or at least for starting with. Choosing rules with certain characteristics may also help assuage fears about the misuse of coded rules, particularly at the beginning of the process when there are the most unknowns. This is not to say that the 'most suitable' rules will not change over time, it may eventually be that all rules can be at least partially addressed by RaC. For example, these considerations are driven (at least in part) by available technology solutions, which are likely to change and advance over time. Nonetheless, the following sets out some of the key characteristics that have been used to choose rules for various initiatives.

Requiring little discretion, **prescriptive** rules leave little ambiguity about the course of action that must be taken. The prescriptive criterion naturally lends itself to certain types of rules, such as those relating to eligibility and calculation. Such rules are also conducive to the development of IF-THEN statements. While some initiatives are now challenging the encoding of only (or mostly) prescriptive rules, most RaC experimentation to date has focused on this type. Focusing on prescriptive rules may also help reduce concerns about automated decision making, that is, by avoiding the codification of rules that substantively require subjective (and therefore human) interpretation.

Although additional research is required in this area, this criterion may also offer some insight into the type of legal or legislative systems to which RaC is most suited. In the domain of computational law, Genesereth (2015) argues that efforts are best suited to civil law, which allows less scope for normative interpretation and discretion. This is not to say that computational law approaches are not applicable in common law contexts, only that they may be currently more effective in areas where prescriptive rules predominate. He also notes that once 'technology becomes established, it is conceivable that regulators may find advantage in creating more and more categorical regulations, thus enlarging the applicability of the technology' (Genesereth, 2015: 5-6).

Rules that would be **valuable** if codified. These are rules that are likely to offer significant social or commercial benefit, for example, in their capacity to better enable economic activity or reduce business compliance costs. They are also likely to be used **repeatedly** and by **multiple parties**. Such rules are typically suitable for automation or straight through processing, which requires machine-consumable rules. By contrast, certain rules may only be used once or for a limited time. One example is those laws governing the establishment of a statutory authority (Digital.Govt.Nz, 2018). In these instances, the investment of time and resources required for RaC efforts may not outweigh the likely benefits. The New South Wales Government has provided a useful decision tree that can help implementers determine if the rules they are looking to code are suitable (Figure 8.1).

Figure 8.1. Do you need Rules as Code?



Source: digital.nsw, 2019

Of course, identifying these characteristics presumes an earlier decision: whether to adopt a RaC approach for old or new rules (see *Challenges*). Teams will be required to decide whether to focus on existing, high-value rules or to address rules from the outset, that is, for policy or legislation that is not yet in operation. To date, most RaC initiatives have focused on coding pre-existing rules. This seems a logical choice while other questions, for example, those relating to technology choice or processes are explored. As the RaC approach matures, however, the greatest benefit may be derived by applying a RaC approach from the outset, and thus avoiding unnecessary duplication of effort, allowing collaboration and better facilitating data-driven rulemaking (see *Considerations*).

Principles for a successful approach

Drawing on the experience and findings from a number of previous RaC projects, the adoption of a principles-based approach could help to guide the construction of fair, just and effective systems based on machine-consumable rules. Understanding and adopting some or all of the suggested principles may help individuals realise the benefits of RaC, while also reducing the likelihood of adverse outcomes. Consideration of the following principles, for example, could also help inform answers to some of the questions previously described, such as: *What rules should be coded?; Who should code the rules?; What technologies should we employ for the projects?* Drawing on de Sousa and Andrews (2019), a basic set of principles could emphasise:

Transparency – the rules generated by RaC projects, and the processes and thinking involved in their creation, must be transparent for end-users and citizens. This could be achieved by directly exposing coded versions of rules (which would make rules more transparent for technical experts), but also indirectly through front-end applications (which allow citizens to assess their own circumstances in relation to the rules). Such efforts will help RaC democratise access to the law, increase overall comprehension and reduce reliance on intermediate actors. The outputs generated during RaC processes, such as concept models, decision trees, and the actual code, can be made publically available. Draft code for new laws or policy could also be exposed for public comment and suggestion, thereby increasing the potential for *ex ante* stakeholder engagement in the policy process. Finally, when using coded rules to inform tools, such as eligibility calculators, efforts must be made to make these clearly accessible. This will aid the related goal of greater traceability.

Traceability – strongly related to the goal of transparency, the thinking and decisions underpinning the generation of machine-consumable rules should be clearly documented and understandable. Publishing supporting artefacts in the open would aid actors to interrogate and understand the laws with which they must comply. Traceability requires that the coded rules isomorphically reflect the original rules, for example, as contained with legislation or policy. That is, the coded rules are developed in such a way that there is a one-to-one correspondence with their natural language equivalents. This would also allow the coded version of the rules to be audited to ensure the faithfulness of the representation to the original versions. This is also connected to the principle of accountability.

Accountability - part of the value that can be derived from governments publishing machine-consumable rules will result from them being trusted. Efficiency gains are most likely to accrue if third parties are able to trust that the rules provided by governments are correct. For companies to base their regulatory compliance on an official set of machine-consumable rules, for example, they must have certainty that the rules are correct and consistent with the relevant human-readable counterparts. The organisation or entity publishing the rules should therefore be willing to assure the correctness of the rules. This would require that the government is accountable for the coded rules if errors are made.

Appropriateness and Appealability – Appropriateness[31] requires that consideration be given to the question of if a RaC approach is suitable for a given area or problem. This will include determining if generating machine-consumable rules will create value, as well as if available technology solutions possess the required capability. Of course, errors will inevitably arise in the coding of rules. Accordingly, there also must be mechanisms that allow the coded version to be corrected or appealed. Further, to the extent that a jurisdiction chooses to treat the coded version as having the force of law, the importance of mechanisms that allow the subject of the decision to seek a review (undertaken by a human actor) will rise. Options and mechanisms for people to contribute a correction of a faulty rule may also be beneficial. For example, this may be because an error has been made in the interpretation of a rule and its subsequent application. In instances where coded rules are used to support straight through processing or automated decision making, this may also be a legal requirement. For example, the GDPR only allows for fully automated decision making without human involvement in limited circumstances.[32] Ensuring that a RaC approach is appropriate and that there are avenues for appeal should enhance trust in machine-consumable rules and reduce concern over potential misuse.

Further to these, RaC approaches should seek to ensure:

Availability and Interoperability - Rules should be published openly and with mechanisms that enable their consumption by third parties. Opening up the availability of rules for use by a broader community of actors could help spur innovation and enable the development of new applications that use coded rules. While platforms need not necessarily be open source, they should be based on open standards and produce open outputs. This may also help governments avoid the typical problem of vendor lock-in, which can be expensive in terms of cost and other factors such as interoperability. For RaC efforts to be efficient, machine-consumable rules will also need to be made available in formats that support interoperability between technical systems. Placing an emphasis on ‘openness’, whether in terms of technology and/or standards, may help to achieve this objective. Failing to ensure interoperability, by contrast, may reduce potential benefits and possibly increase existing complexity.

Security - governments may need to consider how to secure rules from cyber threats. For example, if a malicious actor were to alter the content of digital government rules, such as those relating to welfare

[31] Public Consultation 2020

[32] The General Data Protection Regulation (GDPR) 22(1) provides that: ‘The data subject should have the right not to be subject to a decision, which may include a measure, evaluating personal aspects relating to him or her which is based solely on automated processing and which produces legal effects concerning him or her or similarly significantly affects him or her, such as automatic refusal of an online credit application or e-recruiting practices without any human intervention’.

eligibility, the results could be serious and detrimental. Here, best practice should apply. There may be some cases where specific instances of coded rules might be preserved for simulation and testing purposes by government. For example, using this technology to test and simulate policy changes (prior to it becoming official government policy) may require specific instances for political parties. Further, if coded rules are being used in conjunction with data, particular care should be taken to ensure the security of the data being employed.

As RaC is an emerging area, it is likely that multiple and competing approaches (technological or otherwise) will emerge. Such innovation will likely be positive and should be encouraged. Keeping a strong set of principles at the heart of all approaches, however, will help ensure the original aims of RaC initiatives are realised.

Practical steps

The adoption of RaC would necessitate change for the processes and people involved in government rulemaking. By virtue of it being disruptive, RaC will create a need for enabling changes to occur both up and downstream in the rulemaking process. Its adoption could involve rethinking how policy is formulated and designed, for example, by opening up new avenues of modelling and consultation. An improved ability to simulate and project the impact of policy changes represents a tool that may become available to law makers. To the extent that RaC initiates are adopted across government, the effect of these forces will be more or less significant. Governments that move early to make their rules machine-consumable may derive advantages, which could give them the ability to dictate (i.e. through standards, best practice) how systems unfold and mature internationally.

This primer has outlined why RaC is needed and the case for its adoption. To better facilitate this, the primer now turns to the practical steps that actors in the existing rulemaking process could take to investigate or even instigate RaC initiatives. Here, this involves considering what action policy makers and regulators, those involved in the legislative process, service design and delivery experts and government technologists could take now, to see RaC implemented and used in the future.

For policymakers and regulators

For policymakers and regulators, RaC could result in a number of changes to the way they create and shape new rules. These could include:

- A focus on a more multidisciplinary, integrated approach to policy making and service delivery, as well as agile methods of policy making, with a focus on iterative improvement.
- Stronger and shorter feedback loops between implementers and policy makers. Policy makers cannot expect implementers to deliver policy outcomes that cannot be achieved with the current infrastructure, but equally implementers need to use this information to improve their capacity to deliver the required policy outcomes.
- An increased emphasis on the use of data and its integration into policy making, as well as the use of *ex ante* modelling to deal with a greater number of known interconnections between different policies.
- An emerging need to understand basic ideas associated with coding (as they are relevant and relate to service delivery implementation).

For policymakers seeking to engage with these changes, and with RaC more broadly, steps that could be taken now include:

- Assessing which policies or regulations within their own field(s) of expertise may be suitable for a RaC approach.

- Identifying mechanisms to achieve greater integration of service design and delivery experts into the policy making process, before the policy is written and agreed.
- Investigating stakeholders' appetite for machine-consumable rules and options for partnerships to test, trial and experiment with approaches for delivering RaC.
- Considering the frameworks, governance requirements and standards that may be required to achieve maximum utility from RaC within the given jurisdiction or, even, nation.

For those involved in the legislative process

Clearly, the adoption of RaC at the initial drafting stage could influence how those involved in the legislative process work. Some of the salient changes could include that:

- Legislative drafters and technologists need to work in tandem while writing new rules.
- Legislative drafters need to adjust their drafting style in order to facilitate the RaC process.

To prepare for, or to accelerate this, interested individuals could:

- Investigate the application of a multidisciplinary, iterative and agile approach to existing drafting methods.
- Investigate methods for better communicating legal matters to non-experts, as well as for improving comprehension of technical terms and concepts.
- Investigate and identify methods of drafting which are more conducive to development of RaC-style rules.
- Examine the types of rules most likely to be suitable for the application of RaC approaches.
- Engage and collaborate with the academic community to consider the potential legal and ethical implications that could stem from the development and use of a RaC approach in government.

For service design and delivery experts

Service design and delivery experts may need to:

- Understand the full limitations of existing systems, and how these could be better configured to deliver the sought after policy outcomes.
- Develop new processes and ways of working that allow for more rapid deployment of services (service updates) as new rules are created and agreed.

They could:

- Work with policy experts to understand the problem space(s) being targeted with a RaC approach.
- Research how RaC could maximise value for the people, businesses and governments consuming a given service, while experimenting with service delivery approaches.

For technologists

Technologists may need to:

- Communicate the technology component of RaC to non-specialists, to bridge the gap between rules and rules as code.
- Test and agree on a consistent RaC approach that guarantees interoperability and moves towards standardisation across jurisdictions.
- Contribute to the research and development of new, open source technologies and communicate the results of these efforts with the broader community.

If technologists wish to start to engage with RaC, they could:

- Understand what the common issues are in terms of legislative requirements that commonly prevent the realisation of intended policy outcomes.
- Investigate technology options that are most applicable in given jurisdictional contexts, as well as those most suitable for the national sphere. This could include fostering the research and development of new technologies.
- Engage and collaborate with the academic community in order to draw and build on research insights, for example, from the field of computational law.

RaC Checklist

The section above provides some practical steps for actors throughout the rulemaking process, who are interested in exploring a RaC approach. The following checklist is for those individuals and teams who are actively considering using a RaC approach in a public sector context. This checklist has been developed from existing literature and from the experiences of teams who have run RaC initiatives.

RaC Checklist			
What is the problem you are trying to solve with RaC?			
Description: (e.g. Have you considered if you're solving the right problem? Do you have evidence of the problem? Is RaC the right solution for this problem?)			
Is your approach...			
☐ Strategic (Initiatives that probe potential RaC approaches and effects)			
☐ Operational (Initiatives designed to result in the output of machine-consumable rules)			
Description:			
Have you chosen a rule set?			
☐ Yes		☐ No	
Are the rules…			
☐ Valuable	☐ Repeatable	☐ Automatable	☐ Mainly prescriptive
☐ Old		☐ New	
Description:			
Have you assembled a team?			
☐ Yes		☐ No	
Does it have…			

☐ Policy experts	☐ Software developers	☐ Legislative drafters	☐ Service design and delivery experts
Description:			
Have you established a set of objectives and principles?			
☐ Yes		☐ No	
Description:			
Have you decided on a technology option?			
☐ Yes		☐ No	
Description:			
Have you decided how your coded rules could or will be used?			
☐ Yes		☐ No	
Description: (e.g. Do you understand user needs?)			
Do you have plans and mechanisms in place to share your learnings?			
☐ Yes		☐ No	
Description:			

Summary

This chapter has highlighted considerations for those looking to undertake RaC initiatives. It has suggested that several actors may be involved in RaC initiatives, but that governments should lead in this area. In examining the issue of what rules to code, it has outlined a number of characteristics that may make certain rules more amenable to RaC efforts. It has also outlined several practical steps that individuals within governments, from policy makers to service design and delivery experts, can take immediately to begin testing or using RaC in their own jurisdictions. Finally, to aid those actively planning a RaC project in their own government context an actionable checklist was provided above.

9. Conclusion

Rules as Code is an innovative concept that has the capacity to fundamentally change the way government thinks about and makes rules. By creating a machine-consumable version of government rules, alongside the existing natural language form, governments may be able to drive better policy outcomes, increase efficiencies and open up new avenues for innovation. Certainly, RaC is strongly connected to the digitalisation of government, that is, it has a strong technological element. Yet, more than this, RaC is a deliberate, strategic approach designed to improve the function of government itself.

This primer has explored what RaC is and is not. It has outlined problems associated with the current state of government rulemaking and how several challenges are leading governments to rethink how rules are created and consumed. In making the case for RaC, it explored the potential advantages that could be realised through its implementation. From reducing the policy and implementation gap to driving innovation, it suggested that RaC could result in a number of benefits for governments, but also for businesses and people. The primer then outlined the various approaches to RaC and the considerations that attend these. It stressed the importance of understanding the long-term impacts of how governments choose to instigate RaC through a discussion of several future state scenarios. Finally, it highlighted a number of practical considerations for those actively designing a RaC initiative in their own jurisdiction.

Certainly, the challenges and unknowns associated with RaC remain significant. Yet, it seems that the transformative potential of RaC is equally great. For governments still early in their digital transformation journeys, an idea with the potential to require the deep reorganisation of government and its operation may seem daunting. Yet, in RaC, governments may have a (potentially time-limited) opportunity to shape the conversation, carve out the contours of the concept's development and define the idea in a way that best meets their (democratic) goals. An unwillingness to explore it now, by contrast, may see it lose this advantage to other nations or have it shaped by private, rather than public, needs.

In the course of the research for this primer, an individual with experience in the legislative process described an almost unthinkable situation. He painted a picture of a Minister seeking to develop amendments to a complex law (relating to digital topics), who was hidden behind mountains of paper scattered across a gigantic table. With her, a group of advisors stood discussing the merits of the proposed changes and desperately trying to work out their potential implications for other national and international pieces of legislation. To achieve this, they were physically searching for relevant clauses across documents, that is, across literally hundreds of pieces of paper. Her question: 'How can we possibly still be doing it like this?' When we have the technologies available to improve the effectiveness of the rulemaking process and the rules themselves, remaining wedded to incumbent ways of working seems wasteful or even irresponsible.

RaC does not promise a panacea that will deliver flawless rules, remove all implementation issues and resolve all democratic trust issues. What it does do is invite a conversation about how we can use technology and innovation to improve the quality of our rules, as well as the processes by which they are made. In this way, RaC represents a starting point for innovators, policy makers, technologists and academics to challenge the status quo and to test, experiment and refine a new way to make the rules that are needed today and in the future.

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