Regsoft

Adoption strategies for Rules as Code

Implementing Rules as Code for traceability and analysing the expected return on investment

About Regsoft

Being compliant should be easy: we want to transform the experience of regulation in Australia to meet the expectations of a modern digital economy.

Regsoft is an Australian-owned leader in Rules as Code (RaC) solutions with over 20 years of experience transforming complex regulations into actionable, machine-readable formats. We specialise in developing scalable, user-centric tools that support compliance, efficiency and interoperability for businesses and governments. We deliver solutions to all elements of the regulation ecosystem and offer solutions tailored to individual needs.

We work closely with regulators and private organisations to transition towards modern technologies, offering guidance at every step along the way. Our combined software- and service-delivery model, supported by channel partners, means we take the effort out of compliance, by automating regulatory and business processes.

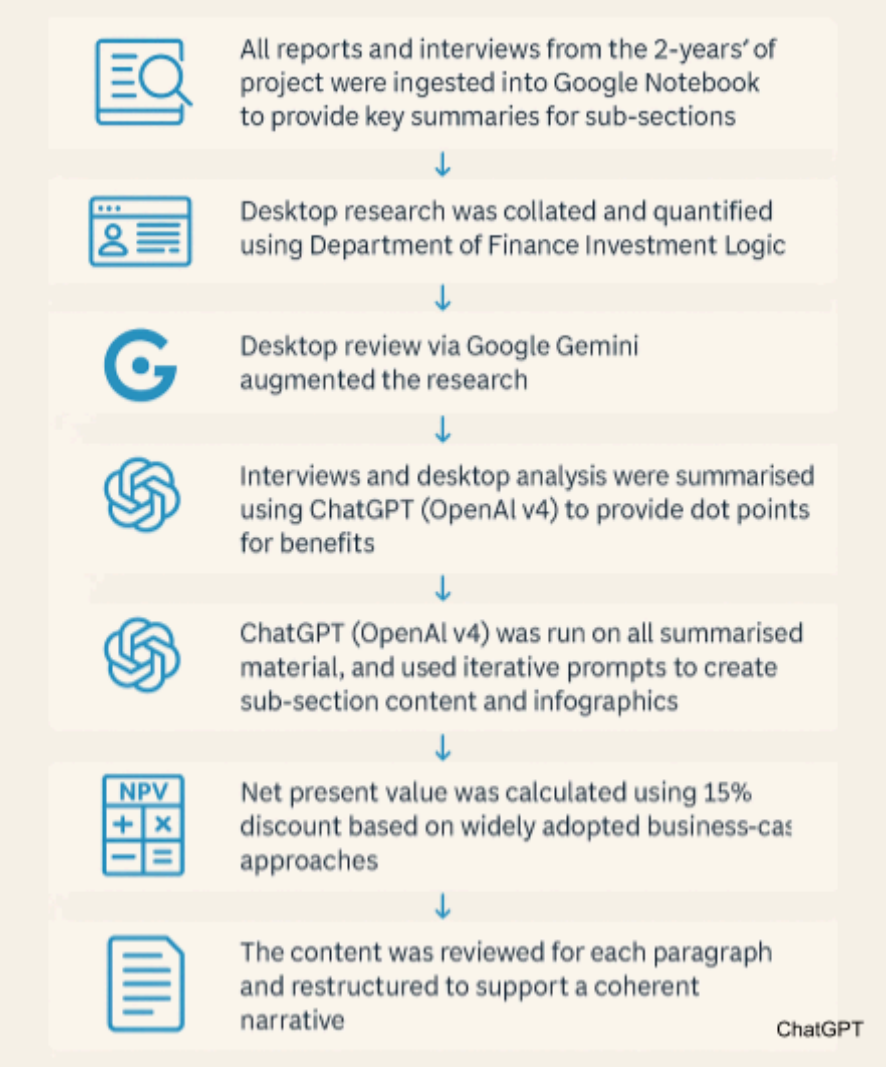
- We encode Australian regulation into executable code. This is sometimes called “rules as code.” We support businesses, regulators and developers to use regulation as a digital asset
- We can also build custom forms to match regulatory requirements to business reports

Acknowledgement of country:

Regsoft respectfully acknowledges the traditional custodians of the lands and waters upon which we work and play.

We are based in the lands of the Ngunnawal people, and we pay our respects to elders past, present and emerging in all lands.

This report was created by leveraging our experience, material developed during the 18 months of this project and work in Australian ICT business cases. We have driven productivity improvements through ethical use of AI to support research, document summarisation and visual prompts.



Executive summary

Rules as Code (RaC) offers a transformative opportunity to modernise regulatory compliance in Australian agriculture by encoding legal rules into machine-readable formats. This enables automated interpretation and application of regulation, bridging the gap between legal intent and digital implementation. It also aligns with the Department of Agriculture, Fisheries and Forestry (DAFF)'s goals of streamlining export processes, improving data interoperability and reducing the cost of compliance.

Key conclusions

Tangible returns with strategic investment

Pilots in the dairy sector indicate that RaC can deliver a positive net present value (NPV) within two years. For an initial DAFF investment of $3.5M, the projected return is $1.2M per annum. A whole-of-agriculture deployment could yield over $130M in cumulative benefits over five years.[1]

Benefits across stakeholders

- Farmers save time and costs ("bottom line") through personalised, automated compliance tools.
- Regulators gain efficiencies in processing, reduced error rates and enhanced trust in data.
- Intermediaries can evolve their business models around verifiable credentials and value-added services.

Strategic fit for complex regulation

RaC is especially beneficial in high-volume, high-complexity environments—making export-focused agribusiness an ideal use case, with benefits shared between producers and regulators. In contrast, simpler, one-off regulatory requirements may not yield the same return.

Governance and co-design are essential

Success requires co-drafting of regulation and code, aligned governance (e.g. DTA AI principles) and structured change management. Transparent implementation and rigorous testing support trust and auditability.

System fragmentation and change resistance remain barriers

Legacy ICT systems, inconsistent data standards and tacit "shadow" processes impede adoption. Change management, investment in ICT and stakeholder training are critical enablers.

[1] Complete methodology breakdown is included from page 32

Strategic recommendations

1. **Commit to a sector-oriented pilot.** In our interviews and engagement across the sector, the main barrier to adoption is a commitment to move beyond small-scale research-investigations: interviewees recommended one or more phased pilot programs.

2. **Start with high-impact, low-risk pilots:** Launch RaC pilots in sectors with strong export value, such as dairy. Focus on digitising traceability standards and automating common permits and approvals.

3. **Invest in open standards and interoperability:** Adopt global data standards and ensure compatibility with national systems (e.g. MICOR, NEXDOC). Promote consistent ontologies to unlock system-wide benefits.

4. **Embed RaC into the regulatory lifecycle:** Build capabilities in regulatory agencies to maintain, validate, and update encoded rules.

5. **Build the business case around export and ESG:** Demonstrate how digitised regulation supports strategic outcomes across trade, sustainability, and consumer trust.

Rules as Code offers a unique opportunity to re-engineer Australia's regulatory landscape for digital delivery. If implemented thoughtfully, through co-design, open standards, and a scalable governance mode, RaC can reduce regulatory burden, accelerate compliance and position Australia as a global leader in digital trade and agricultural assurance.

Regsoft

Table of contents


RULES
AS CODE
NAMBEX

What is Rules as Code?

Rules as Code (RaC) transforms traditional legal documents, such as regulations, legislation, and policies, into machine-readable formats. This transformation allows for automated interpretation and application of legal rules, leading to improved compliance, efficiency, and legal clarity. By encoding legal logic into structured formats using logic-based programming languages, RaC bridges the gap between regulatory professionals and software developers, fostering a more collaborative and efficient regulatory ecosystem .

Benefits of Rules as Code fall into two areas:

- Improved efficiency and increased compliance:
    - RaC reduces ambiguity and promotes consistent application of rules, minimising errors and misinterpretations.
    - Automated rule checking and enforcement facilitate compliance, reducing the risk of non-compliance and associated penalties.
    - RaC streamlines processes, automating repetitive tasks and frees up resources for more complex and strategic work.
- Improved value from regulation:
    - Machine-readable legal rules can be easily accessed and utilised by various stakeholders, including legal professionals, businesses, and citizens.
    - RaC promotes transparency by making rules more accessible and understandable and supports already compliant businesses to access additional benefits, product differentiation and opportunities.

We are often asked **"what about the legal interpretation of the code"** and **"what if the rules are wrong?"** This is where auditability is critical. Test cases allow you to validate every claim in the rules and test that the logic and design is correct.

"But what if the rules are re-interpreted by law?" Often regulation is changed - either by amendment or by additional interpretation. In the same way, new code can be added to the rules, to ensure the RaC matches current intent of documents.

We define Rules as Code as a trusted markup of regulation (rules) in machine-readable format (or 'code'), with a matching data schema that enables automatic evaluation of compliance against these rules. RaC provides the link between existing and emerging data systems and the intent of regulation. RaC has three parts:

1. Defining relevant data fields that match the requirements outlined in regulation
2. Providing rules as linked markup for sections of regulation
3. Aligning the rules through an ontology and vocabularies with processing power

Rules as Code: systems

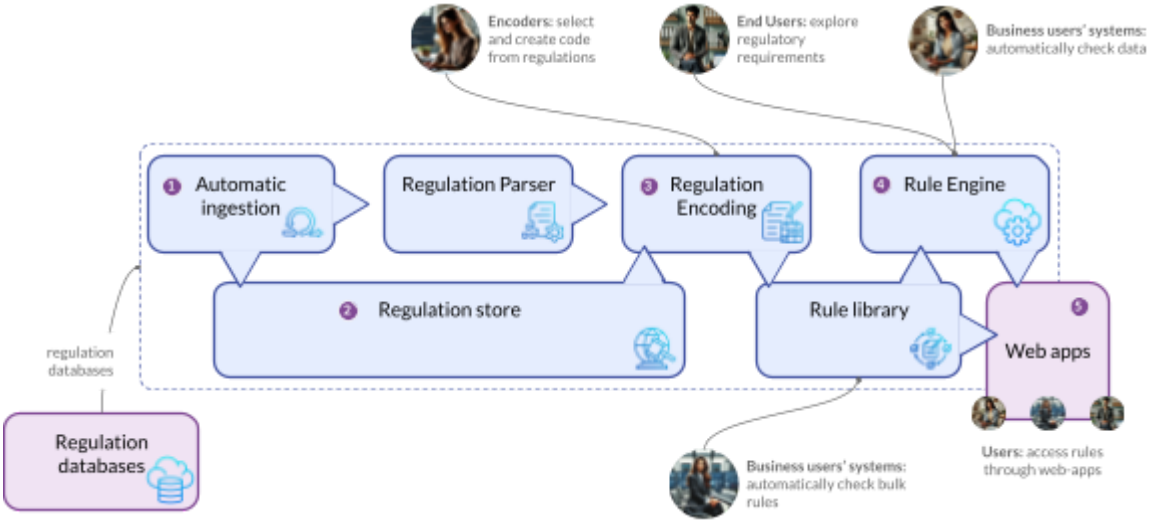


Fig: Rules as code system overview

A standard RaC system includes:

- **Ingestion:** Capturing and maintaining current regulatory text and test requirements, with a regulation store to ensure provenance.
- **Encoding:** Translating regulatory rules into code, via a combination of AI and manual effort, and managing them through a versioned rules library.
- **Rules Engine:** Executing logic against structured business data. Rules are preferably open-source to encourage collaboration and broader adoption.
- **External Access:** Offering APIs for third-party applications and services.

Separating the rules, engine, and applications ensures transparency, flexibility, and avoids vendor lock-in, supporting innovation across the ecosystem.

IMPLEMENTING RULES AS CODE

Implementing Rules as Code (RaC) – A strategic framework for digital regulation

Rules as Code (RaC) transforms traditional regulations into machine-readable formats to improve compliance, efficiency, and transparency. RaC defines regulation as structured, trusted code with an aligned data schema, enabling automated compliance checks and bridging the regulatory-technical divide.

The Whole-of-government Regulatory Policy, Practice & Performance Framework notes that regulation should be fit-for-purpose in a digital era, and sets out a vision for regulation reform:

> *The Australian Government is modernising regulation and improving regulator performance through data, innovation, and stewardship to: ensure regulation is fit-for-purpose in a digital era; protect against regulatory failures; and improve productivity.*

While Australia's regulators and regulations are world leading, continuous improvement is expected, and regulations should align to 6 principles (emphasis added):

1. Targeted and risk-based
2. Integrated in existing systems
3. User-centred
4. Evidence-based and data-driven
5. **Reflective of the digital era**
6. Continuously improved and outcomes-focused

> **Principle 5:** *Regulation should, where appropriate, be delivered **digital first**, both in the interactions between regulators and the community, and in the tools, practices, processes, and skills needed by regulators to perform regulatory functions.* [Dept. Finance][2] Regulators should *"Design the services used by regulated entities to be available end-to-end digital, including collecting information once, providing timely notifications and proactive updates, and to be easily accessed from the places users already go."*

Rules as Code presents a technology-neutral approach to developing end-to-end digital regulatory ecosystems that meet this vision. Leaders should consider three strategic questions before embarking on a RaC initiative:

1. **Regulatory environment readiness:** Is the policy and legislative context conducive to RaC? What incentives or reforms are needed to enable business uptake?
2. **Business benefit:** What are the specific gains for regulated businesses, and when will they materialise? Sectors with complex or high-volume compliance burdens are ideal candidates. For example, our high-level analysis in dairy regulation projects positive net present value within two years.
3. **Return on Investment (RoI):** Can the agency and regulated parties expect tangible benefits within a reasonable timeframe? Early investment may precede long-term value.

[2] Regulatory Policy, Practice & Performance Framework (Framework), Australian Federal Department of Finance, 6 August, 2024.

Co-drafting regulation and code is our recommended model. Legal, policy, and technical teams should collaborate to ensure the coded logic faithfully reflects regulatory intent.

The ideal implementation of RaC involves co-drafting of rules and code by the organisation responsible for the regulation or policy. This ensures that the code accurately reflects the intent and logic of the legal rules and facilitates seamless integration of the rules into automated systems. Collaboration between legal professionals, policy owners and software developers is crucial for successful implementation of RaC.

By making the implementation transparent, and validating the code against the Departmental operating principles and regulatory intent, the implementation can provide better clarity, so that the users of the rules (including business users of software developed using the code) can rely on the implementation.

Implementation considerations:

1. **Transparency and validation:** Validate rule logic against legislative intent, ensuring trust and clarity for users.

2. **System alignment:** Integrate RaC with current workflows, ICT systems, and policy processes. Expect the need for change management to address unwritten practices or reliance on human judgement.

3. **Governance and oversight:** Implement structured governance, formal change control, and documentation. Align with DTA AI governance, including designating accountable officers and rigorous testing protocols before deploying rule change[3].

4. **Phased rollout:** Begin with small-scale implementations to refine processes and demonstrate impact. Prioritise known user and business pain points to achieve early wins.

5. **Support for adoption:** Train stakeholders and internal teams to encourage uptake and proper use of the system. We have outlined the "bottom-line" savings and also the benefits for early- and later- adopters (See: RoI analysis)

6. **ICT governance:** Strengthen ICT governance frameworks (e.g. ISO/IEC 38500) and change control processes to support integration and infrastructure upgrades[4].

7. **Data standards and interoperability:** Ensure interoperability through standards and verifiable credentials[5]. Prioritise compatibility with existing government systems (e.g. NEXDOC, MICoR) and open data exchange formats[6].

[3] We expect that while an AI Accountable officer would be responsible, it is unrealistic to assume a single person can be across every policy and software change in DAFF. Realistically "RaC updates" would need to be built into each policy and regulatory section. This is not a significant cost, as the governance is already in place - for example, while ultimately a single SES is responsible for the content in MICOR, a large section supplies and governs the content in it. Similarly for NexDoc, BICON - a single SES is accountable, but a large part of DAFF already manages and supports changes in it.

[4] The standards should overlap with existing standards development work, Regsoft has made a contribution to the working notes to this effect, and also provided a summary of all public feedback.

[5] We have previously examined the Australian Agricultural Traceability Protocol (AATP), and mapped requirements against the RaC logic.

[6] Open data exchange formats are (open) standards that define how data is transmitted, received and used. The standards define how data should be defined and understood - for example "we use metric, and milk fats are calculated in ml/L" Open standards also imply free (or very low cost). A counter-example for this would be many current Australian standards which require payment before reading. This does not refer to the underlying content -the data content- which might be proprietary.

Regulatory environment: a ready reckoner

The regulatory environment may be viewed through "preferences" for regulators. The extent of business impact for (non)-compliance, the support (or otherwise) of the regulator and industry bodies for RaC and the willingness of the regulator to support a risk-based approach.

Environments that are toward the top of the thresholds, will tend to encourage innovation and adoption of RaC by businesses. In the bottom area, businesses may not benefit from RaC. Between these areas, incentives - such as financial incentives, or exemplary agency behaviour - may support business adoption.

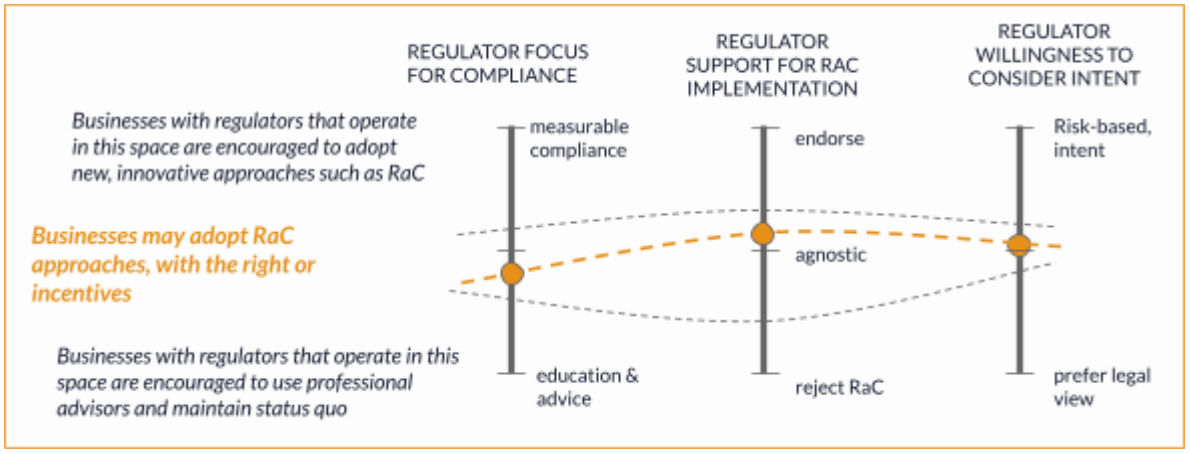


Fig: The regulatory environment. **Reference:** Regsoft DAFF report 1

Business benefit: a ready reckoner

Business benefits may be aligned on a 2x2 matrix for adoption of RaC, outlined in the following figure. The top-right quadrant (green) has all the relevant ingredients to support ongoing RaC adoption. In the two orange quadrants, effort is needed to change either business benefits, or agency processes, to support RaC. The bottom-left quadrant (red) is not conducive to RaC adoption and use.

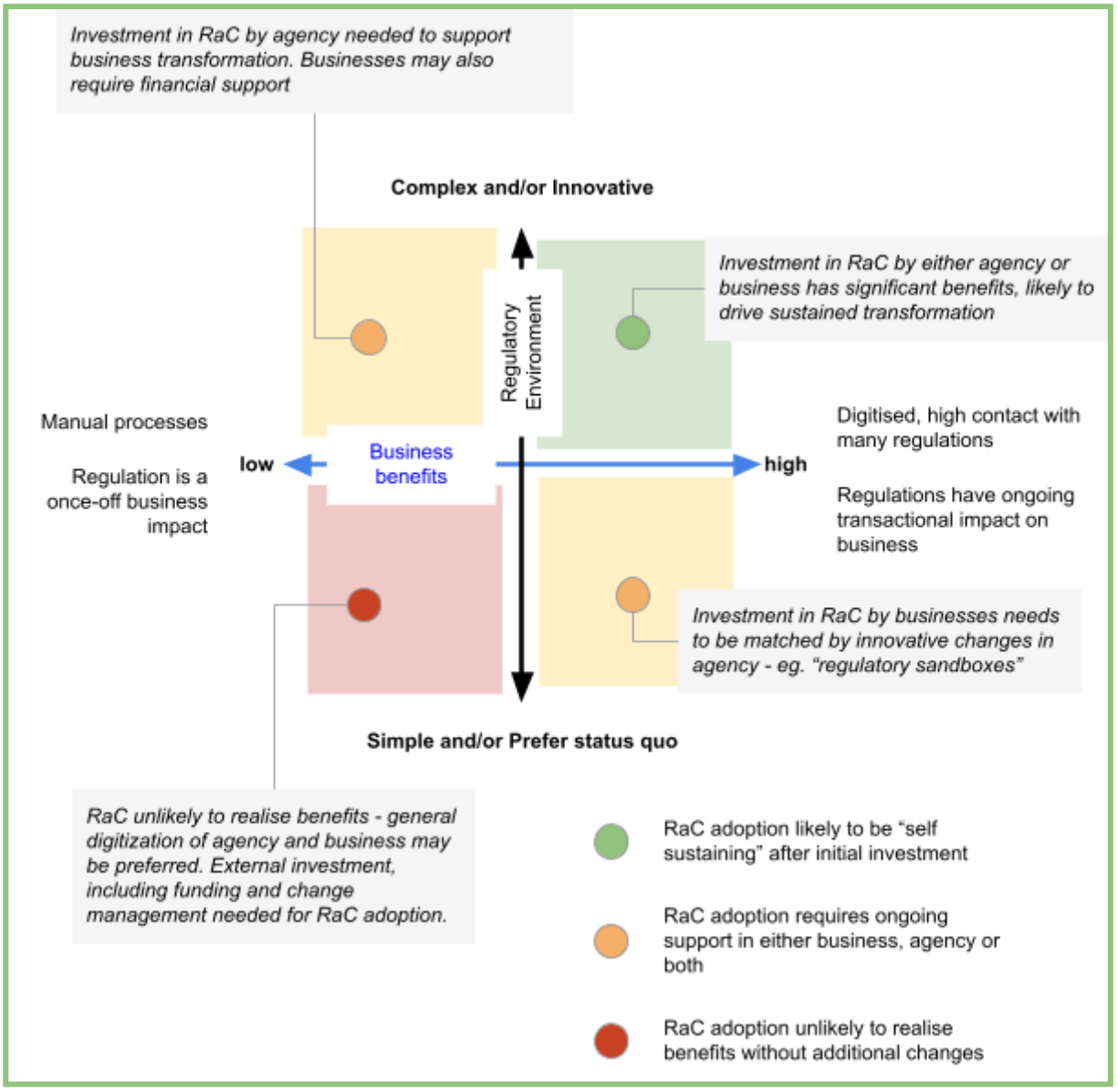


Fig: 2x2 matrix for adoption of RaC.

The 2x2 adoption matrix for Rules as Code (RaC) offers a strategic lens to guide agencies and businesses on where to focus investment and reform. This matrix evaluates the potential benefits of RaC along two axes: the frequency and importance of regulatory interactions for business (low to high), and the complexity or openness of the regulatory environment (simple/status quo to complex/innovative).

High business benefit, high regulatory complexity (quadrant 2):

This is the most promising setting for RaC. Businesses face frequent, high-stakes compliance challenges, such as in export logistics or agri-food traceability, within a complex and dynamic regulatory context. Here, RaC investment yields outsized returns through automation, real-time validation, and reduced compliance overhead. Investment can come from either agencies or industry, with strong mutual benefit. After initial systems are in place, adoption tends to be self-sustaining and scalable, as early efficiencies drive broader uptake.

- **Drivers for adoption in this quadrant:** regulated entities (**industry**) seeking reduced cost and/or improved market access, where specific permits are required.
- **Barriers to adoption:** regulators require change management to support digital 'twins' of regulation. Regulators have current manual costs included in approved Regulatory Impact Statements, which drives inertia.

Low business benefit, high regulatory complexity (quadrant 1):

In this quadrant, regulation has little day-to-day impact on business operations—often limited to once-off or infrequent requirements, yet the rules themselves are complex or evolving. In such settings, RaC adoption is unlikely to be industry-led. Government agencies must lead the effort, both technically and financially, to deliver transformative regulatory services. This may include subsidies or grants to offset the adoption burden for businesses, particularly in sectors where market incentives are weak or diffuse.

- **Drivers for adoption in this quadrant:** regulators seeking to improve efficiency (e.g. more approvals/permits for the same time/effort) and/or reduce cost of audits.
- **Barriers for adoption:** limited market drivers, a focus on "bottom line" for businesses, which does not consider regulatory burden. Regulators must lead change here, which requires significant change management.

High business benefit, low regulatory complexity (quadrant 3):

In cases where regulation is simple but compliance needs are high-volume (e.g., digital licensing, recurring reporting), businesses may lead RaC implementation to streamline internal processes. However, this needs to be matched by regulatory innovation—such as the use of sandboxes, co-drafting frameworks, or flexible enforcement models. Without corresponding reforms, the agency risks becoming a bottleneck, limiting the full realisation of RaC's potential benefits.

- **Drivers for adoption in this quadrant: regulators** seeking to improve efficiency (e.g. faster responses) and industry seeking to reduce transactional costs of compliance.

- **Barriers for adoption:** limited market drivers, a focus on "bottom line" for businesses, which does not consider regulatory burden. Regulators must lead change here, which requires significant change management.

Low business benefit, low regulatory complexity (Quadrant 4):

This quadrant reflects low regulatory friction and low commercial incentive. RaC adoption here is typically unjustified in cost-benefit terms. Instead, broader digitisation initiatives—like structured forms, APIs, or improved guidance—may be more appropriate. Any RaC activity would likely require external funding, clear use cases, and intensive change management to overcome inertia and fragmented digital readiness.

This matrix provides a decision-making framework to target RaC investments, align expectations, and maximise returns across different policy and industry contexts.

Increasing the likelihood of RaC adoption to become sustainable

It is possible to shift from low business benefit to high business benefit. While business incentives may help initiate a change, on-going incentives are unrealistic. Some key changes in regulatory behaviour can support adoption of RaC where business adoption may be slower[7]:

Making regulatory engagement more frequent, but lower cost:
In some cases, such as with single-case permits, and limited audits, the 'cost' of failing an audit might be considered a normal cost of a non-compliant business. Shifting toward more regular engagements—which can be facilitated by RaC at little-to-no cost for the business—helps to improve the profitability of compliant businesses while targeting early-interventions towards borderline businesses.

Whilst low-cost for business, increasing regulatory frequency requires additional (effective) effort by regulators. This can be considered in 3 ways:

1. **Do more, with a larger workforce:** this is not realistic over time, but it may be considered as an 'early' investment by regulators, to allow minimal process changes, and support early business adoption.
2. **Automate compliance activities:** Transforming RaC on the business-side only is unlikely to drive sustained change. Regulators will need to consider what elements of their current approach can be automated[8].
3. **Leverage RaC data-driven approaches for evidence-based risk assessment.** It is expected that highly compliant businesses, who opt to provide details automatically will require "lighter" interventions, much of which can be delivered automatically, while "borderline" businesses would be expected to need additional reviews - this means regulator activity shifts from monitoring all businesses a little, and focusses on "some" businesses.

[7] Obviously, regulators would not **typically** introduce or create complexity, for the objective of driving RaC adoption.
[8] Some RIS's account for time of regulator staff, and provide this as an input to regulatory funding. This can have a counter-intuitive impact of incentivising a regulator to **not** automate, and thus maintain staff size.

What if: What about the increased regulatory workload?

An increasing efficiency of applications and permits, married with an increasing volume of 'regulatory information' provided by producers could drive an increased workload on regulators. This is a disadvantage for business-as-usual. It is important to observe that Rules as Code adoption refines current workflows - if it doesn't then no efficiency is achieved. We have considered 3 elements to address this:

1. **Automation of major compliance systems:** Current regulatory workloads are created by the processes and technologies currently in place. Automating NexDoc with recommended approvals, and/or triage checks will support automation of compliance testing, by using the data available.

2. **Increased business support from assurance and advisors:** A significant amount of compliance work is not performed by regulators - it is performed by 3rd party businesses, such as assurers. These businesses can also provide support for regulatory oversight, and may also provide data analysis of compliance trends.

3. **Investment in support (outside of technology uplifts) such as change management:** our RoI analysis has assumed an ongoing investment in support for change, which may also be re-directed to support interim additional workforce.

Addressing adoption challenges for Rules as Code (RaC)

Like all technology transformations, RaC implementations face adoption barriers, scope risks, and budget pressures. However, RaC introduces specific challenges because it directly encodes regulatory best practices into machine-readable formats. This requires alignment with existing business processes, regulatory intent, operational norms, and legacy ICT systems.

Unlike typical digital transformations, RaC often exposes hidden "shadow processes," such as:

- **Tacit practices**: Unwritten norms (e.g. "we've always done it this way") that differ from formal processes.

- **Workarounds**: Informal solutions used when systems fall short.

- **Implicit trust**: Reliance on staff judgment and institutional memory.

Codifying these practices requires investment in change management to surface and formalise expert knowledge. As RaC makes previously

informal decisions explicit, it can reveal missing steps or undocumented processes. This can slow early implementation unless properly supported.

This dynamic is illustrated in the "AI sandwich" metaphor—initial tech adoption may promise efficiency gains but quickly reveals underlying manual dependencies and system gaps. *This is not a reason to avoid the technology transformation, but it emphasises the need to address change management, governance and enterprise transformation as part of the technology change.*

Addressing key barriers for Rules as Code

1. **Delayed proof of value:** RaC targets complex regulatory ecosystems with many stakeholders. Meaningful gains often require multiple layers of integration across policies, agencies, and industry participants. This delays early value, placing a burden on first adopters who may incur costs before realising benefits.
   Addressing the barrier: *To mitigate this, a staged, co-developed rollout is essential to sustain engagement and leadership continuity.*

2. **First-mover disadvantage:** In sensitive domains (e.g. payroll), RaC may surface compliance risks, such as underpayments, triggering immediate consequences. While long-term benefits exist, short-term exposure creates disincentives.
   Addressing the barrier: *This can be addressed through regulator-sanctioned "sandboxes" and temporary tolerance frameworks that encourage safe exploration without penalty. In payroll, for example, "best effort" can allow early discovery of underpayment, without triggering regulator intervention.*

3. **Lack of clear compliance metrics:** Where compliance relies on "best practice" or third-party interpretation, the encoded rules risk entrenching the ambiguity. Ambiguity erodes the value of automation.
   Addressing the barrier: *Addressing this requires regulators to clarify obligations, supported by structured change management to explain and validate design decisions.*

4. **Compliance cost-savings, vs revenue-increases:** In a cost benefit analysis, reducing a cost is equivalent to increasing a benefit. However, farming business compliance costs are typically unaccounted for, e.g. time used at night on paperwork, while mechanisms that increase revenue (and grow the business) are of interest. RaC is often presented as a cost-saving approach.
   Addressing the barrier: *Measure and define the benefit of new revenue sources, attributable to Rules-as-code. This may be achieved by considering currently compliant businesses, accessing or opening new markets.*

Using business-information to advantage compliant businesses:

In our experience, around 80% of business information requested on any form/permit from regulators is related to business identity, and could be achieved by asking for business information once. Changing regulator information sharing (even within a single agency) can markedly reduce compliance overheads.

Tell-us-once can be misinterpreted as "tell everyone once" with immediate negative reactions of

inter-governmental data sharing - the implication of privacy and confidentiality must be considered in the context of shared information. However the adoption of Tell us Once approaches are becoming more common, and also referenced in the National Agriculture Traceability Roadmap:

- Reducing the amount of "administrative" details provided by the same business to the same regulator - for example, submitting the full business details and reasons for export, for every export certificate, can be avoided.
- Businesses will form small communities of practice that support data sharing where this drives clear business benefits and
- Government sharing of data can be framed as voluntary - in a similar manner as GovID supports personal information sharing between agencies.

We have used our AI technologies to provide rapid-review documents for data sharing and business-information sharing, in the agricultural sector. These are attached[9].

We also envisage businesses using common ontologies[10] to cache their business data prior to submitting it, allowing the data to be reused without the owner having to manually re-enter it.

[9] See: "03- AI - Agriculture Regulator Business Information Sharing" and "04 - AI - Agriculture Data Sharing Challenges"
[10] Businesses may use a "common" ontology in the same way we speak a common language - businesses can choose to share the information, or keep it entirely confidential

Key changes in regulation

We note key regulation changes to support adoption:

1. **Harmonised, standardised**, product codes
2. Digitising means **open and free** templates, standards and systems
3. Make regulatory compliance **digitally falsifiable**

1: Harmonised and standardised product codes

A harmonised and standardised product coding system is fundamental to the successful implementation of Rules as Code (RaC) in agricultural traceability and trade compliance. The absence of precise, machine-readable product identifiers limits the ability of regulators and exporters to automate the application of complex rules, especially when those rules vary by jurisdiction, processing method, or product composition.

A harmonised and standardised product coding system is fundamental to the successful implementation of Rules-as-Code (RaC) in agricultural traceability and trade compliance.

Current global classification systems such as the U.S. Harmonised Tariff Schedule (HTS) or Australia's version of the Harmonised System (HS) provide a foundational taxonomy for trade but lack the necessary granularity for detailed regulatory enforcement. For instance, meat products may be categorised as "beef, bone-in" under HS codes, without distinguishing between cuts (e.g., sirloin vs. brisket), processing (e.g., vacuum-packed vs. frozen), or additional criteria (e.g., Halal-certified, organic). However, regulations—such as biosecurity restrictions, tariff exemptions, or food safety rules—often apply only to specific subcategories. Without fine-grained identifiers, applying these rules as code becomes infeasible or error-prone.

By contrast, systems like GS1 offer globally interoperable identifiers such as GTINs (Global Trade Item Numbers) and GLNs (Global Location Numbers), which can encode detailed product, location, and actor information. For example, in a dairy export scenario, the GTIN could differentiate between a 1-litre full-cream milk carton with a specific shelf life, packaged at a certified facility, versus a lactose-free variant with a different processing standard. Using standardised codes, Rules as Code platforms can automatically validate whether a product meets the specific criteria for export certification, biosecurity declarations, or market entry under bilateral trade agreements.

This is particularly relevant for processed foods or value-added commodities. A tomato sauce made in Australia using locally sourced organic ingredients may be eligible for preferential access under a free trade agreement, if, *and only if*, its constituent ingredients and origin are proven. A standardised product code linked to verified data (e.g., from IoT sensors, audit logs, or certification databases) enables this compliance to be automatically assessed, without manual paperwork or regulatory uncertainty.

Standardisation is also vital for detecting and managing risks. For example, in the event of a food recall or disease outbreak, being able to trace a specific batch of minced meat, by type of processing or a consignment of leafy greens back to its source relies on consistently encoded data. In a Rules as Code framework, this allows for real-time regulatory action—blocking exports, notifying trading partners, or triggering inspections—with speed and precision.

Ultimately, without harmonised product codes that reflect the real-world complexity of agricultural goods, Rules as Code cannot deliver its promise of transparent, auditable, and automated compliance. Standardisation transforms product data into regulatory intelligence, enabling digital regulation that is scalable, secure, and export-ready.

An example of the 'coding dilemma'

> Currently the Australian Department of Agriculture has 'standard' export dairy product codes which are built for a legacy system using a coding format of 'DC-xxxx[*]' where "DC" standard for "Dairy Code" and 'xxxx' allows for integers from 0000 to 9999, and there is an option for an asterisk, for special cases, (ie, 20,000 possible combinations). This does not align with:
>
> - Food Standards Australia codes (domestic),
> - ABS (domestic statistical) Australian Harmonised Export Commodity Codes which are also used for export
> - USA Harmonised codes - widely adopted throughout the world.
>
> The "Dairy Product Code" aligns to NEXDOC, and as such every exporter must use the code (or pay a supplier who has developed a legacy system to use the code). The barrier to change for this is both the legacy design of NEXDOC, and the **small** number of incumbent software suppliers who provide NEXDOC services to farming businesses. The (interim) solution is to ensure that the export permits align to existing standards, and accept coding that aligns to the legacy NexDoc system codes.

What if states and federal agencies don't agree?

A common concern for RaC is "but, what if the states don't agree with the data formats, or the federal rules?" In part, this comes from the (incorrect) picture that regulation is homogenous, and universally agreed from federal through state to local. Change might be problematic if this were true.

However, State regulations don't align with Federal, and very few jurisdictions agree on reporting. RaC is ideally suited to this scenario, by considering precedence:

- Rules are a combination of local requirements, policies and a patchwork of agreed behaviours. They are not "general" nor is a common set of rules "applied universally for all"
- Local data measurement requirements can be combined to build whole-of-system data reports, and can even be aligned to international requirements.
- Where data formats do not align, the underlying metrics, or relevant common measures can be combined and the rules themselves can transform data to meet local requirements.
- This means that where permission occurs under various, and sometimes contradictory rules, the same permissions and prohibitions can be encoded into RaC.

2: Digitising means (open and free) templates, standards and systems

One of the most critical enablers for widespread adoption of Rules as Code (RaC) is the capacity of regulatory agencies to deliver rule updates in formats that machines, and software developers, can directly use. Today, most regulatory change is communicated via traditional means: public notices, PDFs, amended text on legislation websites, or regulator circulars. While these may meet legal publication obligations, they are not sufficient for a digital-first ecosystem where real-time, automated compliance is both possible and expected.

To unlock the full potential of RaC, regulators should publish change notifications and rule updates in machine-readable, structured formats. This means adopting consistent, open formats such as JSON or XML that are capable of supporting "diff" versions (highlighting changes between versions), metadata tagging, and version history. Just as developers rely on source control systems like Git to track changes and trigger updates downstream, regulators can provide the same capabilities for regulatory logic.

Imagine a scenario in which a change to milk-fat compliance thresholds is issued. In today's world, this might take the form of a new PDF posted to a website or a technical standard revised quietly in a manual. By contrast, in a RaC-ready system, the regulator would publish a structured diff indicating that the threshold for compliance changed from "<1.5 mL/L" to "<1.2 mL/L." This diff would then be ingested by compliance engines across farms and authorities, automatically updating dashboards, alerts, and audit tools—without human intervention or misinterpretation. The rule change becomes instantly actionable, verifiable, and testable.

If the rule was changed "back" the same process would apply. This provides provenance and traceability of regulatory changes.

However, structured change notifications are only one part of the puzzle. Digitising regulation means more than tagging legal clauses. It requires a deliberate shift toward open, reusable legislative infrastructure, comprising templates, standards, schemas and systems that support the encoding, validation and testing of regulation in its full lifecycle. To validate and test rules, we must publish and maintain machine-actionable regulation alongside real examples, such as canonical datasets, positive and negative test cases, and processing logs.

These components form the unglamorous but essential backbone of digital regulation. They allow regulators, businesses and developers to assess how a rule should behave across typical and edge-case scenarios. Without them, regulatory logic remains theoretical, difficult to trust and even harder to implement at scale.

At present, many agencies, even those promoting open data or transparency, maintain closed implementations of regulation[11]. This might involve exposing summary logic through a user interface, while the actual processing code remains proprietary or obscured. In the RaC context, this creates significant barriers to adoption. It undermines the credibility of encoded rules and stifles innovation by limiting access to the rule logic itself.

The alternative is an open digital legislative asset model. In this model, regulators treat encoded rules as public infrastructure, akin to publishing legal text itself. This includes:

- Versioned rule sets with traceable provenance to specific legislative instruments.
- Reference data schemas that specify the input and output fields used by the rule logic.
- Validation suites containing test data and expected results for both compliant and non-compliant scenarios.
- Execution trace logs that demonstrate how a rule reached its decision across representative cases.

Such assets need not be manually constructed each time a regulation is passed or updated. They can be generated as part of the regulatory development lifecycle—through co-drafting processes that combine legal, policy, and technical input. In jurisdictions where legislation is developed iteratively, these assets could be built in parallel to traditional instruments, allowing both transparency and technical deployment readiness.

Importantly, these digital assets should be open and freely available. Just as businesses can view the text of the law today without paying for access, the executable logic of that law (as expressed through RaC) should be equally accessible.

In practical terms, this means regulators must think and operate more like digital service providers, adopting practices from software engineering and data governance: publishing API documentation for regulatory logic, providing changelogs and release notes, maintaining backward compatibility where possible and supporting a user community of compliance tools, auditors, developers and businesses. This is a different model of regulation to many Australian regulators[12].

Ultimately, the goal of RaC is not just to convert law into code, it is to make regulation more trustworthy, testable and transparent. Structured change notifications and open legislative infrastructure are the mechanisms that deliver this. They shift regulation from a static document to a living service, one that evolves alongside policy and industry and one that can be validated, challenged and improved with every update.

With these enablers, a step change is possible: rules that can be embedded into software, tested before deployment, and instantly updated when the law changes. This is not just better regulation, it is regulation that works at digital speed.

[11] We are aware of 4 Australian federal agencies, and 3 Australian state government agencies who have all adopted "open source" rules as code, but who have not opened their rules which violates the principles if not the license requirements of the AGPL license of the particular codes.
[12] It is not unique in the world - EU, Irish and several Scandinavian regulators have a similar approach.

Scenario: what if the rules are mis-encoded

Questions for RaC encoding often relate to possible issues with the code:

- What if an incorrect numeric value is entered in code? (making the regulation incorrect)
- What if the code needs to be updated (or rolled back?)
- What if producers can't (or won't) provide the level of information required to meet a specification?

The typo in the legislation

In June 2024, the Australian Department of Treasury acknowledged that "drafting errors" had created issues in the Delivering Better Financial Outcomes bill. The errors were unintentional and had "*nothing to do with the government's policy direction*"[13].

> *The error, acknowledged by Treasury officials, was introduced during amendments to the bill. It inadvertently removed the legal basis for commissions on general financial advice, a long-standing and integral part of the business model for many financial advisers and insurance brokers.* ***If enacted as written, the legislation would have forced a dramatic and immediate overhaul of the industry, impacting how a wide range of financial products are sold and serviced.***
>
> *The mistake was quickly identified by industry stakeholders and reported in the media, prompting an immediate scramble by the government to assure the sector that this was an unintentional drafting error.* ***Treasury officials took responsibility for the mistake, stating it was an "error of an official's making" and was missed during the final quality assurance checks involving both Treasury and the Australian Securities and Investments Commission (ASIC).***

The key points here are relevant for a RaC implementation:

1. Everyone makes mistakes;
2. Open review of legislation - "identified by industry stakeholders" drives improvements;
3. Changes to mistakes can be made easily, although they rarely appear in news headlines.

What if an error was made in a coding regulation?

It's important to understand that RaC would be implemented in an open visible system in the same way the legislation is visible on legislation.gov.au, provided by the Office of the Parliamentary Council. A full RaC development should not be hidden in proprietary systems, or on "local" servers. In this scenario, a rule update could be made in error. In this case a few additional governance systems would be at play, in addition to the ones already in place above:

- Test-driven design: changes in the rules would run through many (thousands of) test cases, to ensure that the intent of the rules matched the output of the code. This would also provide evidence that "something" hadn't been accidentally erased.

- Early-test roll out: API suppliers often provide "advanced" tests of APIs and allow "roll-back" based on user feedback. This is similar to government grandfathering clauses, to allow

[13] See Professional Planner, Jun 2024 "Treasury takes fall for DBFO drafting errors"

business time to change and providing white-papers or drafts. Unlike drafts, businesses can apply new rules to their existing software and instantly evaluate the impact of changes, rather than waiting for an advisor to interpret it.

- In the case of a typo ("1.2mL vs 1.2L") such as occurred for Treasury, test cases and early ("draft") release would immediately flag issues in the regulation. This could be assessed and either accepted as intended, or corrected.

A quick side-track into modern (web-based) computer programs

In previous-era software systems, updates were coded into complex monolithic systems, and deployed via downloads and/or upgrades. These were large, required significant review, and in extreme cases required the services to be turned off whilst the upgrade occurred. Modern web-applications run over the web - connecting to various services and remaining up-to-date in real time. "Updates" to such systems - like updates to web-pages occur rapidly, and do not require significant change to operating services.

How is RaC rolled back?

RaC handles regulatory updates through the same amendment process as traditional regulation, but delivers them digitally. Updates are pushed via approved services, automatically notifying business systems, similar to a web subscription. Local rule copies are updated instantly without manual intervention. Where "roll backs" occur, this can be treated in the same way as "roll forward"; every update looks the same to business software.

Why this is better than current practice:
In traditional systems, each business (or technology vendor) must interpret and implement regulatory changes independently, often causing delay, inconsistencies and additional cost. For example, payroll updates require every payroll vendor to rewrite code, to distribute patches and to inform users.

With RaC, a central rule set is maintained and shared. All compliant systems read from the same source. If a critical parameter, like allowable milk fat, changes, systems can flag the update immediately, trigger alerts and adjust workflows. This ensures faster, clearer compliance at lower cost, with far greater precision than relying on newsletters or passive notifications. Regulators can put notices forward that allow parallel use, that is "future planned" regulation and "current in force" regulation. Producers can easily verify the exact impact this will have on their own business.

3: Making regulations measureable

Regulation works when it can be tested. In science, this principle is called falsifiability—the ability to prove whether a claim is right or wrong using evidence. This is the difference between measurable rules and generic advice[14].

Today's food safety landscape often relies on non-testable "best practice" advice. For example, ACT Health recommends consumers "plan your shopping" and "check the use-by dates." This sounds reasonable, but what does it mean in compliance terms? If a consumer buys an expired product, who is responsible? Is the retailer in breach? These are not enforceable standards—they are suggestions.

This vagueness is built into the system. Australia's Food Standards Code 4.2.4 requires food safety programs to be "documented," but offers no standard for content or format. In practice, this means a sticky note could qualify. Without clear thresholds or validation criteria, compliance becomes a paperwork exercise, not a public safety measure.

Some jurisdictions try to fix this with templates. NSW, for instance, offers a 94-page manual for small dairy producers. It must be printed, filled out by hand, and verified by auditors. This imposes administrative burden without measurable safeguards. By contrast, Rules as Code offers a scalable pathway to remedy this, by turning well-meaning advice into enforceable, measurable safeguards.

What about producers' concerns in codifying best practice?

A common view in our interviews (outside producer communities) was that producers would reject any regulatory changes from implied local expertise, to documented, codified approaches. There is some nuance to this:

1. Producers often complained of "regulation that is not fit-for-purpose" such as recording heavy vehicle movement times manually in log-books, when moving across a road (minutes), where the regulation is designed for long-haul trucks. Creating additional reporting burdens in such cases is unlikely to encourage uptake.

2. Producers (particularly niche providers) noted that "general" and "best practice" advice presented a risk of so-called green-washing or organic-washing, where the specifics of what defined "green" or "organic" was left to suppliers.

We found that where clarity provided a business benefit (e.g. differentiation or reducing need for reporting), producers were more likely to accept it. Where clarity drove new measurements, and had no measurable benefit, this was less likely to be supported. We also found that smaller, more competitive businesses appreciated the use of explicit (non-mandatory) tests to confirm they were operating at best practice. This drives different approaches to support codifying:

[14] "Best practice" can highlight an intended outcome, or summarise implicit knowledge, but, without auditable (verifiable) details, it can easily obfuscate a lack of accountability. This was similarly noted in the Banking Royal Commission: *"Industry codes are expressed as promises made by industry participants. If industry codes are to be more than public relations puffs, the promises made must be made seriously. If they are made seriously (and those bound by the codes say that they are), the promises that are set out in the code, [...] must be kept. This must entail that the promises can be* ***enforced by those to whom the promises are made..."*** Without a clear definition of best practice" we would ask "how can it be enforced?"

1. Where “general” regulations (such as vehicle movement) create burdens that are unintentional. The specifics of the vehicle distances can be automated to ensure reporting is compliant but not burdensome.

2. Finding regulations where guidance risks commercial differentiation (“organic washing”) and providing clear differentiation between what “is” and “is not” organic

3. Providing “equivalence” to guidance. Providing easy, non-mandatory tests which can validate that a producer is performing at best practice. This encourages self-assessment for businesses without demanding the assessment.

Case Study: Biosecurity - moving from guidance to falsifiability

Prior to 2015, Australian biosecurity was handled through the Quarantine Act of 1908, which relied heavily on broad guidance, decentralised enforcement and patchy coordination across states. The system was outdated, reactive and lacked strong risk-based, enforceable standards. The 2008 Beale Review, among other assessments, emphasised Australia's heightened vulnerability to pests and diseases and the need for a unified, risk-based framework. These internal reviews called for a shift toward clear, enforceable, national regulation. In response, the Biosecurity Act 2015 was passed, repealing the 1908 legislation. Key changes include:

- Risk-based import controls for all goods, vessels and passengers entering Australia.
- Stronger compliance powers including inspections, border seizures, biosecurity prohibitions, and steeper penalties.
- A single, integrated legislative framework replacing fragmented regulations across states.

The federal Department of Agriculture led a structured change process:

- Stakeholder engagement with farmers, industry groups, states and exporters.
- Clear transitional provisions and compliance grace periods eased adoption.
- Training and outreach programs helped farmers and businesses understand their new obligations.
- An emphasis on evidence-based enforcement, aligning penalties with assessed risk levels.

The Act solidified Australia's “unacceptable risk” standard, enabling proactive controls. Farming and export industries gained clarity; expectations and responsibilities became unequivocal. While it introduced new compliance costs, the regulation is widely seen as justified by stronger biosecurity protections, for example, during the COVID-19 pandemic and in managing plant/animal pest incursions.

Key changes included:

Element	Before (guidance-based)	After (prescriptive, encodable)
Framework	Soft guidance, fragmented enforcement	Risk-based, unified legislation
Compliance	Informal, variable across regions	Enforceable, with clear penalties
Clarity	Ambiguity, ad hoc interpretation	Codified expectations and duties
Government role	Advisory, decentralised	Centralised, proactive, and empowered

What if producers don't have the granularity in their measurement apparatus to meet standards?

The specification of the granularity of measurement in RaC would have the same force as current regulations and policies.

> *The Food Standards Australian and New Zealand notes that for safe transport of food, "Safe temperatures are 5°C or colder, or 60°C or hotter."*

Creating numeric coding values also allows regulators to define the range of each parameter support, e.g. "at or below 5 degrees, plus or minus 5%" A food transport operator would hardly be expected to differentiate temperature at 4.9999 degrees vs 5.0001 degrees, one of which technically passes FSANZ requirements and the other technically fails.

For any realistic requirement, a producer could choose to automatically measure it (and thus reduce reporting) or where the producer is unable (or unwilling) to demonstrate regulatory compliance through automatic measurements, they would fall back on existing assurance models.

This will drive a lower efficiency for those producers and eventually differentiate efficient producers from those without measurement equipment. This is a normal dynamic in the market. With RaC rules being explicit, new services may arise to address the gap in low-cost measurement devices. We have accounted for this in the RaC return-on-investment by assuming only a small fraction of producers take on the RaC automation.

Conclusion and recommendation

Conclusion	Rules as Code (RaC) enables efficient, transparent, and risk-based regulatory implementation when supported by aligned governance, co-drafting processes, and business-centric design. Its successful adoption depends on strong institutional support, clear change management, and sustained investment in both technology and stakeholder engagement.

Recommendation	Agencies seeking to implement Rules as Code should begin with small, high-impact projects that address clear business pain points, and embed co-design processes involving legal, policy, and technical experts from the outset. To ensure long-term success, agencies must establish strong governance aligned with DTA AI and ICT frameworks, invest in stakeholder engagement and training, and implement robust testing and change control procedures to maintain trust, accuracy, and regulatory integrity.


RETURN
ON
INVESTMENT
MAUREX
MAUREX

Return on investment (or cost-benefit analysis)

Assessing the Return on Investment (RoI) for a Rules as Code (RaC) initiative requires a balanced view of both financial and strategic value. This includes a comprehensive cost-benefit analysis that accounts for initial development costs, expected efficiency gains and long-term operational impacts across regulatory processes. Key economic indicators, such as Net Present Value (NPV), provide a structured basis for evaluating whether the benefits of implementation outweigh the costs over time.

While many benefits are quantifiable, such as reduced processing times, lower error rates and decreased administrative overhead, others are less easily measured but equally important. These include improved transparency, increased stakeholder confidence and stronger regulatory integrity. Together, these impacts support a compelling investment case. The structure for this section is:

1. **Key (tangible) benefits -** we outline the main areas we used to support measurable benefits for RaC

2. **Key (intangible) benefits -** we outline the additional unmeasured benefits of RaC

3. **Investment logic map** - outlining key program benefits and design, including:
    a. Key activities, and enablers (how to design for success)
    b. Tangible benefits
    c. Intangible Benefits
    d. Long-term goals

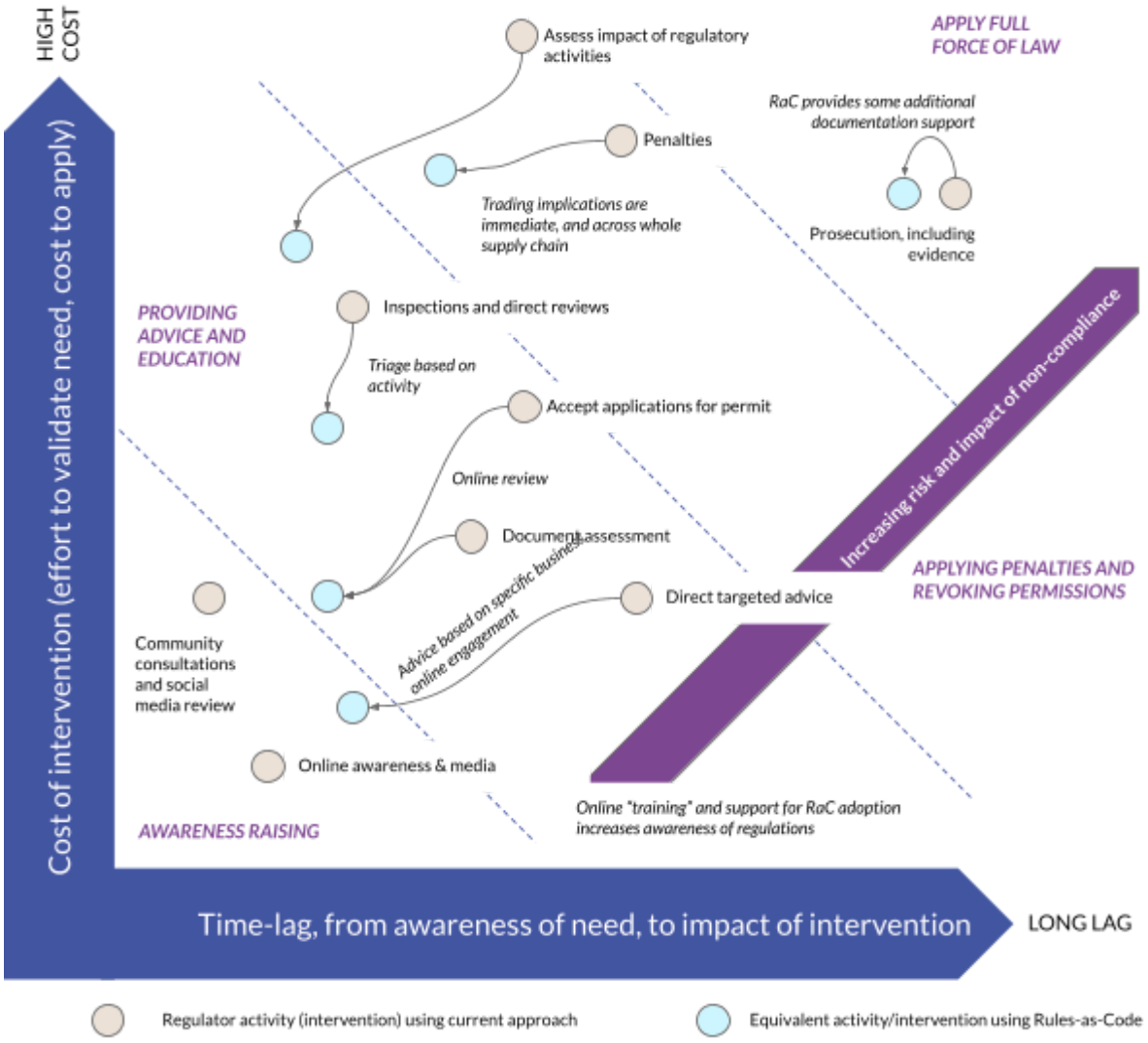
4. **Benefits and beneficiaries** - we look into the types of benefits and the beneficiaries to examine the main drivers and barriers to RaC

5. **Quantified benefits** (RoI)
    a. Dairy sector - the RoI for the single sector is lower, but serves as a demonstrator for next steps
    b. Whole-of-agriculture sector: the return scales with the number of businesses, while the investment cost remains relatively flat, leading to a much larger net benefit.

We consider tangible (quantifiable**)** benefits[15] from a productivity viewpoint:

1. Efficiencies (savings): reducing the time (and therefore cost) in hours of manual or unnecessary effort taken to achieve desired goals
2. Value-adds: being able to achieve previously impossible or difficult activities with new capabilities.

[15] We have been conservative with what is easily quantified. Time saved in a manual process is relatively easy to estimate and validate. Time-saved for an intervention is complex to measure and may not present a significant "cost" saving. Many of the benefits of RaC are value-adds which have multi-factor elements. We have avoided quantifying these to maintain a conservative RoI estimate.



Investment (saving) logic for Rules as Code. RaC provides time savings, and cost savings, for regulatory interventions.

Key tangible benefits

Tangible benefits are based on reduced (manual) workload and/or (manual) effort for compliance. We have not accounted for the reduced risk of non-compliance, as financial penalties for non-compliance are relatively rare.

- **For producers,** spending less manual effort on "compliance" means greater savings:
  - Less manual effort spent entering and recording data for compliance purposes[16]
  - Less manual effort spent responding to audits and/or responding to requests for information.
  - Less manual effort spent addressing and/or providing quality assurance to avoid errors in compliance reports[17]
  - Not included: environmental regulation or planning regulation[18]

- **For regulators,** spending less time on the businesses that are compliant, allows focus on the businesses that 'need' regulation and lowers manual costs:
  - Faster turn around for compliant businesses - aligning with Australian Trusted Trader approaches
  - Faster awareness for "at risk" compliant businesses, reducing the intervention cost to support "minor" issues
  - Less manual effort to address compliant reporting (manual savings)
  - Less manual effort to detect non-compliant businesses (manual savings)
  - Less internal effort to track down relevant regulatory knowledge[19]

Key intangible benefits

Digitisation and automation of regulation

Rules as Code (RaC) transforms traditional legislation into machine-readable formats, enabling automated interpretation and application of legal requirements. This shift streamlines compliance processes, reduces administrative burdens and allows real-time validation of data. By embedding regulatory activity into software systems, RaC supports dynamic rule checking, automated trade documentation and seamless updates to evolving policies. This digitisation makes compliance more consistent, auditable and accessible, benefitting both regulators and businesses, particularly in sectors like agriculture and export logistics.

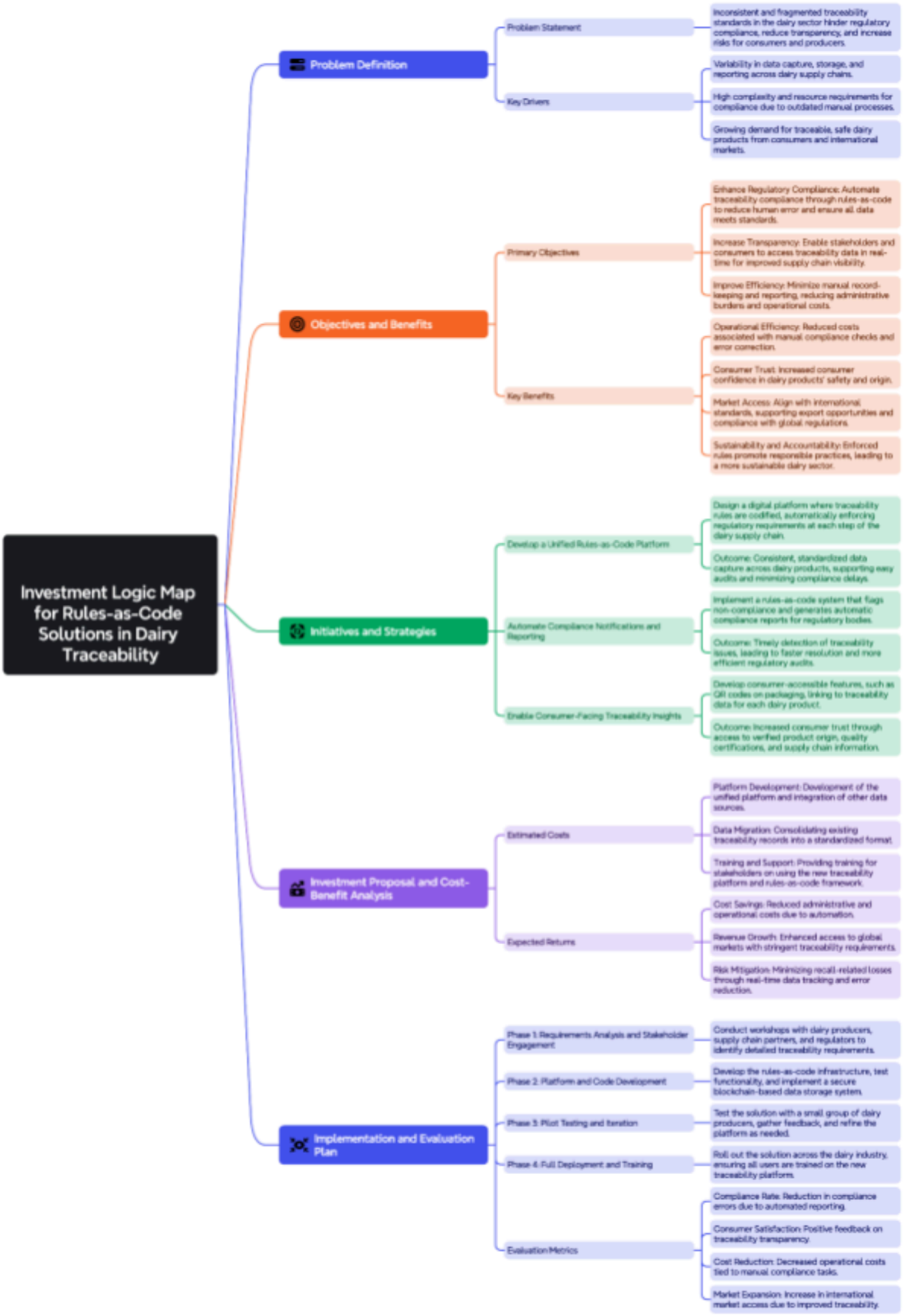
[16] See Productivity commission, review in burden of compliance for agriculture (2013). Record keeping is not only due to agricultural regulations, but also includes heavy vehicle logs due to road safety. Record keeping is often cited as a major burden for farmers.
[17] AUSVEG reported that over 30 percent of respondents indicated they were seriously considering exiting the industry in the next 12 months, and the increasing regulation and compliance requirements, alongside escalating input costs and poor price returns, were confirmed as the main reasons.
[18] All regulation has a natural cost/benefit. We have only considered regulations under the control of DAFF - while RaC can obviously work across regulatory bodies, we have focussed on Agricultural traceability.
[19] In our interviews with BICON team members, and state regulators, significant time is spent finding and reviewing the relevant regulatory details. We addressed this with our Import Assist suggested product.

Transparency, interoperability and market confidence

RaC significantly enhances transparency across the regulatory ecosystem by enabling stakeholders, including businesses, regulators, and intermediaries, to access, interpret and validate rules consistently. By aligning regulatory intent with verifiable data inputs and outputs, RaC ensures traceability, fosters trust and improves the clarity of compliance obligations. Interoperability with global standards (e.g. GS1, verifiable credentials) supports data integration across supply chains, while real-time monitoring and secure data exchange address fragmentation and promote consistency in reporting. These capabilities collectively improve governance, reduce compliance complexity, and enhance market access.

Strategic and economic value creation

The adoption of RaC enables early movers to capture new market opportunities, improve competitiveness and position themselves for future regulatory convergence, especially in export-facing sectors. Businesses benefit from faster access to certifications, adaptive systems for evolving rules and decision-support tools that simplify regulatory interactions. For regulators, RaC improves oversight and facilitates targeted interventions. For both, the outcome is increased efficiency, reduced risk and higher assurance. By supporting ESG compliance, food safety and supply chain integrity, RaC also contributes to broader social and economic goals, including sustainability, circular economy practices and leadership on the global stage.



Investment logic map (Mapify) *The investment logic map is built using a free text-to-mindmap service,*

Mapify. The input text was provided in mark-down and is supplied separately.

Investment logic map

Our investment logic map targets inconsistent traceability standards in the dairy industry by implementing Rules as Code. This issue stems from variable data capture, outdated processes and increasing consumer demand for product safety. The overarching goals are to enhance regulatory compliance, transparency and operational efficiency, leading to streamlined processes, greater consumer trust, global market access and improved sustainability.

The proposed strategies include unifying traceability rules within a digital platform, automating compliance notifications and enabling consumer-facing product data. A cost-benefit analysis weighs development, data migration and training costs against projected operational savings, revenue growth and minimised recall risks. Implementation occurs in four phases: requirements analysis, platform development, pilot testing and full deployment. Success metrics include reduced compliance errors, improved consumer satisfaction, decreased operational costs and market expansion opportunities.

The investment logic provides the context for a return-on-investment analysis. This promotes a robust, transparent and efficient adoption of traceability and Rules as Code (focussing on the dairy sector) to meet evolving regulatory and consumer expectations. It ensures better alignment with international standards and strengthens industry competitiveness.

Scenario: What about other sectors?

The dairy sector was chosen as it has existing traceability regulations, some experience in RegTech (such as Victorian State Government funded projects) and a wide variety of export destinations with varied regulatory requirements. Dairy is also a small part of the whole Australian agriculture industry, providing niche adoption for controlled testing. However, the dairy sector is not uniquely positioned as a pilot.

- Meat (in particular beef) has the NLIS tagging and traceability systems built in. It has also been an area of interest for the Australian Farm Institute. Beef accounts for 39% of Australian farming. A pilot in this sector has benefits (rapid adoption) as well as risks (this space tends to attract a significant diversity of research projects)
- Cropping may be a natural starting point, due to the variation of requirements and limited standards across the sector.

Benefits and beneficiaries

Based on desktop research, including Regulatory Impact Statements, business cases for similar agricultural data sharing and stakeholder interviews, we have provided a high-level analysis of potential returns on investment for Rules as Code. The investment in Rules as Code has two main areas of benefit, with 3 key beneficiaries:

	Business (farms, exporters)	Intermediaries (e.g. assurance)	Regulator (DAFF)
Increased efficiencies/cost reduction	Reduction in reporting, reduced repeated application and reduced time to certification	Efficiencies in assurance can be disadvantages as this reduces time-to-deliver results in a time-based payment service	Reduced cost per applicant (e.g. reviewing) and reduced effort to triage compliant businesses
Value-adds	Access to new information and new markets. Reduced barriers to product development	Comparisons and increased value of certifications (e.g. verifiable credentials combined with Rules-as–Code)	Domestic & international market analysis. Faster access to direct information from producers

Of these beneficiaries, farms and regulators have different costs to adopt any RaC solution. Ultimately, RaC has an early cost to adopt and use, followed by ongoing saving. The costs present differently for the different beneficiaries:

- Businesses have moderate adoption costs, with ongoing fees-for-service.
- For intermediaries, RaC may present a need for different business models. Information brokers in particular are likely to be disrupted by the openness of RaC. However, there is significant benefit for assurance business models that adopt credentials (digital or otherwise) as their primary source of validation.
- Regulators have significant investment costs, with ongoing support for new ICT systems.

Business (producer) investment logic

Producers can expect:

- Early costs - adopting new technology and adjusting the new processes
- Mid-term (after approximately 12-18 months) savings to bottom-line costs - which remain over time
- Long-term value gains - improving access to new markets.

	Business (farms, exporters)	Quantification
Early costs	• Cost to install new services and integration costs such as new data systems and IoT • Training and change management - supporting employees and owners to use and maintain the systems and information • Early-adopter costs: the first adopters of the system may also need to champion the technology to encourage others to use it	Direct ICT costs and staff training costs and support
Mid-term savings	• Reduced time to report (~weeks per year) • Reduced time to market (permits)	Employee time saved
Long-term value add	Network effects (many similar users): • comparison against market averages • information access	Unquantified, highly variable across businesses and sectors

Rules as Code: Reframing compliance into bottom-line savings

Today, producers face growing compliance obligations, shifting export rules, and rising consumer demands. Rules as Code (RaC) turns these pressures into opportunities: automating compliance, reducing costs and accelerating access to markets.

For producers, RaC means:

- Lower compliance costs: Instead of chasing rule updates across websites or relying on manual interpretation, producers using RaC-based systems receive automated updates, cutting time, effort, and risk.
- Faster market access: With export rules encoded in software, producers can automatically check their compliance before product dispatch, reducing rejections and delays.
- Reduced risk and recall: RaC makes traceability real-time and reliable. If standards change (e.g. chemical residue limits), software flags it immediately, protecting your supply and your brand.

- More value, less effort: Data that is already collected (e.g. via RFID, IoT, invoices) is used to prove regulatory compliance, meaning less duplication and less form-filling.

Put simply, RaC-enabled systems do the heavy lifting of compliance. They interpret regulations, confirm eligibility, flag risks and help producers focus on production, not paperwork. According to the National Agricultural Traceability Strategy, full adoption could reduce compliance costs by up to $170 million per year, and add $400 million to $1 billion in export value annually.

For early adopters, this is more than compliance, it's a competitive edge. RaC can unlock access to premium certifications, new markets and reduce the cost of maintaining them. Whether it's ESG labelling, organic certification or halal export compliance, the rules can be embedded into your existing digital systems, ensuring you're always one step ahead.

RaC is not another system, it's a smarter engine inside the systems you already use.

Intermediary investment logic

	Intermediaries (assurance, certifiers)	Quantification
Early costs	• Cost to install new services and integration costs - such as new data systems and security • Training and change management - supporting employees and owners to use and maintain the systems and information	Direct ICT costs and staff training costs and support
Mid-term value	• First mover advantage: early assurance through RaC is likely to drive business benefits for those who adopt it early. • Late adopters are unlikely to see significant gains and may be impacted by commodity approaches. • Increased transparency on reporting and time-to-report	Employee time saved, volume of certifications significantly increased
Long-term value	• Early adopters are likely to build digital business models and capitalise on mid-term value • Late adopters may find the lower margin, high volume assurance drives reduced revenue and increased business risk	Unquantified, highly variable across beneficiaries

Regulator investment logic

Regulators can expect:

- Early costs - adopting and funding development of new technology and adjusting the new processes
- Mid-term (after approximately 6-12 months) savings to manual effort, which remain over time
- Long-term value gains - improving access to information and awareness, driving efficiencies.

	Regulators (Federal and State)	Quantification
Early costs	• Cost to install new services and integration costs, such as new data systems, re-design for legacy services • Training and change management. Supporting staff to use and maintain the (new) systems and information. Staff may also have increased workloads addressing a larger number of applications. • Early-adopter costs: the first adopters of the system may also need to champion the technology to encourage others to use it. Early adopters will not have "full" automation and will incur costs in time and change • Dual systems: digital systems take time to mature and will rely on previous services. Initially, staff may have to use both, increasing the workload and cost.	Direct ICT costs and change management/ training costs and support costs/workload
Mid-term savings	• Reduced time to review compliant applications (~hours per application, per year) • Reduced time to detect problematic applications (ie, triage to human expert) (~days per application, per year)	Staff time saved
Long-term value add	Network effects (many similar users): • data acquisition across markets • information access • market-scale informatics drive whole-of-economy scale changes Possible costs: RaC alteration would fall under the same delegated authorities that are in place (e.g. bio-security forms are approved by a section within DAFF). These teams would need support in approving relevant code-based changes (in the same way that a form is approved, or an update to MICOR is approved)	Unquantified, highly variable across individual businesses

Potential disadvantages are not uniformly realised

The investment in Rules as Code has two main areas of disadvantage, across 3 key stakeholders.

	Business (farms, exporters)	Intermediaries (eg. assurance)	Regulator (DAFF)
Process change cost	Adoption of new technology and processes will incur training costs	Process changes may result in reduced need for current assurance advisories. This may require significant business model change	Adoption of new technology and processes will incur training costs
Ongoing ICT costs	Cost for services and/or technology. Likely to be offset by benefits	Unclear: service costs will reduce, due to ICT, but may be offset by additional support needed.	Cost for change, training and technology. Likely to be offset by benefits

We have also considered state regulators in the analysis.

Federal and state regulators would have similar efficiency improvements, state regulators do not gain the significant benefit of import-export efficiencies. This is a key barrier for state governments. In our diary-only scope, RaC may not provide a net benefit to state regulators.

Because states have a much smaller “catchment” of farm businesses, the same saving per-business does not equate to a large saving overall.

Return on investment

Assumptions for the RoI analysis

Following the logic map, we have made a series of assumptions, designed to provide a conservative RoI analysis. The key parameters for increasing RoI are:

- low (or no) cost to adopt - all benefits, no costs
- high (to very high) uptake - many beneficiaries
- replacement of costly manual effort with low-cost (or free) digital services - large benefits

While each of these would present RaC in a positive light, they are unrealistic and result in an RoI well above reality. Our assumptions drive a lower RoI, which means that real outcomes are likely to be much better than the conservative estimate.

Assumptions:

- **No secondary economic effects:** any benefits or costs are passed to the relevant beneficiary only.
    - For example, a farmer saving $1,000 does not spend any of this in the local community and does not pay additional state/federal government taxes (no secondary returns)
    - This prevents any "double-counting" of benefit. This will tend to under-estimate the economic benefit of RaC.
- Costs and benefits only accrue to the participants in the technology adoption; we have assumed no "crowd" or "free-rider" benefits.
- Costs for adoption of technology occur immediately, while benefits accrue only after a few years. This assumption addresses the uncertainty of technology benefits and addresses the cost to adopt new technologies.
- Farm businesses pay a small annual fee. This covers the natural cost of the services[20]. The cost represents a likely software cost (premium services for accounting vs normal) and the inherent cost of change management for each farm. Reducing these costs (e.g. to $0) will significantly improve the RoI.
- Efficiencies are quantified by time saved x median wage
- Value-adds are quantified by increases in market scope.
- **Net present value:** Costs and benefits are discounted by 15% per year which is a common choice for technology adoption[21]. This accounts for the (lack of) benefits and (reduction in) price which may occur for technology transformation projects. It is far higher than interest rates.

[20] We have assumed a cost of $120 pa for software and $720 pa for ongoing processes updates per farm. Common accounting-only services like QuickBooks charge between $350 pa for normal (basic) software and $550 pa for premium software.
[21] Business models recommend between 10-20% discount for any business case. 10% is a common discount rate for DTA-ICT business cases. We have used a 15% discount rate, to accommodate for the uncertainty in the benefits for the RaC, and to drive a more conservative return-on-investment approach.

- Technology is adopted by 15% of businesses during the pilot. This low number ensures that economic benefits are not overestimated (e.g. by assuming every business will adopt RaC systems). In Australia around 10-20% of businesses tend to adopt digital technology[22]. It is expected that RaC will have similar uptake.
- Technology costs are attributed to the area where technology is needed[23].
- The results are net of any other pilots or BaU. We have not assumed reduced regulatory fees or that benefits flow outside the adoptees.

We have not quantified the benefits for assurance organisations, as the benefits will require new business models. It is likely that early "value adds" would be advisory and services built into advanced assurance offerings and/or adoption of rules-as-code leveraged services.

Assuming farming businesses pay $840 per annum drives a conservative RoI.

We have assumed the cost to adopt and use new technology is not zero. The software service for a farmer would most likely be delivered through an extension of current business software. This might be advanced accounting software (Quick books premium), special licensing software or potentially even a direct market offer.

In interviews with small business owners and with farming producers, there is a negative view of any additional short term costs, which in turn, tends to reduce the uptake and lower the RoI. This cost may be considered the "early adopter" true cost and it ensures that the RoI is realistic.

Have we replaced an existing charge?

No; current permit and licensing fees are built from extensive Regulatory Impact Assessments. To replace these would require regulatory change. Moreover, "replacing" an existing charge would obscure the cost to run the pilot. We envisage that eventually regulatory charges might reduce, which would make the RoI higher, but this would require additional time and work.

[22] Market-wide research notes that while Australian businesses have adopted digital systems for payroll, less than 40% of Australian businesses have adopted a digital approach. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) research notes that around 30% of farming businesses buy ICT each year.
[23] This follows the logic of a Regulatory Impact Assessment, and Productivity Commission approach. The total cost of the pilot can be distributed arbitrarily - e.g. DAFF could fund the entire cost, and provide "free" services to farming businesses - however, our approach has the lowest (most conservative) RoI.

Dairy sector pilot

Dairy farmers generally held a larger stock of ICT assets than other livestock producers. In particular, dairy farmers have invested relatively heavily in sensors and other hardware to monitor individual animal production, tools that are not widely used in broadacre livestock farming. Dairy farmers have also invested relatively heavily in other hardware such as automated milking technologies, including cup removers, drafting gates, cleaning equipment and robotic dairies. [ABARES, 2018]

We outline our analysis based on the assumption and savings above. Detailed analysis is provided in the appendix. We have started with the dairy industry, where we have been working for some time and then scale for whole-of-agriculture.

Input parameter	Value		Input costs	Value
Total farms	4,200		ICT development	$3,500,000
Market adoption	15%	630 users	Regulator yearly costs	$250,000
Total regulators	7			
Regulator adoption	15%		Farm yearly license	$120
Discount rate	15%		Farm yearly process updates	$720
Total 5-year investment, inc. ICT, change and licenses across all farms and agencies				**$9.1m**

	Units	NPV benefit per unit	NPV cost per unit	RoI	Yearly additional revenue / savings
Farm-business	630	$ 14,899	$ (3,656)	4.1	$1,687
DAFF	1	$ 13,305,903	$ (4,552,489)	2.9	$1,313,012
States	7	$ 139,924	$ (322,645)	0.4	-$27,408
Total 5-year return across all		**$ 23,671,989**	**$ (9,114,164)**	**2.6**	**$2,183,674**

For a dairy-sector only pilot, assuming a low adoption and significant discount rate, the overall return on investment for farming businesses is 450%: ie. for every $1.00 spent, they receive an additional $4.50 in revenue. This is largely due to federal agencies taking the major investment, and also most of the savings are due to lower regulatory compliance effort.

The total (economic) return for a dairy-only is 260%. This is due to the heavy investment required and the limited market size. Nonetheless, even at this scale, a RaC pilot would create a sustainable $2.2m net economic benefit per annum, of which $1.3m is DAFF yearly savings. State governments will need to invest $30,000 per annum or else find additional sources of revenue.

For producers, following interviews, we have assumed the following "bottom line" savings:

Producer bottom-line saving (reduced / simplified activity)	Benefit or (cost) per year
Reduction in scope of compliance questions, due to personalised forms	$ 1,500
Pre-population of forms	$ 800
Reduce duplication of reporting	$ 1,700
Integrate Farm Management Systems (FMS) and on-farm devices	$ 300
Regulatory convergence - similar regulations across jurisdictions	$ 400
License / software cost	$(120)
Business change / training cost	$(720)
Total Benefit (Cost)	**$ 3860**

For regulators, following interviews, we have assumed the following savings and costs:

Regulator saving (reduced / simplified activity)	Regulator	Benefit or (cost) per year
Reduce time to review compliant applications x total activities[24]	DAFF	$1,250
Reduce time to detect problematic applications (Fail fast) x total activities	DAFF	$2,500
Reduce workload and effort to "find" up to date information x total activities	DAFF	$500
Pass-through and updates for regulatory change - savings on small changes x total activities	DAFF	$500
ICT costs per year - licenses	DAFF	$(125,000
Change management and/or additional workforce per year	DAFF	$(450,000)
Total benefit (cost) for DAFF		**$3.9m**
Reduce time to review compliant applications[25]	States	$1,250
Reduce time to detect problematic applications (Fail fast)	States	$2,500
Reduce workload and effort to "find" up to date information	States	$50
Pass-through and updates for regulatory change - savings on small changes	States	$50
State licensing for ICT	States	$(31,500)
Change management and/or additional workforce per year	States	$(65,000)
Total benefit (cost) for each State	**States**	**$(15,202)**

What the numbers mean

- **Market adoption: 15%.** Only 15% of all dairy farms adopt the technology. This is well below current technology uptakes, and accounts for the specific nature of the regulatory services. This also addresses the fact that some farms will continue to operate using legacy approaches

- **Regulator adoption: 15%.** Not all states will adopt RaC in the early phases. We have assumed only partial adoption across states. This also means that farmers (even those using

[24] We assume approximately 16,000 application-relevant events each year. This is taken from the RIS for current bio-security permit costs.
[25] We assume approx. 2,400 application events per state per year

the RaC service) will initially work across multiple channels. While this is obviously not ideal, it represents the reality of early technology adoption.

- **ICT development: $3.5m.** The development for NexDoc and relevant ICT changes for DAFF was part of the *$32.4* million *Modernising Agricultural Trade program*, 2018-19 MYEFO, included in an overall investment of *$328.4m* in 2020-21 to modernise regulation. Our 'bottom up' costing based on similar regulatory system production, to build a complete regulatory change for dairy is approximately 10% of the total cost of modernising agricultural trade, or 1% of the total investment in regulatory reform[26].

- **Regulator yearly costs.** We have assumed ongoing change management and software maintenance. We expect the actual costs to be much lower, but this approach ensures the RoI is conservative. That is, any pilot should provide higher return. We note that due to the smaller scale, State regulators have a net cost of approximately $15k per annum[27].

- **Farmers' costs: $840 per annum.** We have assumed the cost to adopt and use new technology is not zero. The software service for a farmer would most likely be delivered through an extension of current business software. This might be advanced accounting software (Quick books premium), special licensing software or potentially even a direct market offer. This is a percentage of the total 'saved' manual effort.

For a cost-benefit analysis, all costs and benefits are "new" and not replace existing costs. Where new costs (e.g. farmers' costs) replace existing regulatory charges (e.g. a farmer in the pilot no longer pays a permit to DAFF), this will **improve** the RoI for farmers, while equally reducing the RoI for DAFF, as it redistributes costs and benefits.

[26] https://www.agriculture.gov.au/sites/default/files/documents/28727-part-2_0.pdf For comparison, the "Dairy Export Assurance Program (one of many regulatory improvements in the $328m) was $14.8m, the total traceability grants program was $7m.

[27] There are a few simple mechanisms to address this - the 'cost' could be viewed as an initial investment. Where public funds are not available, the pilot could be coordinated by a 3rd party - who takes on the early investment risk in return for a greater share of 'profit' or revenue later. This is similar to other Public-Private Partnerships.

Full agriculture sector

We can scale the results for dairy across the wider agricultural sector below. We have scaled the cost for ICT from $3.5m for dairy-only to $15m for the entire Australian agriculture sector. This represents an economy of scale: the dairy sector is 7% of the total sector by farm count. Much of the dairy deployment will also support broad agriculture approaches. We note that farming businesses typically have lower adoption rates (or software vs dairy (see detailed section).

Input parameter	Value		Input costs	Value
Total farms	56,500		ICT development	$15,000,000
Market adoption	5%	users: 2,825	Regulator yearly License	$250,000
Total regulators	7			
Regulator adoption	15%		Farm yearly license	$120
Discount rate	15%		Farm yearly process updates	$720
Total 5-year investment, inc. ICT, change and licenses across all farms and agencies				**$11.5m**

	Units	NPV benefit per unit	NPV cost per unit	RoI	Yearly income
Farm-business	2,825	$ 15,032	$ (3,656)	4.1	$1,706
DAFF	1	$ 59,660,380	$ (17,052,489)	3.5	$6,391,184
States	7	$ 627,097	$ (322,645)	1.9	$45,668
Overall Economy		$ 106,514,899	$ (29,638,668)	3.6	$11,531,435

For a full agricultural adoption, we assume a lower adoption (only 5%) and similar discount rate. The overall return on investment for farming businesses remains 470%. That is, for every $1.00 spent, *every* business receives an additional $4.70 in revenue. This is largely due to federal agencies taking the major investment and most of the savings are due to lower regulatory compliance effort.

For a full sector roll-out, the edge-cases for states not receiving sufficient revenue is covered and states can expect $45k in new savings/revenue. Further, the impact of a large scale adoption drives a very large return on investment. Federal agencies can expect around $6.4m per annum in new income (or savings) and the overall economic return on investment is $3.60 for every dollar invested.

If we assume adoption of 5%, the expected savings for DAFF would be $6.4m per annum, and the economic RoI increases to $3.60 for every dollar invested, creating $11.5m per annum economic benefit

Beef sector

We have separately considered a beef-sector approach. The beef sector has low technology adoption (7%). We assume 3% of beef producers would participate. Using the same modelling, we have a lower RoI, for a significant investment.

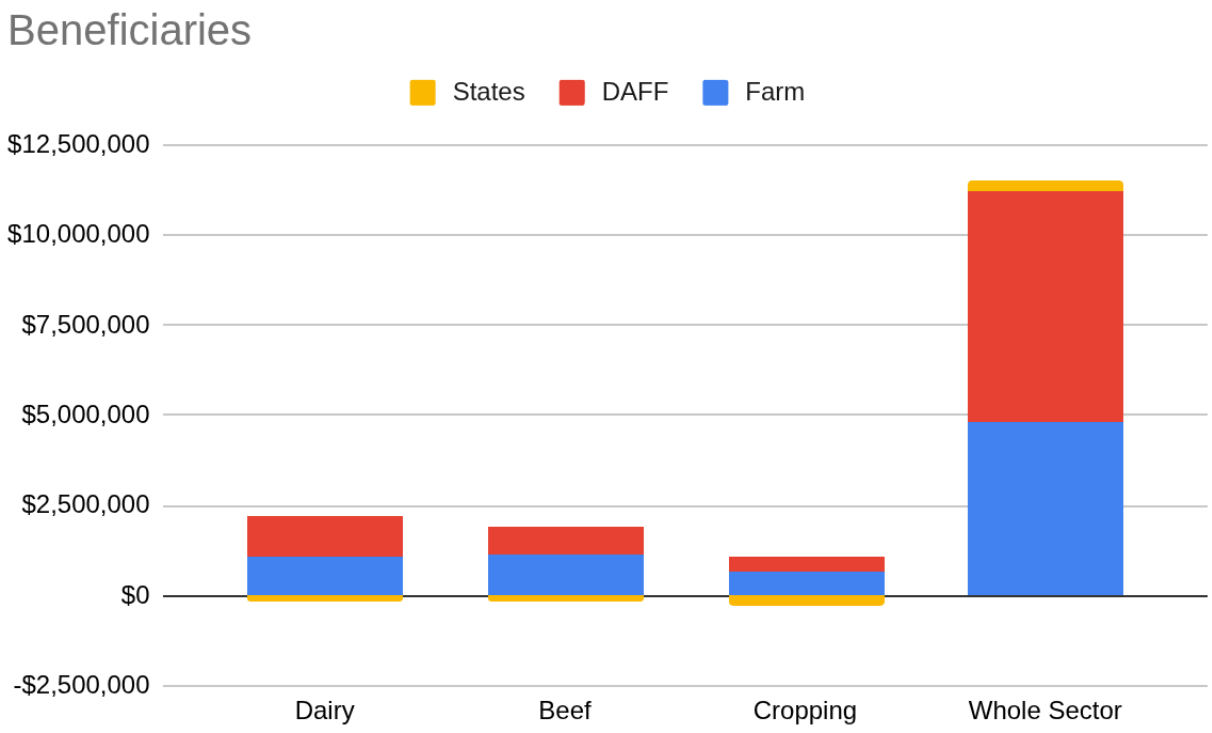
Input parameter	Value		Input costs	Value
Total farms	21,100	39.1% of all farms	ICT development	$7,000,000
Market adoption	3%	users: 663	Regulator yearly License	$250,000
Total regulators	7			
Regulator adoption	15%		Farm yearly license	$120
Discount rate	15%		Farm yearly process updates	$720
Total 5-year investment, inc. ICT, change and licenses across all farms and agencies				**$1.7m**

	Units	NPV benefit per unit	NPV cost per unit	RoI	Yearly income
Farm-business	663	$ 15,164	$ (3,656)	4.1	$1,726
DAFF	1	$ 14,001,857	$ (9,052,489)	1.5	$742,405
States	7	$ 147,184	$ (322,645)	0.5	-$26,319
Overall Economy		**$ 25,086,010**	**$ (13,734,806)**	**1.8**	**$1,702,681**

Sector comparison

For each sector, our modelling provides the total benefit

Beneficiary	Dairy	Beef	Cropping	Whole Sector
Farm adoption rate	5%	3%	4%	5%
Total Farms in trial	630	663	372	2,825
Farm benefit	$1,062,519	$1,144,510	$637,551	$4,820,576
DAFF benefit	$1,163,012	$742,405	$420,591	$6,391,184
States benefit	-$191,857	-$184,234	-$252,052	$319,675
Total (economy)	**$2,033,674**	**$1,702,681**	**$806,090**	**$11,531,435**



Dairy sector details

We assume that only a single federal government regulator (e.g. DAFF) would fund the ICT change, but that 4 federal regulators would need some support for change management. We have assumed similar costs for 7 state regulators. This heavily weights early costs to provide a conservative net-present-value for the investment.

The benefits of the Dairy pilot are (mostly) realised by farmers and the federal government agencies. This is because most export controls and regulatory requirements are driven federally. Where state regulators have rules to transform, these are often a 'local' addition to existing federal rules.

- **Farmers:** A pilot farming business is expected to benefit by approximately $2,500 per annum (mostly in savings).
- **Federal government:** The main federal agencies involved in regulation are expected to benefit by $1.2m per annum, which accumulates to $7.9m Net Present Value over 5 years
- **State regulators:** RaC is an overall cost for state regulators of around $30,000 per annum. They have a much smaller local regulatory 'load' and thus a smaller efficiency gain. As a pilot, the main investment in change and analysis is with states, and hence a regulatory sandbox, where gains by federal agencies are shared with the states to encourage change, is recommended.
- We estimate the overall economic impact, using a Net Present Value approach, we expect a return of $6.4m, for a $3.5m investment.

We have not considered the benefit to DFAT for Rules as Code. However, if we consider the investment from DAFF to rebuild, and maintain the export rules, we expect a significant benefit for DFAT, with little-to-no additional investment.

What's in it for producers?

Although we've noted a saving of $2,500 for producers, we show below how this works:

> **Before RaC:** Laura operates a small dairy business and wants to expand into exports. Navigating compliance required:
>
> - Accountable[28] for 100+ pages of regulation (e.g. Export Control Act, FSANZ 4.2.4, MICOR).
> - Manually completing forms like EX26b and NEXDOC submissions.
> - Coordinating multiple inspections and certificate requests.
> - Delays from mismatched guidance, unclear rules, and slow updates to regulation notices.

[28] Legislative complexity is often cited in terms of "pages of rules" – in Laura's case it is many hundreds of food safety, export controls, import controls, (eg. fertiliser) environmental, local planning requirements and workplace awards along with normal business accounting. In reality, no business owner reads this. The complexity of legislation has built enormous industries of "advisors" and "assurance groups" who do read the rules, and who charge producers' to build trust. RaC removes this Fear Uncertainty Doubt market.

Estimated Burden:

- 6–8 weeks of part-time work annually on compliance.
- ~$9,000/year in direct costs (audit fees, establishment registration, software).
- Unquantified opportunity cost from delayed or missed exports.

After transformation with Rules as Code:
Laura adopts a compliance tool powered by RaC, which:

- **Saving:** Automatically encodes applicable regulations, updates in real-time.
- **Saving:** Pre-fills forms using business data and validates before submission.
- **Risk reduction:** Alerts her to jurisdiction-specific requirements (e.g. new fat requirements for export to New Zealand).
- **Potential revenue:** Simulates tariff outcomes to identify profitable export destinations

Metric	Before RaC	After RaC	Benefit
Compliance Time	~80 hours/year	<16 hours/year	~$2,500 saved annually
Direct Compliance Costs	~$9,000/year	~$5,500/year	~$5,500 saved annually
Time-to-export (new market)	6–8 weeks	1–2 weeks	Accelerated market entry
Regulatory errors	Medium risk	Low (pre-validated)	Reduced risk of rejection

The specific values used for RoI are:

Reduction in scope of compliance questions, due to personalised forms	$ 1,500
Pre-population of forms	$ 800
Reduce duplication of reporting	$ 1,700
Integrate Farm Management Systems (FMS) and on-farm devices	$ 300
Regulatory convergence - similar regulations across jurisdictions	$ 24
Business software for producer (cost)	(120)
Business change and training costs for producer (cost)	(720)
Total benefit per year	**$5,860**

We have assumed only the compliance time is reduced, as the fees (while burdensome) are administered by DAFF. We observe that the compliance costs are ultimately built on Regulatory Impact Statements and that these may need re-assessment as the costs to administer compliance reduces in a digital-first approach. We have quantified the benefit for new export markets as less than $1,250 per year for approximately 30% of participating farms (i.e., small)

This saving is offset by two factors:

1. $120 per year in fees for software, modelled on similar business software pricing such as Xero (which charges ~$15per month) and
2. $720 per year in “change management”

Overall, the regulator (DAFF) that invests in the RaC implementation has a substantial return on investment per annum.

State Governments do not have significant benefits when directly adopting RaC. However, the overall Federal government benefit is very large. This means that funding adoption and use for state governments might be offset. For example, DAFF could provide an investment into each state and still have a positive next return on investment from the total benefits, which provides a whole-of-government benefit.

The layout of this ecosystem is shown below:

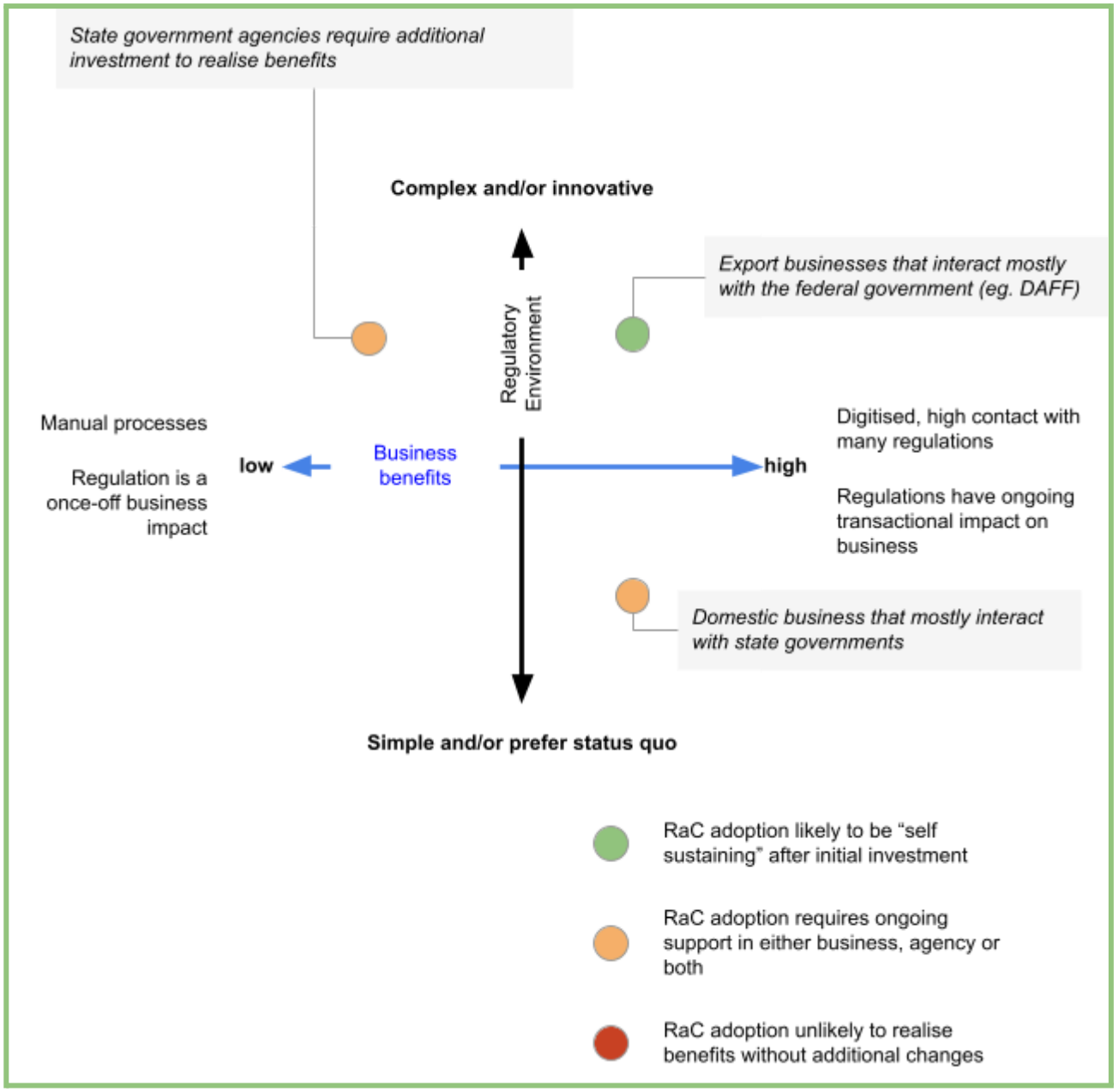
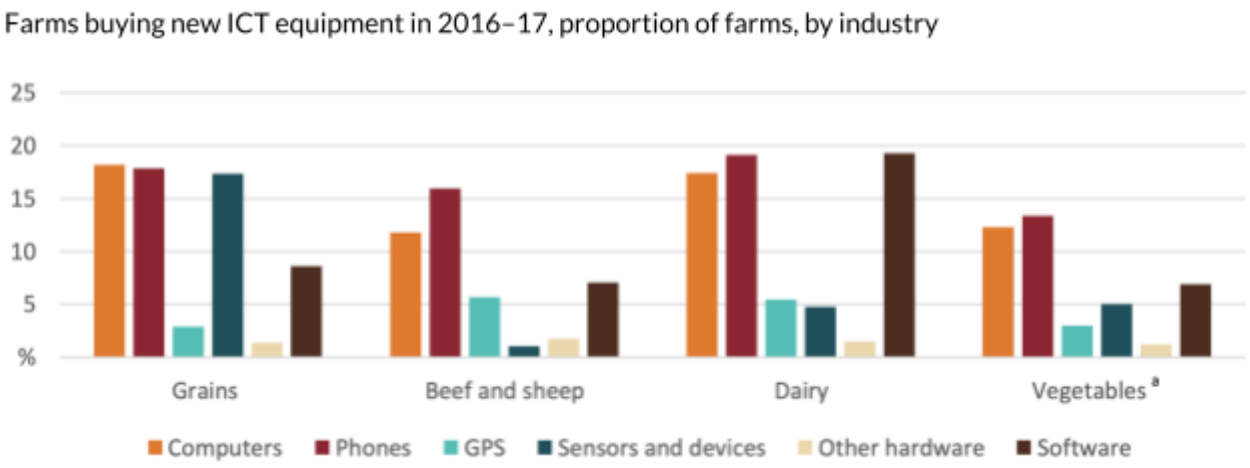


Fig: A pilot for Dairy would significantly benefit export businesses and federal government agencies. However, for full adoption, investment in state government adoption may be needed.

Whole of agriculture sector

Scaling this to the whole Australian agriculture sector requires some care, as the various sectors are quite different. However, using ABARES data, we note dairy is approximately 7% of the total 56,500 Australian businesses.



Farming sector	Count of businesses	Percentage of total	Software market adoption	Assumed RaC market adoption
beef	22,100	39.1%	7%	
cropping	9,300	16.5%	8%	
dairy	4,200	7.4%	19%	15%
livestock crop	8,700	15.4%	8%	
mix	3,000	5.3%	10%	
sheep	8,900	15.8%	7%	
total	56,500	100.0%	8%	5%

From our survey of Dairy industry regulations and export requirements, we anticipate an efficiency improvement as the technology is shifted from dairy-only to whole-of-agriculture. This puts the total cost to develop the ICT at $15m, which we expect is an upper bound on the real costs.

Conclusion & recommendations

Conclusion	Whole-of-sector (all government agencies, all businesses) returns on investment are not uniform. Where DAFF would likely invest heavily, and recoup significant benefits, farmers' returns are large and state governments may need to be supported. A **$2.5m dairy-sector pilot**, ($9.1m 5-year costs covering all ICT and change management for every business and agency) provides an economic return of $2.6m per annum ($2.50 for every $1.00 invested). Farms cover the cost of investment and return $4.10 for every $1.00, while Federal government (DAFF) investment is effectively recouped by the second year of the pilot. Farms would expect a 'bottom line' saving of $1,700 per annum. A whole-of-agriculture approach, costing **$15m for ICT development** ($29.6m for all ICT and change management for every business), produces an economic return of $11.5m per annum. This break down as: • $1,700 per farm "savings/revenue" per year • $6.4m saving for DAFF per year • $45,000 savings per state per year. Federal investment would recoup the costs in the first year.

Recommendation	DAFF should consider a dairy-sector pilot that includes whole-of-sector investment and sharing of costs to provide an ideal 'sandpit' for developing a Rules as Code policy. Dairy, as a pilot sector, provides a sustainable Return-on-Investment, which can be used to support learnings and benefit-sharing. We recommended using the outline of the pilot- and full- transition as supporting evidence behind an implementation roadmap (see next)

Skills required for DAFF in adopting Rules as Code

Role descriptions

RaC implementation requires more than software skills; it demands interdisciplinary capability. DAFF staff must combine legal precision, data fluency, and digital literacy to build trustable, testable and scalable regulatory systems. To implement and maintain **Rules-as-Code (RaC)** effectively, Department of Agriculture, Fisheries and Forestry (DAFF) staff would need a blend of **policy, technical, data and governance skills**. These are outlined below under the following functional domains

Policy and regulatory translation

Skills needed:

- **Regulatory analysis and encoding:** Ability to interpret and restructure legislation, standards, and guidance into precise, machine-readable rules.
- **Falsifiability and logic design:** Understand how to convert vague or principles-based obligations into testable conditions (e.g., "must be refrigerated" → "2°C to 8°C").
- **Outcome-based thinking:** Skills to frame rules in measurable, data-aligned terms.

Example: A policy officer defines the export requirement for a dairy product not as "safe to transport" but as "temperature at point of dispatch must be between 2–8°C, recorded in digital log."

Data and standards alignment

Skills needed:

- **Data schema development:** Understanding of how to map regulatory requirements to structured data formats (e.g. JSON, XML).
- **Data standardisation:** Ability to align regulatory data with existing data-standard frameworks such ISO standards.
- **Metadata tagging and change tracking:** Competence in version control, tagging obligations, and publishing rule changes in structured, diffable formats.

Example: A data specialist ensures that "batch number," "origin site," and "transport temperature" are structured fields, not just free text.

Technology and code integration

Skills needed:

- **Basic coding literacy:** Understanding of how rules are encoded in languages like LegalRuleML, Decision Model and Notation (DMN) or business rule engines.
- **Testing and validation:** Ability to create test cases, simulate compliance scenarios and validate rules against live or synthetic data.
- **API integration and governance:** Working knowledge of how rules interact with enterprise systems and third-party platforms through APIs.

Example: A business analyst works with developers to test a new RaC module against live traceability data streams from RFID devices.

Governance and change management

Skills needed:

- **Version governance:** Capacity to oversee the change lifecycle of rules, including legal authorisation, stakeholder sign-off, and controlled release.
- **Stakeholder engagement:** Ability to work across policy, assurance, audit, IT and industry to ensure rules are understood, agreed upon, and adopted.
- **Communication of machine-readable rules:** Ability to explain encoded rules and their impacts to non-technical audiences and partners.

Example: A governance lead coordinates the update of a milk quality rule, ensuring affected exporters are notified and systems are updated before enforcement.

Summary table

Domain	Core Skills	Example Competencies
Policy & Legal	Legislative interpretation, rule drafting, outcome definition	Convert free-text obligations into testable logic
Data & Standards	Schema design, standards mapping, metadata tagging	Align rules with location fields and publish as JSON/XML
Technology	Rule engine knowledge, testing, API integration	Validate compliance rules in traceability software
Governance	Lifecycle management, stakeholder engagement	Manage version history and regulator-industry approvals

Organisational overview of Rules as Code

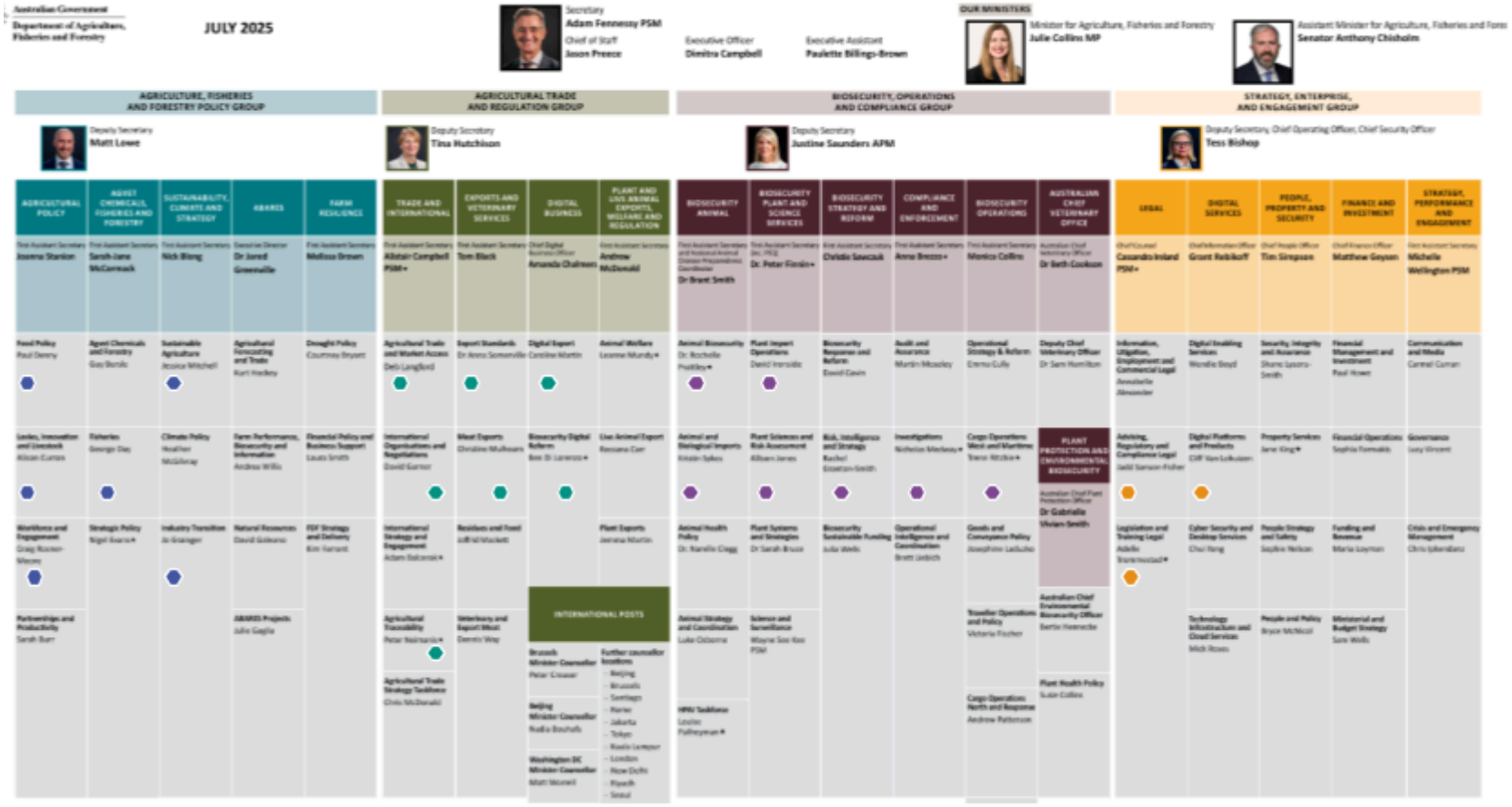
Rules as Code represents more than a technological change. Embedding RaC into whole-of-enterprise and regulatory transformation would take an uplift in skills and change management.

Our report has addressed the return on investment for DAFF to implement Rules as Code to support its traceability initiatives. We have outlined some key skills that would be needed for DAFF. We outline here what the change might look like from an organisational perspective. The impact across DAFF is shown below.

- **Developing the policy** - these teams would be involved in the design of the code, and testing the intent / scenarios for use.
- **Regulator teams** - these teams would see most efficiency benefits and would be involved on a day-to-day basis.
- **Compliance teams** - will benefit later, as the scale of adoption drives whole-of-sector improvements.
- **Validation** - overall assurance of the technology and the processes involved in deploying, using and responding to decisions would require oversight across the department and also within the ICT and legal areas.

Outline of the main engagement points for Rules as Code

We have largely engaged with traceability. However, full adoption of Rules as Code would impact most of DAFF eventually, as RaC presents a new approach to regulation


Australian Government
Department of Agriculture, Fisheries and Forestry
JULY 2025
Secretary
Adam Fennessy PSM
Chief of Staff
Jason Preece
Executive Officer
Dimitra Campbell
Executive Assistant
Paulette Billings-Brown
OUR MINISTERS
Minister for Agriculture, Fisheries and Forestry
Julie Collins MP
Assistant Minister for Agriculture, Fisheries and Forestry
Senator Anthony Chisholm
AGRICULTURE, FISHERIES AND FORESTRY POLICY GROUP
Deputy Secretary
Matt Lowe
AGRICULTURAL TRADE AND REGULATION GROUP
Deputy Secretary
Tina Hutchison
BIOSECURITY, OPERATIONS AND COMPLIANCE GROUP
Deputy Secretary
Justine Saunders APM
STRATEGY, ENTERPRISE, AND ENGAGEMENT GROUP
Deputy Secretary, Chief Operating Officer, Chief Security Officer
Tess Bishop
AGRICULTURAL POLICY
AGVET CHEMICALS, FISHERIES AND FORESTRY
SUSTAINABILITY, CLIMATE AND STRATEGY
AWARDS
FARM RESILIENCE
TRADE AND INTERNATIONAL
EXPORTS AND VETERINARY SERVICES
DIGITAL BUSINESS
PLANT AND LIVE ANIMAL EXPORTS, WELFARE AND REGULATION
BIOSECURITY ANIMAL
BIOSECURITY PLANT AND SCIENCE SERVICES
BIOSECURITY STRATEGY AND REFORM
COMPLIANCE AND ENFORCEMENT
BIOSECURITY OPERATIONS
AUSTRALIAN CHIEF VETERINARY OFFICE
LEGAL
DIGITAL SERVICES
PEOPLE, PROPERTY AND SECURITY
FINANCE AND INVESTMENT
STRATEGY, PERFORMANCE AND ENGAGEMENT
PLANT PROTECTION AND ENVIRONMENTAL BIOSECURITY
Dr Gabriella Vivian-Smith
INTERNATIONAL POSTS
Setting the input - policy to code
Regulators - main beneficiaries, and validation
Compliance - benefits from scale, engagement
Validate the decision & AI support

A real-world roadmap adoption

Based on feedback and the tight funding available to invest in long-term ICT and change, we have outlined a roadmap to deliver on the benefits for dairy, growing toward a full investment after early wins are realised. This scales the dairy pilot to 15 businesses (rather than 600+), and shortens the time to implement. We also note that DAFF has already invested in parts of this roadmap, which allows us to reduce the cost.

Executive summary

This document outlines a 24-month implementation plan to pilot using Rules as Code (RaC) for enhanced traceability within the Australian dairy sector. The project's vision is to transform regulatory compliance and digital traceability by encoding dairy export regulations into machine-readable formats, thereby streamlining processes, reducing the administrative burden on producers and enhancing Australia's agricultural traceability capabilities.

This plan is aligned with the strategic goals of the National Agricultural Traceability Roadmap and the Australian Government's vision for regulation that is fit for a digital era. The pilot will focus on delivering a tangible return on investment, demonstrating the value of RaC before a potential broader rollout across the agricultural sector.

For a proposed initial DAFF investment of $1.3M , this pilot is projected to deliver a sustainable positive economic benefit and achieve a positive Net Present Value (NPV) within two years. The project will be delivered by a dedicated team over 24 months, commencing in January 2026. We have scaled this to a dairy pilot with 15 dairy businesses (contrasting with a full dairy sector pilot of 600+ farms and 7 states).

Project vision and goals

Vision: To establish a modern, digital-first regulatory ecosystem and traceability platform for the Australian dairy sector that reduces compliance costs, accelerates market access, and positions Australia as a global leader in digital trade and agricultural assurance.

Project goals:

Goal 1: Reduce Regulatory Burden: Automate compliance processes to significantly reduce the time and manual effort producers spend on paperwork, reporting, and permit applications. Producers are expected to see a 'bottom line' saving of approximately $500 per annum.

Goal 2: Enhance Traceability and Market Access: Implement a digital traceability framework that meets international standards, such as the US FDA requirements taking effect in January 2026 , and simplifies access to new export markets.

Goal 3: Improve Regulatory Efficiency: Streamline DAFF's and state regulators' internal processes through automation, enabling faster review of compliant applications and better-targeted interventions.

Goal 4: Prove the RaC Model: Deliver a successful, scalable pilot that validates the cost-benefit analysis and provides a clear business case for a whole-of-agriculture RaC implementation.

Scope and key deliverables

In-scope:

- Encoding of key Federal and State regulations relevant to Australian dairy export, including:
    - Export Control Act, FSANZ Food Standards Code, and MICOR requirements.
- Development of a secure, open-source RaC platform, including a rules engine, rule library, and APIs for integration.
- Creation of a proof-of-concept mobile application (AgriTrace) and administrative analytics dashboard.
- Integration with foundational systems like GS1 standards and legislation.gov.au.
- Execution of a closed pilot with up to 15 dairy producers to test, iterate, and validate the solution.
- Development of a "Tell-Us-Once" (TuO) model for data submission.

Out-of-scope:

- Full-scale redevelopment of legacy government systems (e.g., NEXDOC); the pilot will focus on API-based integration.
- Encoding of regulations outside the dairy export domain (e.g., broad environmental or planning laws).
- Full-scale, nation-wide rollout beyond the initial pilot group.

Phase 1: Foundation & discovery (months 1-6 | H1 2026)

Focus: Establish project infrastructure, engage stakeholders, and encode foundational rules, leveraging existing traceability investments.

Deliverable	Key Activities	NATR Alignment	Already completed
Project & governance framework	Establish secure project environments. Finalise governance model, aligning with DTA AI principles and designating accountable officers.	PAA2, PAA5	45%
Encoded foundational ruleset	Co-design and encode initial rules, starting with the Approved Arrangement checklist and key sections of FSANZ Chapter 3.	PAA1, PAA2	75%
Stakeholder engagement & user research	Conduct large-scale workshops with dairy producers, exporters, and regulators (DAFF, states) to map "shadow processes" and confirm pain points.	PAA4, PAA5	10%
Initial technical prototypes	Develop initial Figma demos for the AgriTrace mobile app. Set up a graph database (Neo4J) proof of concept for traceability.	PAA2	85%
Phase 1 report	Present a refined feature priority list for Phase 2.	PAA4	0%

Phase 2: Pilot development & integration (months 7-12 | H2 2026)

Focus: Build the core platform, develop APIs, and prepare for the closed pilot.

Deliverable	Key Activities	NATR Alignment	Already completed
Live RaC platform (v0.1)	Deploy a functional rules engine and rule library. Begin encoding the Export Control (Milk and Milk Products) Rules 2021.	PAA2	50%
Integration APIs	Develop and document data APIs and connectors. Build a connector to the legislation.gov.au API to track rule changes.	PAA2, PAA5	65%
Tell-Us-Once (TuO) prototype	Design and demonstrate a TuO portal using the encoded rules to pre-populate and simplify forms. Aligns with the NATR goal for a TuO beta in June 2027.	PAA3	out-of-box
Traceability demonstrator	Integrate GS1 standards for minimum traceability. Demonstrate end-to-end traceability using the graph database.	PAA1	90%
Pilot recruitment & onboarding plan	Identify and recruit 15 pilot participants from the dairy sector. Develop training materials and support procedures.	PAA5	0%

Phase 3: Closed pilot & iteration (months 13-18 | H1 2027)

Focus: Execute the pilot, gather real-world data, and demonstrate value.

Deliverable	Key Activities	NATR Alignment	Already completed
Live dairy pilot	Onboard 15 producers. Go-live with the AgriTrace app and TuO portal for pilot participants to manage compliance for export permits.	PAA4, PAA5	0.00%
Real-time monitoring & support	Provide continuous support to pilot users. Implement real-time monitoring of compliance checks and data flows.	PAA2	0.00%
Benefits validation data	Collect and analyse data on time savings, error reduction, and user satisfaction to validate the ROI model.	PAA4	0.00%
Traceability process guidance as code	Encode the draft traceability process guidance (due Sep 2026 in NATR) as a machine-readable checklist.	PAA2	0.00%
Interim pilot report & ROI update	Present findings from the first half of the pilot, including qualitative feedback and a data-driven update to the cost-benefit analysis.	PAA4	0.00%

Phase 4: Closed pilot & iteration (months 13-18 | H1 2027)

Focus: Execute the pilot, gather real-world data, and demonstrate value.

Deliverable	Key Activities	NATR Alignment	Already completed
Final pilot report	Complete the pilot and deliver a final report detailing outcomes, lessons learned, and validated success metrics.	PAA4	0.00%
Final ROI and business case	Present the final, evidence-based ROI analysis for the dairy pilot. Develop a comprehensive business case for a whole-of-agriculture RaC implementation.	PAA4	75%
Scalable platform (v1.0)	Refine the platform based on pilot feedback. Ensure ICT foundations are stable, secure, and scalable. Finalise API documentation for broader industry use.	PAA2, PAA5	0.00%
Whole-of-Government benefits sharing model	Propose a model for DAFF to reinvest benefits to support state government adoption, addressing the initial net cost for states.	N/A	0.00%
Transition roadmap	Develop a detailed roadmap for a national rollout, including recommendations on sequencing (e.g., beef, cropping), funding, and governance.	PAA5	50%

Pilot costs, assuming Regsoft delivers outcomes, are given below. We have included a small funding amount for all farmers to engage with the system ($12,000 per farm per phase).

Phase	Dev	License	Regsoft license discount	Support for 15 farms	Total ex GST	GST	Total inc GST
Phase 1	$199,063	$126,800	-$114,120	$0	$211,743	$21,174	$232,917
Phase 2	$218,750	$126,800	-$114,120	$36,000	$267,430	$26,743	$294,173
Phase 3	$393,750	$126,800	-$114,120	$36,000	$442,430	$44,243	$486,673
Phase 4	$218,750	$126,800	-$114,120	$36,000	$267,430	$26,743	$294,173
Total	$1,030,313	$507,200	-$456,480	$108,000	**$1,189,033**	**$118,903**	**$1,307,936**

Appendix: benefits analysis

Activities / enablers	Direct (tangible) benefits
Transform traditional legal documents (regulations, legislation, policies) into machine-readable formats. Create a trusted markup of regulation in machine readable "code" with a matching data schema. Align rules through an ontology and vocabularies with compute capacity. Define relevant data fields supporting processing against the code. Separate the "rules", the "engine", and the "apps" to avoid lock-in, enable open source rules, and encourage growth in new application development. Assess if the regulatory environment supports RaC and identify needed incentives/changes. Determine how and when businesses will benefit, focusing on high transactions and complex regulation. Implement co-drafting of rules and code by the organisation responsible for regulation or policy. Make implementation transparent and validate the code against departmental operating principles and regulatory intent. Accommodate current business processes, regulatory intent, ways of working and ICT systems. Be prepared for RaC to expose hidden processes (implicit approaches, work-arounds, implicit trust). Provide additional support, including change management, as processes become explicit. Adopt a structured approach to change control and governance, aligning with DTA AI governance requirements. Designate accountable officials responsible for overseeing and coordinating RaC adoption. Start small and build on successes to test and refine processes. Focus on business' and users' pain points as starting areas for efficiency improvements. Engage stakeholders early and provide continuous support. Implement formal change management procedures and robust business process governance with strict controls and documentation. Perform rigorous testing of the rules in a test environment supported by executive oversight. Ensure rapid escalation for errors or failures. Embed co-design processes involving legal, policy, and technical experts from the outset. Promote proof-of-concept projects. Establish clear value propositions. Implement educational campaigns.	Efficiencies (cost reduction): Reduced ambiguity and consistent application of rules, minimising errors and misinterpretations. Automated rule checking and enforcement facilitating compliance, reducing non-compliance risk and associated penalties. Streamlined processes, automating repetitive tasks and freeing up resources. Reduction in reporting time (~weeks per year) for farm businesses. Reduced time to market (permits) for farm businesses. Reduced cost per applicant (e.g., reviewing) for regulators. Reduced burden of compliance on farm businesses through personalised forms, pre-population, and automation of reporting. Reduced duplication of reporting, enabling reduction of assurance visits to a single engagement for farms. Reduced time for regulators to review compliant applications (e.g., fast-tracking ~80%). Reduced time to detect problematic applications ('Fail fast'). Reduced workload and effort to "find" up to date information. Reduced operational costs. Reduced compliance costs for businesses. Increased efficiency in the export process. Potential significant reduction in workload for import analysis (e.g., 60% reduction in BICON). Reduction of burden of compliance and cost to act. Efficiency through automation: software-generated combinations of goods and modifiers accelerate code assignment and updates.

Provide financial incentives for early adopters. Explore opportunities to streamline certificate request handling processes, improve visibility into assessment readiness, and enhance communication channels.	Streamlined application and approval processes (e.g., electronic submission, automated validation, efficient workflow).

Value-adds (indirect benefits)	Long term goals / outcomes
Transformation of traditional legal documents into machine-readable formats allows for automated interpretation and application. Bridging the gap between regulatory professionals and software developers fosters collaboration. Machine-readable legal rules can be easily accessed and utilised by various stakeholders. RaC promotes transparency by making rules more accessible and understandable. Supports already compliant businesses to access additional benefits. Access to new information and new markets for businesses. Comparisons and increased value of certifications (e.g., verifiable credentials combined with Rules-as–Code) for intermediaries. Domestic & international market analysis for regulators. Faster access to direct information for regulators. Network effects (many similar users): comparison against market averages and information access. Increased transparency on reporting and time-to-report for intermediaries. Early adopters are likely to build digital business models and capitalise on mid-term value. Early assurance through RaC is likely to drive business benefits for those who adopt it early (first-mover advantage). Value-add beyond traceability, such as enabling compliance against ESG-related requirements or demonstrating proof of meeting benchmarks. Extension of compliance to new markets, saving months for compliant export-businesses. Policies are up-to-date and more easily available. Simplified regulatory interactions. Better clarity for users of the rules. Provides decision support. Solves the issue of inconsistent traceability standards. Digital transformation accelerates a data-driven, near real-time compliance approach.	Improved compliance. Increased efficiency. Legal clarity. Improved value from regulation. Greater consumer trust. Sustainability. Reduced risk of non-compliance and associated penalties. Bridging the gap between existing/emerging data systems and regulatory intent. Ensuring provenance and clarity of encoded rules. Transparency of data processing. Encouraging growth in new application development services. Achieving desired goals with less manual effort. Achieving previously impossible or difficult activities. Promoting a robust, transparent, and efficient adoption process. Better alignment with international standards. Strengthening industry competitiveness. The investment pays for itself and provides a dividend (specifically for the investing regulator like DAFF). Achieving a positive whole-of-Australian government benefit. Realising the targets set out in the investment logic map, such as reducing inconsistent traceability standards in the dairy industry. Solving the problem of the complex, interconnected, and often confusing Australian regulatory landscape. Addressing the challenges of reactive compliance management,

Enhances compliance processes. Reduces compliance complexity. Provides access to up-to-date export regulations effortlessly with automated notifications on regulatory changes. Automates compliance checks at each step of the product journey. Enables real-time monitoring of compliance across data points. Improves transparency and reliability of traceability data. Improves traceability. Integrates with digital systems like IoT sensors, RFID tags, and blockchain. Provides scalability to handle large data volume and complexity. Enables faster access to certifications and permissions. Reduces errors and administrative burdens. Offers a flexible coding system that can adapt to evolving regulatory landscapes and emerging product categories. Enables streamlined application and approval processes. Utilises unified data sharing standards (e.g., GS1). Provides enhanced transparency of data. Automates trade documentation. Enhances food labelling clarity for international markets. Utilises traceability data to facilitate dispute resolution. Offers a tariff optimisation tool. Develops electronic regulation systems tailored to specific markets. Streamlines the export process. Ensures exporters meet importing country requirements. Enhances consistency and ease of understanding for rules. Improves overall efficiency and reliability compared to manual processes. Supports real-time compliance and secure data exchange. Overcomes significant barriers like system fragmentation and resistance to change.	system fragmentation, data management complexities, and resistance to change. Addressing the push towards privacy, data security, and transparency in digital forms of regulation. Driving the digitalisation of trade and similar documents. Meeting consumer demand for product safety. Improving operational efficiency. Minimising recall risks. Reduced compliance errors. Improved consumer satisfaction. Decreased operational costs. Market expansion opportunities. Enabling smoother export processes. Improving data interoperability. Enabling businesses to make better decisions, leading to operational efficiency and product innovation. Achieving streamlined compliance and reduced compliance costs. Enabling competitive advantage for businesses. Increasing profitability by reducing operational costs and accelerating time-to-market. Transforming compliant businesses into global leaders. Supporting risk-based regulatory implementation. ICT governance supporting the sustainability and scalability of implementations. Addresses regulatory complexity and information fragmentation, key pain points for users. Maintaining trust, accuracy, and regulatory integrity. Providing evidence-based results for policy and regulation.

Ensures compliance with complex export regulations, maintaining competitive edge in global markets. Automates regulatory compliance for dairy exports. Maintains high quality and safety of Australian produce. Supports ongoing RaC adoption where key ingredients are present. Meets evolving regulatory and consumer expectations. Positions Australia as a leader in digital compliance. Enables export businesses to thrive. Allows businesses to manage compliance with precision and efficiency. Contributes to whole-of-sector (all government agencies, all businesses) returns, although distribution may be uneven. Provides confidence in assurance for farmers using integrated systems. Facilitates regulatory convergence. Reduces time lag between awareness of need and regulatory intervention. Allows for more objective assessment of compliance. Can broadcast compliant paths to the entire supply chain. Increases access to new markets and higher value products for producers and exporters. Enables domestic consumers to view information on the package. Provides traceability in supply chains for issues like labour practices. Contributes to community well-being by fostering economic opportunities. Promotes transparency in financial and ESG-related regulations. Supports regulatory compliance with ESG standards and related data privacy/security. Supports circular economy objectives. Encodes traceability requirements as rules-as-code. Aligns regulation at supply points with data. Connects physical events, locations, and parties with verified and identifiable data. Enables digitally connected sources for data transfer. Supports compliance against rules automatically.	Addressing real-world challenges through enacted and encoded regulation. Providing access to relevant information for stakeholders via a simulation platform. Facilitating faster cross-border data exchange. Improving user experience. Fostering innovation and improvement in the regulatory ecosystem. Reducing the burden on compliance and reporting for users. Enabling rapid iterative development based on feedback. Increasing producer compliance. Improving food traceability in Australia.

Ensures data stays with the data owner. The platform can verify compliance against rules and provide a certificate for compliant data. Interoperability hinders isolation and inefficiency. Simplifies compliance over complex solutions, enhancing usability, reducing errors, and accelerating adoption. RegData can link rules to physical events. Potential for automatic translation for rules.	

Benefit	Approach	Measurement	Productivity	Beneficiary	Barrier(s)
Reduce burden of compliance on farm businesses	Reduction in scope of compliance questions, due to personalised forms. Pre-population of forms	Time to complete compliance / reporting	reduce 3-4 days of effort per year to 30 mins[29] Automation of reporting can apply similarly across all agri-businesses[30] Larger farms are likely to have greater benefits[31]	Farm: saving approx. $2,000 pa[32]	Time spent on compliance is often a "sunk" cost of doing business. Savings may be offset by business change requirements.
	Reduce duplication of reporting	Total assurances completed	Reduce assurance visits ($200-400ph) to single engagement. Automation of reporting can apply similarly across all agri-businesses[33]	Farm: saving $7500pa	Current accredited bodies are funded by time-on-farm: reducing this may be a threat to assurance businesses.
	Integrate Farm Management Systems (FMS) and on-farm devices	System integration and API use	Unlikely to produce benefits independent of above. More likely to reduce change management required. Although "smaller" farmers tend to use legacy systems, adoption of Xero and accounting software provides an opening. Larger farm-businesses are adopting FMS more widely.[34]	Farm: Non-qualitifiable, confidence in assurance	Network connectivity was often cited as a barrier, however, most owners have reliable phones, and newer (eg. Starlink) systems emerging.

[29] Australian Agrifood Data Exchange Phase 2: Experiment 1- Compliance

[30] Australian Productivity Commission

[31] ACCC, 2017 Sec. 4.5.3, Dairy Inquiry interim report 2017

[32] ABARES, Farm income average

[33] Submission to Productivity Commission – Annual Review of Regulatory Burdens on Business, Victorian Farmers' Federation, 2007

[34] From interviews

	Regulatory convergence - similar regulations across jurisdictions	Complexity of total regulatory environment	Regulatory convergence is found in trade-regulatory reform. Rules as Code can provide a similar convergence by simplifying regulatory interactions.	Competitive producers[35]	

[35] Empirical insights on the dynamics of SPS trade costs: The role of regulatory convergence and experience in EU dairy trade, 2023

Benefit	Approach	Productivity	Beneficiary	Barrier(s)
Reduce burden of assurance on Dept	Reduce time to review compliant applications	Review can take 3-4 days, and may require multiple returns when errors / queries occur.[36] Approximately 80% of applications can be 'fast tracked'	Regulator: saving $3,000 per applicant	Current Regulatory Impact Statement for applications drives revenue stream. Direct savings may create unintended results, and may require new RIS
	Reduce time to detect problematic applications (Fail fast)	Review can take 3-4 days, and may require multiple returns when errors / queries occur.[37] 20% of applications have "problems" such as incorrect, missing or invalid information. A small fraction are rejected due to non compliance.	Regulator + Farmer: limited saving, significant reduction in workload	Current approach is a once-in and review and would require redesign for this more interactive approach.
Value add: up to date policies	Reduce workload and effort to "find" up to date information	Productivity improvements are expected, but hard to quantify.		
	Pass-through and updates for regulatory change	Productivity improvements are expected, but hard to quantify. International: most regulatory bodies have similar issues in reactive compliance.		Requires policy agencies to be onboarded.

[36] Desktop review and interviews

[37] Desktop review and interviews

Benefit	Approach	Productivity	Beneficiary	Barrier(s)
Value add: extension of compliance to new markets	Compliant businesses have access to more markets	Saving of months for compliance and certification. Applies to compliant export-businesses to "repeat" the process in a new market. The savings are significant for a small fraction of farms.	farmer: $12,500pa per market	Requires significant material "ready to use" before benefits can be realised.

The following table quantifies the benefits and costs above for the Dairy Sector.

Benefit (cost) type	Details	Per annum benefit (cost)	Beneficiary (cost bearer)	Market adoption (scale)	Years before benefit (cost) realised
Reduce farmer burden of compliance	Reduction in scope of compliance questions, due to personalised forms	$1,500	Farm business	5%	2
	Pre-population of forms	$ 800	Farm-business	5%	1
	Reduce duplication of reporting	$ 3,700	Farm-business	5%	3
	Integrate Farm Management Systems (FMS) and on-farm devices	$ 300	Farm-business	5%	2
	Regulatory convergence - similar regulations across jurisdictions	$ 2,400	Farm-business	1%	3
(Farmer adoption)	(License cost to farmer)	$ (250)	Farm-business	5%	0 (immediately)
	(Change for Farmer)	$ (750)	Farm-business	5%	0 (immediately)
Regulator cost saving	Reduce time to review compliant applications	$1,250	DAFF	5.25%	1
	Reduce time to detect problematic applications (Fail fast)	$2,500	DAFF	5.25%	1
	Reduce workload and effort to “find” up to date information	$500	DAFF	5.25%	1
	Pass-through and updates for regulatory change	$500	DAFF	5.25%	2
	Reduce time to review compliant applications	$1,250	States	5.25%	2
	Reduce time to detect problematic applications (Fail fast)	$2,500	States	5.25%	2
	Reduce workload and effort to “find” up to date information	$50	States	5.25%	2
	Pass-through and updates for regulatory change	$50	States	5.25%	2

Appendix: Cost estimations

We have based our calculations on the estimated timeframe for an Australian Farmer to obtain all relevant permits for export to the United States. Exporting agricultural products from Australia to the United States requires compliance with several regulatory steps, each with distinct processing times. The following provides an estimate of the time required to obtain the necessary permits and certifications for export.

1. Registration of the establishment

- **Requirement:** Any establishment involved in the preparation or storage of prescribed goods for export must be registered with the Department of Agriculture, Fisheries and Forestry (DAFF).
- **Estimated time:** The duration for establishment registration is not explicitly defined by DAFF. However, early initiation is recommended to account for any potential delays in processing.

2. Development of an approved arrangement (AA)

- **Requirement:** The establishment must develop an Approved Arrangement (AA), which outlines the procedures in place to ensure compliance with export regulations.
- **Estimated time:** The time required for AA approval varies depending on the complexity of the applicant's operations and the completeness of the submitted documentation. Approval can take weeks, with an elapsed time of months for setting up inspections and certification.

3. Application for export permits and certificates

- **Requirement:** Prior to shipment, an export permit and any required certificates must be obtained through DAFF's Next Export Documentation System (NEXDOC).
- **Estimated time:** Processing times depend on the nature of the product and regulatory requirements. For instance, the Australian Pesticides and Veterinary Medicines Authority (APVMA) aims to process Certificates of Export promptly; however, no statutory timeframe is specified[38].

4. Compliance with U.S. import requirements

- **Requirement:** Australian exporters must ensure that their products comply with United States import regulations, which may include obtaining permits from U.S. regulatory agencies such as the Food Safety and Inspection Service (FSIS).
- **Estimated time:** Processing times for U.S. import permits vary. For example, the FSIS advises allowing up to 72 business hours for the completion of required documentation[39].

[38] See for example, APVMA

[39] See for example, NOAA Fisheries

5. Total estimated timeframe for compliance

Considering the various stages outlined above, the entire process—from establishment registration to obtaining all necessary permits and certifications—can take several weeks to several months. Timelines are influenced by specific product requirements, regulatory changes, and the efficiency of document preparation.