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Government's Role in Developing the Digital Standards Ecosystem

The nice thing about standards is that you have so many to choose from.

– Andrew S. Tanenbaum, *Computer Networks* (1981)

Abstract

Standardisation was yielded transformational change in the 20th century, including through the introduction of barcodes and the advent of containerisation. Digital standards have the potential to deliver similar transformational change in the 21st, but this will require new ways of working. The potential exists because the standards architecture has network effects: the more businesses and government regulators adopt it, the more valuable it is to everyone in the club. Metcalf's law – that the gains raise exponentially with increased uptake – highlights the potential opportunity.

The state has a particularly important role to play as steward of the standards system and ensuring that standards embedded in regulatory

systems are fully interoperable with that wider system. The development of the digital standards ecosystem will require the government to enact a number of roles, but the state can't achieve the required change on its own.

The key barrier is that the standards landscape is littered with competing and/or overlapping public and private standards, along with standards embedded in regulations. Cutting through this cannot be achieved by bottom-up incremental changes. It will require a top-down commitment to sustained collaboration from both government and industry.

Keywords digital standards, digital product substantiation, digital public infrastructure, paperless trade, transparency at scale

Barcodes and standardised containers revolutionised logistics in the 20th century (Gill, 2023). This article explores whether digital standards can achieve a similar economic transformation in the digital age. The potential role of standards raises novel public policy questions. At first glance, the application of standards does not map neatly onto classic market-failure arguments which justify direct government intervention. However, digital standards exhibit policy-relevant features – network effects, thin markets, information asymmetries, innovation system incompleteness – which create space for targeted, facilitative state action.

This article draws policy lessons about when, how and why governments should act in the digital standards space. Transformation requires digitisation, which in turn requires standardisation. The focus here is on digital standards, but the arguments are generalisable to the rest of the standards system. The article suggests that the state needs to enact a range of roles to facilitate the development of the digital standards ecosystem, including being a market enabler, fast follower and honest broker. Achieving transformation requires more than facilitation; it will require a sustained commitment to partnership between government and industry.

The role of digital standards

Digital architectures have multiple layers and digital standards are required to enable connections between layers and platforms. Digital infrastructure is the layer that ‘sits between the physical digital infrastructure layer (e.g., an ultra-fast broadband network) and the specific apps people use, such as online banking and passport renewals’ (Deloitte, 2024). Digital standards, along with digital identity and payment systems, are key parts of digital public infrastructure. Digital standards used in the infrastructure layer (Digwatch, n.d.) are analogous to the road code that allows vehicles to be effectively used on the roading network.

Standards are technical specifications designed to ensure consistency and interoperability of products, systems or services. They can be public or private, and national, regional or international. Public standards are developed by national bodies (such as Standards New Zealand), or regional or international organisations

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(Food Standards Australia and New Zealand; the International Organization for Standardization or ISO). In addition, regulations often involve the use technical standards, some incorporating public standards by reference but others developed in isolation from the rest of the standards system.

Public, private and regulatory standards

In today’s economy, both public and private digital standards are vital. New Zealand is primarily a technology taker and has been active in adopting digital standards largely developed offshore. Organisations like GS1 provide public standards that facilitate global supply chain operations. GS1 standards have, for instance, been instrumental in enhancing e-commerce, e-invoicing, and product compliance and traceability, contributing significantly to New Zealand’s GDP. However, the full potential is foreclosed by the use of closed proprietary ecosystems or unique standards in regulatory regimes. There have been times when New Zealand has initiated stand-alone regulatory technical standards, such as a stand-alone farm identification system based on postcodes.

There is also a plethora of competing private standards. ICT development is led by the private sector, and this has produced a wide array of both proprietary and open digital standards. Bluetooth is a classic example of an open private standard, while Wi-Fi is based on an international public

standard. Apple is an example of an ecosystem with a mixture of proprietary and open digital standards. Both public and private standards, though voluntary, can have the effect of non-tariff barriers by creating exclusive requirements that businesses must meet to participate in certain markets. Some product claims can be tested (e.g., marine-grade stainless steel against standards such as EN 10204), while credence claims (such as ‘organic’) require backing from audit certification processes. Either way, substantiation involves significant costs, as there are often multiple overlapping standards required in different markets.

Standards, despite the costs, can significantly enhance productivity and economic growth by reducing switching costs for consumers, enabling economies of scale, and fostering trust between trading partners. Historical examples such as the adoption of barcodes and standard container sizes illustrate how standardisation can drive transformational change. However, poorly set standards can lead to lock-in effects and hinder innovation, particularly if they favour specific technologies or business models.

Barcodes, containerisation and GSM: historical transformations

The standardisation of container sizes in the mid-20th century revolutionised global trade by reducing shipping costs and enabling the development of global supply chains. But achieving this transformation was a tortuous process. It took a dominant player (the United States Department of Defence) and a willing counterparty (the US standards body) to drive through the change (Levinson, 2006). Similarly, when barcodes were introduced in the 1960s, these improved labour productivity by automating checkout processes and reducing errors. This technology not only cut costs but also expanded the capabilities of market research and logistics management (Gill, 2023). In the digital space, the introduction of GSM (the Global Standard for Mobile Communications) by the European Union created a global standard for cell phones. In the 21st century, new technologies like 2D digital barcodes offer the potential for the next step change if leadership is forthcoming and support is provided by other elements in the digital ecosystem.

The potential of digital standards

Information exchange in value chains currently consists of a series of closed point-to-point paper- or PDF-based ecosystems that are not joined up. There are emerging trends for markets to move to a new baseline: trusted, verifiable, digital product information that spans the entire value chain. Gill (2026) provides a more detailed discussion of these trends using mānuka honey as an example.

The widespread adoption of digital standards holds the potential for transformational change at multiple levels. These include better decision making at the micro level of individual product lines, improved meso or firm-level integration of data, and macro-level value enhancement by joining up data across each step in the value chain. For example, more advanced application of digital agriculture would realise a range of benefits. Direct benefits arise from improved input use and more timely decision making at both the macro and herd levels. Indirect benefits include improving the quality of biosecurity, food safety and animal welfare market assurances, and reducing the costs of complying with resource consents around water and nutrients. But achieving this full potential will require a common descriptor for land parcels replacing the current multiple, overlaying descriptors for owners, farms and fields, environmental catchments, soil types, micro-weather forecasting mosaics, and other spatial data.

These benefits would improve a range of outcomes: economic, environmental, biosecurity, animal welfare and food safety (see Gill, 2027). There is also reduced downside regulatory risk from the potential loss of market access if New Zealand does not align with emerging global standards on authenticity and sustainability.

Challenges in standardisation

Creating a single dominant standard is challenging, particularly in established domains with multiple competing standards. History shows that technically inferior standards can sometimes persist due to switching costs. Two approaches are possible: bottom-up working sector by sector (wine, kiwifruit, honey) and top-down economy wide approach that maximises the use of global standards in

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the wider digital infrastructure layer.

Kenneth Irons (former chairperson of AgriTech New Zealand and New Zealand's head of delegation for the ISO technical committee on data-driven agrifood systems) makes the case for a top-down approach as follows:

While 'bottom-up' initiatives are important, they need to follow top-down digital standards development, prioritisation and adoption. The world's major public digital standards entities, GS1 and ISO already mentioned, but also, the International Telecommunication Union 'ITU', the International Committee for Animal Recording 'ICAR', and others, all exist for a vitally important reason. Their top-down orientation ensures global alignment and relevance by following robust protocols that have been developed and refined over decades. These include proven processes for the identification, prioritisation, research, development, democratic approval, release, adoption and refreshing of digital standards that facilitate international trade from the global to regional to national to provincial to local levels.

Standards developed from this top-down perspective will ensure that definitions, controlled vocabularies, metrics, ontologies and other attributes are available at the granular level e.g. at farm or factory scale, and that will

maintain their relevance, interoperability, trading, compliance and sustainability integrity whether products and services are traded at local, national, regional or global levels.

It is not a New Zealand mindset, but a human condition, that sees bottom-up rather than top-down to be the default mechanism. Problems or constraints can accurately be identified between small cohorts of actors. Without 'looking over the parapet' it is easy to assume that since there is no awareness of already existing standards, a local group or entity can start creating their own introverted or myopic 'standard' or 'technology'. Real disadvantages of a bottom-up approach arise when locally generated standards are developed which aren't interoperable with other locally generated or global standards. (personal communication with the author)

International direction of travel

The line of argument for a top-down approach is linked to the case for paperless trade supported by a range of international organisations over the last decade, including the WTO, UNESCAP, UNCITRAL (the United Nations Commission on International Trade Law), the International Chamber of Commerce and the Commonwealth Secretariat (Nixon, 2024). More recently, this paperless trade approach has been expanded to include the ability to digitally exchange traceability and environmental, social and governance credentials using interoperable standards. Examples of this expanded approach include a recent APEC report, *Improving Supply Chain Transparency* (APEC, 2026), the Economic Commission for Europe's publication for the UN 'Recommendation no. 49: Transparency at scale – fostering sustainable value chains' (ECE, 2025) and a just-released report by Peter Stevens for the Pacific Economic Coordination Council, *Product Claims, Substantiation and Climate-Related Disclosures in the Value Chain through Digital Standards* (Stevens, 2026). These later reports suggest that a profound shift is underway in how firms communicate the attributes of their products, such as physical characteristics (GMO free) and production practices (organic). This shift will involve enhanced transparency,

accountability and trust. The reports argue for high quality, verifiable, interoperable product level information such as digital product passports. This would require an open architecture that supports digitally verifiable certificates issued by governments, industry bodies and auditors.

The Economic Commission for Europe report suggests that national policy settings need to include:

- adopting a national transparency at scale framework that prioritises high impact export sectors;
- mandating the use of international digital standards that align with recognised frameworks and seeking to embed digital standards in free trade agreements;
- digitising government services such as export certificates and other regulatory documents using verifiable digital credentials;
- building capability and industry playbooks by providing guidance and templates;
- investing in enabling infrastructure, including APIs, structured data systems and verifiable credentials.

The role of government

The New Zealand government has recently launched a 'digitising government' programme and a Digital Strategy for Aotearoa with a series digital public infrastructure initiatives for the core state sector (i.e., public service agencies and Crown entities).¹ While including important components for the wider digital infrastructure, such as the development of digital identity and digital payment systems, and a commitment to the principle that government agencies be 'open and interoperable' by design, the current focus of these strategies is on core central government systems. While exploratory work is underway, available public documents are largely silent on the role of digital standards in the wider public sector, regulatory systems and the economy as a whole.

The government has a vital role to play in realising the transformation potential through the adoption of digital standards across the economy. By acting as a facilitator leading and supporting the development, awareness and adoption of global digital standards as the primary source of digital

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standards used in New Zealand, the government can help to unlock significant benefits. However, achieving this requires both a top-down strategy and bottom-up initiatives, leveraging existing infrastructure and fostering collaboration with industry leaders.

The typology below emphasises a 'facilitator first' stance: the state focusing on working with the industry to set the conditions that allow private actors to both coordinate and compete, avoiding the use of unique, stand-alone proprietary digital standards in regulatory systems, and intervening directly only where genuine market failures prevent socially valuable outcomes or where the state's authority is required to reduce barriers to realising network effects.

The state's roles can be usefully categorised as follows:²

- Market enabler/rule maker: provide the general legal and regulatory framework that enables transactions, protect property rights (including data rights), and enforce digital standards.
- Busting barriers/infrastructure provider: invest in or coordinate investments in physical and digital infrastructure that private markets under-provide – rural broadband, shared data platforms and APIs. Public intervention can be catalytic when it reduces fixed costs that block many smaller firms from participating. One area where the state often acts as a 'blocker' rather than an enabler is in the use of unique, stand-alone proprietary digital standards in regulatory systems: this

reflects both a lack of awareness of digital standards and how they might be used, also also the 'not made here' problem based on a suspicion of technical standards unless developed internally.

- Icebreaker/risk-sharer: use limited, targeted co-investment or insurance mechanisms to overcome initial market reluctance – venture capital funds, or co-funded pilot projects – while maintaining strong monitoring and sunset clauses. Effective design treats these as portfolios, accepting that some projects will fail while a few succeed.
- Organiser/convenor: bring stakeholders together to build trust and alignment – standard-setting bodies, cross-industry consortia for data governance, and public-private R&D partnerships. Where industry is fragmented, government can provide a neutral convening role to promote collective solutions.
- Authority/international negotiator: represent sector interests in international rule-making (FTAs, mutual recognition of digital standards) to improve market access and reduce regulatory frictions for interoperable digital systems. In addition, support a wide range of pro bono work done by industry volunteers in international forums who do not have the financial or communications resources of central government.
- Fast follower: the state being an early adopter of emerging digital standards and adopting a digital-first approach to engagement will encourage the take-up of digital technologies. New Zealand currently lacks the equivalent of the US National Technology Transfer and Advancement Act. Instead of developing government-unique digital standards or regulations, this law directs all United States federal government agencies to use, wherever feasible, digital standards and conformity assessment solutions developed or adopted by voluntary consensus digital standards bodies and to report regularly on whether they have adopted unique, stand-alone proprietary digital standards.
- Honest broker: maintain policy capability to gather rapidly evolving technical and market intelligence, enabling iterative policy responses in a fast-moving digital ecosystem.

What needs to change?

The New Zealand government has a crucial role in supporting transformation based on standardisation and digitisation by acting as a 'facilitator', not a dictator. This involves leveraging the existing international digital standards rather than developing bespoke regulatory standards, and ensuring that regulatory platforms are interoperable in order to maximise network effects and economic benefits. The partnership on digital agriculture formed in 2020 between government agencies and AgriTech New Zealand – the peak industry body – is a recent example of the government–industry partnership that is needed to drive the transformation required. The experience with the agritech taskforce highlights that success requires more than good intentions (Gill, in press-b). Driving transformational change will require sustained commitment, strong co-leadership and the resources to deliver on a credible action plan.

There have been repeated calls in recent years for central government to take a stronger leadership role in the digital space. This could include introducing a regime that mirrors the requirements in the US National Technology Transfer and Advancement Act by making the default

settings digital-first based on open and interoperable standards.

The New Zealand government's experience with digital standards underscores the importance of acting as a steward of the standards system. This involves establishing a regulatory regime that supports digital standards while being agile and responsive to international trends. Government provision should focus on areas with significant network effects, such as digital identity, and providing leadership through a digital-first approach based on open and interoperable standards.

Key themes and conclusions

This article has highlighted the importance of digital standards in fostering improved economic, environmental and social outcomes. The government's role is not merely supportive, but also involves setting up a conducive regulatory framework for digital standards. This includes ensuring that public agencies participate fully in initiatives like paperless cross-border trade and avoid stand-alone regulatory ecosystems.

Additionally, the government should adopt a collaborative approach with industry leaders to drive a top-down strategy to realise the full potential of digital standards. Bottom-up innovation is

useful and necessary, but it requires a top-down alignment layer to ensure interoperability. This alignment layer is not about centralised control; it is about enabling interoperability so that diverse sectorled solutions can connect, scale, and participate in global digital ecosystems.

The key to this enhanced leadership role is to find a 'Goldilocks zone' where the government supports but does not dominate the adoption of digital standards, ensuring that the domestic economy can thrive in an increasingly globally integrated environment.

An open standards approach is critical to ensure interoperability and avoid fragmentation. Governance frameworks must balance accessibility with security and trust. Export markets in the EU, US and Asia are increasingly going to require robust, comparable, machine-readable data to verify claims. Product attribute disclosures are impossible to scale manually across global supply chains. A move to whole-of-value-chain transparency will be required. Economies that delay risk exclusion from high value markets including, for our agricultural exports.

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¹ <https://dns.govt.nz/digital-government/digitising-government-programme-dgp>; <https://dpihub.nz/strategies>.

² Gill (2026) elaborates these enacted roles in more detail.