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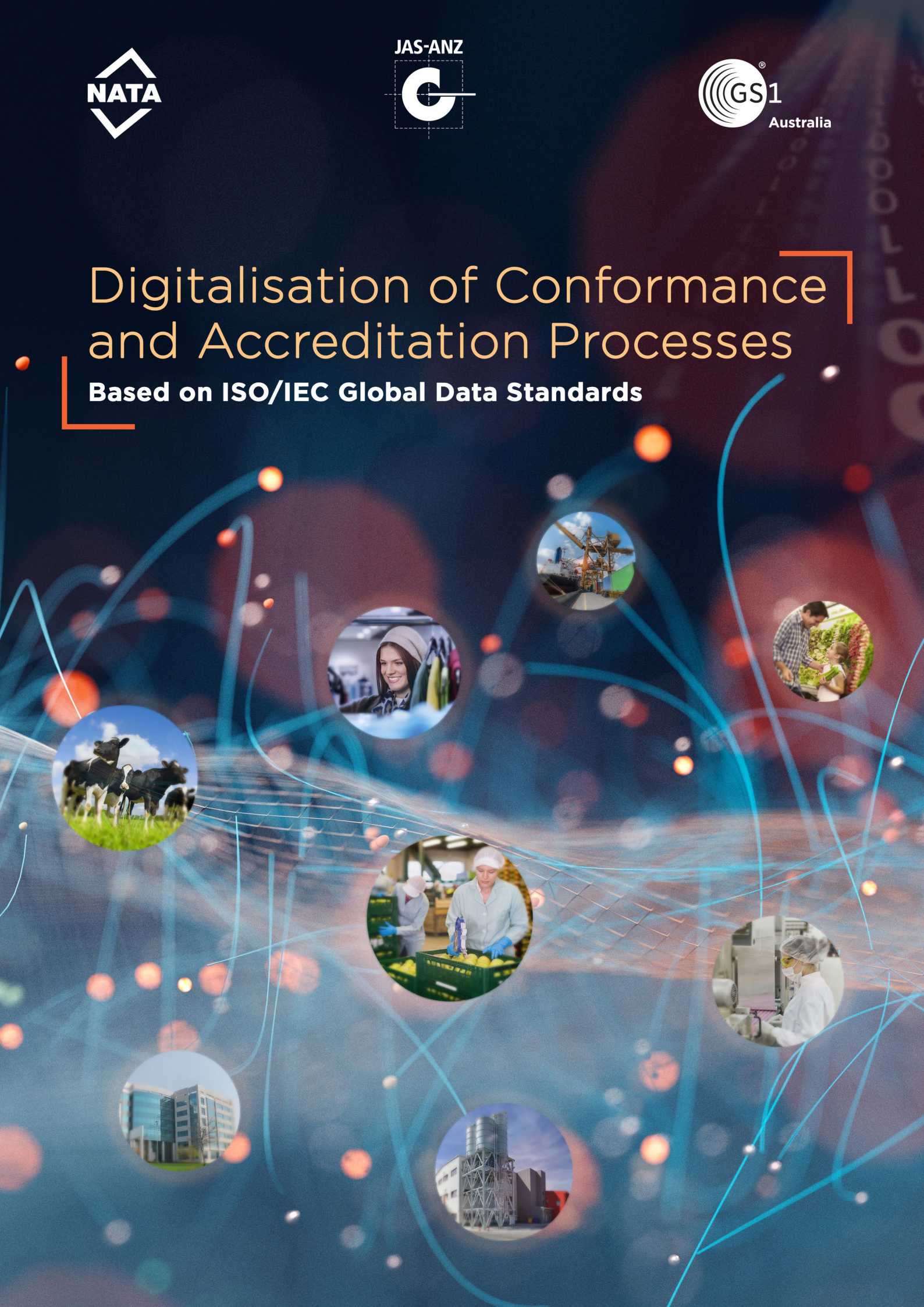
GS1 Australia

Digitalisation of Conformance and Accreditation Processes

Based on ISO/IEC Global Data Standards



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1. Executive summary

The rapid transition of global supply chains to data-driven, digital systems is placing new and increasing pressures on product conformity systems, their relevance, and the ability to deliver benefit through international trade income growth and the economic wellbeing of people.

Specifically,

- There is a growing gap between digital product traceability and the traceability of associated product conformity and credentialing information
- Efforts to simplify trade systems require that the national product conformity infrastructure and supporting systems are responsive and of high integrity – enabling rapid verification of credentials and detection of fraudulent or erroneous claims; and
- Use of recognised standards for the support of digital data exchange, traceability and interoperability is now critical

This discussion paper identifies that the common factor among these challenges is the absence of a standardised framework for the digitalisation of conformance and accreditation processes - including the necessary information architecture and common language to identify, capture and share data of relevance to national product conformance.

This paper puts forward a broad framework ('the framework'), rather than a specific technological implementation. The framework represents a general structure aligned with global data standards that can accommodate different supporting technologies (for example, blockchain, non-fungible tokens or verifiable credentials).

The structure of the framework can also accommodate existing industry-specific approaches and schemes by assigning globally recognised identification keys to track elements such as products, certificates, and companies/ entities. The application of ISO/IEC ratified global standards brings benefits beyond those that can be achieved using local or proprietary systems that do not include any common data structures.

Importantly, the proposed framework is not intended as a replacement or alternative for any existing conformity or approval schemes. The framework strengthens and simplifies the referential integrity of existing programs. It leverages an established system of global data standards used extensively by Australian industry and internationally for identifying, capturing, and sharing information through international supply chains.

A voluntary, rather than a mandatory, approach is proposed such that individual organisations can implement the framework based on its merit and the value that it may add. No new data would be captured or exchanged through the adoption of the framework, and information disclosures would be subject to existing industry norms.

Well-established existing national certification and conformity schemes can be accommodated, as well as processes involving multiple streams of evidence or optional pathways for approval of goods. The framework is extensible in that the international accreditation community responsible for overseeing certification and conformity schemes already operates to well-established ISO/IEC norms and standards.

Implementation will be achieved by:

- Developing a framework for national product conformity and credentialing data exchange, which will be compatible with existing and emerging ISO/IEC-based supply chain frameworks. This would involve applying ISO/IEC standards to achieve traceability of product conformity certificates, business entities, products, test samples and more, using GS1 identifiers and data carriers
- Establishing a common credentialing service to enable all conformity assessment bodies (CABs) to transition to data-driven and interoperable information exchange systems
- Providing a defined framework and supporting tools for CABs and the broader product conformance community as a pathway to future document-less data flow, distributed trust, and verifiable credentials exchange; and
- Ensuring that appropriate standards are recognised that specify the governance requirements for data platforms, including requirements for data security and privacy

An analysis of cost and benefit considerations is provided in Appendix A, and an industry example to illustrate how existing approaches might be accommodated within the proposed framework is given in Appendix C.

A coordinated national approach with high-level governance and support would greatly facilitate the achievement of these specific objectives.

2. Introduction

A growing gap between physical product traceability and product conformity data flow

Data exchange standardisation for all conformance and accreditation processes will assist in closing the gap between physical product and product conformity data flow to support government and industry modernisation and help align Australia with global supply chain and traceability developments. To achieve this, it will be necessary to:

- Develop and apply a standards-based framework for national product conformity and credentialing data exchange
- Establish a common/shared credentialing capability to provide confidence in product conformity data; and
- Support the product conformity ecosystem in embracing a digital future involving document-less data flow, distributed trust, and the exchange of verifiable credentials

The world is changing, and product conformity infrastructure must evolve

International markets have increasingly opened through free trade agreements; however, technical trade barriers and other non-tariff barriers have increased, along with the trafficking of falsified or sub-standard goods.

Traditionally, product conformity systems have been heavily reliant on trust and the exchange of manual documents and electronic (mostly PDF) certificates. While such documents can be fraudulently altered, even legitimate documents can be misused. A test certificate, for example, generally pertains either to the sample as received or to a batch/shipment; however, it can often be in the interests of suppliers to spuriously infer that the test certificate applies to the ongoing supply of the product (or even to a related, but different product). Similarly, a product certificate in current circulation may have ceased to be valid because associated credentials, authority, or standing of the certificate holder have changed.

The need for digitalisation of national product conformity systems

Defining a robust traceability system, addressing both physical products and product conformity information, represents an essential measure to ensure Australia's competitiveness and market access are maintained.

Such a system must enable highly systematised data exchange between manufacturers, exporters, importers, distributors, retailers, consumers, and regulators, as required. It must be underpinned by global data standards and exhibit interoperability across equivalent systems used by trading partners.

Linking conformance with traceability using common elements (product, place, and party identifiers) has merit for economic and data efficiency. It supports the Australian government regulatory reform agenda; in particular, for trade simplification and related 'tell us once' initiatives to reduce complexity. Applying ISO/IEC ratified standards and industry adopted business vocabulary is attractive, as the ready-made system is already in place.

The objective

The objective of the proposed framework is simply to move to an approach based on global data standards to deliver international alignment, harmonisation, and interoperability, that leverages the existing data standards used by industry for product traceability.

The framework provides an industry pathway to possible future states, including open attestation systems that are less reliant on central registries. In doing so, credential holders could have greater control over information disclosures than is currently possible.

Data exchange standardisation for conformance and accreditation processes will assist in closing the gap between physical product and product conformity data flow. It will help to align Australia with evolving supply chain traceability systems around the world.

An effective digital architecture will minimise the impact on existing business processes whilst providing Accreditation Bodies (ABs), Conformity Assessment Bodies (CABs) and others with the means to deliver value through innovation without compromising the integrity of product conformity systems.

What is the alternative?

Solutions developed by individual industries to address their context-specific concerns have, and will continue to perpetuate, a patchwork of incompatible systems. Efforts to coordinate information exchange from several thousand certifiers, testing and inspection authorities (within Australia alone) will become chaotic and potentially intractable, ultimately impacting on trade competitiveness.

Without intervention, it is easily imaginable that the existing mosaic of systems and methods will proliferate (e.g. proprietary QR or other codes), each using different semantics and pointing users to different data sources, such that conformity attestation becomes complex, costly, incompatible or impossible.

3. Conformity assessments and traceability

Conformity assessment

Conformity assessment gives us confidence in the products that are supplied to us. Conformity assessment processes touch almost every product that we encounter in our lives, from the food we eat, to the houses we live in, the cars we drive and the appliances we use.

The global conformity assessment ecosystem comprises a vast pool of specialist providers, undertaking a wide range of expert assessments, to ensure the functionality of supply chains in delivering suitable and safe products. This network of providers of conformity assessment includes testing laboratories, inspection bodies and certification bodies.

- Within Australia alone there are over 3,000 testing laboratories[1] and inspection bodies accredited to world-recognised standards, that operate across every industrial sector
- Among the myriad of compliance and assurance schemes having a local presence, over 34,000 Australian companies, and products related to food, building materials, timber, gas, and electrical sectors are currently certified[2] by accredited providers operating to world-recognised standards
- This structure is mirrored in essentially every economy around the world, involving shared protocols and norms

[1] www.nata.com.au/find-organisation/
[2] www.jas-anz.org

Traceability

Traceability, as defined in ISO 9001:2015, is the ability to trace the history, application, or location of an 'object' (e.g. product). When considering a product or a service, traceability can relate to: (1) origin of materials and parts; (2) processing history; (3) distribution and location of the product or service after delivery.

Traceability is primarily concerned with tracking a product as it moves through the supply chain, while certification and conformity assessment occurs at points along the supply chain. While there is a single traceability chain, there are multiple points at which conformity assessment is provided, verifying the compliance and authenticity of the product at each stage.

For example, milk can be physically traced along the supply chain. At various points, milk from the farm is tested and certified. The milk may be processed at the dairy or manufactured into strawberry yoghurt, for example. The yoghurt, strawberries and other ingredients are also subject to testing and certification, as well as the final packaged product.

While one might choose to view the product conformity and credentialing information (which attests to the product's suitability) as a natural part of the traceability of a product, the conformance and credentialing also require distinct traceability.

Conformity certificates and test reports are traceable items. An issued product certificate, for example, also requires tracking and tracing, adding an additional layer to the overall traceability. Questions typically asked about certificates include: 'Is it valid?', 'Does it apply to the product in question?', 'Was it issued by an accredited body?'. Conformity certificates are inextricably linked to products, manufacturers, manufacturing locations or other related entities. However, the certificates are also physically separate traceable items and are often only 'loosely coupled' with the physical subject of the test or certification.

Conformity assessment data - a critical component of traceability

When conformity assessment does not work as intended, there are inevitable product failures, recalls, or other disruptions to supply chains and trade. These problems can be attributed to inadequate safeguards over the integrity and traceability of conformity assessment data.

Traditionally, product conformity data has been heavily reliant on trust and the exchange of manual documents and electronic (mostly PDF) certificates. However, such arrangements are cumbersome and open to misuse and abuse by bad actors.

i. Is it valid?

Paper-based certificates (or their electronic equivalent) can be altered or falsified. It can be challenging to detect such activity in a timely manner. Detection after consumption, or following incorporation into finished products (buildings, for example), can be expensive or impossible to remedy. Another issue is that formal product certifications cease to be valid when related credentials, authority, or standing of the certificate holder change (i.e. the certificate holder has become subject to a restriction of activities or has ceased trading).

ii. Does it apply to the product in question?

A test certificate, for example, generally pertains either to the sample as received or to a batch/shipment; however, it can be in the interests of a supplier to spuriously infer that the test certificate applies to the ongoing supply of the product (or even to a different, but related product). Similarly, a certified product could be made in a factory with several related production lines; so, does the certification cover all production or only specific production lines?

iii. Was it issued by an accredited body?

Conformity assessments undertaken by unqualified parties cannot be relied upon. Indeed, this may be worse than no assessment at all since it can provide a misplaced sense of confidence. The global accreditation framework exists to provide assurance over the competence of bodies that undertake conformity assessment. Accreditation and credentialing constitute critical foundations for supply chain systems integrity.

4. Australia's current state and challenges

Changes in the global landscape

International markets have progressively opened through free trade agreements; however, technical trade barriers have increased along with the trafficking of falsified or sub-standard goods. Over the past 20 years, whilst applied tariffs in the Asia-Pacific region have halved, non-tariff trade barriers, including sanitary and phytosanitary controls, have risen significantly[3]. At the same time, the OECD and World Bank have also reported a significant increase in counterfeit and pirated goods; these now represent between 3.3% and 5% of the value of world trade[4].

The growing complexity of international supply networks, driven by increased globalisation and the use of digital technology, is outstripping the capacity of traditional controls that ensure compliance of traded goods and services. The consequences of this are widely acknowledged. For example, the Housing Industry Association (HIA) submission to the Senate Economics Reference Committee Inquiry into Non-Conforming Building Products, 3 August 2015 noted:

[3] https://www.unescap.org/sites/default/d8files/APTIR2019_Introduction.pdf

[4] https://www.oecd.org/corruption-integrity/reports/trends-in-trade-in-counterfeit-and-pirated-goods-g2g9f533-en.html

"The supply and distribution framework for building products provides a critical point in the supply chain. Any lack of accurate information, or in most cases, lack of any information to confirm to the purchaser that the product is 'fit for purpose' at the point of sale, perpetuates a situation where products can be sold for any purpose, and the obligation falls to the user of the product to be solely responsible for the correct selection."[5]

A fundamental shift has begun in the handling of the information that supports product supply, partly in response to these issues, with considerable interest shown in achieving a more robust connection between physical goods and the underlying assurance processes. This shift has intensified during the COVID-19 pandemic, with global supply chain vulnerabilities exposed.

To illustrate, global healthcare industries and the World Health Organization have regulated the use of ISO/IEC standards to ensure patient safety and provide unique device identification for implants. Food industries have called for end-to-end supply chain traceability with the United States (US) Food and Drug Administration developing a policy[6] to identify and recall contaminated food in a matter of minutes, rather than days or weeks. Nation-states, including New Zealand, have moved to require the identification of building materials using standardised semantics and labelling.

Australian response

In response to global trends, as well as historical domestic supply incidents, government agencies have become more focused on the issue of supply chain system integrity, traceability, and resilience. Australian and international momentum to enhance product traceability had already been accelerating prior to COVID-19, but the pandemic has intensified this focus, with many governments now developing policy and regulations to address supply chain resilience and associated challenges.

Between 2019 and 2021, the Australian Department of Agriculture, Water, and the Environment (DAWE) reviewed the food traceability system and developed a national traceability framework[7]. CSIRO and Data61 launched national challenges and missions on supply chain integrity[8]. The Therapeutic Goods Administration released Therapeutic Goods Orders for the unique identification and labelling of medicines based on ISO/IEC standards (GS1 product identifiers) and is currently working towards similar requirements for medical devices. Additionally, in 2021, the Office of the NSW Building Commissioner, along with the Australian Building Codes Board, called for submissions to improve, amongst other things, material labelling and traceability of building and construction materials, as part of its consultation on a new National Construction Code[9].

The Australian government's momentum to reduce the complexity of trade systems through regulatory automation, innovations and trade sandboxes has also increased. This includes global work to automate the exchange of product conformity data via eCertification systems. One example is ePhyto[10] or electronic phytosanitary certificate exchange. Early adopters of ePhyto and related single-window trade systems, have moved quickly to implement more sophisticated product conformity certificate credentialing systems to streamline trade clearance. For example, the evolving NexDoc system[11] by DAWE.

[5] https://hia.com.au/-/media/HIA-Website/Files/Media-Centre/Submissions/2015/Inquiry-into-Non-Conforming-Building-Products.ashx?la=en&hash=01E9E733591896126B5D602617BCD96608E5F558

[6] https://www.fda.gov/food/guidance-regulation-food-and-dietary-supplements/food-safety-modernization-act-fsma

[7] https://www.agriculture.gov.au/sites/default/files/documents/National%20Traceability%20Framework.docx

[8] https://www.csiro.au/en/about/challenges-missions/trusted-agrifood-exports/building-an-australian-food-provenance-infrastructure

[9] https://consultation.abcb.gov.au/engagement/ncc-2022-public-comment-draft/

[10] https://www.ippc.int/en/ephyto/

[11] https://www.agriculture.gov.au/export/certification/nexdoc

Australian industry has also been actively engaged in addressing traceability focusing on trade, competitiveness, and sustainability[12]. A national traceability advisory group (NGTAG) has been established, representing a cross-section of industry and government with emphasis on the importance of a whole of economy approach to standards-based traceability of products.

Steps towards the digitalisation of data flows are now evident across almost every sector.

A problem of standardisation

Australia has a long-standing policy of accepting trusted international standards, where appropriate. Global standards and systems to support digital product traceability through supply chains are now well established in the form of global trade identification numbers and global location identification numbers.

In contrast, the systems for managing product conformity and credentialing information[13] have not kept pace with digital transformation.

This gap between digital product traceability versus traceability of product conformity and credentialing information is now a problem. This gap is less apparent in Government to Government (G2G) ePhyto, Patents and IP and some Business to Consumer interactions (for product marketing claims e.g. organic certification). However, it is becoming quite stark for Business to Government (B2G) and Business to Business (B2B) exchange of product conformity data.

In terms of industry involvement, there is an opportunity for the Australian government to provide clear guidance to industry regarding the value of adoption of global standards in trade digitalisation. This might be adequately achieved through policy and consultation, rather than legislative or regulatory reform.

However, until emerging platforms begin specifying the use of global data standards as a key deliverable, then it is likely that proprietary interests or other stakeholder concerns will limit progress. For now, it remains the case that disjointed efforts, by various stakeholders involved in supply chain development, are compounding the challenge of achieving national and international harmonisation.

Trade implications and single windows

It should be recognised that there are already digital capabilities being trialled by government that could provide guidance around possible options and help inform the delivery of the necessary verifiable credentials. Examples include the Australian Border Force's trial of a proof-of-concept digital verification platform, in partnership with the Singapore Government. The Australian Government's Simplified Trade System Taskforce, operating within the Department of Foreign Affairs and Trade, is exploring trade single window as a core modernisation priority for government, as part of the Taskforce's broader role in delivering trade reform.

Leveraging digitalised conformity processes within a trade window could, among other benefits, simplify the border clearance process for businesses by enabling automatic acceptance based on credentialed attestations.

It is also worth noting that several countries (including China, New Zealand, Vietnam, Russia, and Canada) have adopted the Global Trade Identification Number as a standardised form of strong entity identification for traded goods.

Appendix B provides international insights and perspectives on standards adoption to improve physical supply chain transparency and traceability.

[12] https://www.gs1au.org/what-we-do/standards/traceability/national-gs1-traceability-advisory-group

[13] https://casco.iso.org/key-considerations.html

Shaping the future - an issue of national interest

Australian national interests are finely balanced between maintaining public safety, health and security and the need for economic recovery, productivity improvements, industry competitiveness and international market access.

The relevance and importance of product conformity and verifiable credentials exchange in a digital world, cannot be overstated. Aligning standards and capabilities to connect physical product flow with product conformance information is critical, as the current misalignment is a cost/efficiency burden impacting all industries. It is often overlooked that the need to address credentialing requirements ('Is the buyer a legal entity?', 'Is the product prohibited or does it meet local specifications?', 'Is the purchase order legitimate?') comes well before any physical product flow.

In order to simplify and harmonise international trade procedures, governments have a critical role to play, as do global data standards and the norms supported by key trade facilitation agencies, including the World Trade Organization (WTO), World Customs Organization (WCO) and United Nations (UN) agencies.

Australia has specific obligations under the WTO Agreement on Technical Barriers to Trade that directly or indirectly relate to digital trade initiatives. To support alignment with international standards, government policy officers are advised that "If an applicable International Standard or risk assessment cannot be found, then a regional, national, industry or other standard can be used."[14]

However, the adoption of recognised standards to identify, capture and share product conformity and credentialing information is lagging in Australia. To help address this, one component of the Australian trade modernisation agenda is the concept of a single window[15] , creating a secure digital interface between government and industry and providing a single data touchpoint for Australian businesses to meet all international trade regulatory requirements.

Australia is not alone. On 28 October 2021, the Asia-Pacific Economic Cooperation (APEC) Business Advisory Council (ABAC) published their annual Report[16] to APEC Leaders, noting:

> "ABAC has welcomed the recognition by APEC Leaders and Ministers that wider use of global data standards can improve supply chain performance and visibility, enabling greater interoperability and supply chain integrity across the region. This has only become more important with the increasing digitalisation of trade and greater use of e-commerce, but many economies lag in the uptake of this technology, and approaches are often bilateral rather than regional. APEC should encourage a regional implementation approach."

International perspectives provided in Appendix B indicate that many of Australia's key partners (and competitors) are pushing ahead with digitalisation agendas. Notably, General Administration Customs in China has adopted GS1 standards for product identification to support customs clearance[17]. The Green New Deal is set to redefine requirements for trade with the European Union with emphasis on greater transparency of product and production systems credentials. The United States (US) Food and Drug Administration has proposed wide-ranging traceability requirements for imported products[18] and US Customs has commenced trialling GS1 entity identifiers to credential economic operators. Closer to home, New Zealand, which uses ISO/IEC standard keys to identify all local companies, has regulated the use of GS1 product identifiers on import declarations where available.

[14] https://www.industry.gov.au/sites/default/files/2019-03/best-practice-guide-to-using-standards-and-risk-assessments-in-policy-and-regulation.pdf

[15] https://www.dfat.gov.au/trade/services-and-digital-trade/Pages/e-commerce-and-digital-trade

[16] https://www.apec.org/Publications/2021/10/ABAC-Report-to-APEC-Economic-Leaders

[17] http://static.gds.org.cn/b2b/Content/Index/GDSN_call_to_action.html

[18] https://www.fda.gov/food/food-safety-modernization-act-fsma/food-traceability-list

Maintaining the status quo presents a significant risk to industry and government in the form of continued inefficiency, market failures and widening gaps with our trading partners. Failure to respond to the changing global trade landscape risks damaging national product conformity system integrity, losing relevance and the ability to influence the global direction, while other parties begin developing potentially incompatible solutions to address this gap.

There is a window of opportunity for timely action, adding gravity and urgency to the current government policy focus on streamlining and simplifying trade systems to enhance market access and support accelerated economic recovery.

Focusing on the now and planning for the future

The framework provides a mechanism to improve the way current certification information is captured and shared by CABs and others. As noted earlier, the objective is not to change existing processes but rather to enhance them and make existing systems more useful and less onerous for users.

A voluntary rather than a mandatory approach is proposed such that individual organisations can implement the framework based on its merit and the value that it may add. No new data would be captured or exchanged through the adoption of the framework, and information disclosures would be subject to existing industry norms.

As described in the future state analysis in section 8, the future may well involve less reliance on physical forms and certificate exchange through the exchange of verifiable credentials. In this future state, only the particular information applicable to the certificate use case would be exchanged. In other words, information unrelated to the transaction would not need to be disclosed by the holder of the credential. This may benefit some use cases where there are trust issues or sensitivities concerning access to unrelated data - for example, revealing the identity of businesses.

The framework provides an industry glide path to possible future states, including open attestation systems that are less reliant on central registries and where credential holders have greater control over information disclosures than is currently possible.

5. Building blocks for effective digital trading systems

There is growing realisation that technology on its own is not the complete solution to enabling industry transformation. Agreed frameworks and standards provide the necessary foundation upon which interoperable technological solutions, suitable for global data exchange, can be built.

Australia's standards and conformance infrastructure

The four core bodies responsible for Australia's Standards and Conformance Infrastructure (refer Figure 1) are:

- National Measurement Institute (NMI) - the Australian Government national authority on measurement
- Standards Australia - responsible for the development and publication of documentary standards
- National Association of Testing Authorities (NATA) - accreditation body for conformity assessment bodies, including laboratories, inspection bodies, proficiency testing scheme providers and reference material producers
- Joint Accreditation System of Australia and New Zealand (JAS-ANZ) - government appointed accreditation body for certification and inspection bodies

International standards and product conformity systems depend on Scheme Owners and Accreditation Bodies (ABs) for the delivery of rigorous and consistent conformity assessment against defined standards. In Australia, NATA and JAS-ANZ provide accreditation for those conformity assessment activities for which they are responsible, including conducting evaluations of the performance of Conformity Assessment Bodies (CABs) against the criteria for accreditation by the AB. CABs include public and private laboratories, certification, and inspection bodies.

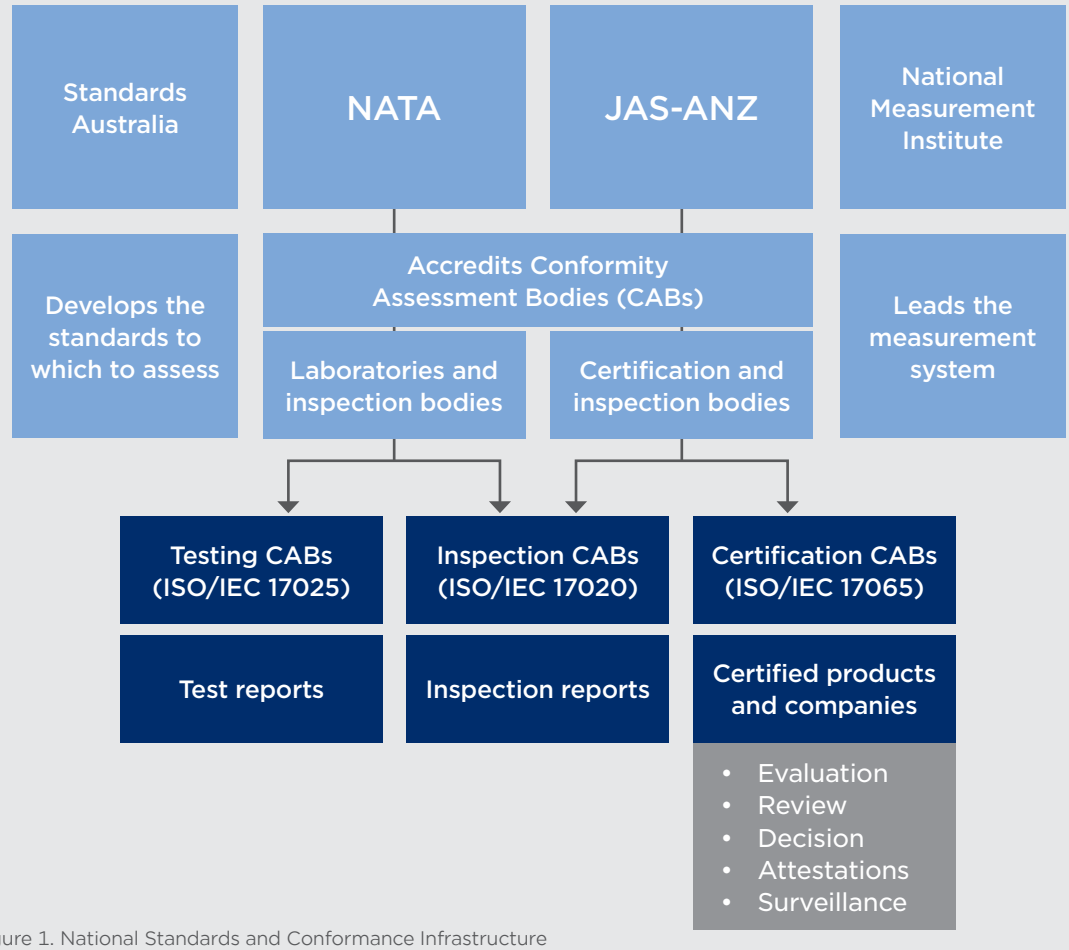


Figure 1. National Standards and Conformance Infrastructure

There are three main forms of conformity assessment that can be used individually, or more often, in combination:

1. Testing and calibration – the determination of one or more characteristics of a sample or product, usually performed in a laboratory
2. Inspection - evaluation of a product or process against defined specifications using experience and professional judgement
3. Certification – written assurance by an independent body that a product, service, or system meets specific requirements

In relation to product conformity, it is the role of NATA to accredit testing laboratories and other technical facilities as well as inspection bodies. It is the role of JAS-ANZ to accredit certification and inspection bodies.

CABs are accredited to provide specified conformance assurance activities – in some cases making public the results of testing, certification, and inspection activities. They are not prohibited from providing additional activities if this is disclosed.

In addition to granting accreditation, JAS-ANZ and NATA have the authority to sanction CABs that do not comply with the accreditation criteria, including suspension or withdrawal of an accreditation.

Further information regarding Australia's standards and conformance infrastructure is available via the Department of Industry, Science, Energy and Resources (DISER) website and the Australian Technical Infrastructure Alliance (ATIA) website[19].

[19] https://www.industry.gov.au/regulations-and-standards/australias-standards-and-conformance-infrastructure

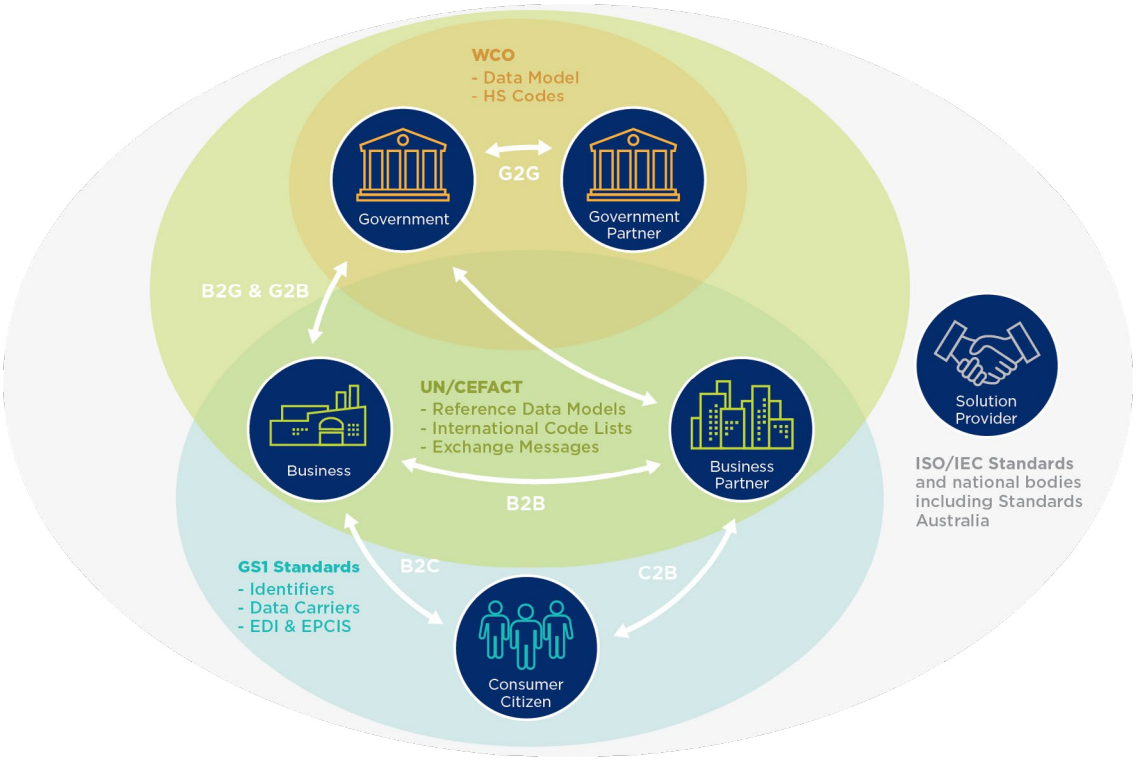


Figure 2. Relationship between key trade facilitation agencies

Digital traceability standards – supporting simplified global trade systems

Global data standards for traceability are critical for efficient and resilient global supply chains and trade. Digital traceability systems are dependent on quality data, including the exchange of product conformity information. Australia is a signatory to APEC and committed to best practices for the adoption of global data standards[20] to ensure simplified, harmonised, and standardised trade.

Product conformity systems are tightly integrated with global trade systems. Key United Nations (UN) agencies and the World Customs Organization (WCO) work together alongside global standards bodies to enable efficient and effective data exchange between governments.

The relationship between key agencies that are focused on global trade and supply chain data exchange, is shown in Figure 2.

Overlapping circles within the diagram should not be interpreted as duplication. Agencies focus on different layers of information management. ISO/IEC typically focuses on the 'what should be done' whereas UNCEFACT and GS1 focus on the 'how' – with GS1 concentrating on the operational pre-requisites, not limited to globally unique and unambiguous product and location identification, to enable businesses to transact.

ISO/IEC and national standards bodies, including Standards Australia, are responsible for global data standards. At the international level, publishing and maintaining standards that relate to the exchange of trade information, falls within the responsibility of the ISO/IEC Joint Technical Committee, JTC1.

GS1 is an international standards-writing organisation that supports government and industry by developing supply chain standards encompassing traceability, chain of custody and related needs. GS1's standards-writing activities contain several standards that have been adopted as ISO/IEC standards. Additional information on GS1 standards compatibility and compliance is available from the GS1 website[21].

The United Nations Centre for the Facilitation of Procedures and Practices for Administration, Commerce and Transport (**UN/CEFACT**) supports trade facilitation through recommendations and electronic business standards, such as electronic messaging, eCertificates, Core Component Libraries, UN Code lists and UN Recommendations.

World Customs Organization (WCO) supports the effectiveness and efficiency of customs administration through the development of international conventions and instruments. WCO maintains the international Harmonized System goods nomenclature and the WCO Data Model that addresses the procedural and legal needs of cross-border regulatory agencies[22].

Simplification, harmonisation, and standardisation of trade processes requires the global alignment of multiple parties. UN/CEFACT and WCO's work on intergovernmental data exchange is enhanced and supported by the adoption of global data standards across most industries. This reflects the far-reaching application of such standards for global and domestic trade. UN/CEFACT Core Component Libraries[23], WCO Data Models[24] and the GS1 Standard and Core Business Vocabulary[25] are well aligned – and in some cases, one and the same. However, the way this alignment operates and how businesses use GS1 standards through supply chains, is not well understood by many government agencies.

There is a growing awareness that traceability solutions that are not based on global data standards create inefficiency that is contributing to market failures and supply chain vulnerability[26]. The costs and benefits for government and industry of applying global data standards have been well defined[27].

[20] https://www.apec.org/Publications/2020/03/APEC-Guidelines-and-Best-Practices-for-the-Adoption-of-Global-Data-Standards

[21] https://www.gs1.org/docs/GS1-and-ISO-06BD.pdf

[22] http://www.wcoomd.org/DataModel

[23] https://unece.org/trade/uncefact/unccl

[24] http://www.wcoomd.org/DataModel

[25] https://www.gs1.org/standards/epcis/epcis-cbv/1-0

[26] https://www.pc.gov.au/inquiries/completed/supply-chains/submissions

[27] https://www.apec.org/Publications/2017/11/Study-on-the-Application-of-GDS-for-Supply-Chain-Connectivity-Phase-2

GS1 - Global Data Standards for supply chains

GS1 standards focus on the unique identification of products, locations, shipments, consignments, documents and many other 'items' involved in supply chains and trade. GS1 standards support the automatic capture of data as these 'items' physically move between trading partners, via technologies such as barcodes, RFID and IoT. Finally, GS1 standards enable data sharing between all stakeholders in the supply chain (both public and private) to automate master data sharing, Order to Cash and Procure to Pay processes, traceability, freight management, product recalls and a range of other business processes.

6. Applying standards to product conformance infrastructure

The challenge

A fully digitalised supply chain should accommodate all the following types of information and processes:

1. Commercial transaction data
2. Regulatory and cross-frontier processes
3. Conformity information
4. Real-time monitoring data (where applicable)
5. Document authentication
6. Tracking of physical goods, including bulk breaking
7. Uniquely linking data with individual shipments of physical goods ('digital twin')

Linking conformity information (Item 3) with individual shipments (Item 7) carries the potential to solve certain intractable supply chain weaknesses – in a way that is not possible, even in principle, with legacy (paper-based) trade systems.

However, no standard or common convention is currently available for the capture and exchange of product conformity information along a supply chain. There is also an absence of a standardised framework for connecting disparate processes which may share a common link with a product. One of the challenges is that the information of interest is generated by a large and diverse group of entities, which are not directly part of the supply chain. This situation has compounded the difficulties with incorporating such information into digital data flows.

Conformity information itself is a complex mix of data types and may include any, or all, of the following:

- Product and system certifications
- Sampling and test results
- Source/origin attestations
- Inspection reports
- Sign-off/clearances
- Sampling and test results
- Credentialing of conformity assessment bodies

Existing treatment of product conformity and credentialing information

ABs maintain publicly accessible registers of accredited CABs and, in some cases, the certificates that have been issued by their accredited CABs. These registers typically enable searching using an accredited organisation number or a certificate reference number. However, it is more challenging to authenticate or validate that the test results, certification, or inspection results in use at any given time are genuine, current and pertain to the supplied product(s).

The following weaknesses are inherent to most supply chains:

1. It is relatively easy for nefarious agents to fraudulently alter a test/inspection report or product certificate, as well as take a genuine report for one product and imply that it relates to another product
2. It can be difficult to establish whether specific items 'as-supplied' are conforming or not, since traditional documentation is often not unequivocally linked with a delivery shipment
3. Establishing or confirming the authority upon which issuing bodies make conformity claims can be problematic where a single product relies on multiple testing and other conformity data points that require checking across multiple information sources
4. There is no easy way to share or query information about entities, locations, products, or events that may have occurred, as each party is capturing information using different methods

These weaknesses create challenges for product conformity stakeholders and adds cost and complexity for industry and governments to interact with product conformity data.

Common entities and data elements

Traceability of product and related conformity processes, involve many of the same entities and data elements:

- Legal entities that are Accreditation Bodies (ABs)
- Legal entities that are Conformity Assessment Bodies (CABs) and are approved by ABs to undertake specified testing, certification, or inspections
- Organisations (legal entities) that produce, or supply, products that are tested, certified, or inspected
- Physical locations/sites where the above legal entities operate, carry out activities or are subject to testing, certification, or inspections
- Products that are subjected to testing, certification, or inspection
- Samples of products that are tested, certified, or inspected; and
- Test results, certificates, or inspection reports (product conformity process outcomes).
- Additional entities of potential relevance to product conformity systems include:
- Assets – including configurable items such as weighing, measuring, or dispensing machines
- Service relationships – defined as an approved scope of service offered by a CAB; and
- Events – that may include calibration, testing, certification, or inspection

Applying digital identities within the accreditation ecosystem

So, how do ISO/IEC based identification keys, used extensively in physical supply chains, map to elements of the product conformity systems components? An illustration of the accreditation ecosystem is depicted in Figure 3, with a short description and references to applicable GS1 Identification keys.

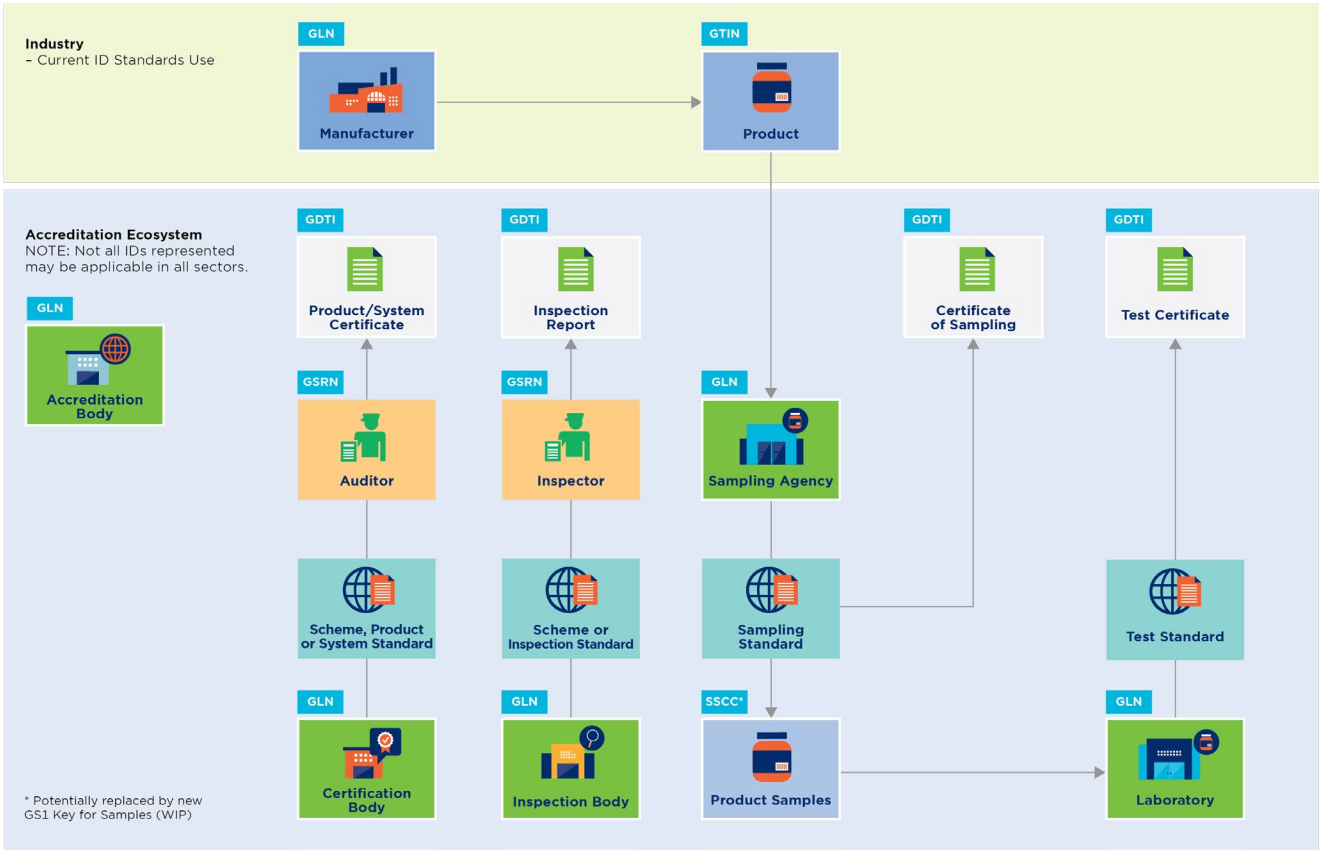


Figure 3. ISO/IEC Identification keys mapped to product conformity entities.

GLN (Global Location Number)

- GLNs are used to identify legal entities, organisational business units and physical or virtual locations. In the case of the accreditation ecosystem, they are used to identify the ABs, CABs and the organisations that are subject to testing, locations where tests occur (or sites that are certified) and the location where process conformity data may be stored (a server or address). This identifier is compliant with ISO/IEC 6523. GLN semantics and rules are defined at https://www.gs1.org/standards/id-keys/gln
- Application example: A CAB issues a certificate to an organisation's business unit, located at a defined site. Each entity, including the CAB, its client (the organisation), the client's business unit and the relevant locations are all identified using GLNs

GTIN (Global Trade Item Number)

- GTINs are used to identify products. The GTIN is composed of a Company Prefix and a unique item reference (typically represented as a barcode number). GTIN specificity may be enhanced via batch/lot referencing or serialisation to identify specific items. GTIN is compliant with ISO/IEC 15459-6. Further details are available at https://www.gs1.org/standards/id-keys/gtin
- A product that is subject to testing is assigned a unique product identifier. The same identifier that is used for supply chain purposes is used for test and certificate referencing

SSCC (Serial Shipment Container Codes)

- SSCCs are used to uniquely identify shipments, containers, or logistics units. A test sample provided for a product may be defined as a logistical unit. SSCC is compliant with ISO/IEC 15459-1 and described at https://www.gs1.org/standards/id-keys/sscc
- GS1 is addressing unique identification for samples as part of the Global Standards Management Process. Note that laboratories often create their own sample identification codes that often have weak links, or no links, to the product/shipment that the sample relates to

GDTI (Global Document Type Identifier)

- A GDTI identifies documents such as Purchase Orders, Invoices or any other type of document used in supply chains and trade. A GDTI can be used to identify certificates, test or inspection reports or declarations. GDTI is compliant with ISO/IEC 15418. Further information is available at https://www.gs1.org/standards/id-keys/gdti
- A test certificate, for example, can be uniquely identified with a GDTI, as well as including the appropriate symbology on the document (e.g. a QR code) embedded with the GDTI and linking to additional information about the certificate, including its authenticity via validation mechanisms

GSRN (Global Service Relationship Number)

- GSRNs are used to identify relationships, for example, between individual service providers such as an accredited service provider (defined scope) and an inspector or auditor. GSRN is compliant with ISO/IEC 15418. Further information is available at https://www.gs1.org/standards/id-keys/gsrn

Why leverage GS1 standards?

GS1 emerged as the de facto international global data standard for retail products via a cooperation agreement between the Uniform Code Council in the United States (established 1974) and the European Article Numbering Association (established 1977).

As previously noted, ISO/IEC standards now explicitly recognise the GS1 system of standards for a wide variety of supply chain elements. The GS1 system of ISO/IEC compliant standards are recognised by the United Nations and related bodies applying legislated standards.

Global businesses and governments have long recognised the importance in international trade of a common vocabulary to identify and share information about products, places and the parties involved. The rapid expansion of post-war global business, especially fast-moving consumables, deregulation, internationalisation, and now, digitally-driven systems, has amplified the importance of global data standards for trade.

The GS1 system of standards is:

- Voluntary
- Multi-sector
- Globally adopted
- Technology agnostic
- ISO/IEC compliant
- Industry governed and led
- Not for profit

Global membership is now close to three million organisations, spanning all segments of industry supply chains across diverse sectors.

At a national level, the GS1 system of ISO/IEC compliant standards are increasingly adopted by governments to simplify regulatory systems. To illustrate, in New Zealand the local business identifier, or NZBN, is based on a GS1 identifier (the Global Location Number). An increasing number of economies are introducing GS1 standards in single window and trade processes, including the USA, Canada, Vietnam, New Zealand and China. China now uses GS1 keys to enhance the harmonised system (HS) of tariff codes to classify traded products[28]. GS1 and WCO trade code nomenclature is well aligned and increasingly integrated.

Australian government examples include the Australian National Freight Data Hub and the Therapeutic Goods Administration medicines labelling orders both of which are based on GS1 standards. Over 20,000 companies use GS1 Standards in Australia. Appendix D provides a snapshot of Australian industry adoption and use of GS1 standards.

From a founding member base of 12 countries, the GS1 federation of not-for-profit member organisations has grown to 114 national offices, supporting 150 nation-states to maintain the currency of data and provide open registers and related services to address economic and public policy priorities. In Australia, this includes national product registries, national product recall and national location registries. As not-for-profit entities, GS1 member organisations cover their operating costs through membership fees and the licencing of identification keys. All GS1 standards are available royalty-free for members and non-members to use.

Cutting through some of the complexity associated with digital trade, the GS1 system of standards fundamentally provides an economic foundation. The common business vocabulary provides the building blocks. Standardised identification keys enable capturing and sharing of data and efficient exchange of information. As outlined in this paper, there are very close similarities between the data elements relevant for tracking the physical exchange of products and those related to product conformity data flows. These similarities may be exploited to address existing challenges in achieving the goal of full traceability for product conformity and credentialing information and avoid the need to duplicate standards or re-invent the wheel.

It is perhaps helpful to clarify that the proposed framework (as depicted in Figure 3) involves some digitisation (digital capture of content) and, more importantly, the digitalisation of processes and systems that use digital content. Both benefit from consistent structures to identify common entities such as companies, operating locations, products and in some cases, test samples or testing equipment that requires calibration.

7. **Priority applications for GS1 identifiers** – Use case examples

As described in the previous section, GS1 standards that are widely used across industry for supply chain management and trade can be directly applied to the conformity ecosystem. In other words, there is a single global standards framework that is applicable to all sectors.

This section provides an overview on the priority areas for adopting ISO/IEC data standards in the conformity process. The recommended priority use cases include:

1. Governing Accreditation
2. Product Conformity Assessment Data
3. Supply Chain Conformity Events
4. End-to-end digitalisation of product attestations

[28] https://www.gs1hk.org/about-us/news/China-Introduces-GS1-GTIN-for-Customs-Clearance

Governing accreditation - Use case

The use case involves the identification of the formal recognition awarded by accreditation bodies (ABs) around the world (such as NATA and JAS-ANZ in Australia) to the individual organisations (CABs) involved in making conformity attestations. In this way, the authority upon which such attestations rest can be verified. This use case enables the 'accreditation status' of these attestations to be digitally associated with all issued conformity certificates as well as with physical entities or product releases.

The identification keys of relevance are the GLN and the GDTI:

1. Use a GS1 Global Location Number (GLN) (ISO/IEC 6523) to identify
   - Each Accreditation Body (AB)
   - Each Conformity Assessment Body (CAB)
2. Use a GS1 Global Document Identifier (GDTI) (ISO/IEC 15418) to identify:
   - AB-issued credentialing information for each accredited CAB (including accreditation standard, accreditation number and accreditation scope/licence)

Product conformity assessment data - Use case

This use case involves the unique identification of certificates issued by CABs as part of their testing, auditing, or inspection processes and, to the greatest extent possible, the unique identification of parties, locations and products relevant to all certificates issued by CABs.

A range of identification keys are in scope for this use case:

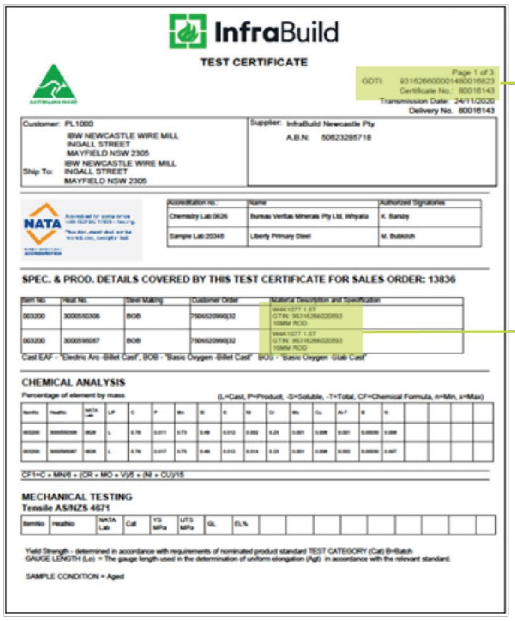
1. Use a GS1 Global Location Number (GLN) (ISO/IEC 6523) to identify:
   - Unique business entities – e.g. manufacturers, importers
   - The CA provider (e.g. laboratory, certification body, inspection body) issuing a product conformity certificate
   - The business entities (e.g. manufacturers/ locations relevant to the certificate)
3. Use a GS1 Global Document Identifier (GDTI) (ISO/IEC 15418) to identify the certificate itself
4. Use a GS1 Global Trade Item Number (GTIN) (ISO/IEC 6523) to uniquely identify each product being tested; and
5. Use a GS1 Serial Shipping Container Code (SSCC) (ISO/IEC 6523) to identify:
   - Each unique product sample sent for testing

The following real-life example of a bundle of reinforcing steel manufactured and supplied by InfraBuild Steel, marked with a product label carrying GS1 standards compliant data, demonstrates how this can work in practice. This is further supported by the InfraBuild Steel Mill Test Certificate which not only links the certificate to the GS1 compliant product labels, but in turn, has its own unique identity based on GS1 standards.

AI Code	AI Type	Data	Comments
01	Global Trade Item Number (GTIN)	99316266014168	This is the InfraBuild issued GTIN for Deformed Bar 24x15000mm
21	Serial Number	1613802680	Unique Serial Number for this bundle
10	Batch/Lot Number	1600231688	Identification for the heat number for this bundle
30	Variable Item Count	54	Indicating there are 54 Deformed Bars 24x15000mm in the bundle
31	Logistic Measure (Weight)	3002	Indicating the weight of the bundle

Figure 4. Infrabuild steel bundle data embedded barcode example

The information embedded on the GS1 DataMatrix barcode in the example, can be used in test certificates issued for this specific bundle as demonstrated in the example below:



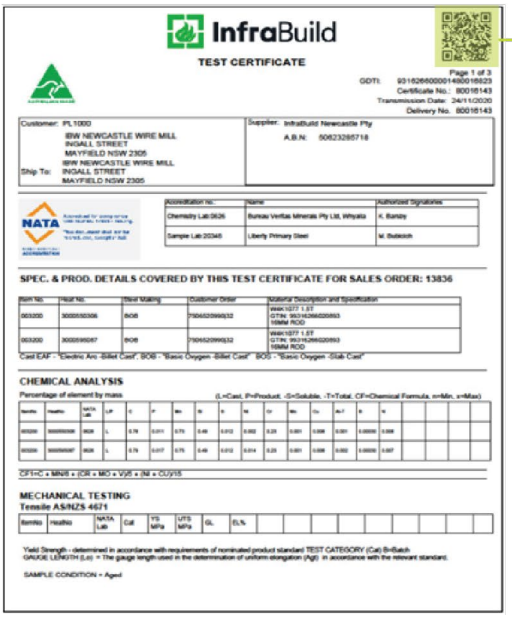
Certificate Identification using Global Document Type Identifiers (GDTI)

Product Identification using Global Trade Item Numbers (GTIN)

NOTE: Multiple locations (customer and ship to) along with certified entities and/or functional units (labs) are named and could also apply Global Location Numbers (GLN)

Figure 5. Example use of GDTI and GTIN on Infrabuild Test Certificate

The use of a unique Certificate Identifier based on GDTI as well as the inclusion of the product's unique identifier (GTIN) in the certificate, provide the foundation for digitally linking items to their corresponding certificates as they 'travel' across the supply chain:



GS1 QR Code providing

- A link to the certificates digital twin
- Additional information not on the certificate
- Machine readability – to enable rapid scan receipting and matching

Also

- Track user interaction with the certificate
- Mechanism for enhanced security through public and private key encryption

Figure 6. GS1 Data Embedded QR Code Example on Infrabuild Test Certificate

Further information about the GS1 Digital Link Standards is available online[29]

[29] https://www.gs1.org/standards/gs1-digital-link

Supply chain conformity events – Use case

Tracking of supply chain events using the Electronic Product Code Information Services (EPCIS - ISO/IEC 19987), combined with a Common Business Vocabulary (CBV - ISO/IEC 19988) represent mechanisms for improving supply chain transparency and enhancing overall product conformance system integrity.

EPCIS is a GS1 standard that enables trading partners to share information about the physical movement and status of products as they travel throughout the supply chain – from business to business and ultimately to consumers. It helps answer the 'what, where, when and why' questions, to meet consumer and regulatory demands for accurate and detailed product traceability information.

EPCIS is providing the foundation for traceability systems across the world in sectors including agriculture, packaged foods, healthcare, among others. EPCIS is also a foundation for the Australian National Freight Data Hub for the tracking of freight. As the adoption of EPCIS standards continues to grow in Australia and abroad, the opportunity for 'digital certificates' to travel along with products' digital twins is increasing.

Current and possible future states are illustrated in Figure 7.

The future will involve product conformity data being exchanged in real-time to automate government and industry traceability and decision support systems.

Event-based information about testing, inspection and certification processes and the exchange of such data has dramatic implications for regulatory automation and the value of product conformity processes.

Additional information about EPCIS is available at https://www.gs1.org/standards/epcis

End-to-end digitalisation of product attestations - Use case

Certain supply chain functions can only become possible as a result of connecting sequential discrete supply chain stages.

Consider the tracking of sustainability measures, or ethical manufacturing practices, which could reflect the sum of all stages of a supply chain. Each precursor stage in supply might be subject to its own type of local certification, oversight, and conformity outcomes.

Linking separate stages of supply chains to generate a complete picture of supply has remained elusive, largely due to the complexity of modern supply chains, but also due to the absence of a standardised framework for connecting disparate processes. While end-to-end digitalisation is a sophisticated use-case, the potential payoff is large.

A recognised framework, in which product flows could be tracked and then linked with associated attestations under valid protocols would provide a powerful basis for managing complex layers of attestations. Clearly, for this use case, cross-border interoperability would be important for success.

To illustrate what might be possible, consider the examples in Figure 8 of existing industry schemes and the ways in which current outcomes might be augmented through the power of global standardisation.

Current State	Future State – leveraging a common event language
Accreditation events, product conformity tests and certificate issuance and use are static. A focus on 'current state' with few systematic controls over prior states or event history to ensure currency and change	Critical Tracking Events (activities defined by CAs), as well as key data elements required to enable traceability, are systematically captured. Dynamic user interaction with conformity information – including real-time verification of credentials (with proofs). Process and regulatory automation leveraging electronic certification data exchange (eCert) - ePhyto is an early example of this

Figure 7. Current and Future State Analysis Table

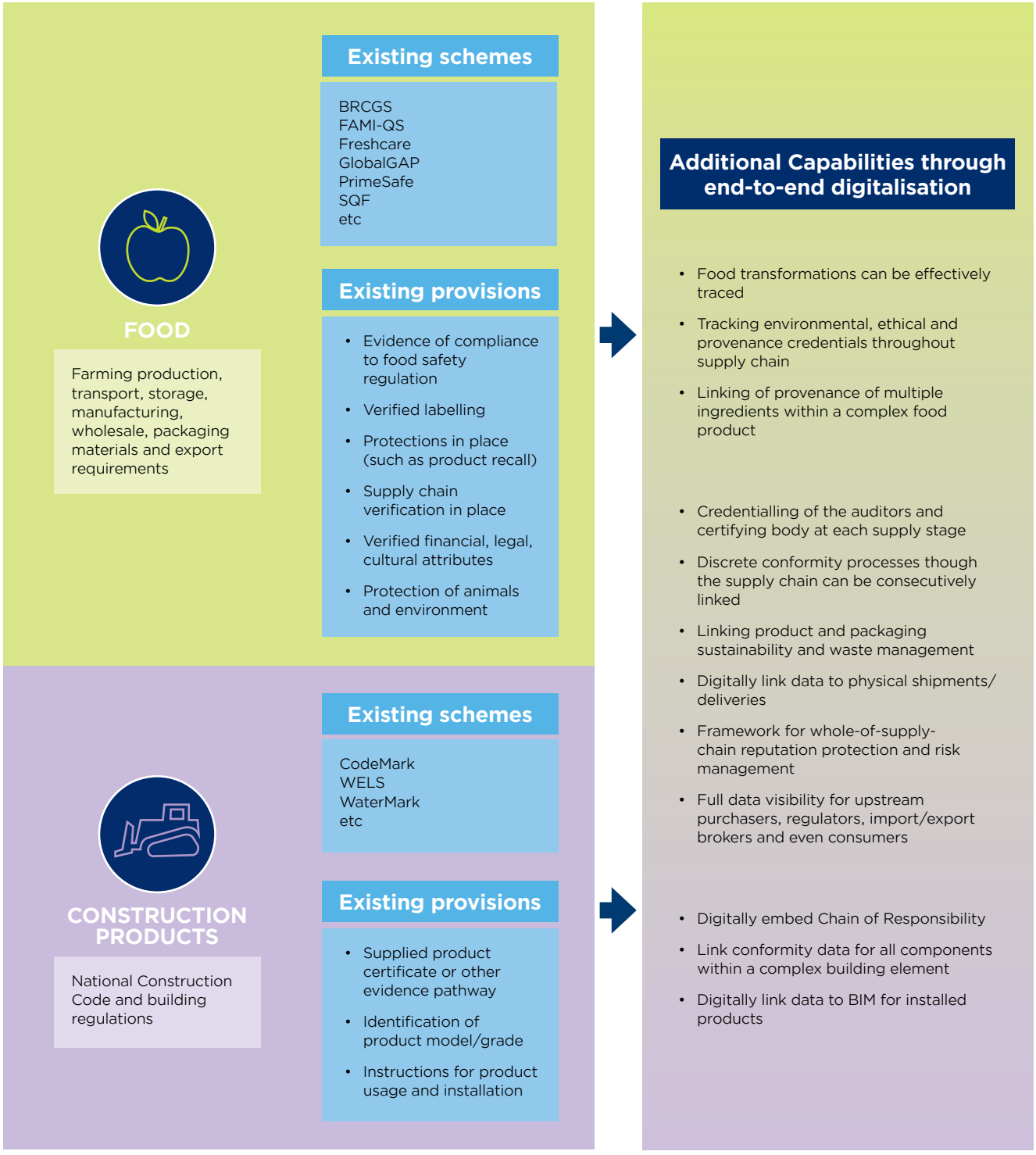


Figure 8. Illustration of Framework Benefits for Existing Food and Construction Schemes

8. **Managing credentialing information** – Shared infrastructure

Checking the credentials of CABs and others in the product conformity community is not a new process. NATA and JAS-ANZ publish information on their respective websites to enable users of product conformity data to verify that CABs are accredited and that the certificates they issue are authentic.

Some CABs are already applying data carriers (QR codes etc.) on certificates to direct users to CAB websites and related services. In this case, the certificate holder is required to trust that the CAB website and verification services are trustworthy.

The diagram below illustrates how credentialing is currently managed by CABs and the opportunity for NATA and JAS-ANZ to standardise processes and reduce the potential complexity for industry of having many different processes (possibly hundreds) and methods to verify the authenticity of certificates issued.

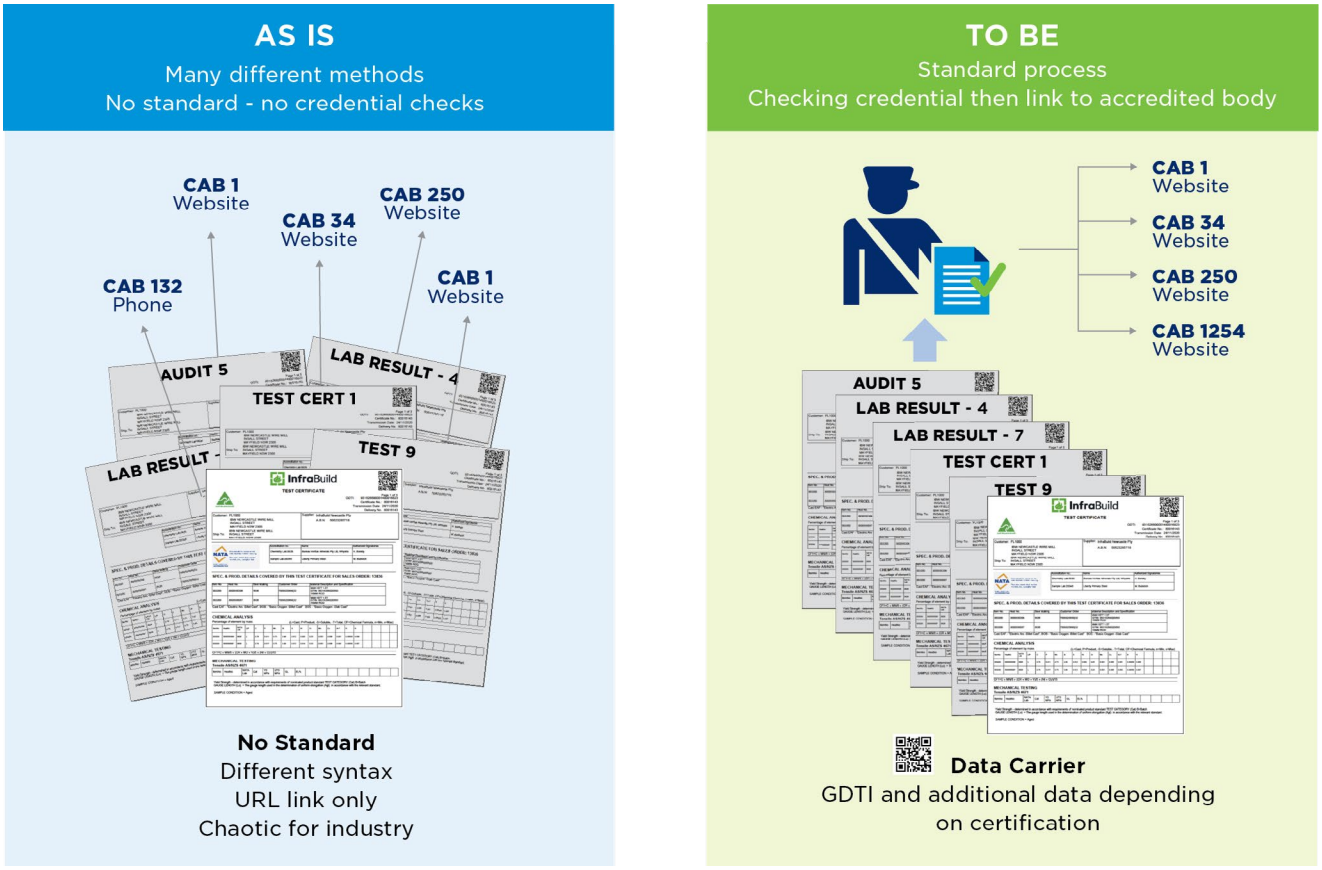


Figure 9. Product Certification Credentialing – 'as is and to be' illustration

The 'as is' state shows CABs applying data carriers or contact information (an email address or phone number) for users to check that the certificate is as printed (or as stored in soft copy). That is, a user wanting to check credentials is invited to visit a website to ensure that the details on the certificate are correct. Applying a QR code and directing users to a URL address results in hundreds and perhaps thousands of pathways with no independent checking of the authority/credentials held by the CAB.

In the 'to be' case, CABs apply a standardised certificate identifier, the Global Document Type Identifier (GDTI). Additional data is written into the QR code using GS1 Digital Link[30] syntax for human and machine reading, for example, scanning for an expiry/lapse date.

[30] https://www.gs1au.org/what-we-do/standards/digital-link

In the 'to be' case, all scans (via mobile phone or other means) direct users of certificates to a central 'resolver' (a pointer service) that:

1. checks the certificate issuer credentials are correct and current; and
2. directs the certificate users to the CAB (certificate issuer) services, i.e. a business website or online checking systems

The 'to be' case depicted above does not involve the centralisation of CAB data. This is a preferred (lowest impact) approach and is one of several credentialing information management options. More advanced processes, including the use of cryptography (public and private key exchange as used in online banking), is also possible but not discussed here.

Our focus is supporting existing product conformity business processes and laying the foundations for a future transition to data rather than paper-driven systems - over the next ten years.

Shared infrastructure options

Like most accreditation bodies (ABs) around the globe, NATA and JAS-ANZ manage accreditation information for CABs via central registries.

Determining the currency of CAB credentials does not necessitate that all certificate issuance or product conformity activity records are maintained in a central register (which would be costly and complex to administer). Three models are possible and are illustrated in Figure 10:

The 'register with links to CABs' is recommended for the following reasons

- It avoids a major cost of managing data and minimises the impact on CABs, by leveraging data platforms which are currently operated by ABs in the national interest
- It has the lowest operational impact on existing processes and systems
- It involves the least amount of effort from CABs. The credentialing mechanism and 'resolver service' is managed for and on behalf of CABs who simply provide a web address (or in the case of no online presence, an 'information page' with a phone number to call)
- It provides a pathway to more sophisticated credential exchange processes; and
- It effectively addresses the risks described earlier in the discussion (many disparate processes and complexity for industry and individual users of certificates)

The future will likely involve less emphasis on central registries (more distribution of trust across multiple organisations) and less reliance on paper and PDF certificates (more direct data exchange). The suggested approach is:

- NATA and JAS-ANZ focus on governance and managing CAB credentialing information; and
- NATA and JAS-ANZ provide support to their members via a digital credentialing service that verifies the currency of the CAB accreditation and points to their data (to support certificate authentication and perhaps 'future' data exchange)

This can be achieved with relative ease via the use of existing ISO/IEC standards.

Large Central registry	Register with links to CABs	Distributed Registers
• NATA and JAS-ANZ maintain information about CABs and their certificates in one central database. • CAB activity and certificate issuance information are centralised • Large single/few central registries for lookups • Central administration for members	• Only CAB credentials are maintained in central registers. • CABs maintain their transactional data (activity and certificate issuance) • NATA and JAS-ANZ provide a service to point users to CAB data sources (resolver service based on global standards) • CABs manage their own data	• All CAB data is distributed and maintained without a central register • Minimal data is maintained by NATA and JAS-ANZ • CAB provides a data exchange service based on verified credentials • Less reliance on document exchange

Figure 10. Table defining shared infrastructure options

9. Future vision for conformity and credentialing

The move between the current state and a future vision must be evolutionary rather than revolutionary. A radical and immediate change to the present conformity and credentialing processes is not recommended, but rather the progressive application of ISO/IEC standards and enabling technologies over time to allow the community to adapt and manage change.

Having said this, a clear future vision is required to ensure all stakeholder activities are aligned to a common goal, and different stakeholder groups can map their glide path to this future state, perhaps with different priorities and actions but all leading to the same destination.

To define this future vision, we refer to the UN/CEFACT principles of interoperability for customs and single windows (Recommendation No. 36[31]), which defines interoperability as "the ability of two or more systems or components to exchange and use information across borders without additional effort on the part of the user". The UN/CEFACT Recommendation provides the foundation to illustrate the future vision for conformity and credentialing as detailed in Figure 11.

Applying principles to product conformity agents and processes

The perspectives described in Figure 11 provide one of many possible views on the future state of conformity assessment and associated credentialing processes based on the above UN/CEFACT principles. The scenarios draw on insights from online content verification and developments moving industries away from a traditional reliance on trust-based systems and exchange of paper or PDF certificates – including but not limited to third party laboratory testing results, site audits, declarations, or passports.

[31] https://unece.org/DAM/trade/Publications/ECE-TRADE-431E_Rec36.pdf

System Property	Current State	Future State
Autonomy	Industry and region-specific protocols requiring interpretation for data exchange	Standard system functions do not require specific details to seamlessly exchange digital information
Agreement and consensus	A mixed mosaic of G2G and B2G agreements to enable exchange of information	Widespread agreement and a common understanding of data exchange protocols
Responsiveness and connectivity	'Acting on demand' and issue-specific responses using digital automation	'Always on' interconnected systems across transnational boundaries with security
Data flow, security, privacy, and confidentiality	Trust-based with centralised risk management and governance to manage interoperability functions	Trustworthy systems with distributed control and management of information for privacy, security, and risk management
Data harmonisation and open standards	Focused on advances in technology and the modernisation efforts of governments	Emphasis is placed on data and open architecture to leverage international standards and protocols

Figure 11. Table defining systems properties – current and future state analysis

Dimension	Current State	Future State
NATA / JAS-ANZ	NATA, JAS-ANZ and related bodies maintain product conformance systems that are heavily dependent on trust and manual exchange of data between many parties	NATA, JAS-ANZ and related bodies enable their members to transition to digital product conformity – delivering value by managing risk, ensuring relevance, and supporting systems that focus on integrity and credentialing of claims
Conformity Assessment Bodies	Focus is on data issuance, not data exchange systems	Conformity data is available via a distributed trust involving many accredited bodies with NATA, JAS-ANZ and others involved to provide trustworthy data exchange mechanisms to strengthen overall product conformity system integrity. Certificate issuance and credential mechanisms become standardised to enable interoperability
Certificates	Document heavy – with paper and PDF-based information exchange in a range of formats as determined relevant by certifiers – few data standards	Certificates are issued in digital format (as data exchange) with supporting physical twins (continued paper or PDF) for business continuity (and compliance with legacy laws) until paper forms are no longer needed (use case dependent)
Certificate Credentialing	Reliance on trust and reputation of certified agents – weak and difficult mechanism to prove the authenticity of a certificate – with widespread abuse	Digital certificates authenticated using a distributed trust model (by credentialed certifiers) and without reliance on a central registry. Verifiable credentials enable industry and government to deliver efficiency and safety through real-time data exchange i.e. regulatory automation
Certified Products	No common process across all certifiers for identifying products or samples used for testing and certifying conformity	The link between product and certification (layered certificates) is simple and universal – via a standard global system of product, location/ entity (the certifier) and related entities. Each certificate is unique
Certification Events	Testing, certification, and certificate use processes are dependent on the certifiers – making auditing challenging	A structured language is used (based on EPCIS) to manage certification events for products. This language is aligned with regulatory events to enable better government with industry rules and legislation that leverages digital credentialing (via verifiable credentials exchange) that NATA and JAS/ANZ make possible
Certificate Use	Few mechanisms exist for certificate users to capture information about certificate use	Every time a certificate is interrogated (by industry or government users) there is an audit trail that facilitates greater insight into the value and effectiveness of product conformity processes
Certificate Data	Certification master data is held by certifiers and challenging to access – certifiers derive little value from the information other than knowing their customer	Certifiers become more relevant and valuable to industry and government, ensuring that certification processes are applied for public and industry benefit (via enabling transaction data to drive industry and regulatory process efficiency)

Figure 12. Table summarising current and future state product conformity system impacts

Technology will be a key enabler, once Global Data Standards are in place

Key technologies that will support the journey to this future vision include:

1. Distributed trust systems – for product conformance information management and credential exchange
2. Verifiable credentials – to enable digital authentication of organisations involved in product conformance – and the conformity activities they manage; and
3. Blockchain and distributed ledger technology – for maintaining and sharing data

Distributed trust systems

Many-Party Attestation Models are already in place and have major implications for the future of product conformity data management systems:

- Less or no paper exchange options
- Certificate authentication through verifiable credentials - code exchange
- Avoiding the need for centralisation of many/large registers; and
- Allowing accreditation and certification agencies to provide business as usual services

This is a popular model for government as it avoids a requirement for larger central registers, costs or complexity managing proprietary data.

Verifiable credentials – what are they?

Verifiable credentials have been used extensively for online content verification and will become increasingly important for the exchange of trusted information between parties involved in product conformity systems.

In the physical world, a credential might consist of information related to the subject of the credential, the issuing authority, the type of credential, the attributes or properties being asserted, constraints and evidence related to how the credential was derived.

A verifiable credential can represent all the same information that a physical credential represents. The addition of technologies, such as digital signatures, makes verifiable credentials more tamper-evident and more trustworthy than their physical counterparts.

Holders of verifiable credentials can generate verifiable presentations and then share these verifiable presentations with verifiers to prove they possess verifiable credentials with certain characteristics. Both verifiable credentials and verifiable presentations can be transmitted rapidly, making them more convenient than their physical counterparts when trying to establish trust at a distance.

Examples of how to use this data model using privacy-enhancing technologies, such as zero knowledge proofs, are widely available. A demonstration of how GS1 uses verifiable credentials to support brand owners is provided in this video link
https://www.youtube.com/watch?v=iDkANArgdKI

Blockchain and distributed ledger technology

Is blockchain relevant? Possibly, but not on its own or without strong governance, quality data and standards. Blockchain and related technology (and there are many forms) which enable distribution or sharing of data between and across businesses also need a range of foundational building blocks, without which the technologies will not deliver their intended benefits.

A critical underlying assumption for blockchain and related technologies is that a unique digital representation of physical objects (sometimes called digital twins) is always possible. This requires unambiguous, globally unique, and persistent identification of the physical item e.g. the hip implant, the bale of wool, the physical certificate of conformity, litre of diesel or grain of rice. We know that this is difficult for the latter two cases.

In addition, immutable registers have their own inherent issues, especially when incorrect information is included or when data redaction is required (as is often the case in law). Governance, security, and computational issues are also relevant and are subject to ongoing research, as the fitness-for-purpose of blockchain becomes better understood. In the context of product conformity and traceability, blockchain applications should be considered alongside other data management systems. However, it is important that global data standards remain prominent, to define the structure and meaning of all data that is shared.

A clear focus on data standards, instead of selecting specific platforms/solutions (based on blockchain or any other technology) will lead to greater flexibility. Companies can choose their own technology partners, leading to increases in competition and innovation and, ultimately, lower costs.

Cybersecurity

Any platform on which confidential information is held and exchanged, regardless of the technology implementation, must deliver adequate security of access and robust protections against penetration, denial of service and other attacks. While addressing these issues is beyond the scope of this paper, it is recognised that there is a clear need to specify appropriate data security standards as a basic element in the development of any data exchange platform.

10. Conclusion

The need for digitalisation of national product conformity systems

Defining a robust traceability system, addressing both physical products and product conformity information, represents an essential measure to ensure that Australia's competitiveness and market access are maintained.

Such a system must enable highly systematised data exchange between manufacturers, exporters, importers, distributors, retailers, consumers, and regulators. It must be underpinned by global data standards and exhibit interoperability across equivalent systems used by trading partners.

What is the alternative?

Solutions by individual industries to address context-specific concerns will result in a patchwork of incompatible systems. Efforts to coordinate information exchange from several thousand certifiers, testing and inspection authorities will become chaotic and potentially intractable.

Without intervention, it is easily imaginable that the existing mosaic of systems and methods will proliferate (e.g. proprietary QR or other codes), each using different semantics and pointing users to different data sources such that conformity attestation becomes complex, costly, incompatible, or impossible.

For individual CABs, this may not be a concern, but for an entire industrial supply chain the problem's rate of growth rapidly becomes exponential.

The objective

The objective is simply to move to an approach based on global data standards to deliver international alignment, harmonisation and interoperability in a way which leverages the existing data standards which are used by industry for product traceability.

A nationally coordinated approach is required to address the risk above and close the gap between digital product traceability versus traceability of product conformity and credentialing information.

Data exchange standardisation for conformance and accreditation processes will assist in closing the gap between physical product and product conformity data flow, to support government and industry modernisation initiatives, by aligning Australia with the evolving supply chain traceability systems around the world.

Implementation

What is being proposed is a technology-neutral data standards framework, rather than a specific implementation. The framework is sufficiently flexible to accommodate and support:

- pre-existing certification schemes;
- refinement/formalisation of existing industry approaches;
- progressive development of capabilities based on need and specific use cases;
- conformity approaches which may be unique to a particular industry;
- different supporting technologies (such as blockchain and non-fungible tokens); and
- evolving regulatory and other external impacts.

Also, since the framework is based on open standards, it avoids locking in a proprietary solution and therefore permits competitive selection in respect of ongoing platform operation.

This will be achieved by:

- Developing a framework for national product conformity and credentialing data exchange, which will be compatible with existing and emerging ISO/IEC-based supply chain frameworks. This would involve applying ISO/IEC standards to achieve traceability of product conformity certificates, business entities, products, test samples and more, using GS1 identifiers and data carriers;
- Establishing a common credentialing service to digitally enable all CABs to transition to data-driven and interoperable information exchange systems;
- Providing a defined framework and supporting tools for CABs and the broader product conformance community as a pathway to future document-less data flow, distributed trust, and verifiable credentials exchange; and
- Establishing that appropriate standards are recognised which specify the governance requirements for data platforms, including requirements for data security and privacy.

A coordinated national approach, with high level governance and support would greatly facilitate achievement of these specific objectives.

Appendix A – Benefit and cost considerations

The benefits and costs envisaged for the proposed digitalisation of national product conformity systems are summarised in the table below. As the framework proposed is flexible and may be progressively adopted and elaborated by different industries at a varied pace, risks are considered low. The timing of benefits realisation and costs noted would apply on a case-by-case basis.

The analysis addresses cost and benefit considerations as outlined in Department of Industry, Science, Energy and Resources' Best Practice Guide to Using standards and risk assessments in policy and regulation (2016)[32]

Key benefits

Factor	Magnitude	Likelihood	Timing	Comment and example
Public Health and Safety • Improvements in public and workplace • Increased community safety	Significant	High	Ongoing	Improved transparency through supply chains – enabling product recall and reducing fatalities and morbidity through information system failures.
Society and Community • Better public information • Improvements to products and public services • More reliable outcomes	Significant	Medium	Ongoing	Simplification of processes and reduced duplication of data capture. Improved public access to compliance information.
Environmental Benefits • Reduced noise/pollution • Improved amenity • Resource use accountability	Significant	Medium	Ongoing	Making circumvention of regulation more difficult and improving compliance system response times.
Competition Benefits • International and domestic interoperability (Harmonisation) • Increase in market innovation • New technology take-up	Significant	High	Ongoing	Standards application ensures technology neutrality and enables interoperability of legacy and emerging capabilities for industry. Avoids proprietary data structures which would otherwise limit competition by favouring historical platform providers.
Economic Benefits • Improved efficiency • Greater utility • Productivity improvements • Trade and market access • Economic growth • National brand trust	Significant	Medium	Ongoing	Improved conformance systems integrity reinforces national brand trust, consumer confidence and enables market access for trade growth and realising benefit of FTAs.

[32] https://www.industry.gov.au/sites/default/files/2019-03/best-practice-guide-to-using-standards-and-risk-assessments-in-policy-and-regulation.pdf

Cost considerations

Factor	Magnitude	Likelihood	Timing	Comment and example
Business Costs • changes in business procedures or practices • registration fees • cooperating with audits and inspections • other compliance costs.	Minor	High	Once off & Ongoing	Reduced 'paper burden' and administrative costs through standardisation and sharing of digital compliance information. Minimal to no impact on business (industry) processes.
Consumer Costs • More information to manage and choices to make	Nil	Medium	Ongoing	Utility benefits through access to information not otherwise available e.g. compliance status reports etc. via smartphone.
Community & Environment • Net positive benefit due to improved transparency of processes and supporting data.	Nil	High	Ongoing	Reduced paper use. Informed decision making with environmental consequences.
Government costs • running education campaigns and the provision of additional information to stakeholders • provision of data collection or collation of business information • administration or inspection services • enforcement costs	Minor	High	Once off & Ongoing	No net new costs. A level of initial and ongoing support for CABs and key agencies to manage digital transformation is assumed (as a 'business as usual' activity).

1. **Magnitude** of cost or benefit - Nil, Minor, Major, Significant
2. **Likelihood** of cost/benefit impact – High, Medium, Low
3. **Timing** of benefits realisation or cost – Once off (immediate) and/or ongoing

Appendix B – International insights

Global trajectory of change

The United Nations Industrial Development Organisation publication, Standards & Digital Transformation - Good Governance in a Digital Age – October 2021 notes that there are limits to the effectiveness of national policy-setting approaches and that global standardisation has an important part to play:

"Progress in the innovation and development of digital technologies and digital transformation is creating a fast-moving environment and is unstoppable. The evolving regulatory and policy frameworks develop appropriate governance rules for technology; however, this evolving framework has limitations such as being primarily nation bound and time-consuming. Standards have an important role in this framework, being transnational, multi-stakeholder driven, speedy to develop and responsive to user needs."

"Standards are a voluntary complement to regulation, which have the effect of enhancing efficiency and productivity. These standards inform effective regulations, which can create an enabling environment for innovation and minimise risk for disruptors and investors. Standards developed by international organisations can provide an effective response to market barriers. In the context of digital transformation, the timely and harmonised adoption of standards is likely to play a key role to this end, both as a means of promoting interoperability, productivity and innovation, and also of ensuring the scale-up of solutions to be implemented globally."

Closer to our region, ABAC's Report to Ministers[33] also highlights the impetus from industry to move to greater adoption of global data standards to support digitalisation:

"ABAC has welcomed the recognition by APEC Leaders and Ministers that wider use of GDS [global data standards] can improve supply chain performance and visibility, enabling greater interoperability and supply chain integrity across the region. This has only become more important with the increasing digitalisation of trade and greater use of e-commerce, but many economies lag in the uptake of this technology, and approaches are often bilateral rather than regional. APEC should encourage a regional implementation approach."

The World Economic Forum Report Shaping the Future of Construction - A Breakthrough in Mindset and Technology May 2016 identified the need for agreement on common standards and greater adoption of technology, including digital technology, along the value chain. In particular, the report noted the development and deployment of digital technologies and processes as being central to the required transformation of the construction industry.

The New Zealand (NZ) Government has already implemented the New Zealand Business Number (NZBN), the equivalent of ABN in Australia, in the form of GLN identifiers which are issued under the GS1 framework. In addition, regulation within New Zealand is increasingly adopting the GS1-based GTIN product identifiers, which are already called up in New Zealand customs regulation.

Significant NZ initiatives and reforms include:

- NZ Business Number based on GS1's GLN: https://www.nzbn.govt.nz/whats-an-nzbn/about/
- NZ Customs Regulation: https://www.customs.govt.nz/globalassets/documents/legal-documents/customs-deemed-entry-of-goods-rules-2021.pdf
- NZ Building Regulation (Proposed): https://www.mbie.govt.nz/dmsdocument/14150-building-amendment-bill-proposals-for-regulations-discussion-document

[33] http://www2.abaconline.org/assets/2021/ABAC_Report_2021.pdf

The following extracts from the BRANZ's Report "Digital Product Data for Lifting Productivity" [2020][34] (Pages 17-20) represent a partial survey of the global situation for digitalisation within the construction industry. While specific to the construction sector, the general direction of change among other sectors is likely similar.

[34] https://www.brandz.co.nz/pubs/research-reports/er56/

European Union

The European-based Digital Supply Chains in the Built Environment Work Group (DSCiBE) brings together major industry stakeholders involved in the built environment supply chain by developing processes for the digital exchange of data and information based on global data standards. Their initial focus is on product/material master data enabling real-time synchronisation of a physical object with its digital twin through the product's life cycle.

A published white paper[35] outlines DSCiBE's definition of structured product master data and the potential benefits on offer if the European construction sector harmonises on its use and implementation. DSCiBE defines a data template as a common data structure containing the properties, measures, units, and values for a product stored in a data dictionary.

Foundational to the group's focus is the widespread adoption, implementation and use of global data standards for the identification of construction products, assets, documents, logistics consignments and relationship identifiers based on GS1 ISO-compliant standards.

United Kingdom

The UK BIM Alliance Product Data Working Group outlined seven key areas of focus for the UK construction sector with regards to structured data and data standards, including the following:

Structured data definitions to gain universal sector-wide agreement of structured data to enable interconnected dictionaries, structured data creation and approvals.

Product data standards because (as per paragraphs that follow) there are no commonly agreed standards for digital product data in the UK or in Europe and given the landscape is both fluid and complex, common data standards need to be developed and agreed to by all stakeholders.

Product data journey – there is no 'golden thread' of product information for most projects. "Because the data journey involves information provided at different times by different stakeholders, any system to manage that information may need to be connected to/merged with each other at different points in the journey; and

Product data naming and product identification – implementing a unified methodology to produce data templates in the UK is considered long overdue, unlike Europe, so the UK needs to align with European and international standards in a collaborative manner.

Scandinavian countries

Norway

While there is no legislation in Norway (or other Scandinavian countries) we are aware of, the implementation of standardised product data for e-procurement and for identification purposes is pushed by government agencies that are applying GS1 identification standards. This follows on from the fact that around 200 Norwegian municipalities have adopted GS1 standards for the identification of delivery locations for e-procurement purposes.

Sweden

In Sweden, while there are no official requirements, all major construction companies, several retailers, and the BIM Alliance Sweden asked sector suppliers to use GTINs for product identification to streamline procurement processes and enhance sector-wide traceability outcomes.

In 2018, the five biggest construction companies together with the industry retail organisation formed the largest manufacturing organisation and BIM alliance in Sweden and asked the entire supplier base to identify all building products with a GTIN.

Two years on, most retail products are now identified by a GTIN, and GTINs are being introduced in procurement systems to increase transparency and traceability outcomes. As a result of the success of the 2018 initiative, the Industry User Group was set up to look at how GTINs could be configured for building industry products or objects.

[35] Digital Supply Chains in the Built Environment (DSCiBE) Report "Digital Supply Chains Data Driven Collaboration" https://cobuilder.com/en/the-digital-supply-chain-data-driven-collaboration/

Appendix C – Supporting existing schemes (e.g. Building products)

CodeMark Australia certificates in the building sector

The CodeMark Australia Certification Scheme is a voluntary third-party building product certification scheme, owned by the Australian Building Codes Board (ABCB) and administered by JAS-ANZ. It helps facilitate the use of new or innovative building products in specified circumstances in Australia by providing a nationally accepted process for demonstrating compliance with the requirements of Australia's National Construction Code (NCC)[36].

The CodeMark Australia Certification Scheme is referenced within the NCC and building certifiers must accept the use of CodeMark certified products when consenting building work in those jurisdictions that regulate for mandatory acceptance, so long as the products are intended to be used in accordance with the certificate conditions.

A CodeMark Australia certificate for a product may only be issued by certification bodies which hold JAS-ANZ accreditation for this activity. JAS-ANZ maintains an online register of accredited CodeMark Australia certification bodies[37].

Under the proposed framework, each CodeMark Australia certification body would be allocated a unique Global Location Number (GLN). Similarly, the specific product in question would be assigned a Global Trade Item Number (GTIN). Note that not every type of product is suited to CodeMark Australia certification.

[36] https://ncc.abcb.gov.au/

[37] https://register.jas-anz.org/accredited-bodies

Alternative evidence pathways - including other forms of product certification

Under the NCC, consumers and building practitioners have range of methods and schemes that can be used to test and prove that a building product or material is genuine and will do what it is made to do. There are six (6) different types of substantiation or evidence that can be used to verify that a product conforms and complies with the NCC:

1. Certificate of Conformity by CodeMark or WaterMark
2. Certificate of Accreditation from a State or Territory Accreditation authority
3. Certificate from an appropriately qualified person such as an engineer
4. Certificate from a product certification body accredited by JAS-ANZ
5. Report registered by a registered testing authority
6. Other documentary evidence

Certificates issued by conformity assessment bodies accredited by JAS-ANZ under certification schemes other than CodeMark may be acceptable. Similarly, test reports issued by an accredited laboratory can represent another acceptable form of evidence within the NCC. The framework proposed within this paper has the capacity to link any documentation issued under a formal accreditation process with physical supply of the product in question, in a way beyond which is currently available.

Staying within globally recognised structures is preferable, to permit inter-operability with other schemes, yet it is still possible for non-standard conformity pathways to be incorporated within the general framework that has been proposed. Depending on the extent to which regulators see advantage in doing so, the framework is flexible enough to accommodate a variety of approaches which might include, for example, expert assessment panels or approved practitioners.

Online Access to data

An accredited CodeMark Australia certification body is entitled to upload copies of issued CodeMark Australia certificates to the JAS-ANZ CodeMark Australia register (held on the JAS-ANZ website) where such documents are available for downloading by third parties. This process ensures that an authenticated source for a given certificate is always discoverable.

Under the proposed framework, each CodeMark Australia certificate would be allocated a unique Global Document Type Identifier (GDTI), which enables the documentation to be uniquely linked to the 'Master Data' set for that product and thereby connected to the physical supply of that product through the supply chain. This can be digitally linked to the physical product through barcoding, or similar, as there are established GS1 processes for achieving this.

This approach is equally applicable for other certifications, or test reports, which have been issued by accredited conformity assessment bodies (CABs).

One of the key issues in the building sector at present is the misuse of products, that is, used in a manner which is not fit for purpose or does not comply with legislated requirements or Australian Standards. There are various initiatives underway within this sector looking at the digitalisation of the data held on product certificates and other sources, to provide traceability of product through supply chains and information to users of products to ensure that they are used in the manner intended. In other words, there is a convergence of effort apparent here.

Building Information Modelling (BIM) and item tracking

The digital linking of certificates and related data to the physical delivery of product opens new potential use-cases.

It also links with developments around the use of GS1 standards being seen in the construction sector within New Zealand and various other trading partners.

Digitally linking the product data (for a physical shipment) to a BIM system would mean that full product traceability can be digitally preserved for the life of the building, while facilitating product recall events and also assisting Building Certifiers in the initial certification process, such as for components which might be embedded within a complex building module such that it cannot be visually verified.

Industry Foundation Classes (ISO 16739) commonly form the basis of BIM systems and interoperability with GS1 standards is available[38]. Both globally and across several economies BI Chapters and GS1 Member Organisations in these countries have put in place MOUs for the integration of GS1 standards into BIM, including Australia, France, Hong Kong, Hungry, Sweden to name a few[39].

Chain of responsibility and other relevant classes of informationt

There is existing and proposed legislation across various jurisdictions requiring certain 'Chain of Responsibility' data to be conveyed which addresses product usage and installation requirements.

Under the proposed framework, such information might be digitally linked to a supply contract, thereby becoming automatically available to all authorised upstream users.

Tracking of supplementary data which may become available from sources, for example, sustainability schemes, can potentially also be digitally linked to the product supply chain, enabling more sophisticated assessments of cost and value to be undertaken, potentially on a whole-of building basis.

[38] https://www.pbctoday.co.uk/news/bim-news/gtin-welcomes-manufacturers-bim/29295/

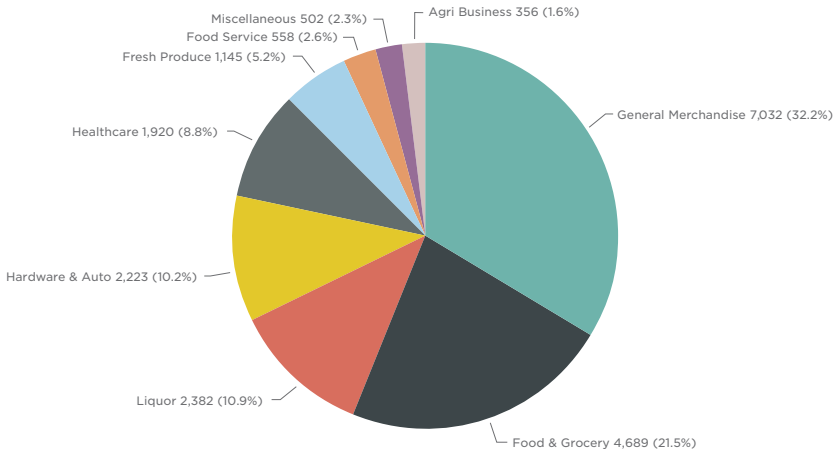
[39] https://www.gs1au.org/resources/media-centre/news/buildingsmart-and-gs1-sign-memorandum

Appendix D – GS1 standards use by Australian industry

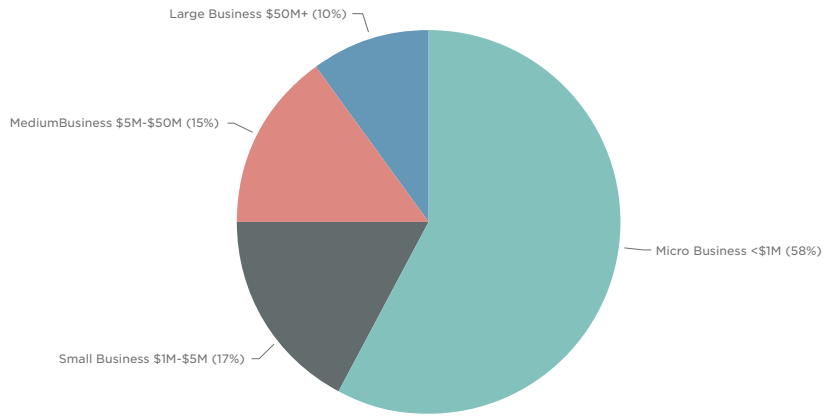
Since the inception of the Australian Product Numbering Association in the early 1970s (now known as GS1 Australia), the number of Australian companies implementing GS1 standards has grown consistently.

Today, GS1 Australia has close to **22,000** active Australian Member companies. These organisations include different types of businesses such as retailers, marketplaces, manufacturers, suppliers and distributors, wholesalers, transport companies (including passenger and freight), primary producers, solution providers and government agencies (both state and federal).

Australian companies using GS1 standards operate in a range of sectors. The graph below illustrates GS1 membership spread across sectors in Australia:



Although GS1 standards are used by companies big and small, the most significant portion of GS1 Australia's members is micro and small businesses, with 75% of all members having an annual turnover $5M or less.



Finally, Australian Companies using GS1 standards are based across all states and territories, with 32% based in NSW and another 32% in Victoria, 15% in Queensland, 8% in South Australia and another 8% in Western Australia, with the balance across the Territory, Tasmania and ACT.

GS1 Australia is one of 114 GS1 member organisations that collectively support close to 3 Million global businesses managing more than 150 million uniquely identified products. To facilitate effective and efficient global trade GS1 makes global product, location, and related information (master data) available through open registries. It also develops and makes standards freely available to assist industry and government in identifying, capturing, sharing, and using supply chain data.

Appendix E – Glossary of Terms

Term	Meaning
Accreditation	Third-party attestation related to a conformity assessment body, conveying formal demonstration of its competence, impartiality, and consistent operation in performing specific conformity assessment activities.
Accreditation body (AB)	Authoritative body that performs accreditation.
Batch / Lot Number	The batch or lot number associates an item with information the manufacturer considers relevant for traceability of the trade item. The data may refer to the trade item itself or to items contained.
Brand Owner	The party that is responsible for allocating GS1 System numbering and barcode symbols on a given trade item. The administrator of a GS1 Company Prefix.
Certification	Written assurance by an independent body that a product, service, or system meets specific requirements.
Conformity assessment	Demonstration that specified requirements are fulfilled.
Conformity assessment body (CAB)	Body that performs conformity assessment activities, excluding accreditation.
Data Carrier	A means to represent data in a machine-readable form; used to enable automatic reading of the Element Strings.
Electronic Commerce	The conduct of business communications and management through electronic methods, such as Electronic Data Interchange (EDI) and automated data collection systems.
Electronic Product Code Information Services	EPCIS is a GS1 standard that enables trading partners to share information about the physical movement and status of products as they travel throughout the supply chain – from business to business and ultimately to consumers.
Global Location Number (GLN)	The GS1 Identification Key used to identify physical locations or legal entities. The key is comprised of a GS1 Company Prefix, Location Reference, and Check Digit.
Global Trade Item Number (GTIN)	The GS1 Identification Key used to identify trade items. The key is comprised of a GS1 or U.P.C. Company Prefix followed by an item Reference Number and a Check Digit.
GS1 Company Prefix	Part of the international GS1 System identification number consisting of a GS1 Prefix and a Company Number, both of which are allocated by a GS1 Member Organisation.
GS1 System	The specifications, standards, and guidelines administered by GS1.
Inspection	Evaluation of a product or process against defined specifications using experience and professional judgement.
Logistic Unit	An item of any composition established for transport and/or storage that needs to be managed through the supply chain. It is identified with SSCC.

Radio Frequency Identification	A data carrier technology that transmits information via signals in the radio frequency portion of the electromagnetic spectrum. A Radio Frequency Identification system consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the radio frequency circuitry and information to be transmitted.
RFID Tag	A microchip attached to an antenna that sends data to an RFID reader. The RFID tag contains a unique serial number and may contain additional data. RFID tags can be active, passive, or semi-passive.
Sampling	Selection and/or collection of material or data regarding an object of conformity assessment.
Scheme	Scheme (conformity assessment scheme) - set of rules and procedures that describes the objects of conformity assessment, identifies the specified requirements, and provides the methodology for performing conformity assessment.
Scanner	An electronic device to read barcode symbols and convert them into electrical signals understandable by a computer device.
Serial Number	A code, numeric or alphanumeric, assigned to an individual instance of an entity for its lifetime. Example: Microscope model AC-2 with Serial Number 00001 and microscope model AC-2 with Serial Number 00002. A unique individual item may be identified with the combined GTIN and Serial Number.
Serial Shipping Container Code (SSCC)	The GS1 Identification Key used to identify logistic units. The key is comprised of GS1 Company Prefix, Serial Reference, and Check Digit.
Testing	Determination of one or more characteristics of a sample or product and usually performed in a laboratory.
Trade Item	Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain.

For further information regarding GS1 Standards terminology please also refer to https://www.gs1au.org/resources/glossary