NATIONAL ARCHIVES OF AUSTRALIA

BUILDING TRUST IN THE PUBLIC RECORD

managing information and data for government and community

DATA INTEROPERABILITY MATURITY MODEL

DIMM

Data Interoperability Maturity Model

The Data Interoperability Maturity Model (DIMM) lets you assess your agency's progress towards data interoperability.

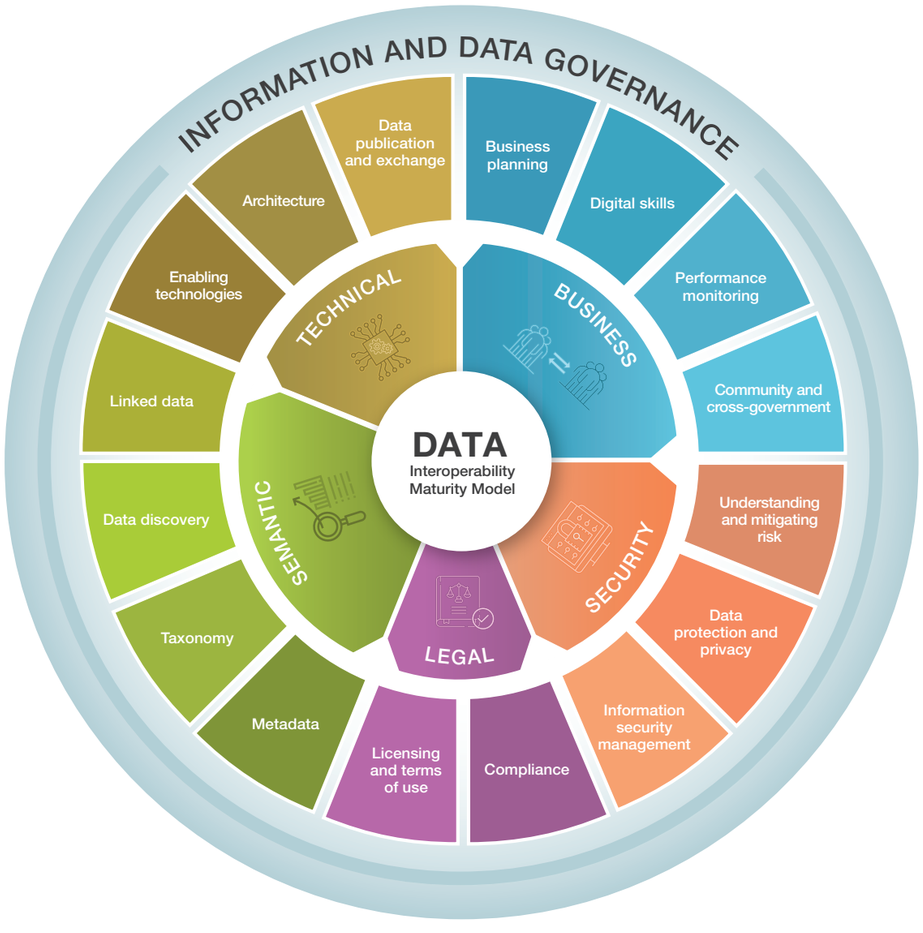
It can be used to:

- self-evaluate your current level of data interoperability maturity
- identify gaps in your data interoperability maturity
- plan improvements to reach the level of maturity your agency needs.

DIMM themes and steps

The DIMM helps you measure progression across the five interoperability key themes as well as their overall governance.

Each area is split into several categories. Each category has 5 steps that describe the common data interoperability behaviours, events and processes for the corresponding level of maturity.



How to use the DIMM assessment

Scope assessment

- Define your key participants and assessment parameters.
- Who are the key stakeholders that need to be involved in the assessment?
- Are you assessing interoperability maturity for the whole agency, a division, a branch, a program or a single project?

Current state Baseline maturity

- Using the DIMM assessment tool, talk to subject matter experts and stakeholders to identify and document your current level of maturity (step) for each category. This is your baseline maturity.
- To choose a level of maturity, you must also meet the characteristics and behaviours of all lower levels. For example, you should only select the 'optimising' step if you already meet the behaviours in the 'managing' step.
- Your level of maturity can vary between categories.

Future state

- Talk to key stakeholders about what level of maturity you need to meet your short- and long-term business needs.
- Document your desired future state for each category, noting that it can vary between categories and be different to other agencies.
- For each category, compare your baseline maturity to your desired future state and document any gaps in data interoperability maturity.

Analyse results, plan for change

- **Analyse your results to confirm your agency's current strengths and document areas for improvement.**
- **You can use the results to inform strategic planning and investment activities or to create a roadmap for improvement. We recommend plotting a path that leads from your baseline to your target maturity for each category.**
- **Repeat the assessment regularly to track data interoperability improvements and trends over time.**

INFORMATION AND DATA GOVERNANCE: An agency's information and data governance maturity – used to coordinate and drive data interoperability across the five themes						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Frameworks, strategies, policies, standards, and roles.	**a. Agency understands regulatory, legal, risk and operational requirements and uses governance mechanisms to drive data interoperability.** **b. Agency-wide agreed standards are in place and understood by business.** **c. Roles and responsibilities for interoperability are identified in the organisation structure. Changes are made where required.**	• Data is not governed in a consistent way across the agency. • Data governance framework and practices do not consider supporting data interoperability. • There is limited understanding about data interoperability and how it could be used across the agency. A wider data strategy may exist but does not explicitly address interoperability. • Data owners manage and maintain information and data holdings ad hoc. There are no roles or clear responsibilities within or across teams. • Decisions have not been made about which data needs to be interoperable and which data is not a priority (for example, low value or low risk data).	• Individual groups within an agency have established data governance structures and processes to improve interoperability, but these are not documented or adopted across the agency. • Agency has no definitive view of data quality, standards, metadata and file formats for the data it holds and manages. • A high-level data strategy and policies that support data interoperability are emerging. • Data owners understand the importance of managing and maintaining data holdings for interoperability. Some tasks and responsibilities have been allocated within teams.	• Data governance is defined. It explicitly considers interoperability and is consistently applied to high-value data. • High-value datasets have assigned custodians and conform to agreed data standards. • There is a definitive view of data quality, standards, metadata and file formats for data held and managed by the agency. • Agency has a clear, documented strategy for data interoperability that aligns with wider business objectives and plans. • Supporting policies for data interoperability exist to drive good practice across the agency. • There are defined operational roles that facilitate data management and interoperability (for example, data stewards, curators and custodians).	• Data governance processes and standards for interoperability are applied to all data. • Responsibilities and roles for data governance processes and data ownership are clearly defined across the agency. • All data held and managed by the agency adheres to their common standards, code lists and models. • Agency has set clear targets for the implementation of their data interoperability strategy, including KPIs. • Agency's data inventory or catalogue is used as a key tool for informing data interoperability policy and strategy.	• Agency-wide data governance framework is subject to continual review, monitoring and refinement. • Delivery of the objectives in the data interoperability strategy is reviewed and reported on, and goals are adjusted over time to continually drive improvement. • Policies that promote data interoperability are subject to continual improvement. • Metrics on data holdings are available and used to target improvement efforts, including feedback from external parties such as data consumers.
Leadership	**a. There is corporate support for data interoperability.** **b. Knowledge and understanding of data interoperability exists at senior levels and in relevant committees such as the information governance committee.** **c. Senior levels proactively support interoperability initiatives.**	• The senior leadership team has some awareness of what is needed to build and manage data interoperability and of the management structures to support compliance to related standards.	• The senior leadership team is supporting data interoperability initiatives in some areas of the business. • Senior leadership support of interoperability is not strategic and is inconsistent.	• Ownership and responsibility for delivering the interoperability strategy is defined by a nominated champion for data interoperability. • The senior leadership team is visibly setting targets for data interoperability in line with agency priorities. • Senior support is strategic and aligns with their area's work plan.	• Senior leaders meet to discuss data interoperability as shared initiatives across their areas. • Interoperability is included in the general agenda for the senior leadership team. • Senior leaders continually look to develop and innovate data interoperability that supports their agency or targeted work areas.	• Performance of the senior leadership team includes consideration of progress towards data interoperability objectives. • The senior leadership team continuously reviews and adjusts targets specified in the data strategy, taking on board ongoing developments in best practice for data interoperability from the wider community and standards.

BUSINESS: An agency's operational maturity in producing, consuming and sharing data on a tactical level						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Business planning	a. Business understands its operational requirements and expectations for producing, sharing and consuming data. b. Business strategies and plans consider and set out an agency's commitment to data interoperability.	• Agency does not understand the business need for data interoperability. • Agency does not understand cost and risk to business of not implementing interoperability initiatives. There is no communication of these risks as part of a broader governance approach.	• Agency understands the business need for interoperability. • Agency understands the business cost and risk created by not planning and implementing interoperability initiatives and communicates these agency-wide. • Agency business planning supports interoperability as part of a broader governance approach. • There is no consideration of using data-driven insights to inform interoperability in business planning.	• Agency business planning identifies strategies and programs that support interoperability such as the metadata strategy, the data quality program and, more broadly, the information and data governance framework. • High-level data issues that impede interoperability causing cost to business and increased risk have been identified. Plans to address these issues are emerging. • Data analysis to support and inform interoperability in business planning is emerging.	• Business planning addresses the identified high-level data issues and projects that action these plans are in place. • Performance monitoring including tools such as business intelligence and business analysis, are used to acquire data-driven insights that help develop interoperability as part of business plans. • Industry and sector developments in data interoperability help inform the core targets and future visions of business plans.	• Plans are regularly reviewed and updated to reflect industry expectations and developments in interoperability. • Performance monitoring is shaped to support interoperability core targets and milestones in business plans. • Business plans are regularly reviewed and updated so as to provide holistic governance of the strategies and programs that support data interoperability.
Digital skills	a. Staff have the required training, skills and support to deliver on data interoperability needs. b. Data interoperability skills are maintained and kept up to date.	• Agency is unclear on the skills required to meet their data interoperability needs. • Plans to put the required skills in place are emerging. • Data literacy is low across the workforce.	• Agency recognises the value and potential uses of data and there is some awareness of the skills required to support managing and implementing data interoperability. • Training and support for data interoperability are planned and provided on an ad hoc basis for individual teams. • Immediate skills shortages are being met through use of third-party specialists. • Pockets of strong data literacy are starting to appear.	• Agency has identified the key digital skills it requires to meet its data interoperability commitments and a suitable plan that implements them has been agreed to. • Agency has identified and trained internal specialists who can mentor others and execute on data interoperability commitments. • Internal teams support, mentor and provide formalised knowledge transfer to other staff creating a more flexible workforce. • General data literacy is strong.	• Agency is building an internal community of practice around data interoperability, as well as participation in wider data interoperability forums within government and industry. • Awareness and training of data interoperability, data governance and data management are part of the induction and development program for relevant staff. • Staff have access to training materials and guidance to assist in executing best practice data governance for interoperability. • A culture of self-driven data literacy is emerging across the general workforce.	• Agency has the digital skills required to execute on data interoperability needs. • A plan is in place to continually develop and improve data interoperability skills in line with industry developments, emerging best-practice and agency needs. • Agency is making an active contribution to interoperability forums within government and industry. • Staff across all parts of the agency have an awareness and understanding of the importance of data interoperability. • General data literacy is of a high standard and self-driven across the general workforce, supported by an agency-wide program of development. Interoperability specialists lead by example.

BUSINESS: An agency's operational maturity in producing, consuming and sharing data on a tactical level						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Performance monitoring	a. **The effectiveness and efficiency of data interoperability related processes are tracked through defined KPIs.** b. **Quality of data assets are monitored and results drive ongoing improvements.** c. **Agency has defined methodology for evaluating the value and potential change in significance of data.**	• The value of data (especially datasets) and the performance of data interoperability capabilities are based on perception and not measured using formalised standards. • Results and methods for data evaluation are inconsistent across the agency.	• Agency performs ad hoc evaluations of data value frequently and retrospectively to justify investment. • Individual projects have funding allocated for data interoperability enhancements that are not tied into formal KPIs. • Agency performs ad hoc assessments on the impact of data interoperability initiatives. • Evaluations of data do not consider key elements that support monitoring and enabling interoperability such as data flow, data profiling and data quality.	• Agency has defined a consistent approach for evaluating the value of its data holdings. • Investments in data interoperability tend to be reactive rather than strategic (for example, responding to an immediate business or user need rather than planned in line with agency needs). • Pockets of performance monitoring exist and include quality assessments within different areas of business such as the data inventory/catalogue, privacy and protection, and data entry standards. • Performance monitoring includes evaluating key elements that support data interoperability.	• Agency actively tracks the value of its data assets, and uses this to inform investment decisions. • Agency actively monitors the KPIs used to track the effectiveness and efficiency of data interoperability related processes. • Agency investments in data interoperability initiatives are guided by KPIs. • Performance monitoring from different areas of business are used to inform strategic monitoring for the agency. • There is clear benchmarking for best practice against industry and sector leaders in data interoperability initiatives.	• Agency regularly assesses the set of metrics used to evaluate the value of data. • Agency is transparent on the mechanisms used to value data wherever applicable. • Agency investment focuses on more strategic areas such as improving data governance, enterprise data management tools and internal and external data interchange. • Performance monitoring is machine aided or driven and may include value identification. • Performance monitoring helps establish the agency as an industry or sector leader in data interoperability.
Community and cross-Government engagement	a. **Agency engages with the broader data community including other government agencies to share learning and experience, promote data interoperability activities, understand the needs of consumers and drive ongoing improvement.**	• Agency is unaware of the wider data interoperability community (for example, industry and government conferences, forums, standards boards) or is not actively engaged. • Interactions with data consumers are ad hoc and reactive. • There is minimal collaboration with other government agencies in response to tactical needs.	• Individuals within the agency undertake ad hoc engagements with the wider community. • Agency has a defined mechanism for engaging with its data consumers, and interactions are tracked to inform an understanding of consumer's needs. • Teams within the agency collaborate with other agencies on a demand-driven basis. They respond to requests for information and share some data via access to datasets.	• There is a coordinated, agency-wide commitment to engagement with the wider community. • Agency proactively obtains feedback from its data consumers (for example, through the use of forums and feedback channels), using metrics to inform and prioritise data interoperability initiatives including publishing publicly accessible datasets. • Formal data sharing arrangements and practices are established between agencies that regularly work together. • External agencies provide regular feedback to collaboratively improve the quality of data holdings.	• Agency actively shares its findings, insights, successes and challenges with other agencies and the wider interoperability community. • Agency engages with data suppliers and consumers in data sharing experiences and providing or receiving feedback. • Agency has data sharing arrangements across government, implements data exchange frameworks with other agencies, and works with agencies from different sectors to aggregate data for shared outcomes.	• Agency engages with the wider community to support the creation of new data standards and models for its sector, supporting thought leadership within the community. • Agency becomes a regarded authority in terms of data interoperability for the sectors and industries in which it is involved. • Agency has data sharing arrangements with other agencies internationally where applicable, and works to help develop global standards in their domains. • Data sharing agreements are made publicly available where applicable.

SECURITY: An agency's awareness and response to security risks and issues with respect to data interoperability, including alignment with legislation and industry standards, understanding and mitigating potential risks and considering data-specific issues such as disclosure and re-identification						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Understanding and mitigating risk	a. The potential security risks of data interoperability are understood, with risk assessments undertaken and information security policies in place to mitigate risks.	• Agency has a risk assessment methodology, but this does not explicitly consider risks associated with data interoperability.	• Risk assessments relating to data interoperability are ad hoc and not based on an agreed documented process (for example, driven by external requests to share or access data). • Appropriate mitigations are agreed, actioned and monitored.	• There is an agreed and documented risk assessment process which is applied consistently and regularly and considers specific data interoperability issues such as disclosure, tamperproofing, and re-identification. • Some business areas have a risk reporting system but there is no consistent and holistic documentation of data interoperability risks across the agency.	• Regular risk management forms part of overarching data governance. • Regular risk assessments are carried out across all data, tooling, interchange and publishing channels. • Risk reporting is monitored and documented consistently across the business area or agency.	• Agency routinely assesses new and existing data for any risks associated with interoperability during their ongoing lifecycle. • The risk assessment process is regularly reviewed and updated to include new risks for data interoperability identified by the industry and sector.
Data protection and privacy	a. Standard processes consistently support the application of safeguards to de-identify data and prevent disclosure of sensitive data including personal information. b. Agency applies APS principles for data protection such as the Australian Privacy Principles and the Australian Government Agencies Privacy Code. c. Data sharing aligns with the Best Practice Guide to Applying Data Sharing Principles.	• There is limited awareness and capability in data protection and privacy including legal and legislative requirements. • Privacy and protection aspects linked to interoperability such as de-identification (anonymisation), tamperproofing and disclosure are not considered.	• Data protection and privacy for interoperability initiatives for data sharing are considered on an ad hoc basis and implemented reactively. • Agency has a policy and plan in place for information privacy, protection and security but these do not address data interoperability requirements. • Agency is aware of relevant data protection and privacy principles and policies but their application is inconsistent and unclear.	• Agency has identified, documented and applied a standardised approach and policy for data protection and privacy in interoperability. • Policies and standards that support data protection and privacy in interoperability are cross-checked with legal and legislative requirements. • APS principles for data protection and data sharing are embedded into relevant processes and initiatives. For example, Privacy Impact Assessments (PIA) are undertaken for all 'high privacy risk' projects or initiatives. • A register of Privacy Impact Assessments that have been undertaken is created and published online.	• There are standardised processes for data interoperability initiatives such as publishing datasets and general data sharing. • Formal procedures for data interoperability workflows such as de-identification (anonymisation), assessing sensitive data and disclosure awareness are documented and consistently adopted across the agency. • Datasets are independently verified to prevent disclosure of sensitive information prior to release. Privacy risks associated with verification undertaken by third parties are known and managed. • General awareness of best practice for data protection and data sharing exists agency-wide.	• Agency continuously monitors the data it has released as well as the sector and market to ensure there are no emerging issues or ways in which the data can be re-identified. • All data is routinely assessed to ensure no sensitive information is inadvertently released. • Published datasets (that are publicly available) are routinely checked for tampering; and tamperproofing methods have been implemented. • Consultation with internal information security specialists occurs regularly. • Agency internally promotes and provides training in best practice for data protection and data sharing.
Information security management	a. Agency maintains the confidentiality, integrity and availability of all official information. b. Best practice information security controls are applied in conjunction with an agency's governance activities, strategies and business plans.	**Agencies should refer to the Protective Security Policy Framework (PSPF) and related PSPF Maturity Self-Assessment Model.** https://www.protectivesecurity.gov.au/sites/default/files/govsec05-annexa-information-security.pdf				

LEGAL: The maturity of legal support for data interoperability, considering aspects such as licensing and terms of use to reduce unnecessary barriers to data sharing and interchange						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Compliance	a. Agency complies with relevant government legislation, regulations and ethical requirements on providing services to consumers. b. Agency complies with internal and external policy relevant to data interoperability.	• Agency is not aware of all government legislation and legal requirements relevant to data interoperability. • Plans for ensuring data interoperability initiatives are compliant are still being formulated. • There are no formal processes for ensuring compliance with internal or external policies applicable to data interoperability.	• Agency is aware of relevant legal requirements and government legislation. • There are agreed plans for compliance in data interoperability initiatives (these often provide services to consumers). • Agency is compliant with its own policies but does not monitor changes to requirements. They are aware of external policies applicable to data interoperability.	• Agency is implementing their plan in order to meet government legislation, legal requirements and external policies relevant to data interoperability. • Agency is progressing towards proactive monitoring. • Data interoperability initiatives are compliant with internal and applicable external policies by design.	• Agency is able to demonstrate compliance with all relevant government legislation, legal requirements and external policies in regards to data interoperability. • Plan for meeting relevant legal and legislative requirements is established and implemented across relevant sections.	• Agency continually reviews, analyses and improves existing services to meet or exceed policy requirements. • Data interoperability initiatives are routinely checked to ensure compliance is sustained. • New legislation, legal requirements and policies relevant to data interoperability are tabled for internal discussion with relevant sections.
Licensing and terms of use	a. Agency has appropriate mechanisms in place to licence the data for use by others including data custody arrangements, ownership, intellectual property considerations and appropriate terms of use. b. Licensing and terms of use are managed to capitalise on the potential value of publishing, linking and sharing data. c. The government's open data principles are recognised and managed as part of general licensing and terms of use.	• Considerations of licensing and terms of use aspects linked to data interoperability initiatives such as data supply, intellectual property and data reuse are not consistently addressed across the agency. • Agreements with third parties that define licensing or terms of use do not exist or do not identify necessary data interoperability considerations. • Data produced and published by the agency is not supported by relevant licensing arrangements and terms of conditions, or they are unclear. • There is no awareness of open data principles.	• Individual teams begin reviewing existing contracts to understand the licensing constraints and terms of use for the data they are responsible for as part of a data interoperability initiative. • Individual teams establish sharing arrangements with other agencies or third parties. • Data produced and published by the agency is supported by suitable licensing arrangements and terms of conditions. • There is an awareness of open data principles and related resources (such as data.gov.au). However, they are not applied to business.	• Agency has standardised contractual clauses that address data licensing, data re-use, data sharing, intellectual property and ownership. • All high-value datasets released have defined terms of use which support reuse and interoperability. • Agency is defining how open data may work for their business for access and interoperability, and is developing assessment procedures to identify what could be released as open data. • There is clear understanding of the government's open data principles and informed decisions are made about if and where the principles apply to the business area.	• Agency uses contracts with standard clauses that ensure there is clarity around rights and licensing for data re-use, intellectual property, shared access arrangements and data ownership. • Agency uses data sharing arrangements such as a letter of exchange. • All datasets have their terms of use published with the data and all datasets are offered under a clear licence. • An open data assessment of produced and owned datasets is undertaken and results clearly documented.	• Licensing and terms of use contracts are being written for machine execution using agreed data models. • Agency proactively encourages data interoperability by actions such as helping remove legislative barriers and other risks in sharing data (for example, consults with the Office of the National Data Commissioner of Prime Minister and Cabinet). • Data that is publicly released is available through an appropriate open licence to facilitate easy re-use (for example, Creative Commons). • Open data assessments are scheduled for new datasets produced by business areas across the agency.

SEMANTIC: The maturity of structures for enabling the meaning of exchanged information to be understood by people and systems, promoting more effective and efficient interoperability						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Metadata	a. **Agency creates and maintains standards-based structured information about its data and systems to ensure assets are discoverable and documented.** b. **Agency ensures appropriate information about data assets is captured throughout the data lifecycle.** c. **Agency is an active contributor to the national and international communities on metadata standards.**	• Agency does not have agreed metadata standards in place. • Data quality statements are not created as standard practice. • Published and unpublished datasets do not include structural metadata or data quality statements. • Agency has no plan for a metadata strategy. • Metadata is inconsistently created using personal judgement across the workforce. • Metadata that is available does not adhere to recognised industry standards or standards as part of a data interoperability initiative.	• Metadata and data quality statements are managed on an ad hoc basis per dataset. • General agreement about metadata structure and completeness exists but is inconsistently applied across general data and different datasets. • General metadata standards and standards for interoperability initiatives exist but are not adapted from industry standards. • Existing strategic documentation, such as an information and data management framework, has elements of metadata strategy but they are not clearly defined.	• Agency has defined metadata standards and policies that align with industry standards or standards developed for interoperability initiatives. • Metadata standards for interoperability initiatives adopt and adapt from industry standards. • Metadata standards are applied consistently to the correct data across the agency. • Responsibilities for the quality of metadata are clear, and processes for creation and maintenance of metadata are embedded. • Elements of metadata strategy are identified and defined within strategic information and data management documentation.	• All data has metadata that complies with relevant standards and is maintained in an open format. • All datasets have associated data quality statements that are linked to the data. • Cross-walks between metadata standards are created when agency standards are updated, altered or referenced to other standards. • Information such as data lineage is captured in metadata with processes throughout the data's lifecycle. • Agency has mechanisms to enable search, query and reporting on metadata across agency. • Automated tooling is used to reduce the manual effort involved in metadata maintenance. • Metadata statements are created as part of standard practice.	• Agency proactively monitors the effectiveness and completeness of metadata for all its data and undertakes continual improvement. • A single access point for metadata exists across the agency and this is made available in a suitably secure and controlled manner for external parties to query (for example, through a data catalogue or a metadata repository). • Metadata creation and maintenance is automated. • Metadata is harvested from other repositories and successfully mapped to the schema of your data catalogue, repository etc. • Agency proactively shares and promotes its metadata standards with relevant communities. • Metadata standards include core models (common subsets) that facilitate linked data. • A metadata strategy exists with a clear review schedule.
Taxonomy	a. **Agency aligns its thematic lists, schemas, standards and conventions to those relevant in their industry or sector, enabling their data to be more easily interchanged with other organisations.** b. **Agency is an active contributor to the national and international communities' controlled vocabularies.**	• Agency has limited or no controlled vocabularies in any form for its data (for example, taxonomies, data dictionaries, glossaries, thesauri or thematic lists). • Agency's information and data management systems use controlled vocabularies but the meaning of terms are not understood and are inconsistently applied using personal judgement. • There is no consideration of monitoring or implementing consistent and accurate use of any of the available forms of controlled vocabularies.	• Ad hoc controlled vocabularies in different forms are created and managed by individual teams. • Agency engages with communities who consume their data to determine appropriate taxonomies to be used. • Controlled vocabularies of information and data management systems are understood but poorly documented. • Agency is informed of existing industry vocabularies that align with their business but does not use them.	• Agency has defined and delegated the responsibilities for taxonomy creation, governance and maintenance. • Agency-wide taxonomies and controlled vocabularies have been defined and documented. • Industry vocabularies that align with business have been adopted and adapted where relevant. • There are plans for schemas, thematic lists and code lists to be stored in open formats and be adherent to open standards. • Monitoring of consistent and accurate use of controlled vocabularies has been implemented into procedures such as metadata quality checks.	• All agency's high value data uses community and industry driven, standards based controlled vocabularies. • Agency's controlled vocabularies such as taxonomies, data dictionaries, glossaries, thesauri and thematic lists are routinely reviewed and updated to reflect current business. • Agency's controlled vocabularies are made available for sharing in a form adherent to open standards. • Agency uses technologies such as automatic taxonomy construction (ATC) to create ontologies.	• All information and data that is generated, published or exchanged from the agency adopts or adapts an industry-recognised controlled vocabulary. • Agency proactively engages with the wider community to ensure that the right controlled vocabulary terms are collected and maintained. • Agency adopts or develops automated tools to reduce the manual effort involved in publishing structured data. • Agency proactively shares and promotes its vocabularies with relevant communities.

SEMANTIC: The maturity of structures for enabling the meaning of exchanged information to be understood by people and systems, promoting more effective and efficient interoperability						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Data discovery	a. **Data is managed as an asset and holdings published or used by the agency are discoverable through catalogues or registers.** b. **Cost savings are realised through reduction of the management of duplicate data and applications.**	• Agency does not have an up-to-date, centralised view of data holdings and data services. • There is no consideration of inefficiencies caused by data duplication across the agency's data holdings.	• Catalogues or registers of data holdings exist across the agency, but are siloed within business areas and not always up to date. • Data dictionaries for catalogues do not exist or are not consistent and relate only to individual catalogues. • Datasets are managed ad hoc and not clearly described so as to be easily findable. • An awareness of inefficiencies caused by data duplication is understood across the agency. • There are no clear standards for data entry into data catalogues.	• A central, consistent and reliable agency-wide data catalogue is established and maintained with defined owners. • High-value data and data services have been captured. • Datasets are clearly described. • Performance monitoring of inventory/catalogues is implemented to ensure they identify and capture the most valuable data. • Data entry standards for data catalogues are defined and documented. • A data dictionary exists but is incomplete and general staff are not aware of its benefits.	• A full and up-to-date data catalogue exists and is available in a secure and controlled manner both internally and externally. • Routine quality checking for duplicate data within and across holdings is scheduled. • Routine quality assessments of the data held by the data catalogue are scheduled and identified problems are documented. • A full and complete data dictionary for the data catalogue exists and general staff understand its value and how to use it. • Tools such as APIs are implemented to aid data discoverability internally or for the public.	• A full and up-to-date data catalogue exists that supports machine-based open-standards querying. • Agency uses automated tools to find and resolve duplicate entries across catalogues and registers. • The data inventory or catalogue is aided by user-centred workflows and tools. • The data inventory or catalogue is interoperable with other data inventories or catalogues across the APS.
Linked data	a. **Linked data is part of a strategic plan for developing data interoperability through controlled vocabularies.** b. **Linked data technologies are implemented and the principles of linked data are used to build data interoperability.**	• Agency does not publish its controlled vocabularies online. • Agency shares its vocabularies online but as unstructured data such as images or scanned documents. • There is no consideration of linking the agency's vocabulary terms to those from other agencies that have the same meaning.	• Agency publishes ontologies as machine-readable structured data. • Published vocabularies and ontologies are in proprietary formats. • A plan for mapping the agency's vocabulary terms to those from other agencies and industry standards is in development.	• Agency publishes ontologies as machine-readable structured data in open formats such as CSV and ODS. • Agency's most common vocabulary terms have been mapped to those from other authoritative agencies and industry standards.	• Agency uses open standards from W3C such as RDF for their published ontologies. • Agency uses persistent unique resource identifiers (URIs) to denote their vocabulary terms, enabling other agencies to link to them and their meaning. • Agency's complete vocabulary terms have been mapped to those from other agencies and industry standards where relevant. • Agency's ontologies uses core models that align or are based on industry and agency standards.	• Agency publishes ontologies as machine-readable structured data in open formats such as CSV and ODS, using open standards from W3C such as RDF. • Agency has implemented their vocabulary mapping. Vocabulary terms are linked to those from other agencies using persistent URIs. • Agency uses tools such as APIs to expose their knowledge graph and aid finding, querying and sharing their content. • Agency publishes its ontologies as easily accessible human-readable information such as web pages. These provide clear user guidance on details such as core models and vocabulary terms.

TECHNICAL: The maturity of the technology that supports data interoperability, including computer systems and services						
CATEGORY	**OBJECTIVES**	**STEP: Initial**	**STEP: Developing**	**STEP: Defined**	**STEP: Managing**	**STEP: Optimising**
Enabling technologies	a. **Tools and automation systems that are used within an agency consistently and reliably create, transform, maintain and publish data.** b. **Data interoperability is built into technologies and systems by design.** c. **Redundant and obsolete technologies are managed and do not compromise data access and procedures essential to meeting business requirements.**	• Agency does not have a defined data architecture and does not consider data interoperability. • Data collection from customers and third parties is largely through manual means. • Critical data processes depend on manual or paper-based workflows. • Agency has limited tools and solutions for data management. • Digital systems currently used are outdated and siloed where interoperability would be most effective. • Legacy systems exist and are not managed. Legacy data is difficult to access or inaccessible and there is no consideration of how to access these systems or their data.	• Agency has created a data architecture roadmap which has been validated but not widely applied through the agency. • The roadmap has elements that support data interoperability but there is no holistic plan of how they can be most effective. • Where data collection is taking place, there are pockets of emerging best practice which use digital rather than paper-based collection and validation. • Agency has started to digitise and automate high-value data handling and management processes (for example, scanning with OCR technology and ETL). • Legacy systems are known and documented. Discussions around how to manage and access their data are in progress. • Cost-effective 'plug and play' systems are used to implement easy solutions that enable data interoperability.	• Agency is implementing an architectural roadmap which is appropriate to their needs and supports the creation of flexible and scalable data services and interfaces. • When evaluating technologies, the agency explicitly considers support for data interoperability (for example, support for open and industry standard file formats, APIs). • Data handling and management workflows are largely digital from end to end. • Data, including high value data held in legacy systems, is identified. There are plans for how to access legacy data including migration to current systems. • There are clear procedures for decommissioning legacy systems including data migration and **disposal** of temporary value data.	• Agency has established an architecture which enables the flexible and responsive creation of new data services and the automated creation of new data holdings. • Building and supporting data interoperability is a key principle of the roadmap and included by design. • The processing, transformation, update and publishing of data to consumers is automated wherever possible. • Published data is made available through standards-based APIs. • Agency has an understanding of big data technologies and how they can harness their potential benefits (for example, data lakes, NoSQL, in-memory databases, analytics and visualisation, data mining, AI and machine learning). • Legacy systems are decommissioned and required data migrated. Temporary value data no longer needed for business purposes is accountably **destroyed**.	• Agency is continuously reviewing architecture models and emerging and disruptive technology to ensure their enabling technologies are optimised, efficient and cost effective. • Where appropriate, the agency uses natural language processing, data mining and machine learning tools to process data into meaningful, structured, high-quality datasets. • Forward planning successfully mitigates the risks of data inaccessibility caused by legacy systems and ensures technologies and procedures remain current to best address these issues. • Subject matter experts monitor emerging technologies as business as usual and update systems as appropriate.

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Architecture	a. **Business architecture facilitates data interoperability by design.** b. **Strategic planning prioritises business agility and meeting the demands of rapid shifts in technologies.**	• Decision-making regarding data use, reuse and sharing is difficult and tied to a centralised business owner. • Lack of boundaries between business concepts or domains results in linked, interdependent systems (tightly coupled) that cannot be individually updated or developed. • Assigning business owners to specific data sets or attributes is made difficult by data being tightly coupled within legacy systems. Business agility in decision-making is affected.	• The value of systems that can be easily and individually unlinked, updated and developed (loosely coupled) is understood and supported at senior level. • The need to decentralise business owners to support agile decision-making for data use, reuse and sharing is agreed. • A general understanding of monolithic systems and how they inhibit interoperability exists at senior level.	• Scoping has begun to break down monolithic systems into smaller services so that data is easier to expose to internal and external consumers. • The scope of smaller services is defined through technologies such as domain-driven design (DDD) to create a bounded context for the data relating to that service. In this way, a service does not contain more data than it requires to fulfil its core function. Reference data is obtained through API calls. • Clear boundaries between data domains and business concepts enable business owners of data to be decentralised, facilitating agile decision-making in data use, reuse and sharing.	• Data in legacy systems is made accessible through internal APIs for consumption by modern applications. • API usage is monitored to understand the demand on data assets and to tailor resource availability accordingly. • Access points that facilitate machine-to-machine connectivity are managed through gateway technologies to ensure security policies are 'baked-in'. Data can only be accessed by parties that have the appropriate level of authorisation.	• Agency has embraced DevOps practices. These increase their ability to build data sharing technologies such as API-enabled systems and the speed and amount of data that can be shared increases. • DevOps practices bridge the gap between development project changes and release. Keeping data access points (such as APIs and other backend services) evergreen by swapping old for new functionality is fast and efficient. • Strong business agility enables breaking down and development of features quickly as part of business as usual instead of large projects. • Legacy systems are decommissioned and data is made accessible by being migrated to target modern systems or data stores.
Data publication and exchange	a. **Agency uses standardised publication and exchange methods to ensure data is interoperable.** b. **Bespoke software is not required to interpret the data.** c. **The government's open data principles are recognised and implemented into the business area as appropriate.**	• High-value datasets that have appropriate licensing or terms of use are not published online or are published in non-machine readable formats such as scanned images of documents. • Exchange of data frequently involves a significant level of ad hoc manual intervention. • Agency has no data standards for data exchange including in agreements with other agencies.	• Data being published is machine-readable and structured and can be processed using proprietary software (for example, Word documents). • Standardised, repeatable processes support data exchange but involve manual work. • Agency is working to develop standards-based processes for data publishing and exchange that define elements such as file format, data structure and approved data-sharing channels. • There is an awareness of open data and supporting resources (for example, data.gov.au) but there is no consideration of how this applies to published and exchanged data.	• There is clear understanding of the technical and licensing or terms-of-use requirements for open data, how this can aid interoperability, and where or if it is relevant to business. • Datasets with appropriate licensing are available online in open formats such as XML and CSV. • Automated tools are being introduced to reduce the level of manual effort in data exchange. • Standards for data exchange have been agreed upon and are being used between the agency and other organisations supplying and consuming data. • Data with licensing and terms of use that facilitate sharing and reuse, such as open data, is flagged for priority publishing. • There are trusted users for data exchange that have been accredited through external or internal procedures (for example, **TDIF** accreditation or 'whitelisting').	• Data with appropriate licensing is published in open standards that enable it to be efficiently linked and integrated with other datasets (for example, RDF, OWL and SPARQL). • Processes for data exchange are automated and their standards specify open or industry-standard formats. • Agencies reuse or integrate with existing government platforms and data hubs for data exchange where appropriate. • There are clear procedures and a strong culture of data exchange with accredited trusted users. • A system is in place for publishing data identified as eligible to be open data. The data is published on the appropriate public channels.	• Agency publishes open-standards based web services to allow machine-based access to data. • Agency collects and monitors metrics on the automated exchange of data. • Compliance with standards for data exchange is continuously reviewed and updated to reflect best practice. • Mutually beneficial data exchange agreements with other agencies and organisations are proactively sought.