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# Introduction to data interoperability

Data interoperability refers to the ability of different information technology systems and software applications to access and exchange data in a seamless manner, internally and externally across organisational boundaries, to optimise the timeliness and efficiency of data use.

Data interoperability in supply chain systems is increasingly vital as industries turn digital. Tracking goods globally in near real-time is crucial and now possible. However, modern supply chains are complex and involve multiple parties. Currently, many industry and vendor-specific solutions are incompatible, resulting in costly and error-prone translation of data between different systems.

Consider a typical Australian red meat supply chain, which can consist of thousands of producers that buy and sell cattle directly between themselves and through saleyards, who then sell onto one of hundreds of feedlots or hundreds of abattoirs. In turn, the abattoirs transform cattle into meat, with the products derived from one animal potentially going to over 60 markets worldwide, with each of those markets potentially sourcing beef from over 30 countries. The number of data sharing pathways through such a complex supply chain would require hundreds of system-to-system connections.

Adopting a standardised, universal method for supply chain data exchange is hugely beneficial. It promotes traceability and paves the way for sustainable production and consumption.

Data interoperability is crucial for several reasons, particularly in sectors like agriculture where diverse systems and stakeholders are involved. Efficient data exchange between different data systems and software enables:

* timely decision-making, collaboration, and coordination among supply chain stakeholders - essential for addressing complex challenges like supply chain management, food safety, and environmental sustainability
* cost reduction and efficiency gains via reduced manual data entry and the potential for errors associated with it
* standardisation of data formats and protocols makes it easier to comply with regulatory requirements and industry standards
* scalability and innovation encouraged by easier integration of new technologies and systems - also supports scalability, enabling organisations to grow and adapt without being hindered by incompatible data systems.

Data interoperability can be conceptualised at 2 levels:

1. interoperable structure of data messages (syntactic interoperability)
2. interoperable understanding of data (semantic interoperability).

## Syntactic interoperability

Syntactic interoperability refers to the ability of different computer systems and applications to exchange data using a common format and communication protocols. It focuses on the structure and format of the data being exchanged, ensuring that it adheres to a specified schema or standard so that the receiving system can parse and interpret the data correctly. While syntactic interoperability ensures that data can be shared and that the structure of the data is understood by different systems, it does not guarantee that the meaning of the data (semantic interoperability) is preserved or understood in the same way by all systems.

## Semantic interoperability

Semantic interoperability is a level of data interoperability that ensures that the meaning of the data exchanged is accurately understood and preserved across different applications, systems, or environments. This involves the use of shared vocabularies, ontologies, and data models to ensure that the information is interpreted in the same way by all parties involved. Semantic interoperability addresses the challenge of ensuring that the context, constraints, and intentions of data are consistently maintained and understood, enabling meaningful and actionable information exchange. It is crucial for complex systems where data from diverse sources needs to be integrated and acted upon accurately.

**Acknowledgement of Country**

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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