CSIRO Submission 20/722

Australian Competition and Consumer Commission Inquiry into Murray-Darling Basin Water Markets

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Introduction

CSIRO welcomes the opportunity to provide input to the Australian Competition & Consumer Commission (ACCC) in relation to the ACCC's Murray-Darling Basin water markets inquiry. CSIRO would be pleased to discuss any aspect of this submission in more depth with ACCC and other agencies.

CSIRO's submission has been prepared in response to a specific request from the ACCC seeking input from CSIRO in relation to section 11 of the ACCC interim report available here: https://consultation.accc.gov.au/agriculture/murray-darling-basin-inquiry-interim-report/. As such, this submission provides input on general aspects of digital and data technologies relevant to water markets and does not seek to provide input or comment on Murray-Darling Basin water management.

CSIRO acknowledges that digital and data technologies can play an important role in water markets from improving the quality and timeliness of information to market participants to streamlining trade processes. Advanced digital technologies can also enable more efficient market oversights, which could help ensure the integrity and trust of water markets. In particular, we provide some suggestions on realigning trading languages, using emerging technologies such as distributed ledger technology, managing privacy and commercial sensitive information and enabling new financial products.

CSIRO has world class research capabilities in digital and data technologies and delivers rigorous and comprehensive research to Australian and international partners in relevant research areas such as digital registry, federated and distributed systems, distributed governance technologies, distributed ledger technologies and blockchain, business process/rules modelling, analysis, monitoring and automated compliance, rules/policies-as-code, regulation technologies, trust-enhancing technologies for privacy and commercial sensitive information, data standards, data quality and validation, and quantitative financial risk modelling.

CSIRO's submission draws on our broad range of expertise from the above scientific areas and our activities in industry and government sectors. This includes work that CSIRO has undertaken for an agricultural company on water options market considerations. A summary of this project is available here: https://data61.csiro.au/en/Our-Research/Our-Work/Monitoring-the-Environment/Tracking-environmental-health/Innovation-in-Water-Resources. Whilst this work has informed this submission, CSIRO also notes that traders on the water market include both industry and government.

Comments related to 11.3.1 Open Digital Protocol, 11.3.2 Single Water Market Information Portal

The ACCC report provides options for improving information flows and transparency in the Australian water market in Chapter 11 Section 3. The first two, 11.3.1 Open digital protocol and 11.3.2 Single water market information platform, focus on ensuring the information is compatible across the market, the former by sharing information between markets and the latter by centralising the information. The other options focus on the form of trading and the mechanisms and institutions required for trustworthy transactions.

Both a protocol and a platform can be seen as different points on a continuum. A protocol is needed for the right part of the digital ecosystem in order to provide a single platform. In section 11.4 the report talks about the Common Registry System (CRS) that was under development by the (then) Department of Sustainability, Environment, Water Population and Communities (DSEWPaC) in 2011/12, which is now the Department of Agriculture, Water and Environment. The DSEWPaC developed a solution architecture for the CRS encompassing a digital protocol (and associated business case) for a registry platform and data exchange. It had a detailed database schema for the trading and measurement of water, but the information model for secondary information about the state-based rules and constraints had limitations.

Water trading registries are state based and have been developed to meet the needs of intra-state trades and to some extent can accommodate trades from interstate. Each state (and in some cases each region)

have a local language (set of terms) and local traditions (rules) for water measurement and trading. The language and traditions are not necessarily aligned across state boundaries so it is not always possible to cleanly translate from what is meant in one state to another.

A common approach to standardisation involves introducing new language (terms) and traditions (rules) with clearly defined meanings. However, in introducing these new elements there is potential to create confusion for those familiar with the existing language. An alternative approach is to make minor changes to language and traditions so that the alignment across states is improved and translation is reasonably clean.

A protocol to share trading information underpins this realignment of language. A common exchange format, if sufficiently rich, can identify how information can be translated from one state water language to another. Each state can preserve its own language. It can take significant effort to work through all the significant language changes required to realign the terms across the states. In the short term a protocol would need to support the transfer of terms in their local form for reporting as is. A protocol would also need to be extensible to support changing needs.

The Bureau of Meteorology (the Bureau) publishes a glossary of terms across the national water market system that translates between state registries. This could be improved for the purposes of an efficient market because it was designed to support the Bureau's reporting requirements. The previous CRS activity had many more terms in play. Once a protocol is in place, creating a single information platform is straight forward if the protocol has dealt with the mismatch in language. However the single platform is not a replacement for the state based registries and would reflect different local languages.

Translation of traditions (rules) is harder as it is based on secondary trading information mentioned in the ACCC report. These are typically available in the form of legislation. In markets for financial products, Product Disclosure Statements (PDS), support the price information given to customers. Secondary water information could be treated the same way. The challenge is to provide the secondary information succinctly.

CSIRO is undertaking a range of research projects that are relevant to addressing these challenges, as follows, and we would be happy to meet with the ACCC to discuss this work in more detail:

- Processing document collections (e.g. PDFs, Database artefact descriptions) in ways that preserve context and data provenance metadata;
- Digital registry frameworks;
- Setting standards for the Consumer Data Rights (CDR) regime
- Regulation technology, including machine-understandable legislation, rules, policies and standards, automated compliance and compliance-by-design.

Comments related to 11.3.6 Distributed Ledger Technology and smart contracts

Water markets currently operate with many isolated centralised systems. Depending on the number of systems in the market this can limit overall market scale and access, reduce transparency, and lead to complicated and inefficient trading processes. Blockchain and Distributed Ledger Technology (DLT) systems could be used as a component or platform technology in the broader implementation of market technologies for water markets. We agree with the observation in section 11.3.6 that smart contracts provide great potential, including for tracking water use against its entitlement. These systems provide other potential benefits:

- Decentralise governance – Blockchain and DLT systems can create a logically-centralised body of information, while remaining administratively-decentralised. This means that multiple authorities can use the same digital platform to create a uniform experience for participants, but each

authority can retain their own powers and responsibilities for the integrity of digital assets (e.g., entitlements) they are responsible for.

- Enhance trust – Blockchain and DLT systems can be designed so that the underlying infrastructure is operated by participants as a collective. This can increase confidence that the infrastructure is equal and fair for participants. Applied cryptography in the platform ensures that digital signatures are continually checked, which can support proper authorisation for participants, market operators, and regulators.

- Improve efficiency – Because of continual business information exchange, automatic transaction processing with in-line regulatory enforcement, and the audit history in the ledgers, the overall efficiency of business could be significantly improved.

- Help regulators – The full history of all essential business data is stored on the ledger and is manipulated only through core platform mechanisms and smart contracts. This provides an audit trail which can allow regulators to continually monitor and audit business activities for compliance and investigation. Moreover, the digital assets exchanged on a blockchain or DLT system can be implemented as smart contracts, and can contain regulatory and other rules that can be checked in-line, as a precondition to the exchange of those assets.

However, blockchain and DLT systems have some risks and limitations that must be considered in the design:

- Section 11.3.6 notes that a DLT system can be hosted on private secure networks to hide information from the public. However, this will not necessarily hide information between competing market participants if they can access the DLT system. For example, all transactions on a blockchain system are visible to all node operators in that system, even if it is run on a private network. This might impact the normal function of markets and existing norms for commercial confidentiality. It is possible to design ledger architectures for DLT settlement systems so that a central trusted party (or parties) has many smaller ledgers each only shared with a different participant. This can support commercial confidentiality, but reduces many of the benefits of decentralisation that DLT systems can otherwise provide. Nonetheless, this kind of architecture might be suitable for a national water market. We note that for any particular data item, broad transparency is in exact opposition to confidentiality – resolving this trade-off is a policy issue, not a technical one.

- Blockchain and DLT systems currently have limitations on time-based performance. While *throughput* (number of transactions per time period) for new platforms may be adequate for a low-transactions water market, the high *latency* (time to complete a single transaction) of blockchains and DLT increase the risk of market front-running. However, if a blockchain and DLT system is only used for settlement (and not for price determination), then this risk is avoided.

- Great care must be taken to ensure that the smart contracts used to implement digital assets for entitlements, or used to implement regulatory controls, do not have “bugs”, and also have adequate and secure facilities to allow their update over time as may be required in the governance of the system.

Overall, blockchain and DLT systems have significant potential benefits for use as one of the components in the implementation of a broader system to operate water markets. The benefits, costs, and risks arise from the specification, design and implementation of the system. An important consideration will be which functions within the market are directly supported by blockchain and DLT systems, e.g. whether a DLT

system would directly support only registers of entitlements, or also settlement, or also an auction or trading market.

Comments on Privacy and Sensitive Commercial Data

The availability of accurate and comprehensive data is one of the key enablers for a water trading marketplace to efficiently and fairly provide value to its participants. While data contains information that indeed enables such value, it also includes other information that may be private to individuals or confidential to businesses and which may lead to negative impact on them if accessed by third parties. The challenge is how to assess and measure the risk of such private/confidential information being exposed in the data and how to mitigate these risks while still allowing the data to be used for the purposes of the marketplace. This challenge also exists in similar marketplaces, which rely on data to enable fair and optimal trading, such as the negawatt marketplace in smart grid communities. Similar considerations as the ones presented below also apply to these other marketplaces.

One area of the ACCC report considers the concept of "identifying details". This is a good start to considering privacy but may not go far enough. Section 11.4.2 addresses such details as including "the names and other identifying details (such as addresses, ABNs, ACNs)". However, people's identities can be connected through other pieces of information. The process of re-identification is the process of using data (whether "identifying details" such as someone's name, or other information such as the size of a transaction) to re-associate a person with other data. In the case of water rights, the size of a parcel may be the information that can allow the re-identification of an individual. Re-identification risk arises when information already known (background information) can be linked to data. Where the information already known matches only a small subset of the dataset, re-identification risk is significant. For example, a trade of a large parcel of water rights might be able to be tied to a specific person or entity due to its size. Other information might also increase this risk, such as knowing the timing of a sale. If privacy or commercial sensitivity is a concern, there is likely to be an inherent conflict between openness and privacy that would require more sophisticated mechanisms to provide the desired utility while protecting privacy and confidentiality.

Data in a water trading marketplace will provide value if it holds the information that the market requires, i.e. if it is fit-for-purpose for that market. This purpose of data use (utility of the data) may be composed of several parts, but ultimately needs to be well defined to further allow the selection of the right data to collect, hold, process and share. These concerns and the following related comments equally apply to many categories of data and their purpose for the market, such as ownership information on water entitlement, broker details, Irrigation Infrastructure Operator (IIO) trading data or broker-facilitated trades. Section 11.4.2. stresses the importance of such definition of purpose in the case of "transparency". Proponents of releasing identifying data (e.g. ownership information on water entitlement, broker details) argue that it will support transparency in the marketplace. However, such a proposition would need to be accompanied with a detailed definition of how such identifying data would achieve this purpose and how that benefit outweighs the cost to privacy and confidentiality in the proposed data. If such a clear definition is to be presented and agreed, then the definitions of the type and characteristics of the required information (to achieve the purpose) in the data could be derived as well. From these definitions, explicit utility criteria that the data must meet can be produced. This would in turn allow the design of mechanisms that would mitigate some of the privacy and confidentiality concerns around the data, while still allowing it to be fit-for-purpose (e.g. improving market transparency). There are emerging mechanisms backed by strong mathematical guarantees, which could provide such trade-off between privacy/confidentiality and utility. One example of a relevant purpose for data in a water trading marketplace would be to ensure optimal gain for all participants (such as best achievable profit in dollars). There are trading strategies based on Game Theory, which farmers, brokers, investors and other participants could employ to reach such optimal gains. Such strategies rely on the availability of accurate statistical data about market transactions and forecasts over some give time periods. In this example, the utility from the data can be explicitly defined and detailed. Thus privacy-preserving mechanisms could be applied to such data, which in turn would allow

market participants to use such game theory-based strategies to achieve best trading outcomes while providing some strong assurances on the privacy and confidentiality of their sensitive information.