

**The Agriculture of Things!**

A submission in response to the Minister for Agriculture Barnaby Joyce referring the subject of Agricultural Innovation to the Standing Committee on Agriculture and Industry.

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## The agriculture of Things!

### Executive summary

The following information has been prepared in response to the Minister for Agriculture Barnaby Joyce referring the subject of agricultural innovation to the Standing Committee on Agriculture and Industry. As a matter of national interest this submission explores the issue of interoperability among agricultural technologies and the opportunities for Australian agriculture to become a global leader in farming systems. The submission is made acknowledging the private interest of SST Software Australia Pty Ltd and its parent company SST Development Group Inc., but defines the discussion points and concepts as being a recognised industry problem and opportunity for Australian agriculture.

The Single Desk for Wheat marketing was developed to assist Australian agriculture to harness the collective value of the industry to better compete in the international marketing of Australian grain. In the digital information age the single desk may have passed its “use by date”, however a new opportunity is emerging in a single digital language for agriculture which Australia can utilise to enhance national competitive advantage in global markets. If any country needs to harness the collective capacity of its agricultural industry, it’s Australia, given our geographic isolation and challenging climate. Enabling a platform to underpin our potential as leaders in innovation, technology adoption and even R & D will be part of the answer to the challenges we face. The flood of new technology into agriculture is dominated by major international players who are promoting proprietary solutions as well as a host of smaller independent local and international players. If Australia is to both make the most of these technologies and evolve as a participant in the knowledge economy for agriculture we need to take advantage of our collective capacity.

Just like everyone else with a smartphone today a farmer can choose from a multitude of apps to help run their farming operation. Some are useful, some are just fluff driven by venture capital funds betting on finding the next big thing. In farming which is serious business all of these apps need input data to operate and very few of them talk to each other meaning the farmer has to maintain multiple databases and repetitive input of the same data. It gets worse when the tractor hardware has field computers speaking different data languages, and every new sensor and decision support tool is designed to be “special” with its own proprietary data format. It’s worse again when industry R & D is carried out on another data format again and can’t even relate to other research, let alone a farmer’s data management system. The resulting chaos is directly impacting the adoption of farm technology and consequently inhibiting advances in farm management practice and natural resource management.

Technology has been instrumental to date in maintaining the viability of many rural economies and farming sectors and it will be even more critical in the face of climate change, higher input costs, international trade competition and lower commodity prices. Efforts are being made at the industry and academic levels to standardise agricultural data. AgGateway and OADA are two examples of international committees actively trying to identify the best way to describe and standardise the language of agriculture. These efforts are valuable stewards of the elements needed to manage the industry, but tangible resources to engage with private enterprise will not evolve via a committee. Australian agriculture must innovate its way to improved economic output, profitability and viable regional communities by leveraging international efforts and transforming them into a working industry system and supply chain. The best way to do that is to become a world leader in transforming the best of the international technologies along with Australian innovation into market leading agricultural supply chain and production systems.

## The State of the Industry

Today a farmer wanting to utilise new technologies must wrestle with an infinite number of proprietary data formats relating to the different devices, systems and applications they want to use. Advances in tractor computing, decision support systems, sensors and software applications all require data collection and storage to function (much of it spatial). Each of these systems operate using proprietary data formats which generally do not communicate with each other. The mix of Red, Green and Yellow tractors all with unique file formats is bad enough but wait until we have a flood of robotics machinery on the farm each with a unique proprietary data format that can't communicate to another company's machine. This complexity and inefficiency is directly correlated with frustration and limited adoption of new technologies.

Once data has been wrestled with and imported into one data system it can't talk to other data systems. This means an edit to a data layer like "yield" in one app is not recognised in the other apps or on farm systems let alone with key stakeholders, like the agronomist, accountant, input supplier, fertiliser contractor, spray applicator and so on. The inability of data to transfer between systems requires farmers and industry service providers to maintain multiple databases in multiple systems. Even worse the research and development being done in the industry is isolated from the decisions being made on farm, meaning knowledge transfer is limited. Finally the dream of "Big Data" assisting decision making from aggregate learning is a nightmare for those attempting to work with data from disparate systems that describe data differently, where a single query produces infinite results due to free typing of input data.

Paul Schrimpf a USA based agricultural journalist recently stated that, *"if I had to work as hard to get my computer up and running as the farmer is required to work to maintain a legit data platform, I'd be using a typewriter. I'm a writer, not a programmer. Farmers want to farm."* (Paul Schrimpf, 2015). No single tech company will ever be able to develop everything a farmer needs from a technology platform. Even if this was possible it's not in the industries best interest, let alone the farmers, to have all of their data held by a single global player. Therefore integration between proprietary vendors of technologies, R & D and input supplies is essential to our industry achieving its goals. To further complicate matters, agriculture is an inherently spatial industry. When a single seed is placed at a point on the earth, it then interacts with many decisions, natural resources and products which can only be understood spatially and temporally. The tractor is becoming the farm office, and by default, ALL tractor data is spatial. So, any non-spatial core data management tools have been "put on notice", at least as primary tools.

## The USA Supply Chain example

Farmers do not get excited about data collection. They get excited about value from data and information services supplied that represent value. Farmers want to Farm and make good decisions, not manage data.

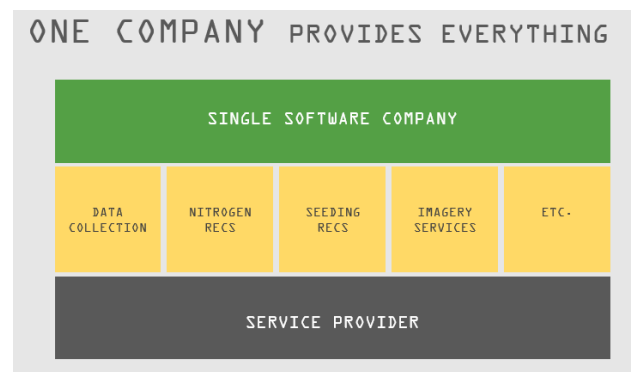
The USA Agricultural market has evolved public and private services channels that drive farm data collection. These drivers include the provision of government funded Multi Peril Crop insurance and farm Subsidies and the private sector supply of fertiliser to farmers as a service based on cheap soil testing and variable rate application. The data required to run these initiatives and the activity required to collect it, has driven the evolution of capacity around farm information services by private enterprise that is now acting as a "spine" for the private enterprise investment in farm services. Many criticise the agronomic approach of the USA but that's not the point. It has driven the development of capacity in the agricultural and regional community's services sector with skills,

knowledge and resources that now support around 200,000 farm businesses with technical services. The result is that farmers will proactively collect data or pay for data collection services because they value the data. That subsequently underpins private sector investment to value add to the information, invest in human and physical capital and focus energy on the sector. New more robust and advanced science is now blossoming off that “spine” or “information supply chain” as start-ups, spin offs and increased private sector investment to develop differentiated resources around farm information services.

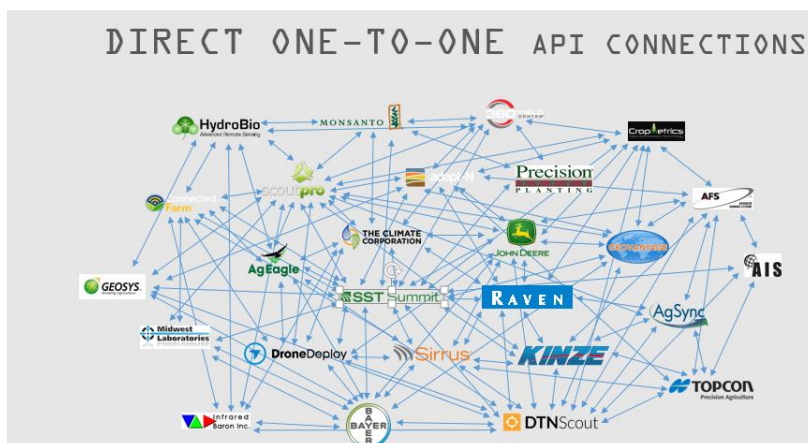
Australia needs to find our own common driver of farm data collection that will provide a platform for private sector investment in farm information services. It may be that a public sector initiative is required to “kick start” an information services industry by creating enough momentum and critical mass for the private sector to invest in human and physical capital in this sector. The capability to respond to a new demand for data is in place with abundant technology and knowledge, what is missing are the market drivers.

### The market response

Two models are appearing within the agricultural industry for managing what is becoming a globally recognised issue of data interoperability and innovation competition. The first is the “one company does it all” model. If this was possible then it might bring some initial benefits to a user but it is unlikely to be a viable approach. The reality is that no company is good, let alone the best, at everything. No matter how large the organisation, the chance of being best of breed across all sectors is unlikely. Even in the impossible scenario of this working, this model will deny innovation competitiveness, and place farmers’ data in jeopardy of manipulation and control by a single organisation who can set the rules on data exchange options to other third party innovators.

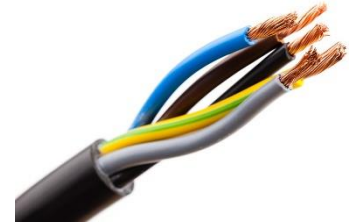


The second and most common evolving approach is a “best of breed” approach to connect all the required players together via what are called API’s (application programming interfaces). The idea is that each company connects with other companies that they need to share data with. This is simple enough when a few companies need to collaborate, but the agriculture sector is never going to be like that. If we follow the best of breed model then agriculture is so complicated in nature that we will end up with many companies providing a diverse range of solutions. This will never work.



*A change made at one node will not be reflected by all the others, because an API is just a pathway to “import” data from another system and not necessarily a way to stay synchronised.*

It's not about sharing data, which is simple enough, but rather about maintaining currency of information between the required systems, so that an edit of a data layer in one system is reflected in others systems as needed. That cannot happen via simple data import and export processes. It's not about a common data format with a standard file extension either, because it's not about the file format, but rather what is inside the file that matters. There is a reason that electrical industry standards for wiring cable don't focus on the conduit "around" the internal wiring bundle, but instead focuses on the quality and nature of the individual wires inside the conduit. It's the same for data management in agriculture. We DO need a standardised conduit to "carry and connect" the data, but the main focus is the internal aspects of the data schemas and structures, descriptors, terminologies and units of measure. It's not about one software system over another either. The analogy is a standardised highway network operating around Australia where car manufacturers are free to compete to develop the best vehicle to win the favour of the driving consumer, knowing that any vehicle they use will work on that road network. And it needs to be a global network since much of Australia's adopted technology has USA or European heritage.

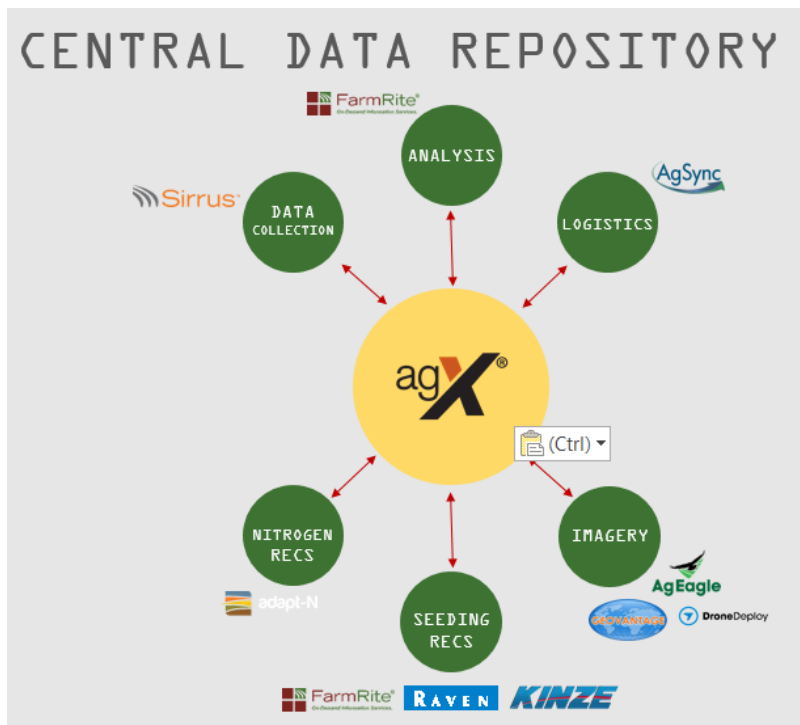


Neither of these models will support Australian agriculture becoming a global leader in agricultural innovation let alone harness our inherent industry capacity. A third option is required and is emerging in global markets. SST Software, a USA based company with 20 years of agricultural data management experience, is developing a platform called agX<sup>®</sup> which is being increasingly adopted by industry players. SST Software is a private company with a subsidiary office in Brisbane, QLD working to provide an integration and innovation platform for agriculture. The fact that SST is a private company will deter many in the public sector from seriously considering agX<sup>®</sup> as a platform for collaboration. However, governance issues are being considered as a fundamental part of the platforms development. Emerging investment of public and institutional funds into agricultural innovation (ag-robotics, sensor networks etc) will inevitably lead to a recognition of the need for interoperability between systems. The worst thing Australia can do, is end up invested in a publicly funded but proprietary industry standard that isolates us from connection to the main global stage.

## The Third option

The third and emerging model is about synchronisation, and not just integration. By standardising the content and the file format, systems can connect in a synchronised manner and maintain currency of information. When the descriptors, data schemas and processes for passing data are all maintained as a common platform, the data systems become dynamic. Protection of data privacy does not have to be compromised, as a user-based administration process can be embedded. If anything, data is more secure by acknowledging data rights, rather than trying to hide data behind flimsy proprietary walls. Innovation is enabled and barriers to market entry are lowered, because each new company does not have to build the entire value chain to attract customers. They can focus on niche elements where they have core skills.

When unique proprietary technologies share a common data language and philosophy, they can focus on competing on features and value delivery, rather than on creating proprietary exclusive channels into the market. A farmer can now have one central spatial data repository, yet interact with a suite of best of breed proprietary systems and technologies.



*In this example, a farmer can collect their yield data and soil test information once in the software of their choice. They can then use those data to engage with third parties such as Adapt-N who uses it to provide a weekly nitrogen rec. Or, AgSync, who has software for managing work orders to contractors. Primary data like yield data can then be managed with care knowing that a single import will be used to drive many different decision support outcomes.*

## What is agX®?

agX® is a robust, spatial data repository, along with sophisticated permission settings, APIs, and automated processes, collectively referred to as the agX® Platform. This platform creates a spatial infrastructure for bridging agricultural hardware and software offerings throughout the industry. Companies who integrate with or build new technologies on the agX® platform can seamlessly communicate with other agX® technologies and transfer data between them as needed.

agX® is being licensed to any company who wishes to engage with the platform without exclusion or favour. This means that the focus of agX is turning toward the support of terminologies and attributes that can describe industries from broadacre, cotton, sugar, rice and horticulture. Some tractor manufacturers such as Raven Industries (Viper pro, Viper 4) have fully integrated with the agX® sync process while others are recognising the agX® Reference Data for transfer compatibility. Many software and R & D spin-offs such as Adapt-N (Cornell University spin-off), AgSync and Drone Deploy have integrated with agX® to provide seamless movement of data between systems. Additionally, there are many more companies engaged at various levels of evaluation, or implementation, of the platform.

There are four key areas of the agX® Platform

1. Content standardization via the agX® Content API.
  - a. If users are allowed to free type information into a system, the opportunity of common digital descriptors is lost. Seamless cloud sharing, machine automated processing and “Big Data” opportunities are also compromised.
2. Secure storage and synchronization via the agX® Central Data Repository and the agX® Sync API.
  - a. This provides the “conduit” mentioned above as a structure to share, store and maintain edits of data based on an agreed framework.
3. Permission-based sharing of field operations via agX® Connections

- a. The best way to protect data privacy is to build administration controls into the physical data structure. A user has full control over where data is shared, and any third party access.
4. Commerce opportunities via the agX® Store.
    - a. Why should every new player have to replicate the infrastructure needed to develop and market agricultural software? Let core business focused businesses evolve and contribute without the burden of replicated infrastructure and marketing channels.

One-to-many integration industry efforts are currently proposing that each company share data through open APIs. While API data exchange is superior to using USB thumb drives or emailing files, the improvement complicates the problems previously discussed. By each company creating independent APIs, the resulting web of APIs may entangle users and software developers in a frustrating solution. Without standardization, every API transaction would require human interaction to address content standardization issues. Furthermore, when data exists in multiple applications without centralized synchronization, edits that occur in one system will not be reflected in the others. This results in users 'chasing their tails' trying to keep everything in sync. Contrast this to the agX® CDR, which allows agX® compatible partners to use the agX® APIs to synchronize data to and from the central repository. This ensures that all data are standardized both spatially, and in regard to content. When an application needs a particular type of data (yield, weather, fertility, etc.), those data are already available within the agX® CDR. Access to those data is dependent on permission settings that are set in place by the administrator of those data. This one-to-many approach drastically reduces development overhead and human interaction.

## Innovation acceleration

Many small enterprise and start-up initiatives are emerging to focus on agriculture. These efforts are being funded by venture capital and private equity. Many government funded institutions are also actively participating in R & D, with a view to commercial collaboration in spaces such as ag-robotics and sensor networks. Most companies are founded on one or two core feature offerings, and have core skills in those fields. To establish themselves these companies must invest in infrastructure, back end systems, process design and marketing channels. The current replication in information management infrastructure, software development and marketing channels is wasteful and inefficient. Many companies fail to survive the transition from niche features to a platform provider with multiple value offerings. Which means the failure rate of innovation is unnecessarily high. A common innovation platform would resolve many of these issues. It will also act as a basis to better identify and justify government and private sector investment initiatives in rural infrastructure, such as mobile phone towers and bandwidth, when a common set of resources are focused around infrastructure access.

## Farmer Service Provision

The publicly funded farm extension resources were disbanded a decade ago in Australia, and commercial service provision has been left to fill the void. The publicly funded and farmer funded industry bodies have largely used the emergence of the internet and digital technologies to transition extension to a farmer direct model. In many cases this training and subsidised technology provision is unintentionally competitive with commercial service provision, or at best, is funded through specialist services channels that don't provide day to day local support. A farmer is only ever "a shower of rain" away from their decisions changing, and local support is critical to make those decisions using the data they have collected.



A disconnect exists between farmers who are interested in new technologies and the services sector who can supply them or embed them in new services. Farmers don't know what it looks like since all these technologies can look different on each farm and they are not like a "drum" of chemical that has a known form and technical label. On the other hand the services sector without a clearly identified product is struggling to present a productised service to the farmer which is limiting private sector investment. The chasm between demand and supply is a void in Australia that threatens our global competitiveness.

The only sustainable model for farm services lies in locally based commercial organisations who have access to public institutional R & D, to act as a services channel to the farmer. These organisations, like ag retailers and private consultants, who live as part of local communities with local knowledge, can act as conduits for the transfer of information and services to farmers. Access to application technologies that connect into a range of private and public decision support tools using a common data language will allow these businesses to participate in the institutional and commercial technology sector. It won't of course help us much if each new services organisation that responds is using a unique data format to manage data which will only create islands of isolated knowledge across the industry.

## Big Data

"Big Data" in agriculture basically means lots of small data that has been aggregated together in a compatible format. If we focus on the value of small data exchanges between farmers, R & D and service providers, and the opportunities for "Big Data" will emerge. Without a lot of small data that was collected accurately, our "Big Data" opportunities remain a dream. If those data are collected using non-unique descriptors for terms like "preemergent", then the chance of making sense out of the data is lost, and stifles the development of machine-automated decision support systems. We can, of course, define "Big Data" as networks of weather and sensor data, which is valid. However, to evolve the ability to apply findings in a decision support context, we need to have the ability to reference that data to a farmer's management regime and practices, so as to connect it to documented decision making. This requires compatibility with on farm data applications and systems.

## Governance

The probable immediate response to this document is to compare what agX<sup>®</sup> represents in the platform space to what major industry manufacturers are doing in the applications space, and then question the independence of a privately developed single central data repository. Governance of that platform is a key issue, which SST Software recognises and is addressing. The reality is that with Australia's reliance on international technologies such as tractor field computers, any integration standard must be globally recognised and compatible. The development of an institutionally driven standard or framework, will only serve to isolate Australian agriculture from future innovation pathways, partnerships and synergies. SST Software is currently evaluating governance options. However, the continued adoption of the agX<sup>®</sup> Platform by proprietary technology companies is, in essence, the best way of ensuring good governance for farmers, because a growing collective of private enterprises are now invested in a common platform which they require to remain independent. A private organisation is also the most likely to be nimble and responsive enough to keep pace with technology change over time, whereas a public institution may struggle to keep pace with private sector innovation.

## Recommendations

### **The proposal to the enquiry is that:**

1. The issue of interoperability among public and private technologies be recognised as a matter of national interest for Australian agricultural competitiveness, and particularly, as a factor in farmer adoption of emerging technologies and publicly funded R & D.
2. Global compatibility must be considered during the examination of agricultural information standards, given the inherent reliance of Australia on internationally developed technologies in agriculture (e.g., tractors).
3. Consideration be given to existing market momentum towards industry interoperability, when investing in publicly funded or industry collaborative R & D, particularly with respect to potential future commercial engagement.
4. Consideration be given to utilising common agricultural data interoperability in reshaping public policy around farmer support initiatives, so that commercial service provision is enabled to sustainably replace the loss of public extension resources.
5. Consider investment in publicly funded “stimulus initiative” of data collection that can act as a foundation for investment by private enterprise to develop commercial services.

## References

- [www.agxplatform.com](http://www.agxplatform.com)
- The AgX Whitepaper , 2015 ([www.agXplatform.com](http://www.agXplatform.com))