

STATUS AND FUTURE PERSPECTIVES OF SMART TOOLS AND APPS IN NUTRIENT AND WATER MANAGEMENT

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Abstract:

The pace of technological development is vast, and exponentially increasing. Research suggests that this will also have an ever increasing impact on agriculture, with the deployment of drones and sensors as just the beginning.

Farms are highly complex systems, and they operate differently from any other form of enterprise. The demand for formal control, especially in the field of nutrient and water management, has increased greatly in recent years. This was promoted, in part, by an increased awareness / concern about impacts on the environment and subsequent government legislation (both in New Zealand and abroad).

The Centre of Excellence in Farm Business Management (OneFarm) is a project managed by Agri One which is a joint venture company owned 50:50 by Lincoln and Massey Universities. This is funded by two Primary Growth Partnership funds, namely the Transforming the Dairy Value Chain and Red Meat Profit Partnership. It is an independent source for information on recent developments in farm management related topics. Providing an overview on resources is the 'Toolbox' which contains reviews of smart device (smartphone & tablet) apps, websites and other helpful tools available in the marketplace. The website also delivers commentary on recent developments via blogs and supports the industry with academic research on current farm business management topics.

Our research into decision making and information management has shown that formalisation and the use of software solutions / apps is largely driven by compliance requirements. Another driver for adoption is the perceived value add. A number of apps are already available to farmers with respect to nutrient and water management, such as Ballance's Ag Hub and Ravensdown's Smart Maps. Other examples for smart tools and apps currently used in the field of nutrient management are OVERSEER (predominantly for compliance), FieldMAP (precision irrigation), FarmIQ (holistic farm system approach) and Harvest Electronics (wireless telemetry).

Albeit, or because of, the large number of smart tools available to farmers a whole different set of challenges arises, namely connectivity, rural broadband and the perceived overload of data / single solutions. In the future, New Zealand farmers will have to be able to leverage their existing knowledge and combine this with new technologies (including farm tools) to remain not only compliant but to stay at the top of their game. Smart systems will start 'talking' to each other (via the Internet of Things) in order for collected data to be useful to the end-user and to have the biggest impact on their business and the agri-food supply chain as a whole.

Introduction:

Change is the only constant; a statement which seems to hold true for farming.

Global overview

There is significant uncertainty with regard to the future developments within complex farm systems. Nevertheless, Zappa (2013) took a look into the future of agricultural and manufacturing technology up to 2028 for Horizons Canada. Since its publication in August 2013, several developments have already become commercial reality, such as variable rate swath control, air and soil sensors or equipment telematics (Zappa, 2013). Other foreseen developments are still expected to come to the market in the coming 10 to 12 years, such as 'in vitro' meat, robotic farm swarms or vertical farming (Zappa, 2013). In fact, 'in vitro' meat could be on the market in less than 5 years (Friedrich, 2016).

Within technological developments timeliness and information accessibility are important movements, hence smartphones and tablets have become prominent devices. Also here, the developments are continuous and their speed is incredible. For example, by now almost 2 million apps are available for the android operating system in the Google Play Store, representing the largest platform (Statista, 2016). On the other side, over 200 billion app installs are expected for 2016 (Roy, 2015). One of the reasons for this high speed of development is the low entry barrier for customers in terms of cost, considering most apps are free or come at a low cost. This is especially interesting, when 100% of New Zealand farm owners and managers are reported to have a smartphone as published in Horizon Research's survey, with +/- 5.5% "the maximum margin of error, at a 95% confidence level" (McInman, 2015).

New Zealand smart tools in nutrient and water management

There is already a wide range of New Zealand specific smart tools in the market, particularly targeting nutrient and water management. A snapshot of this is provided in this paragraph. The two main New Zealand fertilizer companies Ballance and Ravensdown have both developed their own smart solutions for fertilizer management, Ag Hub and Smart Maps, but are also offering a wider range of modules and options within these tools (Hammond 2015, Hammond 2015a). Their use is constantly increasing, e.g. about 30% of Ravensdown shareholders were using Smart Maps as of October 2015 (Hammond, 2015). More recently, sensor technology with the aim to measure soil moisture, soil temperature and enable customers to make better decisions for irrigation has become available (Hawkins, 2016).

Other tools include OVERSEER used mainly for compliance; Production Wise for crop management, FieldMAP for precision irrigation; but also Harvest Electronics and FarmIQ, both providing a more holistic approach; just to name a few.

New solutions are constantly being developed and promoted including programs like Fonterra Activate and Sprout agritech business accelerator programme, or useful online tools like the DairyNZ Riparian planner which is expected to be available mid-2016.

Our research into decision making and information management has shown that formalisation of information provision, including the use of software solutions (or apps), is driven by increasing on farm compliance requirements (Hammond, 2016). Another driver for adoption is the perceived value add that new technologies can provide through decision making improvements.

Problem statement:

As shown before, many standalone solutions are already available, many of them for free or at a low cost – especially apps. However, with many choices available to the customer, they face the risk of delaying or not making a decision at all.

More challenges lie ahead in the communication to and with farmers, covering a wide range of topics. The following collection represents the results of a Connectivity Workshop, held by the Centre of Excellence in Farm Business Management in October 2015:

- Convenience / interface / formats
- Common language / understanding
- Value proposition / desire to change
- Internet / connectivity
 - Last statistics on mobile coverage show that for example Vodafone covers 98% of New Zealanders (Vodafone, 2016).
 - That leaves approx. 90,000 New Zealanders without mobile coverage, of which a large proportion are presumably rural dwellers living outside large centres.

If these challenges are not addressed appropriately, there is risk of lack of adoption of existing solutions.

Solution:

Within AgriOne, a key project of work is the Centre of Excellence in Farm Business Management (OneFarm) (Fig. 1).



Figure 1: Overview on AgriOne

Within OneFarm, joint research is done between Massey and Lincoln Universities as well as scholarships, guided by the Five Themes:

- Strategy and Structures
- Resilience and Decision Making
- Farm Systems

- Data
- Human Capability

Another focus for OneFarm is improving connectivity between the agricultural community and research and a part of this is done via the website, which includes a Toolbox (Fig. 2), blogs, webinars and a large community of researchers, farmers, rural consultants and other stakeholders around the world with interests in farm management.

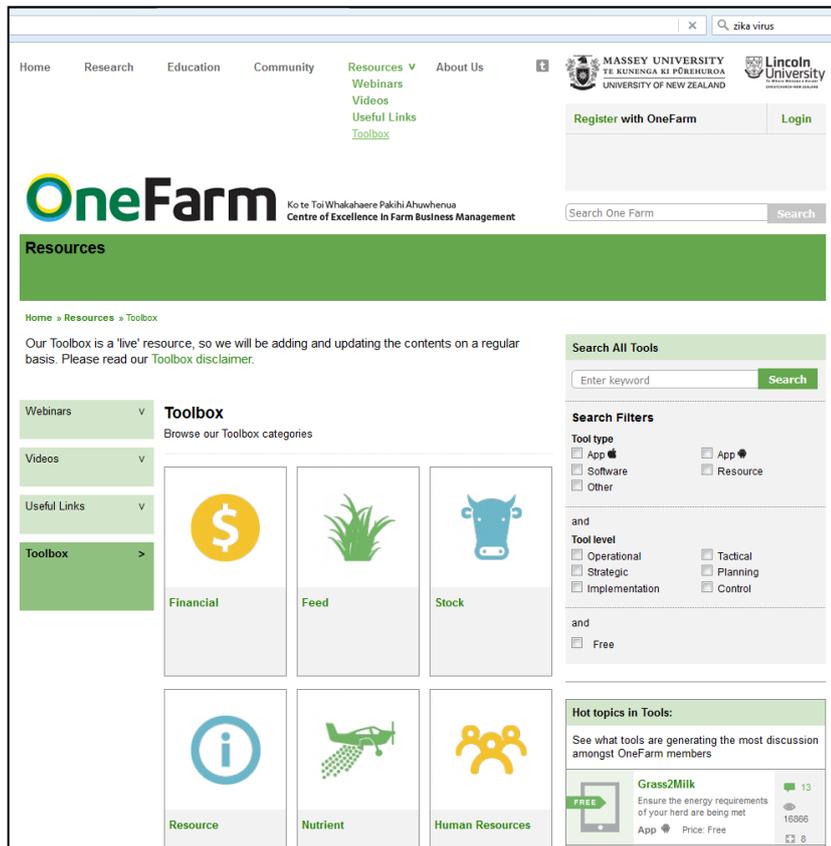


Figure 2: Screenshot of the Toolbox, the “online library” for tools and resources available to the NZ primary sector

The Toolbox acts as an “online library” for smart tools and other resources available to the agricultural sector. It has a wide range of categories as well as search filters and provides the opportunity to rank or comment on listed tools. In combination to this, there is a wide range of blogs, some specifically aimed at recent technological developments in agriculture ([Agri Tech Review](#), [Agricultural Innovations and their usability on farm](#), [Farm Tools](#)).

This is all aimed at supporting people in the primary sector to make better informed decisions.

Conclusion:

What will the future bring? All signs are aiming in the direction of more and faster technological development in the agricultural sector. This is underpinned by OneFarm research, e.g. the [Dairy Farm Systems for the Future project](#), as well as the ever expanding [Toolbox](#) (which currently has around 400 listings). Outside of OneFarm, New Zealand initiatives such as Fonterra Activate and Sprout Agritech assist this development by supporting new advances in the agri-tech field. Other developments that are expected to find their way into everyday agriculture are Big Data and the Internet of things. The speed of

technological development will ebb off at some point in the future, and eventually entities or “things” will become integrated and communicate with each other throughout the agri-food supply chain. But the timing of that, due to the high complexity of farming and pace of change in the technological world, is still unknown.

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