STIRLINGS TO COAST FARMERS

Smart Farms Workshop Manual

Making the most from your system - from start to finish

Philip Honey, Smart Farms Coordinator, SCF

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Contents

SCF Smart Farm Initiative

Digital agriculture technologies, the Internet of Things (IoT) and big data analytics, present opportunities for growers to improve their farm business productivity & profitability in modern farming systems. As farms become digitally connected, they are adopting a wider range of sensors and non-integrated management platforms, which often results in under-utilised data. This data is often left to accumulate with no clear path to integration, which results in the inability to use it effectively for wholistic decision making.

Stirlings to Coast Farmers is committed to road-testing a range of digital tools that will help farmers become more efficient and competitive in the long-term through our Smart Farms Initiative. The three-year initiative consists of several projects testing some of the tools and technologies available to landholders, and to de-risk agtech adoption within the region by identifying what devices work, and how they can lead to improved management & productivity outcomes.

Over the three years, we will be testing a range of weather stations, hyper-local weather prediction services, remote rain-gauges, GPS trackers, soil moisture probes and tank level sensors on various connectivity solutions (mobile broadband, WiFi, Sigfox & LoRaWAN). The Smart Farm projects will also have a strong focus on how SCF members can better manage their on-farm data generated from a range of equipment such as machinery, drones, security trackers & remote monitoring systems.

This manual will help explain the beginning steps to smart farm solutions and the careful approaches required to begin your smart farm journey, helping to maximise your overall success. Stay tuned through our communication streams as we continue to share our successes & learnings with you throughout this initiative.

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Smart Farms Initiative Aims:

In the short term, SCF aims to:

Define what AgTech solutions are currently available, what works and what currently doesn't

Identify any upcoming technologies that are most likely going to contribute effectively to improved practice change

Improve grower knowledge on the use of digital technologies

Whilst in the long term:

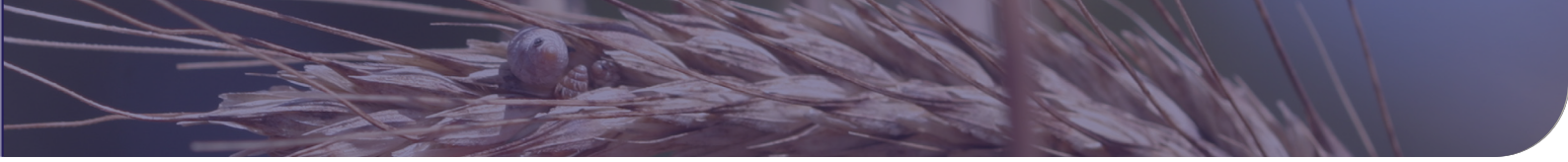
Improve climate resilience – Improve the ability for landholders & managers to predict, plan, respond and recover to/from adverse seasonal conditions

Improve soil health, fertility and crop performance - reducing the effects of soil acidity, compaction, waterlogging and chemical/ pesticide use

Pasture and feedlot performance – maximising feed conversion efficiencies through improved pasture and crop management

Improve on-farm connectivity and decision making processes through the use of IoT equipment and decision support platforms

Removing the barriers to technology adoption by identifying which tools are most useful and likely to return an economic benefit to the farm



Smart Farms Demonstration Sites

As part of the Smart Farms Initiative, Stirlings to Coast Farmers will be road-testing a range of digital technologies on two individual demonstration sites located within the Shire of Plantagenet. Each demonstration site will host a high-speed farm internet connectivity achieved through a mobile broadband connection; with various AgTech sensors installed utilising a low-powered wide area network (LPWAN) connectivity. Each demonstration farm has a slightly different operating focus.

Demonstration Site 1 – Broadacre cropping operation
Located in Woogenellup, this site will host a range of AgTech solutions to demonstrate how farmers can take advantage of new technology in grain production systems. AgTech solutions implemented on this farm will include a mixture of cellular & LoRaWAN devices.

Demonstration Site 2 – Mixed farming operation with feedlot operation
Located in West Kendenup, this demonstration site will focus on a range of AgTech solutions that could help farmers mitigate risk by integrating new technology into their sheep/pasture systems. A range of cellular and Sigfox enabled devices will be operating & implemented across the landscape.

Satellite Monitoring

PAIRTREE

Soil Moisture Probes

AXISTECH

STIRLINGS TO COAST FARMERS

Farm Connectivity

LoRaWAN

sigfox

Wi Fi

TELSTRA

pivotel. mobile everywhere

Water Level Sensing

AXISTECH

ellenex

Weather Stations

DTN

AXISTECH

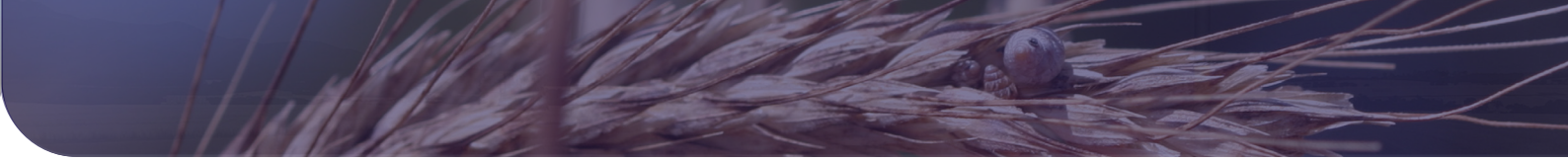
STIRLINGS TO COAST FARMERS

Goanna Ag

Control Centres & Dashboards

HITACHI

PAIRTREE



Steps to smart farm Implementation

PHASE 1 Design

What problems are you trying to solve on farm?

- Can it be physically measured?
- Can you manage it, or at least change management practices from it?
- Will it boost productivity or improve efficiency?

PHASE 2 Sensor Choice

What sensors can I use?

- Water Monitoring
- Weather Stations
- Soil Moisture Probes
- GPS Tracking
- Livestock Tracking

PHASE 3 Connectivity Solutions

What Connectivity forms will I need to implement/improve for efficient use?

- Sensor Connection (Sigfox vs LoRaWAN vs Cellular)
- Physical Home/Farm Connectivity (High Speed Internet Access)
- Additional Connectivity (On-Farm WiFi & Building Connectivity)

PHASE 4 Data Aggregation & Dashboards

How will I be able to access this data to make meaningful decisions?

- Supplier Dashboards (GoannaAg, Axistech etc.)
- Aggregated Dashboard where I can show everything on one page (PairTree)
- Decision Support Platforms (Hitachi)

future considerations

Machine Learning & Predictive services

How can I better use this data to improve productivity?

- Nitrogen Prediction
- Yield Prediction
- Weather Forecasting

Blockchain

Can I use this data to create additional income?

- Value adding of agricultural produce
- Creation of greater levels of market access
- "The story of me": food provenance & traceability

phase 1

Design Considerations - Farm IoT & Networking

Step 1 - Planning and design

Planning is ultimately the first important step in starting your AgTech journey. It is essential to create a system which suits your current needs but also can add/remove sensors & systems as your needs change over time.

Things to consider when planning your design include:

- Define the problem(s) that you are trying to solve on farm, prior to selecting your sensors.
- Determine where you would like devices to be placed, taking into consideration:
  - Elevation (typically the higher the better!)
  - Line-of-sight (make sure there isn't anything that can block your signal)
  - Maximum device cabling lengths & wireless device limits
- Device types you'd like to connect:
  - Wi-Fi Access Points (Wifi access for mobile phones, laptops, etc.)
  - Wi-Fi connectivity across paddocks (Complete Farm Wi-Fi Solutions)
  - Wi-Fi Connectivity between farms and/or buildings (Point to Point Solutions)
  - Customised AgTech Sensors & Solutions:
    - Tank Monitoring
    - Weather Monitoring
    - Soil Moisture
    - Vehicle Tracking
    - Animal Health Monitoring & Geofencing
- Determine your budget, and make sure you consider future potential repair/ maintenance costs or upgrades.

Step 2 - Select your technology partner

Identifying the correct technology partner for your project will not only help ensure that your installed solution meets your current & future requirements, but it also helps ensure that the system works to its full potential and meets industry best practices. Handy things to consider when choosing your partner include:

- What is their experience in the industry? Are they a start-up or well-established company?
- What level of support will be given to you after the equipment is installed? Is it local, WA based, interstate or international?
- Can they provide reference farmers for you to talk directly to?
- Do they provide a "Service Level Agreement" to ensure issues are rectified quickly? If so, what's included and what are the additional costs?
- Do they offer the option to share your data through data exports & API's?

Step 3 - Determine your ongoing support, updates & maintenance requirements:

Please make sure you understand what support you will be entitled to after your installation and identify whether you'll need additional support.

- Are you able to maintain your system, or will you need to consider outsourcing your maintenance?
- Can devices be updated "over the air" or do they require a physical update by a technician?
- Are devices remotely monitored to ensure they're working correctly?

Step 4 - Installation

To maximise the efficiency of your system and to ensure its longevity well into the future, it's essential to have your solution installed correctly by professionals.

- Use ACMA Accredited "Open Registration" licenced installers, and check that they are endorsed for the job that is going to be completed.
  Endorsement examples include:
  - Coaxial (antennas, tv wall plates, tv-leads etc).
  - Structured Cabling (Fixed network cabling between computers, servers, switches & WiFi equipment).
- All Security solutions, planning and/or installations need to be completed by a licenced "Class 2 Security Installer" or "Class 2 Security Consultant". Do not risk using a dodgy, unlicensed person that could compromise the efficiency of your system.
- Ensure all cabling installations come with a "Telecommunications Cabling Advice Form" (TCA1) to describe works completed, or a statement on the invoice stating "I hereby certify that the cabling work described in this advice complies with the Wiring Rules (AS/CA S009:2013 or its replacement)".
- Ensure that equipment is fit for its required purpose:
  - Ensure outdoor equipment has an appropriate IP Rating.
  - Outdoor installations/cabling requires UV Rated cabling:
    - UV Rated Cat6 network cables for outdoor installations
    - UV Rated Gel-Filled Cat6 network cables for outdoor buried installations.
- Installation of "Surge Suppression" and Shielded cables as recommended by suppliers specifications.
- Ensure that equipment is installed to meet the current wiring rules (AS/CA S009:2013), or its replacement.
  - Utilise certified, ACMA approved cables that meet/exceed the industry standards.
  - Reduce the risk of interference & utilise certified/approved equipment that meets Australian testing requirements (RCM Approvals, A-Tick or C-Tick).

phase 2

AgTech Solutions

2a. Weather Stations

Weather stations are an essential tool for improving farm management decisions. They collect data autonomously without human interaction, operate on a combination of solar power & batteries, and require very little maintenance over time. They record data from a variety of specialised sensors that help provide real-time conditions from the paddock remotely and in some cases, this data can be fed back into algorithms/models to help predict future weather events.

There are two types of weather stations used on most smart-farms:

- The traditional “mechanical” style weather stations that use separate components for each measurement type, for example, an anemometer for wind speed/direction, temperature & humidity sensors, and a tipping bucket for rainfall measurements. These stations are typically low cost, with general weather station solutions starting around $500 plus the cost of the communications module/platform. The mechanical based stations are highly popular across most Ag-Tech vendors, should the farmer have an issue with a critical part, they can easily swap & replace an individual sensor, and also have a low-pricing entry point.

Figure 1: Davis mechanical weatherstation. (Source: Davis Instruments)

- “All-in-one” weather station devices that can host up to 12 different sensors (air temperature, relative humidity, vapour pressure, barometric pressure, wind speed, gust and direction, solar radiation, precipitation, lightning strike counter and distance), all in one small modular unit. All-in-one units utilise ultrasonic technology for wind-speed & direction sensing, and as they have no moving parts there is minimal wear & tear.

Figure 2: Atmos 41 All-in-one device. (source: Meter Group)

SCF Handy Hints:

If highly accurate wind speed & direction is of high importance to your farming operations, systems that involve Ultrasonic Anemometers are typically more reliable at measuring low-wind speed conditions than their mechanical counterparts. These Ultrasonic anemometers include models such as the Atmos 41 (12 sensor all-in-one system), or Atmos 22 (sonic anemometer sensor only) for example.

2b. Remote Rain Gauges

Whilst the concept of rainfall variation isn't new to most farmers, very few are actively recording the levels of rainfall variation at a resolution to be able to vary inputs or effectively measure water-use-efficiency across the landscape in greater detail.

Remote rain gauges are a cost effective method to in fill rainfall data between weather stations.

Figure 3: Sigfox connected remote rain gauge on the SCF Smart Farm.

Figure 4: DTN Hyper-local Weather station at the SCF cropping demonstration site.

Hyper-local weather forecasting:

The aggregation of weather station data and adaptive machine learning technologies can be utilised to help improve weather forecasts at a higher level than ever before!

Both SCF Smart Farm Demonstration sites each host a DTN Weather station, which is continually feeding in current climatic conditions into the DTN cloud. This data – along with the nearby DPIRD & BOM weather station data – is added into self-learning machine learning practices to create more accurate 36 hour and up-to 15-day weather predictions.

2c. Soil Moisture Monitoring

Soil probes are a useful tool that allows managers to utilise soil moisture data to manage soil & crop resources in real-time. How they are effectively used varies between farming operations, but they can assist with:

- Identifying soil moisture at predefined depths.
- Monitoring how rainfall events & plant growth influences moisture levels at depth.
- Assistance with planting & fertilising times and the effective rates of application.
- Tracking salinity/salt movements over time.

Gypsum Blocks

Gypsum blocks are utilised on some weather stations to record soil water tension. Comprising a gypsum block with electrodes, these sensors measure the effective forces that a plant must overcome to extract water from the soil.
These sensors are typically buried in the plant rooting zone and are connected to either a data logger or weather station setup such as the Davis based systems.

Figure 5:Watermark Soil Moisture Sensor.

Capacitance Probes

These are the most commonly installed soil moisture probe for broadacre farming systems, as they often take multiple soil water content readings along the length of the device. Some devices will also measure and record soil temperature levels & electrical conductivity.
Common brand examples include companies such as EnviroPro & Sentek, and these sensors come in various lengths up to 1.6 metres. Installation is completed by drilling a slightly oversized hole in the ground, with a liquid slurry added (either soil-based or bentonite-based), followed with the sensor then being inserted down into the hole. However, please do keep in mind that they take time for their readings to settle from installation.

Figure 6: Capacitance probe which measures soil water content. (Source: EnviroPro)

SCF Handy Hints:

- For capacitance probe installation in transitional soils, it's recommended to install these sensors into a bentonite slurry for higher levels of accuracy.
- Consider burying your soil moisture probe deep (i.e.: 30cm) below the surface to ensure device longevity against implement damage!

2d. Water & Object Level Monitoring

Easily accessible through web-dashboards, ultrasonic level sensors or submersible sensors are giving farm managers a live level reading inside water tanks, fuel tanks, troughs, dams & grain silos. These systems always ensure levels are adequate and allow the potential for early leak detection and water-use tracking, while actively reducing the risk of occupational health & safety issues from working at heights.

Dependent upon the sensing platform used, trigger warnings can be created should the level drop beyond a specific rate per hour or beyond a preset height. These warnings can then potentially be used to trigger automatic pump operation based on recorded tank levels. There are several different types of sensors that can be used on-farm to measure levels, with each being better suited to specific applications.

Ultrasonic Sensors

Ultrasonic sensors are the most universally applied sensor, with the ability to read tank, trough and dam levels. These sensors work by sitting above the water and bouncing ultrasonic pulses off the water surface and calculating the time it takes to receive the signal back. This is then calculated automatically into the distance from the sensor to the water surface, which is later converted into the level in percentage and litres.

Figure 7: Maxbotix Ultrasonic Sensor.

Submersible Sensors (Differential pressure)

Differential pressure sensors work by calculating the pressure of the water body at its lowest point. The sensors calculate the liquid levels from the differential pressure, the pressure in the water body relative to the atmospheric pressure. This is then automatically converted to level percentage and litres based on the calibration. These tank sensors are straightforward to install on tanks or dams, with minimal effort for highly accurate results.

Figure 8: Ellenex Submersible Level Sensor.

SCF Handy Hints:

Ultrasonic depth sensors can be affected by condensation or algae in tanks & troughs. In certain conditions, either of these can result in false recordings.

- Ultrasonic sensors are recommended to be installed with free air-flow between tank & the sensor to prevent false “tank-full” alerts generated by condensation.
- In high Algae load areas, submersible level sensors are recommended to avoid “tank-empty” alerts that are generated from ultrasonic sensors when algae pass under the sensor.

Smart Farms Calculator (Tank Monitoring Example)

Number of tanks monitored on property = _____ tanks (a)
Km's travelled per water run = _____ kms (b)
Hours taken to complete each run = _____ (c)
Number of water runs per week = _____ (d)
Hourly Labour Rate = _____/hr (e)
Kilometre Travel Rate = $____/km (f)

Upfront Hardware Cost = (a) _____tanks x $_____/device = $_____(G)
Annual Maintenance Cost = (a) _____tanks x $_____/device = $_____(H)
Annual Labour Cost = _____ hrs (c) x _____runs (d) x $_____/hr (e) x 52 weeks = $_____(J)
Annual Travel Costs = _____kms (b) x _____ runs (d) x $_____/km (f) x 52 weeks = $_____(K)

		Year 1	Year 2	Year 3	Total
Monitoring Costs	Annual Labour Cost	$_____(J)	$_____(J)	$_____(J)	$_____
	Annual Travel Costs	$_____ (K)	$_____ (K)	$_____ (K)	$_____
	Total	$_____(L)	$_____(L)	$_____(L)	$_____
Hardware Costs	Hardware Cost	$_____(G)	-	-	$_____
	Maintenance Fee	$_____(H)	$_____(H)	$_____(H)	$_____
	Total	$_____(I)	$_____(I)	$_____(I)	$_____
Total Savings (L-I)	$_____	$_____	$_____	$_____	$_____

2e GPS Tracking

Figure 9: Digital Matter Oyster GPS Tracker (Source: Digital Matter).

As overall farm size and distances spent travelling between farms increase, the challenges of monitoring staff welfare and machine locations often becomes difficult. GPS tracking devices come in a range of sizes, connectivity options (cellular, Sigfox or LoRaWAN variants) and can be battery powered for discrete installations. Some of the newer variants also include accelerometers, which can send alerts when particular behaviours occur (i.e. harsh vehicle braking, detected roll-over events).

Some of the many benefits of implementing GPS tracking includes:

- Improved safety of workers & vehicle security – knowing where your workers are, and if they've arrived safely at home that night.
- Improved fleet & asset coordination – know where your vehicles are operating.
- Better asset management & maintenance – the implementation of "run-time" recording or telematics for maintenance monitoring & scheduling.

2f Security Cameras

Figure 10: Battery powered 4g security camera. (Source: PBTech)

As farms have become larger and typically have less staff working across the landscape, farm crime has been increasing across Australia. The importance of good on-farm security can help ensure that theft incidents of livestock, fuel, chemicals or machinery simply does not occur.

Security Cameras are a great option in mitigating thefts or improving operational safety and can come in many different forms. For example, there are mains powered, battery powered and/or solar variants, which can record to a memory card, send a picture by text message or view live/historic footage via website or mobile device application.

Farm Security Camera Considerations:

- Does the site have power?
- Do I have mobile connectivity or access to an internet connection?
- How clear does the video need to be?
- Do I need licence plate recognition?
- Is the camera rated to handle the elements (heat, dust or rain)?
- Am I purchasing this from a licenced dealer?

phase 3

Connectivity Options

Sensor Networks & Internet

Connectivity types on any Smart Farm can be broken down into two distinct groupings: high-speed & low-speed offerings. Each of these groupings has its own independent strengths and weaknesses, with communications and streaming services best serviced under high-speed offerings and sensor networks best served on the low-power networks. It is important to note that there are different connectivity methods available in each of these offerings. Some of the key differences are listed below and on the following pages.

Network Offering Type	High Speed, Wide Area Networks	Low Speed, Wide Area Networks (LPWAN)
Connection Examples	• Mobile Broadband • Satellite Broadband • Fixed Wireless/WiFI	• Sigfox • LoRaWAN • Cellular Cat-M1 or NB-IoT
Use Case Examples	• Security cameras, • Voice & Video transmission • Video streaming services • File Sharing • General internet usage	• AgTech Weather stations • Vehicle/asset tracking • Vending Machines
Strengths of Network Offering	• High-speed internet access • Ability to remotely access devices easily	• Low cost of data transmission (Free transfer or low data transfer cost < $10/ month) • Greater coverage in remote areas (NB-IoT, Cat-M1). • Coverage options in “no-coverage” zones (Locally hosted LoRaWAN) • Low Power requirements (Sensor/Comms battery life of up to 10 years)
Weaknesses of Network Offering	• High ‘power requirement’ for operation (requires large batteries or a permanent power connection) • Data costs are relatively higher ($35-400/month). • Typically not suited for IoT data transfer (not good value for money)	• Not designed for high-speed data transfer. Best suited to tiny data packets.

Smart Farm Networks in Use:

3G / 4G Mobile network

Both Smart Farms will be connected to the SCF Pivotel Mobile Network for general internet accessibility, and to provide connectivity for gateways as required. These systems work on a 3G/4G modem which connects directly to the Pivotel network tower located on-farm or nearby. This network will be utilised for the sensors & security cameras to access/communicate out to the world-wide-web, where users can view sensor data/ security footage off-farm.

LoRaWAN (Low Power, Wide Area Network) – Cropping Demonstration Site

LoRaWAN is a wireless network that operates in the free 900mhz ISM (Industrial, Scientific & Medical) frequency band, which allows users to freely install gateway devices to create networks without requiring a licence. Coverage can be provided by either user-supplied or community gateways (free to access) or via paid subscriptions from National LoRaWAN providers such as NNNco. At the Woogenellup demonstration site, Stirlings to Coast Farmers have installed a local gateway device, to create a network available for sensors. This means that SCF and farmers within the coverage zone will not have to pay a connectivity fee for every device that is installed.

Sigfox (Low Power, Wide Area Network)

Sigfox uses similar technology to LoRaWAN, however, is not an open standard network. The company is currently rolling out its network across Australia through the network operator Thinxtra. Although coverage is more limited than LoRaWAN due to the limited towers currently installed nationwide, Sigfox allows users to add additional coverage to their area with an “access station” for a yearly fee. At the Kendenup Smart Farm demonstration site, there currently is limited coverage available, which will soon be supplemented with an additional Gateway. Each device requires a Sigfox coverage subscription package to be able to utilise the network.

Which LPWAN connection should I use?

This question is often hard to answer, and results vary depending on what the farmer wishes to implement.

It is essential to research & consider what connectivity currently exists in your area, what brand/type of sensors you would like to implement, how many sensors you wish to connect and if there’s planned coverage coming into your region soon, as this ultimately shapes which LPWAN connection type you would use. For farmers wishing to employ limited stations, cellular solutions are preferred where there currently is no other sensor coverage available. In high-density sensor installation scenarios, users may be better off installing their own gateway to create a LoRaWAN network.

Network Connectivity – High Speed

Connection Name	Satellite	Fixed Wireless (NBN)	Fixed Wireless (WISP)	Mobile Broadband
Coverage	"Anywhere that sees the sky"	Selected areas. Dependent upon providers location & coverage footprint		
Connectivity Speeds	25/5 Mbps	50/20 Mbps, potentially....	Depends on provider utilised/ plan selected (25/5, 50/20, 100-200/x)	Carrier & network dependent.
How can I get additional coverage?	Not Applicable	Await build of additional towers, or utilise Point to Point WiFi to share internet coverage from building to building, farm to farm.		
Coverage Cost & device fees	$34.95 - $130 / month	$55.95 - $89 /month	$60-$400/month, dependent upon provider and service level	Telstra $15 - $75 (5 - 100gb) Optus $15-$85 (5 - 500gb)
Data Allowances	10gb peak/40gb off-peak	Typically Unlimited		Plan Dependent (Some unlimited, some limited)
Connection Limitations	Restricted data usage (data allowances for peak/off-peak times)	Sometimes congested (slow), dependent upon tower configuration/ connection.	Reliant upon towers within range. Sometimes higher monthly cost, but this is outweighed by unlimited data plans.	Usually high costs of access, but this is dependent upon company used/plan type.
Connection Strengths	Works everywhere	Unlimited Plan options available (ISP dependent)		Typically portable

Note: Pricing is suggestive only, will vary between providers and is subject to change.

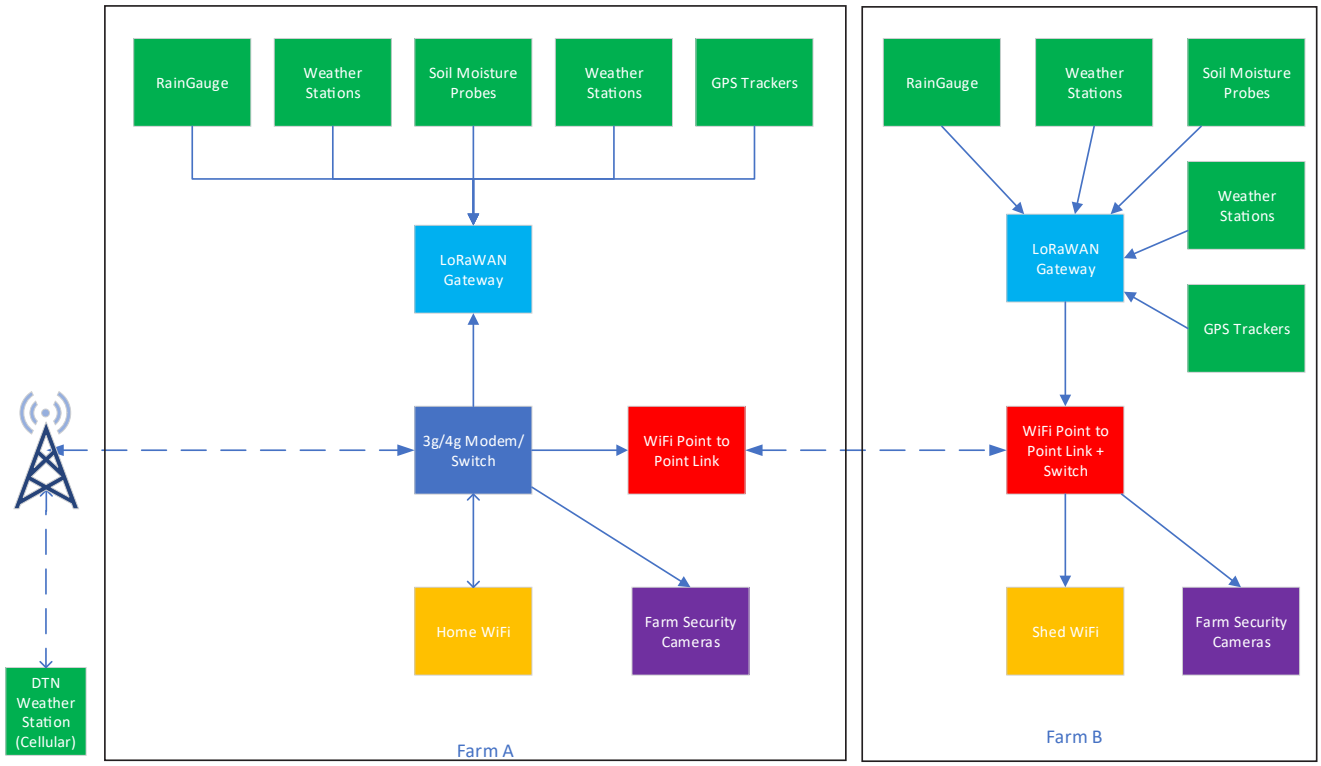
Network Connectivity – Low Speed (Low Power)

Connection Name	SigFox	LoRaWAN – Public Access Network	LoRaWAN – Private Access Network	DigiMesh	Cat M1 or NB-IoT
Network Type	Public Network	Public	Private (Farmer Owned)	Private (Farmer Owned)	Public Network
Potential Range	Micro Node ~ 5kms Mini Node ~ 15-20km Macro Node ~40km	Up-to 20km (dependent upon tower location, line-of-sight, interference levels, elevation, antennas & device limitations)			Estimated <100kms Telstra (CatM1 = 3million km2) Telstra (NB-IoT = 3.5m+ km2)
Connectivity Type	Node (Sensor Node to Gateway)	Node (Sensor Node to Gateway)		Meshed (Sensor Node to Gateway, or Sensor Node to Sensor Node to Gateway)	Node (Sensor Node to Cell Tower)
Connectivity Speeds	600bps	27kbps typically.		156Kbps	NB-IoT – 100kbps
How can I get additional coverage?	Await for Thinxstra to add additional towers into area Can lease stations for a yearly fee	Await additional towers to be built	Add in additional coverage through additional gateways purchased ($400-$3,500 each) + cost of internet connection.	Additional stations can act as repeaters	Await additional towers to be installed.
Coverage Cost & device fees	Device fee charged on max. messages per day	Yearly device fee + software fee	Cost of gateway connection (Telstra, Optus, etc). + software fee per device (if applicable)	Cost of gateway data subscription + software fee (if applicable)	Data sims start at $1.76/month (typically Ag IoT is 100mb or approx. $10/ month per station)

Note: Pricing is suggestive only, will vary between providers and is subject to change.

Connectivity Options - Sharing your internet access

Once your home farm is connected to the internet, there are many methods of sharing internet access beyond the household should you need without an additional data connection. The strengths of sharing your internet connection across one (or many) farms is that the data is not metered inside your network. An example of this is outlined in figure below. This means that if a user is connected to the Wi-Fi connection at Farm A on an iPad, they would then be able to view the security camera on Farm B without the data counting towards your monthly allocation.



Point To Point Solutions

Point to Point solutions involves the installation of at least 2-directional WiFi antennas to form a wireless bridge between buildings. These systems are cheap to implement, have a vast range (subject to line-of-sight) and are ideal for allowing the potential to implement additional upgrades or the addition of security cameras, WiFi access points, LoRaWAN gateways to other farms/buildings.

Paddock Coverage Solutions

Sector WiFi utilises towers to beam a WiFi signal across paddocks, and into vehicles/ buildings with dedicated WiFi antennas, before being able to be utilised by a mobile device. These coverage solutions are ideal for sharing internet connectivity to both fixed and moving assets and can beam internet connectivity across the whole paddocks.

Figure 12: Sector Wi-Fi Tower with Point to Point Radio on the bottom. (Source: Blackhawk Antennas)

Figure 11: Point to Point WiFi solution. (Source: Philip Honey)

SCF Handy Hints:

- Always utilise “Registered Cablers” to perform any connectivity work to maximise the efficiency of your system and minimise risks, hazards or network interference.
- In lightning prone areas, it is strongly recommended to utilise surge suppression systems to prevent system damages where possible.
- There are Link Simulation & Elevations tools available to see if physical WiFi links are possible between farms/buildings (www.link.ui.com & Google Earth).

phase 4

Dashboards

Dashboards are the final critical element in the development of Smart Farms. They have varying ranges of complexities and features; from simple manufacturer display systems to complex systems that include machine or process intelligence to value add & drive larger on & off-farm efficiencies.
The Stirlings to Coast Farmers Smart Farms Initiative will be using all three tiers of dash-boards as listed below:

Supplier Dashboards & Make Your Own (MYO)

Most devices - if purchased through a reseller - will come with a generic dashboard to view your current sensor data, historic measurements over time, and often the ability to export this data into spreadsheets or ".pdf files". These dashboards typically have mini-mal features or options to interrogate the data into something more meaningful.

For those who are technically minded and are utilising 'home-built' solutions, there are now platforms available such as UbiDots & Cayenne that are low cost, and allow you to display sensor data with minimal amounts of coding.

Aggregated Dashboards

As smart farms get complicated with multiple sensor types and sensor vendors, it's often easier and more efficient to combine data into one singular dash-board. By utilising API's (Application Programming Interfaces), data can be automatically fed into these dash-boards with minimal effort for the user.

The Smart Farm Initiative will be utilising PairTree for aggregated data services, where the SCF soil moisture probe data can be displayed in conjunction with plant biomass/ NDVI imagery, virtual weather stations & additional sensor data streams.

Complete Decision Support Platforms

When data is aggregated (both on or off-farm) and combined into one single system/ dashboard, intelligence processes can be added to create further opportunities and ef-ficiencies. For example, through the aggregation & interrogation of climate data in adap-tive learning models, farmers can utilise hyperlocal weather forecasting to help schedule crop application treatments in ideal spraying conditions, and finishing before bad condi-tions arise. In livestock operations, production data can be examined and interrogated to maximise feed conversions through animal selection derived from genetic & IoT data. SCF will be partnering with Hitachi to trial and implement the Hitachi Process Intelligence (HPI) platform.

Notes

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