CAPTURING ON-FARM INNOVATION TO WORK SMARTER NOT HARDER

Corrigan and Ruth Sowman
Uruwhenua Farm, Golden Bay

Introduction

The range of technological innovations available to New Zealand dairy farmers is increasing all the time. From the invention of the herringbone cowshed by Ron Sharp in the 1950s, to the advent of robotic milking and a whole spectrum of technologies in between which assist farmers with milking, pasture, animal and environmental management. Many of these technologies were not cost-effective or proven even five years ago; however, an increase in products and suppliers, and a surge in uptake by dairy farmers have resulted in rapid improvements. The adaption of such technologies can be likened to the integration of the robot into meat-packing works which has resulted in increased efficiency and decreased labour requirements. At the scale of a single farm however, can adopting technology make a similar difference, and how does a farmer choose which technologies to adopt, and will the right choice result in labour savings and profit?

This paper shares our experience in converting a relatively 'low tech' farm with pressured infrastructure, high complexity and high labour requirements to one which utilises innovative on-farm technology to evolve our business into a simple, enjoyable and profitable workplace that will sustain the next generation.

Background

Corrigan's parents, Brian and Glenda, had spent 25 years expanding the family farm by growing off the farm boundaries, tacking smaller units together. However, to not preclude future options of employing sharemilkers or selling part of the farm for retirement the farm was not completely consolidated as a whole unit. This added complexity to the business with multiple cowsheds, water systems, uneven paddock sizes and three herds. Thus the farm was challenging for a farm manager to operate because of the extra decisions that needed to take place on a daily basis.

Farm system analysis

When returning to manage the family business we set about farm consolidation using a process of analysis to redesign the farm infrastructure and system (for more information about our analysis, see Sowman 2009).

SWOT analysis of the business revealed strengths associated with the farm amalgamation, irrigation consent and herd genetics, but considerable risks and weakness particularly around labour

requirements, isolation and layout (Table 1). It was apparent that the 'straw breaking the camel's back' in our business was the need to employ a lot of people to milk our cows on a daily basis and the risk associated with this given the farm's isolation and tight local labour market. Because we spent most of our time managing low-skilled staff, we often missed opportunities in day-to-day management. We set out to implement changes that would reduce these risks and allow us to achieve more on a day-to-day basis with less people.

Table 1. SWOT analysis of our farm prior to redevelopment

Strengths	**Weaknesses**
• Low capital cost employed regarding milking infrastructure • Farms amalgamated over time relatively cheaply • Ability to split business into two farms to provide options for share milking, partial sale or sale as two units • Resource consent for 275 ha of irrigation water • High BW and PW herd	• Reliant on high supplement (900+ kgDM/cow/year) to support stocking rate • High labour requirement to milk the cows (five staff milking) • Isolated location of farm limits labour pool • High labour required to shift irrigation daily • Historic multiple-farm layout largely retained in current form i.e., variable paddock sizes, water systems, cowshed locations • Difficulty managing individual cows given three herds, two sheds, multiple milkers • Low kgMS as % of liveweight • Comparative stocking rate higher than ideal for farm system • Support land not large enough for stocking rate • Pattern of staff turnover costing money through recruitment, orientation

Opportunities	**Threats**
• Reduce labour involved in milking • Redirect time milking to shifting irrigation • Reduce three herds to two reducing daily management decisions • Re-subdivide paddocks to similar area based around rotation speeds to improve grazing management i.e., residuals, pasture quality • Replace wages with interest, turn variable costs into fixed costs • Reduce stocking rate to better match with feed supply • Reduce associated cow costs (wintering, breeding, health) through running a lower stocking rate	• Short-staffing issues prevent critical tasks being completed • Low-skilled staff means less time spent on the business and more time managing people and completing low $ tasks • Reactive vs. Proactive management style • Lack of enjoyment may result in family exiting the dairy industry

Our farm has 274 ha of K-line irrigation taking up to five hours/day to shift during the dry season. This system was chosen to suit farm topography and at a time when irrigation was only needed for a short period of time during the season; the low capital cost of K-line suited this situation. Recently extended dry summers have added time pressure associated with daily irrigation shifting over multiple months (e.g., November through till April for the 2009/10 season). We identified that while improvements could be made to the K-line to improve watering efficiency we could not automate shifting of this system; therefore, we looked to make changes in other areas to lower our labour dependency.

As part of our plan we defined our vision for the farm: to operate a (relatively) large-scale dairy farm as hands on owner-operators through employing innovative technology to reduce manual labour, aid decision making and achieve an enjoyable, profitable workplace.

Changes implemented

1. Farm layout and stocking rate

More than 12 months of monitoring pasture and grazing (paddock yield assessments), climate and soils (moisture, temperature, soil water-holding capacity) (Sowman 2009) and time-in-motion study (Table 2) was used to assist our decision making process. We identified how much feed we were growing and calculated an appropriate stocking rate to convert as much pasture into milk solids, while minimising maintenance requirements. It was clear to us that the stocking rate needed to be reduced to improve feed-conversion efficiency and reduce cow-costs. Our herd is in the top 6% for BW and PW nationally; however we felt it hadn't had the chance to express its full potential. We reduced our stocking rate from 1030 cows at peak-milking to 840 cows.

Table 2. Time in motion study of our farm prior to redevelopment

Activity	Approximate Labour Hours	Total Labour Hours
Milking – 2 herringbone sheds (22 and 46 bail)	AM: 5 people x 3 hours PM: 5 people x 2.5 hours	27.5 hours/day
Getting Herds	30 minutes x 3 herds x 2/day	1.5 hours/day
Grazing management	3 herds x 30 minutes/day	1.5 hours/day
Irrigation	5 hours total time each day for approx. 100 days/year (irrigation season can vary greatly)	5 hours/day
Supplement(seasonal)	45 minutes x 3 herds/day	2.25 hours/day

Once we had decided what our stocking rate needed to be we designed a new cowshed and farm layout to match. We are fanatical about 1500-1600 kgDM grazing residuals and wanted to build a farm system that matched this philosophy and reduced the complexities of grazing management. Creating similar sized paddocks was an important step towards allocating feed more accurately, and making management easier (MacDonald & Headley 2010). We used FarmKeeper (Version 3.0.9, Overland Corner Holdings Pty Ltd) and aerial photographs to develop a detailed map of the farm. We were then able to define more accurately our effective milking platform (as opposed to dry-stock grazing land) and layout new paddock boundaries. Our reduced stocking rate coupled with the building of a new cowshed allowed us to reduce our number of milking herds to two, further simplifying daily grazing decisions. We also used FarmKeeper to assist with the location of the new cowshed, map out new lanes which have improved cow flow, and to assist with the upgrade of the stock water and irrigation system to reflect the new farm layout, stock numbers and cowshed location.

2. Cowshed

Building a new cowshed is a huge investment; we did a large amount of homework and considered how we wanted the shed to integrate into our business before breaking ground. We opted to do the design ourselves rather than purchasing a turn-key shed. This gave us the flexibility to set things out exactly as we wanted, maximising efficiency in areas such as cow flow and employing the best technology to streamline our system where we could.

A main objective of our design was that the cowshed would become the "hub" of our operation, incorporating a staff room, office, wet and dry storage, yards, and a central location for stock and wash water management. In designing the new shed we wanted a 20-30 year investment horizon, employing technology that was modular to allow further technological advancements as they become available. We wanted a shed with enough automation to allow one person to milk all the cows if required in an efficient way. We also wanted to be able to collect lots of cow information at the shed with minimal effort, and to have the ability to make decisions about individual cows on the spot by having relevant information at hand.

The level of automation we chose for our new shed saves us approximately 16.5 labour hours milking per day (Table 3). The technologies we wanted to create our ultimate shed were:

- Auto-drafting linked to herd management software
- Proven automatic cup removers (ACRs)
- Milk meters measuring yield and flow so as to have more control over ACRs
- Some SCC management technology
- Auto-wash technology that would allow one person clean-up
- Simple in-shed feeding system linked to herd management software that gave us flexibility around supplementation (e.g., reduced supplement wastage in inclement weather).

Table 3. Time savings associated with farm redevelopment

Activity	Approximate Labour Hours	Total Hours	Savings
Milking 1 rotary shed (54 bail)	2 people x 5.5 hours/day	11	16.5 hours and 3 people/day
Getting herds	30 minutes x 2 herds x 2/day	1	30 min/day
Grazing management	2 herds x 30 minutes/day	1	30 min/day
Feed planning (farm drive using tow-behind pasture meter)	3 hours/week	3	3 hours/week
Irrigation	No change *	5 hours/day	nil
Supplement	45 minutes x 2 herds/day **	1.5 hours/day	45 min/day
Total savings (labour hours/day)			Approx. 18 hours/day

* No direct time savings associated with irrigation shifting have been achieved. However, because we have altered our paddock layout and made paddock sizes more uniform we have been able to reduce the number of irrigation lines while reducing our irrigation return interval from 12 days to 9 or 10 days. This has resulted in less shift decisions to make on a daily basis and increased irrigation accuracy.

** Change dependent on use of in-shed feeding system (subject to feed available at price to payout ratio) which reduces time spent supplementing, however this is difficult to quantify. If not using in-shed feeder: 1 less herd = 1 less trip with silage wagon, or 1 less trip with trolleys of PKE.

There are a number of companies supplying these components; to aid our purchasing decisions we found it useful to map out how we wanted the components to integrate. For example, we wanted ACRs, animal record software, milk meters and drafting gate to integrate. We used a simple diagram (Figure 1) to map this relationship. By fitting different products into the diagram and altering the relationship arrows we were able to choose products that fit our ideal scenario. The coupling of these technologies reduces work associated with data transfer or doubling up of data collection. ACRs collect information about milk yield and flow in order to detect when to take the cups off; it made sense to us to link this data to our herd management software where we can use it to make decisions about feeding, and for identifying cows for dry-off reducing our need for herd testing.

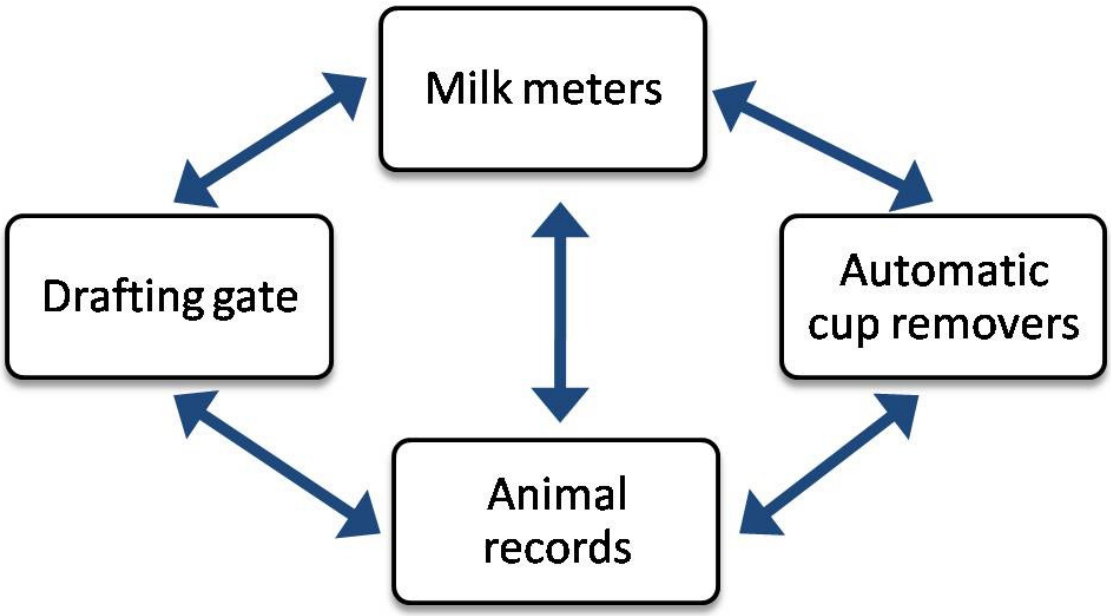

Figure 2. Mapping out relationships between different components can be used as a design tool or aid for purchasing decisions. The diagram illustrates our ideal integration of different cowshed components, we chose technology that was able to integrate in the way shown. Different farms will have different scenarios.

Herd management

We chose to install herd management software in the shed with the overriding objective of managing cows as individuals. Our previous management was more focused on mobs rather than individuals, and we wanted to get the feel of a 150 cow owner-operator scenario on our larger farm. In choosing herd management technology we were looking for a system that integrated with our milking machine (i.e., yield and conductivity) while not needing to replicate our herd records and would reduce time to manually enter data. We also wanted to be able to access accurate individual cow records on the spot to make smarter decisions about animal health treatments. We wanted a system that was simple enough for all staff to operate and to have access to good technical support.

We use MINDApro (LIC 2008) for herd records and having decided to invest in LIC's Protrack Vantage for our new shed because it fits our system best (Figure 1) (NB. different farms will have different scenarios and requirements). This technology can be used simply as a drafting gate; however we felt the use of our investment was maximised by learning to customise the information displayed (on touch screens at cups on and off) to fit our needs depending on seasonal activities. By adding buttons linked to groups and/or events in MINDA, time associated with herd records is dramatically reduced. For example, by customising our touch screens pregnancy testing, calving, heats and Body Condition Score records are a matter of a press of a button and then records synchronisation. We also increase the accuracy of our herd records by minimising transfer of information between paper and computer, and enjoy certainty in correctly observing withholds and treating cows accurately in our sick mob. During heat detection we choose to display days since

calving and days since last heat for each cow; that way we can make more accurate on the spot assessments about submitting a cow for AI. Having our drafting facilities linked to herd management software also gives us the ability to set up drafts of individuals or groups of cows, instead of looking for them during milking. For example, a lame cow spotted in the paddock can be set to draft prior to any milking ensuring that she is removed from the herd for treatment. Other ways we save time and gain accuracy by using herd management software include:

- use of audio alerts at cups-on to draw attention to particular cows, e.g., recently cleared mastitis cows have a prompt to check a previously infected quarter for the first few days after they are returned to the milking herd
- the ability to review lame cows at set intervals after treatment before drafting back to the herd, this ensures good follow-up of lame cows
- a simple scheduled draft of mastitis cows from lame cows after each morning milking allows these animals to be milked again at night without bringing the OAD milked lame cows back to the shed. We save time and ensure this draft occurs by setting a 'draft every milking' function which is automatically applied when a mastitis treatment is allocated to a cow
- the screen displays the number of cows that have entered the shed and exited through the gate, we use this on a regular basis to change mob sizes in order to hit target grazing residuals
- displaying cows by colour depending on a particular group they belong to. This allows us to occasionally alter herd sizes for grazing management purposes and then return cows to their correct herd at the following milking i.e., running a lights mob and a fats mob or mobs of different age classes
- ability to supplement during milking if necessary (less need for staff and equipment to feed out during busy times such as the Spring). In-shed feeder linked to herd management software ensures accurate feed allocation to different cows and no repeat feeding of repeating cows
- 'Gentleman's cows and calves' While calves are being picked up, springing cows are brought to the shed, fed supplement, teat sprayed and calved cows drafted out – on some days a one person job.

Flow on benefits of technology

Milking interval

A well known and respected farm consultant in our area, Brent Boyce, described to us the benefits of varying our milking interval to match feed supply throughout the season ("beat the attack of the slack sack!" Boyce 2007). We had been unable to implement three-in-two milkings previously due to the labour required to milk on our farm. Building the rotary dairy removed this restriction and this season we chose to milk our cows 1.5x/day for 106 days from early December through till late

March, and then once-a-day for 67 days till the end of May. This regime saw little negative production impact relative to the saving of 100 milkings during the season.

Staff rosters

Previously our farm was unable to run attractive rosters because of the need to have many staff milking each day. By selecting a high level of automation in dairy we are now able to:

- ensure our staff can take regular breaks, and get to breakfast on time
- apply flexibility to our work day such as getting dry stock shifted early on wet days without impacting on milking
- offer variable start times to match the tasks for the day
- strive for working weeks less than 50 hours
- utilise flexible milking intervals in a manner sustainable with our roster
- roster a 6-on 1-off, 5-on 2-off roster based around weekends
- for large periods of the season, staff only milk once in a day and often only 1 herd (420 cows).

Overall, we have achieved highly attractive working hours and rostered days off that can cater to family requirements, casual staffing solutions, and the ability to run the farm on a skeleton crew on public holidays. More time outside of the cowshed has meant completion of delayed on-farm projects and a reduction in the use of contractors.

3. Other technologies

In addition to the technology adopted in the cowshed, we also use other innovations to save us time and labour (Table 3). This includes replacing a rising plate meter with a tow-behind pasture meter to save time associated with measuring pasture. We use Pasture Coach (Version 4.0.1.0, AgSoft Solutions) as a feed wedge and grazing planning tool because it is simple and quick to use (Sowman 2009). We use FarmKeeper as a central recording system for all grazing, fertiliser and effluent applications and to accurately allocate break sizes. To streamline the collection of data relevant to this centralised recording process we run a simple day sheet which all staff can fill in (Figure 2).

Daily Records Sheet				**Week starting:**				
Please fill each day, any additional information record and date at bottom								
		Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
Herd 1 size	am/lunch							
(# cows)	pm							
Herd 2 size	am/lunch							
(# cows)	pm							
Herd 1 paddock	am/lunch							
	pm							
Herd 2 paddock	am/lunch							
	pm							
Herd 1 supplement	am/lunch							
(Type)	pm							
Herd 2 supplement	am/lunch							
(Type)	pm							
Herd 1 supplement	am/lunch							
(Type)	pm							
Herd 2 supplement	am/lunch							
(Type)	pm							
Effluent applied								
and where								
Topping (where)								
Spraying what/where)								
New lame cases (no.)								
New mastitis cases (no.)								
Urea applied today (where)								
Other Notes (rainfall, residuals, etc):								

Figure 2. An example of the daily recording sheet we use to streamline record keeping, the format shown is used when milking 3 times in 2 days

Conclusions

The concept of working smarter not harder in our business was born from the need to move away from a high stress, high labour system to one where we have good control and efficiency in converting grass to milk. As farmers, we need to adapt to whatever our biological system throws at us. Removing the stress of "who am I going to find to milk my cows tomorrow?" allows you to redirect you energy to the aspects of the business you enjoy, whatever that may be.

Our advice for farmers considering new technology

- Step back and do SWOT analysis of your business – can you take advantage of opportunities and identify weaknesses that can be addressed? Are there ways you can streamline your business to work smarter not harder?
- Plan carefully when considering investing in technology – how do you see it integrating with your business? Be aware that what the neighbour has may not fit your system, look at feasible alternatives. Are you willing to do the work needed to take full advantage of the investment?
- Talk to other users of the product to get an honest opinion, and find out how others use that technology to their advantage.
- Choose a product that has a track record of upgrades, training for you and your staff, good technical support and after-hours service.
- When implementing new technology to your business, be prepared that often it is not a quick fix solution. There is a 'breaking in" period where time and effort needs to be put in to get things functioning correctly, and while everyone learns to use it.

References

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