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HAS INFORMATION TECHNOLOGY FAILED TO DELIVER? (FOR NEW ZEALAND AGRICULTURE)

Sub-theme: Knowledge and Information

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Abstract:

New Zealand has lead the world in pastoral agriculture for several decades. Its ability to innovate on-farm combined with the application of directed research and science produces products of the highest quality at a good return for the land owner. Technology in the form of computer software applications has been available to New Zealand farmers since the eighties, yet there are few examples where those applications have been fully embraced by the majority. The adoption curve lags other technologies such as artificial insemination, automation, rotational grazing, to name a few. Has information technology failed to deliver on farm? In many cases the answer is affirmative, the potential that exists in utilisation of many excellent software based systems has not occurred. There are certain principles specific to the rural market that need to be applied in order to achieve greater adoption.

1. *Make it simple and intuitive*
2. *Effective, efficient data entry*
3. *Deliver value to the farm business*
4. *Refine and focus information delivered*

Keywords: *Information Technology, Decision Support Tools, Agricultural Software, Agri-Tech*

INTRODUCTION

Has information technology failed to deliver expected results for pastoral agriculture in New Zealand? For years, and in some cases decades, we have been led to believe that advances in application of information technology (IT) would lead to significant increases in productivity and profitability. Each year millions of private and public dollars are invested in agricultural IT, yet pastoral farming remains relatively unchanged from 20 years ago. There are *some* significant developments, but in most cases uptake by farmers is snail-

paced – what's happening? What are we getting right, what's going wrong and what have we got to look forward to in the future?

Information technology involves the development, implementation, and maintenance of computer hardware and software systems to organise and communicate information. Since the use of computers became mainstream in modern society and business (which is generally accepted as the late 80s and early 90s), applications for agriculture have also been developed.

Starting initially in research and tertiary educational institutions, fast followed by enthusiastic farmers who dabbled with computers and software, there has always been a stream of software applications targeted towards farming businesses[1]. A great example of pioneering computing spirit is Brian Eccles, managing director of CRS Software (Cashmanager Rural), which is one of New Zealand's most successful companies involved in agricultural IT.

Figure 1 - circa 1992 Brian Eccles (right) and the other founders of CRS software.

[1] In 2011, James Allen and Sjaak Wolfert (Allen and Wolfert, 2011) conducted a stocktake of farm management tools used by farmers and rural professionals. In Australasia alone 120 tools were classified. A further study "Stocktake of Farm Management Apps used by Farmers and rural Professionals" written by Hamish Hammond, 2012 found 59 agricultural specific app's were available on iTunes. In 2017 the number is likely to be much higher.

A former winner of the Wairarapa Farmer of the Year Award in the late 80s, Brian saw the potential that computer software could provide to farm businesses. Focusing on financial management software and benefitting from the dropping of subsidies and introduction of GST[2], the company has never looked back, and now boast a large and loyal customer base.

Adoption of IT for financial management has been one area of relatively widespread acceptance by farming businesses, predominately driven by the compliance required from the introduction of the Goods and Services tax Another has been herd performance recording in the dairy industry. Livestock Improvement Corporation's MINDA application has over 90% market share, a dominance few others can rival. In that case, the recording of individual animal performance, mating and pedigrees had been done on paper for decades by New Zealand dairy farmers, and through having an almost monopoly in Artificial insemination, LIC strongly incentivised the use of software as an alternative. In fact, it saved the company millions over the years through not requiring a dedicated data entry team to manually enter the data received in paper format.

In these cases it was not the compelling value proposition of using software to benefit the farm business, it was more a reaction to an external pressure. Unlike the majority of modern businesses today which would struggle to operate without computer systems – a reflection of the widespread adaption of IT – many New Zealand farms can still operate effectively minimising the use of agricultural software systems. Speaking generally, because there are always exceptions, there is still a suspicion and reluctance to fully utilise information technology on farm. The Value proposition is not convincing enough.

The stakes are getting higher though. As the value of land continues to increase, and food security and quality becomes a national interest, farm businesses require "modern" tools, many in the form of software applications to manage their investment both efficiently and effectively to obtain profitability and sustainability. This can no longer be totally left in the hands of consultants, bank managers or accountants.

"Listen here boy, no bloody computer is going to tell me how to farm!"

[2] Goods & Services Tax, introduced in 1986 is New Zealand's variation on VAT

New Zealand farmers pride themselves on being in-tune with the land, being great stockmen with an ability to trust their intuition and 'gut feeling'. It is almost a quintessential part of being a farmer in New Zealand, to be your own boss, make your own decisions, and trust your instinct.

It's served us right for three generations hasn't it? We've done pretty well haven't we?

No doubt it has served well in general, but can the avoidance of information technology last? Will the increasing pressures being faced by New Zealand farmers this century, such as environmental compliance, increased drought frequency, and fluctuating prices, force more reliance on modern day tools like computers and information technology?

There are three main categories of software applications applicable to New Zealand farmers:

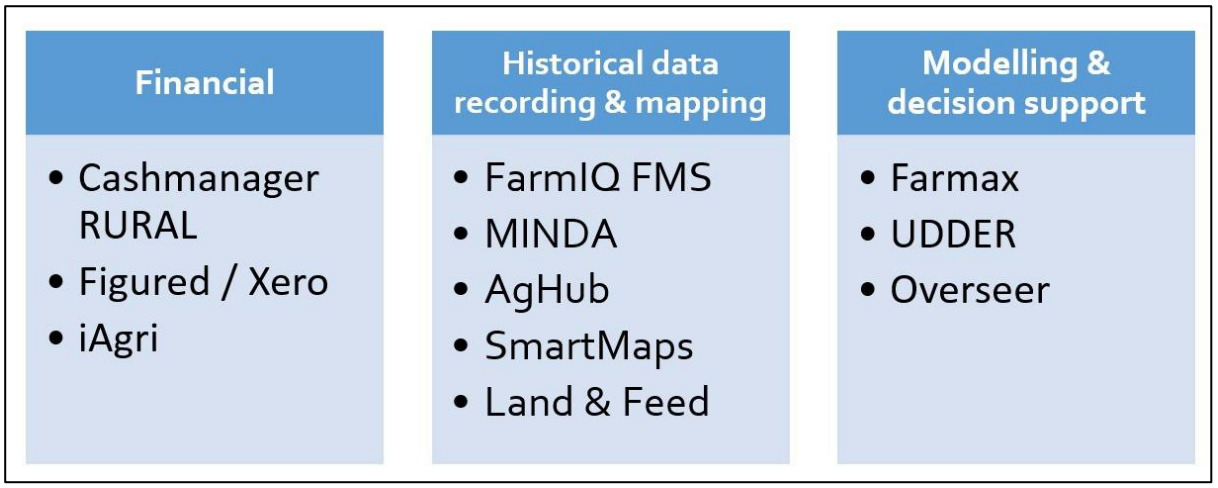

Figure 2 - main categories of farm software, examples of applications not exclusive

1. Financial applications like Cashmanager RURAL, and a more recent contender – the Figured/Xero combination – are relatively widely used and focus on prudent cash management, and the need for all farm businesses to submit statutory accounts.

2. Data recording and geo-spatial applications seem to attract the most attention by developers, and include MINDA[3], AgHub, FarmIQ, Smartmaps, Land and Feed, and Agri360 to name a few. This category focuses on providing a container to store

[3] Management Information for Dairy Animals (MINDA)

the myriad of data that can be collected off a New Zealand farm, and also gives the ability to display it in a spatial format.

3. The last category is comprised of applications that model different aspects of a farm business. By using scientifically validated principles these applications forecast or predict likely outcomes given certain parameters of real or hypothetical farms. Examples are the environmental output model Overseer and farm system models like Farmax and UDDER.

Given the dominance of the agricultural sector in the New Zealand economy it's understandable that the market of farmers has attracted a fair bit of attention from software development companies and entrepreneurs over the years. Every year during the National Fieldays at Mystery Creek a new software application set to revolutionise the farming

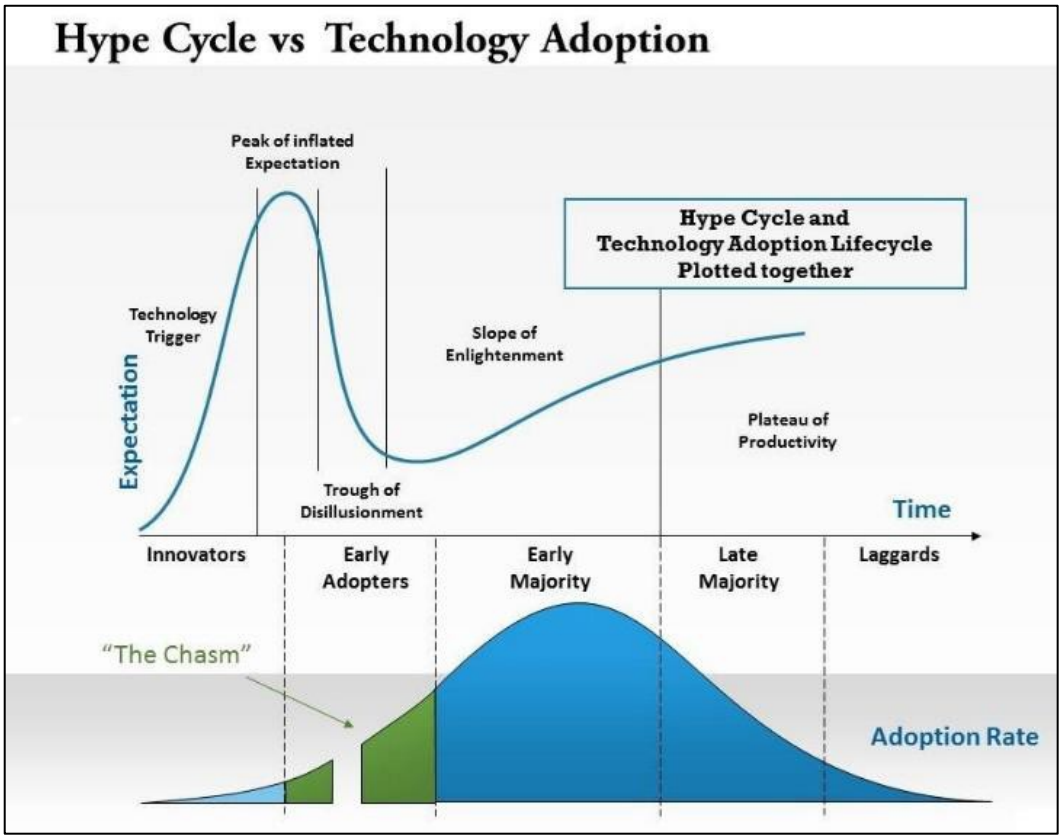

Figure 3 - the hype cycle vs. technology adoption curve

sector is released. Sadly, very few have ever achieved that promise.

At around 25,000, the market size of 'professional' New Zealand farmers is relatively small on a global scale, and is notoriously hard to get to what is called the 'tipping point' of market penetration. A tipping point is a concept popularised by Malcolm Gladwell in his

2000 publication, *The Tipping Point* hypothesises that a product or idea will reach the mainstream once 15-20% of market penetration has been reached.

In the uptake of technology products, the agricultural industry is no different. A market can be segmented into stages or groups of consumers with common attributes that tend to reflect the market penetration of a new technology or product. As shown in Figure 3, the innovators consisting of 2.5-5% of the total market are the first to buy in. These are the risk takers or 'enthusiasts' that pride themselves on being first and having a go. The early adopters come next, an informed group who are often industry leaders and like to keep ahead of the pack. This group consists of around 15% of the market, and it's in this phase of market development there exists 'the chasm' – a glass ceiling that many technology products fail to push through at somewhere between 5-15% market share. This is where many attempts at delivering software solutions to New Zealand farmers has ended. They can't get over the 'chasm' to achieve a market share that makes their investment worthwhile and sustainable.

THE HYPE CYCLE

It also coincides with another theory about market dynamics called the 'hype cycle', and it's something most people are familiar with, but farmers in particular seem highly attuned to through what is eloquently known as the bullshit radar. Most new technologies are met with high expectations fuelled by savvy marketing, media hype and increasingly social media. Take for example robotic milking: a decade ago it had the potential to revolutionise dairy farming, yet we are still waiting. The innovators and a few early adapters have brought in, but market share is small and the majority are still yet to be convinced.

New technology has a habit of being constantly 'over hyped', and expectation can rapidly peak before crashing into the trough of disillusionment – often this coincides with products trying to cross the chasm. It takes a strong product, with a great value proposition to cross the chasm and climb up the slope of enlightenment. There are a great number of products that face this challenge and software based information technology is no exception.

So what's going wrong? Why are information technology products often struggling to cross the chasm and become mainstream? It is not through lack of trying and investment. In the past three decades it is estimated that $200-400 million[4] has been invested by the public

[4] Based on the author's knowledge of the industry over 30 years.

and private sectors in New Zealand, on information technology software applications focused in the agricultural sector.

Apart from a few notable exceptions the return on investment is very poor. The first question that needs addressing is; are we on the right track? Can information technology products really add value to farm businesses? Anecdotally, yes. But there is no silver bullet; great agricultural software systems do not transform a farm business from average to upper quartile overnight or in isolation.

Information technology has been most successful where it is used as a tool in combination with other factors like motivation, regular data collection, and following good business principles. Effective software systems are just modern tools, in many respects no different to any other farm implement, they leverage, but good software systems effectively leverage information. In other words, they take raw data and turn it into information that can be used to enhance decisions made on farm. Farmers do this in their heads all the time, however computer software can handle more data, more efficiently, and be impartial. The human brain can not process more than four variables at a time. Five way interactions? forget it measured performance is no better than chance.[5] P.L. Nuthall[6] has demonstrated that for even the simplest decision on farm there are multiple outcomes requiring considerable calculation.

EXAMPLES OF IT ADDING VALUE

An example where information technology has helped improve farm profitability is the MINDA system. The modern dairy cow produces a vast amount of data during her productive lifetime. Through analysis and benchmarking of that data – a job almost impossible by hand as the average herd size is now over 400 – herd owners are constantly skimming off the poor producers and replacing them with animals of higher genetic merit and production potential. Over the last 10 years information technology has contributed to the average New Zealand cow producing 18 per cent more milk today than what she did 10 years ago.[7] Farmer's ability to make the right culling decisions is greatly enhanced

[5], "How Many Variables Can Humans Process?" published in the January 2005 issue of Psychological Science, a journal of the American Psychological Society.
[6] P. L. Nuthall Farm Business Management: Analysis of Farming Systems, 2011
[7] Dairy NZ Statistics, 2014-15

through individual animal performance recording software, backed up with performance indexes generated by one of the most comprehensive bovine databases in the world.

Another example is found in the sheep and beef industry when comparing the performance of farm businesses who do utilise decision support tools (DST's) against the average performance of all drystock farms. Gross margin per ha was used as the benchmarking indicator because it filters out any noise or bias introduced by including farm expenses that are highly variable and dependant on the type and intensity of the farm. Farms modelling DSTs compared to all farm classes over eight seasons from 2004 to 2011, the average increase was 78%: $600/ha gross margin compared to the national average of just over $300/ha. For North Island Hill Country farms the difference was a staggering 157%. DST's are not the only factor in in those farm's success, there are others like motivation of the Farm owner, use of experienced consultants, and effective asset management. However the use of decision support tools was the one common denominator.

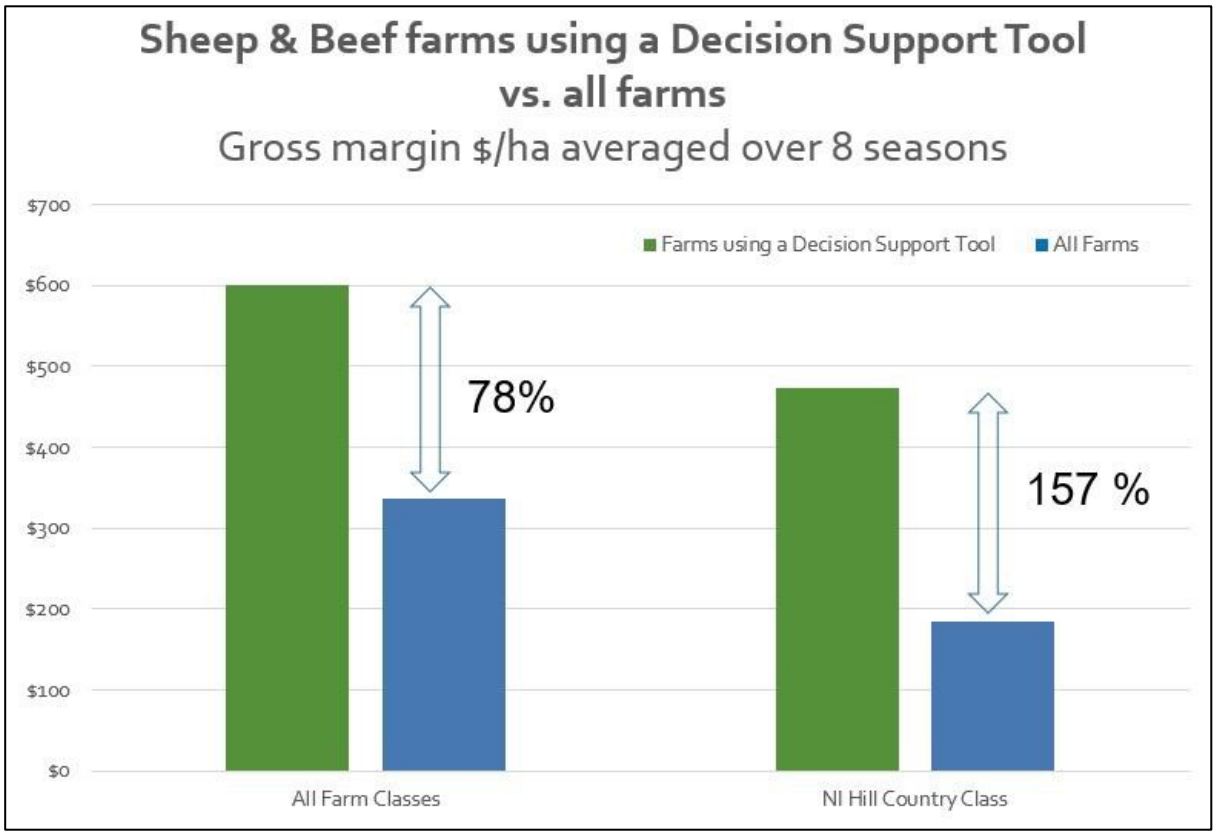

Figure 4 - comparison of sheep & beef farms that use a DST vs. the industry average (all farms).

Why then, when there are excellent examples of innovators or early adopters getting substantial financial benefit from incorporating these information technology tools into their farm businesses, isn't everyone doing it?

REASONS FOR FAILURE AND LACK OF UPTAKE

It's easy to generalise about farmers, but in truth they like simplicity and reliability. Why? Because it makes business sense. They get more work done, quicker. There is not a better example than the humble tractor: it starts first time, it's reliable, and it gets the expected job done. Unfortunately, you cannot say the same thing about computer hardware and software. There are too many examples of overly complex, difficult to use, error ridden software.

Software developers are often guilty of being too clever for their own good. Just because you can doesn't mean you should. Developers love the challenge of converting real life procedure and practices into computer code, and early adapters get caught up in the hype: "that's great, but wouldn't it be nice if…?". Before long we have bloated, complex, difficult to use software that turns off all but the most dedicated and persistent users. There are some rules or guidelines that all software developers targeting the agricultural sector need to keep in mind.

Rule number one: keep it simple and intuitive, hide complexity where I can find it **IF** I need it.

The popularity of the iPhone and apps have done all 'average Joe' users a huge favour in setting the standard for user friendly, simple to use applications. If a five year-old can't figure out what to do next using an iPhone app, the interface is probably too complex and not intuitive.

A lot of software on the market today has so many functions and features it ends up confusing and discouraging users. Agricultural software is no different, to encourage uptake and maintain use, the application should not require a large investment in time to learn. Simple, clean, uncluttered interfaces are proven to engage users. Any complexity or seldom used features can always be hidden from view in menu options. Advanced users will always remember where to find a function if it is of use to them.

Rule number two: don't waste my time by making me enter data twice.
Your average computer user, let alone time poor farmers, do not like having to enter copious amounts of data into a computer. Tell them they need to enter the same data twice and they'll revolt.

No one software system covers all the bases for agricultural businesses. There many different applications that solve different problems for varying needs. Modern farm businesses may have a cashbook software application, a paddock recording application, a herd recording system, and a farm system modelling tool. Very few of these software systems can exchange data seamlessly between them. This is a major turn-off for users of agricultural software applications. A well-known and established vendor of software systems surveys its uses every year, and every year the most requested feature is; give us better integration with other systems.

Greater integration between disparate systems is occurring slowly, but it needs focused attention if we expect the mainstream to utilise information technology more. Companies like Ballance Agri-nutrients, AgHub, FarmIQ, Cashmanager, and Farmax are leading the way with integration between systems.

ADD VALUE OR ELSE

Farmers are pragmatists. They get bombarded with offers and promises every day, so in order to spend wisely they have to have a clear value proposition in mind.

The value proposition of most agricultural software is not compelling for the majority of farmers. If it was, the evidence would be greater uptake. The understanding of 'what's in it for me?' has to be first, established, and second, maintained.

The action of forking out hard-earned cash for something intangible (you can't kick the tyres on a piece of software) is hard enough. Then comes the investment in time to get the software set up before it becomes even remotely useful. Then, to maintain the usefulness, software is like a hungry chick, constantly requiring and demanding a feed of data. Without that, it dies a useless investment, causing farmers to be wary of ever being suckered into buying a product like that again. The value proposition of information technology tools is still a dark and murky place for the average New Zealand farmer which leads to

Rule number three: unless it adds value to the farm business, don't bother me.

TELL ME WHAT I NEED TO KNOW

Farmers deal with a staggering amount of information and it's getting worse. The amount of decisions required each and every day on any type of farm is huge, and the information required to make these decisions comes from a multitude of sources – the eyes, the ears, a weather station, a cell phone app, the phone, the stock agent…it goes on and on. There is a strong correlation between good information and good decisions. No farmer will intentionally make the wrong decision; however, the quality of the decision is dependent on the quality and timeliness of the information.

Farming has increasing complexity, risk and uncertainty. Information has to be delivered in a concise, understandable and compelling manner.

Rule number four: just tell me what I need to know and forget the rest.

There is a science to the display and interpretation of information. Displaying information in tabular reports with multiple rows and columns of data is off-putting. The amount of effort required to extract the important information often exceeds the actual value of that information.

Take for example a herd test report for an average-sized herd of approximately 400 cows. With over 10 pages of data, and numerous rows, columns and cells to navigate, misinterpreting the data is easy. But mistakes are costly.

LIC

Current Herd Test Results

SCC & Test Day Details Option

Herd Averages as at
Ancestry: 95 %
Herd EBL Status: EBL Free

Date:

Test Date:
PTPT Code:
Herd Code:

Animals Included: **Group:** Whole Herd **Sorted By:** Cow Number **Current as at:**
Test Type(s) this season TAD

Cow Details					Test Day Results										Lactation Details to 31/05/2015								Current Indexes		
Cow No.	Birth ID	Calving Date	Year Born	Breed	Milk			Milkfat		Protein		Milk-solids (kg)	Ab *	Cell Count	Milk (l)	Milkfat		Protein		Milk-solids (kg)	Days in Milk	SCC Exceed	BW $	PW $	LW $
					pm	am	Total	(%)	(kg)	(%)	(kg)					(%)	(kg)	(%)	(kg)						
1	CDQJ-11-1	26/07/14	11	A	4.2	3.9	8.1	2.89	0.23	3.54	0.28	0.51		156	3716	2.67	99	3.42	127	226	266	1/4	-129/38	-288/63	-301
2	CDQJ-08-1	31/07/14	08	A12F4	3.8	6.0	9.8	4.57	0.44	4.33	0.42	0.86		170	4999	4.79	239	3.53	176	416	263	1/4	-73/45	-38/81	-67
3	CDQJ-07-26	17/09/14	07	A8 J4	7.4	7.8	15.2	4.71	0.71	4.28	0.65	1.36		29	5131	4.78	245	3.80	195	440	215	0/4	-44/43	-87/80	262
4	CDQJ-09-3	10/08/14	09	A PED	4.6	7.1	11.7	3.68	0.43	3.87	0.45	0.88		38	4333	4.22	183	3.63	157	340	253	0/4	-89/47	-142/81	-103
5	CDQJ-08-24	05/08/14	08	A12F4	3.8	6.8	10.6	6.18	0.65	4.33	0.45	1.10		41	4157	5.91	246	3.77	157	402	258	0/4	-39/44	2/80	-83
6	CDQJ-12-2	06/08/14	12	A PED	4.8	7.4	12.2	3.81	0.46	3.42	0.41	0.87		16	4421	3.53	156	3.24	143	299	257	0/4	-77/34	-97/44	-84

Figure 5 – a typical herd test report.

The value proposition of information technology based products increases if the information being delivered is understandable, easy to comprehend, and often visual. A great example is the new way of displaying somatic cell count results from a herd test as shown below.

Figure 6 - a more graphical and interactive way of displaying a large amount of information. Each dot represents a cow in the herd.

The key pathway for successful adoption of these modern tools is: **Data -> Information -> Action**

In other words, feed in the relevant data, turn that data into information, and deliver it in a way that compels and promotes action.

SOLUTIONS FOR GREATER UPTAKE

Information technology tools can and do make a difference in farm businesses, yet uptake in general remains poor. What is happening and what can we do in order to encourage greater utilisation of these tools?

Education and awareness

Education and awareness is a cornerstone of adoption. First, it makes farmers aware of what is out there, and second, users can be trained in how to best utilise the tools. While it is obvious to introduce agricultural IT tools at secondary and tertiary levels to prompt generational change, there are plenty of older generation farmers who are willing and motivated to attend workshops or training seminars provided by industry organisations and private enterprises.

On-going training opportunities backed up with excellent help desk support are ways to help new users stay motivated and engaged. An increasing trend now that broadband internet is becoming more widespread on farm is using remote control software for support and training. The ability for the support person to view and share the user's screen is a leap forward in the way help desk services are delivered. As a vehicle for either individual or mass training, webinars are also proving popular, and use similar technology allowing live, interactive questions and discussion.

Data Sharing

Careers in farming appeal to those who enjoy the physical challenge and freedom to work outdoors as opposed to pinned to a desk. Extended hours in front of a computer screen is not something most farmers would say they enjoy. Therefore, the less time entering data into software applications the better. The paradox is that the majority of applications being promoted today to New Zealand farmers have an insatiable need for raw data before they deliver any true value. That in itself is ok. What is not ok is the keyboard time spent entering it, and god-forbid if the same data must be entered more than once into different applications.

'Automagical' is a term coined to explain data that 'just appears' from other sources and knows where it belongs. The best example of this is automatic bank feeds: transactions from your bank that automatically end up in your financial application, and better still, are often coded from your chart of accounts. Remember the days when you had to wait for the paper bank statement to arrive, then laboriously enter all that data into your cashback application again and code it? No more. It now 'automagically' appears in your application.

Other examples are appearing in the fertiliser industry. On farm fertiliser application information is automatically fed into paddock recording and mapping software, showing date of application, what was applied, and even where it was applied thanks to sophisticated GPS technology.

We are starting to see carcass weight information being linked with livestock sales, milk production data appearing shortly after collection; pasture cover data being uploaded via the internet to create instant feed wedge graphs, animal health information from vets being populated into animal recording software…the list of possibilities goes on. The

opportunities are almost endless and will revolutionise the way data is collected on farm and how information is generated to allow more informed, proactive decision making.

How all that computer-generated information could be amalgamated and used for industry good or to solidify our position as a high-quality food producer suppling global markets is another opportunity waiting to be taped. The paradigm shift from computers being beasts of burden, appealing only to a motivated few, to an information source that leverages time and focuses decision making is upon us.

Mobile applications

The other trend emerging that farmers are ahead of the bell curve in is the mobilisation of computing power. Smart phones in combination with clever, intuitive apps and enhanced internet connectivity, have broken the shackles of computing power only being available at the farm office.

Observe any meeting of New Zealand dairy farmers in a local hall nowadays and they'll be pulling out their smartphones to check the daily milk production, what the somatic cell count was, and how the whole milk powder price faired at the latest auction. Smartphones as tools to not only enter data, but as delivery mechanisms of relevant information will continue to grow.

Integration and collaboration

While many of these changes are gathering uptake momentum, we are not there yet; there are huge gaps in functionality, user friendliness, and capability. There is no shortage of world class applications directed towards the farming market. There is, however, historically a real lack of integration and collaboration between the providers of software applications. This is without doubt one reason why the majority of farmers have been slow to adopt in particular paddock recording and farm modelling software. Linking applications from different vendors is too hard and too frustrating, prompting inaction and eventual apathy towards these tools because of lack of benefit.

It's up to the software vendors and industry to collaborate and allow better integration, because the outcome will be more productive, profitable, and sustainable farms. On a national and global scale there is opportunity for New Zealand produce to command

premiums not only through quality, but also by integrated information technology systems underpinning and validating those market premium attributes.

Integration and collaboration between vendors of agricultural software and holders of farm data has been ashamedly slow. There are positive signs this is changing. Through commercial imperative and customer demand, integrations and data sharing between disparate information systems are happening. New applications like Xero and Figured have it engineered in by default. Companies like FarmIQ are pushing boundaries through sharing data with NAIT and processing companies. Even established players like Cashmanager RURAL and Farmax have collaborated to enable the transfer of data between their systems, resulting in less double entry of data by their shared customers.

There are some glaring gaps in integration capability. Despite the fact the need to link farm system modelling tools with environmental modelling tools like Overseer has been demanded for years by practitioners who are increasingly analysing farm systems changes for environmental output and associated profitability impact, it is yet to happen.

WHO'S GOT MY DATA?

A side effect of data sharing and integration is increasing concern by farmers around guarding and understanding who has access to their data and how it is being used.

The Farm Data Code of Practice is an initiative funded by DairyNZ and FarmIQ that puts in place an agreed minimum best practice where member companies will apply for certification. Companies able to show their Code of Practice membership will help demonstrate to farmers that their data is being handled in a responsible and ethical manner.

Another industry based initiative is the Data-Linker, a mechanism that will give farmers direct control on who they share data with. It relies on the majority of information system vendors being party to the Data-Linker system, and having a reasonable level of data standardisation and sharing ability built between them. This is a work in progress with a prototype expected in 2016.

New Zealand farmers are fortunate to have some of the best information technology systems in the world available to them. However, lack of integration, ease of use and value proposition are hindering uptake for the majority of farmers. Apathy towards and difficulty of data collection creates further issues.

Information technology on New Zealand farms is at a crossroads, but steps are being made in the right direction. The future of agricultural IT is looking brighter with better education, collaboration, and integration which will drive a faster than generation change to enable more profitable, sustainable, and resilient farm businesses.

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Biography

Gavin is from a dairy farming background, with a degree from Lincoln University. He has 30 years' experience in the agricultural sector in both owning and operating his own businesses, to managerial positions in high profile organisations.

He was the co-founder of two technology start-ups, in the early 2000's, creating one of the first Cloud based database systems marketed internationally, and being recognised in the Deloitte's Fast 50 and the top 100 fastest-growing technology businesses in the Asia-Pacific region in 2004.

He is a trained Business consultant, and over the years helped struggling agricultural and technology companies turn their businesses around. His directorial experience includes companies involved in property investment, agricultural manufacturing and agricultural information technology.

From a pragmatic perspective, Gavin's focus is on furthering the potential of pastoral agriculture. He is an extensive networker believing that transparency and collaboration among the agricultural service industry is long overdue, and is key to unlocking that potential.