# Skills required by dairy farmers when strategically adapting their farm system

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**Abstract.** Many New Zealand dairy farmers have significantly adapted their farm systems in the past decade but there has been minimal focus on the subsequent implications for skill requirements on farms. The aim of this study was to understand the skills farmers require to successfully run different dairy farm systems. Using a survey of farm systems experts, focus groups with farmers and industry representatives, and semi-structured interviews of farmers throughout New Zealand we identified eight key skills that change across dairy farm systems. The most important skills were: managing risk associated with feed prices and ordering supplements at the best price, managing supplements, managing marginal costs, communicating (and negotiating) with suppliers and contractors, balancing nutritional requirements, knowledge of different feeds, and managing acidosis. We identified the concept of 'system drift' where farmers do not make conscious decisions to change. Farmers need to develop skills, or source skilled advisors, to first consider change at a strategic level, and the skills to communicate change with staff and build a team to manage and enact change.

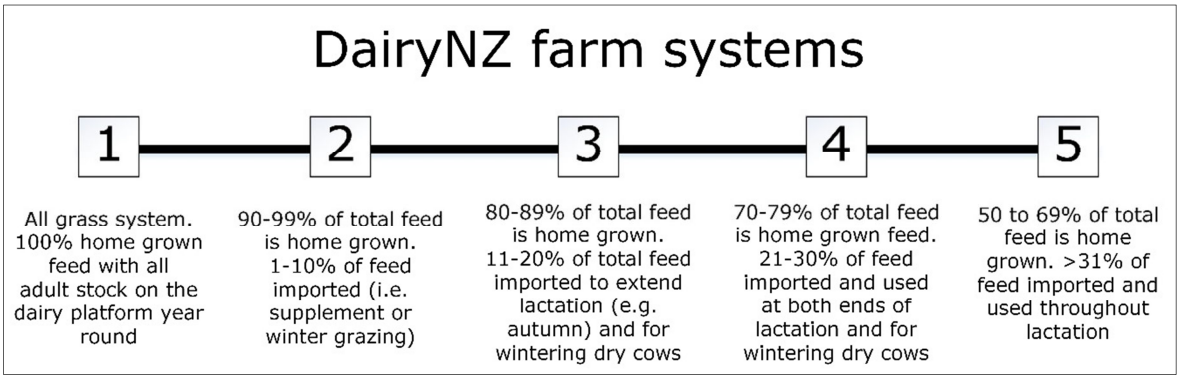
**Keywords:** Capability, skills, farmer learning, farm teams, managing change.

## Introduction

### *Defining dairy farm systems, and system change*

Farming systems can be segmented in a variety of ways (Waters, Thomson & Nettle 2009; Brown & Bewsell 2010), and for the past decade New Zealand dairy systems have been described in terms of five production systems (Figure 1), known as System 1 to 5 (Hedley et al. 2006). These systems are primarily based on the proportion of home grown and imported feed fed annually to the herd. System 1 comprises all-grass systems self-contained in terms of feed, and where all stock are on the dairy 'platform' year-round. At the other end of the spectrum, System 5 comprises farms where 25 to 40 per cent of total feed is imported and used all year for both lactating and dry cows (Hedley et al. 2006).

**Figure 1. The five DairyNZ dairy farm systems classifications**




Dairy farm system change is not limited to movement within the System 1 to 5 classifications. Major farm change can also include the use of winter or year-round housing, once-a-day milking, automatic milking systems, use of different forages, and change in farm scale. Dairy farm systems in New Zealand are becoming increasingly complex and dynamic. Farmers are reacting to greater milk price volatility and environmental regulation pressures by adapting their farming operation, in particular their feedbase and wintering strategies (Edwards et al. 2017). This complexity is evident in the diversity of dairy farming operations now found in NZ.

System change has predominantly been driven by a variable milk price. As the milk price increases it is cost effective (at least in the short term) to feed more supplements, increase the number of cows and produce more milk. With a decrease in milk price, supplements and fertilisers are withdrawn and therefore milk production drops. Environmentally driven regulations are also pushing farmers to make longer term changes to their farm systems, e.g.

by reducing the amount of imported nitrogen (fertiliser and feed). Potential benefits of altering the proportion of imported feed, therefore changing your farm system according to the 1 to 5 classification, include the ability to have greater control over feed supply year-round, especially in areas subject to drought or wet weather. Potential disadvantages include higher feed costs, exposure to changes in feed prices, and the need for infrastructure to manage imported feed (e.g. tractors, mixer wagons, and feedpads).

***Dairy farming skills assessments***

Farmers are multi-taskers, having to manage: animals, feed, people (including health and safety regulations), impact on the environment, and the overall business. The jobs that farmers and their team undertake range from fixing burst pipes and managing animal health to managing feed contracts and creating strategic budgets. In New Zealand, the skills and capabilities required to complete these jobs have been summarised through a range of projects. The Dexcel Task Groupings (Taylor, van der Sande & Douglas 2009) describes twenty-six broad tasks areas undertaken on dairy farms. The Workforce Capability Matrix (WFCM), compiled by DairyNZ and the Primary Industry Training Organisation in 2013, outlines capabilities under four main areas (farm productivity, business management, human resources, and natural resources). Under these areas, a farm assistant alone has more than 100 capabilities identified.

Many of the skills required on dairy farms (e.g. the correct placement of break fences, and cleaning and maintaining the farm dairy) remain similar regardless of the type of farm system. However, farmers have anecdotally identified different skill requirements across their farm team after they significantly changed systems. An example is a change from a system 1 to including imported feed. The new skills can be related to the changing nature of the farm feedbase, such as increased use of imported maize silage, concentrate supplements, palm kernel expeller, and choice of fodder crops. Changes in scale can also influence the skills needed amongst individuals in the farm team, as task specialisation occurs and there are increased demands on aspects such as human resource management, and health and safety.

Because the DairyNZ system 1 to 5 classification relates to the proportion of the feedbase imported onto the farm, there can be a difference in the type, and number, of skills required to run the different dairy systems in relation to the management of feed sources. In system 1, for example, there is a strong focus on managing pasture through the year and, therefore, farm teams require skills to optimise pasture growth and utilisation, while limiting damage to the pasture in wet periods. On a system 5 farm there will be skills required to manage pastures and the feed that has been imported, such as purchasing feed at a suitable price and determining appropriate rations for the herd, along with other tasks such as operating a mixer wagon.

***Farm management, learning and adaptation***

Many farmers are experiential learners, learning in 'loops' or creating mental models based on prior experiences (Argyris 2008). Farmer learning is a socially-embedded process, with farmers favouring interaction with trusted networks, including other farmers and advisors, where they feel comfortable testing their values and beliefs (Kilpatrick & Johns 2003). This can impact on the adaptation process as farmers move between different farming systems. Experience and mental models that have been successfully applied within one farming system may not work well in another. For example, the decisions made for managing cow body condition in a pasture-only 'system 1' will differ from those where 30 per cent of the herd's diet is supplied through imported feed. Additionally, the networks a farmer will need to engage with in these two different systems may require different skills, for example a farm consultant with specialist pasture management skills versus a consultant with diet balancing skills.

The ability to learn and adapt may be most important when moving between systems, but also vital is the ability to know what different skills are required, and to know if these skills are present in the current farm team and wider farm support network. Knowledge of the different skills required allows farmers to proactively fill the gaps through upskilling, hiring skilled staff, or contracting in off-farm service providers.

***Problem statement and research aims***

The problem addressed in this study was that many New Zealand dairy farmers are not aware of differences in the skills required to run different farm systems. Increased levels of unplanned farm system change in recent years, in response to economic and environmental pressures, has meant that farmers have found they don't have the skills within their business to effectively manage their new system. The aim of this study, therefore, was to understand the skills that change across dairy farm systems 1 to 5 and to explore how to provide farmers with the means to identify the skills and knowledge needed to successfully implement each system.

## Method

We used an iterative mixed method approach, described below. Initially, we used a survey to determine the skills that vary across the five dairy farm system categories. Then we sense-tested the short-list of skills using focus groups of dairy farmers in different regions in New Zealand. The final step was to explore the skill areas in depth with farmers, using semi-structured interviews.

### *Phase 1: Survey*

Using the DairyNZ/Industry Training Organisation capability matrix (DairyNZ 2017) as a guide, we compiled a short list of skill areas that may vary across dairy farm systems. The capability matrix is an agreed industry standard definition of on-farm roles and the skills and knowledge required in each of those roles on New Zealand dairy farms. The short list was used in a two-stage survey process aimed at further refining the key capabilities. Two on-line surveys of 23 DairyNZ experts were undertaken, in mid- and late-November 2015. The participants were selected based on their experience with dairy farmers and farm systems. Most of the participants had more than 10 years' experience in dairy extension, or dairy systems research. The SurveyMonkey™ on-line platform was used, as described below.

Survey 1: The aim of the first survey was to reduce the task categories by presenting each one to participants and asking them to indicate if the importance of this area changes across systems 1 to 5 by selecting 'different importance between farm systems' or 'the same importance across all farm systems'. To simplify the survey, we aggregated the dairy systems into three categories of System 1&2, System 3, and System 4&5. This aggregation was done for logistical reasons, as asking participants to rank across all 5 systems individually would have been time consuming and too abstract to produce useful results.

Survey 2: In the second survey, we asked participants to clarify in which systems each task has more potential impact on profitability. For each task area, they were asked to note potential importance for driving profitability ('little important', 'important', 'highly important') for Systems 1&2, System 3, and Systems 4&5.

### *Phase 2: Focus groups with farmers and industry experts*

Three focus groups were held with a total of 25 farmers in Canterbury, Waikato, and Northland during March/April 2016. These three regions were targeted as they involve quite different climatic conditions, differences in access to inputs such as purchased feed and irrigation, and have notable differences in average farm sizes. Participants were selected via DairyNZ extension officers, with the aim of gathering input from a range of farm system types. Participants were contacted first via email, followed by a telephone call, and the primary decision makers were invited to attend the focus groups. Of this total group, five farmers were System 1 or 2, nine were System 3, and eleven were System 4 or 5. Farmer input was used to validate the skill areas identified in the initial survey, and to uncover farmer experiences of changing between systems. The aims of the focus groups were to:

- Verify the skills identified in the project to date were consistent with those identified by focus group farmers
- Collect input from a range of farmers in different regional contexts
- Determine critical success factors for operating dairy systems 1 to 5
- Identify the resources needed for farmers to make informed decisions around system change

An industry focus group with eight non-farmer experts was held in May 2016. Attendees included farm consultants, social scientists, along with experts in capability and training on farms, farming systems, and extension. Participants were selected in a purposeful method aimed at gaining a range of perspectives on the topic. The participants were identified through professional networks, and through their previous engagement with projects related to farm system change. The goals of the industry workshop were to engage industry around this project, sense-test the results to date, provide wider perspective on capabilities needed to run different systems, and guide future research and development in this area.

### *Phase 3: Semi-structured interviews*

The final data collection phase involved 16 semi-structured interviews with dairy farmers from the same dairying regions as the focus groups to discuss the differences in skills required in different dairy systems. Interviews ranged from 1.5 to 2 hours in duration and were audio-recorded and transcribed for subsequent analysis. The aims of the interviews were to discuss the change process with farmers in different scenarios and use the skills framework developed

through Phases 1&2 to specifically discuss tasks and skills required at the operational farm level.

## Results

### *Survey 1 and 2: Shortlisting the skills that change*

In Survey 1, respondents' answers were used to create a short list of skills that were considered to differ in importance across the five dairy systems. The resulting short list included 17 skill areas which were subsequently ranked in Survey 2 according to a scale of 'a little important', 'important' or 'highly important' (Table 1). Eight of the skill areas differed by a ranking point of 1 or more across the System 1 to 5 scale (compared to the next highest which had a 0.4-point range). These most variable skills across farm systems were:

- managing risk associated with purchasing feed at the right price
- knowledge of different feeds, their feed values and properties e.g. maize, pke, total mixed rations, grains
- managing supplements (storage and feeding out)
- managing acidosis
- understanding how to balance nutritional requirements
- ordering supplements at the most effective price
- managing the marginal costs of production
- communicating (and negotiating) with suppliers and contractors.

The skill identified areas were primarily associated with the purchase and management of feed. This is logical given that the System 1 to 5 delineation is based on imported feed. The one area identified where slightly more importance in System 1&2 was indicated was observing 'seasonal weather events and how this affects the farm system'. All other capabilities were perceived to be more important in System 4&5.

**Table 1. Main dairy farming skills from Survey 2**

| Dairy farming skill area | System 1&2* | System 3 | System 4&5 |
|---|---|---|---|
| **Managing risk associated with purchasing feed at the right price** | **1.5** | **2.4** | **2.9** |
| **Knowledge of different feeds, their feed values and properties e.g. maize, PKE, total mixed rations, grains** | **1.5** | **2.0** | **2.9** |
| **Managing supplements (storage and feeding out)** | **1.6** | **2.4** | **3** |
| **Managing acidosis** | **1.2** | **1.5** | **2.6** |
| **Understanding how to balance nutritional requirements** | **1.3** | **1.7** | **2.6** |
| **Ordering supplements at the most effective price** | **1.8** | **2.5** | **3** |
| **Managing the marginal costs of production** | **1.9** | **2.5** | **2.9** |
| **Communicating (and negotiating) with suppliers and contractors** | **1.9** | **2.4** | **2.9** |
| Having support networks of advisers (and other farmers) to supply expertise where required | 2.3 | 2.4 | 2.7 |
| Ability to observe implications of seasonal weather events and how this affects the farm system (e.g. culling, extra feed, stocking rate) | 2.9 | 2.7 | 2.5 |
| Record keeping on feed demand, supply, supplement use | 2.5 | 2.6 | 2.9 |
| Actively managing the breeding programme to nominate sires and select a cow type specific to the system | 2 | 2 | 2.4 |
| Managing lameness | 2.2 | 2.3 | 2.6 |
| Managing mastitis | 2.3 | 2.3 | 2.5 |
| Training staff to have the right skills for the farm system | 2.6 | 2.7 | 2.9 |
| Ability to evaluate on farm information and make decisions | 2.6 | 2.7 | 2.7 |
| Managing staff rosters | 2.4 | 2.4 | 2.5 |

* Skills that change across farm systems highlighted in bold (shown as a weighted average response, where 1=a little important, 2= important, 3=highly important)

### *Focus groups and interviews: Sense-testing the skill categories with dairy farmers*

The 17 capability areas short listed from the survey were then sense-tested with farmers in the focus groups and interviews using a structure that examined the 'skills for success' in each area. The most important skills across the farmer focus groups were being able to evaluate

information to make decisions, maintaining the marginal costs of production, training staff to have the right skills for the farm system, managing supplements and purchasing supplements at the right price. Some of the comments made by farmers in the focus groups and interviews about the skill areas were:

> The relationship with suppliers is important – it's as much social as it is about the price/product, just catching up about their family and life (Source: Farmer Focus Group).
>
> The key to that [relationship with a contractor] is good communication and a good relationship. It's about forewarning – don't ring him up today and expect him here tomorrow. This is the window – a week to ten days in advance at least – this is the window (Source: Farmer interview, Canterbury).
>
> I surround myself with people that complement my skill set – not people like me (Source: Farmer Focus Group).
>
> That's the big difference I think, on the larger farms they can specialise more in one thing [such as] sitting on a tractor and putting cups on cows, or rearing cows. Whereas here [system 1] they need to know how to do the lot, everything, from rearing calves, to fixing water line. It's all got to be there (Source: Farmer interview, Waikato).
>
> [I have] a relationship with that person who happens to have a system five, but he could equally have a system one and the interaction would be no different. But it's good; it just gives me a bit of a feel about what other people are looking at and how they're doing stuff (Source: Farmer interview, Northland).
>
> If you've got a feedpad, you almost need a full-time tractor driver. If you can drive a tractor, you can learn how to do that within a day or two days or whatever. No, that's not a problem (Source: Farmer interview, Canterbury).

Additional skill areas were proposed by the focus group farmers including: use and maintenance of infrastructure/equipment; growing and managing crops; managing body condition score; communication and understanding within the farm team; and financial budgeting and modelling. The industry focus group identified a low level of skills among the farmer population, and the rural professionals that support them, in assessing the underlying goals of farmers. Participants at this focus group observed that farmers first needed to understand why they were farming, and what their individual drivers were, and then to facilitate a discussion of whether a change in farm system would still align with their farming goals.

### *System choice versus system drift*

Participants in the focus groups and interviews identified the concepts of 'system choice' where farmers make a conscious decision to change their farming system, and 'system drift' where small changes (such as levels of imported feed, or changes in infrastructure e.g. addition of a feedpad) are made over time and add up to a significant farm systems change. Participants felt that in a low farm gate milk price environment (such as in 2014-2016) farmers were making more conscious choices to de-intensify, but in the higher milk price era which preceded 2014 the increased use of imported feed supported more intensive systems and led to system drift. This was seen to have implications for how proactive farmers were at managing skill requirements amongst their team. Making a conscious choice, therefore, requires an understanding of thresholds for investing in infrastructure, and changes to staffing levels/skills.

The first requirement for farmers to make conscious system choices was identified as having a good awareness of their current farm system, and then to understand the actual need and implications of change. This was recognised as an important skill in itself, the ability to undertake system analysis. One of the System 4/5 farmers interviewed commented:

> No decision gets made now without some pretty serious scrutinising. [Interviewer: By you and the board?] More me, and then I can make a recommendation to the board. Even little things - like we monitor our feed inventories, I believed that we're going to be a little bit short on maize so I put a proposal to the board saying that we either need to plant 30 hectares of maize or we need to buy some more (Source: Farmer interview, Northland).

### *Revving faster versus changing gears*

As farmers intensify (adding more imported feed), activities around feeding supplements will increase – both in terms of time involved and complexity. Also, specialised equipment and facilities, such as feed bunkers, feeding wagons, and specific feed pad areas, may make the activities more efficient. Focus group participants identified issues around the skill implications of running efficient or inefficient farm systems as the use of imported feed increased. They identified the concept of farmers 'revving faster' within their current boundaries of infrastructure, machinery, and farm team skills. Some farm systems may be able to change key farm system inputs/outputs without major changes in infrastructure or staff levels/skills. For

example, in higher payout years System 2/3 farms could increase purchased feed and stocking rate to increase production. However, this expansion, and possible later contraction, will have 'red zones' where inefficiencies creep in – for example lack of appropriate feeding facilities or specific staff skills for optimal performance. One farmer commented:

> Just make sure you do your numbers around the capital required for investment. If you're running a really simple grass based system, to go and add infrastructure whether it be meal feeders or feed pads or having to buy a silage wagon, those sorts of things, it all adds cost, and understandable cost. I'd argue that just because of my bent that the benefit outweighs the cost, but some people aren't wired for it either. It's not just the cost of the gear and that stuff, it's the cost of Fonterra shares because you've got to produce more milk. Does that add any value to your balance sheet? (Source: Farmer interview, Northland).

It was identified that, at some point on the spectrum of imported feeding input, there would be efficiency gains in consciously 'changing gears' by investing in staff with specific skills (e.g. sourcing and managing feed) and in infrastructure and machinery such as feed wagons, concrete feed pads, and cow housing structures. Farmers, therefore, need the skills (or to access the skills) to assess whether they are operating in an inefficient 'red zone' where their system is revving too fast, and whether investment is required to change gears or undertake more conscious decision making. The knowledge of skills/capabilities will be needed especially when making information decisions about changing gears. One farmer who had made a conscious decision to de-intensify (from System 5 to System 3) commented:

> But yes, advice to farmers - I would just really talk to people who have done it, would be a good one. Then I would really question the people saying don't do it. Where is that advice coming from? Machine company, contractor, feed company? Like...I'd be looking to independent sources (Source: Farmer interview, Waikato).

## Discussion

In this study, we aimed to understand the skills that vary across different dairy farm systems in New Zealand to provide farmers with more information before they change system. According to the farmers and farm systems specialists involved in our study, the most important skills to change across farm systems are: managing risk associated with purchasing feed at the right price, knowledge of different feeds, managing supplements (storage and feeding out), managing acidosis, understanding how to balance nutritional requirements, ordering supplements at the most effective price, managing the marginal costs of production, and communicating (and negotiating) with suppliers and contractors.

### *A process for assessing and managing change*

A primary outcome of this project was the agreed need for skills in assessing and managing farm system change. While the project was initially focussed on investigating skills change at a tactical and operational level, feedback from farmers and industry stakeholders highlighted that farmers initially needed strategic planning skills to work through a conscious decision to change systems. This represents a difference between the skills required to assess change, and the skills require to enact good practice in a particular farming system.

The focus groups and workshops also highlighted the need for more strategic-level skills, such as the ability to analyse a farm system before making a change, and the skills to communicate change with staff and build a team to manage and enact change (Table 2). The industry focus group identified a general low level of skill among farmers and rural professionals to hold basic discussions on farming/life goals, and that these discussions should form the start of any system change process.

Assessing and managing change requires attention to strategic farm business planning and decision making. Farmers in our study indicated that this requires them to have certain skills, in addition to needing their farm consultants to have their skills to help them work through the change. Having the tools, such as financial benchmarking, to assess the performance of their current farm system was also important. Managing and assessing the impacts of change required an ongoing and strong focus on record keeping, for example the number of stock and feed available to manage feed needs.

Table 2 summarises the questions farmers should ask themselves before changing farm system. The questions are focussed at strategic level decision-making, for example infrastructure needs assessment and utilisation of existing infrastructure. Considering the wider aspects of return on investment was vital according to farmers, and this included consideration of the non-monetary implications of change, for example changes to time spent on tasks like tractor driving and managing contractors. Achieving a return on investment was a focus which didn't change

between systems but the types of investment could differ, for example getting more value from imported feed or more value from infrastructural investments.

**Table 2. Questions for farmers to consider prior to farm system change**

| Assessing current state | Deciding on change | Managing change |
|---|---|---|
| Am I in a good state to make this change? How do I know if I am? | Do I know what a good future state looks like? What are the milestones and KPIs? | Have I managed change of this scale before? |
| Do I want to change? | Is the change going to make things better or worse? | Do I have the skills to project manage and stick to budget? |
| Am I properly able to engage other stakeholders in the change? | How risky is the change? Identify and manage risk, what level of risk am I happy with? | How much to invest and when can I expect the change process to be finished? |
| Do I have the communication skills to sell the idea to my team? | Do I know the implications at a regulatory level? | Am I prepared for the peer/public response? |
| Do I have the organisational and delegation skills needed? | Do I have the required level of knowledge? Where can I get it? Who can I get it from? How do I know if the information can be trusted? | What's plan B if things don't go according to plan? |
| What are the teams' current skills and abilities? | Do I understand principles along with the practical knowledge? | How do I change my monitoring system? |
| Do I know my financial position and capacity to invest in infrastructure if needed? | How much do I need to extend my network? | Should I lead the change or should someone else? |
| | Will I need to adjust my life to manage this? | |
| | What could be the unintended consequences? | |
| | Can I assess people skills appropriately? | |
| | Is it part of succession, how does it fit? | |

It is important that the lessons learnt from farmers in this study, and presented in Table 2, are extended to other farmers who are looking to change their farming system. This is particularly the case for farmers who change during times of milk price volatility, or increased environmental restrictions as currently occurring in New Zealand (Edwards et al. 2017). The first step planned is to produce a self-assessment tool for farmers to access on the DairyNZ website. This will be supported by social media campaigns to target farmer engagement at key times of their planning cycle, or when farmers are faced with external forces for change (such as new regulations on nutrient or feed use). However, given the finding in this study of 'system drift versus system choice' regarding farmers strategically changing their system, engaging farmers in conscious decision-making processes around change will require further consideration.

While drivers of behaviour change in agriculture has been, and continues to be, widely studied (e.g. Willock et al. 1999; Hunecke et al. 2017; Morris, Loveridge & Fairweather 1995), a challenge identified in this paper is how to build farmer practice for considered change. Behaviour change theory tells us that farmers (and people in general) are social learners, place greater weight on the opinions and observations of trusted peers/advisors, and do not always make 'rational' choices in the economic sense. Therefore, behaviour change can be addressed through attention to the social networks of farmers, by situating extension within regional contexts, and working with organisations or agents with influence over farmer opinion.

***Identifying the skills for success within farming systems***

In this project, we identified the 'skills for success' required under each of the eight skills areas that change. The eight skill areas represented broad capability descriptions, and farmer focus groups and interviews highlighted that there were a range of sub-skills needed under each of these categories. Communication was a common skill for success, particularly communication within the farm team to establish the need for new skills, and communication with external advisors around purchasing feed or managing the feedbase. Skills for success across the different skill areas also relied on analytical abilities such as managing marginal feed costs and understanding farm costs.

A focus first on pasture eaten was common in all systems, this was subsequently supported by imported feeds rather than the other way around in the higher input farm systems. The specific skills to manage pasture varied across the farm systems in our interviews, with system 1

farmers having a range of flexible approaches to managing pasture, whereas system 5 farmers could implement a standard approach of intensive grazing to maintain residuals followed by feeding on a feedpad.

Across the skill areas there was a need to ensure training for staff where required. This involved an understanding that some jobs just require training to make sure staff are proficient but others may require more attention to ensure a full mind-shift for working in a different system, for example farmers noted that not all staff that have worked on a system 4 can adjust to a system 1 and vice versa. Farmers noted that they needed to establish and be aware of the skill required for the system being run in relation to the actual skill level across the farm team - including the owner, manager, and staff.

An important skill for success was a realistic assessment of timelines for change. For example, farmers noted that changes to herd genetics can take up to six years, and that building capability in the farm team can take time. Farmers may need to organise seasonal help in a new system, and manage changes in expectations of the support team (e.g. heifer grazing, feed contracts, finance).

***The role of advisors and farmer networks in skill assessment***

Farmers in the study noted that it was important to have networks that the farmers themselves value, for example one farmer noted that he consulted other farmers that were operating quite different farm systems than him. This provides a support mechanism to test ideas safely and check assumptions. Advisors are important for exploring new strategies, particularly as they hold a collective of knowledge from their experience and exposure to many farm systems. They can be used to sound out new ideas for change or innovation. One farmer interviewed used a farm consultant to model potential system options annually, then adapted the modelling throughout the year as circumstances changed. In this way, advisors were useful for challenging farmer thinking about their current system (e.g. through the use of modelling) and any potential moves to a different farm system.

Farmers look to develop enduring relationships with key advisors and suppliers (for example feed and seed). Loyalty comes from this trusted relationship developing over time. A good reputation is important for key advisors, for example one farmer moved to a new region and maintained a connection with his existing, trusted accountant. Advisors are important to facilitate wider considerations of systems change, for example implications for culling and genetics, impact on cash flow and ability to get finance, and impact on nutrient budgets.

***A comfort zone for change and a mental shift***

Farmers often work within their own comfort zones. In this study, farmers running system 5 operations commented that they could not handle the uncertainty associated with system 1 dairy systems, because those systems were reliant on pasture management and, therefore, more heavily impacted by climatic conditions. Conversely, system 1 farmers said they were comfortable managing risk within their operations but could not handle the perceived risks in system 5 due to feed and milk price fluctuations and the impact on the marginal feed costs. Farmers develop the skills required to optimise their system, and cope with risk, over several years and via experience of different farm business environments (milk price, interest rates, climate).

To make a conscious decision to change farm system can, therefore, require a mental shift for many farmers. If they 'drift' from one system to another, for example by increasing the level of imported feed to boost milk production in high milk price years, farmers can find themselves outside of their comfort zone and dealing with forms of risk that they have not developed processes or mental models to cope with. One farmer noted that he took two years to decide to change from system 5 to system 3 due to the fear of change and the perceptions others might have if the change was not successful. Conversely, another farmer noted that he changed farm systems more for the challenge of trying something new by being outside of his comfort zone, and achieved a feeling of satisfaction through testing himself. Farmers, therefore, need a process to assess their level of comfort with change and risk, and assess whether focussing on optimising their current farm system might be more satisfying and profitable than making system changes.

***Limitations, future work, and engaging farmers***

This study represents an attempt to build a rich picture of the skill changes faced by farmers as they significantly altered their farm system. While the design of the project was undertaken by a project team with a wide range of skills and experience, and surveys were piloted before being distributed, the limitations to the study should be noted. The skill rankings are based on a

small sample size, and were tested with a limited number of farmers. They therefore need to be viewed as indicative only. The industry context will also have been important, as farmers were focussing on appropriate farm system types due to the low milk price during the period of this study. In terms of the methods used, the survey-focus group-interview process appeared to work well to narrow the 'field of vision' around the important skills, thereby allowing the research to focus on understanding these skills in more depth. However, the potential limitation of this sequential method was that participants may have been 'locked in' to the skill short list in the focus groups and interviews. We attempted to prevent this by leaving space for focus group farmers to suggest other important skills, and the interviews were also semi-structured thereby allowing other important skill areas to surface. Some farmers did discuss additional skill areas, such as grazing management and selection of genetics, and these have been noted in the extension resources prepared for farmers.

Future work could involve undertaking time use studies of farm teams to ascertain the tasks undertaken on a daily basis within different farm systems. The results from the current study will be made available to farmers via a special skills section on the DairyNZ website, through audio podcasts, and using social media campaigns.

## Conclusions

Farmers in this study typically lacked a formal process for assessing change, and although some industry tools exist (such as DairyNZ's Whole Farm Assessment, and farm system modelling tools), farmers made changes and then thought about the skill consequences afterwards. Limited information is available for farmers to help them recognise the skill differences inherent in each system, or how to obtain the new skills. An initial pathway to impact for the results from this study will be via web resources written with the farmers' voices prominent (see dairynz.co.nz) and via a self-assessment tool focussed on the change process. Further research is planned to unpack the broad skill areas into more operational-level skills that farm teams will need to enact on a day-to-day basis.

We identified a need for farmers to develop skills, or source skilled advisors, to first consider change at a strategic level such as the ability to analyse a farm system before making a change, and the skills to communicate change with staff and build a team to manage and enact change. It is here that farm advisors play a key role. Given that farmers tended to 'drift' through system change, the use of farm advisors should be promoted when external pressures are prompting change on farm. Industry bodies, such as DairyNZ in the dairy sector, can engage with farmers to trigger the 'conscious change' process, and highlight the tools available via farm advisors to assess and manage the change.

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