

Smaller scale New Zealand dairy farmers: the context for future innovations

Victoria Westbrooke & Peter Nuthall

Lincoln University, Lincoln, Christchurch, 7647

Email: victoria.westbrooke@lincoln.ac.nz

Abstract. There is a wide variation in the scale of New Zealand dairy herds, 18% of farmers manage more than 600 cows, while 69% of farmers have herds with less than 400 cows (DairyNZ & LIC 2012/13). The smaller scale farms, those with less than 400 cows, are important due to the proportion of the industry they represent, yet little research has been conducted in New Zealand into their particular needs or context. Understanding these farmers' goals, plans and challenges is critical to developing innovations and extension programs tailored specifically to their needs. Farmers with less than 400 cows were surveyed (n=346) by telephone in October and November 2014. On average respondents milked 240 cows on 97 ha, employed staff and had a low level of debt as a proportion of their business assets (33%). Respondents strongly agreed that earning maximum sustainable net cash returns and planning for reasonable holidays and leisure time was important, but were neutral regarding the importance of passing the farm onto family members. Farmers were planning no major changes in farm ownership, but the majority were planning to lift production by more than 10%, and reduce the already low debt levels further and employ a non-family employee to do the majority of the work. The key challenges identified by the farmers were 'environmental regulation and compliance', followed by 'finding suitable staff', then various capital and cash-flow factors were considered moderately challenging. Two key outcomes of the research are:

1. The most likely future plans of New Zealand smaller scale dairy farmers is described, which can inform the development of future programs and innovations.
2. The key challenges for smaller scale farmers plans are identified and ranked.

It is concluded that a range of exit strategies need to be developed for smaller scale farmers without successors, which meets both their financial and personal needs.

Keywords: small dairy farm, business strategies, planning, succession.

Introduction

What is considered a small-scale dairy farm has changed markedly in the last 30 years. In New Zealand, a smaller scale farm in the late 1990s was considered to milk less than 190 cows (Parker, Rauniyar & Dooley 2000), whereas in 2013, it was a farm that milked less than 250 cows (Westbrooke 2013a). This increase of 25% in the herd size of smaller scale farms, is less than the almost doubling of size in the average New Zealand herd size from 220 cows in 1997/98 to 402 cows in 2012/13 (DairyNZ & LIC 2012/13). A different, but complementary way of classifying smaller scale farmers is based on farmer self-identification with the group and its characteristics. The membership of Smaller Milk and Supply Herds farmer group (SMASH), is based on this rather than a specified herd size.

A characteristic of smaller scale farmers is remaining involved in all areas of farm management rather than becoming specialised. Smaller scale farmers are involved in operational, tactical and strategic levels of farm management in contrast to larger scale farmers who specialised in strategic management (Tocker, Shadbolt & Gardner 2005). In terms of staff management, smaller scale farmers didn't want to become specialised "people managers", even though many employed staff (Westbrooke 2013a). Tocker, Shadbolt and Gardner (2005) also noted that smaller scale farm owners were only accountable to themselves and their immediate family, in contrast to larger scale owners who may also be accountable to equity holders or other outside business partners.

Smaller scale farms are important due to their number and thus the proportion of the national herd that they milk. In New Zealand, there are 4156 herds milking less than 250 cows, which make up 35% of the national herd (DairyNZ & LIC 2012/13). This makes smaller scale farms important both from a social and an economic perspective (McNally 2001), particularly in regions with a high proportion of small dairy farms.

The challenge for smaller scale farmers, their associated extension agents and researchers, is how to ensure that the businesses can meet farmers' goals, objectives and future plans. Adopting new innovations or management systems could be critical to farmers' meeting both their economic and non-economic objectives. For farming systems and innovations to be adopted they must fit with farmers' context (Pangborn 2012). The scale of a farm is an important contextual factor due to the influence of scale on decision making (Defrancesco et al. 2008) and farm development (Lambert et al. 2007).

In the 1990s the future ten year plan of over half (52%) of smaller scale New Zealand dairy farmers' was to exit the industry. Farmers planning to exit were older than the average in the study and typically on smaller farms, milking less than 100 cows. The farmers who were planning to expand their business, employ staff or pass the farm onto family members were on larger properties, milking over 141 cows (Parker, Rauniyar & Dooley 2000). Farmers ranked the two highest barriers to their plans as economic, political or industry factors and thus out of their control. Lack of capital was the farmers third highest ranked challenge, yet retiring debt rather than investment in a larger farm, machinery or off-farm, was the preferred option for any cash surpluses (Parker, Rauniyar & Dooley 2000).

Numerous studies have investigated smaller scale farming and contextual issues in Europe (Breustedt & Glauben 2007; Hansson, Ferguson & Olofsson 2012) and the USA (Santelmann et al. 2004), however there is a lack of recent quantitative data on the future likely situation of smaller scale dairy farmers in New Zealand.

The objective of this study was to investigate, smaller scale dairy farmers' future farm business plans and barriers to these plans, in New Zealand. The study also investigated farm and farmer factors related to these future plans and the challenges to these plans. Knowledge of smaller scale farmers' future plans, barriers and their relationship with farm and farmer factors will provide extension agents and researchers with a context within which to fit innovation and systems to assist farmers.

Methods

A telephone survey was conducted by a trained telephone team between the 15th of October and the 21st of November 2014. The basic sample was taken from a randomised selection of the SMASH membership database, thus targeting farmers who self-identified as smaller scale. Farmers milking more than 400 cows, in 2013, were excluded. Additional respondents were randomly taken from electoral rolls of the selected locations. The survey was conducted with the farm owner/decision maker or 50:50 share-milker for a farming business, however share-milkers with agreements less than 50:50 were excluded. An analysis of farm sizes countrywide made it clear most small dairy farmers were located in Northland, Waikato, and Taranaki. Consequently the sample was restricted to these areas. In addition, written responses to the same survey (n=21) were obtained from farmers at a SMASH field day in Taranaki on the 21st October 2015.

The survey gathered farm statistics (farm area, milk production and staff employed), farmer data, (age, gender, education, managerial style, goals), and farm financial information (the farmers' equity in their business, whether the farmer had other farming investments, or any non-farming investments). The farmers' plans for the next ten years were also explored, in terms of likely future farm ownership, who or how the farm work would be done and challenges to these future plans.

The questions were either short answer replies or statements which the respondent was asked to rate the degree of truth of the statement for their situation. A Likert style 1 (not true) to 5 (true) scale with word anchors at each end was used based on trial farmer's scale rating preferences. The questionnaire was designed to take between 12-14 minutes. To encourage participation, and respect the time farmers spent answering the questionnaire, participating farmers were entered into a draw for three \$200 gift cards. The questionnaire was approved by the Lincoln University Human Ethics committee, approval Number 2014-33. The data was analysed using SPSS (Statistical Programme for Social Science, IBM; version 22). Correlations were calculated using Kendall's tau (Field 2009).

Results

In total 858 farmers were contacted via telephone with 325 usable surveys obtained, giving a response rate of 38%. As noted, a further 21 surveys were completed by farmers at a field day, resulting in a total of 346 surveys used in the data analysis.

Farm and business data

The averages for farm size was 97 ha and total production was 86,789 kg of milk solids (MS) and 355 kgMS/cow and 917 kgMS/ha for the 2013/14 dairy production year, as shown in Table 1. It was notable that 47% of smaller farmers surveyed employed between one and two staff members with 15% employing two or more employees and 37% employing less than one full time equivalent (FTE).

Table 1. Data for the farms surveyed

	Mean	SD	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
Peak cows milked (cows)	240	4.41	232	249
Effective farm area (ha)	97	2.45	92	102
Production (total kgMS/year)	86,789	1,935	82,981	90,597
Production (kgMS/cow/year)	355	7.76	301	332
Production (kgMS/ha/year)	971	19.1	934	1009
Staff employed (FTE)	0.83	0.04	0.75	0.91

On average, the peak number of cows milked on participants' farms was 240, with half (45%) of the farmers milking at peak between 151 and 250 cows. A few farmers (11%) milked relatively large herds of more than 350 cows and a minority of farmers (2%) milked relatively small scale herds of less than 100 cows, as shown in Table 2.

Table 2. Distribution of respondents' herd size

Peak cows milked	0-50	51-100	105-150	151-200	201-250	251-300	301-350	351-400
Farmers (%)	0.3	2.3	11.1	23.9	21.0	12.8	18.1	10.5

In terms of business ownership, the majority (75%) were owner operators and just under a quarter (23%) were 50/50 share-milkers or equivalent. Very few farmers were in leasehold (2%) or equity partnership (0<1%) ownership structures.

On average, farmers had a low level of debt as a proportion of assets in their businesses (33%). The majority (70%) of farmers had very low debt levels, less than 20%. At the other end of the scale, a low percentage of farmers (17%) were in a risky financial position with more than 60% debt in their businesses. Few farmers had financial investments outside their home farm. Less than a quarter of farmers (23%) had a financial interest in another farming business as well as their home farm, and just over a third (35%) of those surveyed had non-farming businesses/investments.

Two thirds (67%) of respondents were male and one third (33%) female. There was a relatively even spread of farmers in the 30 to 60 plus years age bracket. Half of farmers (57%) were between 40 and 60 years old, with a similar proportion of farmers in the 30-40 age bracket (20%) and 60+ age bracket (19%). A very low proportion, less than 4%, of respondents were under 30 years old.

Farmers' goals

Farmers were asked to rate their agreement with three goal statements, shown in Table , from 1 strongly disagree to 5 strongly agree. Over half of the farmers strongly agreed with the goal statements of 'aiming for maximum sustainable net cash returns is very important' and 'it is essential to plan for reasonable holidays and leisure'. However, farmers were neutral when it came to the importance of passing the property to family members, as shown in Table 3.

Table 3. Importance of farmer goals, from 1 strongly disagree to 5 strongly agree

	Mean rating	Percentage of farmers rating each value				
		1	2	3	4	5
Aiming for maximum sustainable net cash returns is very important	4.46	0.3	9.3	25.6	25.6	61.9
It is essential to plan for reasonable holidays and leisure time	4.23	3.2	10.8	26.8	26.8	54.5
It is very important to pass on the property to family members	2.93	22.4	30.2	14.2	14.2	18.9

Future investments and sources of income

Farmers' most likely future investments and sources of income fell into three main groups, as shown in Table . The first group were two traditional options of 'reduce farm debt to very low levels' and 'increasing production by more than 10%', with mean ratings of 3.77 and 3.60 respectively, on the 1-5 scale. The popularity of these two traditional strategies is emphasised by over half of farmers surveyed rating them as moderately (4) or very likely (5) to occur in the future.

Farmers were neutral (mean rating of 2.79) about the next most likely future investment/income strategy of 'investing in another farming business, as well as the current farm'. The two options of 'more than 20% of your income coming from non-farm investments or wages' and 'diversifying the current business' were moderately unlikely to occur with mean overall ratings of 2.29 and 2.15 respectively, as shown in Table 4.

Table 4. Future investment and income strategies, from 1 very unlikely to 5 very likely

	Mean rating	Percentage of farmers rating each value				
		1	2	3	4	5
Reducing farm debt to very low levels	3.77	9.9	7.3	17.7	25.9	39.2
Increasing production by more than 10%	3.60	9.3	10.2	23.0	26.5	31.1
Investing in another farming business as well as the current farm	2.79	31.1	12.5	21.8	15.7	18.9
More than 20% of your income coming from non-farm investments or wages	2.29	41.9	21.5	15.1	8.4	13.1
Diversifying the current business	2.15	50.0	14.0	15.4	11.9	8.7

Future ownership and employment options

For the question of who or how will the farm work be done in the future, farmers were close to neutral for the options of 'employing a non-family worker/sharemilker', 'investing in on-farm technology to do farm work' or 'doing the majority of the work themselves' (Table 5). 'Employ a non-family worker/share-milker' was the most highly rated of the options at 3.42. What is interesting about this option is the strong support for either end of the scale. Just under 40% of the farmers surveyed rated this option as very likely, while 23% of farmers rated it as very unlikely. That is just over 60% of farmers had a strong view on whether non-family workers and/or share-milkers would be undertaking the farm work on their properties in the future. Less than 20% of farmers felt that they would 'invest in on-farm technology to do farm work' or that they would do the majority of work themselves', in the future.

Table 5. Future ownership and farm work options, from where 1 very unlikely 5 very likely

	Mean rating	Percentage of farmers rating each value				
		1	2	3	4	5
Future farm work options						
a) Employ a non-family worker/share-milker	3.42	23.1	5.7	15.9	16.5	38.7
b) Investing in on-farm technology to do farm work	2.80	26.7	16.0	22.1	21.1	14.0
c) Doing the majority of the work themselves	2.79	28.1	14.0	26.0	14.9	17.0
Future farm ownership options						
d) Selling the farm within 10 years	2.52	41.5	11.3	18.9	10.6	17.7
e) Increase the size of the current farm	2.40	40.4	14.7	21.1	12.5	11.3
f) The farm being transfer to 1 or more children	2.33	45.9	12.4	17.3	11.7	12.8
g) Selling the home farm and moving to a larger farm	1.80	64.2	12.1	9.8	7.5	6.4

All of the future farm ownership options (shown in Table 5 as d to g) were unpopular. All of the options had mean ratings from moderately (2) to very unlikely (1) to occur in the farmers' businesses in the future. This unpopularity was reinforced by the proportion of farmers rating the options as 1 or very unlikely. This ranges from 41% of farmers for the option of increasing the farm size, to 64% of farmers for the least popular option of selling the current farm to purchase a larger property.

Challenges to farmers' future plans

Farmers were asked to rate how a selection of challenges would affect their future farming plans. Overall farmers rated the challenges to their future plans as no challenge to very challenging, on the 1 to 5 scale, as shown in Table 6. Environmental regulations and issues was rated by farmers as the greatest challenge to their future plans. Over half of surveyed farmers (52%) rated the issue as challenging, compared to 23% who rated it as a minor challenge. The second most challenging issue, was 'being able to find suitably experienced staff'. Like the issue of environmental regulations a high proportion (46%) of farmers rated the issue as challenging, however, in comparison with environmental regulations, a higher proportion (32%) of farmers rated the issue as only a minor challenge to their future plans.

Table 6. Challenge to farmers future farming plan(s), from 1 no challenge to 5 very challenging

	Mean rating	Percentage of farmers rating each value				
		1	2	3	4	5
Environmental regulations and issues	3.44	8.8	14.0	24.6	29.5	23.1
Being able to find suitably experienced staff	3.21	15.5	16.5	22.7	22.4	22.7
The amount of capital and/or debt needed, for future plans	3.11	10.3	21.5	27.6	27.6	12.9
The level of cash return from your potential future plan	3.04	6.5	23.0	39.2	22.7	8.6
The level of cash returns from your farm over the last 4 seasons	2.93	14.4	18.2	38.4	18.5	10.6
Your willingness and capability to manage staff	2.76	21.5	21.5	24.8	24.2	7.9
The level of risk with your potential plan	2.74	14.1	25.0	38.5	17.6	4.7
Lack of suitable, cost effective technology	2.58	16.7	30.4	34.6	14.3	3.9
A lack of knowledge and/or detail about your future plan	2.48	18.8	31.0	37.0	10.1	3.0
Difficult to discuss with next generation	2.02	43.3	25.7	21.0	5.5	4.4

Next, three financial challenges had mean overall ratings of between 3.11 and 2.93, so were considered by farmers to be moderately challenging to their future plans. The 'amount of capital and/or debt needed for future plans' was notable for the even spread of ratings over 2, 3 and 4. The second financial challenge was the 'level of cash return from your potential future plan' which was notable for the high (39%) of farmers who rated this as a moderate challenge. The third challenge was the 'level of cash returns from your farm over the last 4 seasons', as shown in Table .

Farmers rated 'their willingness and capability to manage staff' and 'the level of risk with your potential plan' similarly as moderate risk with overall ratings of 2.76 and 2.74, respectively. Farmers' ratings for 'their willingness and capability to manage staff' were fairly evenly spread over the mid-range of 1, 2, 3 and 4, whereas for the 'risk with the potential plan', a high (39%) proportion of farmers rated this a moderate challenge.

The 'lack of suitable, cost effective technology' and 'a lack of knowledge and/or detail about your future plans' were two of the least challenging issues for farmers, with a mean overall ratings of 2.58 and 2.48, respectively. The difficulty of 'discussing the potential future plans with the next generation' was the lowest ranked challenge overall, with 43% of respondents rating this no challenge to their future plans.

Relationships between farm and farmer characteristics and future farming plans and challenges.

Farm factors With regards to farmers future plans, when farm scale was defined by the area farmed (ha) there was a significant negative correlation with the likelihood of reducing debt, ($\tau=-0.12$, $p<0.01$), but a positive correlation with increasing production, ($\tau=0.09$, $p<0.05$) and employing staff ($\tau=0.22$, $p<0.01$) in the future. When farm scale was defined by the number of peak cows milked there was also a significant negative correlation with the future likelihood of reducing debt, ($\tau=-0.08$, $p<0.01$), and a positive correlation with employing staff, ($\tau=0.22$, $p<0.01$), but not with increasing production. The likelihood of employing staff in the future was also correlated with total production ($\tau=-0.21$, $p<0.01$), and the number of staff currently employed ($\tau=-0.31$, $p<0.01$).

In terms of barriers to farmers future plans, there was a significant positive correlation with the challenge of finding suitable staff, when farm scale was defined as either area farmed ($\tau=0.08$, $p<0.05$), number of peak cows milked, ($\tau=0.10$, $p<0.05$), or total production ($\tau=-0.13$, $p<0.01$). There was no relationship between farm scale, defined by either area farmed or number peak cows milked and the challenge of environmental regulations and issues.

Farmer factors Farmer age was significantly positively correlated with reducing debt, ($\tau=0.11$, $p<0.05$) and increasing production, ($\tau=0.26$, $p<0.01$). The farmer goal of succession was significantly positively correlated with increasing production ($\tau=0.11$, $p<0.05$), however, there was a significant negative relationship with the future likelihood of employing staff, ($\tau=-0.14$, $p<0.01$). Thus the more importance farmers placed on succession, the more likely they were to increase production but not employ staff, in the future. The goal of maximising cash was positively correlated with increasing production, ($\tau=0.10$, $p<0.05$).

In terms of farmer factors that were barriers to future plans, farmer age was positively correlated with the challenge of environmental compliance, ($\tau=0.12$, $p<0.01$). Farmers with the goal of maximising cash had a positive relationship with the challenge of finding suitable staff, ($\tau=0.10$, $p<0.05$). Interestingly, the goal of reasonable holidays was not correlated with any of the three most likely future farming options or the two key challenges identified by farmers.

Discussion

The smaller farmers surveyed had, on average, 40% less cows, a third (31%) less effective area than the national average herd (DairyNZ & LIC 2012/13), As shown in Table 7, both production per hectare and per cow was similar between both groups. Thus farmers participating in this research were owners/operators with a significantly smaller scale compared to the New Zealand national average. The farmers interviewed were also representative of smaller scale New Zealand dairy farmers as they were drawn from SMASH, the group representing these farmers.

Table 7. Comparison of mean data for small herd vs. New Zealand national owner-operators

Diet components	Small herd owners	NZ National
Peak cows milked (cows) ¹	240	402
Effective farm area (ha) ¹	97	141
Production (kgMS/cow) ¹	355	346
Production (kgMS/ha) ¹	971	988
Debt as a % of assets ²	33	44

Source: ¹ (DairyNZ & LIC 2012/13), ² (DairyNZ 2013).

In the current study farmers moderately to strongly agreed with the goal of 'aiming for maximum sustainable net cash returns is very important' followed with the goal of 'it is essential to plan for reasonable holidays and leisure time' yet were neutral with regards to passing the farm onto family members. This was in contrast to work by (Nuthall & Old 2014), who found that dairy farmers in general were neutral about the first two goals and moderately disagreed with the latter. Thus there are potential differences between the goals of New Zealand dairy farmers in general and those of small herd owners.

The most likely future income/investment strategy for smaller farmers' is reducing debt to very low levels, followed by increasing production, in agreement with findings from the 1990s (Parker, Rauniyar & Dooley 2000). Yet smaller farmers on average already have a low level of

debt in their businesses, lower than the national average, as shown in Table . This strategy could be considered low risk as it involves working within a business and system that farmers have experience with. In a recent study, farmers planned that once debt was very low or nil, money previously used for debt servicing could be re-directed to pay a staff member (Westbrooke 2013a). Interestingly, the smaller the scale of the farm (peak cows milked, effective area), the more likely the farmer believed s/he would use the debt reduction strategy in the future. Also as farmer age increased, so did the likelihood of the debt reduction strategy. Thus improving smaller herd owners retirement options.

Increasing farm production was the second most likely future business strategy in this study. Historically, a high (40%) proportion of small farmers felt production could be lifted by 10-20% (Parker, Rauniyar & Dooley 2000), although increasing production may not lift profit (Allen 1998). Increasing farm production had a positive relationship with farmer age and the goals of succession and maximising sustainable net cash returns. Thus, as farmers age, they prepare for succession by lifting production, this is known as the successor effect (Potter & Lobley 1996). What is clear from this and earlier research, is that the two strategies of reducing debt and lifting milk production are key for smaller farmers, thus any future innovations need to fit with these two future business plans.

Only a minority of the farmers believed diversification would be one of their strategies in the future. Yet in Europe, diversification has been promoted as a key business strategy for farmers (McNally 2001; Hansson, Ferguson & Olofsson 2012). For diversification to be successful, farmers need to have the time to invest and the opportunity, such as spare capital, buildings or a suitable location for different business activities (McNally 2001). Not all New Zealand smaller scale farmers will have either the time or opportunity to invest in diversification. Thus innovations targeting diversification need to be carefully considered and researched as they may only be applicable to a minority of smaller scale farmers. In addition, McNally (2001) found that diversification did not lift farm income significantly, rather it provided a buffer in poor years.

Over half of the farmers surveyed were unlikely to sell the farm, expand the current farm, pass the farm to a family member or move to a larger farm. Thus in terms of ownership "business as usual" is the most likely future scenario for a majority of smaller scale farmers. The majority of farmers (76%) were unlikely to 'sell the farm and move to a larger property'. Previous research suggests this could be due to farmers being happy with the farms current location (Parker, Rauniyar & Dooley 2000), close to friends and family and concern over whether a larger farm in a different location would generate more cash than their current business (Westbrooke 2013a). The reasons behind farmers preferred future ownership structure requires further investigation as this is a key issue for farmers and thus future innovations need to fit within this context.

Recently, farm succession has been a topical issue (Dooley & McLeod 2012). Yet these results agree with the earlier work of Parker, Rauniyar and Dooley (2000) where approximately half of smaller scale farmers thought it very unlikely that the farm would be transferred to family members within the next 10 years. Potentially, this leaves a high proportion of smaller farmers considering future career options without succession. Some farmers will not be at the career stage to consider succession, but exit strategies need to be developed with smaller herd owners to provide options and choice in the future. One of these strategies could be to employ a non-family worker, as farmers who placed a lower importance on succession were more likely to employ a staff member.

Given the 'seven day a week', physical nature of dairy farming, a key question is 'who will do the farm work in the future?' These results show that over half (55%) of smaller farmers are likely to employ a non-family employee. This is in contrast to the 1990s where less than a quarter (24%) of farmers were likely to employ staff in the future (Parker, Rauniyar & Dooley 2000). Many small farmers do not want to become people managers (Westbrooke 2013b). Yet in this study, many respondents already employ one or more FTE, and the larger the scale of the farm, the more likely farmers are to employ staff in the future. Currently, the average number of cows milked per FTE is 142 (DairyNZ 2013), so depending on the amount of family labour available, farmers running larger scale farms may have no choice but to employ staff. Westbrooke (2013a), found that some smaller farmers were comfortable with a maximum of one staff member as they felt they could still be a 'hands on farmer'.

The importance of non-family staff in farmers' future plans is emphasised by the challenge of 'finding suitable staff', being rated as moderate to very challenging by almost half of the respondents. It was notable that farmers rated their 'willingness and capability to manage staff as somewhat of a lesser challenge with 30% of farmers rating it moderate to very challenging. In terms of the context for future innovations, as a group, smaller farmers will consist of more employers than non-employers, in contrast with the past (Parker, Rauniyar & Dooley 2000).

Technology, such as milking robots, are becoming established on New Zealand farms (Brakenrig 2014). Yet, only a third of surveyed farmers were likely or very likely to use technology to do farm work in the future. The high proportion of farmers not planning to use technology could be the reason why a lack of cost effective, suitable technology overall was only a mild to moderate challenge to farmers' future plans. This is an area that requires further investigation.

Environmental regulations and compliance have been noted as key challenges for New Zealand dairy farmers (Clark et al. 2007). Smaller scale farmers are keenly aware of this challenge, as shown by over half of the respondents rating the issue as challenging. Interestingly, the older the farmers were, the more challenging they found the issue. There is a wealth of information available on environmental management in New Zealand dairy farms (DairyNZ), and further research is needed to tailor this information to the needs of smaller scale farmers and in particular older farmers. Environmental compliance is a key contextual feature that future innovations for smaller scale farms need to fit with.

Conclusion

Smaller scale New Zealand dairy farmers future situation is characterised by over half of the farmers not planning any changes in farm ownership, including succession. The key strategies smaller scale farmers are planning to use in future are reducing debt to very low levels and to increase production by more than 10%. In addition over half of those surveyed are likely to employ a non-family staff member in the future. Farmers identified the main challenges to these plans as environmental regulations and issues, and finding suitably experienced staff.

These results provide the key context with which future innovations aimed at smaller scale dairy farmers need to fit with. Given the low levels of planned succession, research is required to develop a range of exit, or latter career stage, farm management strategies for farmers who are not planning succession. These strategies should include options that employ and don't employ non-family staff. Research is also needed to identify what technology farmers would find useful, or why few farmers are interested in using technology to do farm work in the future, especially given the level of physical work involved in running a farm.

There is already a wealth of information available in the two areas that farmers identified as challenging: environmental and compliance issues and staff management. The key for extension services is to ensure that this wealth of information is tailored and translated to meet the needs of smaller scale dairy farmers.

Acknowledgements

The authors would like to thank the committee members, in particular Louise Hanlon, of SMASH for their encouragement and support, and also thank the farmers who completed the survey. The comments of the reviewers were also appreciated. This work was funded by DairyNZ via ONEFarm.

References

- Allen, J 1998, 'The viability of small dairy farms', *Primary Industries Management*, vol. 1, no. 3, pp. 26-28.
- Brakenrig, MH 2014, *Adoption of automatic milking technologies*, Lincoln University, Christchurch, New Zealand.
- Breustedt, G & Glauben, T 2007, 'Driving Forces behind Exiting from Farming in Western Europe', *Journal of Agricultural Economics*, vol. 58, no. 1, pp. 115-127. <http://dx.doi.org/10.1111/j.1477-9552.2007.00082.x>.
- Clark, DA, Caradus, JR, Monaghan, RM, Sharp, P & Thorrold, BS 2007, 'Issues and options for future dairy farming in New Zealand', *New Zealand Journal of Agricultural Research*, vol. 50, no. 2, pp. 203-221. [2015/07/09]. <http://dx.doi.org/10.1080/00288230709510291>.
- DairyNZ, *Environment*, DairyNZ. Available from: <<http://www.dairynz.co.nz/environment/>>. [20 September 2015].
- DairyNZ 2013, *DairyNZ Economic Survey 2012-13*, DairyNZ, Hamilton.
- DairyNZ & LIC 2012/13, *Dairy Statistics*, DairyNZ Limited Available from: <http://www.lic.co.nz/lic_Publications.cfm>.
- Defrancesco, E, Gatto, P, Runge, F & Trestini, S 2008, 'Factors Affecting Farmers' Participation in Agri-environmental Measures: A Northern Italian Perspective', *Journal of Agricultural Economics*, vol. 59, no. 1, pp. 114-131. <http://dx.doi.org/10.1111/j.1477-9552.2007.00134.x>.
- Dooley, E & McLeod, M 2012, *Dairy Farm Succession - information evaluation*, Center for Excellence in Farm Business Management, ONEFarm. Available from: <<http://www.onefarm.ac.nz/research/completed-research/dairy-farm-succession-information-evaluation/>>.
- Field, A 2009, *Discovering Statistics using SPSS*, 3 edn, Sage, London.
- Hansson, H, Ferguson, R & Olofsson, C 2012, 'Psychological Constructs Underlying Farmers' Decisions to Diversify or Specialise their Businesses – An Application of Theory of Planned Behaviour', *Journal of Agricultural Economics*, vol. 63, no. 2, pp. 465-482. <http://dx.doi.org/10.1111/j.1477-9552.2012.00344.x>.

- Lambert, DM, Sullivan, P, Claassen, R & Foreman, L 2007, 'Profiles of US farm households adopting conservation-compatible practices', *Land Use Policy*, vol. 24, no. 1, pp. 72-88.
<http://dx.doi.org/http://dx.doi.org/10.1016/j.landusepol.2005.12.002>.
- McNally, S 2001, 'Farm diversification in England and Wales — what can we learn from the farm business survey?', *Journal of Rural Studies*, vol. 17, no. 2, pp. 247-257.
[http://dx.doi.org/http://dx.doi.org/10.1016/S0743-0167\(00\)00050-4](http://dx.doi.org/http://dx.doi.org/10.1016/S0743-0167(00)00050-4).
- Nuthall, PL & Old, KM 2014, *Report on a succession and governance survey of a random stratified sample of NZ farmers*, AERU Research Reports, Lincoln University, Christchurch, New Zealand.
- Pangborn, M 2012, *Growth and innovation in the Canterbury dairy industry*, Lincoln University, Christchurch, New Zealand.
- Parker, WJ, Rauniyar, GP & Dooley, AE 2000, 'The future for the small dairy farm: plans, priorities and constraints', *Proceedings of the New Zealand Society of Animal Production*, vol. 60, pp. 241-246.
- Potter, C & Lobley, M 1996, 'Unbroken Threads? Succession and its Effects on Family Farms in Britain', *Sociologia Ruralis*, vol. 36, no. 3, pp. 286-306. <http://dx.doi.org/10.1111/j.1467-9523.1996.tb00023.x>.
- Santelmann, MV, White, D, Freemark, K, Nassauer, JI, Eilers, JM, Vaché, KB, Danielson, BJ, Corry, RC, Clark, ME, Polasky, S, Cruse, RM, Sifneos, J, Rustigian, H, Coiner, C, Wu, J & Debinski, D 2004, 'Assessing alternative futures for agriculture in Iowa, U.S.A', *Landscape Ecology*, vol. 19, no. 4, pp. 357-374. <http://dx.doi.org/10.1023/B:LAND.0000030459.43445.19>.
- Tocker, J, Shadbolt, N & Gardner, J 2005, 'Management information systems in two New Zealand dairy farm businesses of different scale', *Extension Farming Systems Journal*, vol. 2, no. 1, pp. 65-76.
- Westbrooke, V 2013a, 'Business options and strategies: a study of small herd owners views in the Waikato, New Zealand', *Extension Farming Systems Journal*, vol. 9, pp. 60-66.
- Westbrooke, V 2013b, *Future Farm Management Options for Smaller Dairy Farms*, Center for Excellence in Farm Business Management.