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Ko te Toi Whakahaere Pakihi Ahuwhenua
Centre of Excellence in Farm Business Management

Pilot study of a Mobile Milking System: An investigation of its potential use in New Zealand

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Executive Summary

The purpose of this project was to investigate whether there was a place in the New Zealand dairy industry for a mobile milking system (MMS). In a mobile milking system a movable milking shed is taken to the cows instead of the cows being milked in a permanent centrally-sited milking shed. Such systems are used overseas. It was believed that there could be a niche market within New Zealand, but it was also recognised that there are special challenges associated with the use of such a system. The aim of the project was to garner the impressions of such a system from potential stakeholders within New Zealand, as well as the experiences and ideas from a wider dairying community.

The project consisted of designing an information pack describing how the MMS operates and some of its possible uses, plus a comparative budget that proposed that a MMS system could return 14 per cent return on asset utilising leased land, while a "conventional" milking system, utilising owned land, returned 8.3 per cent for the targeted 200 herd size. The information pack is in Appendix A; the information it contains is not repeated in this report. This pack was then used to gain feedback regarding the following three areas:

a) the perceived need for a mobile milking system;
b) perceptions of its advantages, disadvantages and impacts;
c) and the management issues that may arise from the use of such a system.

Once the information pack was designed, five informants provided feedback on the pack prior to finalising and distributing 120 survey packs. An on-line survey was developed resulting in 66 responses. A further six interviews were carried out with farmers and regulatory bodies, including Fonterra, in order to gain greater in-depth knowledge of the issues surrounding the use of a Mobile Milking System.

Results

The on-line survey participants were mainly from New Zealand (52 per cent) and Great Britain (33 per cent). The response from Great Britain added an extra dimension to the survey as mobile milking systems have been used there, so their familiarity with its use provided insights into the operation and farming systems required. There was a bell curve representation of respondents' ages with a small tail for the 'under 20' and 'over 60' groups. The majority of respondents were from the dairy industry (76 per cent) with a good representation of positions within the industry. In general, participants had been in the industry for many years, for example, 30 per cent had been in farming for 11-20 years and 39 per cent for over 20 years.

With 95 per cent of respondents either 'agreeing' or 'strongly agreeing' that the MMS could be used to milk on leased land, as well as offering a temporary solution when conventional cowsheds are unavailable, the survey indicates positive support for such a system. Three quarters of respondents also considered that it would provide a relatively cheap stepping stone into farm ownership. This indicates a belief in its potential to fill a niche market. Most respondents (between 61 and 75 per cent) believed that the problems associated with the use of a MMS could be overcome.

The participants of the in-depth interviews, farmers and representatives from industry bodies, also believed that the MMS offered opportunities to innovative farmers. Those associated with dairy regulations believed that such innovation should not be stifled, and the problems identified with the system could be overcome.

Future of the MMS

The MMS is of interest as a means for new farmers to enter the dairy industry via land that is currently in other use, such as in cropping or on sheep and beef farms. This land could be leased making the whole system much more attainable for young farmers. The major negative issues involve effluent and milk collection; however Environment Canterbury (ECAN) and Fonterra see these as resolvable. There are potential benefits for animal welfare where walks to the shed could be long, while the use of the MMS as a means to provide an emergency milking system due to weather, maintenance or delays in building new sheds offers a small, yet important, place for the MMS in the New Zealand dairy industry.

The potential of the use of an MMS to aid succession was an interesting advantage identified by a sheep farmer. He believed that using an MMS would allow his son to create a second business. This would have aided farm succession, as both parties could have remained on the farm, creating their own income. All the respondents interviewed recognised that farmer innovation could result in multiple uses for a MMS, and also overcome the potential problems.

Recommendation from project participants

ECAN, Fonterra and the interviewed farmers believe that the way forward is to construct a prototype MMS to allow full evaluation of such a system over a test period. Given the positive support from the survey results, it is consequently recommended that a 20-aside demonstration MMS system be built and trialled over a two year period with input from the regulatory bodies to establish best practice for such a system. Protocols for measuring the system's performance should be established at the beginning of the project

1. Introduction

Dairy farming in New Zealand is changing. Both farm size and herd size are steadily increasing (LIC, 2011). While farm conversions in the South Island are continuing due to increased irrigation and favourable dairy prices, the increase in the capital required to attain farm ownership makes such a goal less achievable for young farmers. In addition, the traditional pathway of farm assistant, to farm manager to sharemilker to farm owner is changing (Allen & Waugh, 2012). There is a need to find alternative pathways.

Once a permanent dairy shed is built, the associated land then becomes 'dairy bound'. In addition to the ever-rising land prices, the large capital costs associated with dairying infrastructure make the purchase of a dairy farm prohibitive for young farmers.

Glen Herud has a Lincoln diploma and was raised on a dairy farm. After going into business he returned to Canterbury and became interested in getting into dairying. He was looking for ways to progress with a lower capital requirement than the traditional pathways. He came across the concept of a MMS on-line and believed it had the potential to offer an alternative pathway into dairying. Consequently, he approached Lincoln University to discuss its potential and this project arose out of these discussions. A Mobile Milking System offers a possible option for a niche market within the industry. Land use remains more flexible as a dairying infrastructure is not required to the same extent, and the actual milking shed itself can be sold off in the future. This system is used overseas, for example, in the Netherlands where a farmer may have several small separate areas of land making up the dairy farm, or in the UK on leased land[5]. It has yet to appear as part of the New Zealand dairy industry.

This pilot investigation of the MMS was designed to provide preliminary information about the scope of, and need for, such a system in New Zealand. The purpose of this project is to determine whether it would be worth building and trialling a prototype mobile milking system.

2. Methods

A survey pack was developed (see Appendix A) by the researchers and reviewed by five industry representatives to ensure accuracy and clarity. The survey pack, once edited, was then distributed via email or hand delivered to a total of 120 survey participants, with an on-line survey providing the feedback mechanism. The information was also released on Tom Phillip's blog[6] and some of the Young Farmer groups in the Canterbury area were also surveyed.

It was originally hoped to be able to access larger databases, but due to privacy issues, timing problems and the cost, this was not possible. However, the release of 120 MMS information packs and subsequent completions of 66 on-line surveys was considered sufficient to give an indication of support or otherwise for the innovation.

Six in-depth interviews were also conducted. Interviews with a sheep farmer and an existing Southland dairy farmer were used to gain an indication of the differing perceptions between farmer groups. Interviews with people from Environment Canterbury, the Foundation of Arable Research, AsureQuality and Fonterra were carried out to ensure that any regulatory issues were identified and possibly resolved.

[5] See http://www.itv.com/news/westcountry/2012-05-16/meet-the-farmers-with-the-mobile-milking-parlour/
[6] Tom Phillips is dairy industry consultant and a senior tutor in farm business management at Massey University. See http://www.onefarm.ac.nz/community/blogs/tom-s-blog/show/1

3. Survey Results

There were two methods used to gain participants' responses; online survey and in-depth interviews.

3.1. On-line survey

The questions asked in the on-line survey are provided in Appendix B. From the 66 responses, 52 per cent were from New Zealand, 22 per cent from Great Britain and the remainder from other European countries plus one from Chile. The age of respondents were spread from less than 20 years old to more than 59 years old. Thirty-two per cent were in the 20-29 age group, with 12-13 per cent for each of the next three decades. Eighty-two per cent were males. Seventy-six per cent were associated with dairying and the remainder were spread across sheep and beef (14 per cent), arable and mixed farming.

The predominant 'current position' was farm owner (33 per cent) with the remaining respondents covering a wide range of backgrounds. These included farm assistant, herd manager, 2IC, farm manager, sharemilker and equity partner on the farm. Off-farm respondents included students, consultants and a dairy scientist. The majority (69 per cent) of the respondents had been involved in farming for over ten years. (See Appendix C for the full on-line demographic results.)

Very strong support (95 per cent for 'strongly agree' plus 'agree') was given to using the MMS on leased land and as a temporary solution to filling the gap on farms when the permanent shed cannot be used and the only option is to send cows out to other herds. Over two thirds showed support for using a MMS to trial milking on a sheep farm and as part of a pasture rotation on an arable farm. Other suggestions included that it could be used to expand an existing dairy operation where the facilities meant there were long walking distances for the cows or on run-off blocks. One respondent suggested that it might be useful to use on more distant land in instances of feed shortages such as drought. Another respondent recognised potential for health reasons (perhaps where there was an outbreak of salmonella, for instance). It is also seen as having potential use for research situations. Table 3.1 provides the full results of the on-line survey with further suggestions in Appendix C.

Table 3.1 Respondents' views on the use of a mobile milking system

7	Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Respon-ses	Mean
1	It could be used to milk on leased land.	53%	42%	3%	2%	0	61	1.54
2	It could be used by a sheep farmer to trial dairying.	30%	34%	18%	15%	3%	60	2.28
3	It could be used on arable farms as part of the pasture rotation system (instead of running sheep).	35%	35%	11%	18%	1%	61	2.18
4	It could be used as a temporary solution when cowshed building or replacement gets behind schedule (e.g. conversions running over time)	58%	37%	3%	2%	0	60	1.48
5	Other potential use - please specify						8	1.38

Three quarters of respondents believed a MMS would provide a relatively cheap stepping stone unit for someone aiming at farm ownership while 93 per cent could see it enabling the use of leased land to be used as a dairying platform. Only half agreed that it had potential to provide the option for a dairy farmer to become a mixed farmer to utilise nutrients better but it may be more likely that an arable farmer would make use of a MMS as part of his rotation. One suggestion that was not previously considered was to use a mobile milking shed in conjunction with a permanent shed on particularly large or long farms. Certain parts of the farm would be milked using the temporary shed and the milk transported back to the standard facilities. A further option is for a large scale farm to use the MMS for a second herd, whether for health or fertility reasons. With some farms moving part of the herd to OAD milking after the peak of the season for fertility reasons, the smaller OAD herd could be milked off the run-off. Table 3.2 provides the full results of the on-line survey with the additional suggestions, which mainly related to the benefits of using a MMS in the early stages of a conversion, in Appendix C.

Table 3.2 Respondents' opinions about the possible advantages of a MMS

8	Question	Strongly Agree	Agree	Neither Agree nor Dis-agree	Dis-agree	Strongly Disagree	Respon-ses	Mean
1	It would provide a relatively cheap stepping stone unit for someone aiming at farm ownership.	14	29	11	4	0	58	2.09
2	It would enable the use of leased land which is not set up for dairying to be used as a milking platform.	22	31	2	2	0	57	1.72
3	It would provide an opportunity for a dairy farmer to become a mixed farmer - milking from part of his farm one year and growing fodder crops on the rest, then swopping - utilising effluent better.	10	19	16	9	3	57	2.58
4	It can be used as an interim shed for emergency use.	20	32	5	1	0	58	1.78
5	Other advantage - please specify:						4	1.25

Close to two thirds of respondents also believe that the problems of effluent and milk supply compliance, pugging of wet ground, and the need for the provision of some sort of yarding system, can be overcome with one commenting that "*none of these issues will prove insurmountable to innovative people*". Additional comments from respondents included the suggestion that the MMS is not big enough for modern large scale dairy farms but it is not intended to fill this role. Another was concerned about the efficiency of labour which would depend upon the design of the shed and its ease of set-up and moving. While some respondents recognised that this system would offer a challenge in some aspects of herd management, the MMS is only intended for smaller sized herds where this would be less of a problem. Table 3.3 provides the full results of the on-line survey with the additional suggestions in Appendix C.

Table 3.3 Respondents' opinions on whether the disadvantages of a MMS could be overcome

Q.9	Question	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Respon-ses	Mean
1	Damage to productive land when wet due to cows standing waiting to be milked.	22%	46%	20%	9%	3%	57	2.25
2	Meeting effluent disposal requirements with Regional Councils.	28%	33%	25%	14%	0	57	2.25
3	The requirement for a (mobile) yarding system for holding cows for AI etc.	26%	49%	14%	6	11%	57	2.09
4	Milk companies conditions of supply e.g. not collecting milk which has initially been transported in a mobile milk tanker.	19%	46%	26%	9%	0	57	2.25
5	Other disadvantage - please specify:						7	1.86

The final question of the on-line survey asked respondents for suggestions of solutions to some of the problems. Several respondents had considered the pugging problem and made suggestions ranging from using raised metal pads or light mats of some kind, considering the siting of the MMS to allowing the cows to come in as they appear, then rounding up the remainders towards the end of milking. It is apparent that there are many possible innovative solutions for each main problem that need to be explored once a prototype is developed. All the suggestions are provided in Appendix C.

3.2. In-depth interviews

The stakeholder Interviews were conducted and reported by Glen Herud.

Six in-depth interviews were conducted with:

- Environment Canterbury (ECAN)
- a sheep/stud farmer
- Foundation for Arable Research (CEO)
- AsureQuality
- milk quality advisor (Fonterra)
- an existing dairy farmer (Southland).

Interview 1: Sheep farmer/stud breeder

This farmer felt that the system had the potential to enable sheep/beef/cropping farmers to increase their farms' turnovers. The financial benefits of dairying are undeniable and if a farmer could milk cows on their land without completing a full dairy conversion, then that would be of interest to many farmers.

He felt that it would have to be well proven before he would consider the system and felt most farmers would feel the same.

He also felt there would be difficulty sorting AB or sick cows out of the herd and wondered how penicillin cows can be kept separate.

He considered this was definitely the most environmentally friendly way of milking cows as there is no effluent being collected and stored that can potentially be discharged incorrectly. He has had a number of occasions where his neighbouring dairy farmer has had effluent flowing into their shared stream as a result of human error and mechanical breakdown of the effluent system. He felt that this system will eliminate this risk.

Having just gone through the farm succession process, he felt that any way a sheep farmer can increase the cash flow of their farm will help a lot with passing the farm down to the next generation. They had the problem of their farm not having enough cash flow to support both himself and his son. So they sold the farm to a dairy farmer. A small dairy operation would have been able to generate enough profit to produce the extra income needed to support both parties.

Interview 2: Environment Canterbury

Environment Canterbury said that dairy farmers need two types of resource consent:

1) consent to draw water/irrigate and

2) consent to discharge effluent.

The environmental officer reviewed the information booklet and his main concern was around the level of effluent that would accumulate in the paddock as the cows wait to enter the cowshed. The operating of the system was clarified by explaining that the effluent issue is solved by only milking 200 cows, by moving the cowshed after every milking, and by ensuring that the cows are not milked in the same spot in any year. The environmental officer said that "he did not think we would require resource consent to discharge effluent at all, because we are not collecting effluent and then spreading it".

The environmental officer suggested that the probable way forward would be to run the system for a season and to monitor the amount of effluent collected in the cow waiting area by laying down a type of rubber mat, etc. He suggested that a set of guidelines be developed on how and where to operate the system from an environmental perspective. This document would cover areas such as:

- Where the shed is not to be used, such as on a riverbank where effluent run-off is greater.
- That the cowshed needs to be moved after every milking
- How waste water from the wash is dispensed onto the land after milking

The environmental officer suggested that we need to breakdown every aspect of the system and have a plan for how each risk is managed, minimised or eliminated, as well as provide some data as to the amount of effluent discharged from the cows in the waiting area. If these are in place he felt that there would be no issue from ECAN's perspective that would "prevent the use of the system as it stands today".

He felt they may require that a yearly check is conducted, as currently happens with all dairy farms anyway.

He said there are some further positives to the system as the amount of water used to wash the cowshed will be considerably less than a conventional dairy farm, simply because we will not be hosing down a yard or have a water driven backing gate or a pre cooler that uses bore water. He considered these aspects to also be an additional advantage of the system, over and above the environmental ones.

I explained that this system will allow a sheep/beef/cropping farmer to integrate a 100 cow herd into their current farming system. Rather than confine the cows to a single 30 ha area (3 cows/ha). They could then rotate the herd around their entire farm over multiple years by moving the cows to a new 30 ha area every year. It is conceivable that it could take over five years for the herd to return to their original 30 ha block. This will essentially mean that the cows stocking rate is very low and therefore the nutrient loading a lot less.

The ECAN environmental officer felt that this type of diversified dairy farm would have environmental benefits.

Interview 3: Foundation for Arable Research - CEO

The CEO had already thought of the idea of a mobile milking system and has talked briefly with Winslow about a mobile robotic milking system. He felt that the concept of dairy cows being integrated into a cropping farming system had environmental advantages and financial advantages.

He said that a typical cropping farmer grew ryegrass and clover seed crops as well as wheat. He felt that once the farmer had harvested the ryegrass and clover seed, they could milk cows on that block for a season or two. Once the cows have moved off to a new block, the farmer would plant wheat into the ryegrass/clover stand that the cows had been grazing. Wheat is a crop that requires a lot of nitrogen and has a deep rooting system that can reach a depth of 1.5 metres. The wheat would take advantage of the nitrogen deposited by the cows in the previous seasons. This works well as it is plausible that the farmer would not need to apply nitrogen fertilizer to the wheat crop, as is usually done, because the wheat is utilising the nitrogen in the soil.

This system has the potential to reduce the nitrate leaching that can occur in an intensive dairy system. By moving the cows onto a new grazing block and planting the old block into wheat. The farmer is utilising the benefits of both farming classes so that they are mutually beneficial.

He felt that there would be a great deal of interest from cropping farmers in this system but said that it would not be adopted until it has been well proven[7].

He also said that cropping farmers would not be interested milking cows and would prefer to either employ a milker or have a sharemilker involved. A further possibility is for 2-3 cropping farmers to join together and share the cost of the cowshed infrastructure and employ a sharemilker who would milk cows.

Interview 4: Dairy Assessor - AsureQuality

I met with two AsureQuality assessors to discuss how the mobile milking system complies with the NZFSA regulations.

The cowshed has to comply with the standards set out in NZCP1: Code of Practice for the Design and Operation of Farm Dairies. The standard covers all areas of the construction of a cowshed and the operation of the cowshed to ensure that the milk harvested is safe for human consumption. The standard covers areas such as location of the cowshed, construction, plant cleaning, milk cooling etc.

After discussing the system at some length their main concern was the potential mess that could be made by the cows in the waiting area at the rear of the cowshed. They pointed out that excessive mud can be an issue from a food safety perspective and measures should be taken to ensure that mud is not a problem. They also wondered as to where the waste water from the plant wash will be deposited and were unsure if the alkali detergent will affect the grass.

They both said that the standards are not there to inhibit innovation and that the intent of the standards is to be taken into consideration. An example of this is:

> **6.1 Floors, Yard Surfaces and Races**
> All the floors of a farm dairy (i.e. in the milking, milk receiving, and milk storage areas, yards and associated storerooms and offices) shall be made of concrete or a similar impervious material. These floors and yards shall be uniformly graded, be able to be readily cleaned after every milking, and have a fall to allow drainage to approved outlet points.

The regulations are written in the context that a cowshed is a building and it was never envisaged by the authors that a cowshed would be mobile. The intent of the regulation 6.1 is to ensure that all floors etc. are able to be cleaned after every milking and the milk/effluent etc. is able to be disposed of correctly.

I was able to show them how the mobile cowshed does in fact comply with all NZCP1 standards. They did point out that they would have to wait until the final inspection is completed before they could be 100% sure that the system complied with the regulations. But on the information I provided to them they were able to say that there were no major issues that would prevent the system from complying.

[7] A Southland farmer currently collects effluent from his wintering sheds and applies it to an arable block which grows successive silage and grain crops, which are then fed back to the cows.

Interview 5: Milk Quality Advisor - Fonterra

After my meeting with AsureQuality, they introduced me to a milk quality advisor who is Fonterra's Milk Quality Advisor. I have had a few phone conversations with the milk quality advisor over the past year, so he is aware of the system.

Brent outlined that the system would be required to operate on land that does not have DDT levels over the minimum levels specified by Fonterra and water quality test must also pass their quality tests.

As far as the mobile system is concerned he felt that it would fit within Fonterra's current Template Risk Management Plan, which is in line with the advice we received from AsureQuality. He said "that if, in the future any changes need to be made to their RMP they are quite happy to make them in order for the system to comply".

He said that "they are not against innovation and do not want the regulations to get in the way of new ideas".

Interview 6: Dairy Farmer - Southland

The farmer owns a 350 cow dairy farm in Southland. He felt that the system would not replace the standard rotary or herringbone cowshed but is an option that would suit some farmers. He felt that the ability to milk off his run-off would be beneficial as it would allow him to extend his lactation and possibly milk off his run-off in the spring.

He felt that this system would be ideal for farmers who had marginal land that did not warrant building a permanent cowshed or farmers who had an odd-shaped farm which meant cows had to walk long distances.

The biggest challenge he felt was getting farmers to change their mind set around what a dairy farm is and how cows can be milked and managed. He felt if farmers can be open about the mobile system there would be countless ways it could be applied to different farming systems.

He said "that the system must be simple to set up and operate as dairy farmers would want to have staff able to use the system". A standard cowshed is very easy for staff to operate as they just start the milking machine and make sure the milk line is hitched up. The mobile system is much more complex and would require more thought from an operator to run the system correctly. So staff would have to be experienced dairy workers.

He told me about a dairy farmer in Southland who has a 50 cow dairy farm operating in a home built cowshed located in a paddock. They are currently supplying Fonterra. So it would appear that they have been able to meet the appropriate regulations.

4. Discussion and Conclusion

4.1. On-line Survey

Although the data set was relatively small, there was a high level of agreement that the MMS has merits and would, along with other potential uses, provide a means of allowing young farmers an alternative path to enter the industry. The respondents also identified some of the regulatory conditions that may prevent such a system being able to be adopted by the industry but around two thirds of them believed that these issues could be overcome. There was agreement that the major issues would relate to effluent disposal and milk collection from a mobile system. The other main issues were seen to be potential pugging of the area where the cows wait to be milked and the problem of separating out cows for AI or mastitis treatment etc. However, some respondents offered suggestions that may reduce or solve these problems.

Some respondents commented on the need for a trial to be conducted to demonstrate the practical use of a MMS and so that guidelines could be developed to ensure that regulatory requirements can be achieved.

4.2. In-depth Interviews

A cross section from regulatory bodies, researcher organisations and farmers gave a snap shot of industries' views on the MMS. The regulatory bodies were willing to work with such a system and to work around regulations that had never anticipated that a dairy shed could be mobile. Some of the regulations would not apply to such a system if well managed. All participants felt a model farm operation was required to trial the system in order to develop best practice guidelines on its operation. The environmental concerns relating to traditional systems of effluent disposal could be minimised with a MMS. This reduction in effluent disposal and the reduced wash-down water requirement were seen as major advantages for the system. Its cheaper capital cost and flexibility would allow it to be used for a couple of years and then sold.

The need for these systems, while conventional sheds are being constructed, repaired or are unavailable was also recognised as a distinct niche for the MMS. Some respondents commented on the possible synergies in combining dairying with cropping as an efficient way to recycle nitrogen. For example, a MMS would allow a sharemilker to milk across several cropping farms. The sheep farmer also saw potential to use a MMS to incorporate dairying with sheep and beef to increase income streams to aid succession.

4.3 Recommendations

1. That a prototype of a demonstration 20-aside mobile milking system be constructed and trialled over a period of two years.

2. That the protocols for monitoring the performance and measuring the success of the mobile milking system be established at the planning stage of the project.

3. That the demonstration farm works closely with the legislative/ regulatory bodies to determine best practice for operating such a system.

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Appendices

Appendix A: Mobile Milking System information pack

Mobile Milking System

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Executive Summary

The Mobile Milking System is a dairy farming system that utilises a portable herringbone cowshed. The system enables farmers to set up a flexible dairy platform and milk cows at a fraction of the cost of a traditional dairy farm. The cowshed moves after every milking and can be transported on public roads easily.

The intention of this document is to gauge from farmers, industry professionals and other stakeholders their thoughts about such a system. We hope to create some discussion about the system's feasibility, and its application and appeal in the NZ dairy industry.

Currently, the only way a farmer can milk cows and benefit from the high commodity prices is to buy suitable quality land, dairy cows, dairy company shares and build a cowshed and the associated infrastructure.

This infrastructure is a significant expense costing anywhere from $1M to $2M depending on the size of the intended milking herd. Therefore, farmers would only invest this amount of capital on land that they owned. The idea is that a mobile milking shed can be used on leased land, so the farmer saves the significant cost of purchasing land and the cost of a permanent milking shed. The reality has been that a dairy farm conversion is a significant undertaking that is irreversible and requires a farmer to have significant equity.

The system allows:

- **Farmers to milk off leased land** as it eliminates the requirement to own land in order to set up a milking platform
- **Sheep/Beef/Cropping farmers to temporarily and cheaply convert their farm to dairy** since the main infrastructure asset (the cowshed) is mobile and the infrastructure required to operate this system is minimal. In the future, the farmer can simply change the land use of their farm again without "mothballing" significant assets and therefore suffering a major financial loss
- **Dairy farmers to milk off their support land**

  Dairy farmers could extend their herds' lactations by milking off their support land, thereby increasing profitability. Dairy farmers could simply just decide to turn their support land into a milking platform.

The Mobile Milking System has the potential to:

- Increase milk production in New Zealand by utilising leased land and non-converted land
- Offer entrants to the dairy industry an alternative method of progression
- Provide a dairy system with greater animal welfare attributes
- Provide farmers with a system that generates a greater return on assets.

How Does the System Work?

System Components

1. Central Point

The central point is a part of the farm where the milk tanker will collect the milk. This area will contain:

- Concrete pad & concrete platform
- Main milk vat approx 12,000 l (situated on the concrete platform)
- Refrigeration unit to keep milk at 4 degrees
- Small building/6 m container
- Hot water cylinders (for washing both main vat and portable vat)
- 300 l tank for vat washes
- Drainage facility for waste water
- 1000 l waste water disposal tank with sprinkler/spreader
- Water bore and pump for stock water
- 9000 l water tank

2. Mobile Milk Room

The mobile milk room is the trailer that will house most of the milking machine components required to run the cowshed and wash the cowshed. The milk room will be a trailer or a flatbed truck with the four sides enclosed so as to keep the wind rain and dirt out. During milking the milk room will be park directly beside the cowshed and the milk lines attached. After milking the milk room is driven back to the central point.

- The milk room will contain:
- A diesel generator (or use a PTO generator mounted on the cowshed)
- 3000 l milk vat
- Refrigeration unit (to cool the milk in the vat)
- Plate cooler (heat exchanger)
- Instant water chiller and 200 l water tank (circulate water through plate cooler)
- Milk filter
- 250 l water tank (for washing the milking machine both hot & cold wash)
- 100 l water tank fed by cooler water (used for shed wash down)
- Wash down pump
- Vacuum pump
- Gas hot water heater attached to 300 l hot water tank (for hot wash of milking machine)
- Stainless steel milk line

3. Mobile Cowshed

The mobile cowshed is the structure that will hold the cows while they are milked. This cowshed will resemble a standard herringbone cowshed seen on traditional dairy farms, only it will be mounted on wheels and be portable.

The cowshed will contain approx 20 sets of cups. Once milking is finished the machine will be washed (hot and cold in the morning and cold in the afternoon). The cowshed will move approximately 20-50 metres to the next milking spot after every milking. The cows will walk onto and off the platform via steps at the rear and front of the shed.

4. Water System

The water system will consist of a 9000 l tank filled by a bore at the central point. The tank will feed a 40 mm low density polythene pipe, laid above ground and will run down the centre of the block of land, under a semi permanent waratah fence. At regular intervals (approx. 50 m) there will be an outlet, which will feed the water trough.

Stock water

There will be 7 x 600 l plastic water troughs mounted onto skids. At the start of the week the troughs for the coming week will be placed in the approximate area that they will be needed. The trough will be attached to one of the outlets on the main stock water line by a pipe with a quick hitch male/female coupling.

Milk Pre-cooler

The milk pre-cooler will have a 200 l water tank attached to an instant water chiller unit. The water will be circulated through the plate cooler. The instant chiller unit is capable of cooling the water to 4 degrees in a single pass, much like an instant gas hot water heater except it cools rather than heats.

5. Fencing

Fencing will vary depending on the property shape. For a simple square block the fencing will comprise a single wire attached to the existing boundary fence. This is to ensure we have a good power source right around the farm. The block of land will also have a single wire waratah fence dividing the block in half.

The daily feed allocation for the cows will be separated by portable electric fence reels and standards. The portable fence will take its power off the boundary wire. Due to the simplicity of the fencing layout there will only be a small number of fences up at any time.

Mobile Milking System Process

1. Farmer arrives at the Central Point (CP). Drives Mobile Milk Room (MMR) out into the paddock where the Mobile Cowshed (MC) is and parks alongside the cowshed.
2. Farmer calls the cows.
3. Attaches milk line, air line and power cord from MC to MMR.
4. Attaches cooler inlet and outlet pipes to the MMR. (These lines are from the stock water system)
5. Farmer begins start up check list which entails starting the generator, turning on lights and gas hot water heater, starting vacuum pump, ensuring filter is in place and milk line is attached to the vat.
6. Cows will have begun walking to and gathering around the entrance of the platform by themselves. Farmer runs a portable electric fence loosely around the cows at the entrance of the cowshed. This is to ensure they trailing cows don't wander off back into the paddock.
7. Farmer begins applying cups.
8. During milking the farmer may need to have a quick wash down of the cowshed. The small washdown pump will be turned on by a switch in the pit area and the platform washed down.
9. Once the last cows have been milked, the cups are attached to the jetters which are attached to the milkline.
10. Disconnect the milk line from the vat.
11. The milking machine is then rinsed with approximately 20l/set of cups of cold water. This done by filling the 250 l tub with cold water. The tub has a pipe located at the bottom of the tub which is attached to the milk line it is attached to a tap. The tap is opened and water is sucked out of the tub and through the entire milking machine including the cups.
12. The rinse water is dumped after the rinse via the filter outlet.
13. The tub is filled with hot water at 80 to 90 degrees and detergent is added. The plant needs 10 l of hot water /set of cups. This water is circulated through the machine including the cups for 10 minutes or until the temperature drops to 70 degrees.
14. The machine is then given a quick cold rinse with acid detergent which sanitises the plant during the day.
15. After the wash is complete the MMR is disconnected from the MC.
16. The MC is towed by the tractor 20 to 50 m to the far side of the cows' current break and parked ready for the next milking.

17. The trough for the next break is moved into the desired position and the ball cock is activated so the trough will fill up.
18. The MMR is then towed back to the CP.
19. The milk is transferred from the portable vat into the main vat, where it will be picked up by the milk tanker daily.
20. The portable vat is then given a cold rinse using water from the CP tub.
21. The portable vat is then given a hot wash using water from the CP hot water cylinders.
22. The MMR is then parked up and ready for the afternoon milking.

- The target is to complete this process in 2-2 ½ hours. 200 cows/20 cups =10 rows. 10 min per row=100 min (1.6 hrs) of actual milking and 20 minutes to complete the wash and move the shed to a new location and wash the portable vat.
- In order to achieve this every component must be designed to be easy to use e.g., quick hitch systems.

Financial Analysis

A brief financial analysis has been conducted to determine the costs involved, and the likely profitability of such a system. We hope this generates further suggestions about the system.

Table 1. Setup costs for a 200 Cow Mobile Dairy Shed		**$**
Cowshed	Cowshed structure	100,000
	Electrician/Lighting	10,000
	Wash down pump	2,000
	Wash down hose	1,000
	Teat spray unit	2,000
	Milking plant	60,000
	Portable vat (4,000 l)	5,000
	Vat trailer/milk room	10,000
	Generator	10,000
		200,000
Central Point	Concrete pad	3,000
	Drainage	2,000
	Hot water cylinders	4,000
	Chiller unit	3,000
	Shed/container	4,000
	Electrician	3,000
	Wash down pump etc.	1,000
	Waste water disposal	3,000
	Power from road	10,000
		33,000
Other improvements	Stock water	30,000
	Fencing	5,000
	Tracks	15,000
		50,000
TOTAL		**283,000**

Table 2. Total investment in farm system on leased land		
Dairy shed and improvements	$283,000	
Vehicles and machinery	60,000	
Fonterra shares (80,000*$4.52)	361,600	
Cows (200 * $2,000)	400,000	
TOTAL	**1,104,600**	**$13.81 per kg MS**

Table 3. Budget for 200 cows on fully irrigated land in Canterbury versus Canterbury average		
	Budget	Cant. average
Number of cows	200	377
kg MS per cow	400	433
Effective hectares	66	134
Stocking rate (cows/ha)	3	3.3
Total kg MS	80,000	300,000
Payout ($/kg MS)	$6.16	$6.16
	$ per kg MS	
Milk income	6.16	6.16
Stock income	0.30	0.33
Farm working expenses	3.70	3.50
Operating surplus	2.76	2.99
Lease ($1,000/ha)	0.82	0.14
Debt servicing		1.02
Total assets	13.81	34.86
Return on asset	**14%**	**8.3%**

Since the proposed system relies on leased land rather than owned land, the financial analysis demonstrates that a very high return on investment can be achieved. This is because the relative return to land in agriculture is quite low (3-4%), however a farmer who leases land does not benefit from capital gain which can be considerable at times. In order for this mobile shed system to be appealing, its cost of construction needs to be considerably lower than a traditional dairy shed of the same size.

One can assume that the income and cost of production (FWE) are similar for a mobile versus traditional system, and that the major difference is in the capital cost of the dairy shed itself, and whether land is owned or leased. Therefore the proposed mobile system may offer opportunities for young farmers and new entrants into the dairy industry with limited capital.

Benefits of the Mobile Milking System

- Allows farmers to set up a milking platform at a much lower cost
- Can be used on leased land, therefore further reducing setup costs
- Land can be "converted" to dairy and then the conversion can be reversed and virtually no cost at a later date
- Allows farmers to share the infrastructure therefore further reducing the setup costs

Animal Friendly

Because the cowshed moves from paddock to paddock with the cows, the cows are not required to walk very far to get to the cow shed. This aspect will lower the rate of sore feet as a health issue on farm. As it does not require a cow to walk up to 12 km in a day (which is common in NZ), milk production may be higher. DairyNZ have calculated that a cow can produce about 30 kg ms/year extra simply from the energy saved from walking to and from the cow shed twice a day.

The traditional methods of progressing in the industry are changing

The mobile system gives farmers another option to help them progress in the industry. Farmers who would normally go sharemilking or become an equity manager have the option of setting up a Mobile System. The system can be set up to milk 100 cows profitably as an owner operator or it can be expanded to milk larger herds using multiple mobile cowsheds.

There are a range of possible scenarios that people wanting to begin a career in dairying can structure using the mobile system, for example:

- Sheep and beef farmers can set up a system on their farm and employ a sharemilker
- A farmer can lease a block of land and milk off it
- Existing dairy farmers can now milk off their run offs
- Young farmers can form a joint venture with a land owner to set up a mobile system, potentially requiring little or no money up front

Who Will Want To Use The Mobile Milking System?

The main domestic market is:

- Dairy farmers, or would be dairy farmers, who do not own land and want to build a career in dairy, providing an alternative to the current progression model
- Sheep and beef farmers who see the potential to "soft" convert a portion of their farm and realise the extra cash flow the system offers – the conversion can be reversed at a later date
- Current dairy farmers who would like to milk off their support blocks
- Marginal land that does not warrant the large capital outlay to convert can now be utilised at a fraction of the cost
- Dairy farmers who can now milk off part of a neighbour's property
- Lifestyle block owners can use smaller models to gain extra income
- Dairy farmers whose conversions or cow shed rebuilds get behind schedule.

There is a potential for international markets:

- In emerging dairying countries such as Chile, Uruguay, Brazil, China and India the potential exists to create a range of mobile systems (including small micro systems) that fit these countries' growing dairy industries. Low set up costs will be a big advantage in these markets.

Appendix B: Online survey form

Questionnaire for the Mobile Milking System

Section A: All about you

1. What is your age group?

Less than 20 years	
20-29 years	
30-39 years	
40-49 years	
50-59 years	
60 + years	

2. Are you: Male Female

3. What sort of farming are you currently associated with?

Dairy Sheep and beef Arable Mixed

Other - please specify

4. What is your current position?

Farm owner Farm manager Farm Assistant Share milker

Equity partner Other - please specify

5. How many years have you been involved in farming, in total? ..... years

Section B: Your views on the use of a mobile milking system

Here are some statements about the ways in which a mobile milking system might be used. For each statement, think of the practical implications for each situation, then please rate your agreement or disagreement by ticking the appropriate box on the scale provided.

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.	It could be used to milk on leased land.					
2.	It could be used on a sheep farmer to trial dairying					
3.	It could be used on arable farms as part of the pasture rotation system(instead of running sheep)					
4.	It could be used as a temporary system when cowshed building or replacement gets behind schedule (eg conversions)					
5.	Other use– please specify					

Here are some possible advantages in using a mobile milking system. For each statement, please rate your agreement or disagreement by ticking the appropriate box on the scale provided.

	An advantage of a mobile milking system is that:	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6.	It would provide a relatively cheap stepping-stone unit for someone aiming for farm ownership					
7.	It would enable the use of leased land which is not set up for dairying to be used as a milking platform					
8.	It could provide an opportunity for a dairy farmer to become a mixed farmer – milking from part of his farm one year and growing fodder crops on the rest then swopping – utilising effluent better					
9.	It can be used in emergencies or as an interim measure when an existing shed is unavailable or not completed.					
10.	Other advantage– please specify					

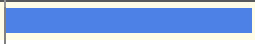
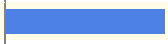
Here are some of the possible disadvantages in the mobile milking system. For each statement consider whether you think the problem could be overcome and rate you agreement or disagreement by ticking the appropriate box on the scale provided.

	I think that this issue could be overcome:	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
11.	Damage to productive land when wet due to cows standing waiting to be milked					
12.	Meeting effluent disposal requirements with Regional Councils					
13.	The requirement for a (mobile) yarding system for holding cows for AI etc					
14.	Milk companies conditions of supply e.g. not collecting milk which has initially been transported in a mobile milk tanker					
15.	Other disadvantage– please specify					

16. Please use this space to outline any solutions to the problems identified, changes to management systems that might make this system work better or different ways of using such a system that we have not identified.

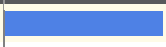
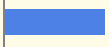
Appendix C: On-line survey results

1. In which country is your farming connection?

#	Answer		Response	%
1	New Zealand		34	52%
2	Australia		1	2%
3	Great Britain		22	33%
4	Other European country		5	8%
5	South Africa		0	0%
6	Other - please specify:		4	6%
	Total		66	100%

Other - please specify:
New Zealand & The Netherlands
Chile
France

2. What is your current position?

#	Answer		Response	%
1	Farm owner		22	33%
2	Farm manager		6	9%
3	Farm assistant		5	8%
4	Sharemilker		4	6%
5	Equity partner		2	3%
6	Not working on a farm		13	20%
7	Other - please specify:		14	21%
	Total		66	100%

Other - please specify:
6 x student
Part Time 2IC / Assistant Manager
Tenant Farmer
Herd Manager
Dairy scientist
2 x Consultant

3. What age group do you belong to?

#	Answer		Response	%
1	Less than 20 years		5	8%
2	20-29 years		21	32%
3	30-39 years		13	20%
4	40-49 years		13	20%
5	50-59 years		12	18%
6	More than 59 years		2	3%
	Total		66	100%

4. What gender are you?

#	Answer		Response	%
1	Male		54	82%
2	Female		12	18%
	Total		66	100%

5. What sort of farming are you associated with?

#	Answer		Response	%
1	Dairy		50	76%
2	Sheep and beef		9	14%
3	Arable		1	2%
4	Mixed		3	5%
5	Other - please specify:		3	5%
	Total		66	100%

6. How many years have you been involved in farming, in total?

#	Answer		Response	%
1	Less than one year		2	3%
2	1-2 years		4	6%
3	3-5 years		8	12%
4	6-10 years		6	9%
5	11-20 years		20	30%
6	More than 20 years		26	39%
	Total		66	100%

Q.7 Other potential uses for a MMS identified by respondents:
Natural disaster
Cheaper option for someone starting out
Expand existing dairy unit where facilities and walking distances are at there max
Disease movement restrictions on out wintering blocks
2 locations of use at housing badly located & central of platform
Research on farm
Reduce walking on large farm
Used on land not walkable by cows during periods of shortage or to increase stocking rate
To reduce walking time, or to better use of far away paddocks with difficult access especially in large farm. If separated milk collections are required (i.e. by healthy reasons) a mobile system can be leased to allow splitting the herd and reduce risks.

Q.8 Other advantages of a MMS identified by respondents:
It could be used by industry bodies to investigate conversion opportunities on land otherwise thought as unsuitable for dairy
Could be used for 1 or 2 seasons as part of building a herd that may then be milked through a static parlour. Could be used as the first couple years of a conversion to dairy as money is made to put in the infrastructure
Probably represents a lower risk investment compared with a definitive milk platform. Can be sold, or may be offered as service to other farmers.

Q.9 Other disadvantages to a MMS identified by respondents:
Not big enough for modern large scale dairy farms
Again the yarding system on daily herd management- but the simple things like multiple herds, bulls, sick cows etc.
damage to working conditions
Earth bonding to ensure no stray electricity
Efficiency of labour
Handling different herds e.g., colostrum cows
Pasture damage caused by moving shed and tanker on soft ground

10. Please use this space to outline any solutions to the problems identified, such as changes to management systems that might make this system work better, or different ways of using such a system that we have not identified.

Text Response for Q.10
Have a centre point to which all milk is brought back to. you could also have a set of yards at this point and do AI and things here
pugging - light PVC/rubber slit mats/ tiles that roll out and hose down
Most farmed land would have some sort of stock handling facilities, yards etc.
We have had 400mm rain in many parts of the Uk this month and many cows are being housed. The implications of this on the milking area and milking time would be considerable
The land area covered by tracks will never grow grass. Seed could be broadcast before milking and cows tread it in. Next time site the parlour in a different position.
The need for good cow tracks is essential in this scenario. Possibility of short lengths of concreted track to use as long thin collecting yards.
I think an appropriate use for mobile milking is where it is semi-permanent. 2 or more locations with milk collection access and effluent storage and possible electricity supply.
1. Damage to wet land might be handled by intensive drainage, using raised metal pads at milk stations, don't hold cows at milking, just milk as they appear and round up towards end of milking. 2. Effluent disposal tricky - either don't hold cows for long, or use grating system at each milk station that can act as mini-effluent pond. 3. Get LIC to design their Protrack system for mobile use, don't use AI, and have fixed more complex yard system at one site which is used for 3-6 weeks of AI - quite tricky because starts to look like a traditional shed!! 4. Fonterra wants more milk they will compromise on this - if not set up a mobile bolting plant and sell direct to public. None of these issues will prove insurmountable to innovative people.
Pugging could be reduced with regular moving of the plant, Effluent could be reduced with a continual flow of cows to the plant as opposed to 'collecting the herd to be milked. Cows only really dung when moved after a long period of standing around, eliminate the standing around; eliminate the effluent/pugging problem.
strategically placed hard standing pads at various points, for use in wet weather
reduced distance cows to walk due to extreme weather conditions, could be rent over large area
I've seen this system functioning overseas in large farms, milking cows with the lower producer cows, which are maintained in the too far away paddocks. Although is not a 'panacea', works perfectly, considering some of the pros and cons you've mentioned here.

Appendix D: Statistical Analyses

Statistical analysis for Q.7

Statistic	It could be used to milk on leased land.	It could be used by a sheep farmer to trial dairying.	It could be used on arable farms as part of the pasture rotation system (instead of running sheep).	It could be used as a temporary solution when cowshed building or replacement gets behind schedule (e.g. conversions running over time)	Other potential use - please specify
Min Value	1	1	1	1	1
Max Value	4	5	5	4	2
Mean	1.54	2.28	2.18	1.48	1.38
Variance	0.42	1.33	1.32	0.42	0.44
Standard Deviation	0.65	1.15	1.15	0.65	0.67
Total Responses	61	60	61	60	9

Statistical Analysis for Q.8

Statistic	It would provide a relatively cheap stepping stone unit for someone aiming at farm ownership.	It would enable the use of leased land which is not set up for dairying to be used as a milking platform.	It would provide an opportunity for a dairy farmer to become a mixed farmer - milking from part of his farm one year and growing fodder crops on the rest, then swopping - utilising effluent better.	It can be used as an interim shed for emergency use.	Other advantage - please specify:
Min Value	1	1	1	1	1
Max Value	4	4	5	4	2
Mean	2.09	1.72	2.58	1.78	1.25
Variance	0.71	0.49	1.25	0.46	0.25
Standard Deviation	0.84	0.70	1.12	0.68	0.50
Total Responses	58	57	57	58	4

Statistical Analysis for Q.9

Statistic	Damage to productive land when wet due to cows standing waiting to be milked.	Meeting effluent disposal requirements with Regional Councils.	The requirement for a (mobile) yarding system for holding cows for AI etc.	Milk companies conditions of supply e.g. not collecting milk which has initially been transported in a mobile milk tanker.	Other disadvantage - please specify:
Min Value	1	1	1	1	1
Max Value	5	4	4	4	3
Mean	2.25	2.25	2.09	2.25	1.86
Variance	1.05	1.05	0.83	0.76	1.03
Standard Deviation	1.02	1.02	0.91	0.87	1.01
Total Responses	57	57	57	57	9

Appendix E: Contact Details

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