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# Dairy farmers with larger herd sizes adopt more precision dairy technologies

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## ABSTRACT

An increase in the average herd size on Australian dairy farms has also increased the labor and animal management pressure on farmers, thus potentially encouraging the adoption of precision technologies for enhanced management control. A survey was undertaken in 2015 in Australia to identify the relationship between herd size, current precision technology adoption, and perception of the future of precision technologies. Additionally, differences between farmers and service providers in relation to perception of future precision technology adoption were also investigated. Responses from 199 dairy farmers, and 102 service providers, were collected between May and August 2015 via an anonymous Internet-based questionnaire. Of the 199 dairy farmer responses, 10.4% corresponded to farms that had fewer than 150 cows, 37.7% had 151 to 300 cows, 35.5% had 301 to 500 cows; 6.0% had 501 to 700 cows, and 10.4% had more than 701 cows. The results showed that farmers with more than 500 cows adopted between 2 and 5 times more specific precision technologies, such as automatic cup removers, automatic milk plant wash systems, electronic cow identification systems and herd management software, when compared with smaller farms. Only minor differences were detected in perception of the future of precision technologies between either herd size or farmers and service providers. In particular, service providers expected a higher adoption of automatic milking and walk over weighing systems than farmers. Currently, the adoption of precision technology has mostly been of the type that reduces labor needs; however, respondents indicated that by 2025 adoption of data capturing technology for monitoring farm system parameters would be increased.

**Key words:** automation, precision dairy farming, survey, technology investment

## INTRODUCTION

Reductions in the number of dairy farms, together with an increase in the average herd size and milk production per herd, have been previously reported in most of the main dairy regions across the world (AHDB Dairy, 2016; DairyNZ, 2016; USDA, 2017). In Australia, dairy farm numbers declined by 60% between 1990 and 2015. During the same period, the average herd size has increased from 107 cows per farm to 272 (around 150%; Dairy Australia, 2016). More than 90% of dairy farms in Australia are still family owned and operate with variable levels of external labor (Dairy Australia, 2015a,c). The availability of skilled labor, and the demands of animal management due to larger herd sizes, have been identified as 2 key variables that might limit future increases in production and profitability on Australian dairy farm systems (Dairy Australia, 2015b).

Farmers considering expanding their business need to ensure best practices in herd management, operations, finances, human resources, and strategic management (Hadley et al., 2002). As dairy operations continue to increase in size, monitoring and managing cows has become more challenging and complex and requires enhanced management ability (Edwards et al., 2015; Bewley, 2016). The use of automation and sensor systems, commonly termed precision technology, is increasingly providing farmers with the means to reduce labor requirements and to improve management of large herds (Bewley, 2010; Eastwood et al., 2012; Eastwood et al., 2016a). On one hand, there are certain technologies that offer the possibility of either reducing pressure on labor or improving labor efficiency, especially in larger herds. This includes technologies such as automation of cup removers, sorting gates, calf feeders, post milking disinfection and milk plant wash systems (Edwards et al., 2015). Additionally, there are other precision technologies that rely on data capture and are currently used to monitor parameters at an individual cow level to increase production efficiency and performance of dairy farms. This group includes technologies such as

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automatic estrus detection systems, inline milk meters, electronic cow identification systems and herd management software. However, these data capturing technologies have only been adopted on a small proportion of farms globally (Bewley, 2010; Rutten et al., 2013; Borchers and Bewley, 2015; Edwards et al., 2015).

Service providers in the dairy industry include people from the private and public sector such as agronomists, veterinarians, nutritionists, consultants, researchers, and farm equipment technicians. They represent an important part of the dairy farmers' network and are an important influence in decision making (Klerkx and Jansen, 2010; Eastwood et al., 2012; Murphy et al., 2013). Opportunities exist for service providers to integrate precision technologies into their businesses and in the interaction with farmers, for example by setting up customized reports around animal health or nutrition (Eastwood et al., 2016a,b).

Previous surveys conducted on dairy farms in different countries have investigated precision technology adoption (Watson, 2009; Khanal et al., 2010; Dharma et al., 2012; Borchers and Bewley, 2015; Edwards et al., 2015). However, in a global context of increasing farming scale, little is known about the influence of herd size on farmer decision-making concerning on-farm precision technology investment. In addition, few surveys have addressed the perception of service providers, despite recognizing that collectively they influence a large number of farmers (Eastwood et al., 2016b). To address this gap, we conducted a survey with the aim of understanding the relationship of herd size on adoption of technologies on Australian dairy farms, as well as investigating the perception of farmers and service providers toward future technology adoption. The findings would allow commercial companies, research, and dairy policy organizations to be much more effective in the development and support of new precision technologies.

## MATERIALS AND METHODS

### Survey Design

A multidisciplinary team including researchers, farmers and professional officers coordinated by the NSW Department of Primary Industries (New South Wales, Australia) designed the survey. It was distributed via the Internet using Google Forms (Google Inc., Mountain View, CA). The survey included up to 32 questions depending on each respondent's profile. The first section allowed a general understanding of participants' demographics (such as region, age, role in the industry, and type of operation). The second section focused on the current adoption of milking-, animal-, and feeding-related technologies as well as the perception of the future adoption of precision technologies (Table 1). Technologies selected for inclusion in the questionnaire were based on experience of the authors, augmented by external consultation with members of the Australian precision dairy reference group (facilitated by Dairy Australia, the service body for the Australian dairy industry). Survey participants also had the possibility of adding other technologies that were not included in the original list. A pilot of the survey was conducted with 5 farmers to refine the 32 questions and logic flow.

### Data Collection

Participation in the survey was voluntary and anonymous. Participants were recruited using a snowball method where the survey was initially distributed to

**Table 1**. Questions and options included in the survey relating to current precision technology adoption and perception of future technology use on Australian dairy farms

| Which of the following technologies do you have? | Which of the following technologies do you expect will have an increased adoption in next 10 years? |
|---|---|
| Automatic milking systems | Automatic milking systems |
| Electronic cow identification systems | Inline milk meters |
| Inline milk meters | Automated mastitis detection tools |
| Automated mastitis detection tools | Automatic sorting gates |
| Automatic cup removers | Walk over weighing |
| Automatic milk plant wash system | Automatic estrus detection systems |
| Automatic post milking disinfection | Automatic calf feeders |
| Automatic sorting gates | Pasture measuring device |
| Walk over weighing | Other |
| Automatic estrus detection systems | |
| Automatic in parlor feeding (in the shed) | |
| Automatic calf feeders | |
| Herd management software | |
| Pasture measuring device | |
| Other | |

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