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Labour self-sufficiency on family dairy farms in Ireland: a case study approach considering labour requirement, input and management

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Abstract

The efficient use of labour input is essential to the success of farms; however, many countries are experiencing a decreasing family workforce on-farm as a result of perceived labour intensive work and poor work–life balance. Four farms identified from two labour time-use studies were selected as case studies to investigate management of the family dairy farm in terms of herd size, while also meeting the labour requirements and maintaining a satisfactory work–life balance. A mixed methods approach was used; quantitative analysis described the labour profile and characteristics of the farms, while the qualitative interviews provided insights into strategies to achieve labour efficiency. The results demonstrate that a family farm with a herd size of ~120 cows with appropriate facilities and streamlined practices can operate effectively with a total labour input of 2,986 h/yr. The labour contributed by the farmer and the farm family represented 77.5% of the total annual labour requirement. Contractors or hired employees contributed the remaining labour input, depending on individual circumstances. The annual average working day length for the farmer (excluding breaks) was 7.8 h/d. The analysed narratives of the farmers demonstrated their view that a seasonal, pasture-based spring calving system of production is a key influence in achieving relatively high labour efficiency on-farm, if it is ensured that the peak workload in spring is managed effectively. The study highlights that the overall labour demand can be reduced on Irish family farms through the management of facilities and practices. The farmer and family members can then decide on the degree of self-sufficiency with regard to labour, that is, what proportion of that labour they wish to contribute based on their lifestyle choices, cost and availability of contractors and hired workers.

Keywords

Dairy farm labour • family farm • labour efficiency • qualitative

Introduction

The efficient use of labour is essential to the success of farms, including family farms which account for 98% of all farms worldwide (Graeub *et al.*, 2016). In Europe, and many relatively affluent countries, the trend in livestock farming systems is increasing farm size, associated decreasing family workforce and increasing reliance on hired workers (Madelrieux & Dedieu, 2008; Deming *et al.*, 2018; Nye, 2018). Despite the high demand for skilled workers, there has been a large decline in the number of people employed in agriculture (World Bank, 2020), with the sector being viewed less favourably than others from an employment perspective. This perception of the sector is associated with long working hours, unsatisfactory working conditions and low wages (Malanski *et al.*, 2019). The reduced availability of workers, combined with farmers placing increased emphasis on achieving a good work–life balance (Nettle *et al.*, 2005; Deming *et al.*, 2020), has led to work organisation and efficiency emerging as a priority research topic, particularly in pasture-based production systems. Furthermore, work organisation and labour efficiency are aspects of social sustainability, which are less well-researched compared with economic and environmental sustainability (van der Linden *et al.*, 2020).

The issue of labour requirement and availability may be exacerbated on seasonal pastured-based milk production systems; these systems are characterised by a compact calving pattern designed to maximise the utilisation of grazed grass (Roche *et al.*, 2017). This can create an unbalanced workload for farmers and, consequently, a higher demand for seasonal workers than full-time employees. It can be challenging for farmers to recruit seasonal staff for short periods of intense work, often with long working days and unsociable hours (Ní Laoire, 2002), and family operated farms

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are often reliant on unpaid help or family members (Hostiou & Dedieu, 2012; O'Brien & Hennessy, 2017).

Inadequate facilities and work practices on farms may also inflate labour input requirements. A review by Malanski *et al.* (2019) showed that increasing the labour productivity through optimising farm and labour management was important for the profitability of family farms. Optimising labour productivity would generally reduce the labour demand and therefore costs. Work organisation on dairy farms can be considered as the interaction between livestock management, workforce and facilities (Madelrieux & Dedieu, 2008). Several studies have investigated work organisation and labour efficiency, particularly on dairy farms (Malanski *et al.*, 2021). The study by Taylor *et al.* (2009) showed an average labour input of 15 h/cow on 20 New Zealand farms with an average herd size of 200 cows. Deming *et al.* (2018) reported an annual labour input of 22 h/cow on Irish dairy farms with an average herd size of 187 cows, which had been selected as "labour-efficient farms". A more recent study by Hogan *et al.* (2022a) investigated labour input during the peak workload period of a seasonal milk production system (February–June); it showed that a labour input of 19.2 h/cow was required on Irish dairy farms with an average herd size of 137 cows between the months of February and June. All three studies included contractor hours in calculating the labour input. It is generally accepted that an economy of scale effect applies: as herd sizes increase, labour efficiency increases. However, variation in efficiency may also be due to variables that are individual to each farm, such as different levels of work organisation, labour management, or farm layout and facilities. Thus, the categorisation of farms, based, for example, on herd size (as used in the studies of Taylor *et al.*, 2009; Deming *et al.*, 2018; Hogan *et al.*, 2022a), may have a limited capability to address the practical question of the appropriate herd size for a family farm intending to be largely self-sufficient in, and to supply its own labour. In this study, we consider the family farm as defined by the FAO (2023): "a family farm is an agricultural holding which is managed and operated by a household and where farm labour is largely supplied by that household."

A farm may consider increasing cow numbers for a number of reasons including, for example, to accommodate new partners, but the most common reason is to increase income (assuming sufficient farm size). In the context of the present study focusing on family farms, new partners are likely family members (children) joining the parent generation or a pair of siblings and their families taking over the original farm. Unless significant changes to the farm are made, through increased labour efficiency and the adoption of time-saving technologies, increasing the farm size would likely result in an increase in the demand for labour, so alternative management options for the traditional family farming unit may need to be considered. If external labour is available, then a cost is incurred. Alternatively, if external labour is not available, contractors may be employed for some tasks (mainly machinery related tasks; Deming *et al.*, 2018; Nye, 2018); contractors will also incur a cost and may or may not be available. However, a family farm unit looking to expand their farm size may wish to supply its own labour, which if non-remunerated, can optimise farm costs but may increase the challenge to achieve a desired work–life balance. In this latter scenario, it is important to consider the appropriate herd size for the available labour and this will be dependent on a number of factors, for example, facilities, work practices and organisation, and management. The objective of this study was to address the question of how to optimise the family dairy farm in terms of herd size, while meeting the labour requirements and maintaining a satisfactory work–life balance, and identifying the options available to farmers to achieve this. Labour efficiency may be interpreted as the ability of the farm family to minimise the total labour input and maximise the labour input by the farm family with reduced input from external sources. A case study methodology approach was used, which incorporated an insight into the management process of those farmers.

Context and methodology

One of the core strengths of the Irish dairy industry is the central role played by the family in the operation of dairy farms (O'Brien & Hennessy, 2017). Traditionally, the Irish dairy sector has been characterised by small farms (average herd size increased from 54 cows in 2005 to 76 cows in 2016; Teagasc, 2017) managed and run by families with a small proportion of seasonal hired staff. This is becoming a greater challenge as the dairy herd size increases with associated increased labour requirement. However, family farming is as much about the lifestyle, which is based on and involves beliefs about living and working on the farm, as about the professional occupation (Calus & Van Huylenbroeck, 2010). Thus, it is important to investigate strategies that present the potential to maintain the small family farm unit whilst ensuring sustainability in terms of labour and work–life balance at the desired herd size. Previous research identified that a key factor influencing the sustainability of dairy farming in Ireland is how the next generation of potential farmers perceive and evaluate the quality of life and lifestyle offered by a career in farming, which can be greatly influenced by the labour input (O'Brien & Hennessy, 2017; Deming *et al.*, 2020).

The four farms selected for this study were operated by farm owners who had the ability to manage their cow herd with minimal labour input from other sources, while still achieving a desirable work–life balance through being labour efficient. The minimal labour input from other sources may be described as family, hired and contractors contributing <0.5

Table 1: Characteristics of farmers interviewed

	Duration of time-use study	Age range	Farm classification	Experience range
Farmer 1	1 yr	40's	Unifamily	20 yr
Farmer 2	1 yr	40's	Multifamily	30 yr
Farmer 3	5 mo (February–June)	50's	Unifamily	40 yr
Farmer 4	5 mo (February–June)	30's	Unifamily	10 yr

of a full-time staff member over the year, or contributing <0.5 of a full-time person +20% during the more labour intensive spring period. Case studies are highly useful for generating context-dependent social science knowledge that can be generally applicable to other contexts and used for generating hypotheses about other contexts (Flyvbjerg, 2006). We employed a case study approach to this reported work and a qualitative interviewing technique to investigate the cases in-depth.

Data from two previous studies involving Irish dairy farms were used to select farms for the present study. These studies (Deming *et al.*, 2018; Hogan *et al.*, 2022a) examined labour requirements or inputs on different groups and categories of Irish dairy farms over a complete year and during the peak work period (February–June), respectively. Deming *et al.* (2018) studied labour-efficient farms, while Hogan *et al.* (2022a) selected farms that were more representative of Irish dairy farms in terms of herd size and geographical location. Deming *et al.* (2018) demonstrated that labour-efficient farms could achieve an average labour time input of 45 h/wk, while farmers themselves have suggested <58 h/wk as an acceptable annual weekly labour input (Clarke, 2018). However, Clarke (2018) estimated that farmers were actually working 63 h/wk. Two farms were selected from the study of Deming *et al.* (2018) that met the predefined selection criteria of: (i) farmer working hours equal to or less than an average of 50 h/wk (allowing for 2 wk of annual holidays); and (ii) other labour (family and hired employees and contractors) contributing 900 h or less, thus achieving a total annual labour input of less than 3,400 h (farmer (2,500 h) + family + hired + contractor (900 h)). Information considered in defining these criteria included the fact that the Central Statistics Office (CSO) of Ireland defines a full-time staff member as working 1,800 h/yr. Spring and summer are critical periods for labour input as 57% of the annual workload of a spring calving dairy farm occurs during this timeframe (Deming *et al.*, 2018). Hogan *et al.* (2022a) conducted a time-use study for a 22-wk period between February and June incorporating more frequent measures and a larger cohort of farmers than Deming *et al.* (2018). Two further farms were selected from that study (Hogan *et al.*, 2022a) that met the selection criteria of (i) farmer working hours ≤60.5 h/wk and (ii) other labour sources (family and hired employees and contractors) contributing 1,080 h or less, thus achieving a total annual labour input of <2,411 h (farmer (1,331 h) + family + hired + contractor (1,080 h)). These criteria are based on a central point between the estimated labour input (63 h/wk) by farmers and an acceptable labour input (58 h/wk) suggested by farmers (Clarke, 2018). The criteria for the springtime labour contributed by the other labour sources (family, hired or contractors) have been increased by 20% of the annual labour input contributed by them to reflect the higher overall labour requirement in springtime. The characteristics of the study participants, including age range and farming experience, are shown in Table 1. Three of the farms selected are located in the County Cork region, while the remaining farm is located in County Limerick; the Cork and Limerick regions account for 25% and 8% of the total cow population of Ireland, respectively (1,504,800; ICBF, 2019).

The four farms selected may be categorised into two of the three organisational structures proposed by Moreno-Perez *et al.* (2011). Three farms could be classed as unifamily farms where the ownership and family labour are of one household and other non-residential family members provide seasonal non-remunerated work. The remaining farm could be categorised as a vertical multifamily farm where two separate households are connected by an intergenerational relationship, where the ownership and labour are of one household while a member of a second household provides a smaller portion of non-remunerated work annually.

Quantitative data collection

Deming *et al.* (2018) and Hogan *et al.* (2022a) collected labour input data using a time-use diary, operated through a smartphone application (app; developed by Acorn Agricultural Research) and an online survey. A more detailed description of farmer selection, the smartphone app and online survey, and the data management processes used are outlined in those studies (Deming *et al.*, 2018; Hogan *et al.*, 2022a).

Qualitative data collection

In 2021, each of the 4 farmers were contacted and arrangements made to collect the qualitative data. Interviewees were issued with a participant information

sheet that explained the purpose of the study and a consent form for research ethics purposes. The interviewed farmers consented to the anonymised use of their personal details regarding labour efficiency. The first author, who is trained and experienced in using the biographic–narrative interpretive method conducted the interviews with all farmers and conducted the analysis. The interviews were conducted in-person on their farm with the exception of one interview (Farmer 1), which was conducted via Zoom due to COVID-19. The interviews involved a two-stage process. First, an initial single question to induce narrative (SQUIN) was presented to the interviewee in which they were invited to tell their story, uninterrupted by the interviewer. This was then followed by subsequent probing by the interviewer of aspects of the interviewee's narrative of particular relevance to the research question (Wengraf, 2011). The SQUIN used for the interviews was, "As you know I am researching work on dairy farms. So, please can you tell me the story about the work that needs to be done on this farm and who does that work? I'll listen, I won't interrupt and I'll just take a few notes in case I have questions for after you have finished. So, just take your time and begin wherever you like." The interviewer was trained to identify parts of the narrative that had the potential to reveal personal incident narratives (PINs) and used probing questions to "push (the interviewee) for PINs". PINs describe particular memories of interviewees and are particularly valuable in identifying detail and substance of important and significant experiences of the interviewees (Wengraf, 2011). The interviewer, while remaining sensitive to what is subjectively important to the interviewees, can "push for PINs" relevant to the research question under study (Wengraf, 2011). The specific research question for this study was, "how do labour-efficient farmers manage their workload?" The interviews were audio-recorded and subsequently transcribed into a written transcript. The average duration of the interviews was 63 min (range 52–82 min).

Data analysis

Qualitative description is defined as reporting "the facts, and the meanings participants give to those facts" (Sandelowski, 2000). Using this methodology, we did not use a fixed interpretive framework to analyse the data. Rather, our approach was to identify patterns across the qualitative interview and to report a summation of those patterns. The first author read the transcripts to identify patterns in the data. Excerpts from the data relevant to a pattern were given a code name (Tracy, 2013). No preset codes were applied in the analysis, rather the codes were "data derived" (Sandelowski, 2000), which means that the researchers interpreted the data, to identify and then refine the final codes that described patterns in the data. We identified all data (and patterns) in the dataset to answer our research question of "how do labour-efficient farmers manage their workload?" To ensure the anonymity of our informants, we have left out geographical information, and all farms were given numbers in the text.

Results

Annual and peak labour input

The herd size and overall labour input for each of the four case study farms are presented in Table 2.

The difference in labour input on Farms 1 and 2 over the 12-mo period was relatively small at 33 h (Table 2). This occurred despite the fact that Farm 1 had 34 cows more than Farm 2; it is likely that a relatively small economy of scale effect is present here and may be observed in terms of efficiency as measured by h/cow; Farms 1 and 2 had efficiency levels of 21.8 and 29.4, respectively. But importantly, differences in the facilities and management are likely also to be contributing to the small difference in labour input (of 33 h). The annual average total dairy labour input across task categories for Farms 1 and 2 in this study are shown in Figure 1.

The milking process was associated with 30% and 35% of the time on Farms 1 and 2, respectively, while the milking and washing tasks combined (excluding herding) represented 20% and 31% of the time, respectively. The milking parlour of Farm 1 operated in a more efficient manner than that of Farm 2, as indicated by the lower proportion of time associated with milking a herd larger by 34 cows. This was likely due to the milking facilities as outlined in Table 3.

The average dairy labour input across task categories for the months of peak labour demand (in a seasonal pasture-based system; Farms 3 and 4) are shown in Figure 2. The tasks focused on included grassland management and calf care, which after milking are two very time-consuming tasks on spring calving farms between February and June (Hogan

Table 2: Average herd size and overall labour input for the four case study farms based on time-use data collected for 1 complete year (12 mo; Farm 1 and Farm 2) or a 5-mo period (February–June; Farm 3 and Farm 4)

	Farm 1	Farm 2	Farm 3	Farm 4
Time period	12 mo	12 mo	5 mo	5 mo
Herd size	136	102	118	118
Total labour input (h)	2,969	3,002	1,376	1,479
Farmer (h)	2,182	2,446	997	1,291
Family (h)	0	5	264	93
Hired worker (h)	119	339	0	80
Contractor (h)	668	213	115	15

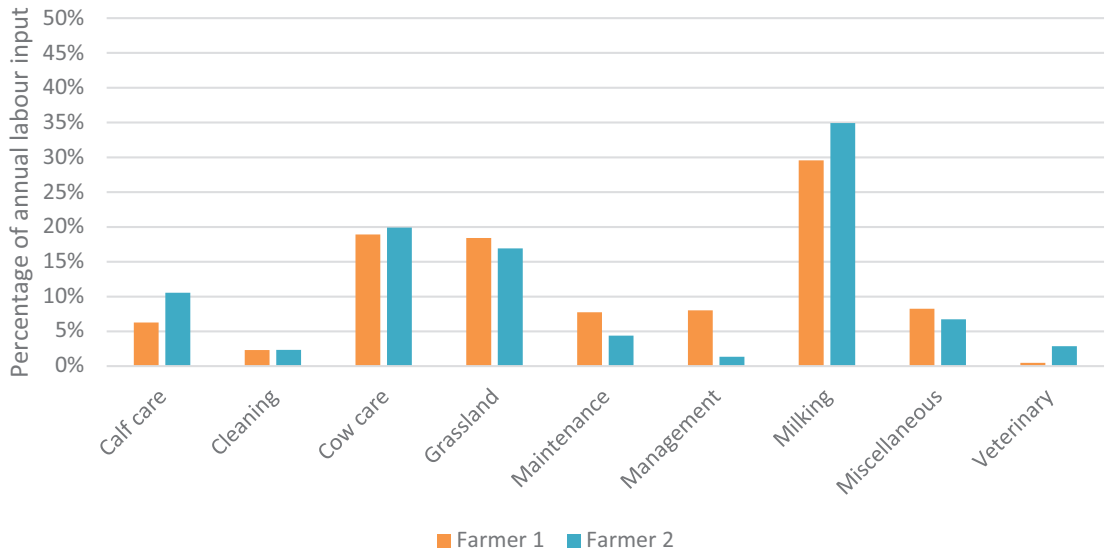

Figure 1. The breakdown of the average annual total dairy labour input across task categories for Farms 1 and 2.

Table 3: Milking facilities and practices on the two case study farms based on time-use data collected over 12 mo

	Farm 1	Farm 2
Number of milking units	20	10
Number of rows of cows milked	7	10
Dump line (yes/no)	Yes	No
Automatic cluster removers (yes/no)	Yes	No
Autowasher (yes/no)	Yes	No
Teat preparation prior to milking	None	None
Once a day milking practiced in spring (yes/no)	No	No

et al., 2022a). Grassland management was associated with the next highest proportion of time, after the milking process (Figure 2).

Farms 3 and 4 spent 12% and 18% of the time, respectively, (or 265 h, on average) at grassland management between February and June (Figure 2). Farms 3 and 4 operated efficiently with respect to calf care (Deming *et al.*, 2018; Hogan *et al.*, 2022a), through the use of efficient practices such as: (i) group training of calves, (ii) automatic feeding, (iii) calves bedded weekly, (iv) mechanical cleaning of calf houses, (v) male calves not reared on farm, (vi) average distance from milking facility to calf house was 34 m, and (vii) each farm had just two calf houses (Table 4).

The daily and weekly profile of farmer labour input to the four farms is outlined in Table 5. The length of the working day (averaged) for the farmer (excluding breaks and other enterprise tasks) was 7.8 h/d. Average hours worked per week annually for Farmers 1 and 2 was 47 h, while average hours worked per week between February and June for Farmers 3 and 4 was 54 h.

The key farm physical performance indicators of the four farms in this study are presented in Table 6. All four farms were operating to a very high standard for pasture-based seasonal calving farms (Shalloo & Hanrahan, 2020), even though they had significantly lower labour requirements when compared with some corresponding farms in the studies from which they were selected (Deming *et al.*, 2018; Hogan *et al.*, 2022a).

Workload management

The quantitative analysis employed for this study describes the characteristics of the four labour-efficient farms, but tells us little about the choices the farmers made and the factors important to them with regard to being time-efficient. Thus, a qualitative method was incorporated to provide insights into the management processes of labour-efficient farmers. A number of themes emerged from the interview data, namely system of production; work organisation and practices; people and technology and facilities. It also demonstrated the choices that the interviewees made in order to increase their free time to pursue their own interests. All interviewees were consistent in suggesting that a seasonal, pasture-based spring calving system of production was fundamental to achieving labour efficiency:

The most important thing that we're doing is that we're spring-calving, compact-calving that's the overriding thing that makes us time-efficient. And it makes us profitable as well. And all the

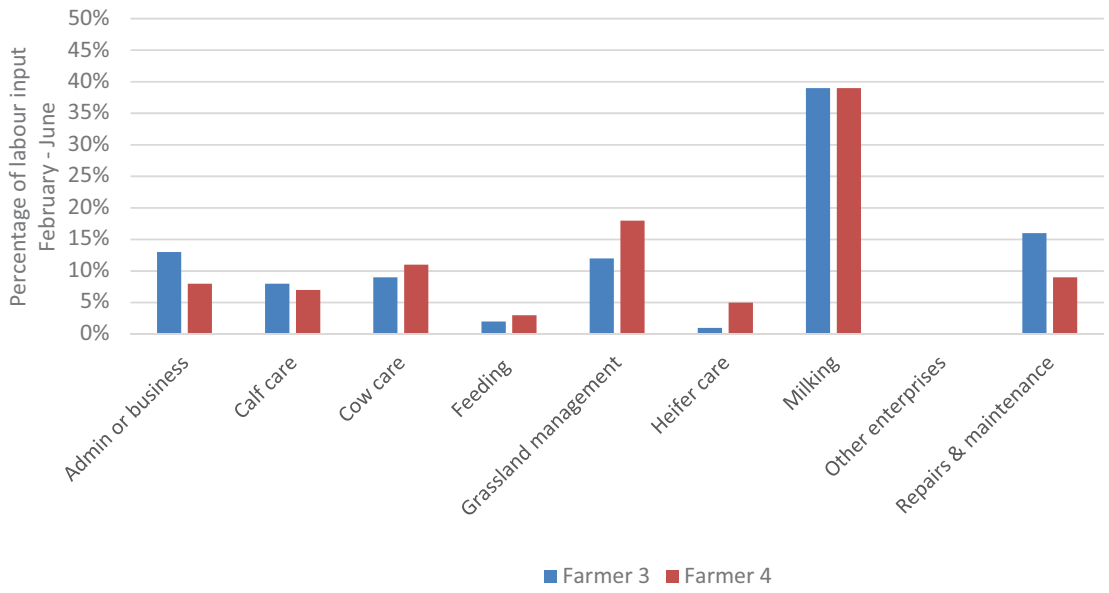

Figure 2. The breakdown of the average total dairy labour input across task categories for Farms 3 and 4 between February and June.

Table 4: Calf rearing facilities and practices on the two case study farms based on time-use data collected over 5 mo (February–June)

	Farm 3	Farm 4
Calf rearing		
Contract rearing (yes/no)	Yes	No
Number of calf houses	2	2
Distance (m) from milking parlour to furthest calf shed	37	30
Method of feeding colostrum	Bottle and teat	Bottle and teat
Milk feeding frequency	Automatic calf feeder	Automatic calf feeder
Weaning age (wk)	9	8
Age out to grass (wk)	N/A	12

other add-ons as I call them, they're all important in their own right. (Farmer 3)

A spring-calving system does create a peak in workload, which needs to be managed in order to achieve overall labour efficiency on an annual basis. The narratives of the four farmers showed that in addition to a spring-calving system, good work organisation and in particular, a structured regimen of routine and planning were essential to managing the workload. The interviewees spoke about having set start and finish work times to structure the working day and used milking times to provide this routine. The interviewees also referred to the importance of appropriate and efficient work practices, particularly associated with grassland management, milking, calf rearing and cow care. The interviewees referred to keeping practices simple and changing practices to save more time, for example:

Table 5: Daily and weekly patterns of labour contributed over 12 mo (Farmers 1 and 2) and between February and June (Farmers 3 and 4)

	Farmer 1	Farmer 2	Farmer 3	Farmer 4
Time period	12 mo	12 mo	5 mo	5 mo
Start time (h)	0730	0723	0658	0633
Finish time (h)	1,717	1,723	1,839	1,821
Length of day (h/d)	9.5	10.0	11.5	11.6
Non-farming activity (h/d)	2.0	2.0	4.8	3.0
Length of day excluding non-farm activity (h/d)	7.5	8.0	6.7	8.6
Average h worked per week	46	48	47	60

Table 6: Key performance indicators of the four case study farms based on time-use data collected for either 1 yr or 5 mo (between February and June)

	Farm 1	Farm 2	Farm 3	Farm 4
Time period	12 mo	12 mo	5 mo	5 mo
Milk solids/cow (kg)	447	418	267	265
Milk fat content (%)	4.24	4.03	4.53	4.23
Milk protein content (%)	3.66	3.45	3.60	3.39
SCC (×1,000 cells/mL)	136	181	190	86
Calving interval (d)	367	373	368	371
6-week calving rate (%)	86	81	92	88
EBI (€)	140	84	171	125

…We've collars now for the cows for breeding and for health. Group-calving pen now, no single calving pens anymore. (Farmer 1)

Farmers experienced an intense period of work during February and March, and to overcome this challenge the interviewees invested in both technology and facilities "*with a view to just cutting down work and making life easier*", focusing on calf care and milking in particular.
Strategic use of technology and efficient facilities and farmyard layout may help minimise the amount of external labour required, as highlighted by one farmer:

But instead of hiring labour we looked at different things. And we decided that we'd buy, or purchase or build facilities, or sheds or whatever. To make our life easier. (Farmer 3)

Alternatively, some farmers spoke about the importance of both part-time employees and contractors to ensure a more manageable workload for themselves:

I just kind of let in more contractors and letting fellas do more and just pay the bill at the end of it and be done with it like. (Farmer 2).

Discussion

Annual and peak labour input

An average total labour input of 2,986 h was observed on Farms 1 and 2, with an average cow herd of 119. On such low labour input farms, the cost of either hired labour or contractors to conduct the margin of labour between the overall requirement of the farm and the contribution of the farmer is low (farmers contributed 77% of the labour input on average). Contracting out of work was shown to have a minimal negative effect (<5%) on farm profitability when own labour costs were included (Deming *et al.*, 2019), and in this study the effect is likely to be even smaller due to the minimal hours inputted by external workers. This emphasises the importance of managing the farm facilities and operations in an efficient manner. This may be observed by examining the key facilities on the farms; the key facilities are considered as those associated with the tasks taking the greatest proportion of time on the farm. The studies of Deming *et al.* (2018) and O'Donovan *et al.* (2008) have shown that the greatest proportion of work time was associated with the milking process (herding, milking and washing; 33% and 34%, respectively) and cow care (17% and 10%, respectively).
In the current study, the milking parlours on both Farms 1 and 2 operated efficiently in terms of efficient milking facilities and practices, as outlined in O'Brien *et al.* (2006) and Deming *et al.* (2018). These practices included (i) having one operator in the milking pit during milking, (ii) the milker not leaving the pit to bring in cows, (iii) cow entry and exit gates operated from anywhere in the pit (eliminating the necessity to walk to specific points), (iv) efficient collecting yard cleaning using a low pressure, high volume washer, and (v) fully automatic bulk tank cleaning. Furthermore, the reduced proportion of time spent at the milking and washing tasks on Farm 1 were likely associated with the somewhat better facilities of (i) the 10 extra milking units resulting in fewer cow rows, (ii) inclusion of a dump-line, (iii) presence of automatic cluster removers, (iv) presence of a milking machine auto-washer, and (iv) automated meal feeding (O'Brien *et al.*, 2006; Edwards *et al.*, 2015; Deming *et al.*, 2018; Hogan *et al.*, 2022b). The overall milking time can be reduced with an increased number of milking units, mainly when the operator still has some idle time in his milking routine (O'Brien *et al.*, 2012); this is assisted by the absence of a teat preparation routine, which is the case in this study. Deming *et al.* (2018) also found that the capacity of the milking parlour and the number of cow rows being milked were likely the most influencing factors in determining the most and least efficient farms with regard to milking. Automatic wash systems can reduce the wash-up time as well; manual mixing of solutions is not necessary (Tuohy *et al.*, 2017). A further practice positively affecting herding time on Farm 1 was the infrastructure that allowed cows to return to the grazing paddock on their own without being accompanied by the operator. Likewise, the cow care task was associated with 19% and 20% of time on Farms 1 and 2, respectively. Both farms operated efficiently in terms of cow care facilities and practices (Deming *et al.* 2018); for example (i) cows could access feed when they wanted to, (ii) auto-scrapers were present on both farms and (iii) Farms 1 and 2 had just 3 and 4 feeding areas, respectively; this was low compared with other farm instances where 5–6 feeding areas were used.

It is crucial to examine the peak labour demand in conjunction with the annual labour demand, as this can be more challenging for the workers in terms of health and safety and for the farmer in terms of difficulty in accessing seasonal workers. In the current study, grassland management was associated with the next highest proportion of time on Farms 3 and 4, after the milking process. The key features of grassland management on Farms 3 and 4 included (i) strip grazing in springtime with a fresh grass allocation every 12 h, (ii) early turn-out of cows to grass by day in spring (1 February) and (iii) the strategic use of contractors. Although strip grazing may increase the workload, it is considered as best practice in springtime to minimise poaching and achieve the optimal post grazing sward height (Teagasc, 2011).

While calf care was associated with just 7.5% of labour demand on Farms 3 and 4 between February and June, which is much lower than 14% which is the average for the other similar sized farms in that study, it is a critical task due to the vulnerability of the animals involved and the significance of health and welfare. Completely out-sourcing calf and heifer rearing tasks to contract rearers can significantly reduce the hours worked per day in spring (Deming *et al.*, 2019). In the present study, Farm 3 sent calves to the contract rearer after weaning, therefore the calf care labour input for Farm 3 (8% of the workload between February and June) refers to the birth–weaning period.

This study shows that a farm with a herd size of 119 cows with appropriate facilities and efficient practices that are matched to the herd size requirements can be operated effectively with 1,428 h between February and June. The study also indicates that the "spring-time peak", which is generally described as an extremely busy period for farmers (O'Donovan *et al.* 2008; Taylor *et al.*, 2009; Deming *et al.*, 2018), can be alleviated by the management of work practices and suitable facilities. The spring-time peak labour requirement of Farms 3 and 4, during 42% of the year (22 wk) in this study, was just 48% of the annual demand of Farms 1 and 2.

The annual average weekly hours of Farms 1 and 2 were lower than the 58 h/wk previously suggested as an acceptable annual weekly labour input, by farmers themselves (Clarke, 2018). Worldwide, farmers are perceived to work for long hours and this is one factor contributing to a reduced number of people pursuing careers in the dairy industry (Malanski *et al.*, 2019). The working hours of the four farmers in this study could be considered as very comparable to many industries and highlights the possibilities for those working in the sector to achieve a desirable work–life balance, irrespective of the industry. Case studies, such as the one presented here, can provide an opportunity for the dairy sector to actively engage with the public to present facts about the realities of working in the industry to encourage more people into it.

In this scenario, the labour contributed by the farmer represented 77% and 80% of the total labour requirement over the full year and over the February–June period, respectively, with contractors, hired workers or family members having contributed the remaining labour input. The four farms in this study used varying combinations of these options. Farms 1 and 2 used hired workers and contractors almost exclusively, over the year, with Farm 1 favouring contractors, while Farm 2 relied more on hired workers for the remaining labour input. Alternatively, both Farms 3 and 4 relied considerably on family labour with contractors and hired workers contributing the remaining labour on these farms. Such decisions on farm labour sources (other than own contribution) are generally made by the farmer and are influenced by the availability and skill level of each source, as well as the cost of the service, particularly in the case of contractors and hired workers. Regarding the tasks conducted by different labour sources, the present study showed that contractor work was mainly associated with milking, maintenance work or machinery tasks related to grassland management, while hired workers' input was mainly associated with animal (cow or calf) care.

Shalloo & Hanrahan (2020) highlighted that farms operating to target performance levels have the potential to achieve 5.3 times more profit than those operating at national average performance levels (as derived from the Teagasc National Farm Survey over the period 2014–2016; Teagasc, 2016). Therefore, as well as being highly labour efficient, the farms in this study were likely to be highly profitable based on the targets outlined by Shalloo & Hanrahan (2020). Labour efficiency and profitability are both strong indicators that these businesses should continue to be resilient and sustainable into the future, which is essential for the survival of the family farm.

Workload management

Because people are at the core of the farm labour issue, diversity in culture, attitudes and outlook must be integral to the way this topic is perceived and addressed. For example, labour efficiency is sometimes associated with the adoption of new labour-saving technologies, for example, automatic milking or drone-based remote sensing of herbage availability for precision grazing (Shortall *et al.*, 2016; Murphy *et al.*, 2021), but the farmer's approach, skills and disposition towards technology can have a significant impact on the use or effectiveness of the technology (Ajzen, 1991). Furthermore, a perception may exist where the use of technology may be seen as "laziness", or an attempt to reduce labour requirement may be seen as evidence of a "poorly" skilled operator. An improved understanding of how and why farmers make decisions regarding technology and work practice adoption can contribute to the design of effective advisory, promotion and policy interventions (Garforth *et al.*, 2004).

Hostiou (2013) has previously shown that choices farmers make regarding work organisation such as farm system, delegation of tasks, work practices and technology

implemented can all affect the daily workload and consequently the free time available. Work organisation is an important aspect of labour efficiency, linked with job quality and working conditions (Malanski *et al.*, 2019). A tight compact calving pattern is a key feature of a profitable pasture-based dairy farm (Roche *et al.*, 2017), but the interviewees in the current study also acknowledged its role in labour efficiency. Despite an intense period of work during February and March, the interviewees acknowledged that the spring calving pasture-based system was a simple system to manage and allowed for an attractive work–life balance for most of the year. All interviewees acknowledged the importance of the strategic use of technology and efficient facilities to reduce the amount of work and minimise the need for external labour, as well as making the work easier and more enjoyable for the farmer. Improving the work–life balance and quality of life of farmers is important to maintain a strong and vibrant industry, as well as attracting and retaining new people to dairy farming.

Grassland management, milking, calf rearing and cow care are the most time-consuming tasks within a spring-calving system (Deming *et al.*, 2018; Hogan *et al.*, 2022a), and the interviewees highlighted the importance of having streamlined practices as a management strategy to cope with the workload. Previous research has highlighted different practices that offer time-saving; for example, automated oestrus detection reduced the total cost of labour for the breeding season compared with manual heat detection, as well as improving overall labour efficiency (Thomas *et al.*, 2019; Adenuga *et al.*, 2020). Likewise, a review of the literature by Creutzinger & Proudfoot (2020) highlighted the advantage of group-calving pens in eliminating the need to move cows into individual pens, and thereby potentially improving labour efficiency. Further references to technologies included an automatic gate-opener timer that negates the need for a person to herd cows from the field to the parlour for milking, automatic drafting and automatic calf feeders. Consistent throughout the narratives of the farmers was that appropriate facilities were very important to reduce the workload and to make the work easier and more enjoyable. A study by Nye (2018) showed that many farmers are becoming increasing reliant on flexible intermittent labour such as part-time employees and contractors (irrespective of farm size), and described agricultural contractors as “crucial” members of the farm workforce. However, this new approach means that many farmers will have to develop new skills in people management, an area that many farmers have traditionally found challenging (Nettle *et al.*, 2005).

Conclusion

This study has shown the possibility of effectively operating a farm and cow herd of 119 cows, with approximately 20% input from contractors, hired workers or family, the proportion of which will be specific to the circumstances of each farm. When the overall labour requirement is minimised by applying appropriate and efficient farm facilities and work practices, it not only makes the work easier and more enjoyable for the farmer, but the requirement and cost of, for example, contractors and hired workers is reduced. Alternatively, in that scenario, the farmer can make further choices based on lifestyle, off-farm work and so on, and contribute less labour himself or herself, and focus more on contractors and hired workers, depending on the individual circumstances. This can be beneficial where the requirement for a full-time employee is borderline, and also reduces the possibility of the requirement for such a person being based on inefficient facilities and practices, and an overestimation of the labour required. A novel aspect of this study was the use of both quantitative and qualitative methods that provided insights into how the participant farmers spent their time, as well as the management process of how they organised their time. Although seasonal, pasture-based spring calving systems of milk production create a large peak in workload, farmers were of the view that this system was simple to manage and allowed for an attractive work–life balance for most of the year. However it is essential that the peak workload in spring is managed effectively. The farmers in this study highlighted the importance of work organisation to labour efficiency, which is a key aspect of social sustainability, yet work organisation is an under-researched topic. Therefore, researchers should continue to investigate optimisation of work organisation for labour efficiency as well as identifying the key influencing factors in the farming context.

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