Automated Milking Systems: A Case Study of a U.S. Midwest Dairy Farm Decision-Making Process

The Pioneer Farm

Today, Friday, June 21, 2024, is an important date for the Schmidt family. **Grandpa Joe**, 80 years old, has decided to retire after dedicating 60 years of hard work to Pioneer, his dairy farm. Located near Madison, WI, the Pioneer farm is a cherished family legacy that has been the primary source of income for three Schmidt generations. The enterprise has adapted to the dairy industry's changes and challengesthroughout the decades. As Joe passes the reins to his only son, **Jack**, he reflects proudly on the farm's journey. With optimism, he believes the farm is well-positioned to thrive in the evolving landscape of dairy farming. Currently, the dairy operation milks 175 cows twice a day in a 20-year-old-free-stall barn and parlor. Pioneer also has 1,033 acres of land devoted to cash crops, 430 of which are owned by Pioneer Farms and another 603 acres are rented.

Jack–who is currently 55 years old–plans to keep the operations as usual, milking the cows twice a day with the help of his wife, and occasionally hiring two or three temporary workers to help in the barn and the field.

However, Joe warns him that it is currently difficult to find farm workers, expressing his frustration with recent experiences: *"We used to get help from Martin's twins, but they are about to finish high school and want to apply to Harvard, so they are focusing all their time on studying. And our last worker, Ernesto, used to show up late almost every day; and sometimes he would not even show up! Unfortunately, nobody else wanted the job."*

To address the issue of labor, **Erika,** a 25-year-old animal science graduate and Jack's only daughter, proposes an alternative: modernizing the old barn by installing **automated milking systems (AMS).**

Erika visited a couple of farms using this technology while taking a Dairy Economics class. *"AMS are robotic boxes that can milk cows on their own; it's super cool! The cows just walk to the machines and get milked. This could solve our issue with the workers."*

Joe shares this vision with his granddaughter: *"Oh, right! Our neighbor Mike has just installed a couple of robots on his farm, and he really likes them. But I wanted to leave that decision to Jack, as I am about to retire."* However, Jack expresses concerns about the financial implications of such an investment: *"I have seen the robots on Mike's farm. Yes, he was happy about it, but he also told me that each robot cost him about 200 grand! Not to mention the cost of installation and barn redesign. It is just too much money!"*

"But imagine how much money you would save from hiring workers, and also, production will increase because cows will be milked more often with the robots!" Erika responds.

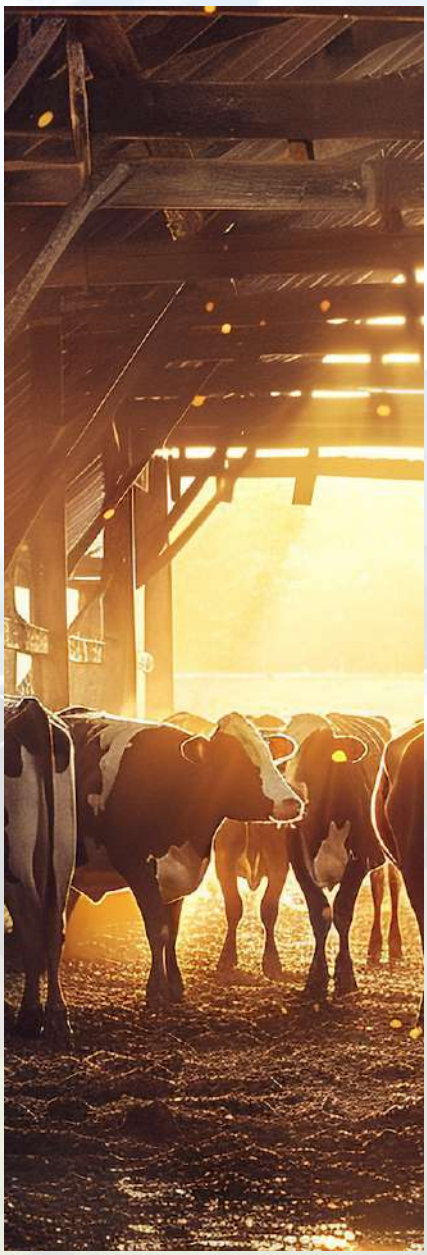
This debate–between Jack and Erika continues for hours, with both providing valid arguments. Joe then interjects, *"It is great to see how passionate both of you are when it comes to our farm; there is no doubt that our legacy is in good hands. I have an idea that could help with this discussion. What about hiring a consultant? Our neighbor Michael did the same before deciding to install AMS. In fact, I have a business card that Mike gave me in case I needed them."*

"Isn't that costly?" – interrupts Jack.

"No, because these are professionals working at a university; they provide their service for free to dairy farmers in Wisconsin and California."–responds Joe, while looking at his pockets–*"hey, I just found it! It is called Louis Lab, an economic group with headquarters at UC Davis. Let's call them to hear their perspective on this issue."*

"Sounds good; in that way, we have an impartial third party" responds Jack, to which Erika agrees.

"Okay, it's settled then. I will call them on Monday morning." concludes Grandpa Joe.



Friday July 12, 2024: Meeting at the Pioneer Farm


Joe


Jack


Erika


Luis


Shaheer

The morning of Friday, July 12, has arrived. As the meeting commences with Grandpa Joe, Jack and Erika, introductions of both your team and theirs are exchanged. Here, we present parts of the conversation, focusing on additional information about the dairy farm and AMS:

Luis: Thanks for having us and for providing us with your financial statements in advance. I'm glad we could sit down today to discuss the potential of adopting robotic milking on your farm.

Jack: Thanks for coming today. We have been debating whether to install milking robots on our farm. It's intriguing but I'm not sure if it's the right move for our farm.

Luis: Absolutely, it's a large financial investment. How many cows do you have, and what's your average milk production?

Jack: We have about 175 cows that are being milked, and we sell around 25,400 lb. of milk per cow annually.

Erika: For the current herd size, how many robots would we need?

Shaheer: About three robots, as each milking box is able to milk about 60 cows per day.

Luis: Do you hire part-time or full-time workers?

Joe: We usually hire workers to help with milking the cows, but this ends up being a lot of labor. Last year's records show that we paid about 12,000 hours in wages. During 2022 and 2023, we hired the kids of our friends that live nearby, but it has been difficult to retain them, as many of them go to high school and have homework, are involved in after-school activities and will be going to college next year.

Jack: We've tried to hire full time employees but that has been a challenge. They often don't show up on time, and on some days, they don't show up at all. We are afraid to let them go because we need the help, and it is difficult to find new employees.

Luis: I see. How many hours per year does your family work on the farm?

Joe: Jack and I spend most of our time at the farm. However, now that Erika has graduated from college two weeks ago and I am retiring, she will help Jack run the farm. I estimate that last year we spent about 5,000 hours on the farm as a family.

Shaheer: Apart from labor, what other costs and risks do you find significant for the farm?

Jack: We are definitely worried about feed cost and price variability.

Shaheer: What are your expectations on milk prices?

Joe: We are not entirely sure. The milk price is determined by the Federal Milk Marketing Order, which in the last five years has fluctuated a lot. Some months we have received as low as $15/cwt, while other months, such as in May 2022, we got an all-time-high of $23 per hundredweight.

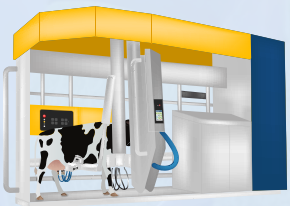
Shaheer: Thanks for the insights. Do you have any questions for us?

Jack: Yes, first off, how much of an investment are we talking about here? I've heard it can be pretty steep.

Shaheer: It can vary depending on the size of your operation. Typically, you're looking at an initial investment ranging from $185,000 to $250,000 per robot for brand new robots. This does not include the cost of the new barn or barn retrofits. Because of the technology, robots also have higher ongoing maintenance costs than conventional milking systems.

The conversation continues for thirty more minutes. Dr. Shaheer and Dr. Luis take notes of all the farmers' concerns regarding automation in order to help you have a better idea of where to focus on your consultancy task. The conversation ends with Jack's remark:

Jack: I really appreciate your input and thoughts. I am looking forward to your recommendation of the best option to position our farm for the future.


Automated Milking System