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By Jennifer Ifft

Capital vs. labor: A historic tradeoff in perspective

Labor costs are one of the major challenges facing dairy farm managers today. Difficulties recruiting and retaining farm workers at a feasible wage, as well as regulatory pressures, often drive decisions to make labor-saving capital investments. While these challenges may seem unprecedented, they reflect the continuation of a transition to more capital-intensive agriculture that has been ongoing since the beginning of civilization. As productivity increases, labor and management, and innovation and adaptation, will continue to be important. The dairy farms that survive and thrive will use various approaches to human resource management, of which labor-saving investment will continue to be a critical component.

History provides important context to critical decisions dairy farms face on labor-saving investment

A historic perspective

Innovation and technological advances have driven development of the agricultural sector since agriculture began more than 10,000 years ago. As farms became more productive over time, labor was free to move to off-farm work that offered higher wages. Human history is full of examples of agricultural innovations, from domestication of wild aurochs (ancestors of the modern cow) to use of simple hand-held tools to aid cultivation, to use of draft animals, to pasteurization.

The pace of agricultural innovation has accelerated over the last century, along with significant structual changes in the US agricultural sector. During the Great Depression, Congress enacted the first farm program legislation that was intended to maintain farm household income. At that time, more than 20 percent of the US labor force was employed in farming and farm household income was about a third of the national average. Farm household income in 1934 was $1,630, compared to $4,980 for non-farm households. Today the situation has nearly reversed, with less than 2 percent of the US population employed in production agriculture. Further, median US farm household income has been higher than the median of all US households since 1999, and the gap is widening.

Substantial productivity gains have accompanied the rise in farm household income. From 1948 productivity increased steadily at an average annual rate of 1.9 percent. This was driven by domestic and international demand, with US export demand growing rapidly in the 1970's and again in the 1990's. More recently, from 1982 to 2007, agricultural sector productivity increased about 50 percent. During the same period, farming used 30 percent less hired labor and 40 percent less operator labor.

While the farm sector has become increasingly capital intensive or "mechanized," and multiple innovations have allowed for less labor to produce more for nearly all farms, some farm specializations still require labor beyond what a typical family can provide. This includes certain livestock and dairy operations, and specialty crops, including fruits, vegetables and horticultural crops. While even these specializations have experienced increased labor productivity, the supply of people willing to work on farms has also declined over time, while wages have increased. A continually tightening labor market, underpinned by overall economic growth, ensures that labor market challenges remain even in the face of substantial technological advances.

The process of innovation and adaptation

Labor shortages are a driving factor of innovations, through a process that the agricultural economics literature calls "induced innovation." Induced innovation occurs in response to economic conditions. While some argue that innovations are the randomly occurring result of research, and provide examples of this type of innovation, most economists now accept induced innovation as the leading driver of technological change. Innovations can be either physical or a capital good (embodied) or innovations that are not physical (disembodied).

Labor-saving technologies, designs and processes are classical examples of induced innovation. In California, labor-saving tomato harvesters and tomatoes with tougher skin were developed through a public-private partnership based at the University of California, Davis. Returns to research and development of mechanical harvesting of tomatoes are estimated to have social returns in the range of 1,000 percent. While mechanization occurred in tomatoes, cotton and other major crops grown in California in the 1960's, farm labor (number of domestic farm workers) actually increased due to increasing production of fresh produce throughout the same period.

Innovations are taken up by farms through an adoption or diffusion process. Adoption occurs when farm-level decision are made on whether or not to use a particular innovation. Several factors will influence whether or not a farm adopts new innovations. Diffusion, likewise, is the aggregated process of adoption across farms. Diffusion may be based on geography, farm size, and other farm characteristics. Innovations are often observed to be slowly adopted by a few individuals or firms, often characterized as "early adopters." Then, at some point the rate of adop-

tion increases, with innovations spreading quickly across a larger share of firms or production. For successful innovations, profits are often higher for early adopters, but dissipate entirely for the last farms to adopt, due to overall production increases decreasing aggregate price levels. However, not all new innovations are ultimately successful or commercially viable, and, like all investments, must be considered carefully.

Adapting to higher labor costs

Adaptation has been defined as "the response of economic agents and societies to major shocks." Adoption of new innovations is one element of adaptation to shocks to farm labor markets. Farms can undertake various strategies to deal with these issues in the current farm labor market. While mechanization is an important strategy, it requires substantial financial risk and potentially restructuring the farm operation. Several other strategies can be used to adapt to changing farm labor markets. Instead of, or in addition to mechanization, farms might also invest in improvements to current human resources management processes. This could involve various strategies, including using guest-worker programs, investing in recruiting and retaining domestic labor, and pursuing alternative or novel sources of labor. They may also invest in new designs for facilities or hire custom service providers to perform tasks. Given the costs and risks associated with mechanization, facilities, custom services, and investment in human resources, some farms might choose to make strategic changes to their business. Examples of this include different agricultural enterprises (grain production vs. dairy), pursuing higher value production (organic vs. conventional), or direct consumer marketing. In extreme cases some farms may exit the dairy business altogether, as rising minimum wages put pressure on labor costs and erode profit margins.

If increased mechanization or an investment in facilities or custom services seems viable, it is important to fully account for all costs, examine motivations, and evaluate if the operation is ready for a transition. Large capital investments, such as robotic milkers or rotary parlors, may lead to a restructuring of a farm's entire production system and business model. Given that substantial risk may be associated with taking on new debt, the investment should be considered in the context of any restructuring involved. This may require detailed capital budgeting beyond what is normal for an operation. To secure financing, a farmer will need to convince their banker that loan repayment is feasible under a variety of market outcomes, fully accounting for all new costs and revenue streams under the new production model. A key consideration is if the farm can meet debt obligations under a sustained downturn in milk prices. Another key consideration is the current rate of technological change. It's important to understand how quickly any new investment will become obsolete, and the flexibility to make upgrades over time. ❐

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Business Analysis Resources:

Cornell Dairy Farm Business Summary (DFBS)

Annual financial analysis and education program offered through Cornell University and Cornell Cooperative Extension.

Contact: the local Extension office in New York State, or Visit: dfbs.cornell.edu or dfbs.aem.cornell.edu.

Farm Credit "Northeast Dairy Benchmark Summary"

Annual financial analysis prepared for New England and New York producers through the efforts of Farm Credit East and Yankee Farm Credit associations.

Contact: the local farm credit office, or Visit: www.farmcrediteast.com or www.yankeeaca.com.

Farm Credit "Large Herd Benchmark Program"

Detailed annual business summary reports, meetings and follow-up targeted specifically for participating dairies across multiple states.

Contact: the local Farm Credit office or Farm Credit business consultant.

Dehm Associates "Dairy Dashboard"

Benchmarking program for monthly, quarterly and annual financial analysis for preparing trends, budgets, actual to budget comparisons, and use in the management teams.

Contact: Dehm Associates, bdehm@dehmassociates.com, 585-243-4427, or www.dehmassociates.com.

Farm Credit "Dairy Profit Analyzer"

Monthly or quarterly business analysis program for tracking year to date (ytd) earnings, trends, and comparison to budget, benchmarking, and use in management teams.

Contact: the local Farm Credit office or Farm Credit business consultant.

Cornell University PRO-DAIRY "Dairy Profit Monitor" Program

Monthly web-based program that tracks select financial and production metrics to monitor progress during the year and over time, with a focus on the milking herd.

Visit: www.dairyprofit.cornell.edu.

Budgeting Resources Websites

http://cdp.wisc.edu/Decision Making Tools.htm
http://www1.extension.umn.edu/dairy/business-tools-and-budgeting