100 Years of Milking: From Buckets to Robots

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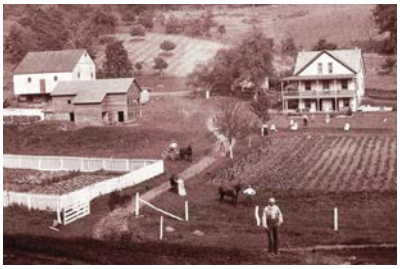
Hand Milking 1880-1920



- 4 cows milked/hr
- 8 cows/farm
- 40 acres with ¼ to feed Horses
- ½ of US population lives on Farms
  - 12M farm workers in 1915, 1M in 2015
- Life Expectancy 54 yrs

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Make hay while the sun shines

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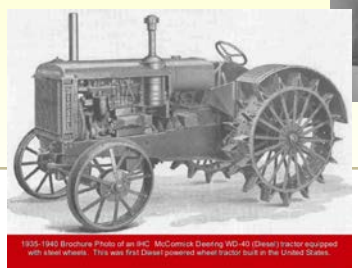
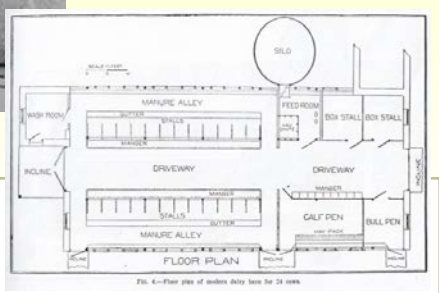
Bucket Milking

- 10 cows/hr
- 20 cows/ farm
- 80 Acres
- Tractors!

Well-Water Milk Cooling



1935-1940 Brochure Photo of an IHC McCormick Deering WD-40 (Diesel) tractor equipped with steel wheels. This was first Diesel powered wheel tractor built in the United States.



What came first?

When electric lines reached their farm in Vermot, Conrad Ormsbee's dad bought automatic milkers. FSA.

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Pipeline Milking

- 30 cows/hour = 60 cows = 240 acres
- Classic Red barn and Silos
- Milking Ergonomics

Parlor Milking

- 50 – 150 cows/hour
- Hired milking labor
- Cows Step up
- Milking Ergonomics
- Semi-Automated

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Count the rings on the tree

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Rotary Milking Parlors

Cows move people stand still

100+ cows/person/hour – highly repetitive work

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Multiple Barns with Large Parlor(s)

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We Need to Talk about Robots

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A political ecology of robots is due, one that is rigorously empirical, dedicated to justice and animal welfare, but unromantic in every regard.

This is a surreal cyborg affair, but the animals are clearly experiencing less physical stress than their counterparts at dairies around the state. Equally, the owner tells me that this technological innovation has allowed him to maintain and raise wages for his very small remaining workforce and has freed time for him to see his grandchildren, and indeed spend more time attending to his cow. Rather than having to oversee an army of workers to march hundreds of animals to the milking parlor in the middle of the night in January, he can tend his animals directly.

What the animal's experience might be is beyond our capacity to know. It is definitely the case, however, that the animals have increased autonomy and freedom of movement, less structured schedules, and lower stress, all resulting in higher yields. This may not compare to a pastoral ideal, but it certainly represents a radical change in trajectory from the massive and stressful milking parlors of past decades.

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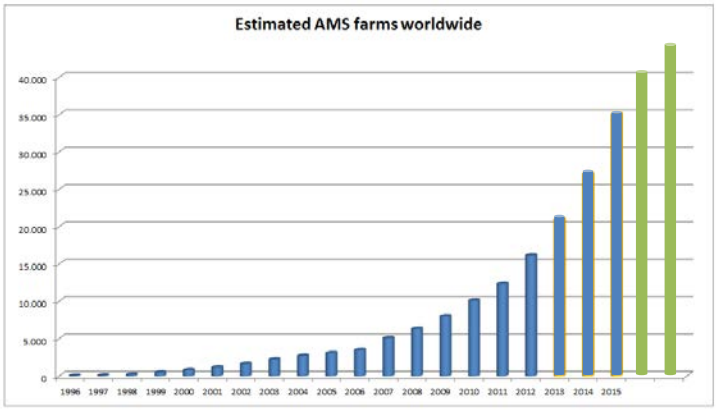
Growth in Robotic Milking
World and US Growth rate has been EXPONENTIAL!!
300+ Farms in US 500+ in Canada



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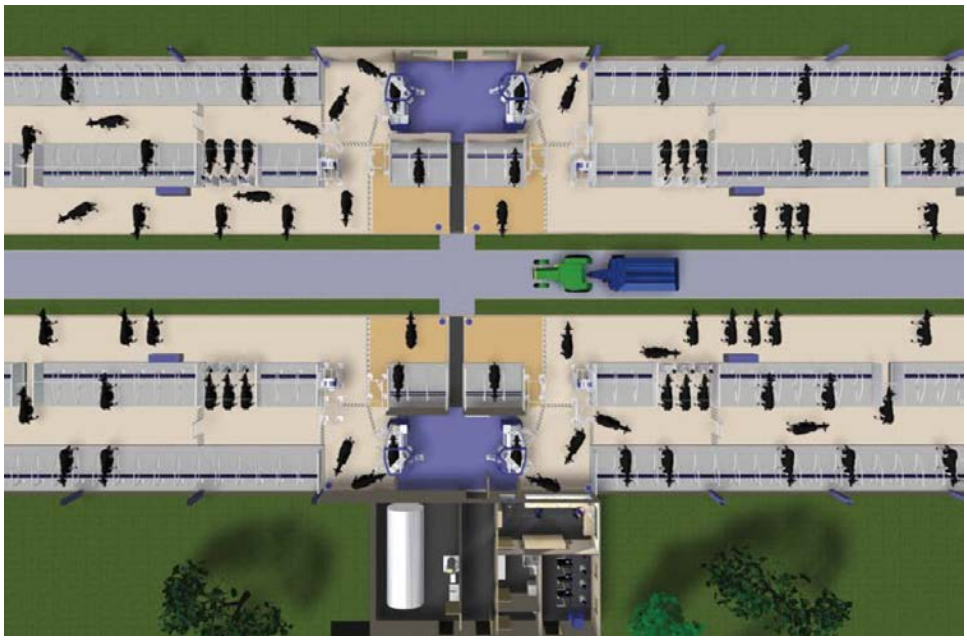
Robotic Milking: Single Box Systems
"Family Farm" = 4-8 boxes

50-70 Cows per box
200 - 500 cows



Robots (and Cows) on Pasture

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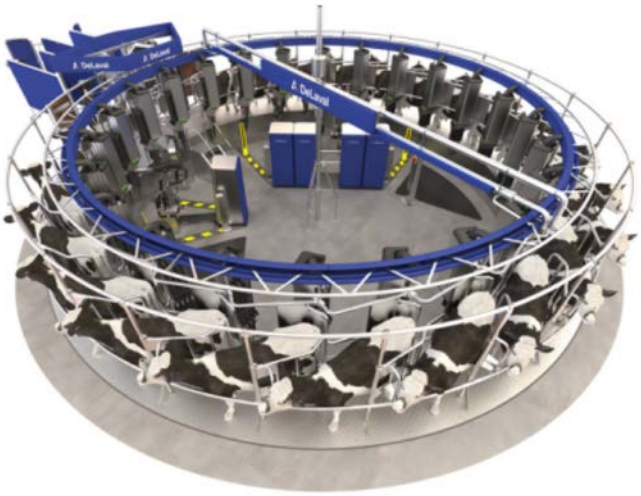
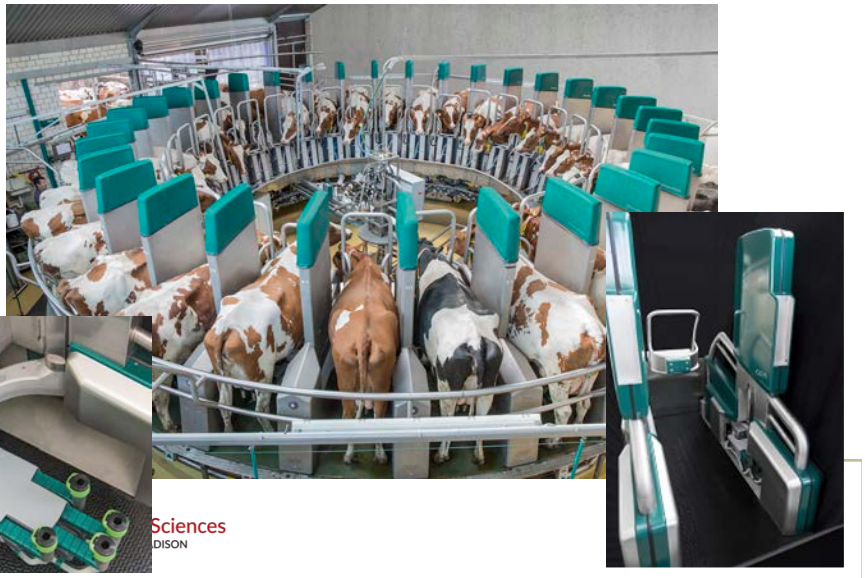
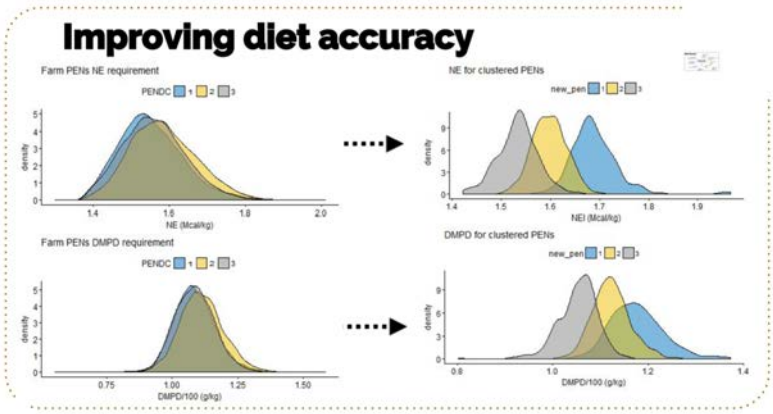
DeLaval Automatic Milking Rotary™ (AMR™)
24 stalls - 5 arms Cows Rotate, Arms Stationary
Batch or voluntary milking



GEA Dairy Pro-Q Rotary Robotic Parlor
1 arm per stall Arms rotate with cows
Batch Milking 1 Operator Monitoring Operations



Manage by Pen or by Cow



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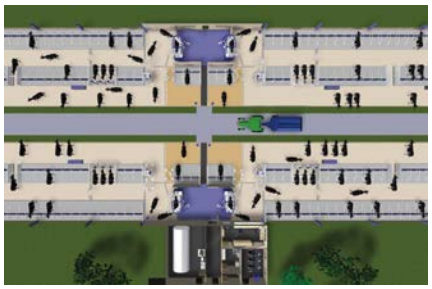
The Future?

Small Farms with Robotic Boxes
Large Farms with Robotic Boxes
Large farms with Robotic Rotaries



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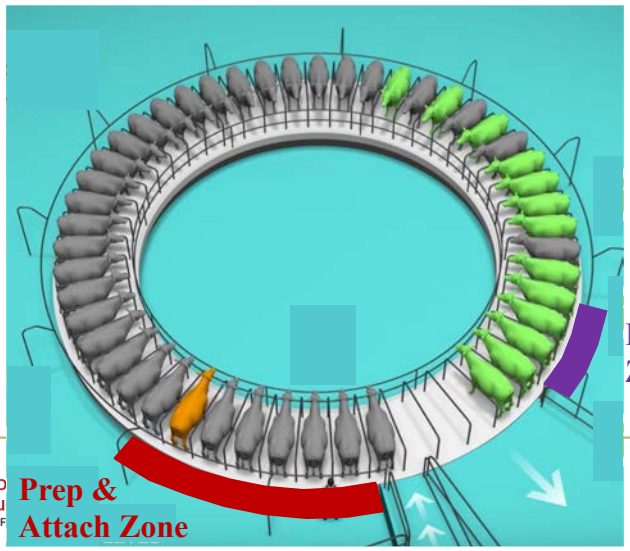
Future Scenario: Fixed arm rotary



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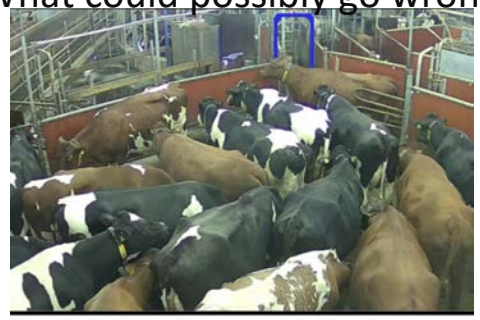
What could possibly go wrong?



Cows in the WA with one cow blocking the entrance

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Future Scenarios

	Cows / arm	Cows / milking labor unit	Feed Management	Milking Management
Small Farm	-	150	Individual Cow	Fixed Interval
Big Farm	-	250	Pen	Fixed Interval
Robotic Box	60 70	240 480	Individual Cow	Variable Interval Unattended
Robotic Rotary Stationary arms	150 225	250 1000	Individual Cow Pen	Variable Interval Unattended Fixed Interval Attended
Robotic Rotary Moving arms	15 40	1000	Pen	Fixed Interval Attended

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Agricultural Economy in Wisconsin

- 12% of employment
- 11% of total income
- 16% of industrial sales
- Relative importance of agriculture has diminished as service sector employment has grown

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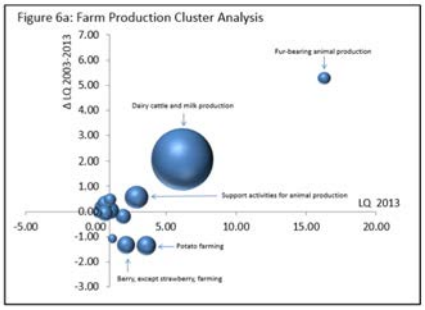
Market Sector Trends

- **Strength and Growing**
  - Butter
  - Dry dairy products
  - Meat
- **Strength & Declining**
  - Cheese
- **Weak & Declining**
  - Fluid milk
  - Ice cream



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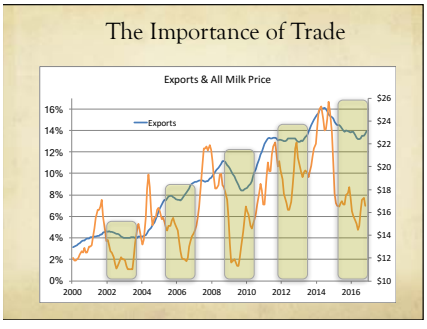
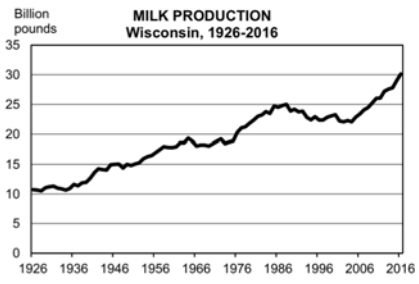
It's a World Market





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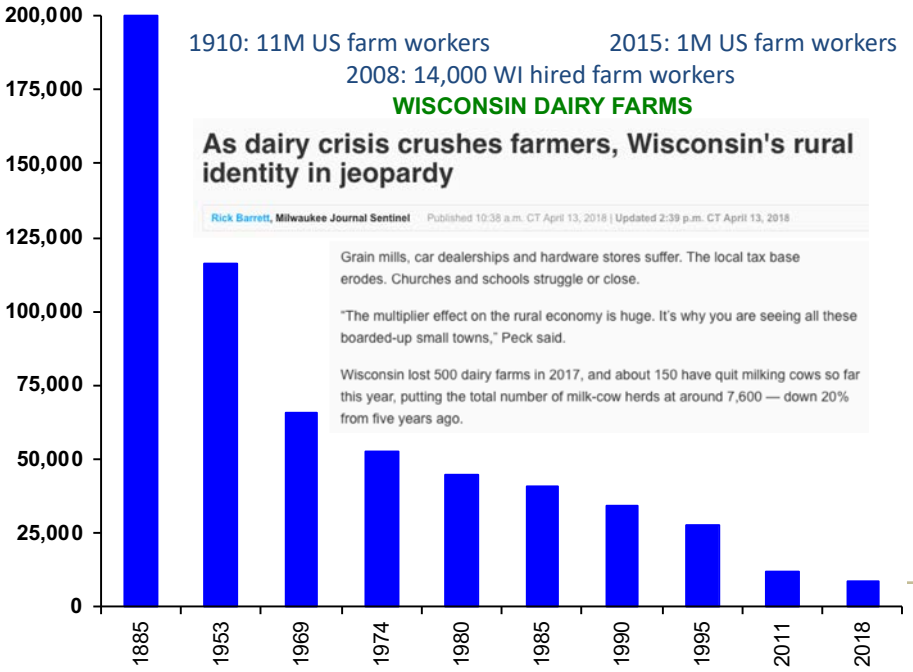
UW Center for Dairy Profitability
Mark Stephenson, PhD
Director of Dairy Policy Analysis



1910: 11M US farm workers 2015: 1M US farm workers

2008: 14,000 WI hired farm workers

WISCONSIN DAIRY FARMS

As dairy crisis crushes farmers, Wisconsin's rural identity in jeopardy

Rick Barrett, Milwaukee Journal Sentinel Published 10:38 a.m. CT April 13, 2018 | Updated 2:39 p.m. CT April 13, 2018

Grain mills, car dealerships and hardware stores suffer. The local tax base erodes. Churches and schools struggle or close.

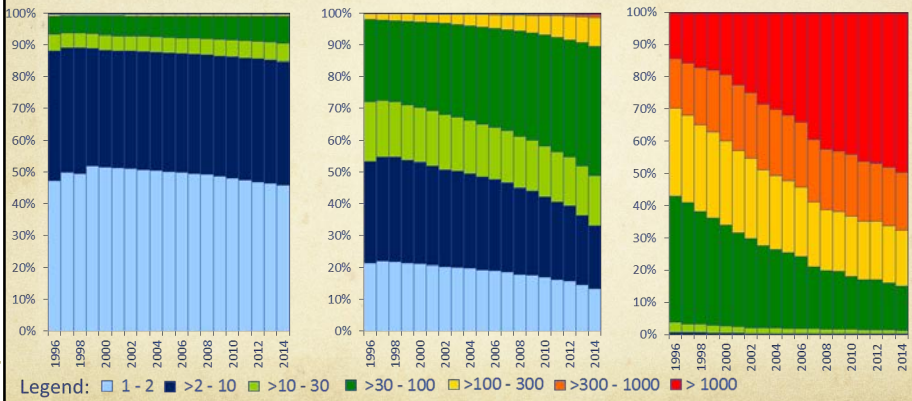
"The multiplier effect on the rural economy is huge. It's why you are seeing all these boarded-up small towns," Peck said.

Wisconsin lost 500 dairy farms in 2017, and about 150 have quit milking cows so far this year, putting the total number of milk-cow herds at around 7,600 — down 20% from five years ago.

Shares of cows per size classes

Distribution in IFCN standard classes 1996-2014

	India	Brazil	USA
Herd size change 1996-2014:	2.0 – 1.7	9.0 – 22	72 – 182
Annual %-change in farm number:	2.8%	-2.3%	-3.4%



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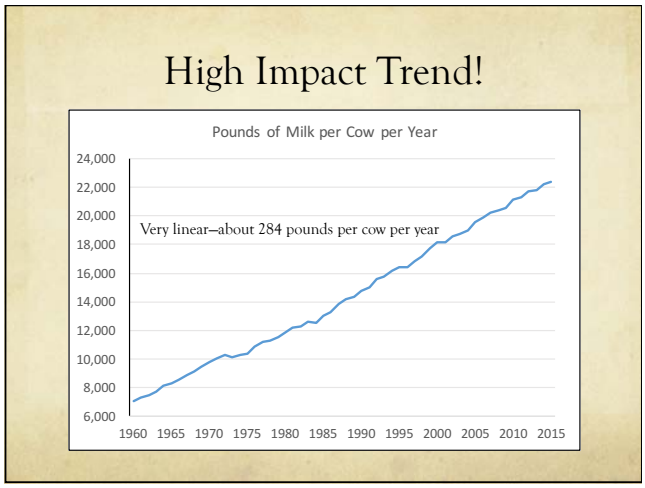

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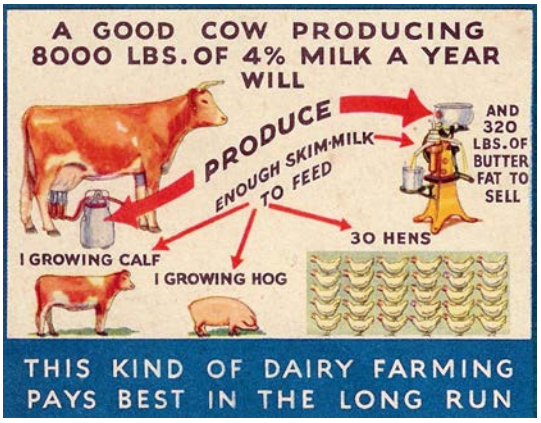
A good cow in 1936 (8,000 lb/yr, 3600 kg/yr)



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Land Value Pressure on Traditional Dairy Areas

AGRICULTURAL LAND VALUES: AVERAGE VALUE PER ACRE, WISCONSIN, 2013-2017 1/

Year	Farm real estate 2/	Cropland	Pasture
	Dollars per acre		
2013	4,100	4,010	2,000
2014	4,400	4,350	2,150
2015	4,700	4,700	2,250
2016	4,750	4,900	2,300
2017	**5,200**	**5,200**	**2,350**

1/Value at which the land could be sold under current market conditions. 2/Value includes land and buildings.

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Farms Entering the Information Age

FARM COMPUTER USAGE: WISCONSIN, 2007-2017

Year	Farms with computer access	Farms using computer for farm business	Farms with Internet access
	Percent		
2007	69	38	58
2009	73	41	67
2011	73	42	67
2013	76	46	72
2015	77	47	72
2017	**77**	**49**	**73**

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The Immigrant Labor Situation

Some dairy farms hire full-time immigrant workers, many of whom are undocumented. In 2008, 40 percent of Wisconsin's dairy workforce were immigrants – up from just 5 percent in 1998, reported the Wisconsin Center for Investigative Journalism. Their numbers have been even higher at larger dairy operations.

Dairy farm operators report difficulty finding reliable U.S. born workers willing to fill these new positions. As a result, there are at least 5,300 immigrant workers on Wisconsin dairy farms, more than 40 percent of all hired employees. The majority of these workers are of Mexican or Hispanic origin.[4] Failure to resolve the debate on federal immigration policy may have an impact on dairy producers in this state.

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Hired Labor Rate $13.30 up 10% in last 5 years

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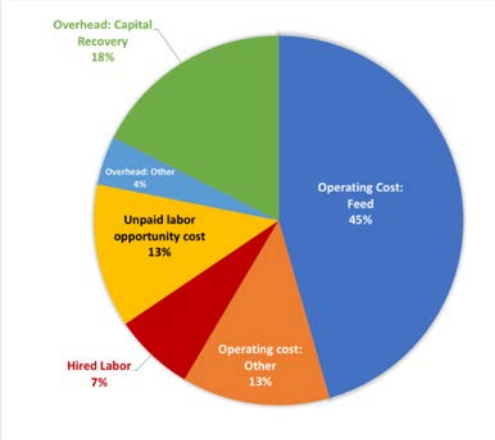
Cost of Milk Production: Wisconsin



- Cost of Production
  $27 /cwt
- Value of Production
  $19 /cwt
- COP-VOP
  -$8 /cwt
- COP – Operating Cost
  $3.2 /cwt

- Robotic Milking
  - Increased Capital cost
  - Modest decrease in hired labor
    - Shift to higher skilled jobs
  - Must have increased productivity to be viable
    - More milk per cow
    - Better cow health and longevity
    - Reduced vet cost, labor turnover

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The Cows Appear to Like Them

"Satisfied? ... I warned you not to invite the cows in for a few drinks."

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