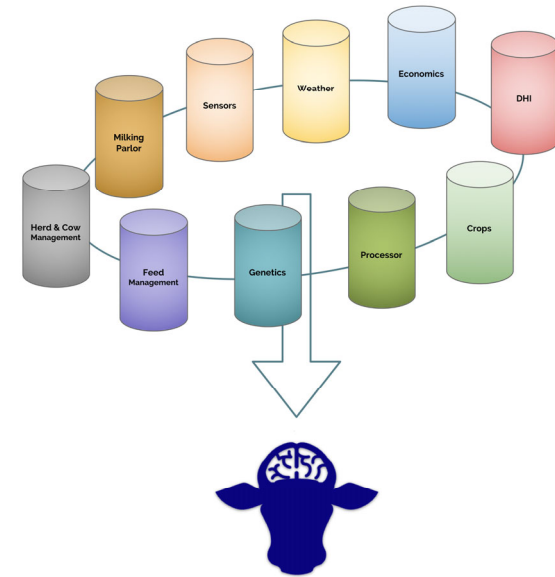




Developing a Virtual Dairy Farm Brain

Integrated Data / Predictive Behavior / Strategic Operations

Victor E. Cabrera
University of Wisconsin-Madison, Dairy Science
Victor.Cabrera@wisc.edu

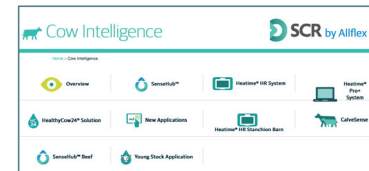
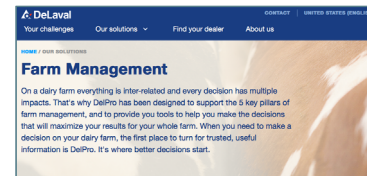


Companies:

- Enforced software interoperability
- Restrictive use agreements

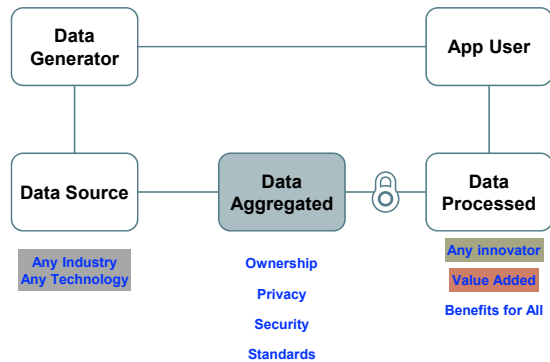
Analytic improvements restricted

- Value of facilitating data exchange
- Collaborative and open environment

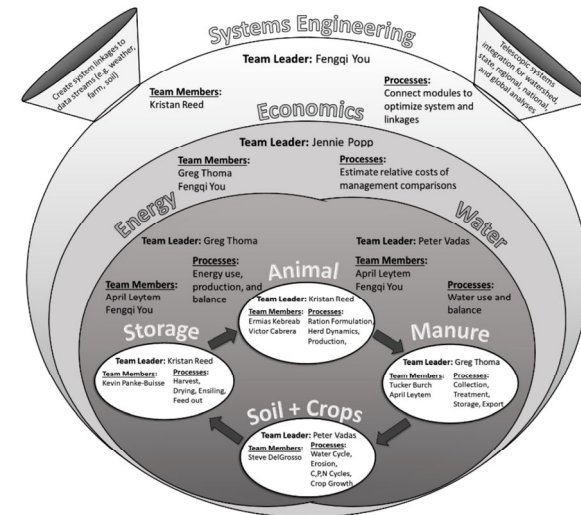


(Responsibility)

Ecosystem of Data Exchange & Services



Ruminant Farm Systems Model (RuFaS)



Critical need data-driven DST

- Greater productivity (same/less cows)
- Push bio-physiological limits
- Unprecedented market volatility
- Reliance on intuition, experience, ..

"actual progress has been minimal"

Opportunity exist:

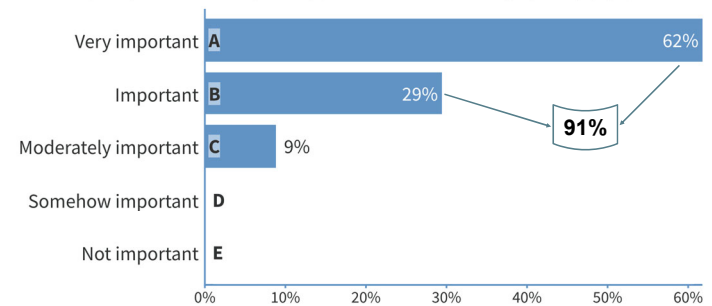
- Technological jump
- Vast data streams



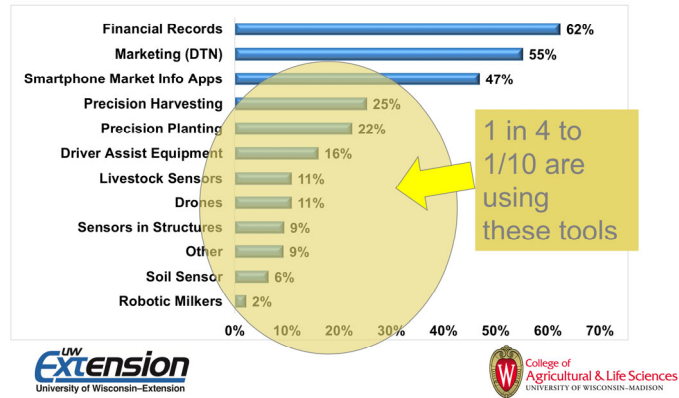
March 2018 Business Conference

How important is for you the issue of lack of data integration of your dairy farm data and software?

Respond at [PollEv.com/brain](https://www.poll-ev.com/brain) Text BRAIN to 37607 once to join, then A, B, C, D, or E



Uses and Applications of Various Digital Technologies:



386 dairy (of 1,090) Midwest farms

Shutske et al., 2018



Cargill brings facial recognition capability to farmers through strategic equity investment in Cainthus

Sensors give farmers clear picture of animal health and well-being



Smartbow is now part of **zoetis**

(MINNEAPOLIS) January 31, 2018 — Cargill and Cainthus, a Dublin-based machine vision company, are reshaping how animal producers make decisions for their livestock through a strategic partnership that will bring facial recognition technology to dairy farms across the world. The deal includes a minority equity investment from Cargill. Terms were not disclosed.

Cainthus uses breakthrough predictive imaging to monitor the health and wellbeing of livestock. Their proprietary software uses images to identify individual animals based on hide patterns and facial recognition, and tracks key data such as food and water intake, heat detection and behavior patterns. The software then delivers analytics that drive on-farm decisions that can impact milk production, reproduction management and overall animal health.



"We are enthused about what this partnership will mean for farmers across the world," said David Hunt, president and co-founder, Cainthus. "Cargill is a natural partner for us, given their focus on bringing a world-class digital capability to the market and their understanding of how technology will truly help farmers succeed. We think this partnership will be a game changer for farmers because it will allow them to efficiently scale their business."

DAIRY INNOVATION ...

9 COMMENTS

DFA invests in artificial intelligence

Invests in SomaDetect, a dairy startup that uses real-time analytics to improve milk quality

PUBLISHED ON OCTOBER 22, 2018



"This is a potentially game-changing technology for our farmers and the industry as it allows dairy farmers to know the health of each cow and quality of milk in real time," says David Darr, president, farm services at DFA. "With access to better data, our farmers can make more knowledgeable decisions, which is a huge value." (United Soybean Board, Flickr/Creative Commons)



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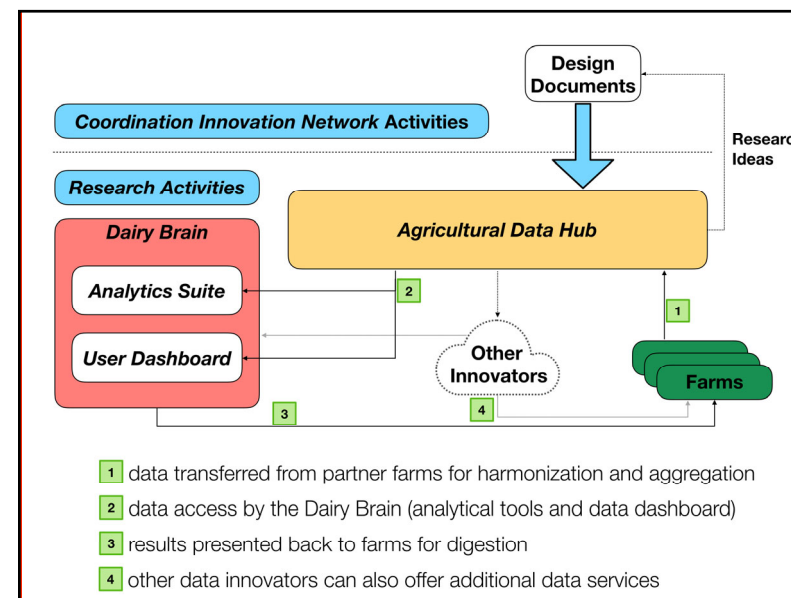
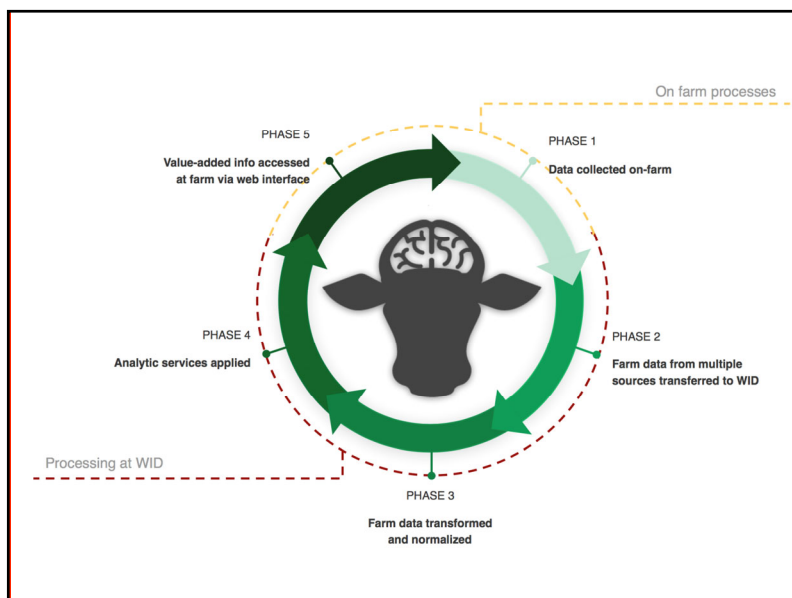
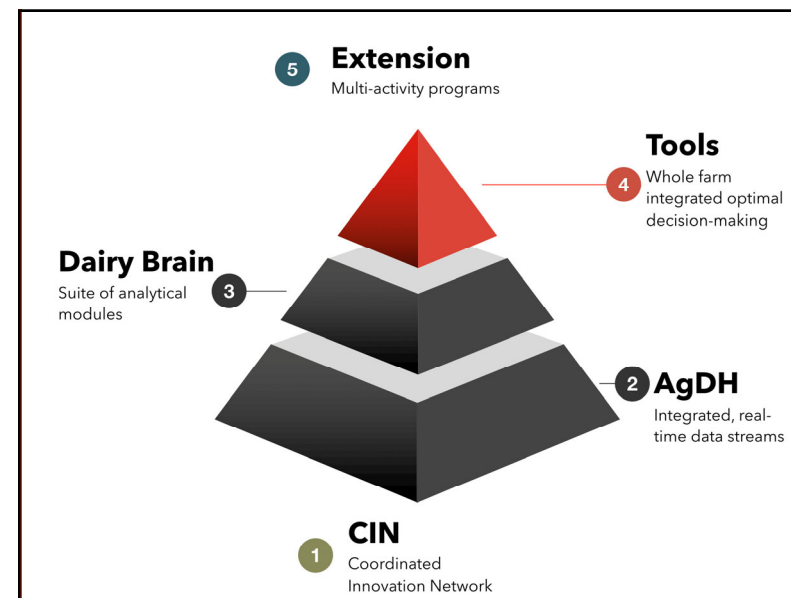
HOME / FUNDING / DATA SCIENCE INITIATIVE

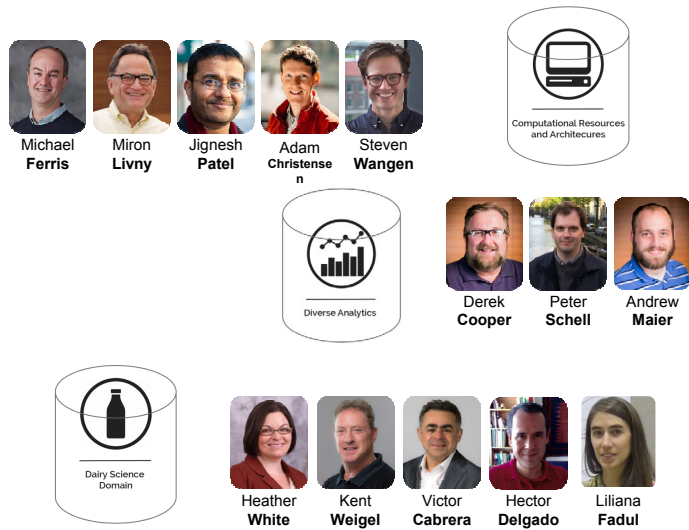
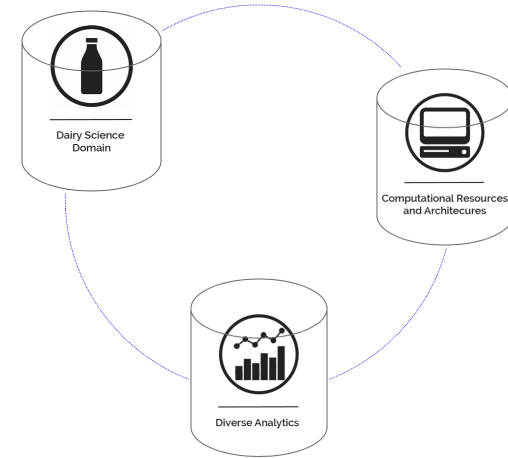
Contemporary Social Problems Initiative
Grant Matching Programs
Microbiome Initiative
Data Science Initiative
Award Administration
UW2020
Publishing Subvention
Conference Travel

Data Science Initiative

The goal of the UW–Madison's Data Science Initiative is to stimulate and support two-year grants for data sciences research and to stimulate development of new research relevant to data science including new tools for applying data to complex problems. In addition, by providing seed funding for data science projects at UW–Madison, the initiative is expected to position UW–Madison faculty to be more competitive when applying for federal and other extramural funding for their research.

In 2018, 10 projects were selected with an average award amount of \$222,000. These projects were selected from 54 proposals submitted from across the UW–Madison campus. The Data Science Initiative is funded by the Chancellor's Office, Office of the Vice Chancellor for Research and Graduate Education (VCRGE), Wisconsin Alumni Research Foundation and the Graduate School.





HT CENTER FOR
HIGH THROUGHPUT
COMPUTING



HTCondor
High Throughput Computing

HTCondor infrastructure for research conducive to Nobel Prize awards in physics

Miron Livny: Collaborative Spirit Supports Nobel Prize-Winning Science

October 10, 2017

In 1964, François Englert and Peter Higgs theorized the existence of a subatomic particle that gives all other particles mass. Nearly 50 years later in 2012, a global team of researchers found evidence that supports the existence of the Higgs boson particle at the Large Hadron Collider (LHC) in Geneva, Switzerland.

This week, the duo [received the 2013 Nobel Prize in Physics](#), a point of pride for the hard-working network of scientists around the world focused on the project, including a group from UW-Madison.

Wesley Smith, a Spem Weis Professor of Physics, and San Lu, an Enrico Fermi Professor of Physics, led research teams in search for the particle, while Miron Livny, a professor of computer sciences and principal investigator of the [Open Science Grid \(OSG\)](#), helped create the computing technologies and infrastructure to store and process the data produced by the LHC.

Livny, who also leads the [Core Computational Technology](#) area of WIS and the [Vincennes Institute for Research](#), weighed in on the news from Geneva and commented on the impact of the LHC experience on global infrastructure.

The Higgs discovery rests on years of work from people in different disciplines. How did your contribution play a role?

Miron Livny: Computing is a central part of this discovery. It's a very large amount of data that's being collected and analyzed. To give you a rough idea, the U.S. contribution that we run, the Open Science Grid, provides about one-third of the total effort of the project, with more than 100 sites that offer the U.S. LHC effort around 1 million compute hours and more about a petabyte of data per day. It's a significant amount of computing that is happening on computers that are scattered throughout the nation.

The [HTCondor software](#) developed at UW-Madison also plays an important role in all of this. It has been adapted widely because the kind of computing that is needed for this science is very well aligned with what we have pioneered with our [High Throughput Computing](#) work. You want to make the science as efficient as possible.

Why do experiments at the collider create so much data?



Computing infrastructure created by Miron Livny supported the large-scale effort to find the Higgs boson, a subatomic particle that gives other particles mass.

UW System researchers played role in Nobel-winning gravitational wave discovery

October 5, 2017 | By Jennifer Smith | For news media



Miron Livny, a UW-Madison computer science professor, is pictured near an enclosed bank of distributed computing equipment in the Computer Sciences and Statistics Building. Photo: Jeff Miller

Advisory committee convened to help guide “virtual dairy farm brain” project

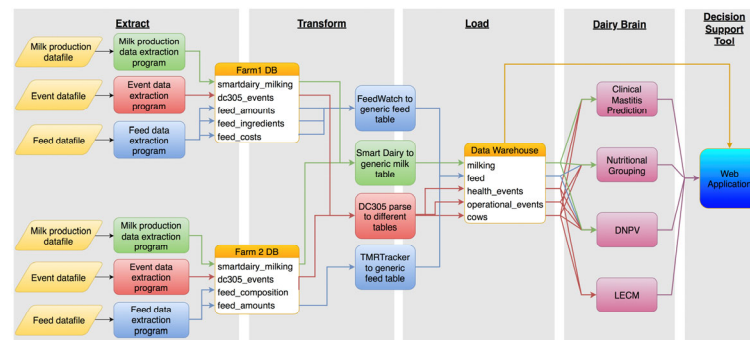
January 25, 2018 | By Virtual Dairy Farm Brain project team

The UW2020-funded “Virtual Dairy Farm Brain” project held its first Advisory Committee meeting on January 19 at the Wisconsin Institute for Discovery. The **big-picture goal of the project** is no small feat: to develop a way to collect and integrate all of a farm's various data streams in real time and then use artificial intelligence to analyze those data to help farmers make better management decisions.

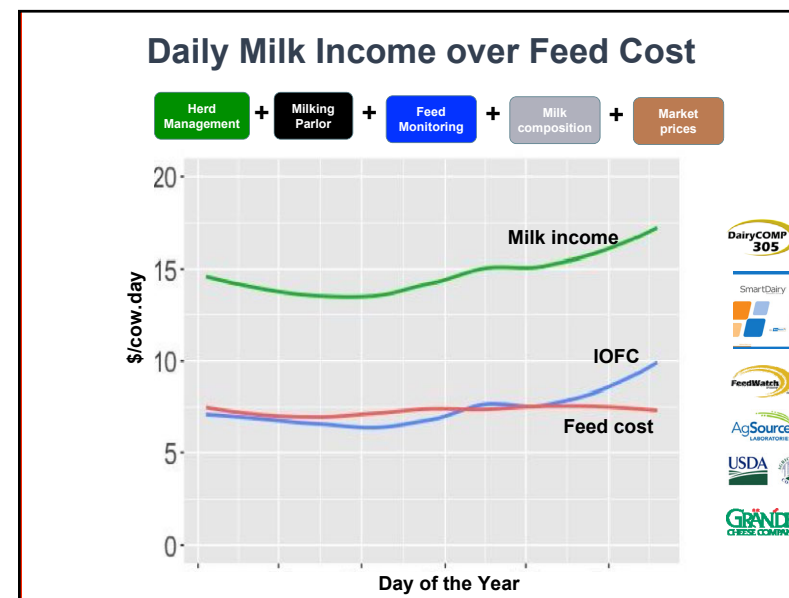
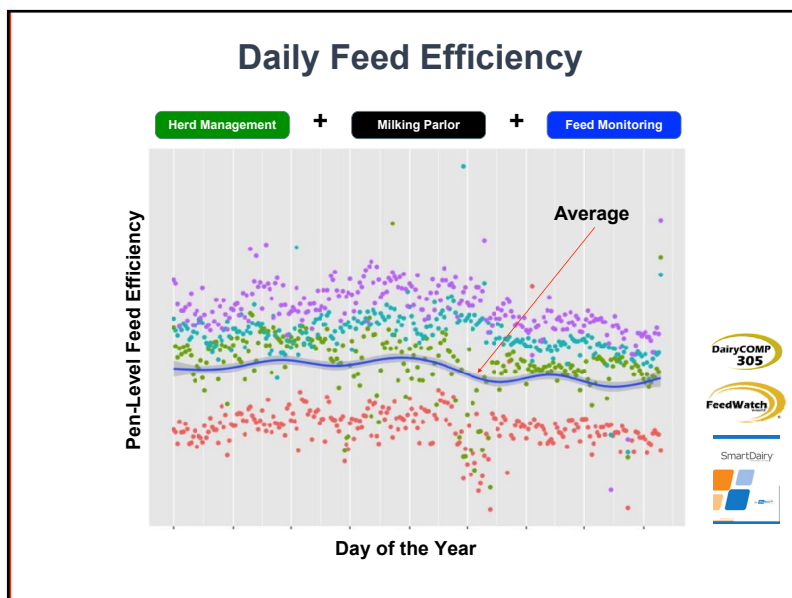
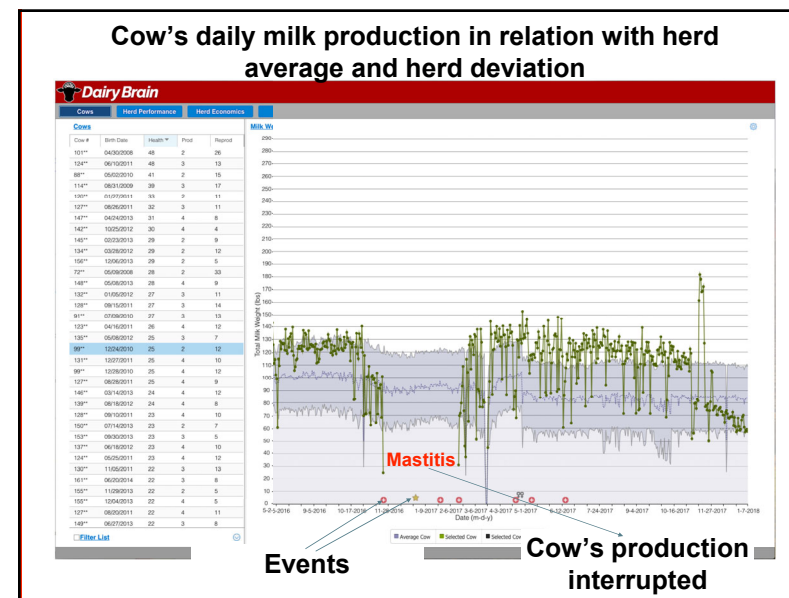
Twenty-seven people attended the inaugural Advisory Committee meeting in person, with an additional eight joining virtually. Attendees included project staff, participant farmers and industry representatives who work in big data dairy farm analytics. Participants were from Israel, Canada, Minnesota, California, Michigan, Missouri and around the state of Wisconsin.



Data Flow and Data Services



Decision Level	Model/Tool	Algorithm	Live data	Benefits
Operational Short-Term	Daily Feed Efficiency	Milk/Feed	Milking Parlor DHIA Feed Monitoring	Early warnings produced
	Daily Milk Income over Feed Cost	Milk Value/Feed Cost	Milking Parlor DHIA Feed Monitoring Processing	Margins optimized
Tactical Mid-Term	Continuous Nutritional Grouping	Mixed Integer Non-Linear Programming	Management Milking Parlor DHIA Feed Monitoring	Diets formulated more accurately
	Early Prediction of Clinical Mastitis	Logistic Regression/Machine Learning	Management Health Events	Mastitis risk cows identified
Strategic Long-Term	Dynamic Net Present Value of a Cow	Markov Chains	All the Above and Below	Cow's long term value
	Lifetime after a Clinical Mastitis Case	Survival Analysis	Management Health Events	Cow's fate after clinical mastitis
	Genetic Selection to Reduce Mastitis	Logistic Regression/Machine Learning	Management Genetic Traits	Best replacement selected

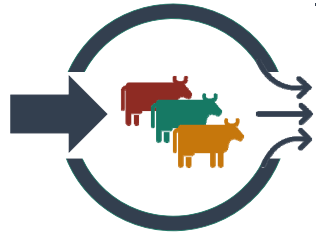


Nutritional Grouping

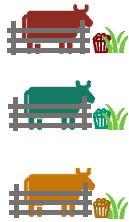
Cow Flow



Cluster



Differentiated diet



Rationale Nutritional Groups

↑ nutritional groups → ↑ homogeneous cows



↑ diet accuracy

↑ diet balancing



↑ nutrient allocation

↓ diet costs

Motivation



Nutritional
accuracy



Health &
wellbeing



Environmental
benefits



Economic
benefits

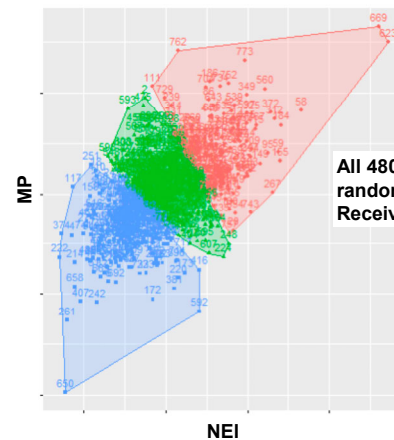


- Automated data integration
- Sophisticated analytics

- Grouping already happens



Herd Management + Milking Parlor + DHI



All 480 cows in 3 pens
randomly assigned.
Receive same diet.

DairyCOMP
305

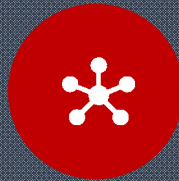


AgSource
LABORATORIES

Descriptive analysis



Data
collection



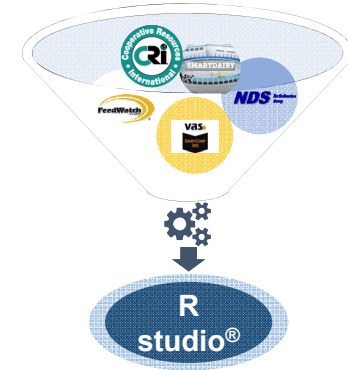
Grouping
Management



Implemented
groups

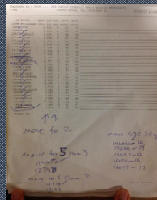
Data Collection

- File Date
- Cow ID
- Cow Age
- Pen ID
- DIM
- Lact
- Body Weight
- Moved date
- Milk yield lb/c/d
- CP %
- Fat %
- DMI lb/pen
- Diet MP g/day
- Diet NE Mcal/kg
- ...

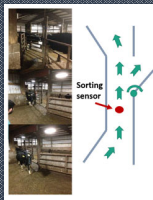


Groping management

GROUPING
LIST



SORTING
COWS



CHECK EAR
TAGS



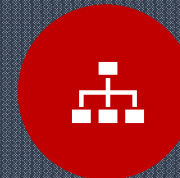
MOVE
COWS

PEN	Lactating cow profile	Days in milk
5	Multiparous, Late lactation	250-360
4	First lactation cows	70-320
4	Multiparous, early lactation	50-250
1	Fresh, first lactation	2-70
3	Fresh, multiparous	2-50
3	Hospital	—
1	Maternity	0-2

Prescriptive model



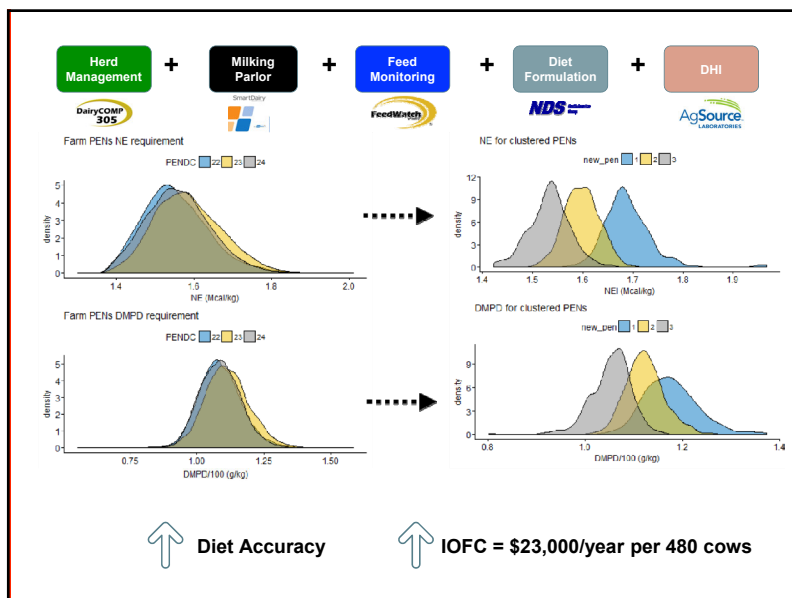
Nutritional
Parameters



Nutritional
grouping



Diet
formulation



DEPARTMENT OF DAIRY SCIENCE
 University of Wisconsin-Madison

HOME TOOLS PROJECTS PUBLICATIONS PRESENTATIONS LINKS

DairyMGT.info

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 IMPROVE ECONOMIC
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Thanks

Victor E. Cabrera
 University of Wisconsin-Madison Dairy Science