DAIRY
PRODUCTS TECHNOLOGY CENTER

Smarter Pilots: Prototyping Prototyping and Successful Pilot Trials

LEARNING OBJECTIVES

What You'll Take Away Today

01

Role of Pilot Trials

Understand where pilot trials fit in the product development journey.

02

Plan Efficient Trials

Learn how to structure pilot trials for maximum learning.

03

Avoid Common Mistakes

Recognize pitfalls that slow commercialization and increase cost.

04

Where to get Support

See how the Dairy Products Technology Center supports innovators.

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From Idea to Commercial Product

The pilot plant bridges the critical gap between bench-scale formulation and full-scale production.
A pilot trial is an experiment — not a production run

Idea

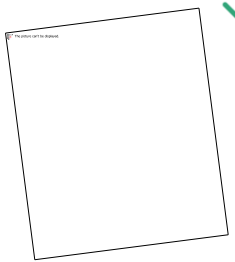
Concept and opportunity definition

Research & Formulation

Develop formulations and tests

Bench Prototype

Small-scale formulation trials



Pilot Trial

Scale-up in pilot plant

Scale

Co-packer or production run validation

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SCALE-UP THINKING

Designing for Scale-Up from Day One

Every successful pilot trial begins with rigorous experimental design. Follow this framework to generate clear, actionable results that accelerate commercialization.

Objective

Define measurable success criteria

Variables to Change

Isolate one or two independent variables; keep everything else

Pilot Trial

Run the trial under realistic commercial conditions with a qualified partner

Collect Data

Record sensory, physical, and process parameters in real time

Make Decisions

Use evidence to iterate the formula, adjust the process, or move to scale

Changing too many variables at once makes data uninterpretable — discipline in experimental design is what separates a faster launch.

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Designing a High-protein Chocolate Milk

Fat content	→	0%, 1%, 3.5%
Protein content	→	10, 15, 20 g/portion
Protein type	→	UF, MPC, WPC
Chocolate flavor	→	30%, 60%, 70%
Shelf-life	→	Pasteurized, ESL , UHT

$$5^3 = 125$$

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Before we start…

What information do I need?

A successful formulation starts **on paper**

All ingredients' specs

- Supplier
- Minimal order
- Composition

Theoretical formulation

- Based on the ingredients' specs
- Claims
- Nutritional value

Constraints

- Regulatory
- Standard of identity
- Customer requests
- Ingredients
- Equipment

Don't forget this step before you start playing with the formulation (s)

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PLANNING

Before You Schedule a Pilot Trial…

Every successful pilot starts with clear planning. Arrive with defined objectives — not just a formulation and a hope.

What question am I trying to answer?

What does success look like?

Which variables are most important?

What do I need to know before commercial production?

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BEST PRACTICES

Designing Smarter Pilot Trials

Keep Experiments Simple and Focused

- Change **one or two variables** at a time
- Establish a **control formulation** for comparison
- Plan all trial runs **before arriving**
- Standardize measurements across batches
- Document everything — including what goes wrong

Common variables: protein source, stabilizer type, heat heat treatment, fermentation time. The goal is to learn as much as possible from every batch.

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DATA COLLECTION

What Data Should You Collect?

A successful pilot generates **knowledge** — not just samples. Capture data across three critical categories.

Process Data

- Mixing time & temperature
- Pressure & flow rate
- Batch time

Product Data

- pH, viscosity & yield
- Texture & stability
- Sensory observations

Operational Notes

- Powder hydration & foaming
- Pumpability
- Cleaning challenges

If you don't measure it, you can't improve it.

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COMMON MISTAKES

Pitfalls That Slow Commercialization

No clear product objective

Arriving without defined success criteria wastes time and resources.

Testing too many variables at once

Without a control, results become impossible to interpret.

No identified co-packer or manufacturing partner

Scale-up decisions must be made before or in parallel with the trial.

Ingredients not commercially available

Lab-scale ingredients that can't be sourced at volume create costly reformulation.

CASE STUDY

Learning Through a Pilot Trial

Client Challenge

A food innovator needed to develop a cultured dairy product but faced multiple formulation ideas (different acidity profiles, packaging formats, and textures) ingredient sourcing questions, and processing uncertainty.

Pilot Approach

- Defined clear objectives
- Limited variables per trial run
- Collected both process and product data

Outcome

- Optimized formulation with documented parameters
- Identified key manufacturing considerations
- Reduced upscaling risk and timeline

Key Lesson: Every pilot should answer questions that move the project forward.

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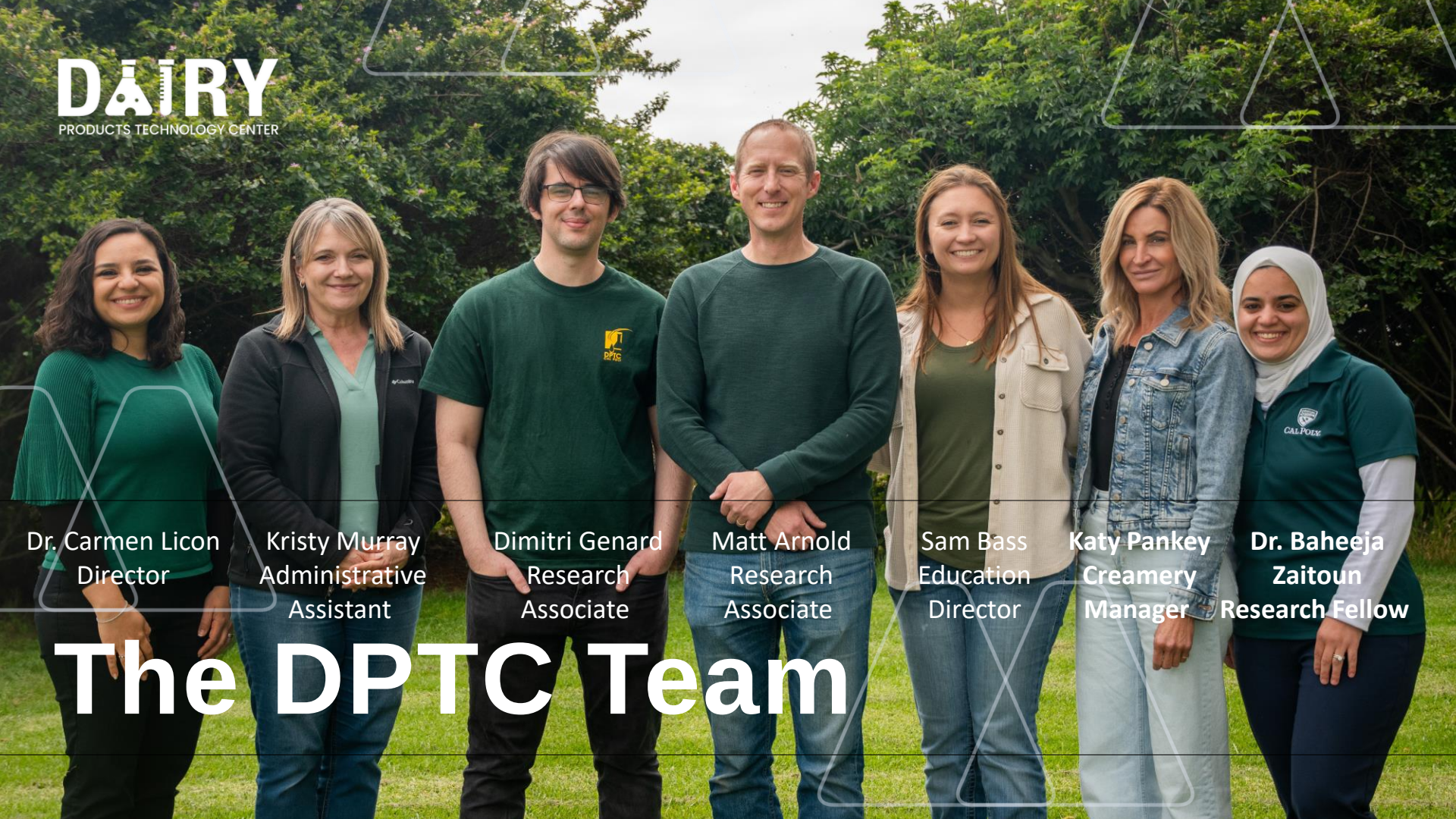
How do I start?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How We Support You — and Final Thoughts

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We help innovators make informed decisions before investing in commercial production

Remember

- Start with clear objectives
- Design experiments that answer specific questions
- Collect meaningful data
- Think about manufacturing early
- Treat every pilot as a learning opportunity

"The best pilot trial isn't the one that makes the most product — it's the one that generates the most useful knowledge"

Product formulation & prototype development

Pilot-scale processing & optimization

Scale-up guidance & technical consulting

Student collaboration & applied research

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Thank you!

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