

Augmenting Decision-making throughout  
the product lifecycle via simulation-based  
insights

**um**  
**2023**

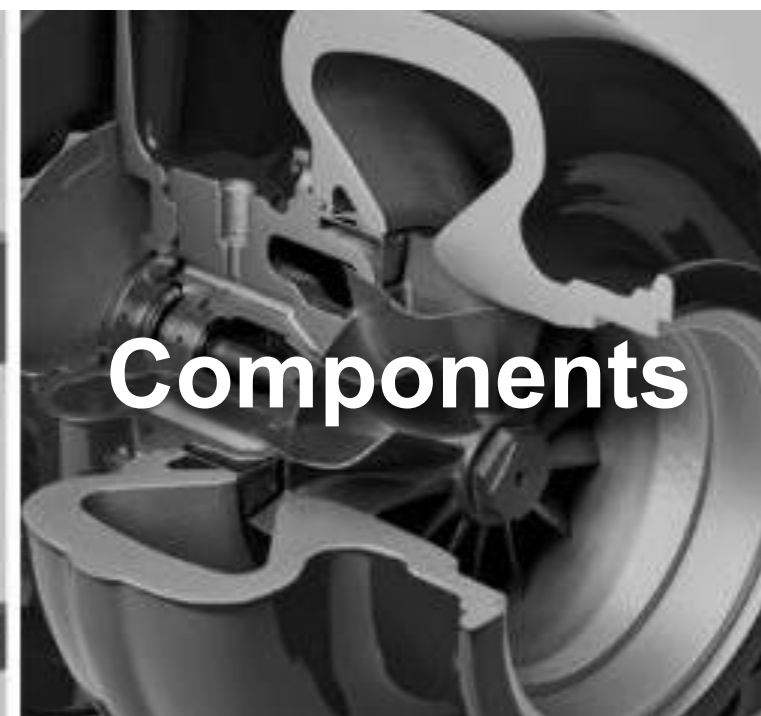
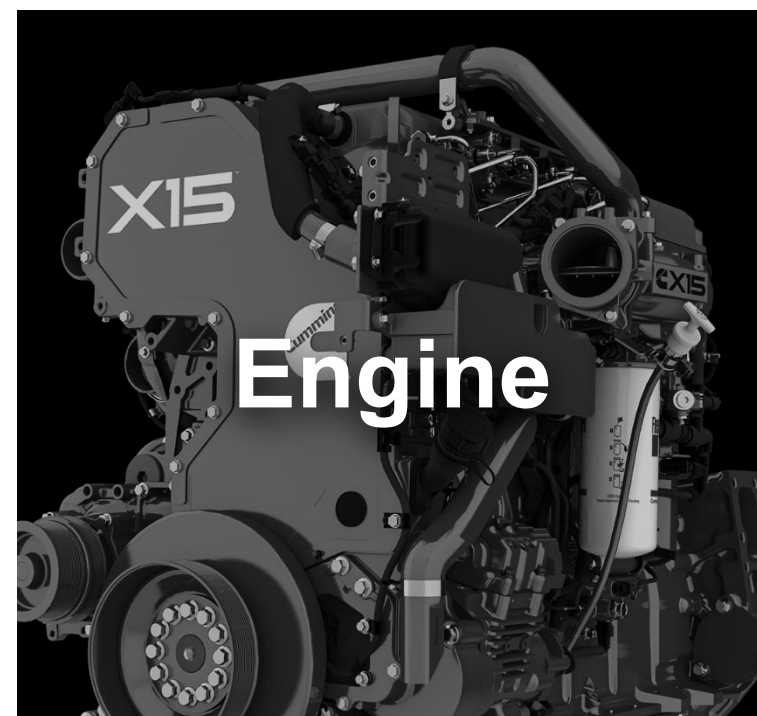


Kevin Brittain  
Technology & Architecture Manager



# Five operating segments

Cummins has a long track record of delivering leading power solutions. As we look ahead, we know our industries and regions will continue to change, and we are committed to bringing our customers the right technology at the right time.



# Powering a more prosperous world

**190** Countries and territories\*

**73,600** Global employees

**104** Years of industry leadership

**10,600** Cummins certified dealer locations

**\$1.2B** Invested in research and technology in 2022

*\* Approximation of countries and territories with Cummins service*

*As published in the 2022 10K found on cummins.com.*

# Our story

## WHY WE EXIST

### MISSION

*Making people's lives better by powering a more prosperous world*

## WHAT WE WANT TO ACCOMPLISH

### VISION

*Innovating for our customers to power their success*

## HOW WE WILL DO IT

### VALUES

#### INTEGRITY

*Doing what you say you will do and doing what is right*

#### DIVERSITY & INCLUSION

*Valuing and including our differences in decision making is our competitive advantage*

#### CARING

*Demonstrating awareness and consideration for the wellbeing of others*

#### EXCELLENCE

*Always delivering superior results*

#### TEAMWORK

*Collaborating across teams, functions, businesses and borders to deliver the best work*

### LEADERSHIP CULTURE

*Inspiring and encouraging all employees to achieve their full potential*

### BRAND PROMISE

*Powering our customers through **innovation** and **dependability***

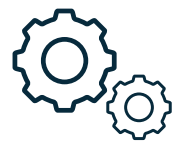
### STRATEGY

*Delivering value to all stakeholders*



# The MDO framework enhances decision-making across the product lifecycle

The formula...



## Process Automation

- Identify the flow of models and automate execution!



## HPC + Optimization Algorithms

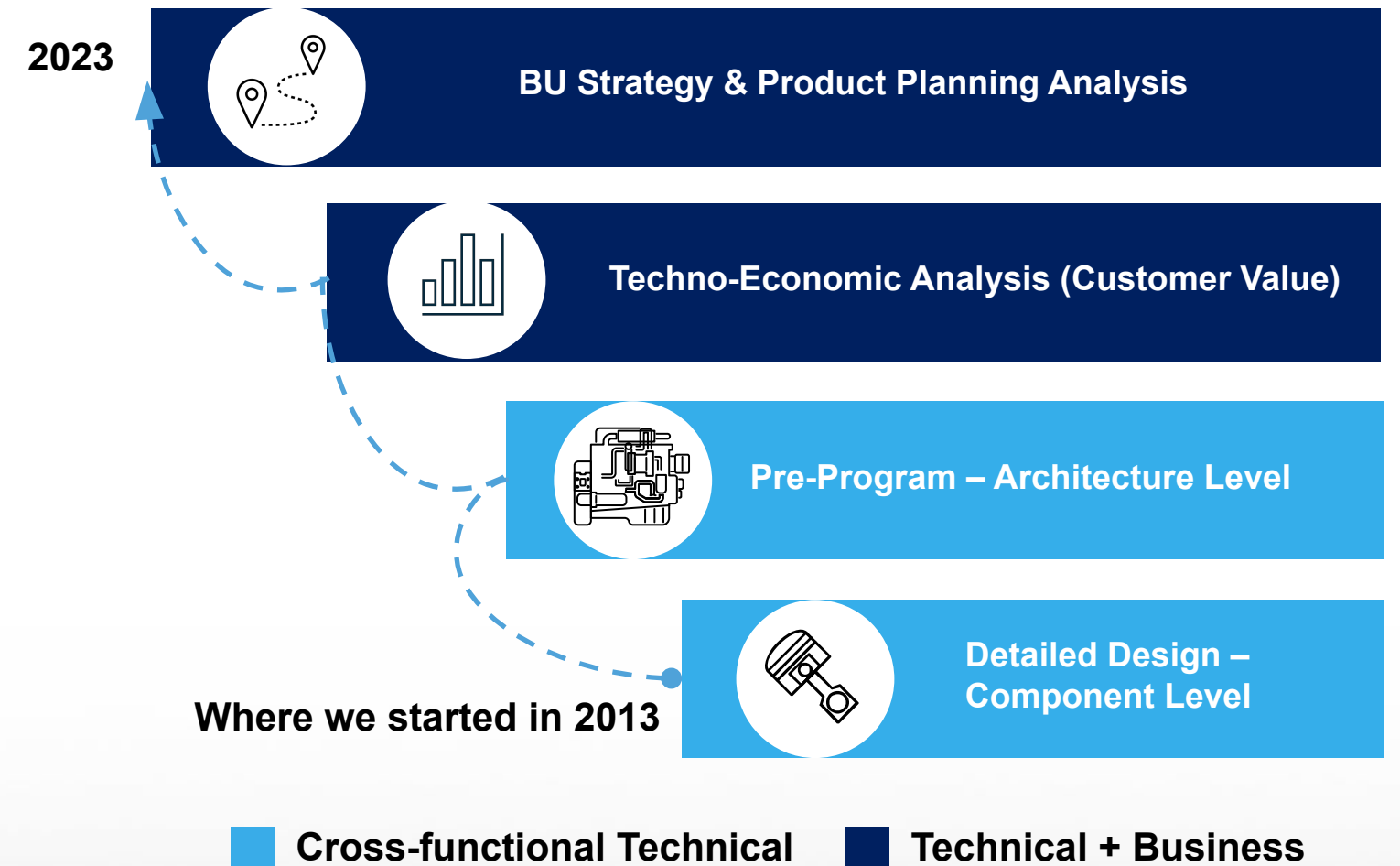
- Explore the design space!



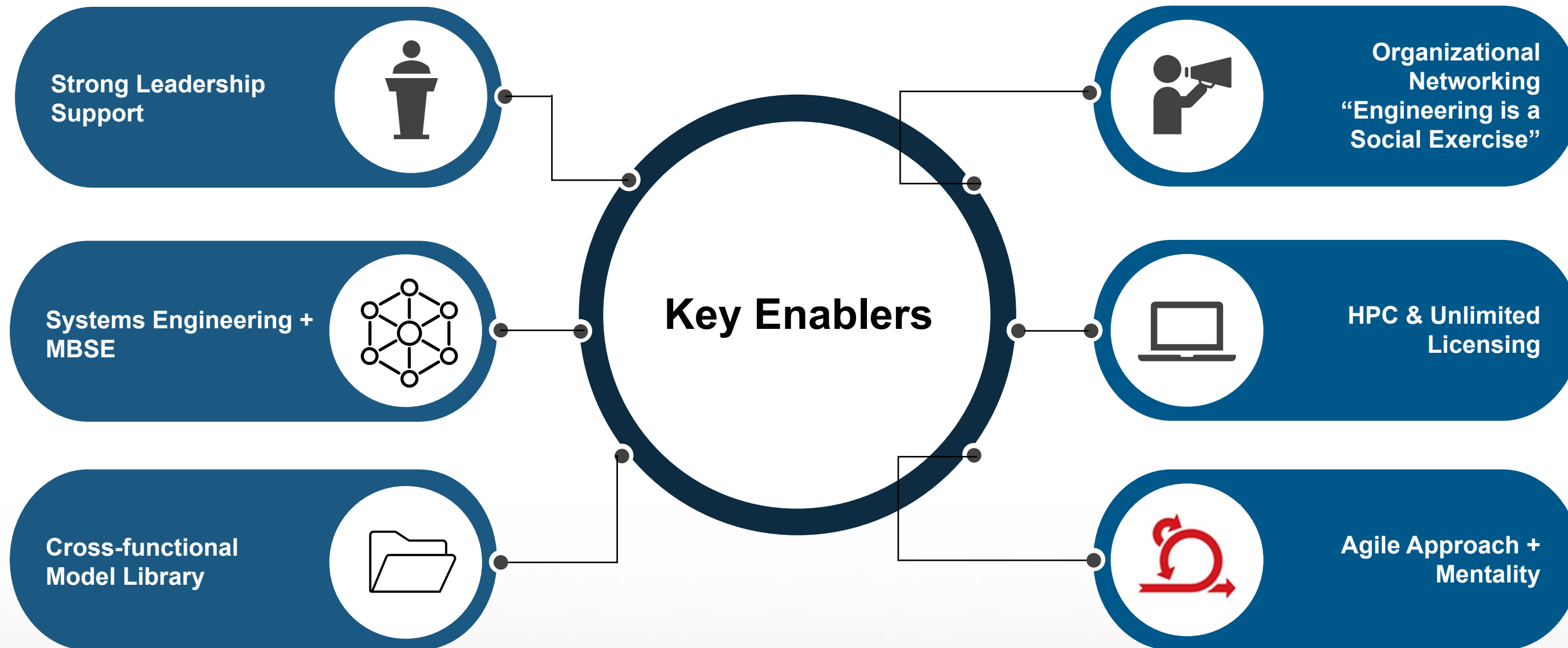
## Data-enabled Decision Making

- Quantify the trade-offs and start the conversations

CMI's evolution across the product lifecycle...



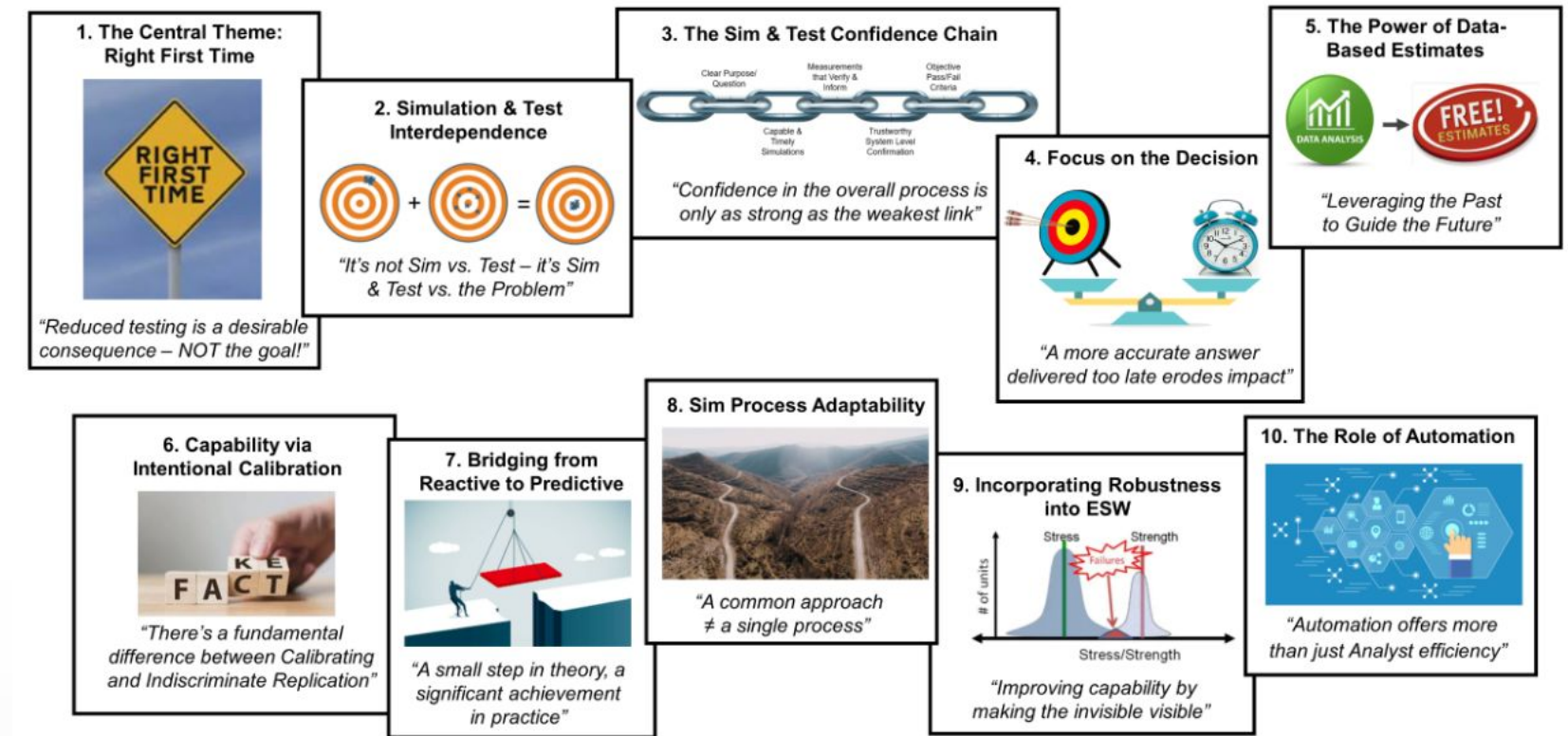
# Key Enablers to our journey...



- CMI has been fortunate to have CTO level support for simulation based product development for decades
- Drives strong emphasis on best practice development and growing of capability globally
- Utilization of MDO methods a key focus area of SBPD

## SBPD Vision – “Right the First Time”

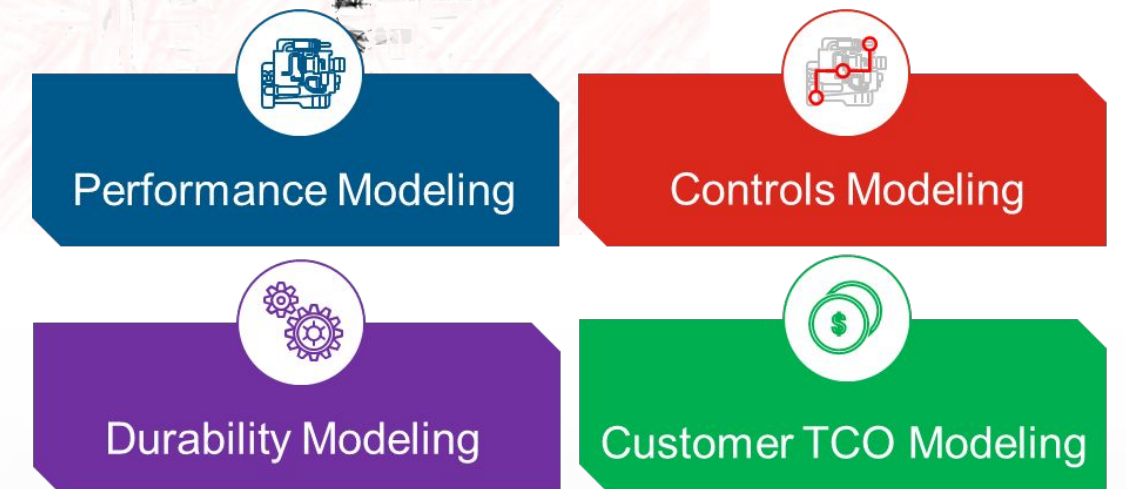
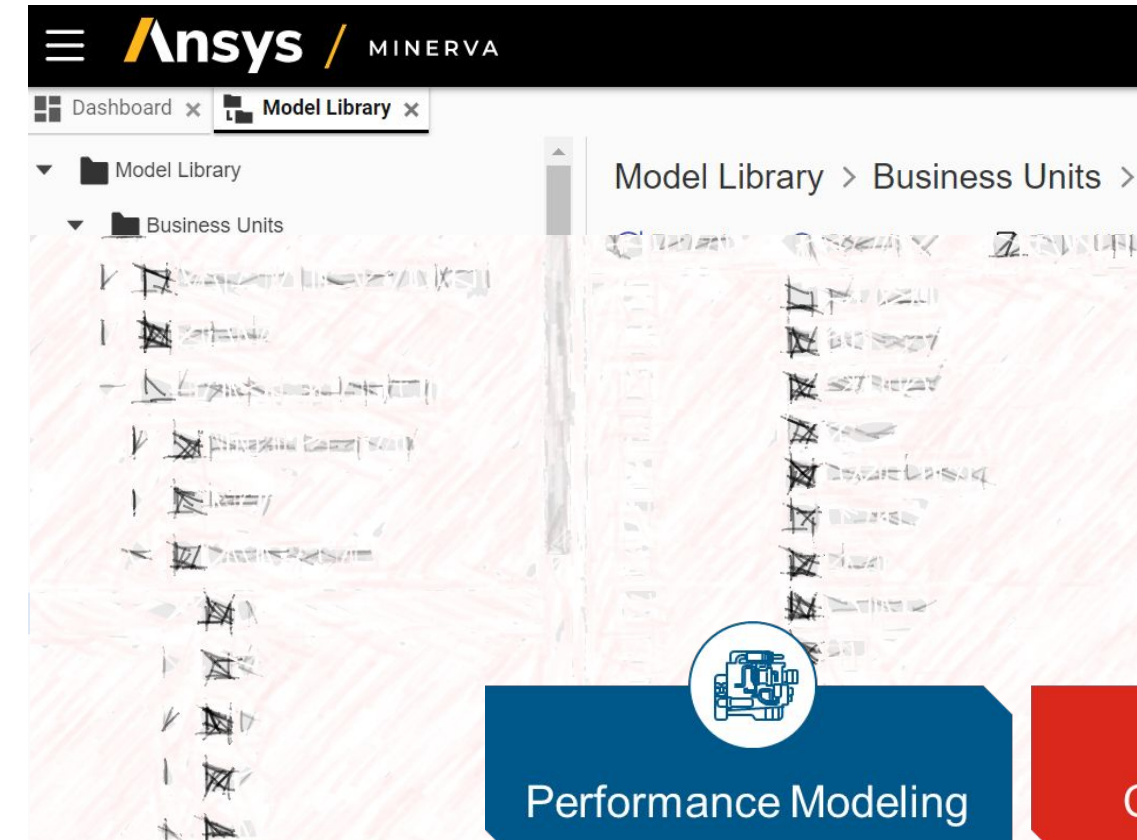
Simulation Based Product Development (SBPD) focuses on thoughtfully integrating simulation with complementary testing to deliver products and solutions that are right the first time and robust for all our customers' uses





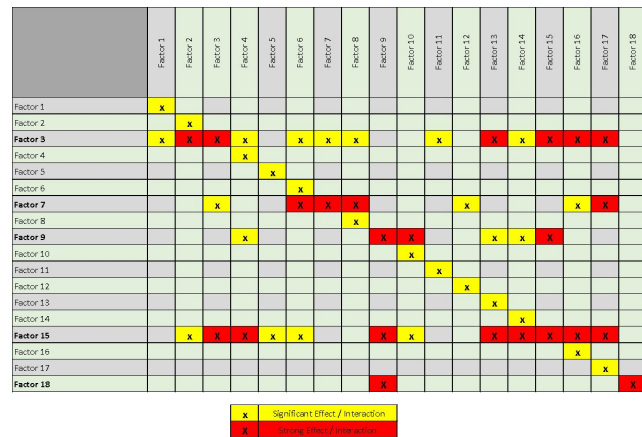
# Cross-Functional Model Library

- To enable sustainable MDO approach, design space capable cross-functional models must be stored and managed by experts
- Models ideally need to be linked to product structure and correlated with test data as the product matures

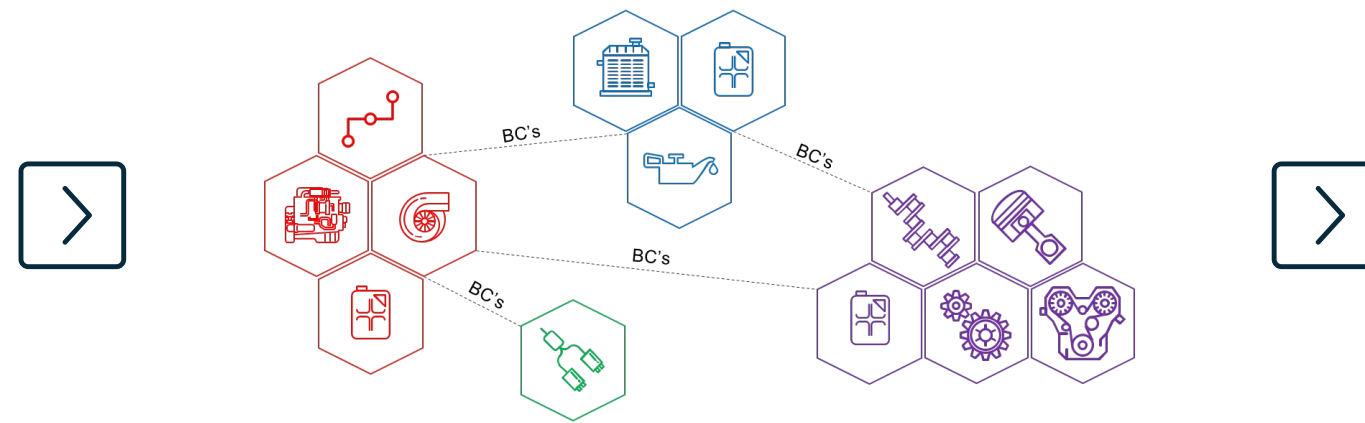




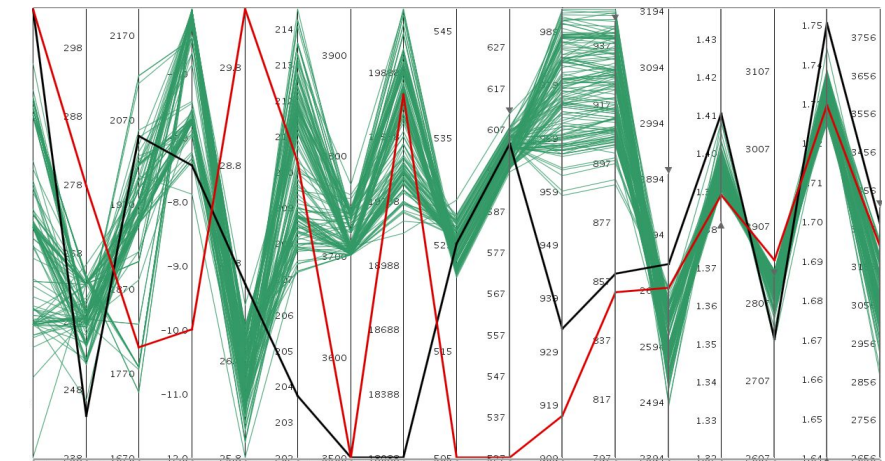
- A successful MDO approach involves systems engineering approaches to identify the critical interactions and trade-offs to focus on
- Success is dependent on cross-functional expert team!
- MBSE can be leveraged as the “hub” for knowledge long term



Critical Systems Identification



MDO Studies



Cross-functional Decision-making



**SPRINT 1**



**SPRINT 2**





# Evolving Forcing Function : Destination Zero

- As we navigate our journey to Destination Zero, the use of simulation-based insights will be a critical enabler to understand the potential paths to...



**Achieve Decarbonization Goals**

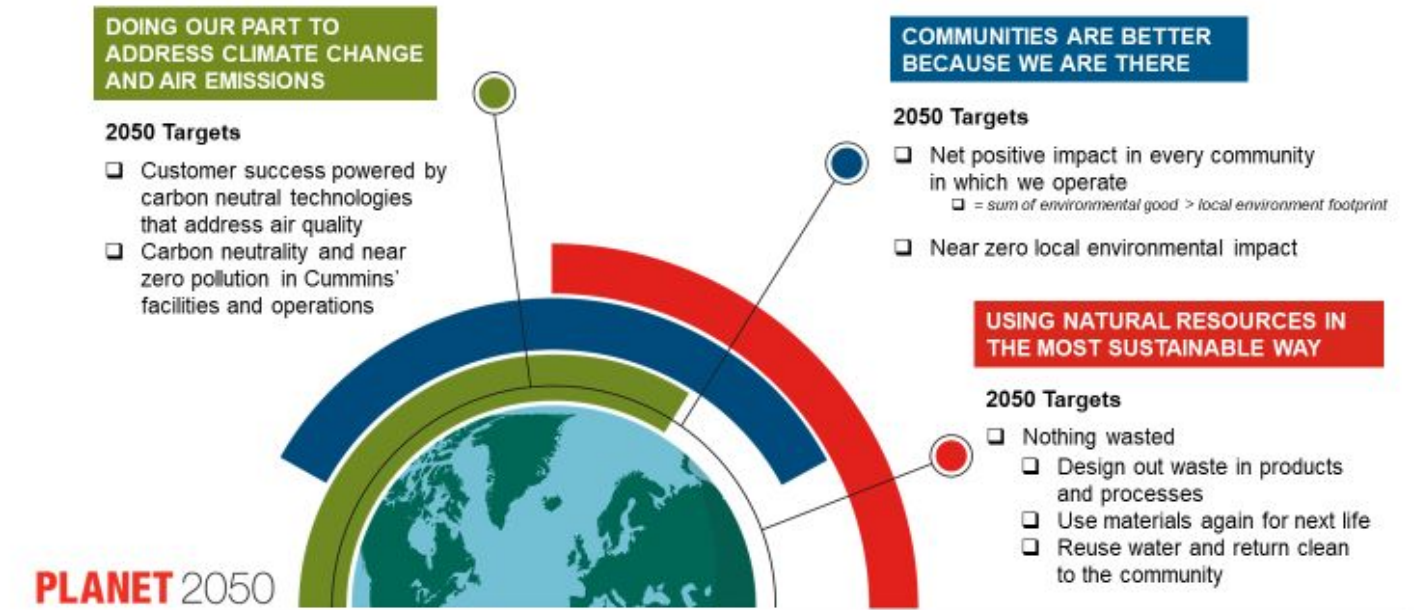


**Maximize our Customer's Success**



**Maximize CMI Success**

## PLANET 2050 aspirational targets



References to "facilities" relate to all consolidated operations and joint ventures subscribing to Cummins' Enterprise Environmental Management System. Goals will be periodically assessed for progress and continued practicability

## Destination Zero



**Lower emissions today**



**Reduce well-to-wheels emissions**

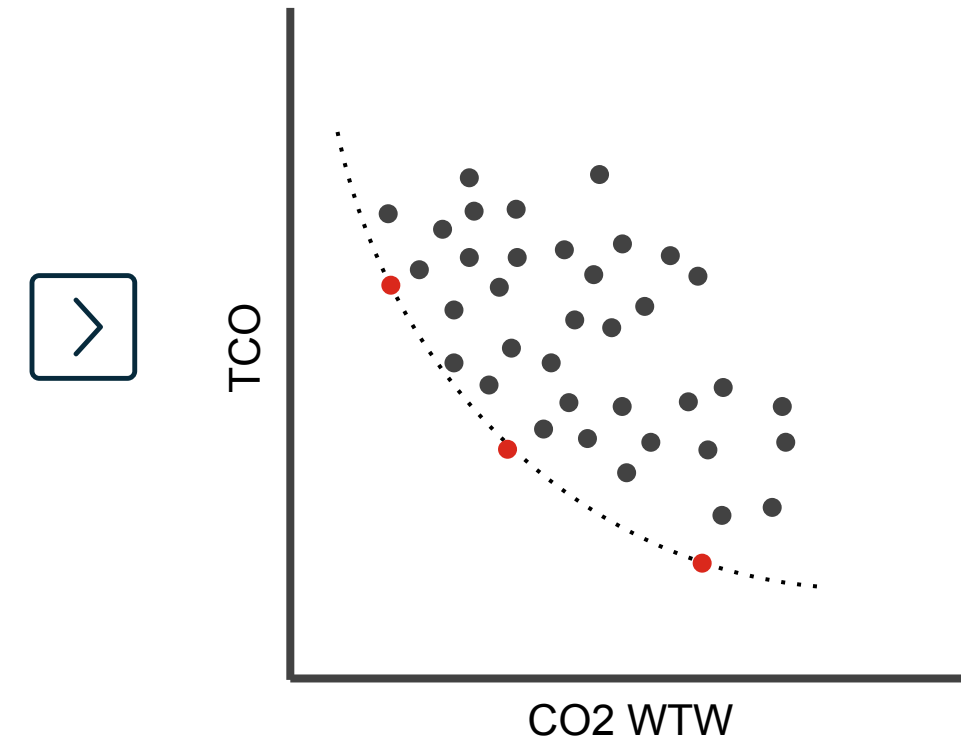
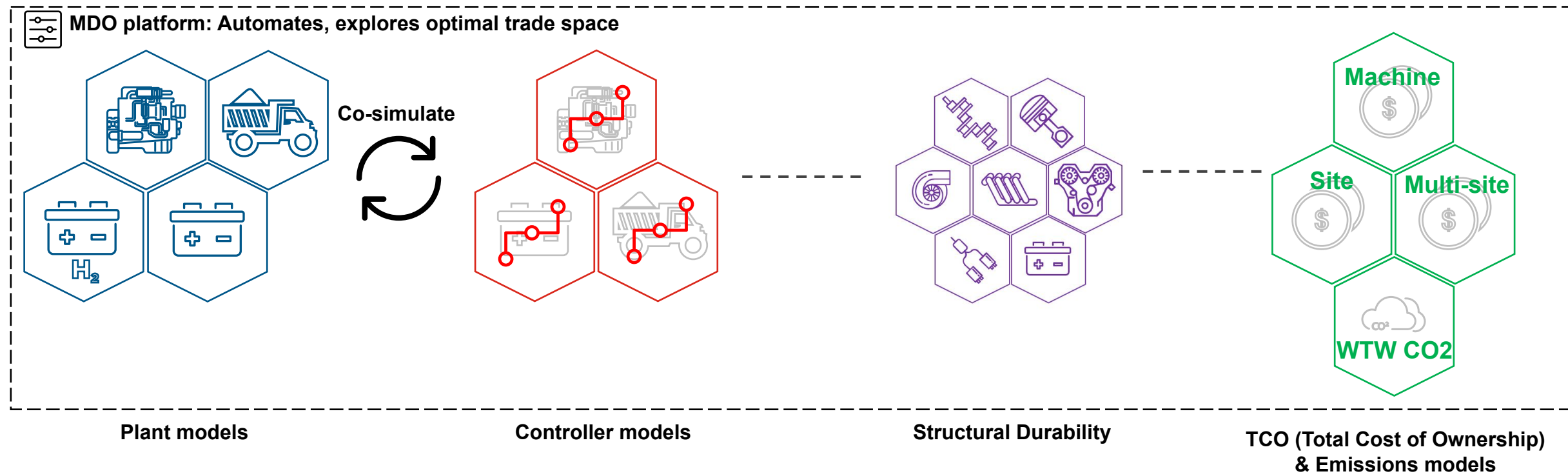


**Drive wide-scale customer adoption**



**Achieve zero emissions by 2050**

Visit the [Destination Zero site](#) for more information



**Customer Engagement** Support customer conversations around new technology adoption and decarbonization

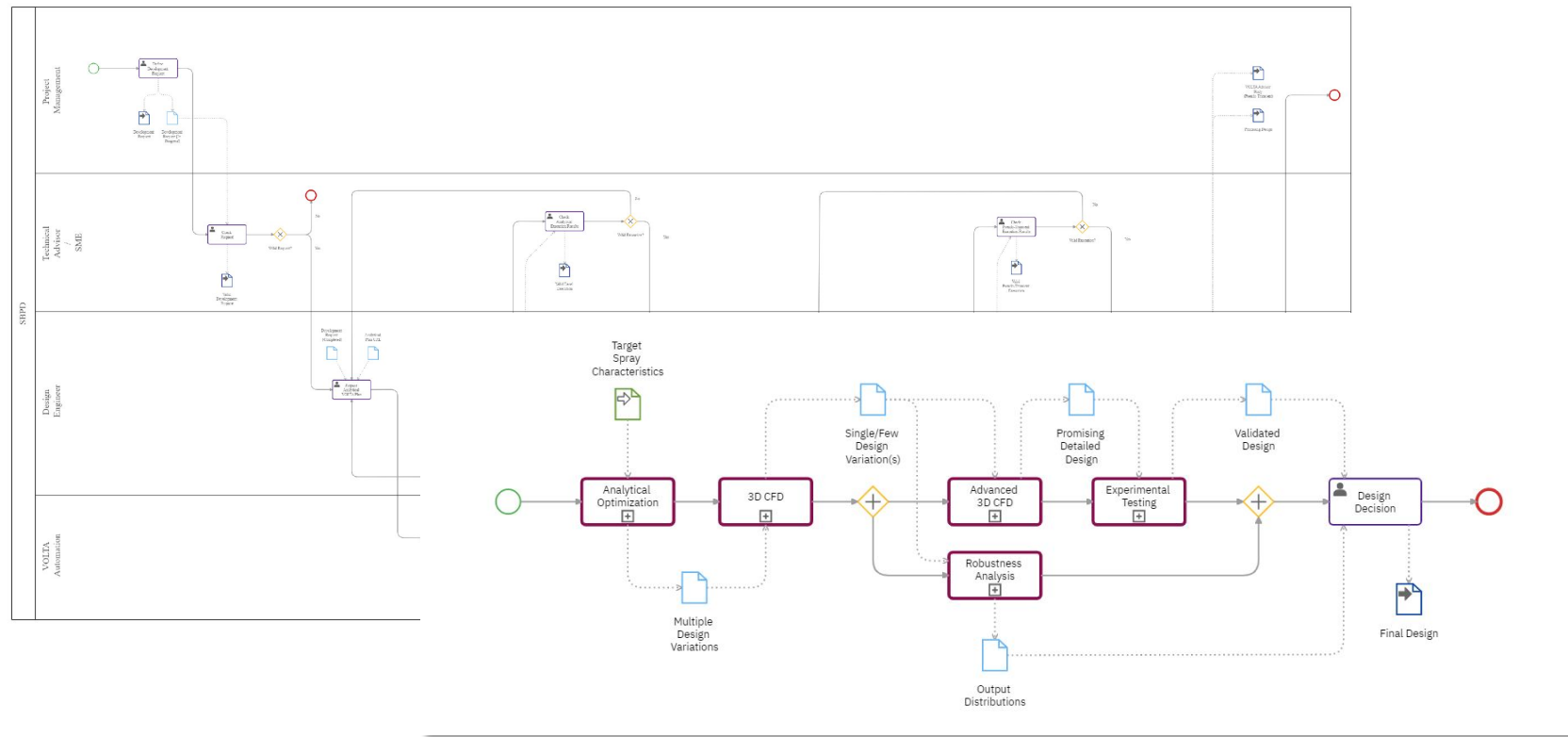


**Product / Technology Roadmapping** Guide technology development projects and product investments

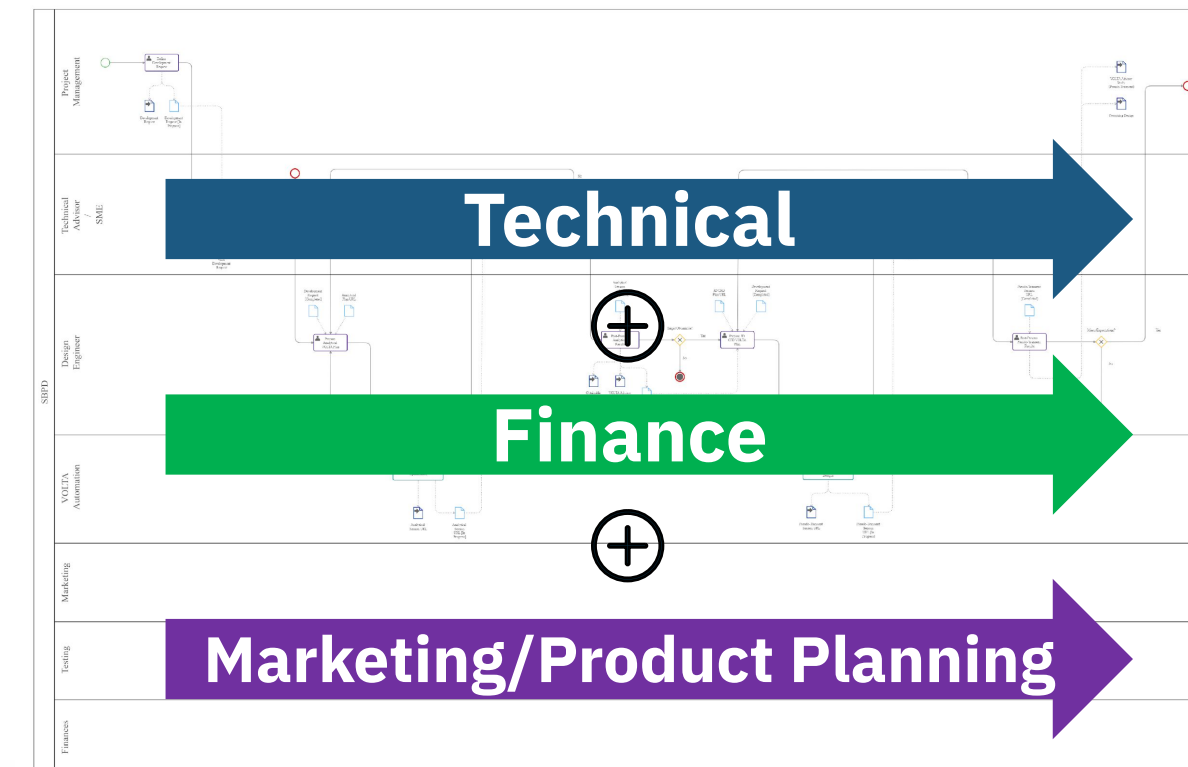


# Codifying the Cross-functional Workflow

**TODAY:** Technical swimlane coordination via BPMN



**FUTURE:** Further expand into non-technical swimlanes as we functionalize more and more



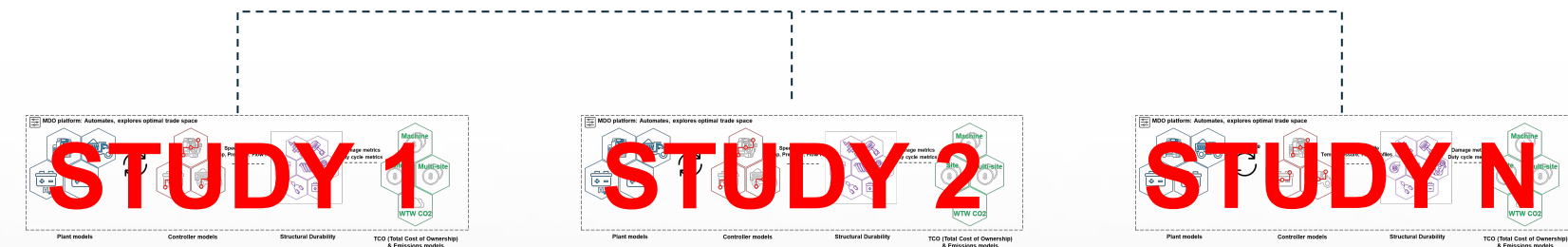
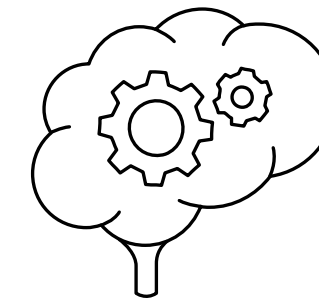
- Collaborations within and outside of technical always ends in a “flow” of transfer functions and inputs/outputs
- As we push to functionalize everything and become more databased in our work, we must “codify” the workflow
- Static document-based approach will not suffice for the evergreen nature of our collaborations across functions
- Need an interactive dashboard to understand and maintain progress!





# Simulation-based insights...

- Data Points to Design Space to Proactive Insights
- We need to view our models as assets that can provide insights to reduce testing, reduce overall simulation efforts, inform product investments, etc.
- Models must be parametric!
- Move from static slides to show results to dynamic web-based post-processing





# Summary

- The MDO approach is an impactful framework that can be leveraged to enable decision-making across the product lifecycle
- Navigating decarbonization as a business will require the use of simulation-based insights to win
- Cross-functional work is becoming more and more model-based and will need to be codified
- We must view our simulation models and data as assets that should be stored, managed and leveraged to provide proactive insights





# Thank you!

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