

# Critical Parameter Management (CPM)

## Problem

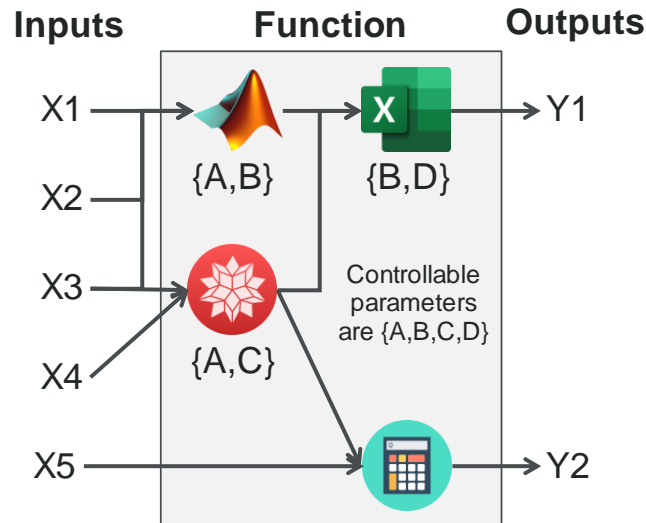
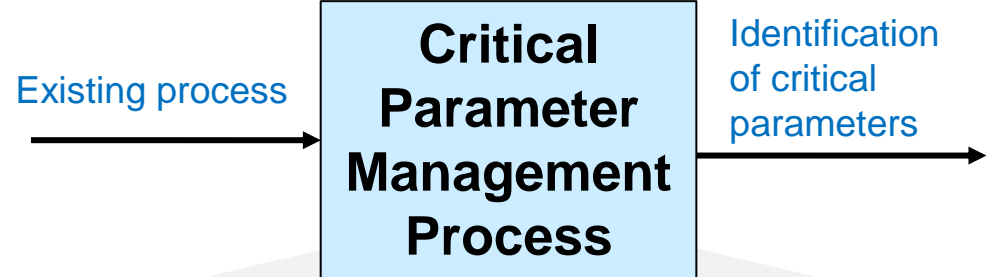
How to identify and manage critical to quality parameters?

## Difficulty

Work with an SME

### Critical Parameter Management (CPM)

- A methodology for ensuring product performance
- A mathematical process that links the inputs and outputs, to identify the parameters driving product quality



1. Determine the process flow, which must include the inputs, controllable parameters and the outputs of interest. (Typically, the output quality is of interest.)
2. With the help of an SME:
  - A. Using experimental data, mathematically model the input/output relationships.
  - B. From the model, determine which controllable inputs have the largest effect on the outputs.
    - These are the *critical parameters*
3. Ensure the process flow properly treats the critical parameters (e.g., by having precise tolerances).

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# CPM – Example – Cake Mixes

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## 1. From experiments

- A. Cake mixes have essentially one critical parameter: the ratio of flour to baking powder
  - This ratio is closely monitored during production.
- B. Cake preparation is robust to reasonable variations in:
  - Quantifies of: water, eggs, oil, cake mix
  - Cooking environment: time, temperature, humidity
- C. Cake preparation is *not* robust to altitude. As this is not under the manufacturer's control, there are separate cooking instructions.



# CPM – Notes

## Slide 1

1. The users of a given process often intuitively know which parameters are most important.
2. To confirm these important parameters, or to identify them, need to create and then analyze a model connecting the inputs to the outputs.
3. Note that not all system parameters are controllable.

### Figures

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## Slide 2

1. Cake mixes are remarkably robust to how an operator does the preparation and baking – the result is nearly always a good tasting cake.

### Figures

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