

Some Thoughts on Chemical Engineering Design Education

Jeffrey J. Siirola
Eastman Chemical Company
Kingsport, TN 37662

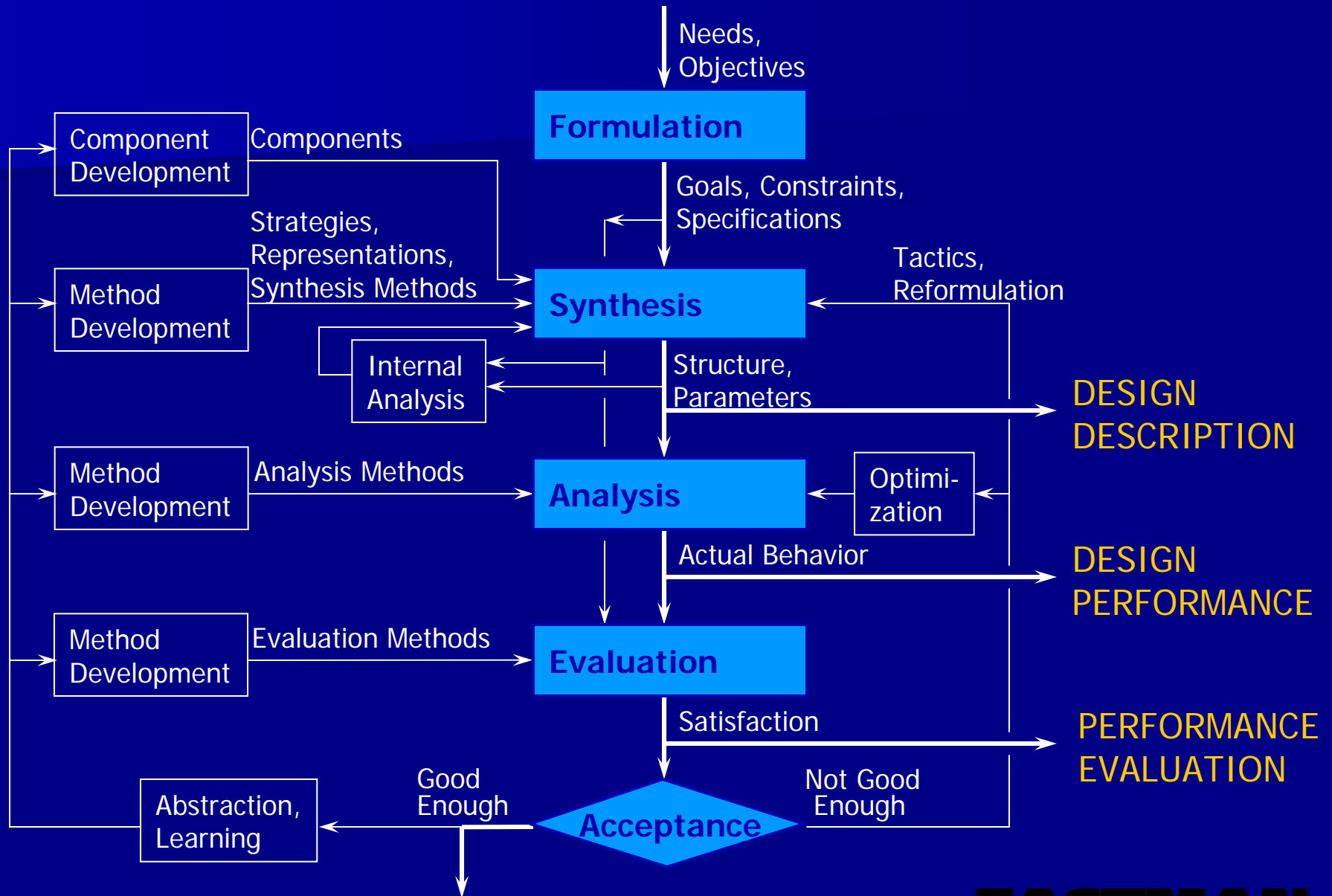
AICHE Centennial Annual Meeting
20 November 2008

EASTMAN

ABET Design Definition

- Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

Design Paradigm



Process Innovation Sequence

Need Identification

Potential Solution

Basic Chemistry

Detailed Chemistry

Task Identification

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

Component Acquisition

Construction Plan/Schedule

Plant Construction

Operating Procedures

Commissioning/Start-up

Production Plan/Schedule

Operation

Each step involves alternatives

EASTMAN

Process Innovation Sequence

- Each step in sequence revisited multiple times at differing levels of detail and refinement (target level, conceptual level, detailed level, etc)
- Each step involves generating, analyzing, evaluating, and choosing alternatives

Synthesis of Alternatives

- One cannot analyze an alternative, nor compare the performance of an alternative against needs or objectives unless

AN ALTERNATIVE IS FIRST CONCEIVED

Process Innovation Sequence

Need Identification

Potential Solution

Basic Chemistry

Detailed Chemistry

Task Identification

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

Component Acquisition

Construction Plan/Schedule

**PROCESS
SYNTHESIS**

Commissioning/Start-up

Production Plan/Schedule

Operation

Process Systems Engineer

EASTMAN

Process Innovation Sequence

Need Identification

Potential Solution

Basic Chemistry

Detailed Chemistry

Task Identification

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

REACTION
PATH
SYNTHESIS

Commissioning/Start-up

Production Plan/Schedule

Operation

Synthetic Chemist, Molecular Biologist, etc

EASTMAN

Process Innovation Sequence

Need Identification
Potential Solution

Basic Chemistry
Detailed Chemistry
Task Identification
Equipment Design
Plant Engineering
Detailed Engineering

Vendor Specifications

**PRODUCT
SYNTHESIS**

chedule

Operating Procedures
Commissioning/Start-up
Production Plan/Schedule
Operation

Materials Scientist, Polymer Scientist, Formulation Chemist, etc

EASTMAN

Process Innovation Sequence

PLANT DESIGN AND CONSTRUCTION

Detailed Chemistry
Task Identification
Equipment Design

Plant Engineering
Detailed Engineering

Vendor Specifications
Component Acquisition
Construction Plan/Schedule
Plant Construction

Operating Procedures
Commissioning/Start-up
Production Plan/Schedule
Operation

Project Engineer, Construction Engineer, etc

EASTMAN

Process Innovation Sequence

Need Identification

Preliminary Solution

**OPERATIONS
AND START-UP
DESIGN**

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

Component Acquisition

Construction Plan/Schedule

Plant Construction

Operating Procedures

Commissioning/Start-up

Production Plan/Schedule

Operation

Plant Engineer, Process Control Engineer, Process Safety Engineer, etc

EASTMAN

Process Innovation Sequence

Need Identification
Potential Solution
Basic Chemistry
Detailed Chemistry

Vendor Specifications
Component Acquisition
Construction Plan/Schedule
Plant Construction
Operating Procedures
Commissioning/Start-up

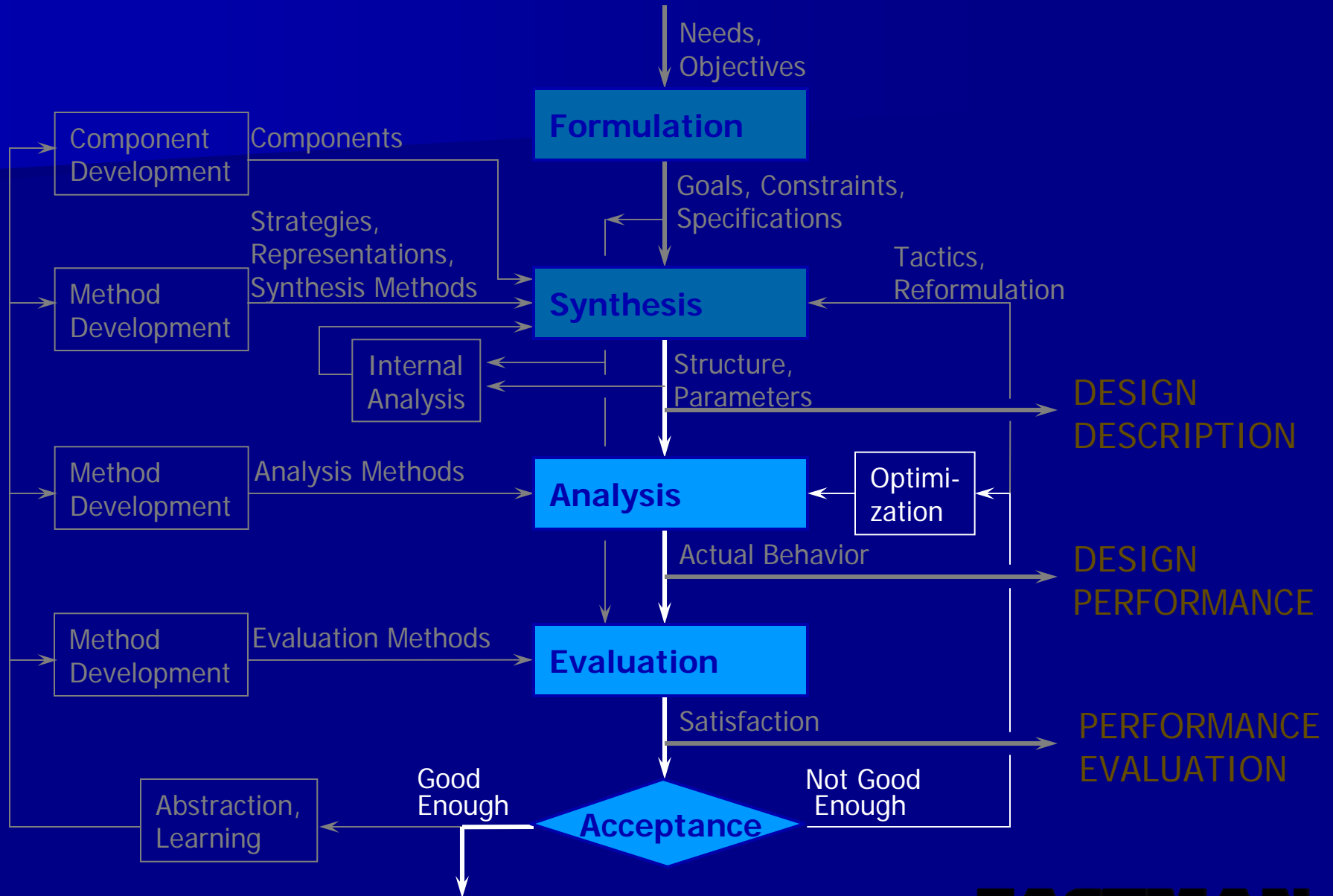
**PLANNING,
SCHEDULING,
AND
OPERATION**

**Production Plan/Schedule
Operation**

Production Scheduler, Plant Operation Engineer, Maintenance Engineer,
Process Improvement Engineer, etc

EASTMAN

Design Paradigm



Process Innovation Sequence

Need Identification

Manufacturing Decision

Basic Chemistry

Detailed Chemistry

Task Identification

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

Component Acquisition

Construction Plan/Schedule

Plant Construction

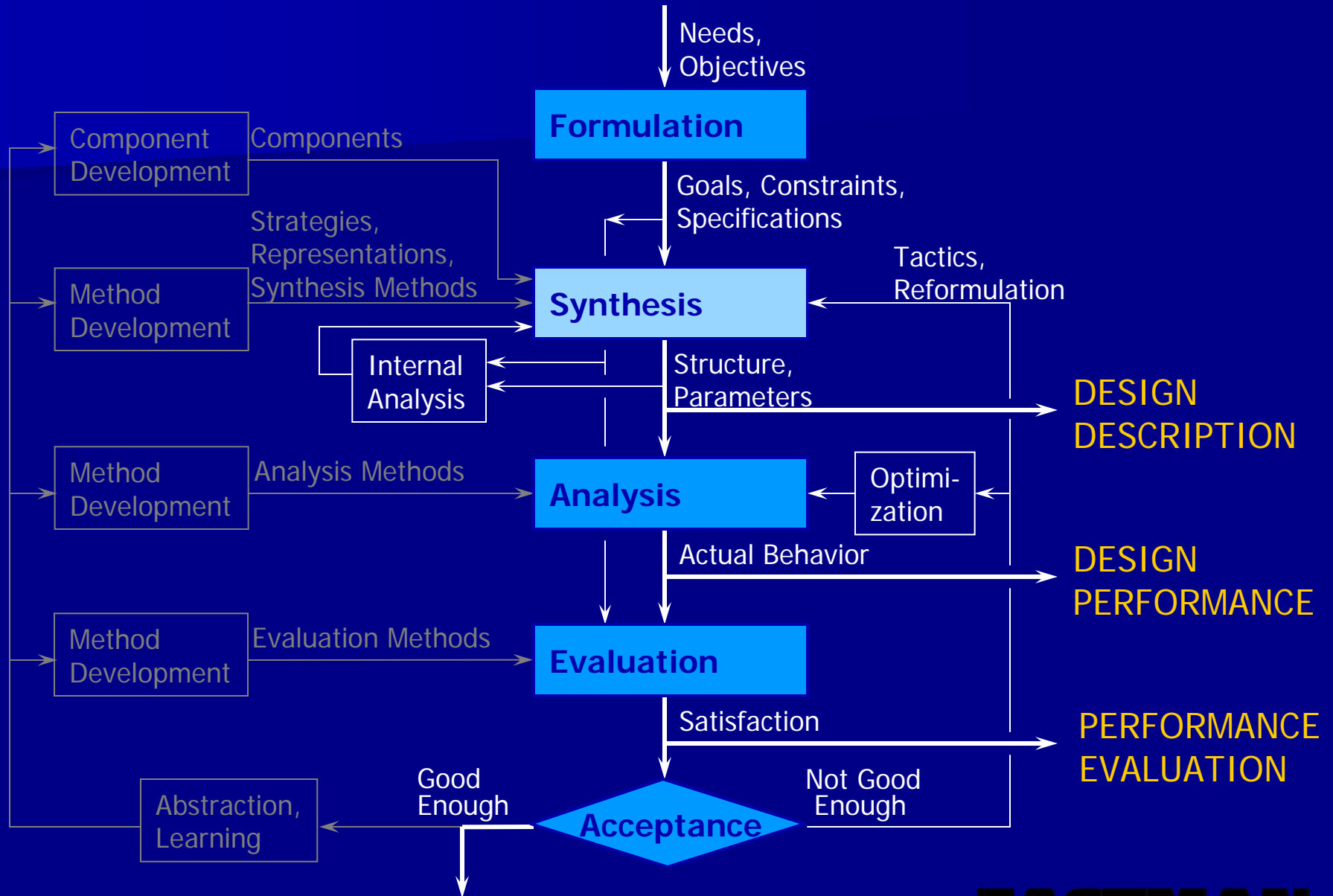
Operating Procedures

Commissioning/Start-up

Production Plan/Schedule

Operation

Design Paradigm



Process Innovation Sequence

Need Identification

Manufacturing Decision

Basic Chemistry

Detailed Chemistry

Task Identification

Equipment Design

Plant Engineering

Detailed Engineering

Vendor Specifications

Component Acquisition

Construction Plan/Schedule

Plant Construction

Operating Procedures

Commissioning/Start-up

Production Plan/Schedule

Operation

Thank You

EASTMAN