

Designing for the environment:

Using lean product and process development to lower carbon emissions and other sustainability concerns

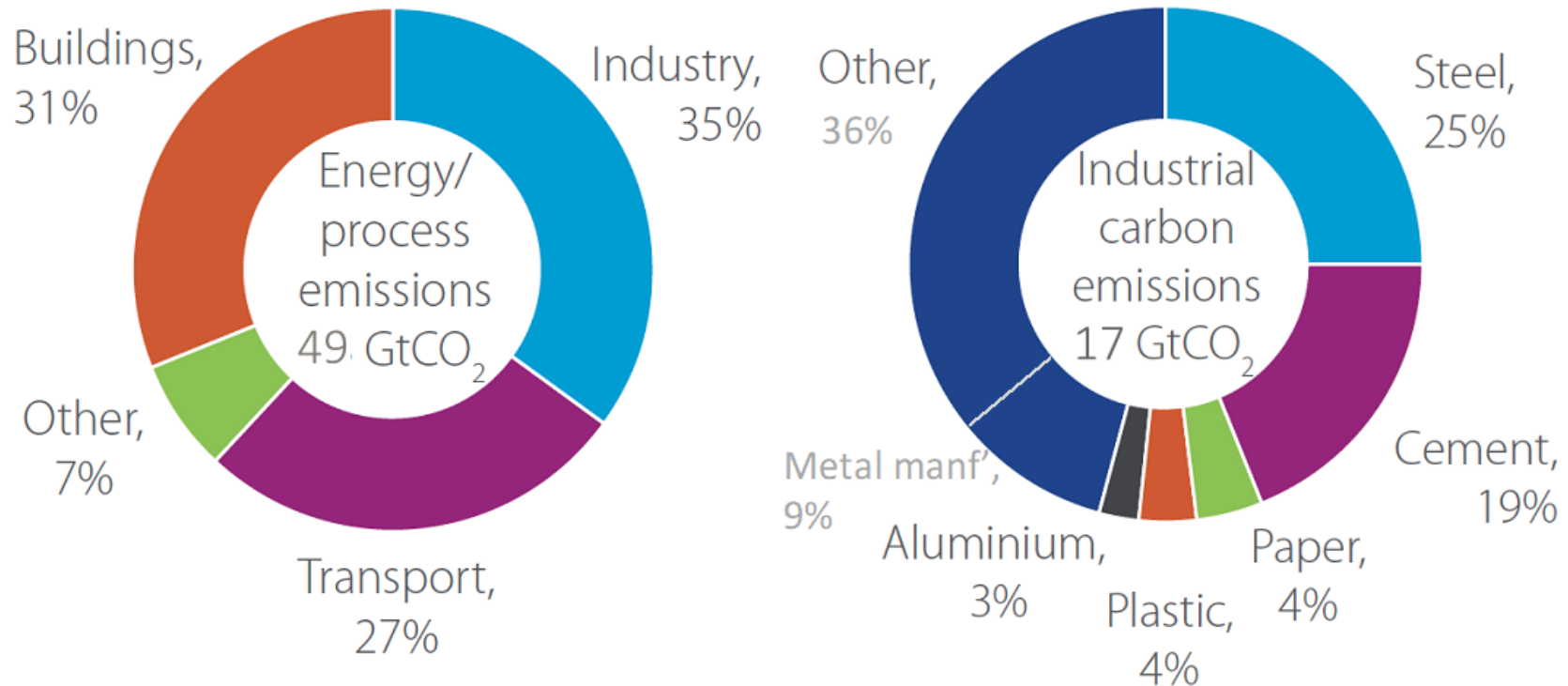
Katrina M. Appell, PhD
Katrina Appell Consulting Inc.
appell@umich.edu

Daniel R. Cooper, PhD
Resourceful Manufacturing & Design (ReMaDe) Group
Mechanical Engineering Department, University of Michigan drcooper@umich.edu

Designing for the Environment



Motivation: Reducing industrial emissions is critical

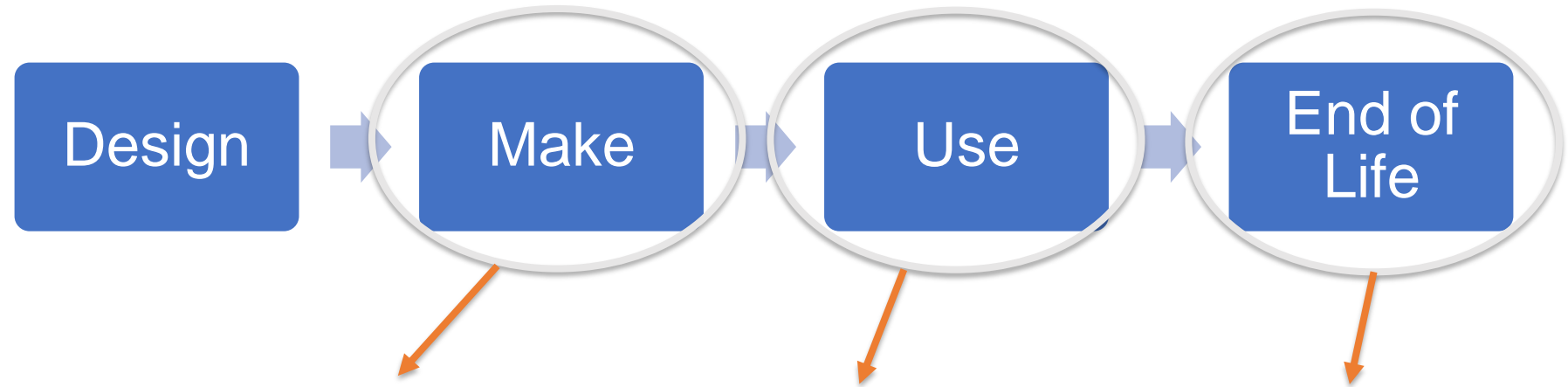
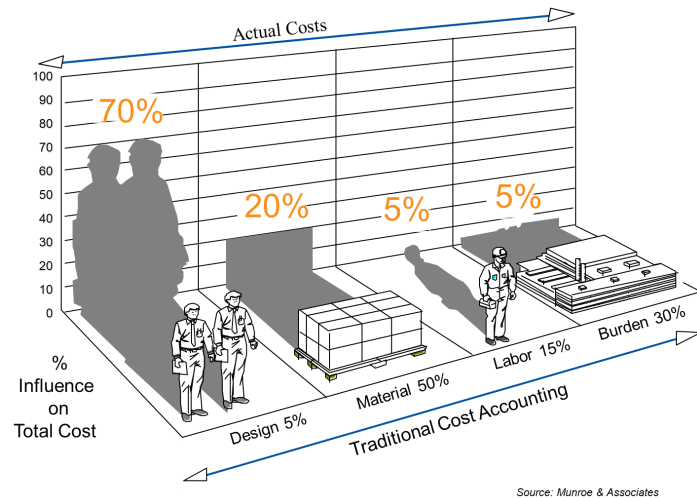


Opportunities in manufacturing: Resource efficiency

- **Energy efficiency.** E.g., Efficient motors, hydraulic & compressed air systems
- **Material efficiency.** E.g., 25% of steel & 40% of aluminum is scrapped along the supply chain

Why focus on minimizing emissions in the design phase?

Decisions made in design have lasting environmental impacts across the entire product life cycle

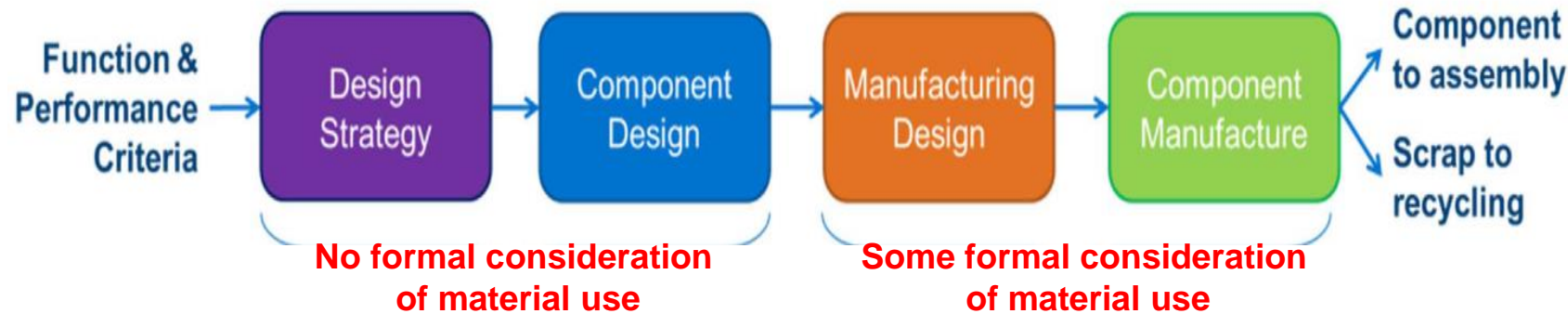


Environmental impacts from production are rising

Often where most environmental impacts occur but has been decreasing in recent years

Design determines potential for component reuse, remanufacturing and material recycling

Decisions that impact the sustainability and efficiency of designs are often made without understanding the impact



Adapted from Horton & Allwood (2017)

“Designers need to consider *material and energy utilization*.”
 - *Easy to say, but for it to happen it needs to be built into the development system*

Environmental Analysis and Product Design Tools



Industrial Sustainability: Reviewing the Past and Envisioning the Future

John W. Sutherland
Environmental and Ecological Engineering,
Purdue University,
West Lafayette, IN 47907
e-mail: jwsuther@ecn.purdue.edu

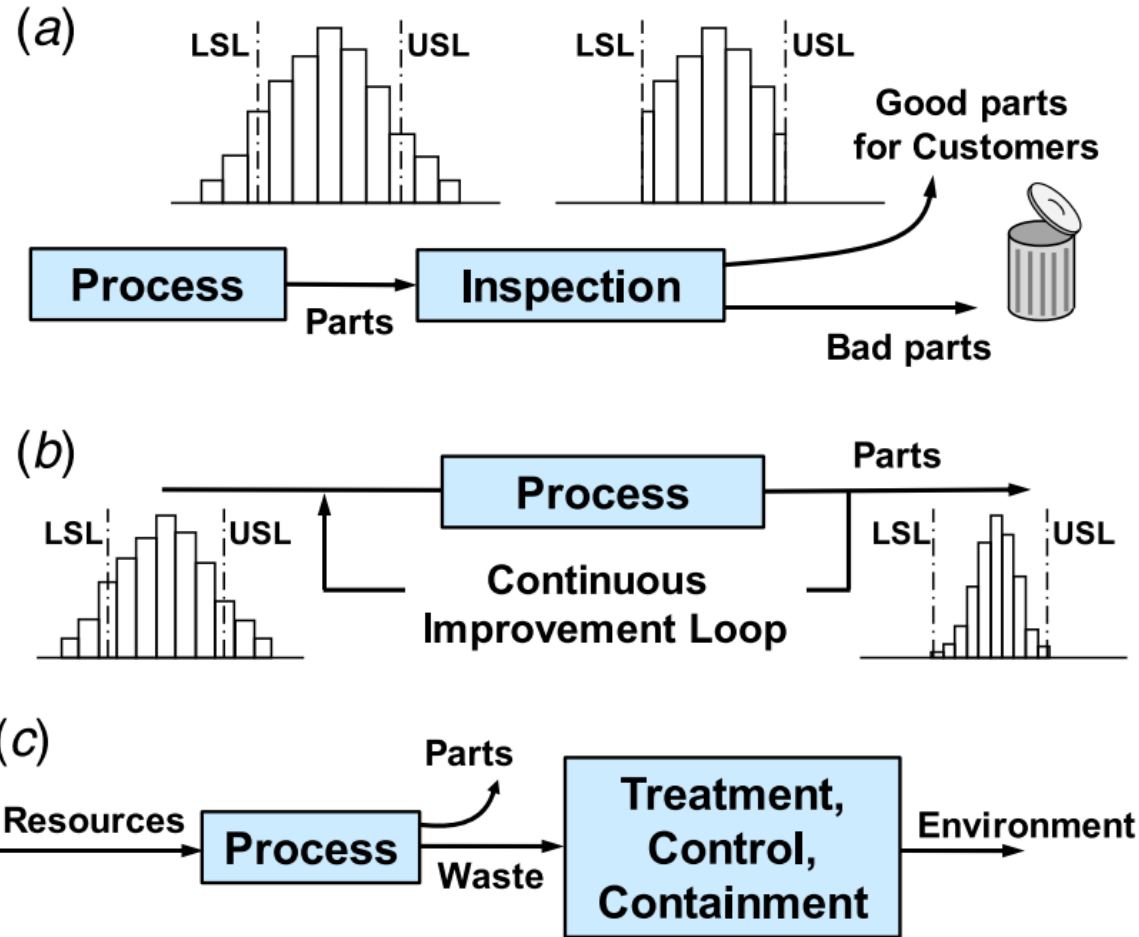
Steven J. Skerlos
Department of Mechanical Engineering,
University of Michigan,
Ann Arbor, MI 48105
e-mail: skerlos@umich.edu

Karl R. Haapala
School of Mechanical, Industrial, and
Manufacturing Engineering,
Oregon State University,
Corvallis, OR 97331
e-mail: karl.haapala@oregonstate.edu

Daniel Cooper
Department of Mechanical Engineering,
University of Michigan,
Ann Arbor, MI 48109
e-mail: drcoper@umich.edu

Fu Zhao
School of Mechanical Engineering and
Environmental and Ecological Engineering,
Purdue University,
West Lafayette, IN 47907
e-mail: fzhao@ecn.purdue.edu

Aihua Huang¹
Environmental and Ecological Engineering,
Purdue University,
West Lafayette, IN 47907
e-mail: huan1363@ecn.purdue.edu



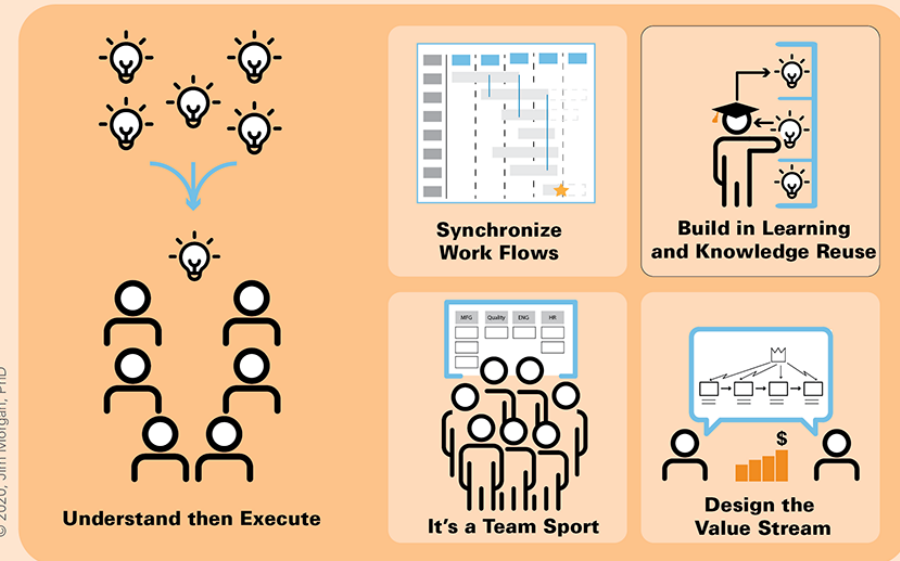
Building Industrial Sustainability into Design using LPPD

- Putting People First
- Understanding before Executing
- Synchronizing Workflows
- Developing Products is a Team Sport
- Building in Learning and Knowledge Reuse
- Designing the Value Stream

Lean Product & Process Development Guiding Principles



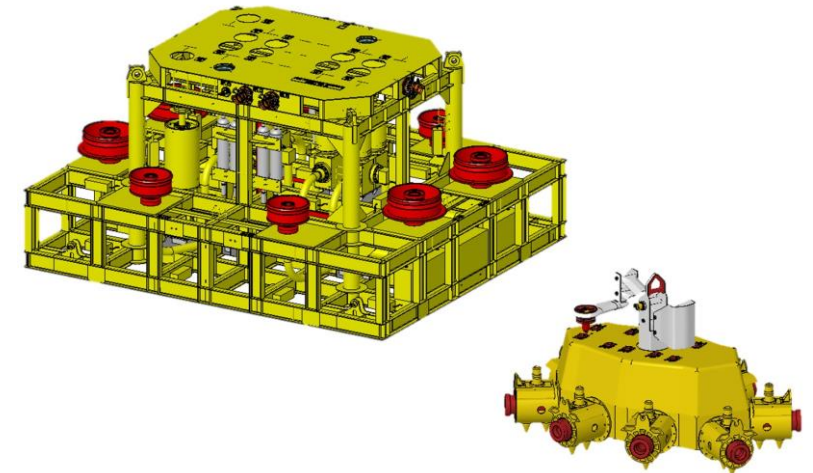
People First



Learn more about Lean Product & Process Development at lean.org/lppd

Case studies where LPPD delivered environmental benefits

- Business motivations were not environmental sustainability
- LPPD strategies that delivered change:
 - *Setting clearly defined targets*
 - *Communication*
 - *Deep collaboration with the supply chain*
 - *Pushing towards optimal standard architectures*
 - *Education and Technical Excellence*
 - *Managing tradeoffs*



AME Interactive Session 2019



Discussion Questions

1. Where are the environmental impacts in your manufacturing operations?
2. What are the opportunities to improve the environmental impact and improve the bottom line?
3. How can LPPD help to deliver these benefits?

AME Interactive Session 2019



- **Upstream manufacturers** identified opportunities through **energy waste / efficiency**
- **Downstream manufacturers** identified opportunities through **material savings / recycling / remanufacturing**
- Most participants identified the potential for:
 - Greater **standardization** (only changing where the greatest value is provided)
 - **Environmental key performance indicators** (KPIs) as engineering targets
 - Higher **material utilizations** in manufacturing
 - Greater **understanding and collaboration** between design and manufacturing
 - Greater use of **design guides** to effectively utilize organizational knowledge

AME Interactive Session 2021



Discussion Questions

1. Where are the environmental impacts in your manufacturing operations?
2. What are the opportunities to improve the environmental impact and improve the bottom line?

Research Findings



- Need for translating environmental aspirations to concrete strategies to reduce life cycle impacts.
- LPPD is in itself agnostic to environmental sustainability.
- LPPD is a system that can effectively cut waste and deliver on organizational objectives.

“Exploring how lean product and process development can promote industrial sustainability” was published as part of the conference proceedings for the ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 17–19, 2021.



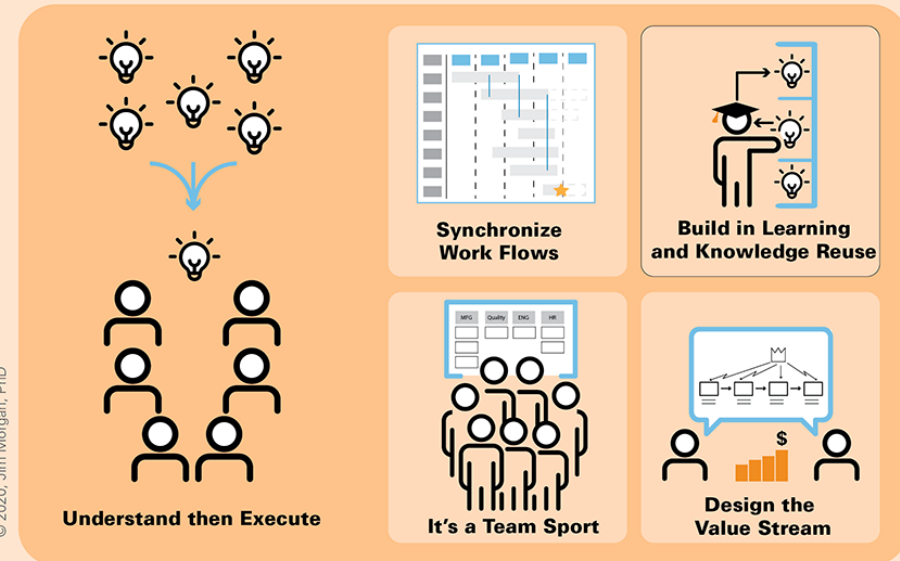
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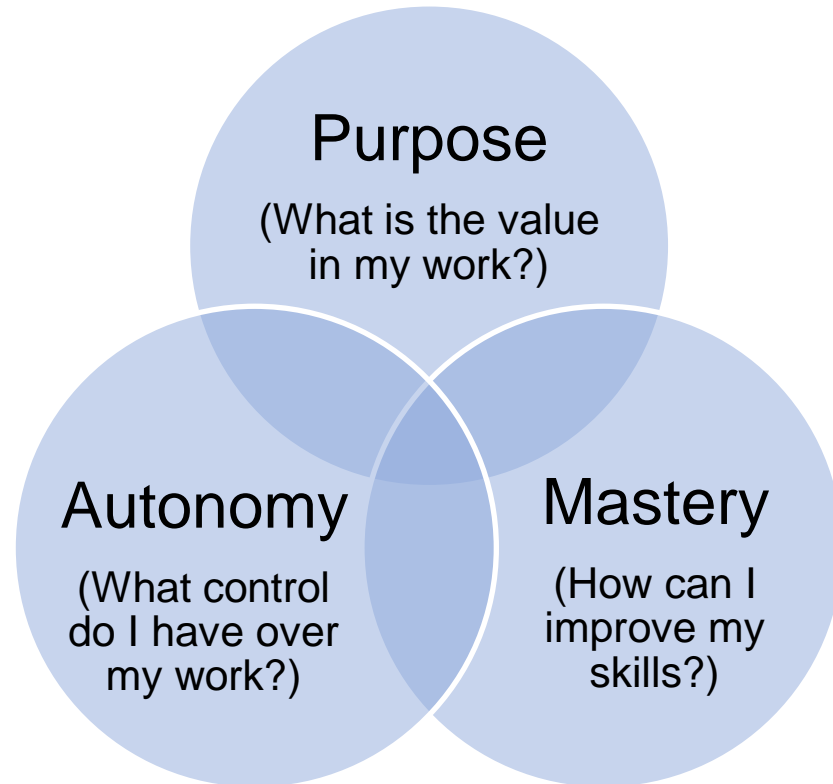


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Better Performance through Putting People First



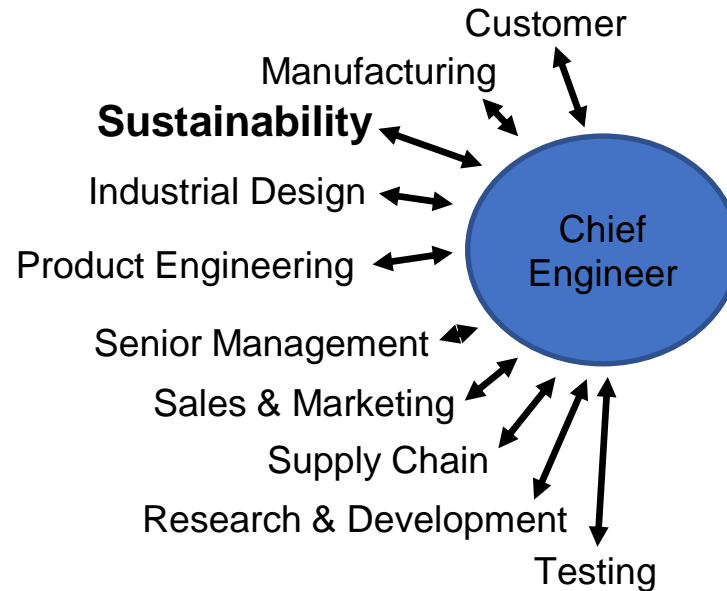
Drive by Daniel Pink (2009)

Lean Product & Process Development Guiding Principles



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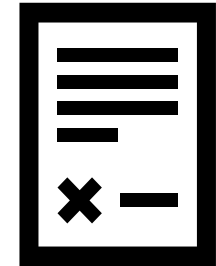
Understanding before Executing



- Architecture
- Specifications
- Targets



- Schedule
- Product plan
- Budget
- Drawings

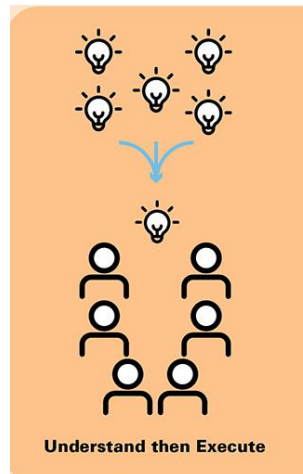


Concept Paper

Study / Concept Phase:
Understand What Your Product Must Be

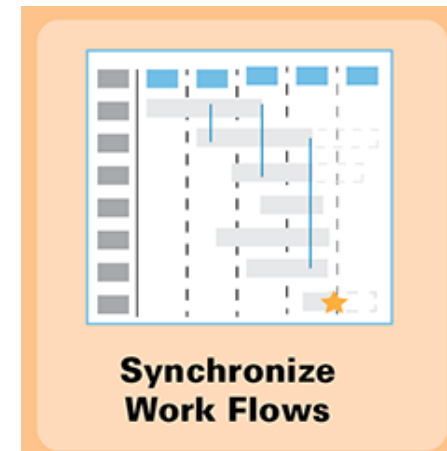
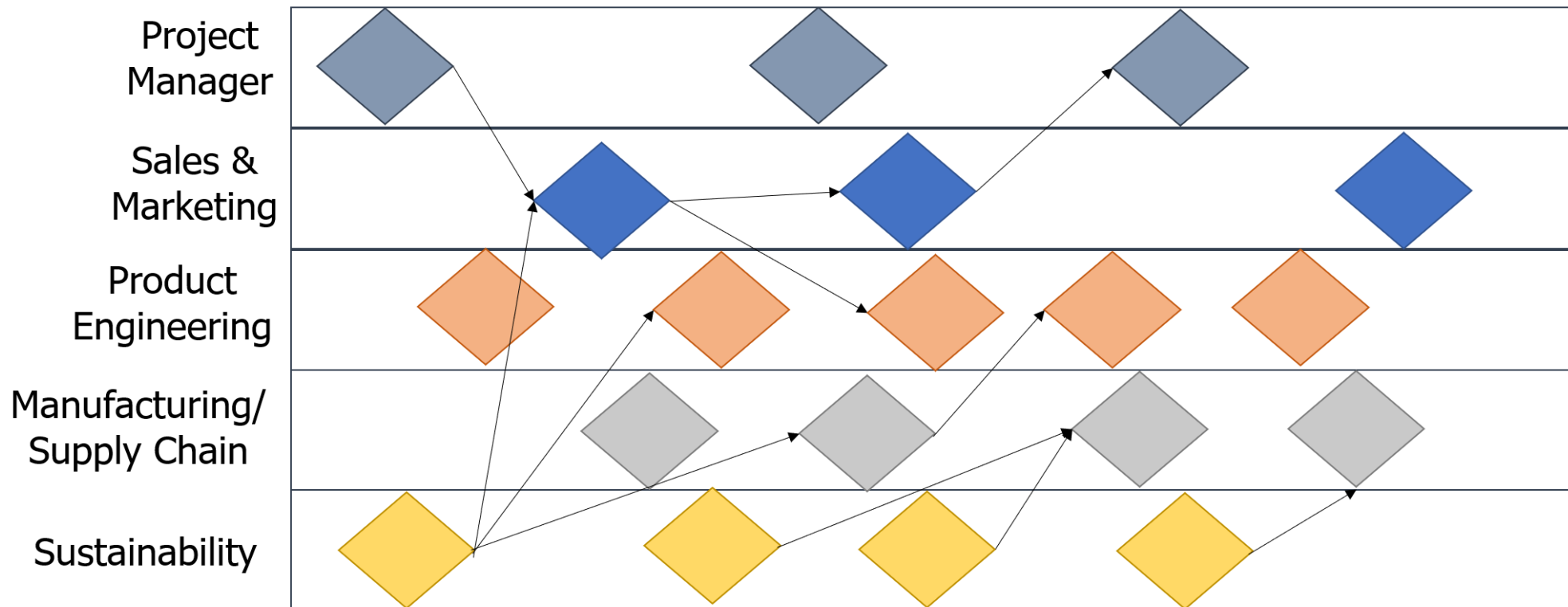
Execution:
Detailed Design

Execution:
Industrialization



Synchronizing Workflows

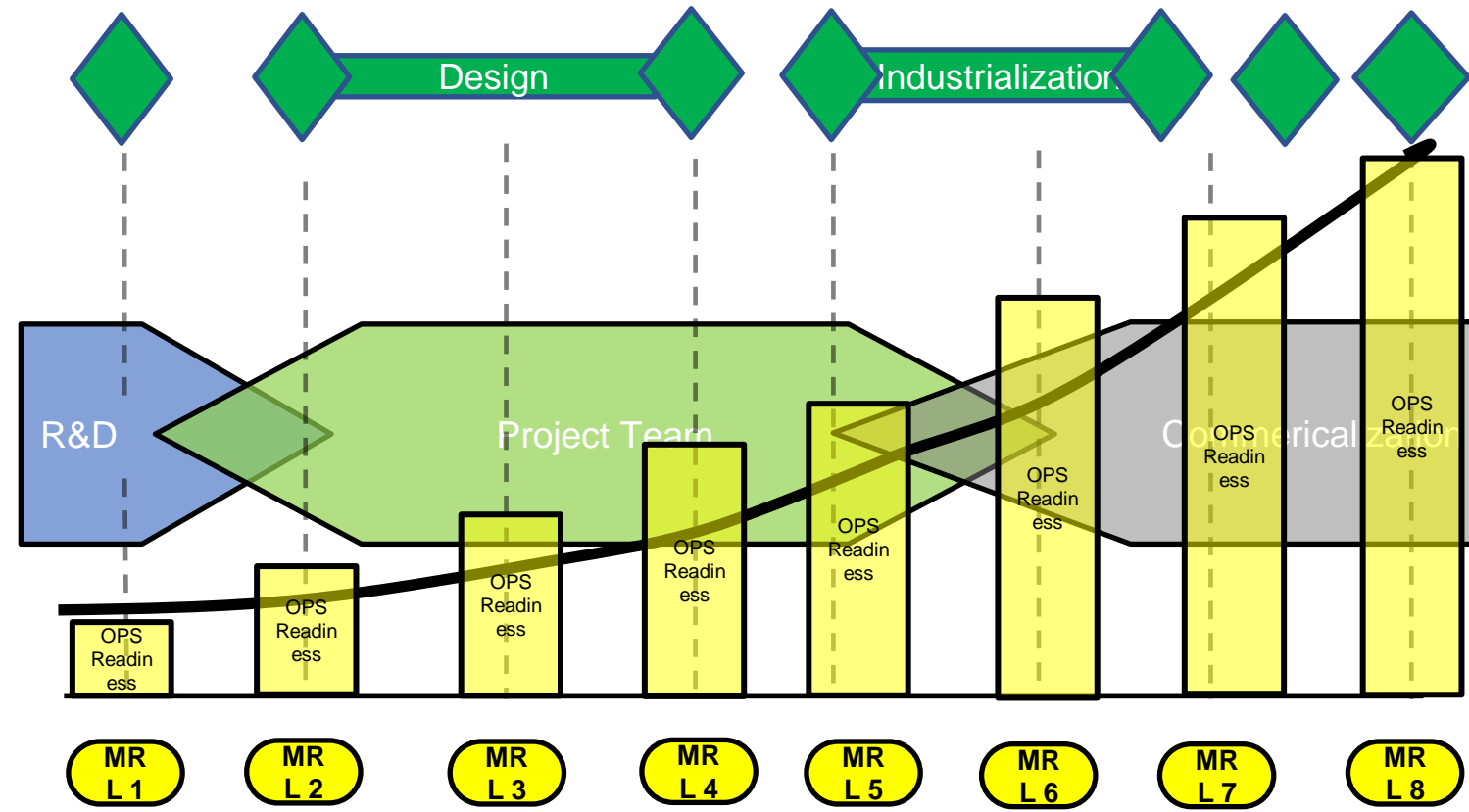
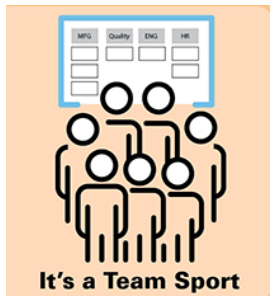
Decision Flow



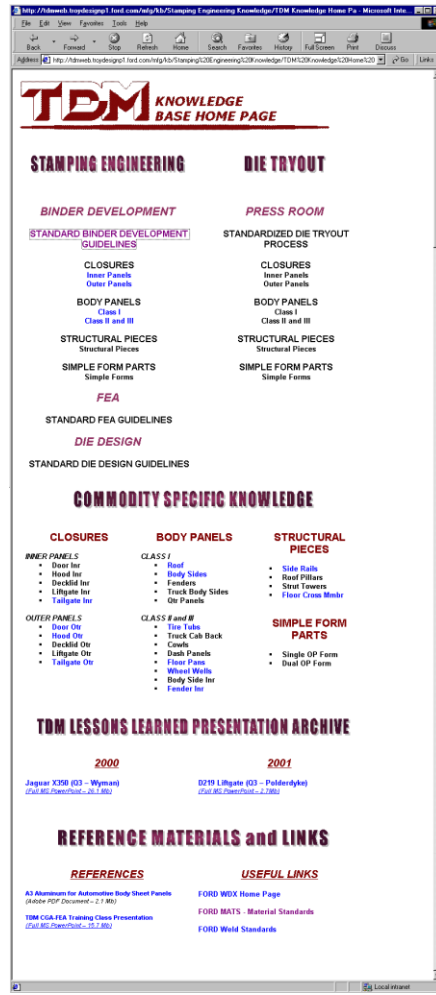
Developing Products is a Team Sport



"Team Meeting" by [Hollywood_PR](#) is licensed under [CC BY 2.0](#)



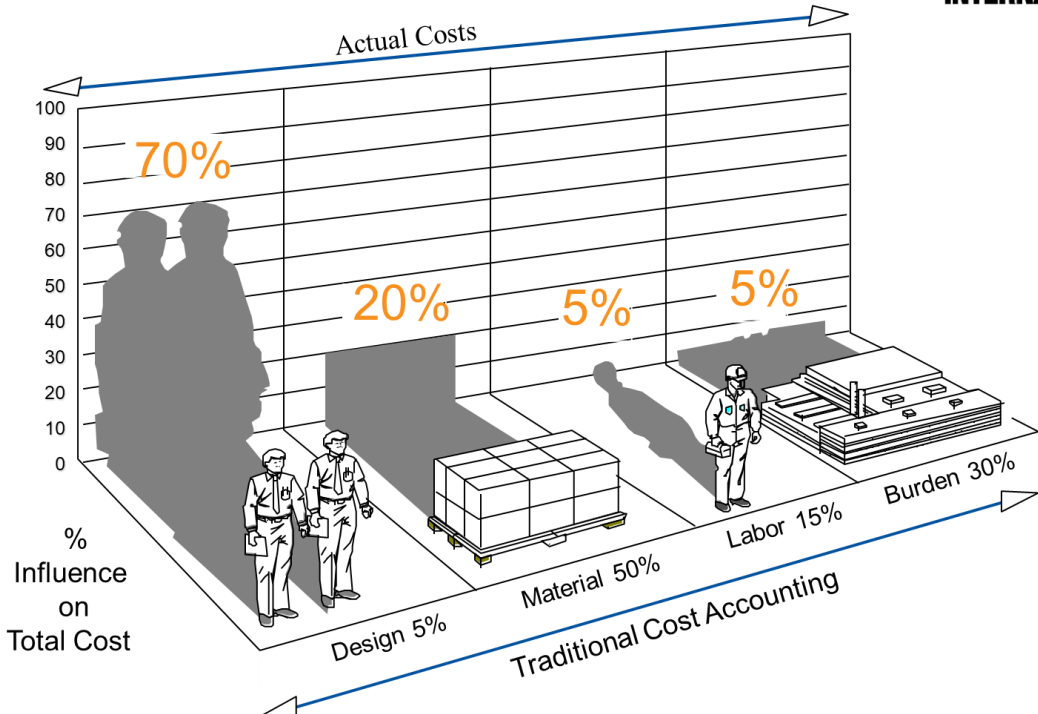
Building in Learning and Knowledge Reuse



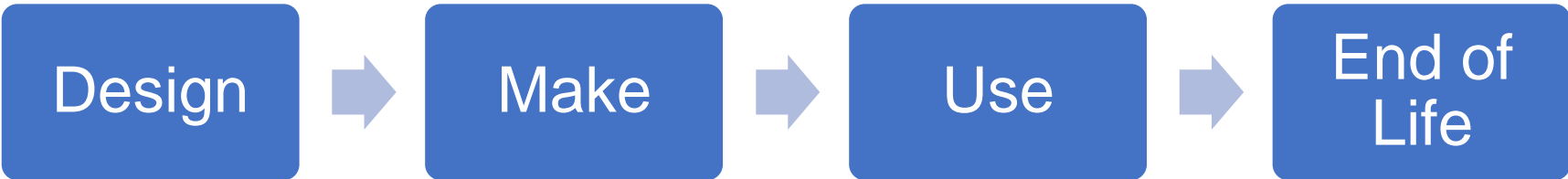
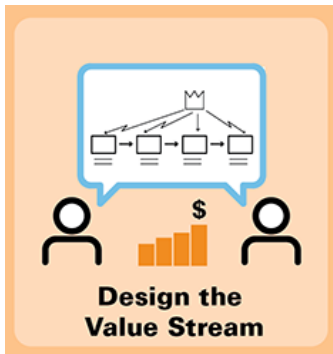
- General Knowledge
- Standard Processes and Practices
- Commodity Specific Knowledge
- Lessons Learned Presentations Archive (Major Programs)
- Technical Reference Links



Designing the Value Stream



Source: Munroe & Associates



Discussion question: How can you Build Industrial Sustainability into Design using LPPD?

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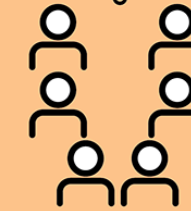
Understand then Execute



Synchronize
Work Flows



Build in Learning
and Knowledge Reuse



It's a Team Sport



Design the
Value Stream

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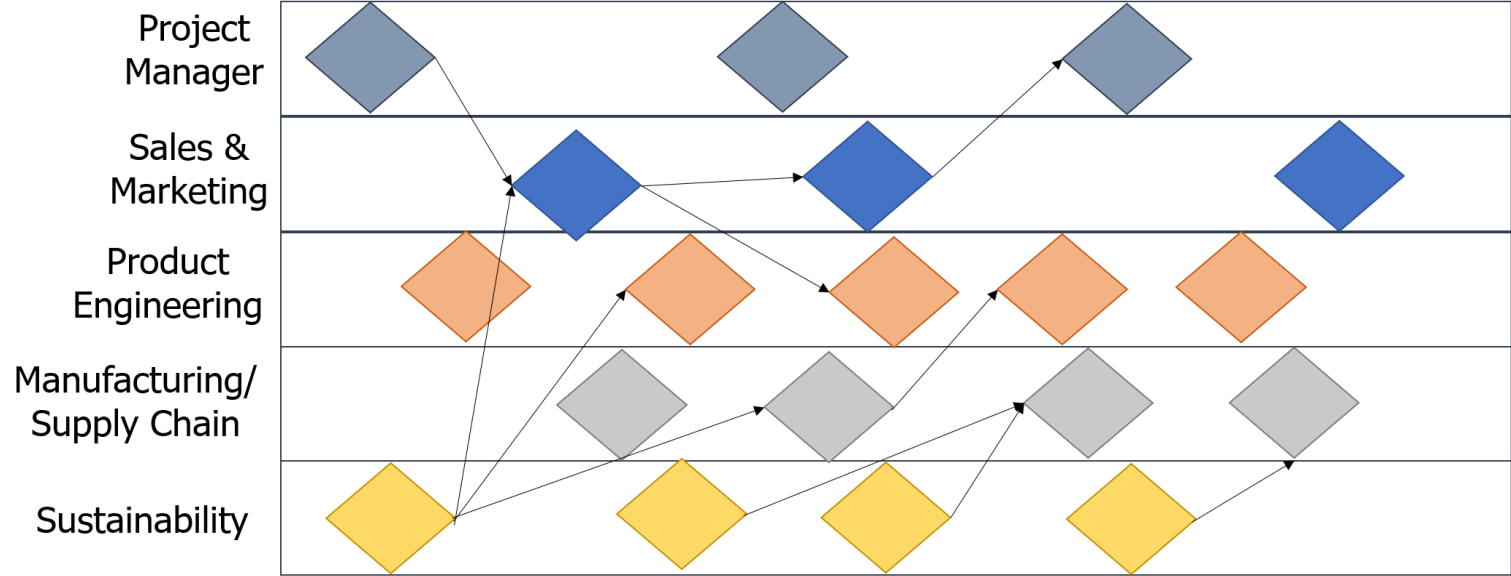


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Continuing Research



Decision Flow



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Guiding Principles**

Questions?

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