Systems Thinking for Design

Session 2

https://sites.google.com/a/iiitdm.ac.in/sudhirvs/courses/systems-thinking-for-design

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN AND MANUFACTURING, KANCHEEPURAM

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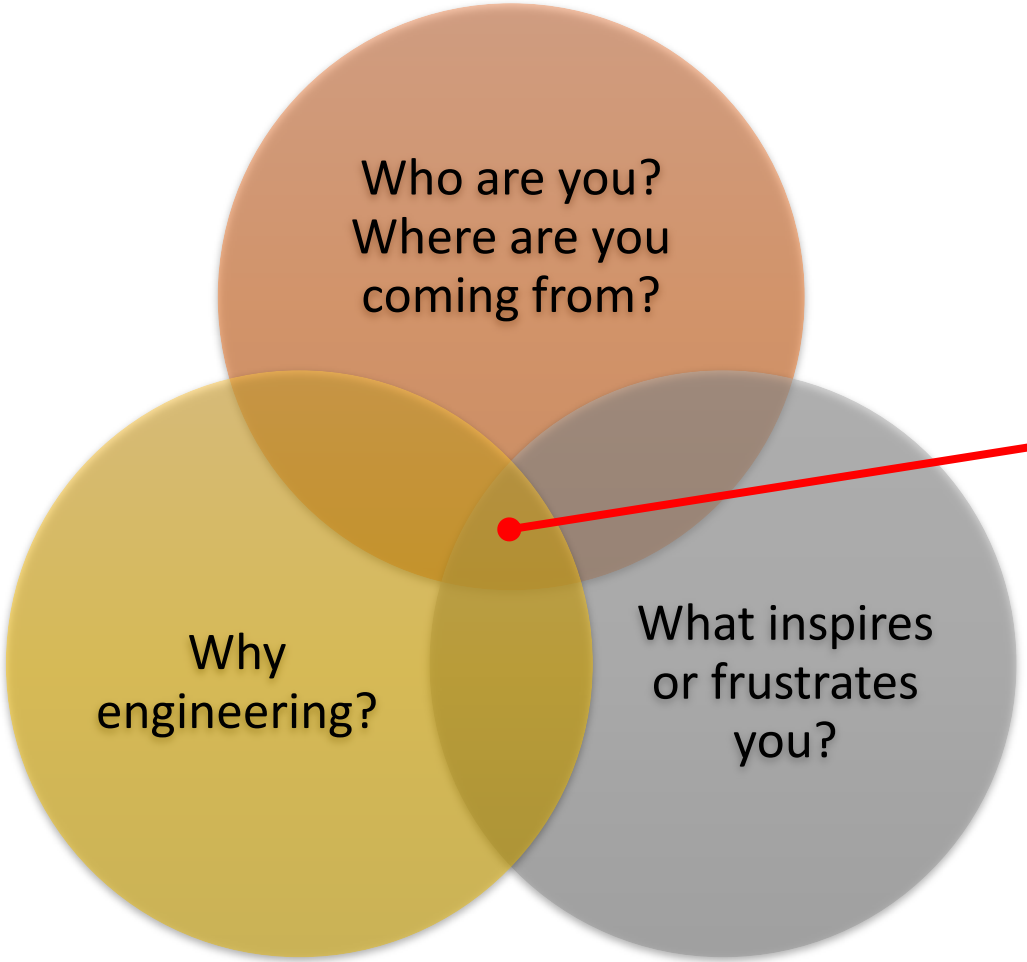
Session outline

- Kickstart Opportunity Identification
- Challenges in the Fuzzy Front End of NPD
- Need for inter-disciplinary concepts and approaches

Exercise 2.1: Revisit your reflection (10 min)



- Look into your notes and identify the issue (opportunity)/idea that is at the heart of the three responses
- Is there an interesting engineering problem/idea hidden in your everyday experience?
- List down 5-6 key aspects of the problem / idea

What challenges did you experience?

- Abstracting key elements from the responses
- Connecting the dots & extracting meaning
- Seeing an opportunity in a problem and distinguishing problem from an idea
- Defining the scope / boundary of the problem or idea
- What about novelty, relevance, feasibility and viability of the idea or opportunity?

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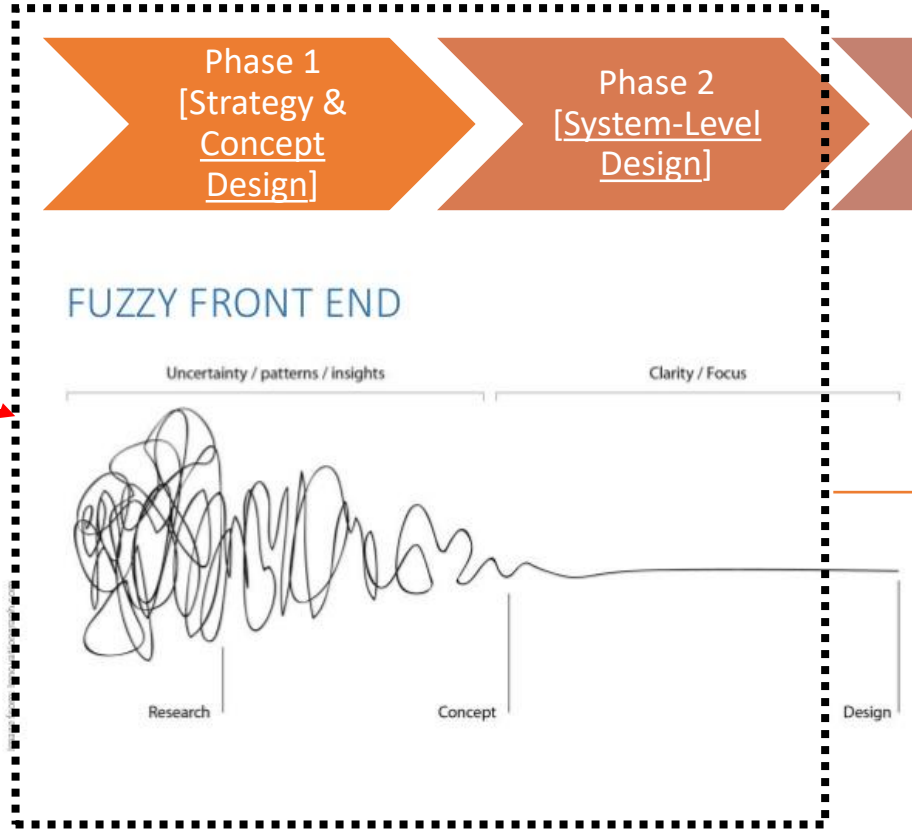
Fuzzy Front End (FFE) of NPD and Innovation

NPD = New Product Development

Phase 1 [Strategy & Concept Design] → Phase 2 [System-Level Design] → Phase 3 [Detailed Design & Prototype] → Phase 4 [Manufacture, Assembly, Test] → Phase 5 [Market Introduction & Penetration]

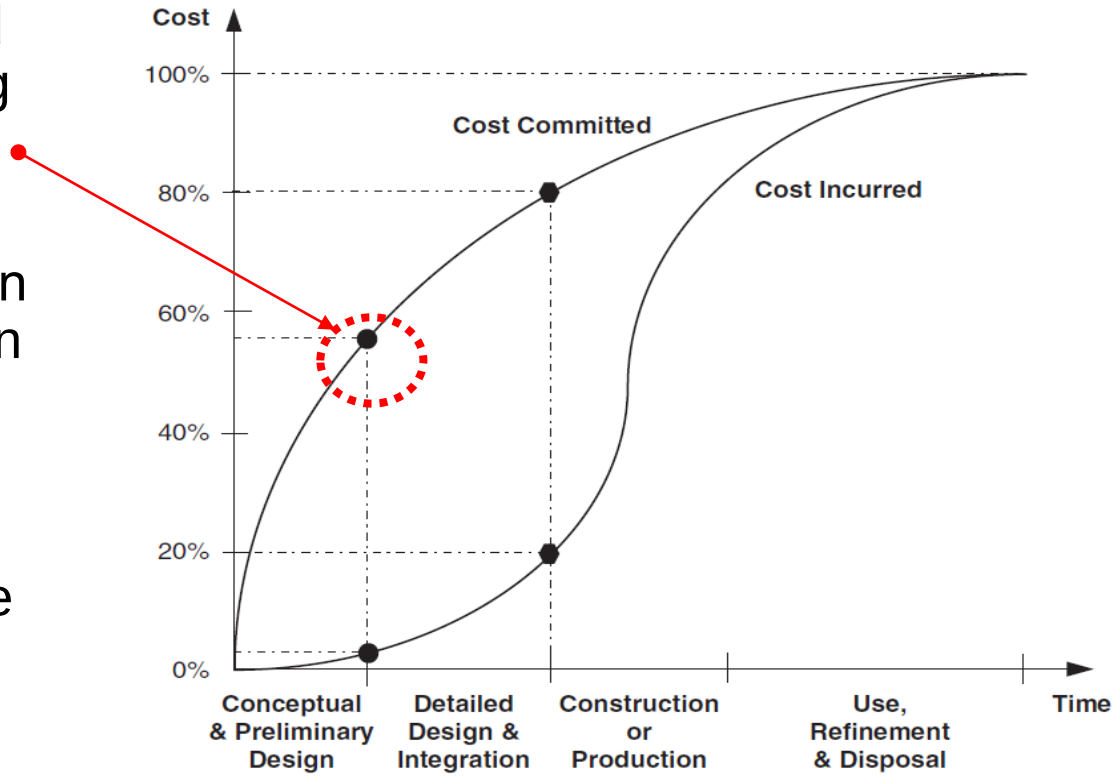


Why is this important?

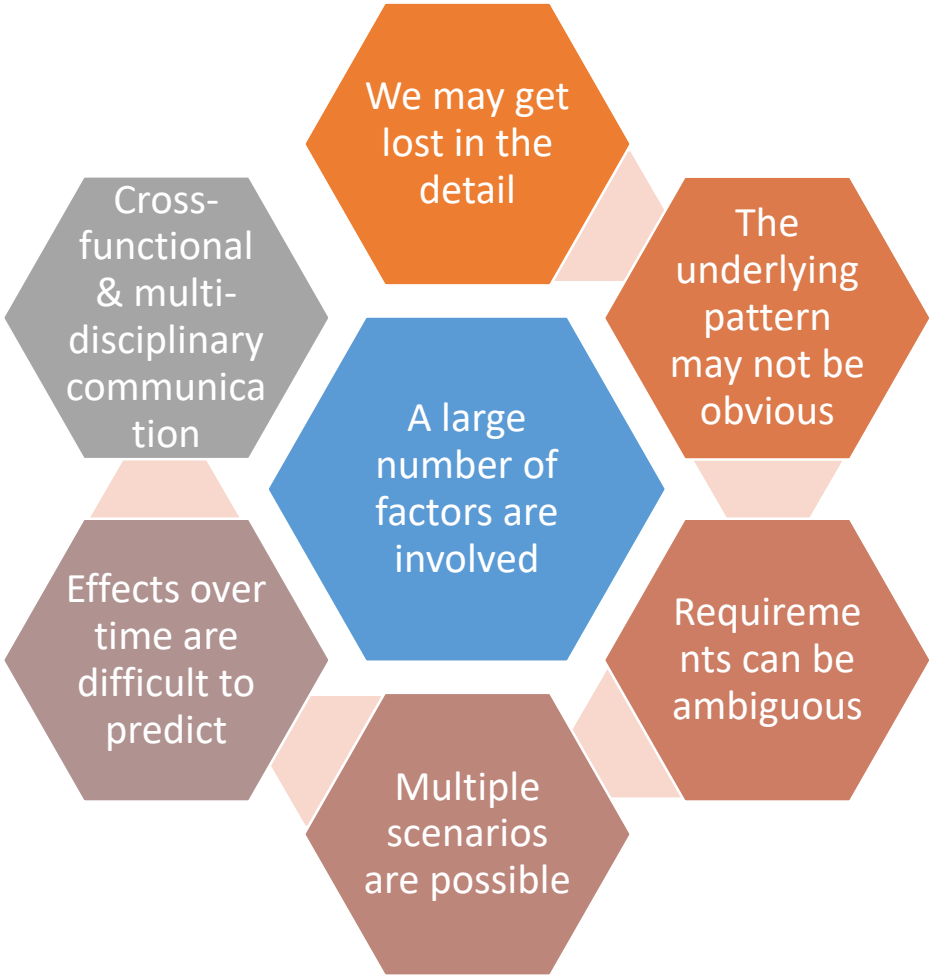
What are the challenges in this phase?

The importance of FFE

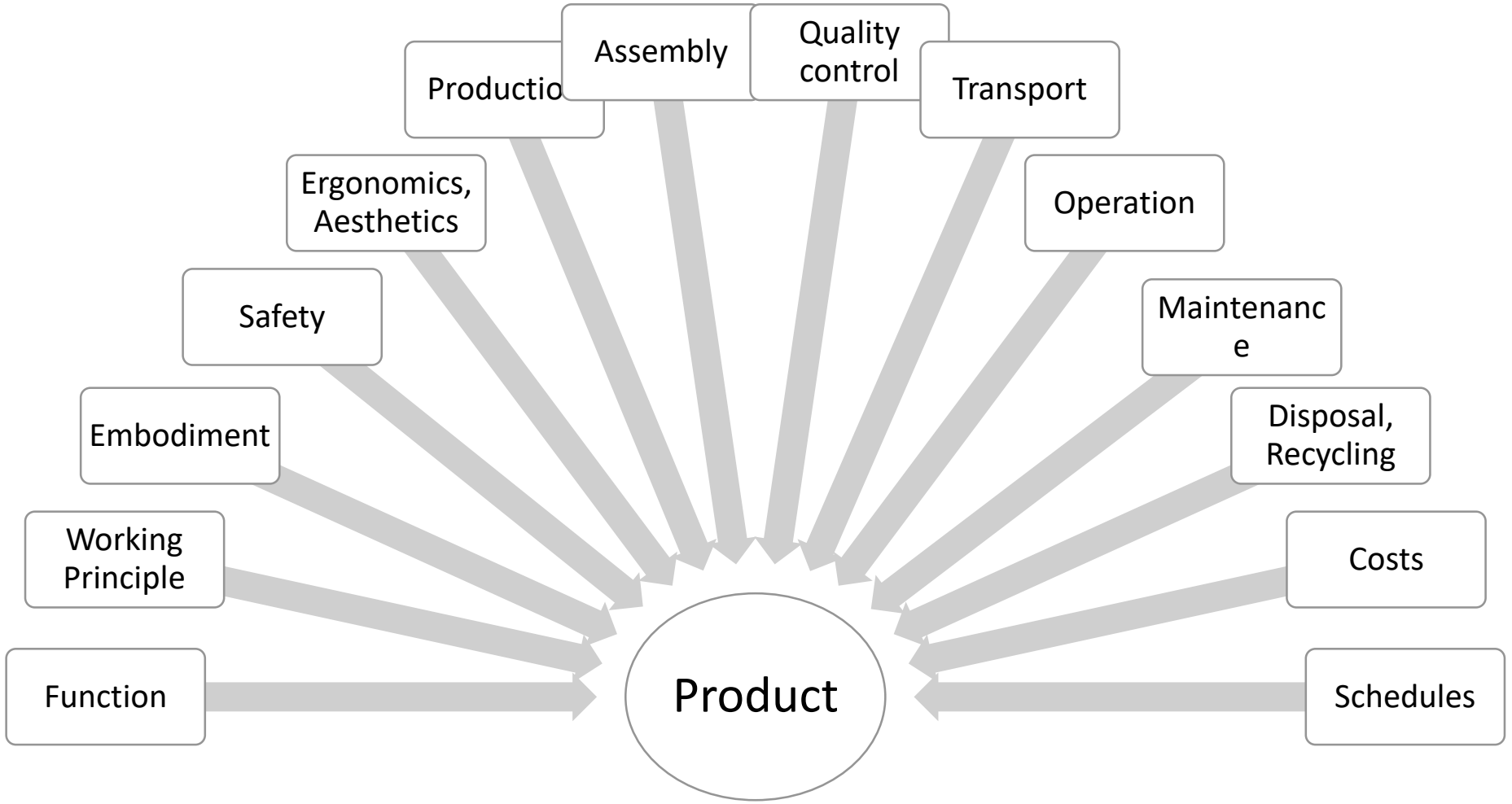
- About 60% of the product cost is committed when the concept design is selected (wrong choices can destroy the advantage)
- Opportunity to shape a market and create new sources of competitive advantage … (In a world of interdependence, competition can come from anywhere)
- Proliferation of technologies (digital), emergence of integrated product concepts (PSS, SCS, CPS) and regulatory issues like sustainability necessitates a deeper understanding of market and technology trends



Key Challenges in FFE



A variety of factors are involved in design

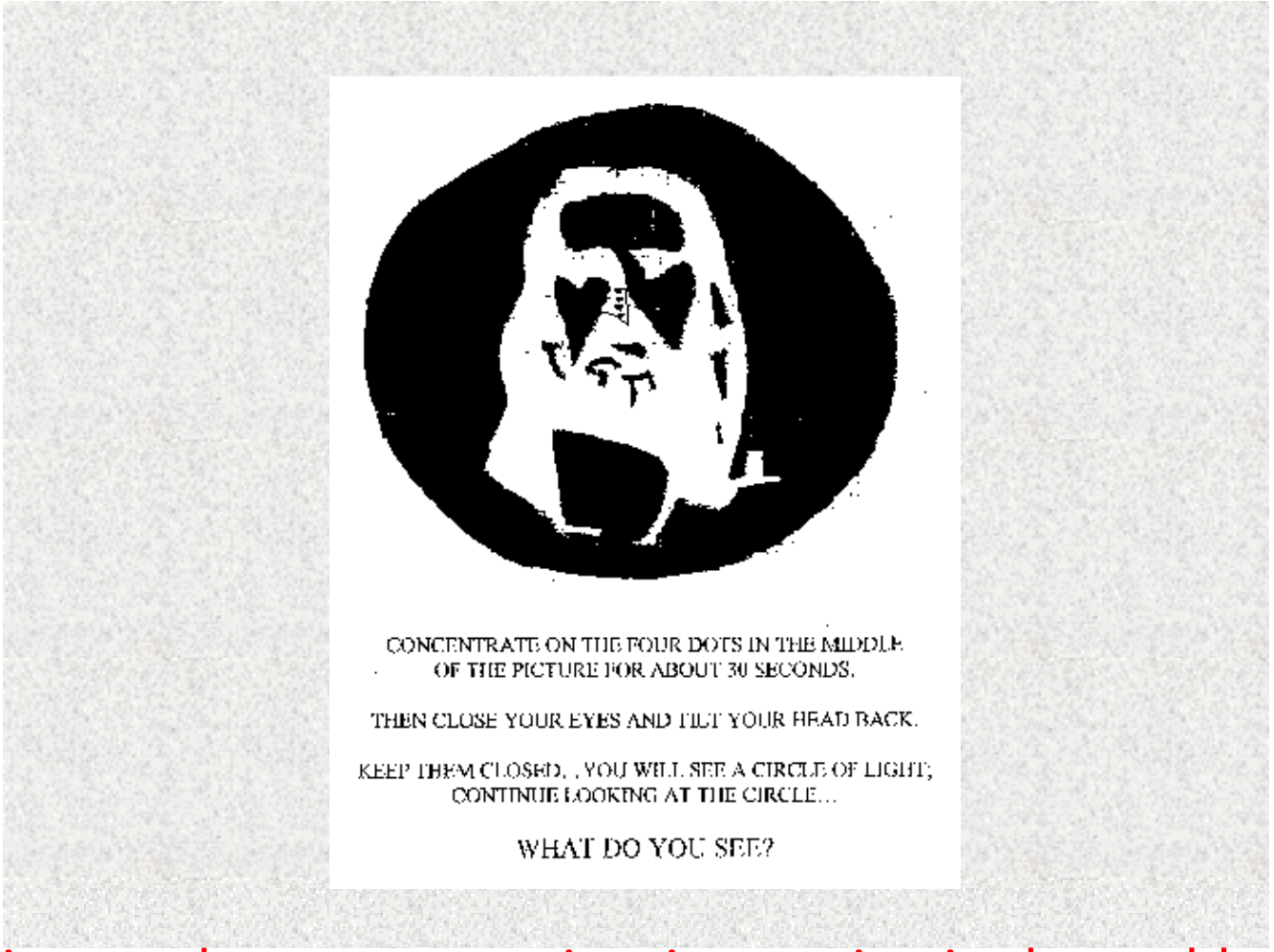


We could easily get lost in the detail

- Cna yuo raed tihs? Olny 55 plepoe out of 100 can.
- i cdnuolt blveiee taht I cluod aulaclty uesdnatnrdwaht I was rdanieg. The phaonmneal pweor of the hmuan mnid, aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it dseno't mtaetr in waht oerdr the ltteres in a wrod are, the olny iproamtnt tihng is taht the frsit and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it whotuit a pboerlm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Azanmig huh? yaeh and I awlyas tghuhot slpeling was ipmorantt!

The power of seeing the whole without knowing all the parts

The underlying pattern may not be obvious



Seeing connections and patterns requires immersion in the problem context

The problem/requirement can be ambiguous

Set of Elements

	A	A
WITH		OFFICE	IN
	I		MY
HANDLE		PROBLEM	COMPUTER

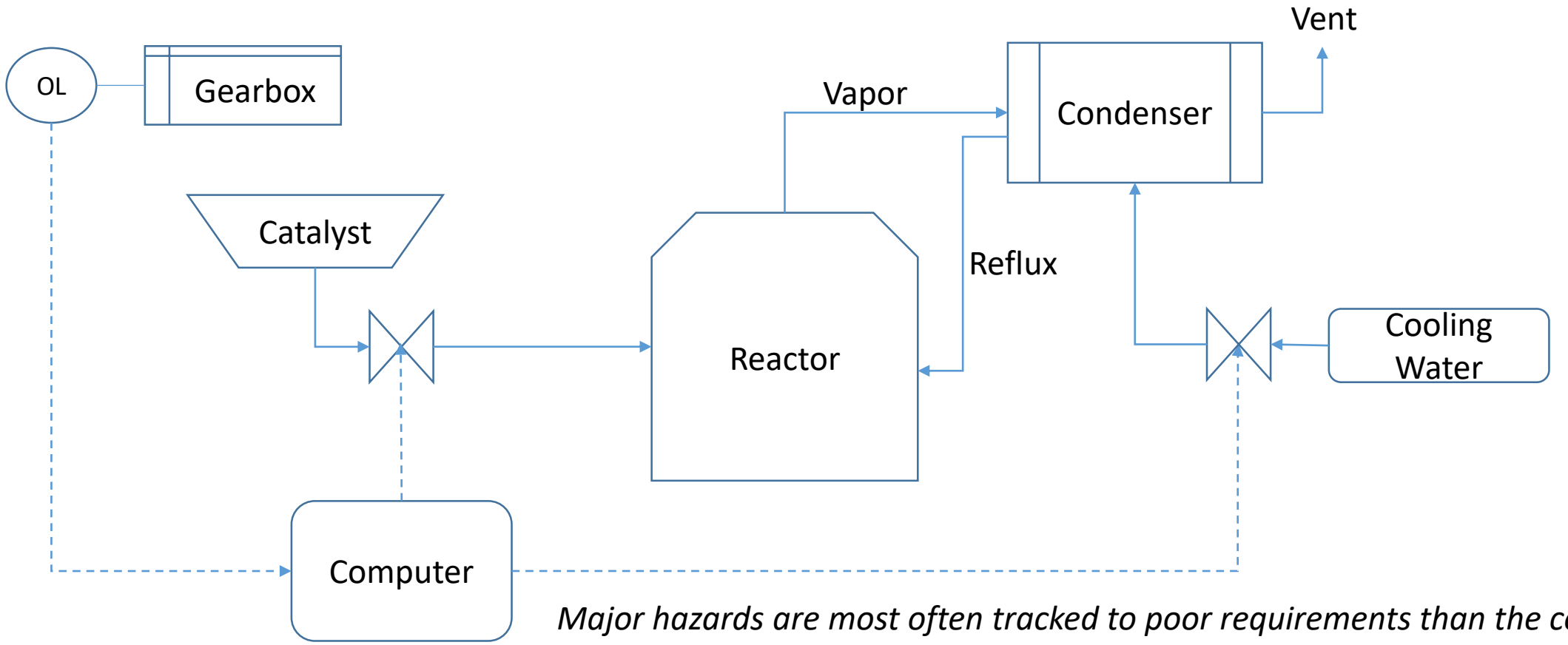
Different Meanings

- WITH A COMPUTER, I HANDLE A PROBLEM IN MY OFFICE
  - Using Computer to handle business problem
- WITH MY OFFICE, I HANDLE A PROBLEM IN A COMPUTER
  - Providing hardware services to clients
- IN MY OFFICE, I HANDLE A PROBLEM WITH A COMPUTER
  - Using computers for solving client problems

Source: Allen S. Lee (1999), Researching MIS

Each pattern suggests different requirements

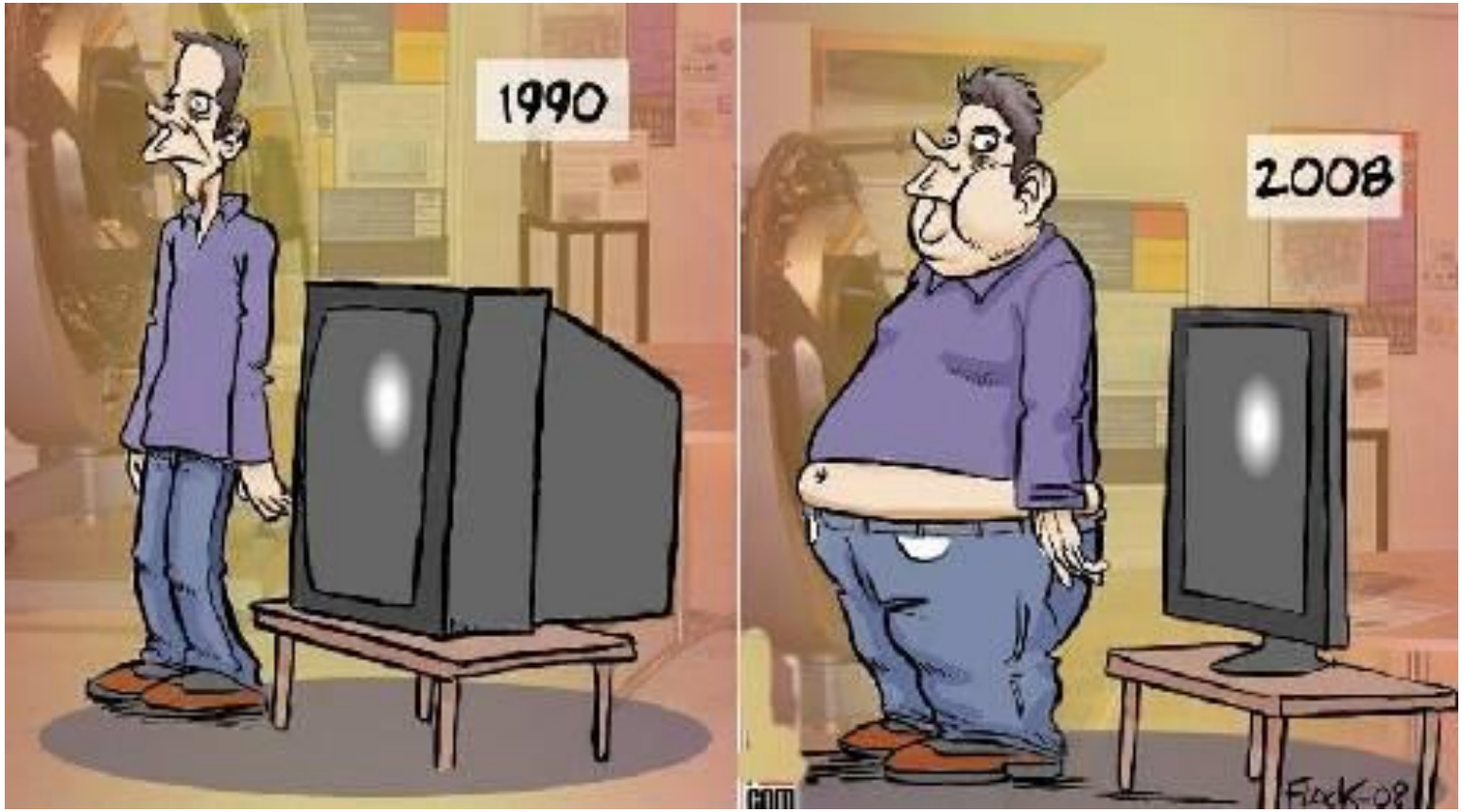
Scenarios may be difficult to visualize



Major hazards are most often tracked to poor requirements than the code

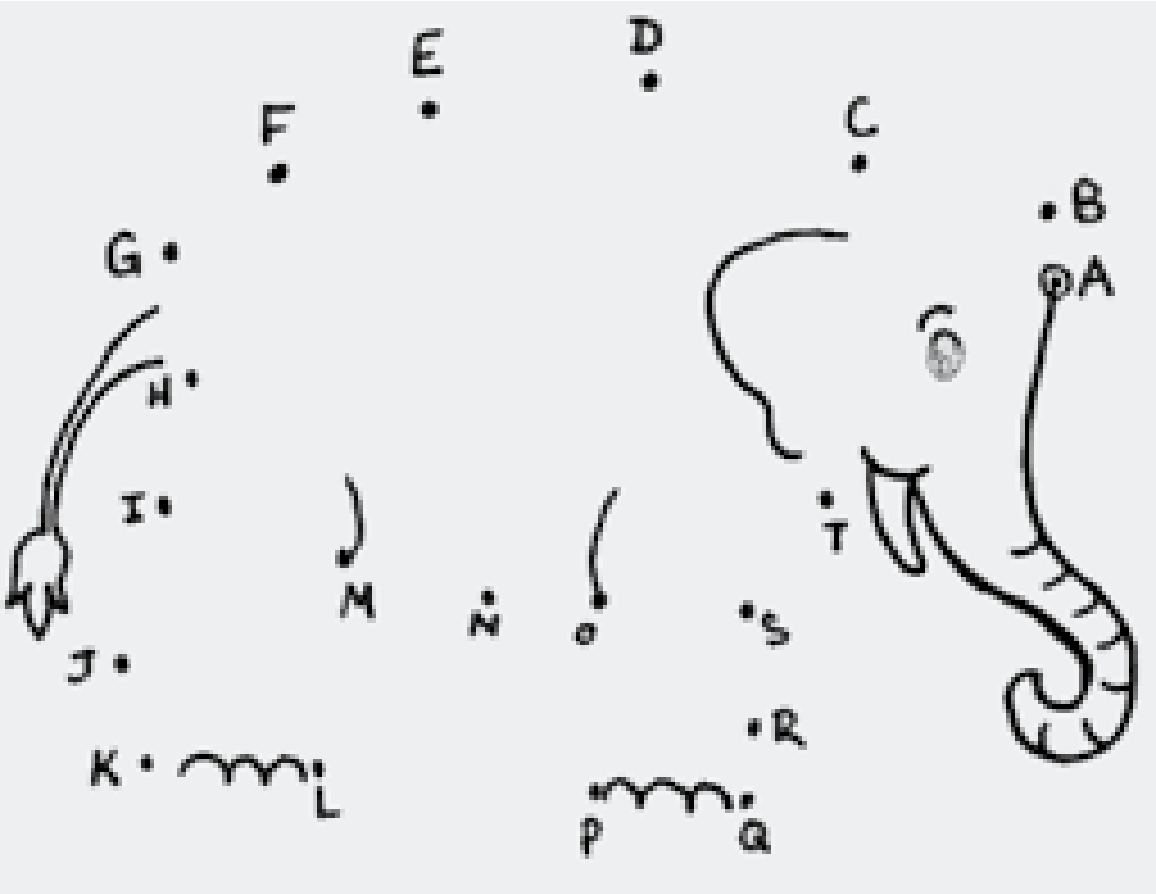
Becomes more problematic with increasing use of IoT

Effects over time may be difficult to predict



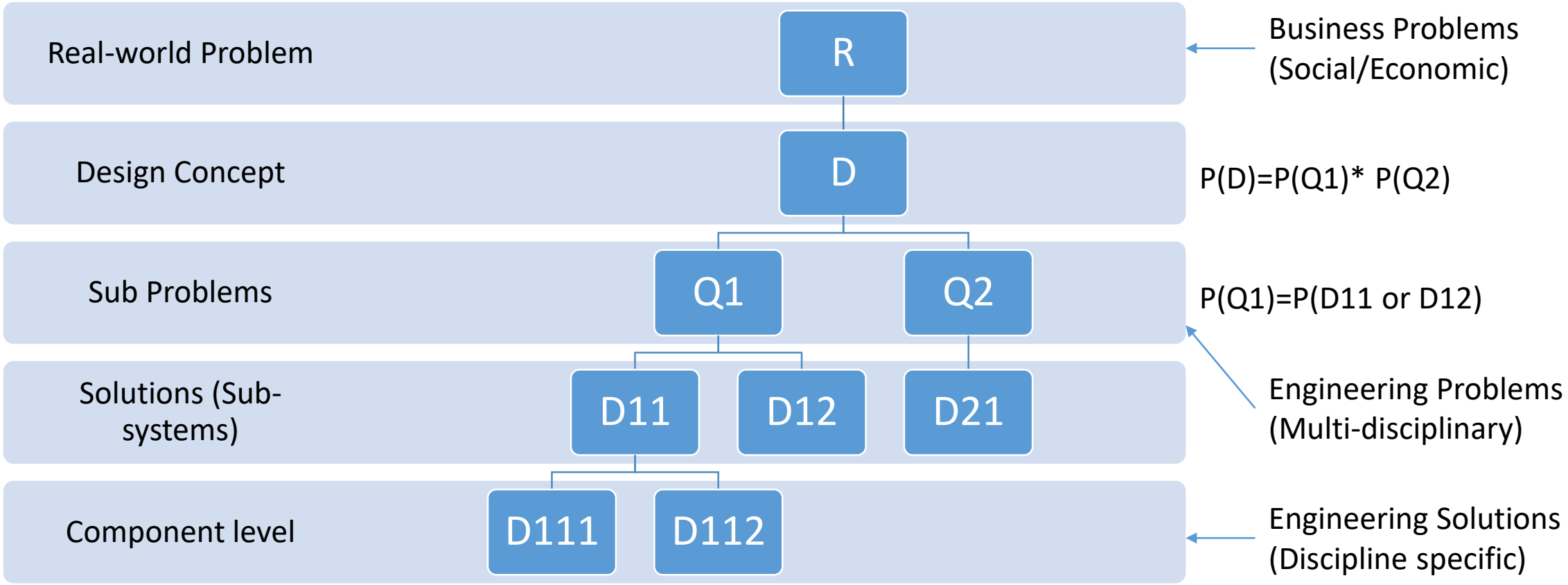
Did we change the TECHNOLOGY? OR It CHANGED us?

Exercise 2.2: Is there scope for taking a more holistic view of your problem/idea? (15 min)



Can you see the elephant in your opportunity/idea description or are you seeing the tail/trunk?

Are you able to see the difference between problem space & solution space?



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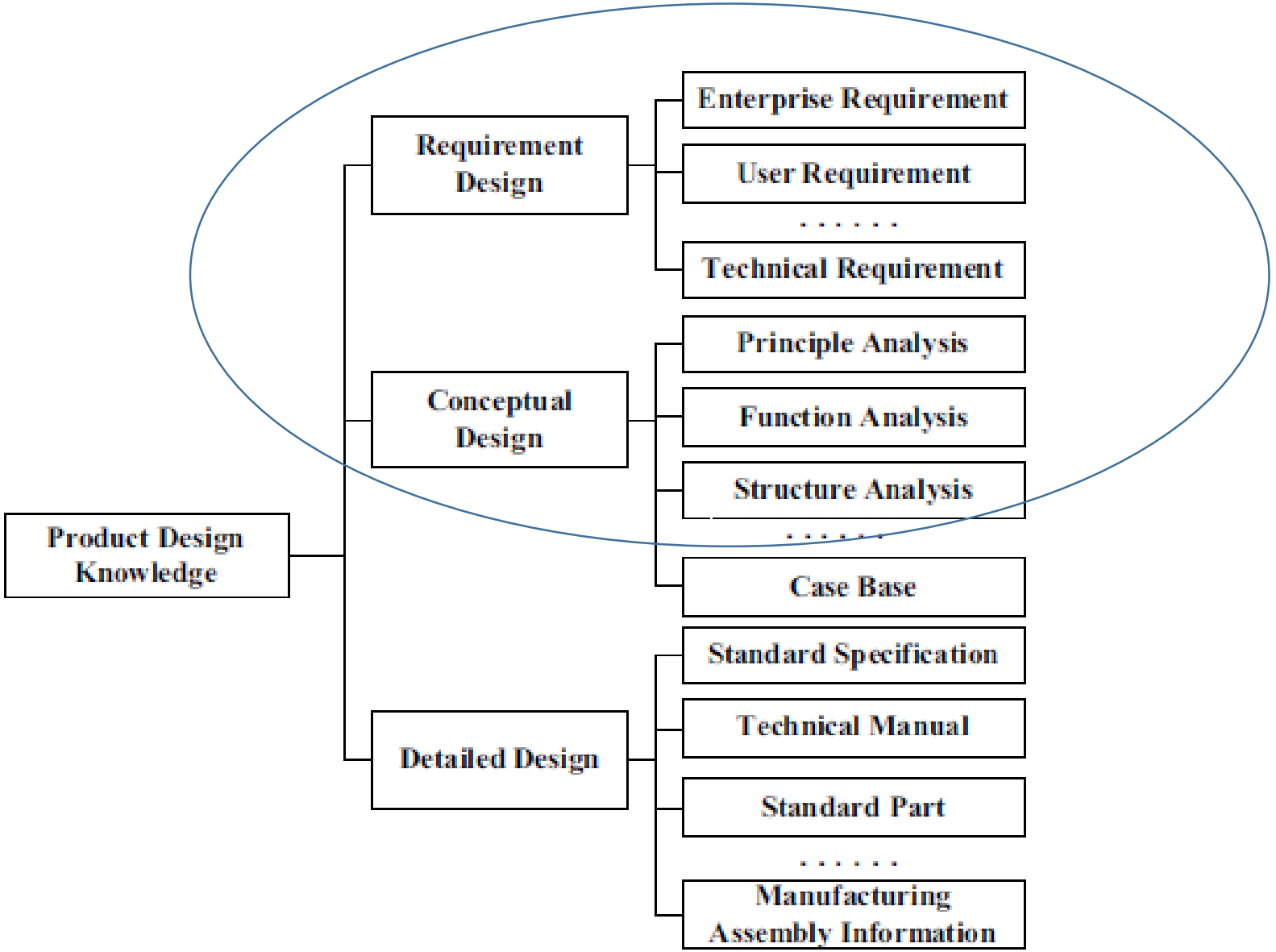
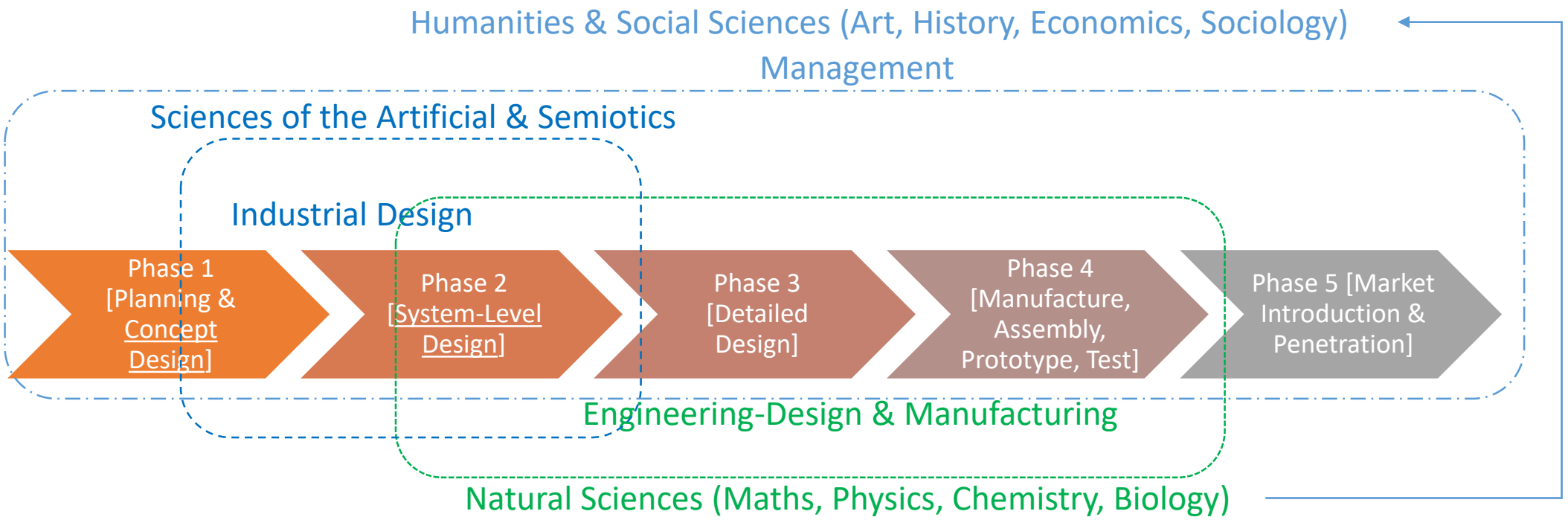
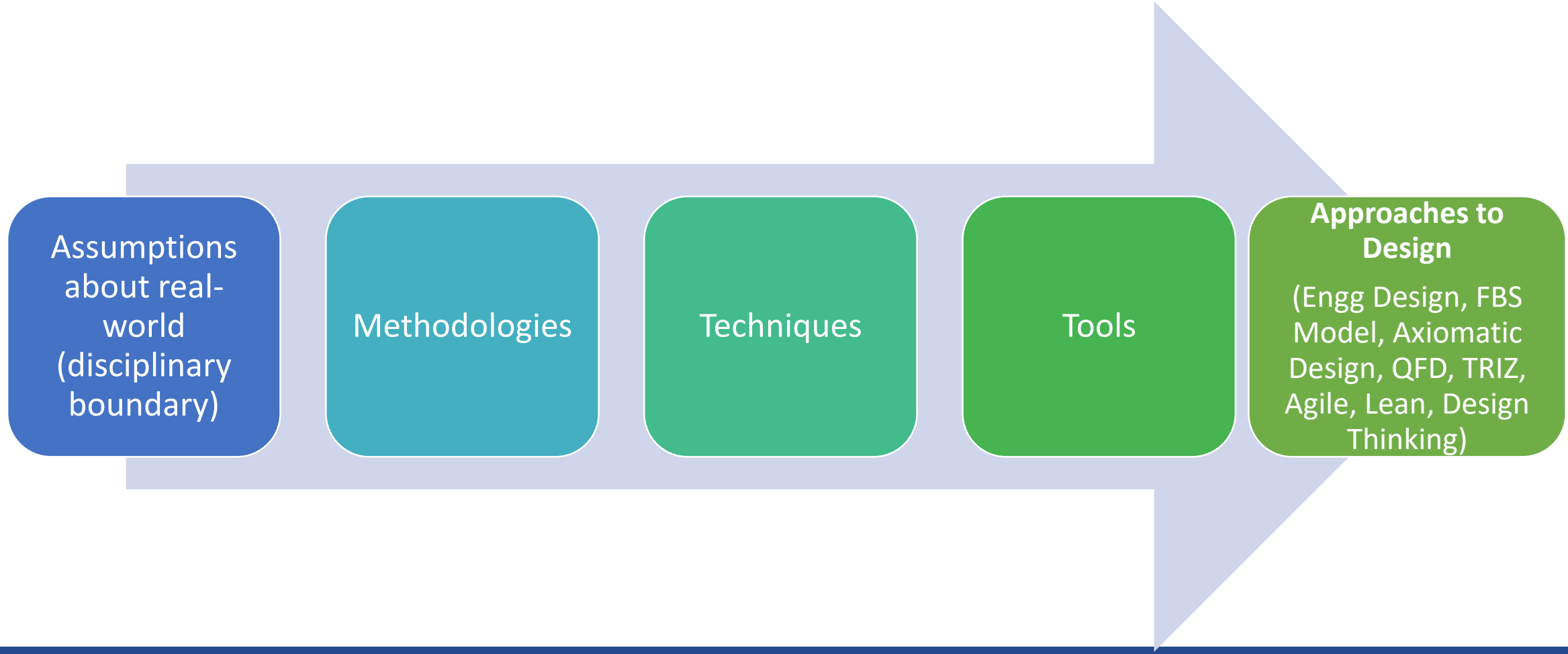

Product Design Knowledge
Requirement Design
Enterprise Requirement
User Requirement
. . . . . .
Technical Requirement
Conceptual Design
Principle Analysis
Function Analysis
Structure Analysis
. . . . . .
Case Base
Detailed Design
Standard Specification
Technical Manual
Standard Part
. . . . . .
Manufacturing Assembly Information

Multi-disciplinary & cross-functional challenge

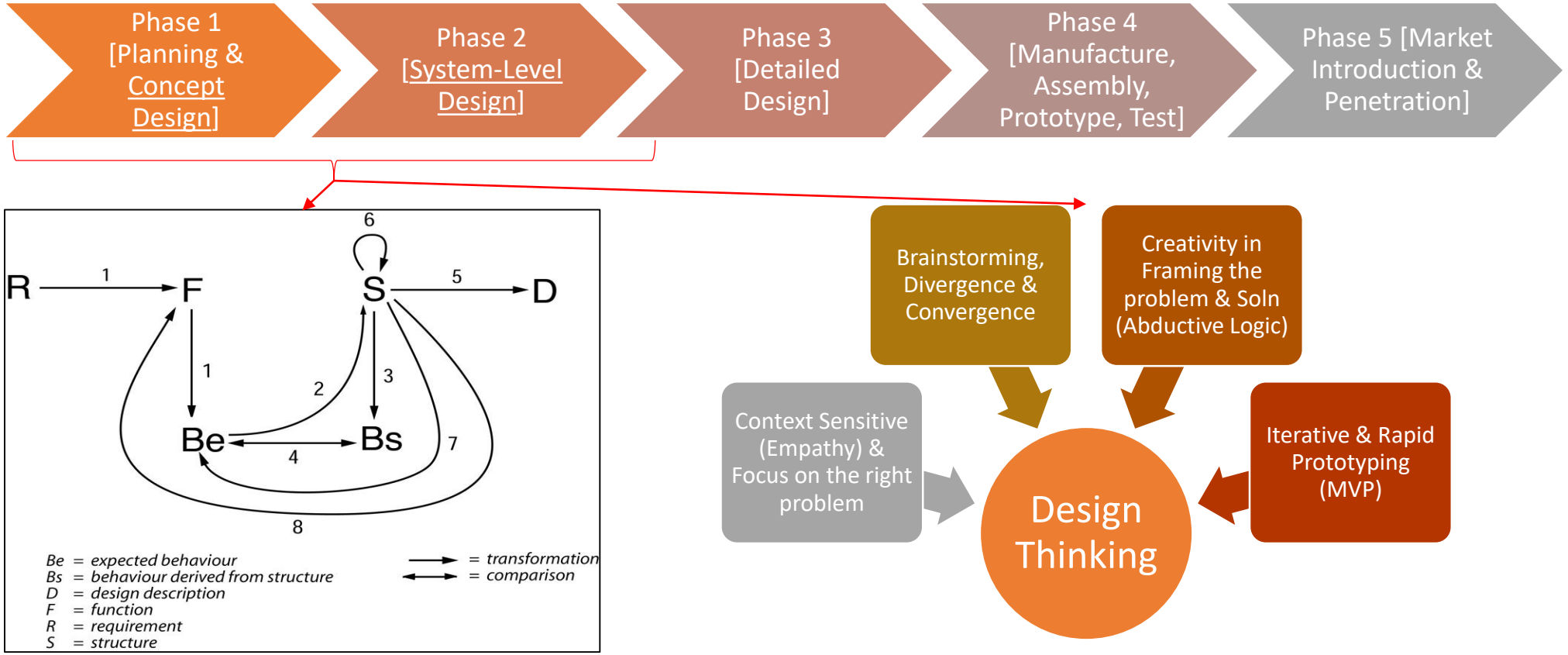


INCOMMENSURABILITY

Multiple disciplines = Multiple approaches



Popular Approaches to Product Design



FBS Framework

Design Thinking of Stanford University & IDEO

Approaches differ in their core assumptions

Real-world problem situations have

Ambiguity

Inter-dependency

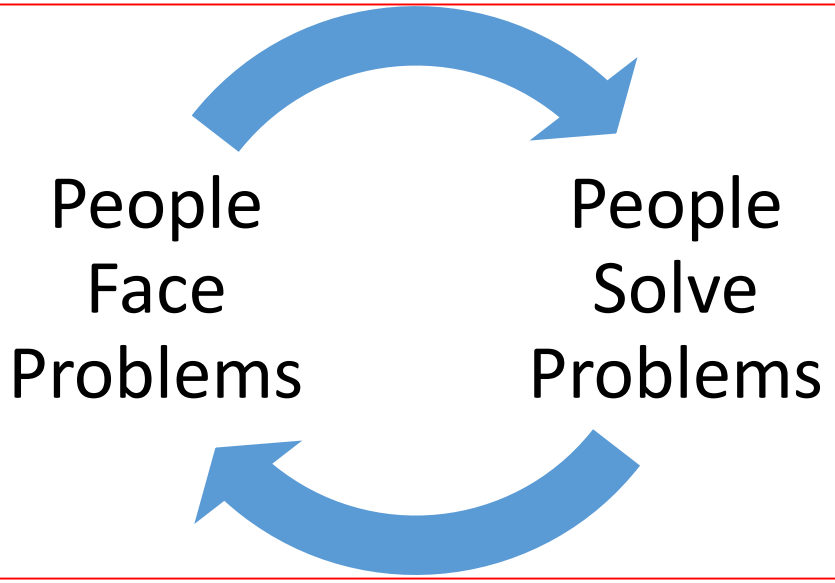
Uncertainty

Multi-disciplinarity

Systems Thinkers are more concerned about these issues because

How do we DESIGN solutions that are creative, efficient and economical?

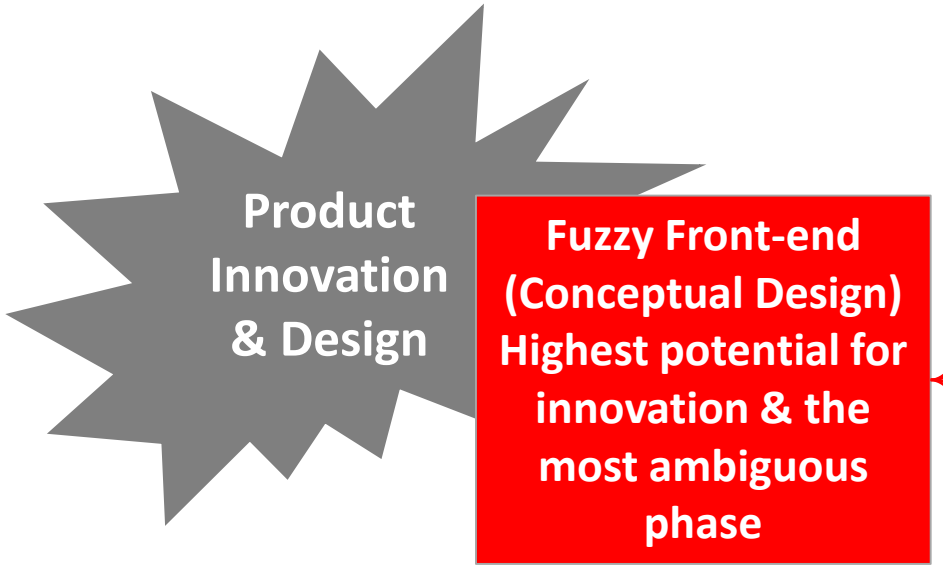
Engineers, Industrial Designers & Managers focus a lot on this



Emphasis on Discovery & Diagnosis coupled with iterative nature can help focus on the right Design Challenge

How do we ensure that the SOLUTION sustains, does not create new problems or worsen the original problem?

FFE & NPD needs a Holistic Approach

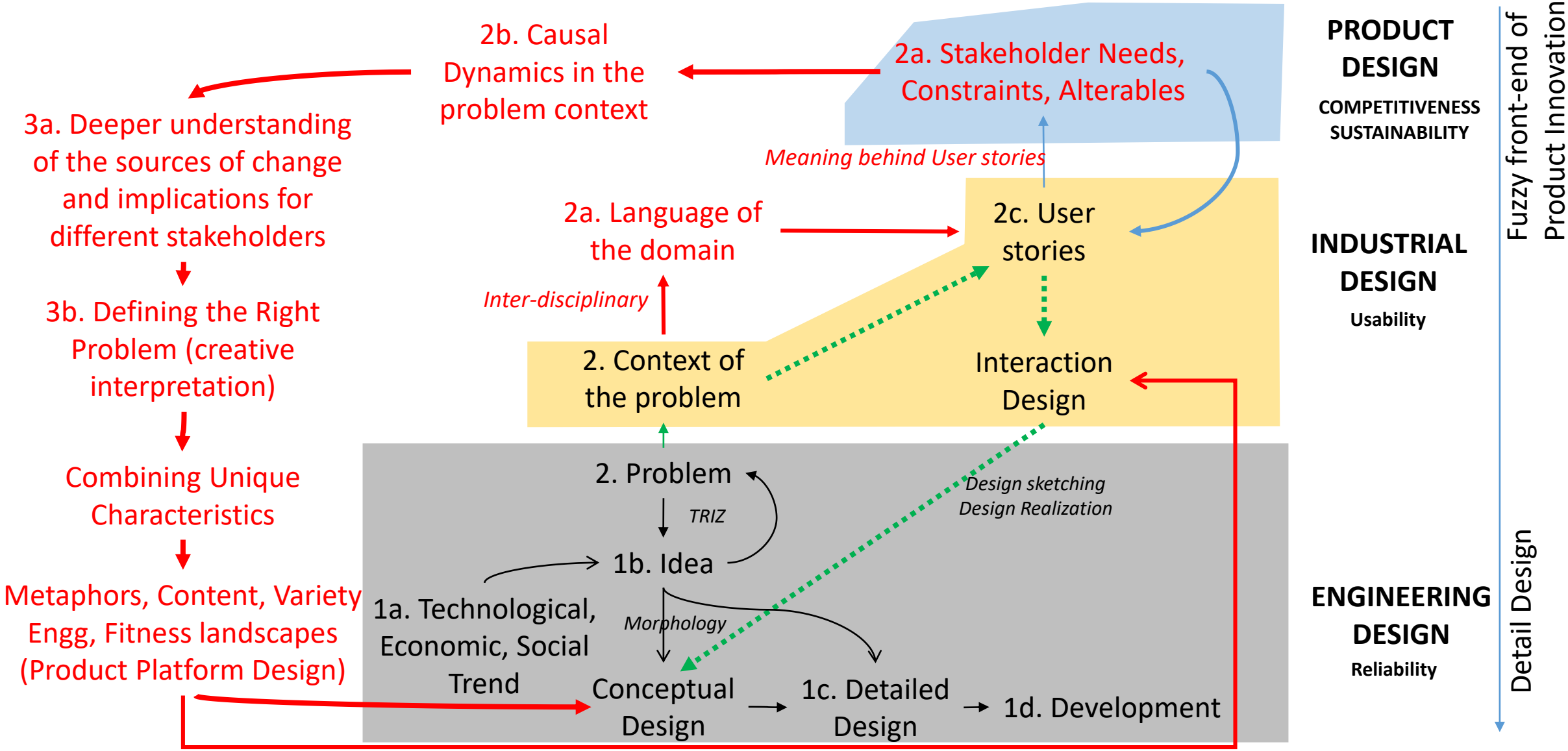


Fuzzy Front-end (Conceptual Design) Highest potential for innovation & the most ambiguous phase

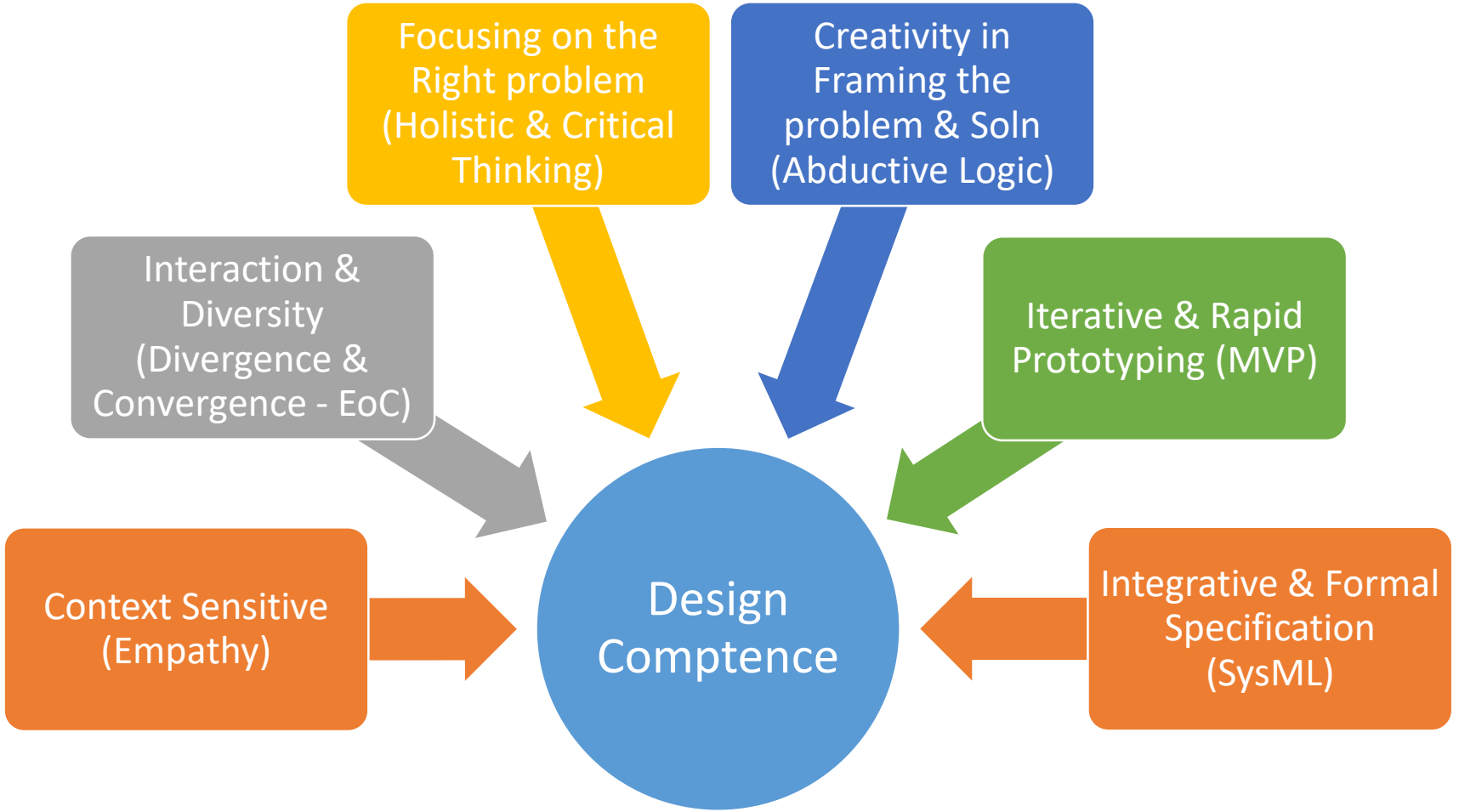
- Ambiguity
- Inter-dependency
- Inter-disciplinary
- Uncertainty

1. Diverse Perspectives & Interactive
2. Qualitative Modeling (Semi-mathematical & Pictorial)
3. Integrative theory / concepts
4. Iteration, Simulation, Physical models & Time to market

Systems Thinking helps in Holistic Design



Systems thinking enhances design competence



While approaches are useful in different ways, never forget that design is a social activity

"Thinking outside of the box didn't work.
Thinking inside of the box didn't work.
Maybe it's a defective box!"

Expert designers pay attention to the real issues without becoming prisoners of methods … Pay greater attention to collaborative problem solving

Welcome to the world of inter-disciplinary concepts

Reflect on today's session and post your comments