

# Concept Selection, Set Based Design and Late Decision Making

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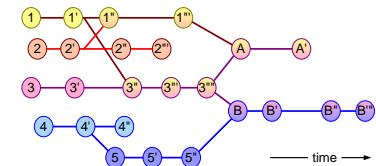
## Abstract

We discuss a systems design approach where several design options are maintained concurrently. In LEAN Product Development this is called set-based design. Conventional systems engineering also promotes the concurrent evaluation of multiple concepts, the so-called concept selection. Finally, LEAN product development advocates to keep options open as long as feasible; the so-called late decision making.

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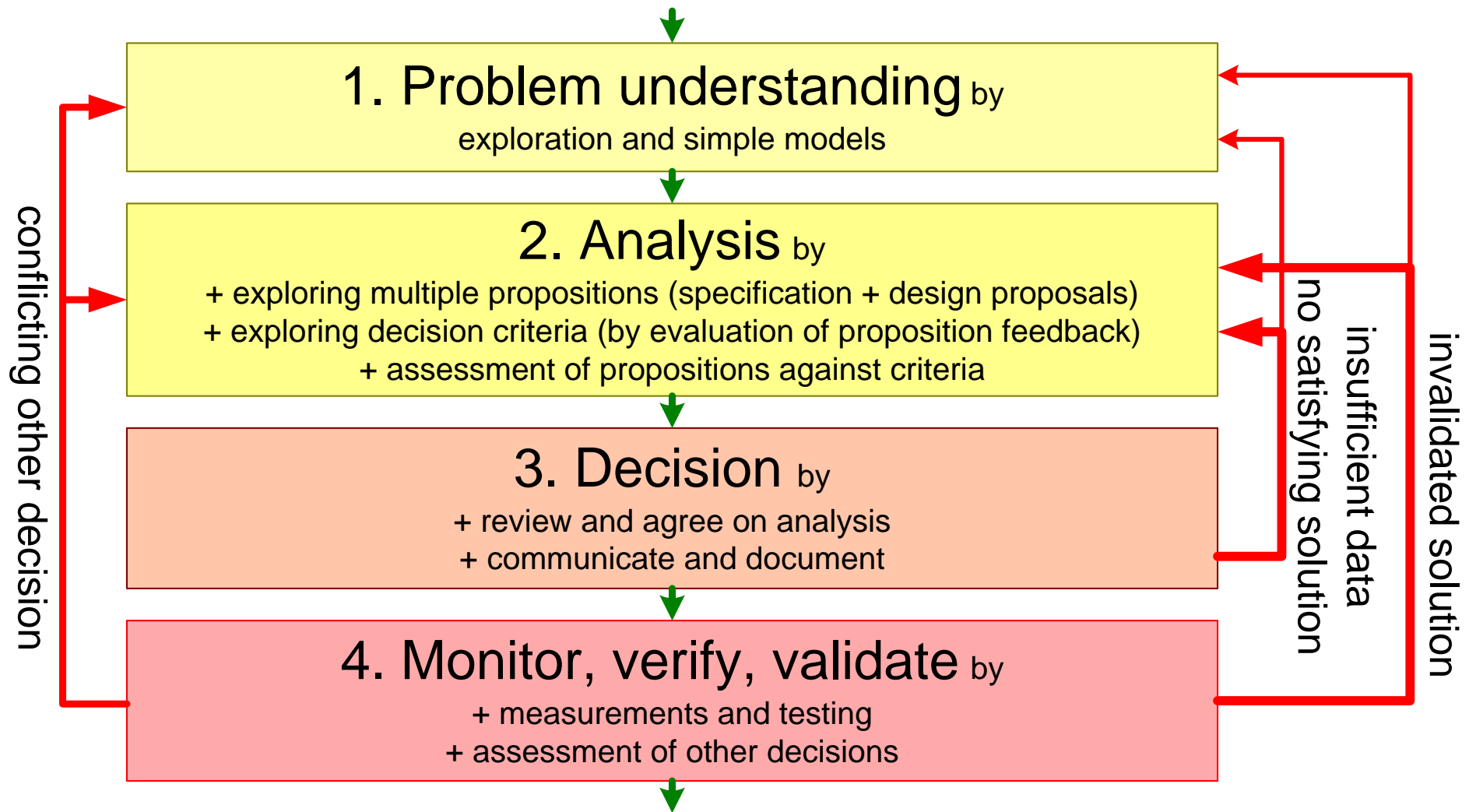
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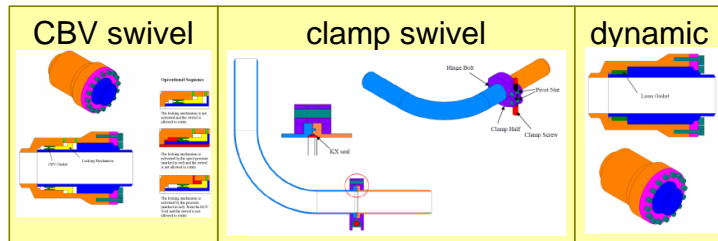
# Problem Solving Approach

vague problem statement



# Examples of Pugh Matrix Application

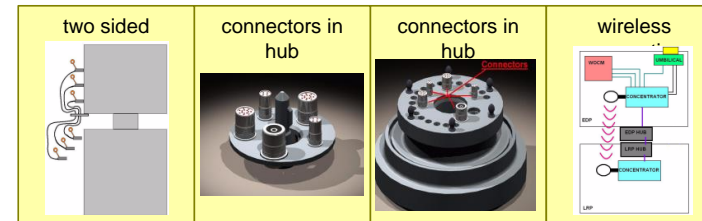
## Swivel concept selection



evaluation criteria	weight	CBV		clamp		dynamic		
Maturity	10	5	50	2	20	2	50	
Development level								
Cost	20	4	80	2	40	5	100	
Hardware cost								
Development cost		5	100	2	40	2	40	
Design robustness	25							
Design life								
swivel cycles		5	125	3	75	3	75	
pressure cycles		5	125	4	100	5	125	
Pressure range								
internal		4	100	4	100	4	100	
external		2	50	5	125	2	50	
Temperature range		4	100	4	100	4	100	
Installation	20							
Initial installatio/retrieval			2	40	3	60	4	80
Connection/disconnection		2	40	4	80	5	100	
Operation	25							
Swivel resistance			1	25	4	100	5	125
Spool Length Short			1	25	4	100	5	125
Spool Length Long			3	75	5	125	5	125
Hub loads			2	50	4	100	5	125
$\Sigma$ points			985		1165		1290	

from master paper Halvard Bjørnsen, 2009

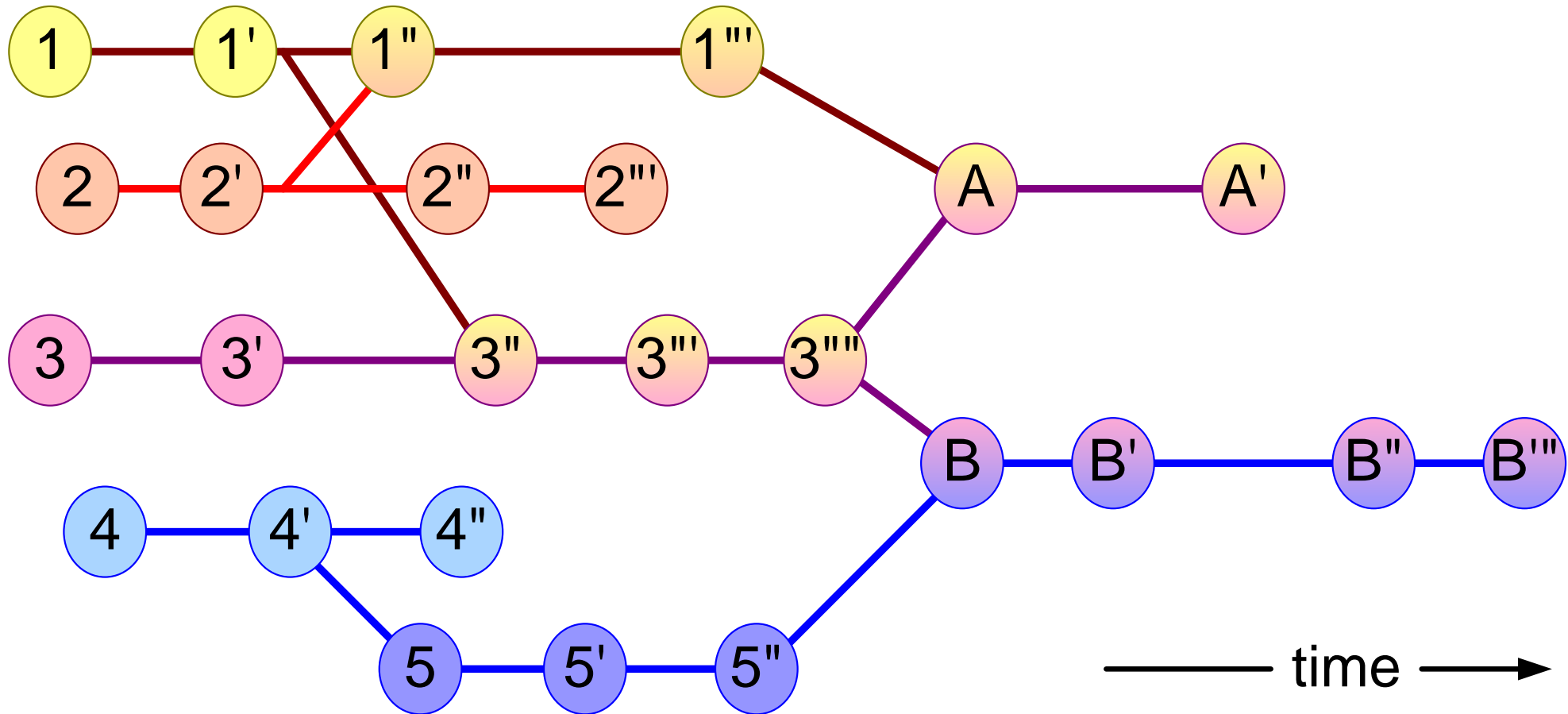
## EDP-LRP connection



Evaluation Criteria	Score	Concepts			
		1	2	3	4
Time to connect					
Need for ROV		-	+	+	+
Design		-	+	+	+
Robustness					
Connector design		-	S	S	+
Number of parts		-	-	+	+
Handle roll-off		+	-	S	+
Influence other		+	S	-	S
Redundancy					
Design		+	-	-	S
Interchangeability		+	-	-	-
Cost					
HW cost		-	-	-	-
Manufacturing cost		S	S	-	S
Engineering cost		+	-	S	-
Service cost		-	+	+	+
Maturity		-	-	S	+
$\Sigma$ -		7	7	5	3
$\Sigma$ S		1	3	4	3
$\Sigma$ +		5	3	4	7
Pos.		3	4	2	1

from master paper Dag Jostein Klever, 2009

# Evolution of Design Options



Evolving multiple concepts increases insight and understanding  
(LEAN product development: set-based design, SE: Pugh matrix)

Articulation of criteria sharpens evaluation

The discussion about the Pugh matrix is more valuable than final  
bottomline summation

Delaying decisions may help to keep options (Lean Product  
Development: late decision making, finance: real options)