

Concept Selection, Set Based Design and Late Decision Making

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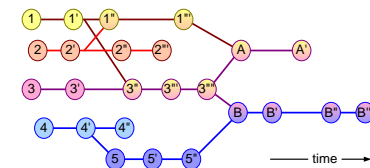
Abstract

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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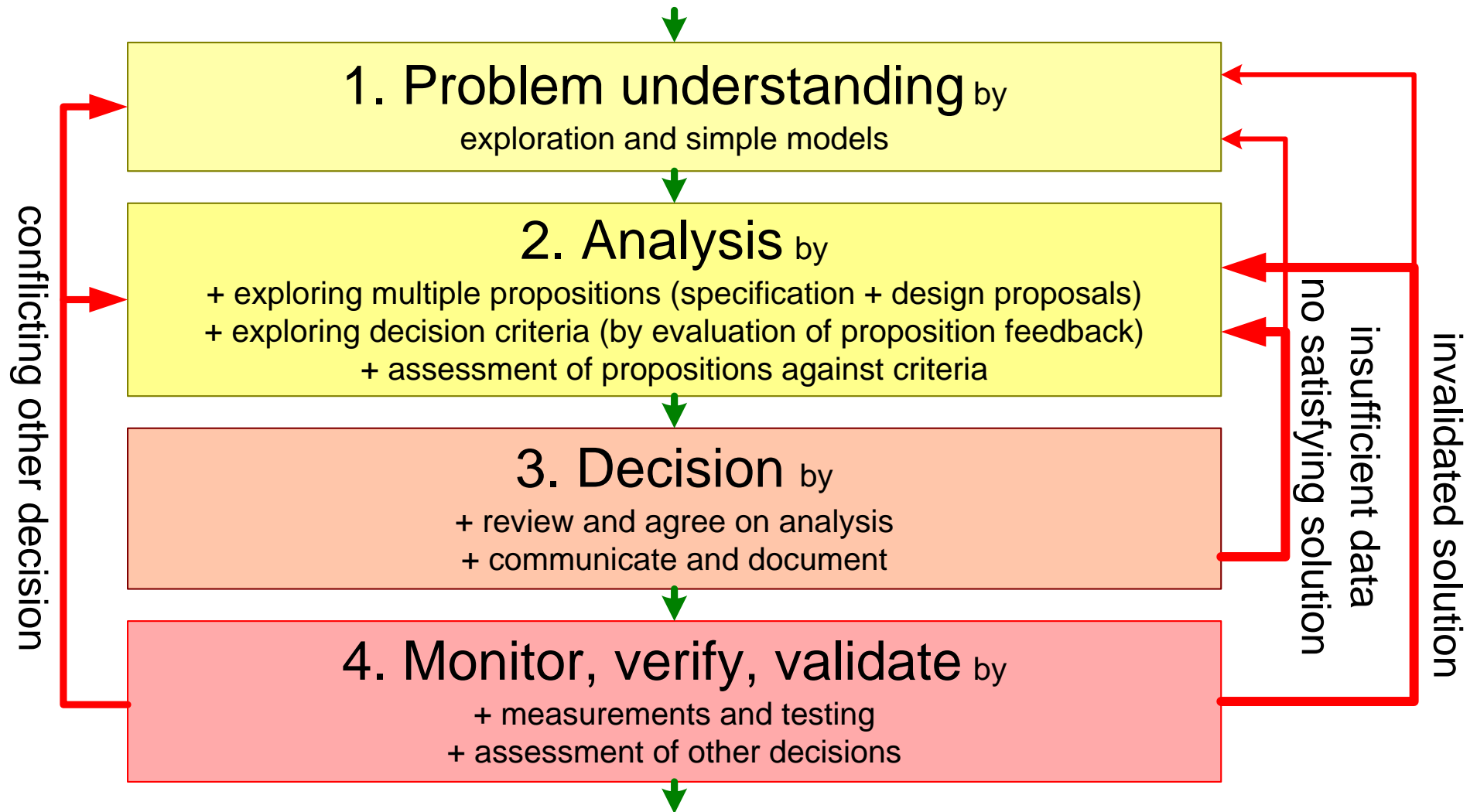
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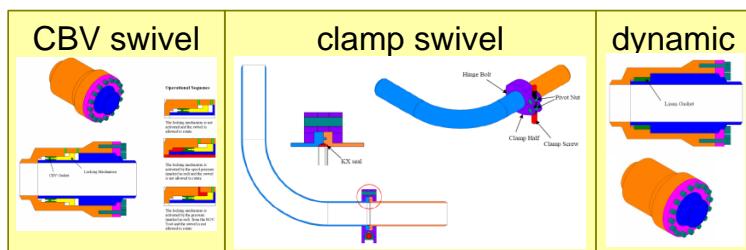
Problem Solving Approach

vague problem statement



Examples of Pugh Matrix Application

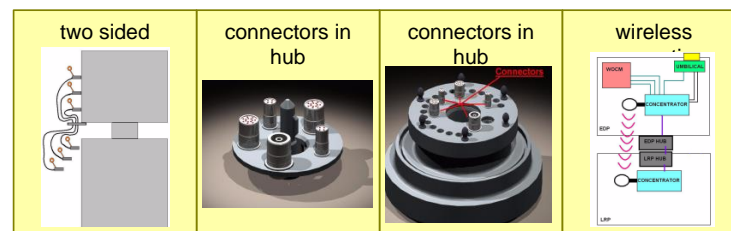
Swivel concept selection



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		3	75	5	125	5	125
Spool Length Long		3	75	5	125	5	125
Hub loads		2	50	4	100	5	125
Σ points				985		1165	

from master paper Halvard Bjørnsen, 2009

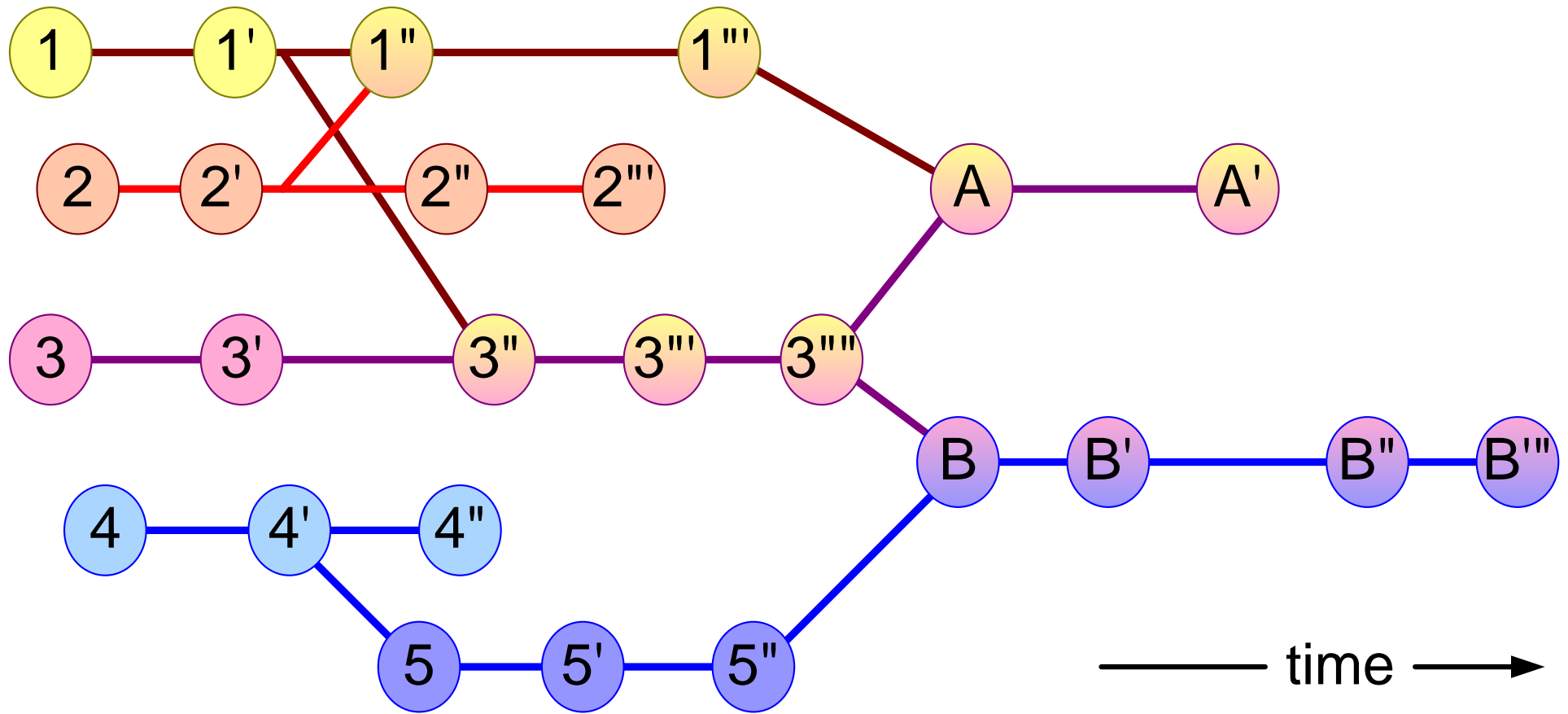
EDP-LRP connection



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	+
Σ -		7	7	5	3
Σ S		1	3	4	3
Σ +		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)