Integrating the End User Perspective in Technical Product Development:

Lessons from the Packaging Industry

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Tetra Pak Packaging Solutions

Human error is to blame*

THREE MILE ISLAND ACCIDENT - 28 MARCH 1979

*Time magazine 13 Aug 1979 quoting the Nuclear Regulatory Commision

Reference: http://www.missingfeatures.com/2007/06/28/the-danger-of-nuclear-power-plants/

Hisory of Human System Integration

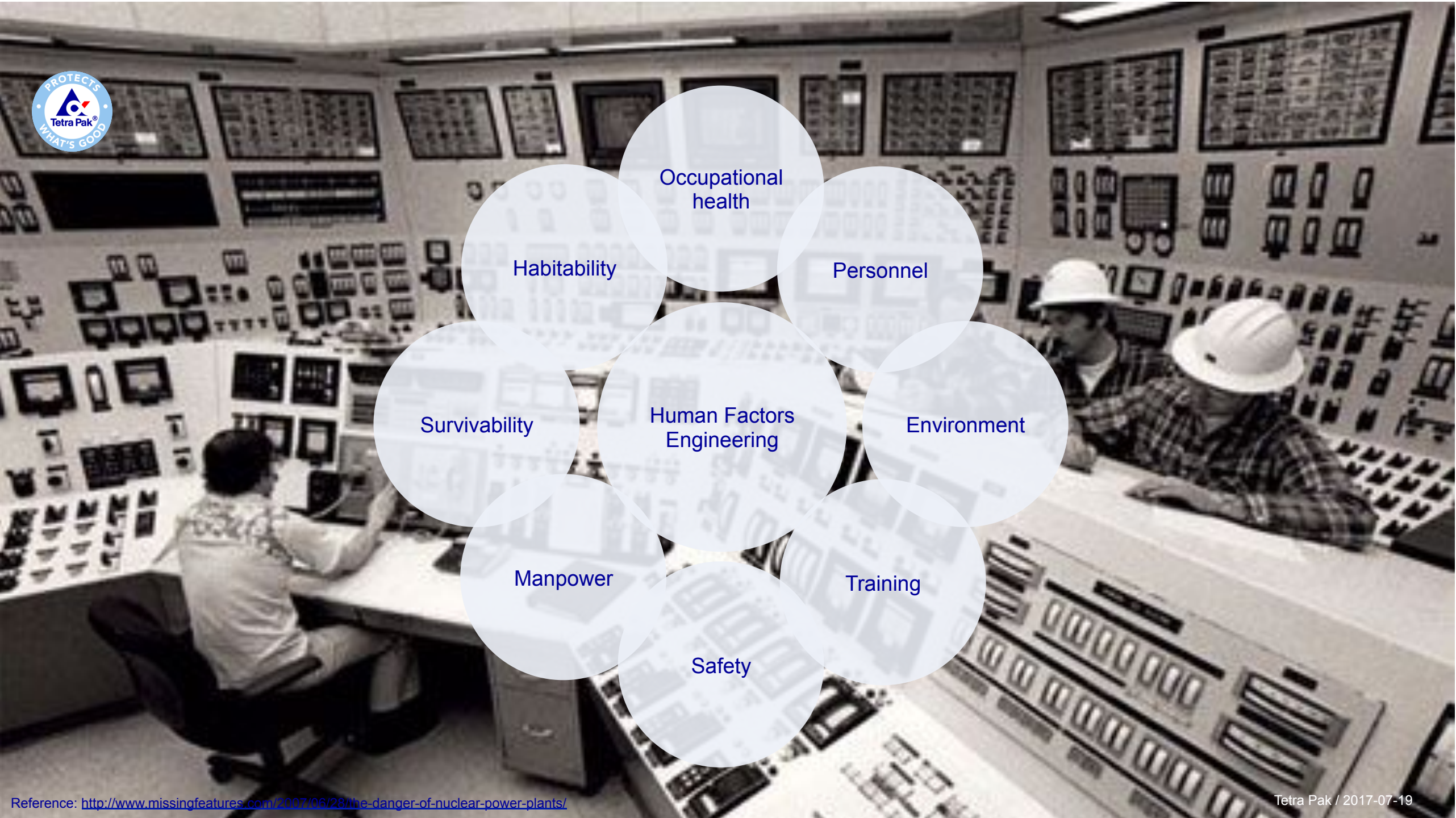
- US Army after WW2
- Nuclear industry
- Human role in complex systems

Reference: http://www.missingfeatures.com/2007/06/28/the-danger-of-nuclear-power-plants/

Definition of Human System Integration

…the interdisciplinary technical and management process for integrating human considerations within and across all system elements

Reference: http://www.missingfeatures.com/2007/06/28/the-danger-of-nuclear-power-plants/



Reference: http://www.missingfeatures.com/2007/06/28/the-danger-of-nuclear-power-plants/


I'M A
RENEWABLE
PACKAGE!
Tetra Rex


Tetra Pak
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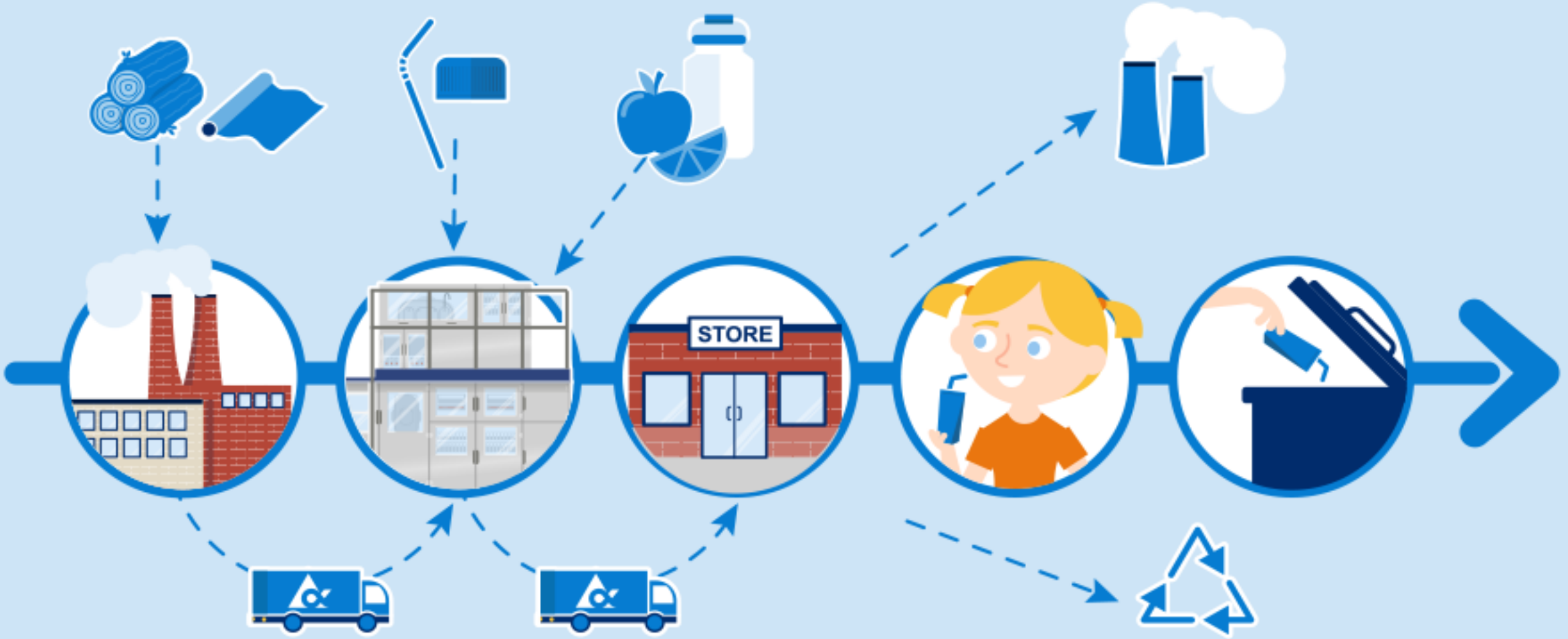
STORE


Tetra Pak
PROTECTS WHAT'S GOOD
Tetra Fino Aseptic
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Tetra Brik Asep
Max 4000 N

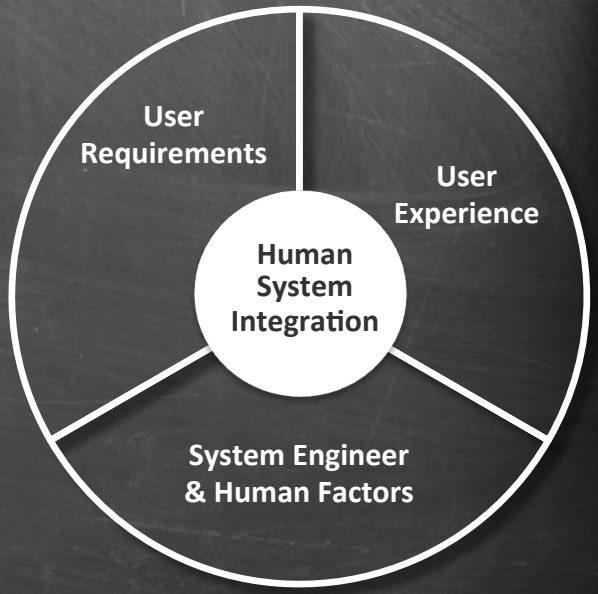
HSI Capability development at Tetra Pak

Business Transformation Process

Participating functions

- Equipment Safety
- Systems Engineers
- Mechanical Designers
- Ergonomics
- Technical Service
- Product Management

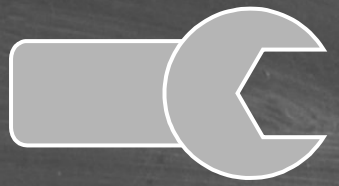
Core team of company experts



HSI Capability development at Tetra Pak

People

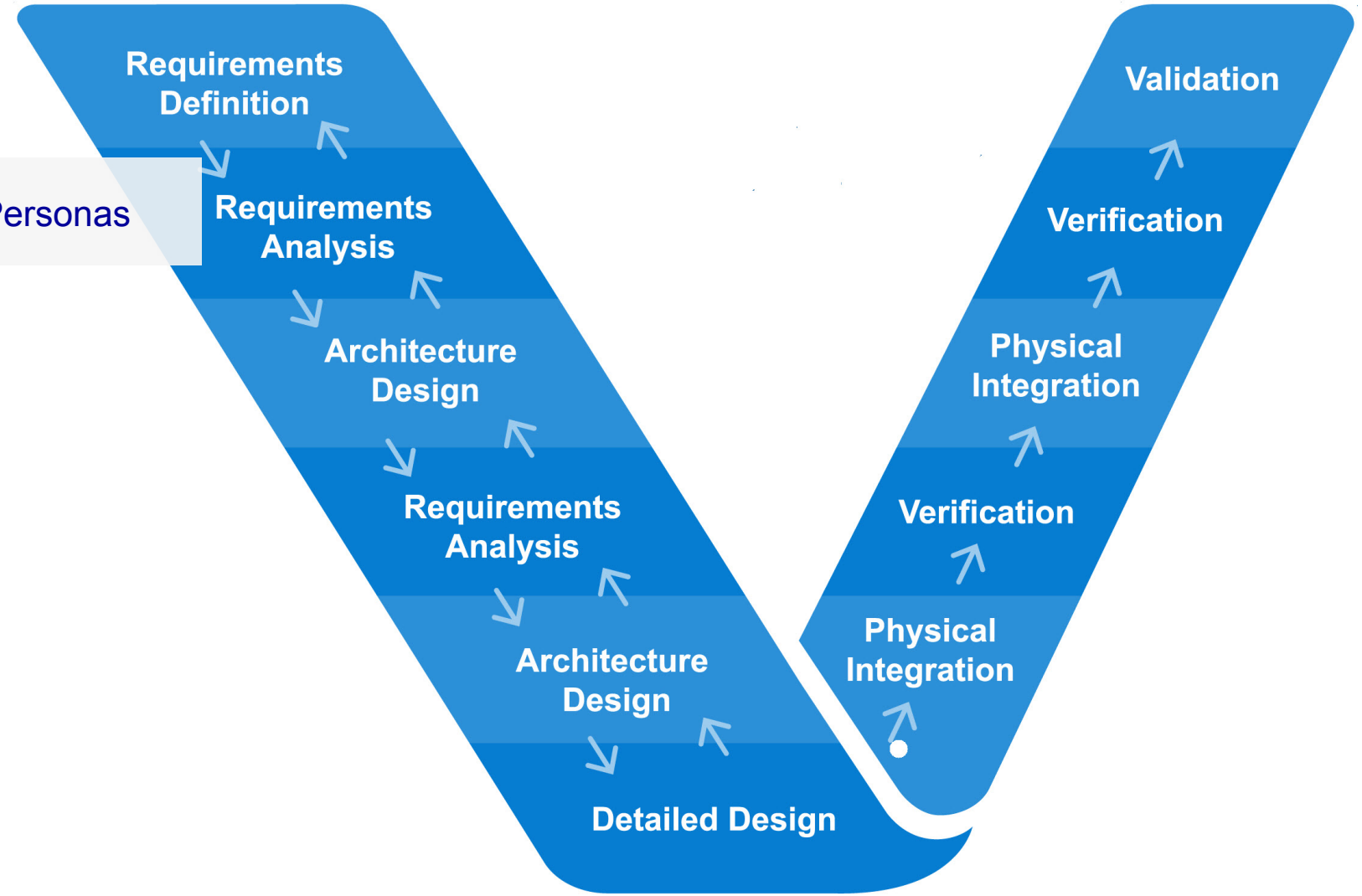
Methods/Tools



Process

Implemented HSI activities

Scenarios & Personas



Implemented HSI activities

Scenarios & Personas

Requirements Definition

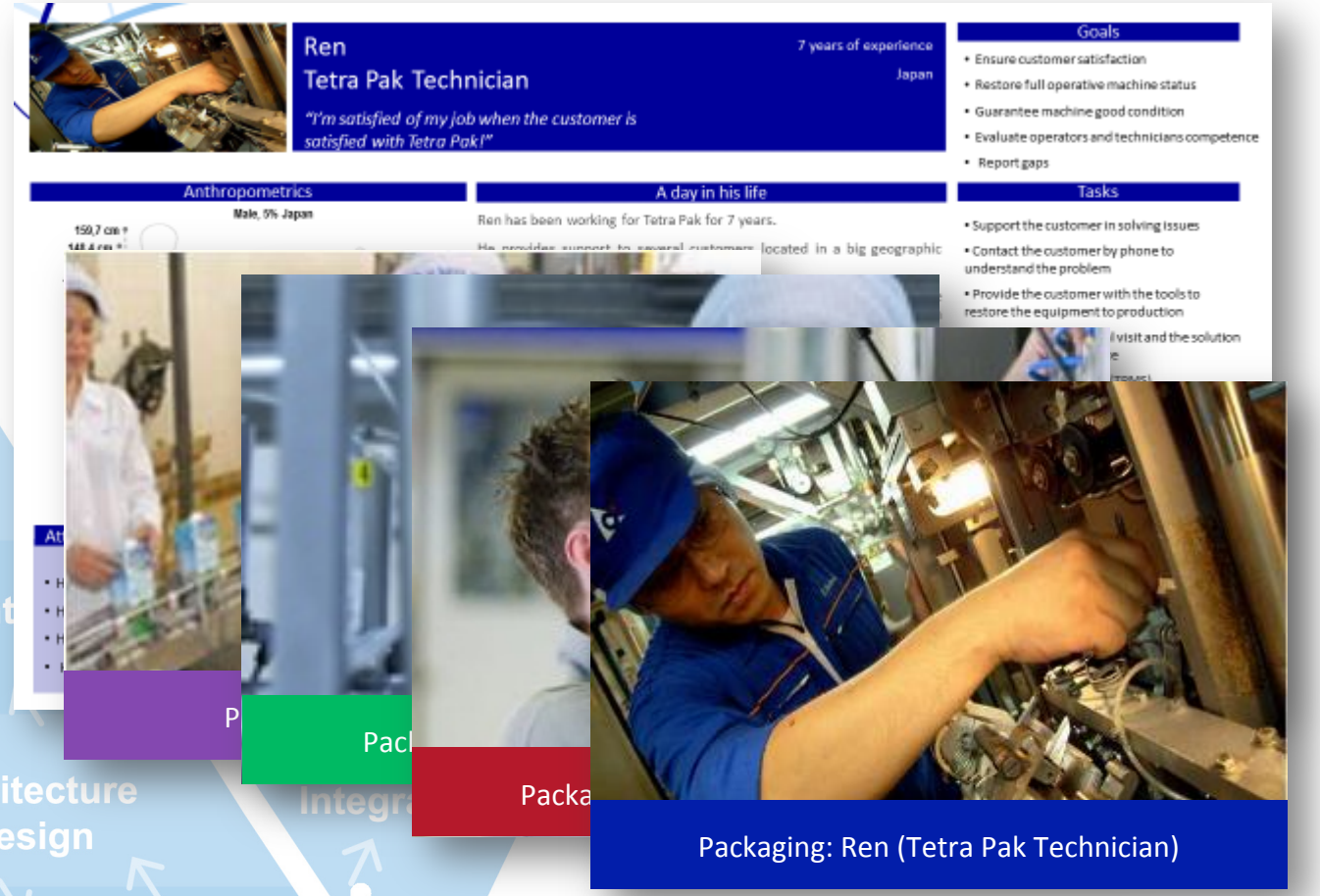
Requirements Analysis

Architecture Design

Requirement Analysis

Architecture Design

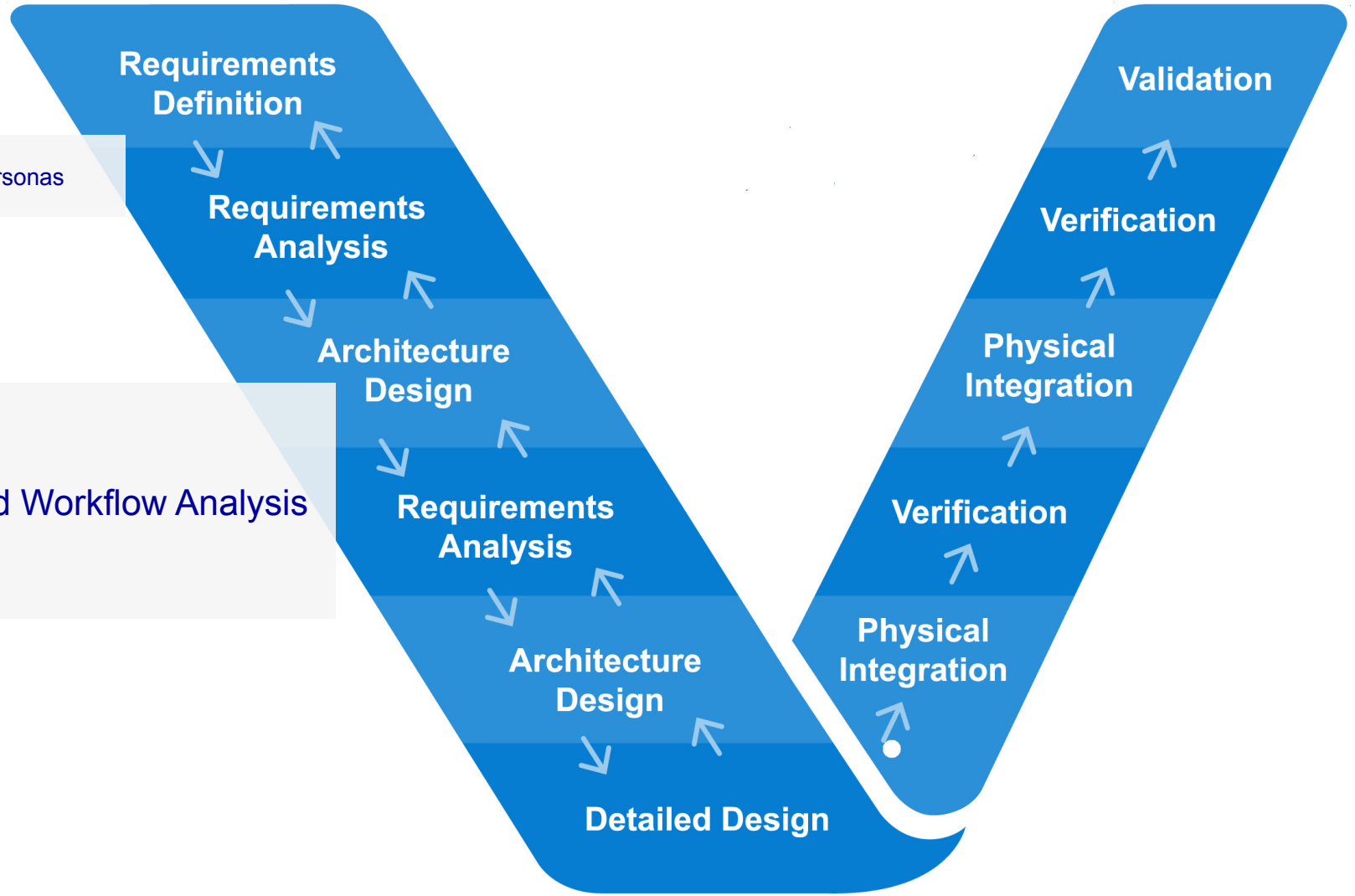
Detailed Design



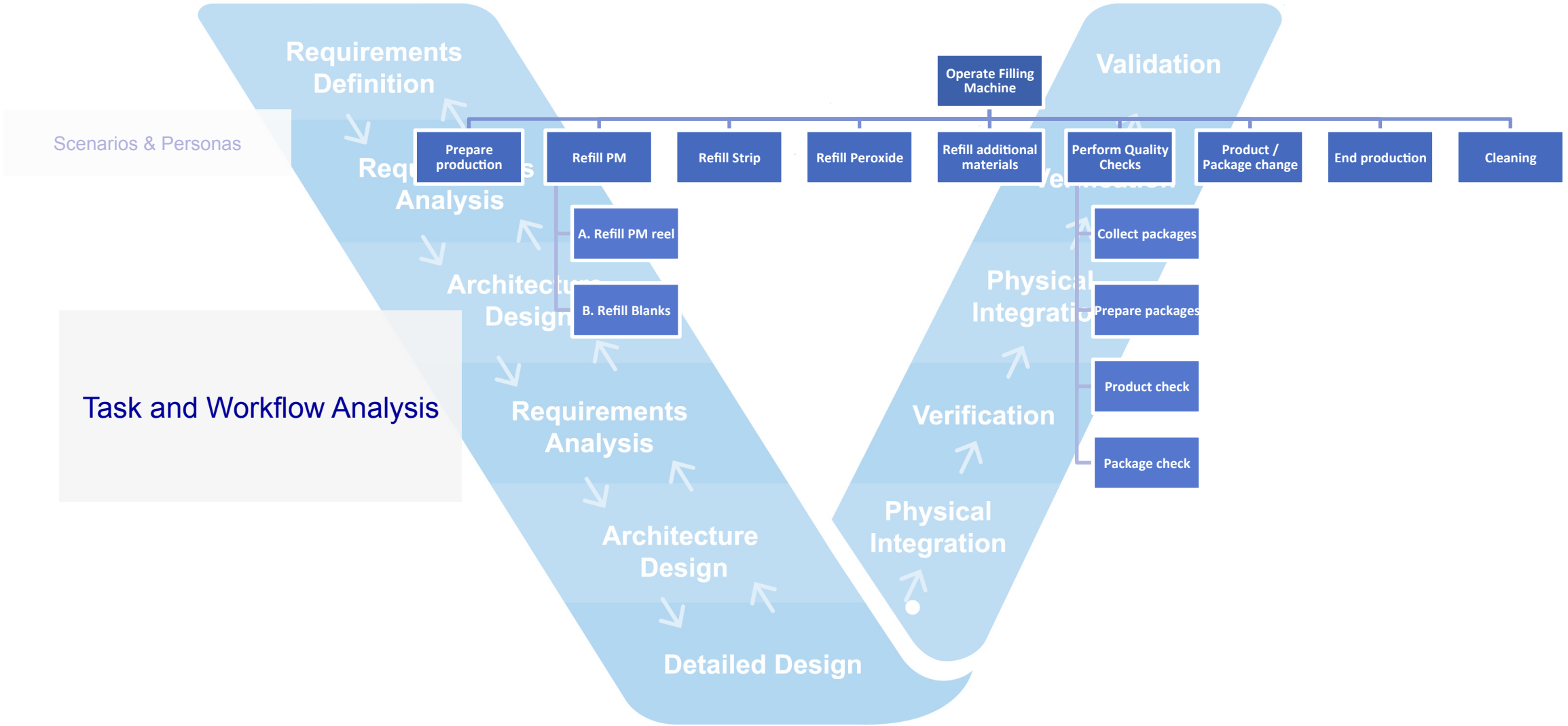
Implemented HSI activities

Scenarios & Personas

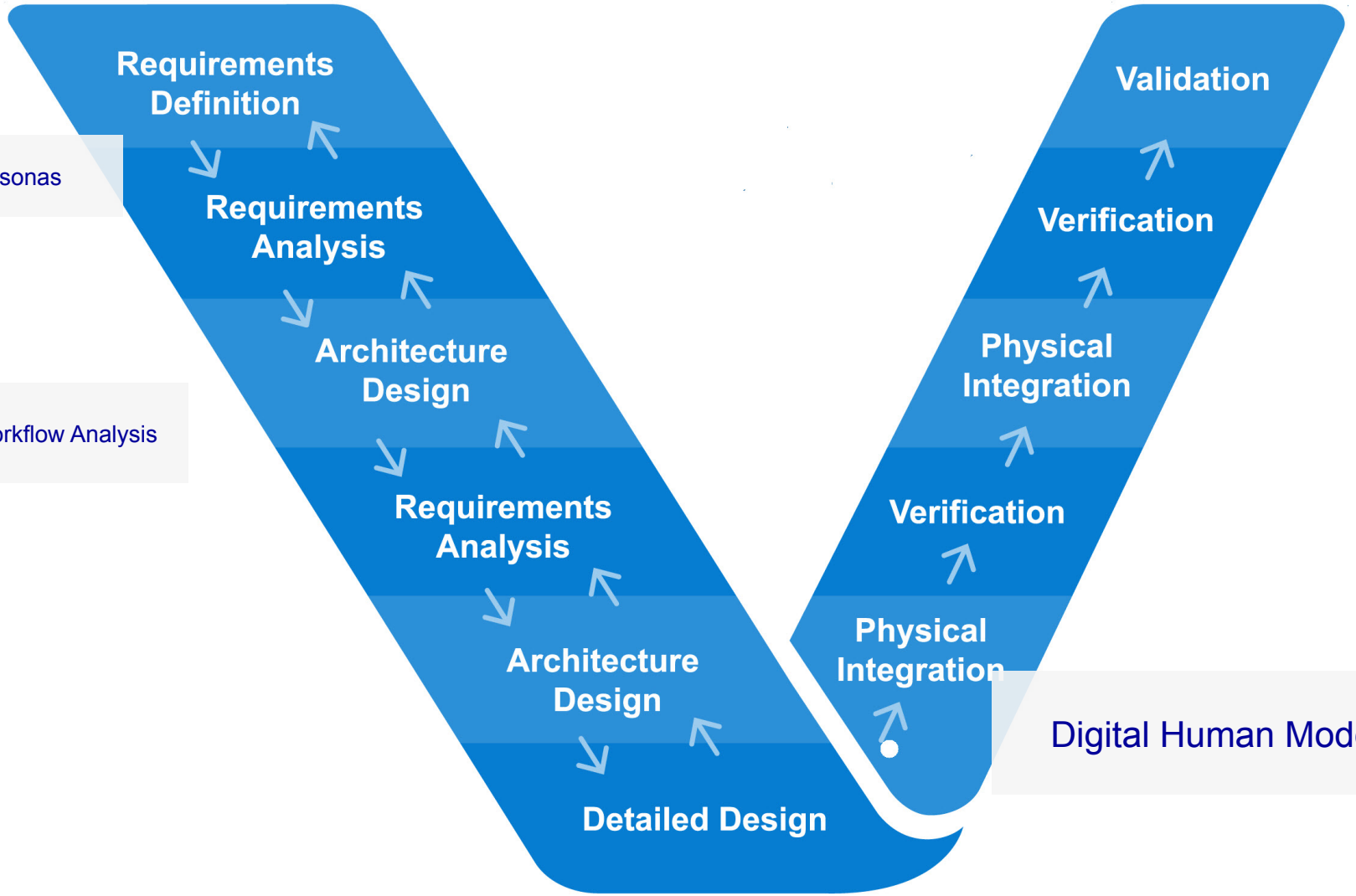
Task and Workflow Analysis



Implemented HSI activities



Implemented HSI activities

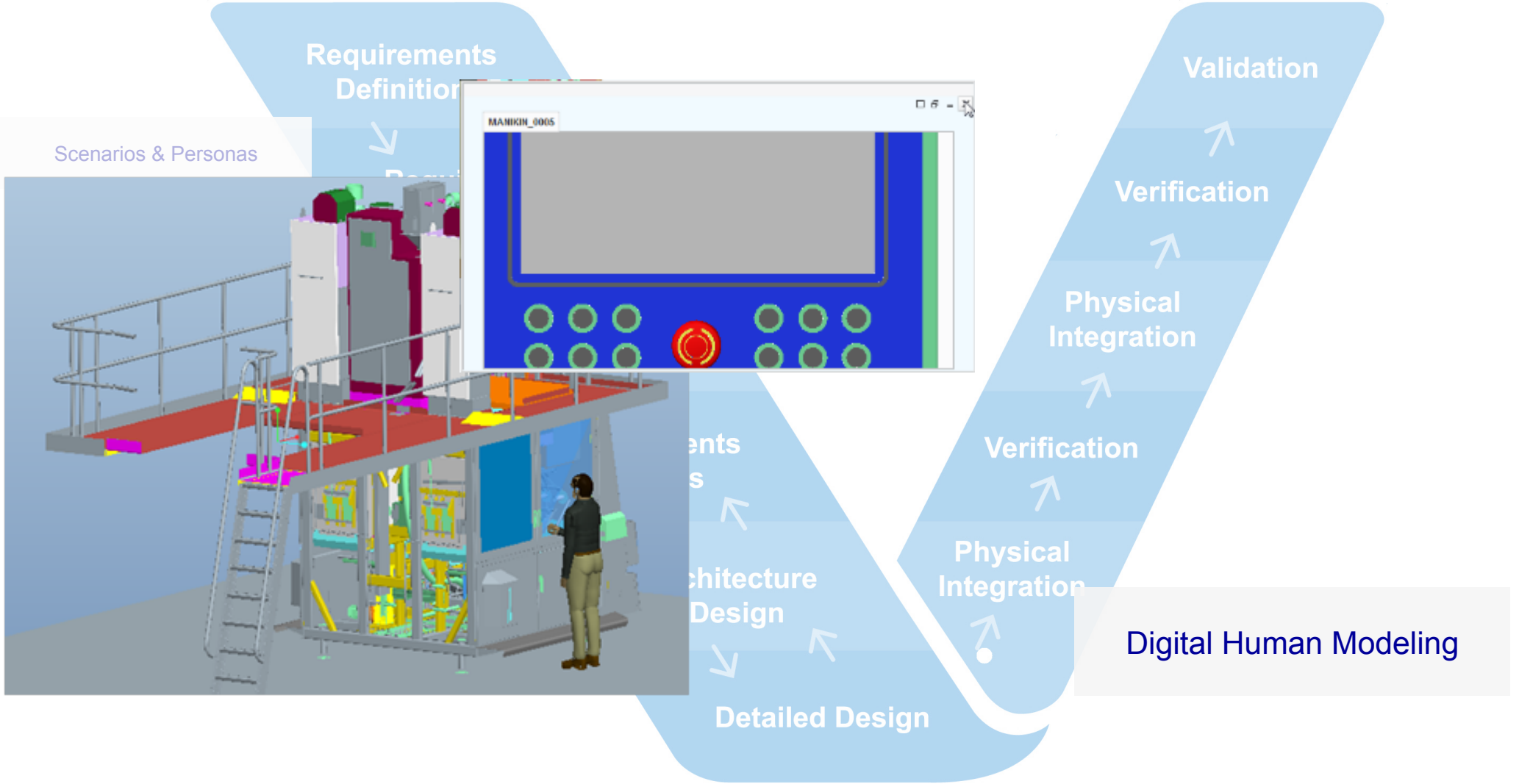


Scenarios & Personas

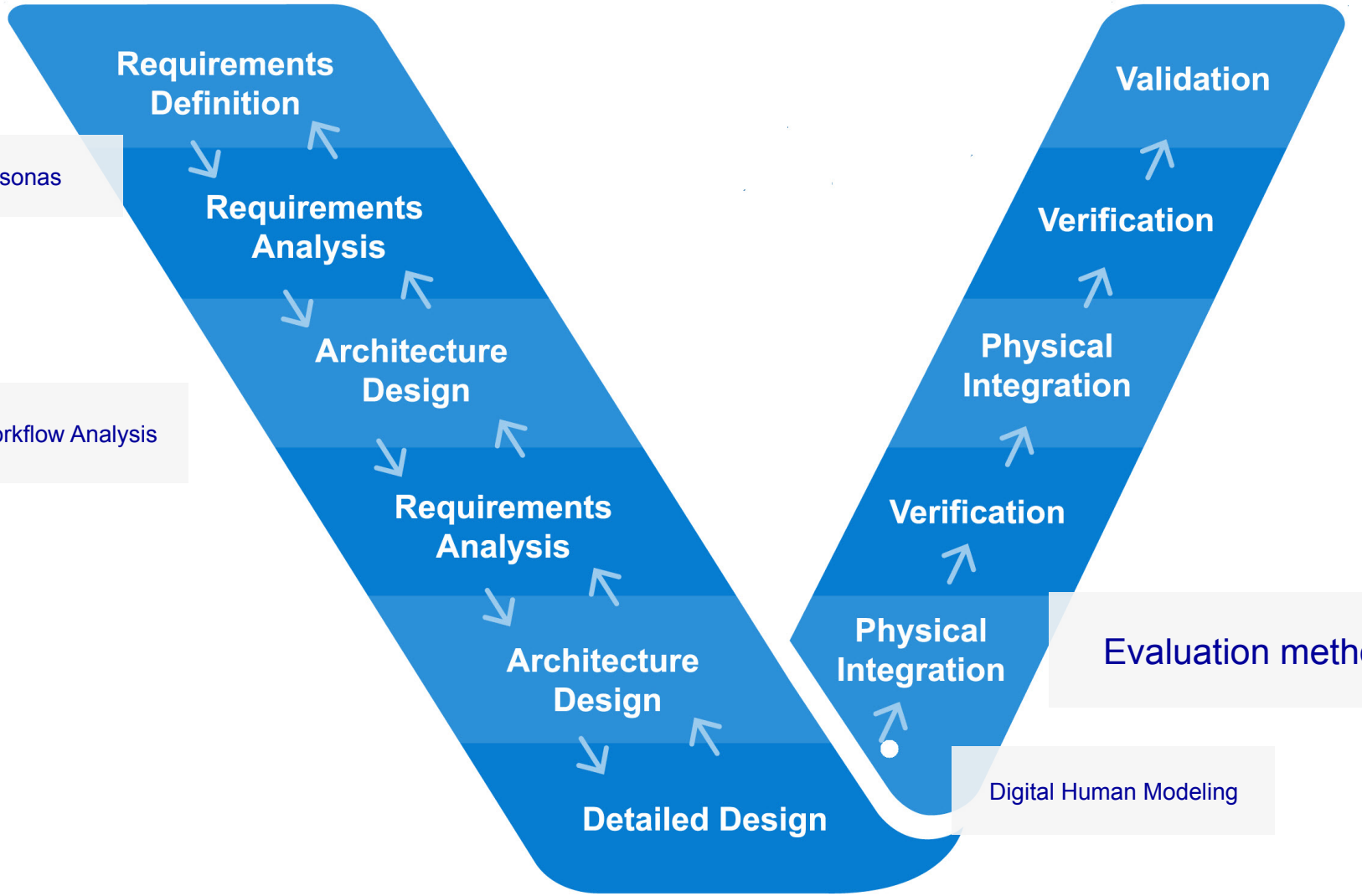
Task and Workflow Analysis

Digital Human Modeling

Implemented HSI activities



Implemented HSI activities



Scenarios & Personas

Task and Workflow Analysis

Evaluation methods

Digital Human Modeling

HSI Capability development at Tetra Pak

Cliché Making Lund

2. Back Exposure

Task step	Error Mode	Error Description	Consequence	Recovery	P	C	Remedial Strategy
2.1.1	C1	Omit to check back exposure is open	Time-consuming and additional risks	Immediate	M		Open with button or pedal
2.1.2	Erg	Fail to adopt appropriate lifting posture	Discomfort	None	M		Slide plate over from pallet, pallet on appropriate height
	S2, A6	Retrieve already exposed plate	Plate overexposed	None	L		Clear storing system
	Latent	No plates in box	Cannot proceed	None	L		Storage near by
	A7	Walk into something with plate	Marks on plate	None	L		Slide plate over from pallet, pallet on appropriate height
2.1.3	A7	Break plate	Plate c				
	Erg	Strain back while placing	Discon				
	A5	Fail to place within limits	Back e				
2.1.4	A8	Omit to close	Canno				
	A9	Incomplete closing	Canno				
	Erg	Strain back while closing	Discon				
2.2	A8	Omit to press button	Machi delaye				
	A4	Fail to press button completely	Machi delaye				
	A6	Press wrong button	Plate c				
2.4	R1	Omit to detect that job is complete	Time-c				
	R2	Mix up signals with other machine/job	Time-c				
2.5.1	A2	Fail to wait	Plate u				

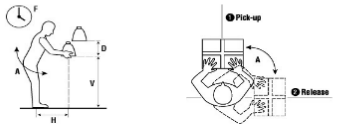
Manual handling of machinery and component parts of machinery

1st step: Define Lift and Carry conditions

Average load of the object	5.00	kg
Duration of lifting task	Long	
Frequency (F) (lifts per min)	0.2	
Gripping	Fair	
Is load being handled with one hand only?	No	
Is load being handled by two persons?	No	
Is the cumulative load of all tasks for one operator exceeding 10.000 kg per shift (8 hrs)?	No	

2nd step: Determine Lift and Carry characteristics

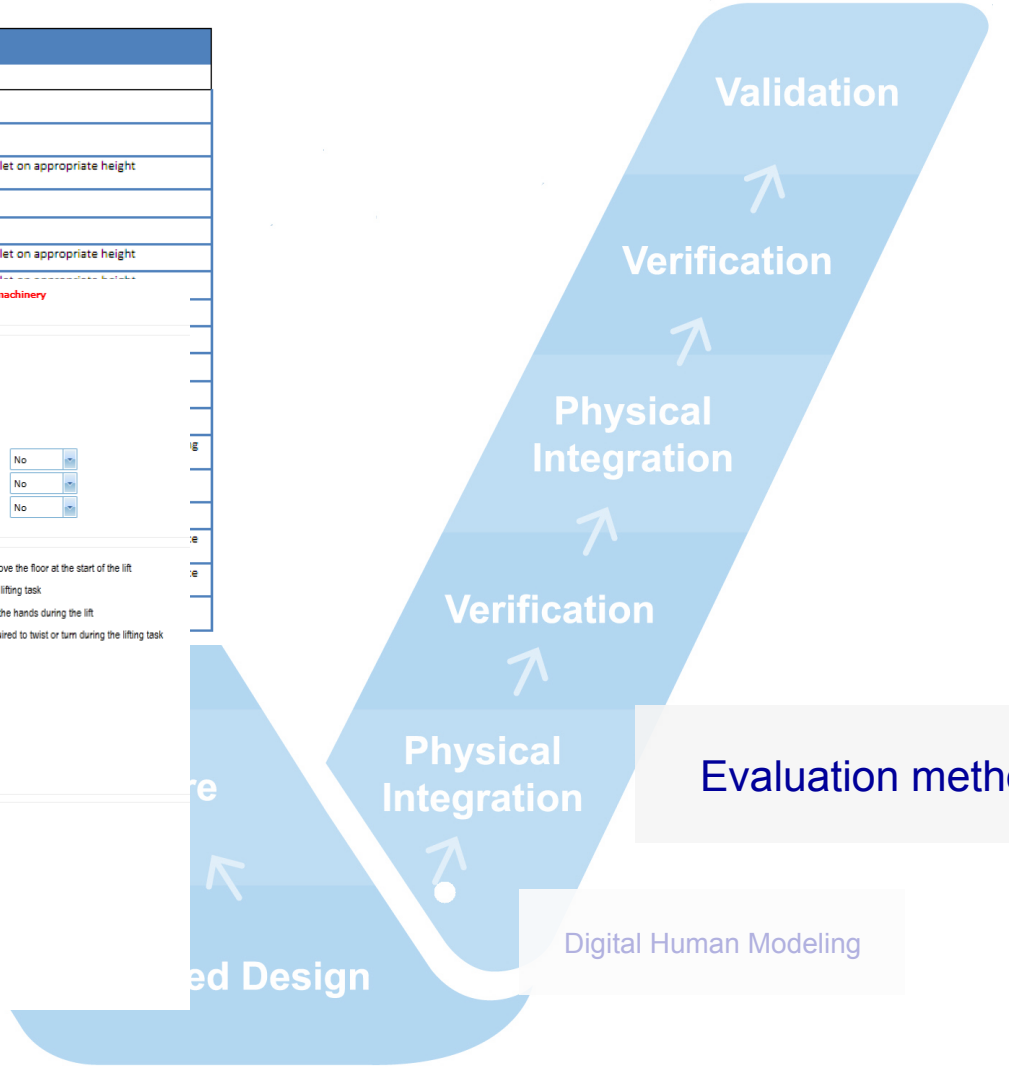
Vertical location (V)	70	cm	The vertical location of the hands above the floor at the start of the lift
Travel distance (D)	55	cm	The distance from start to end of the lifting task
Horizontal location (H)	32	cm	The maximum horizontal location of the hands during the lift
Angle of Assymetry (A)	75		The degree to which the body is required to twist or turn during the lifting task



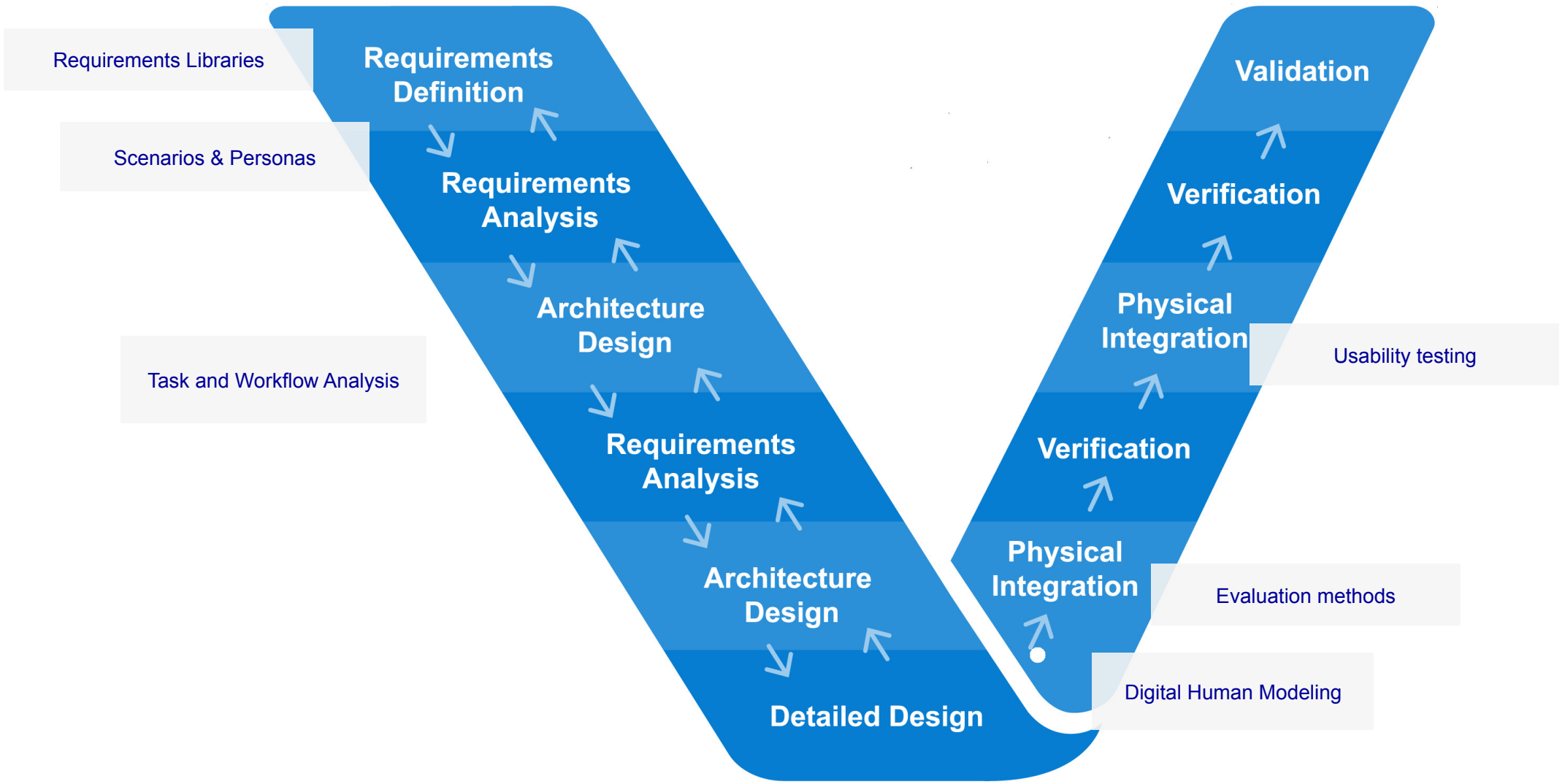
3rd step: Evaluation

Risk Score	0.4689
	Low

Risk Level	Description
<0,85	The risk may be regarded as tolerable (green)
0,85 to <1,0	Significant risk exists (yellow). It is recommended to redesign the machinery or to ensure that the risk is tolerable.
>=1,0	Redesign is necessary. The design can be improved by changing the situations that lead to low multipliers.



HSI Capability development at Tetra Pak



HSI Challenges

HSI Challenges

- Difficult to quantify and measure
- Make concrete

HSI Challenges

- Too late in project
- Role of Systems Engineer

HSI Challenges

- Close cooperation
- Involvement in all phases

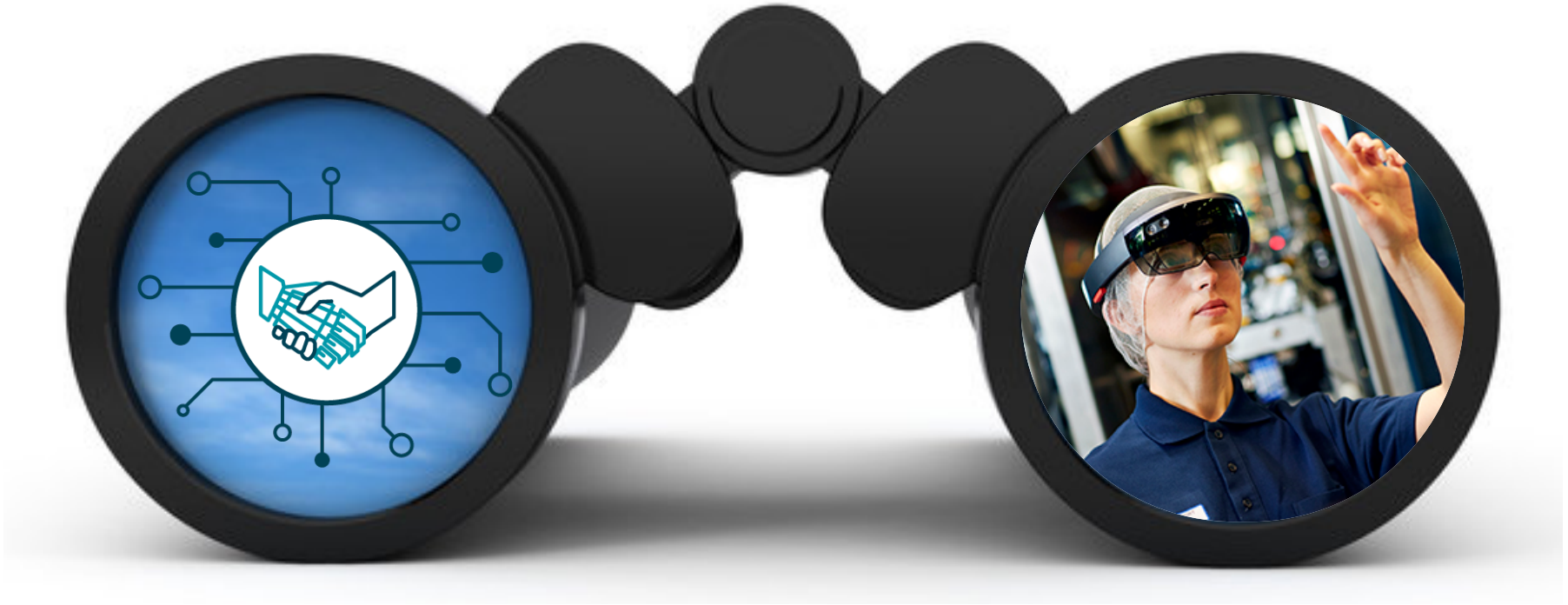
HSI Challenges

- Common sense
- User perspective
- Structured methods, experts and users

HSI Challenges

- Health & Safety
- Avoid negative consequences
- Value in monetary terms

Looking ahead

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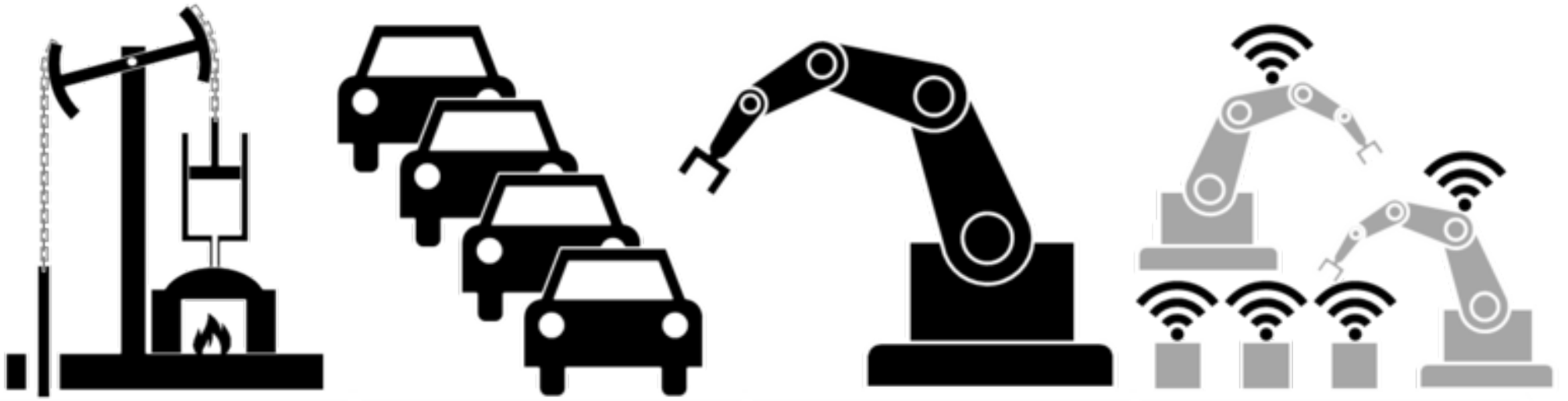
Looking ahead



1st	2nd	3rd	4th
Mechanization, water power, steam power	Mass production, assembly line, electricity	Computer and automation	Cyber Physical Systems

Reference: http://www.allaboutlean.com/industry-4-0/