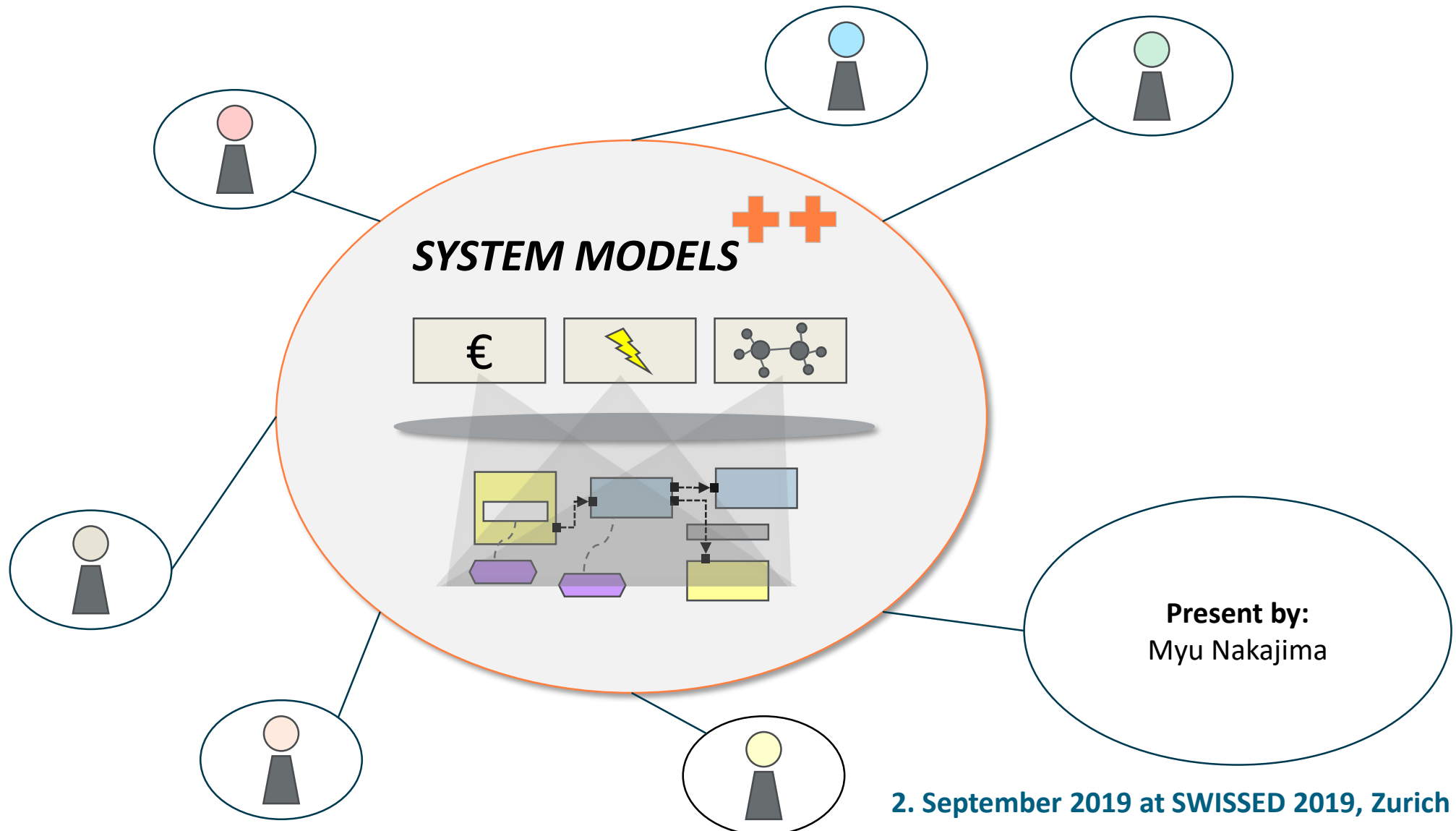


Beyond “Pure” Systems Architecting: Collaboration Based on MBSE to Empower Projects



2. September 2019 at SWISSED 2019, Zurich

Two Pillars – Boost Up Your Engineering!

Company Overview

Established in June 2018

- ..as a joint venture between Fraunhofer-Association and Information Services International-Dentsu (ISID).

Company name: “Two Pillars”

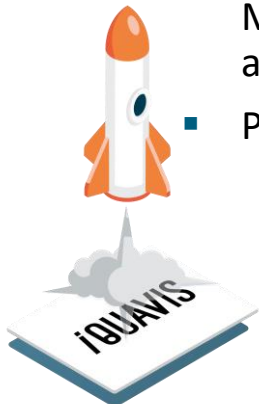
- Architecting + Project Management
- Germany + Japan
- Fraunhofer + ISID

Location

- Paderborn, Germany

Business activities

- Development, Distribution & customer support of our Product **iQUAVIS**: An MBSE-Modeller integrating Project Management, Complexity and risk analysis with system architecture
- Professional consultation service for engineering.

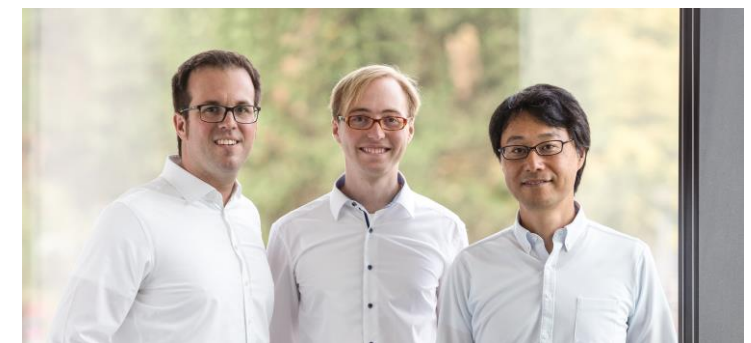


Contact information

- mail: christian.tschirner@two-pillars.de
- web: www.two-pillars.de

two  pillars
MODEL-BASED SYSTEMS ENGINEERING

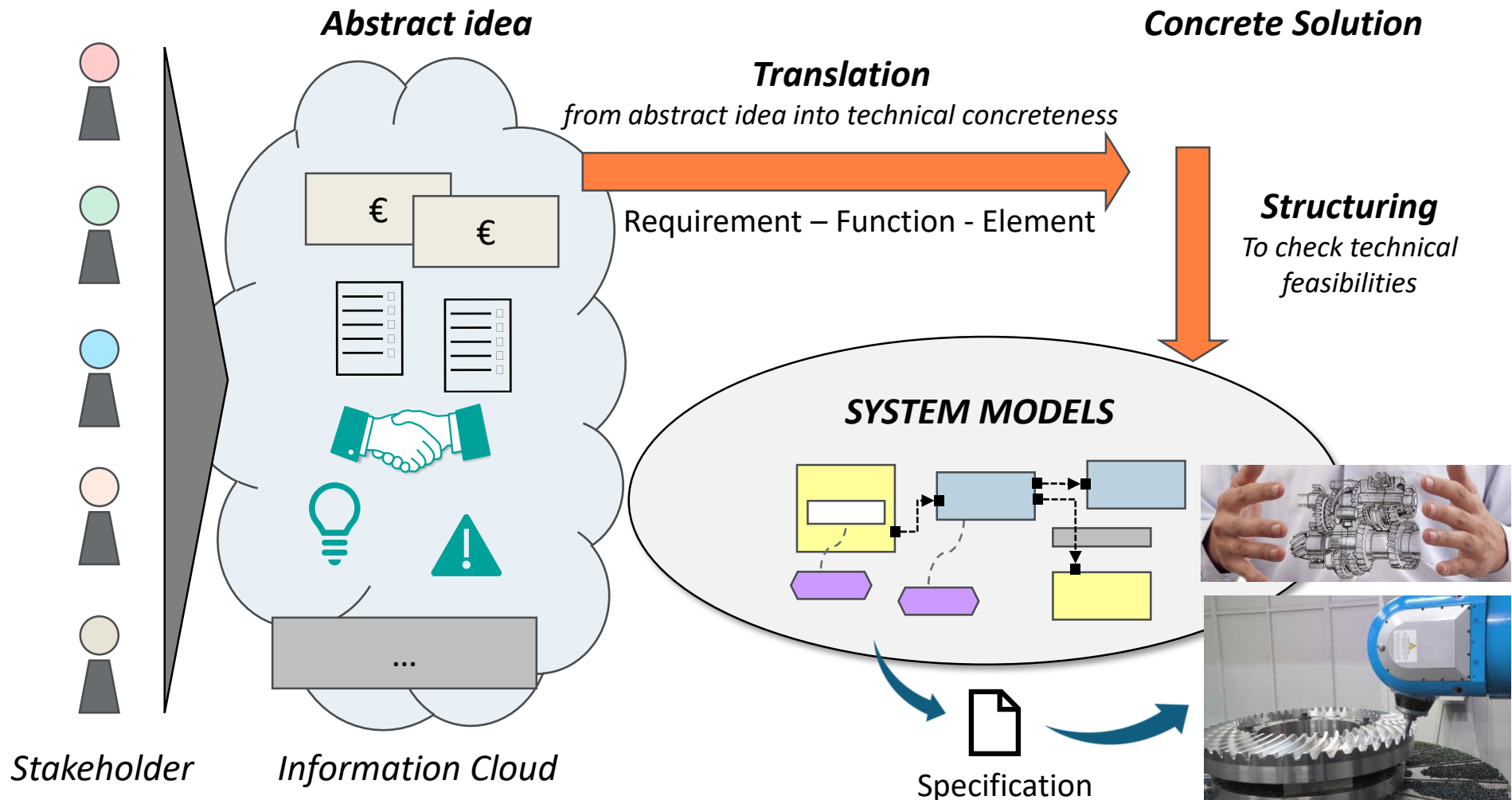
Strategic Investors



Managing Directors:
Dr.-Ing. Christian Tschirner, Christian Bremer, Atsushi Yoshida

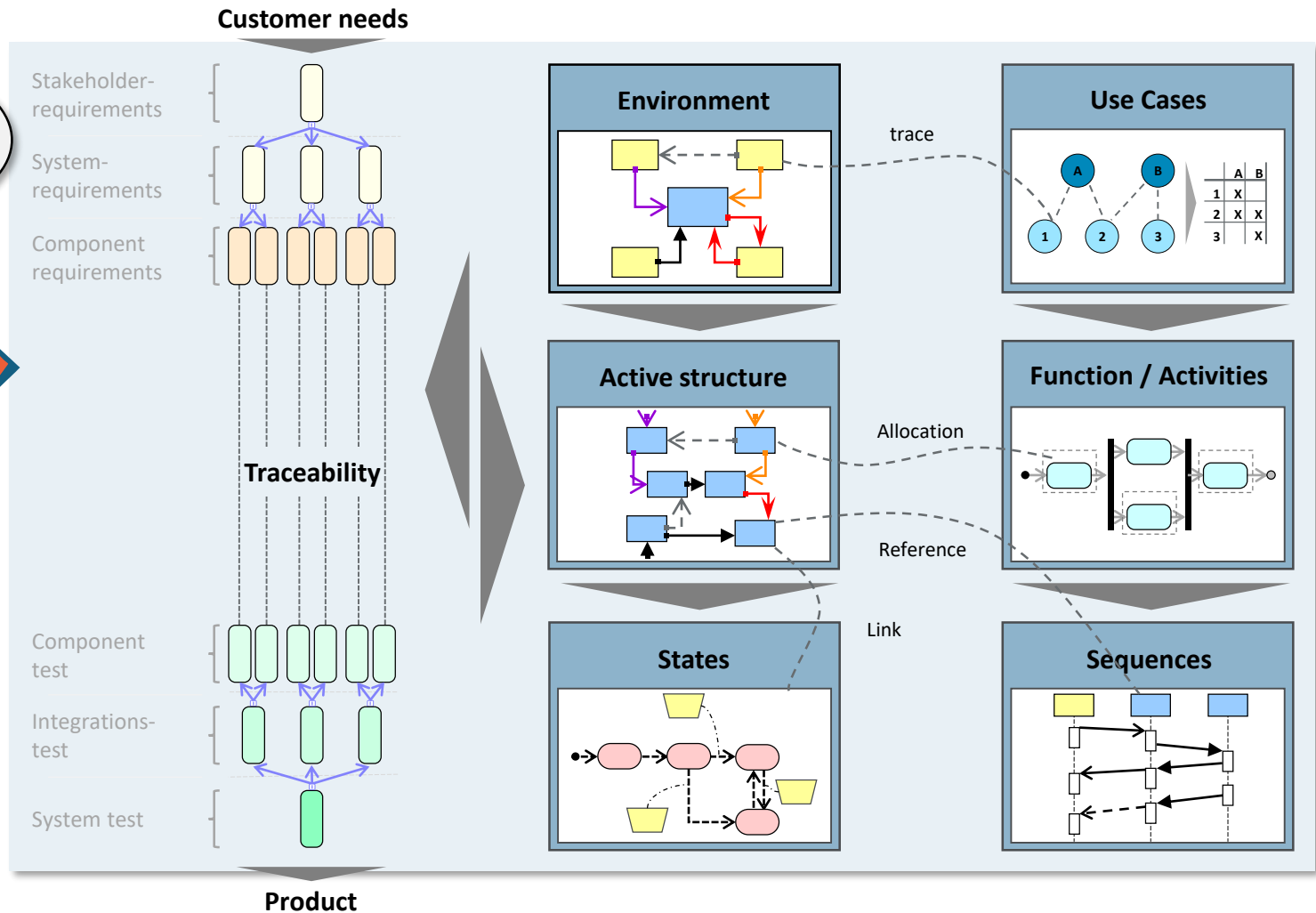
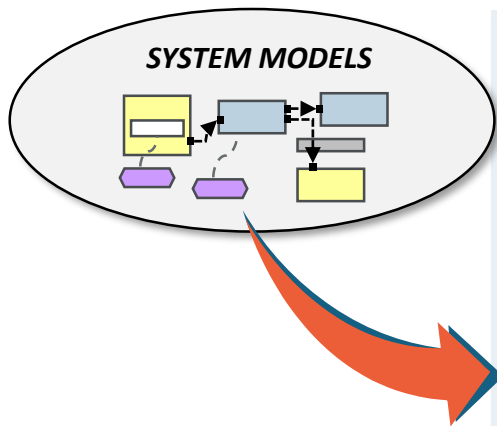
Systems Engineering as means to involve stakeholders in developing concrete solution



Today: Solution-centred Systems



What are the “System Models”?

Means to visually and objectively explain a system

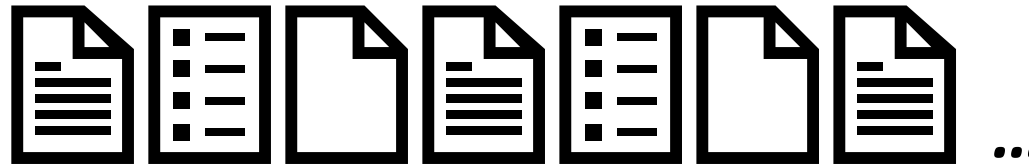


Key for successful communication using System Models  
Use “simple language” easy to understand for all stakeholders!!

Our view on Systems Engineering



Conventional style
Document oriented



Inconsistent among documents



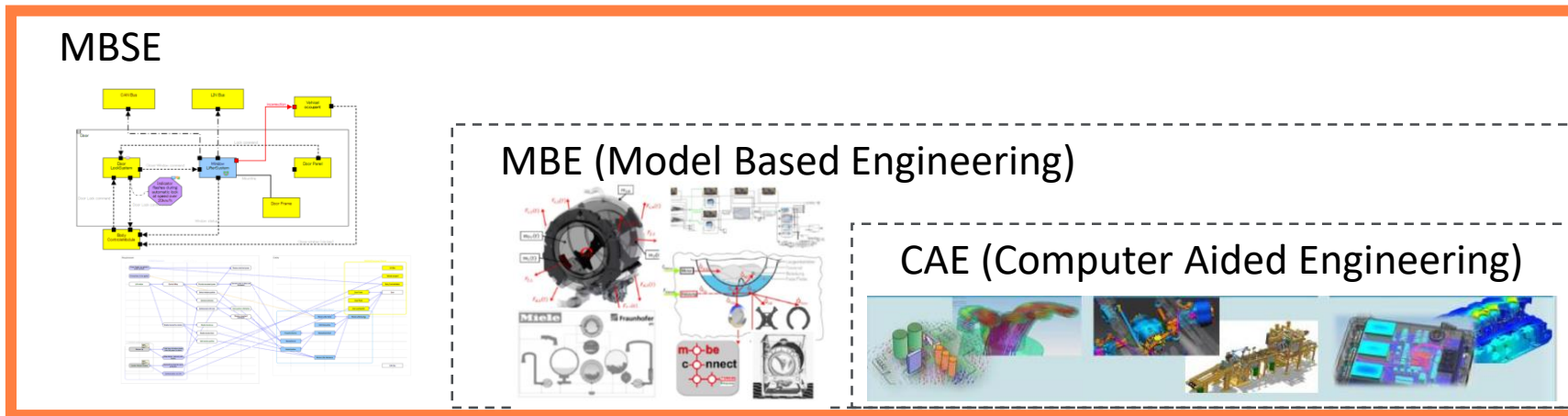
Lack of precision



Difficult to maintain & reuse information

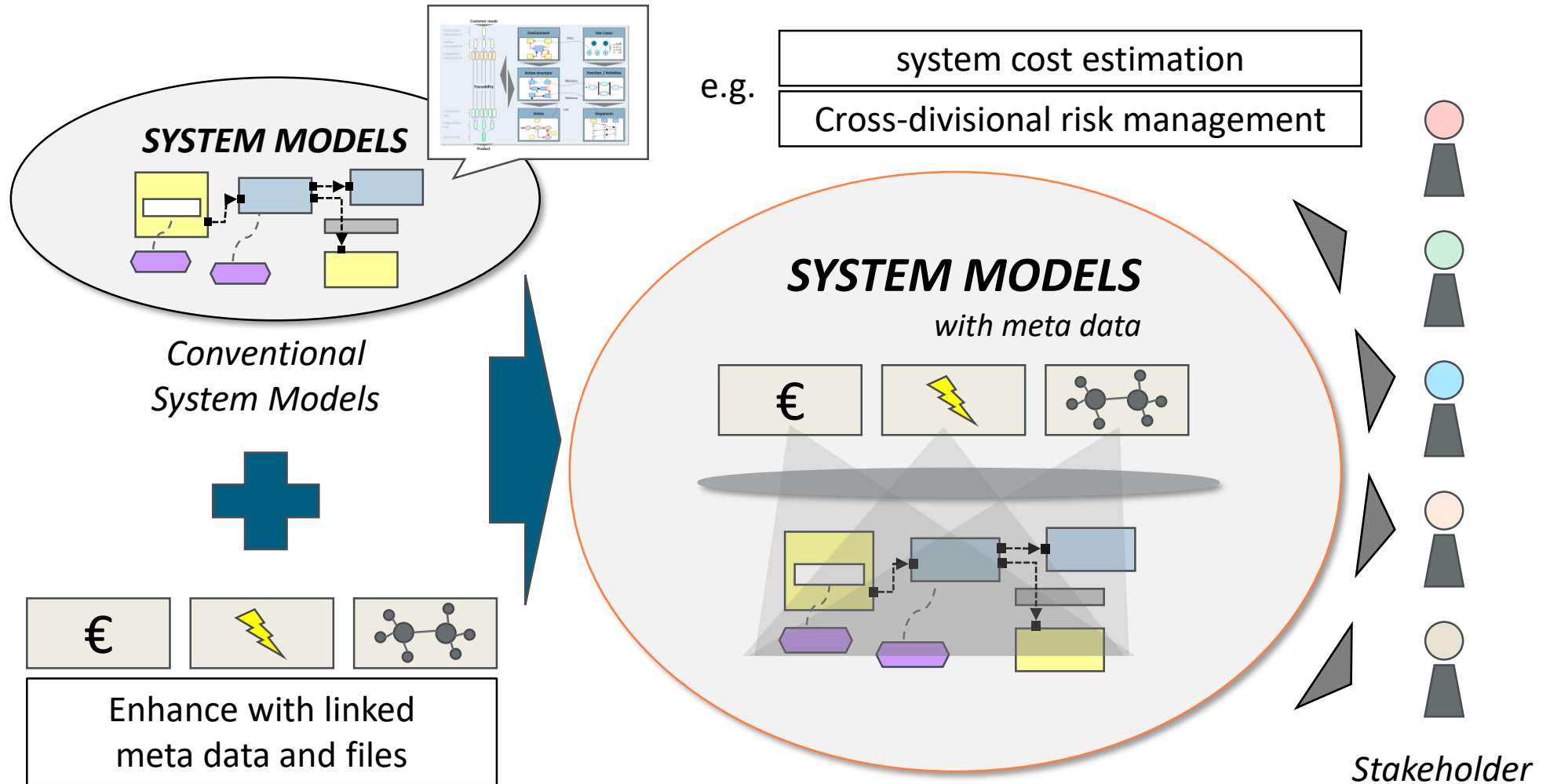


Model Based



Model enables a clear and concise communication.

Extend usage of data more than typical Systems Engineering artefacts



Adding meta data and files to system models expands benefits for Stakeholders, and empowers projects.

Examples use cases for extended usage of system models

Collaborative Requirement

Re-usage
of data

Development

QFD

Function based
cost estimation

Keep track of
production status

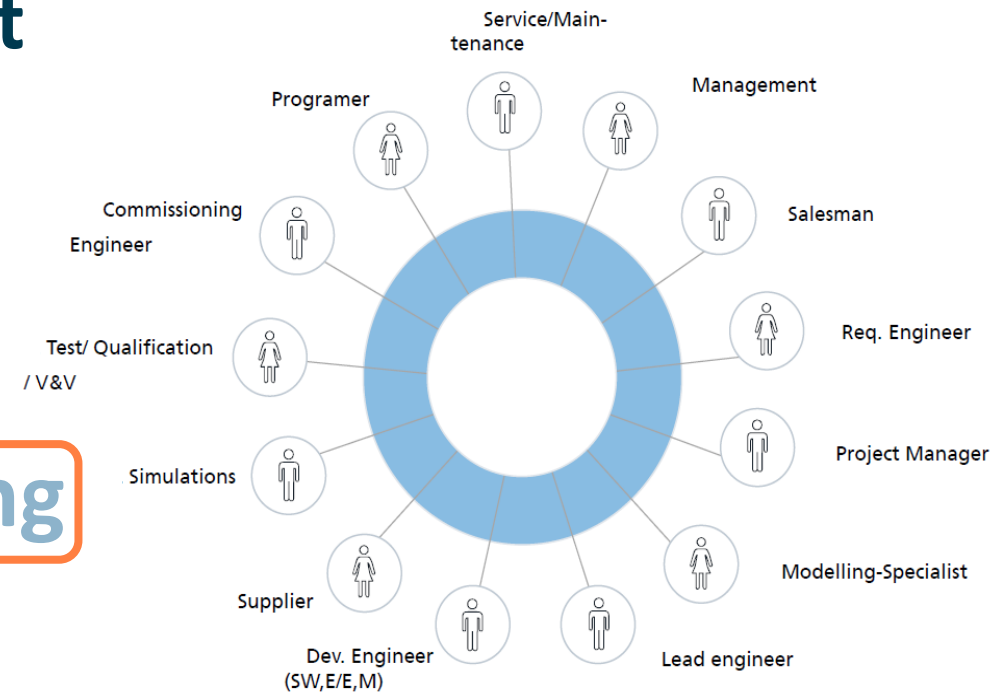
FMEA

Test planning

Deliverable management

OPC-UA
Planning

Cross-divisional library
for models and risks



What is your idea?

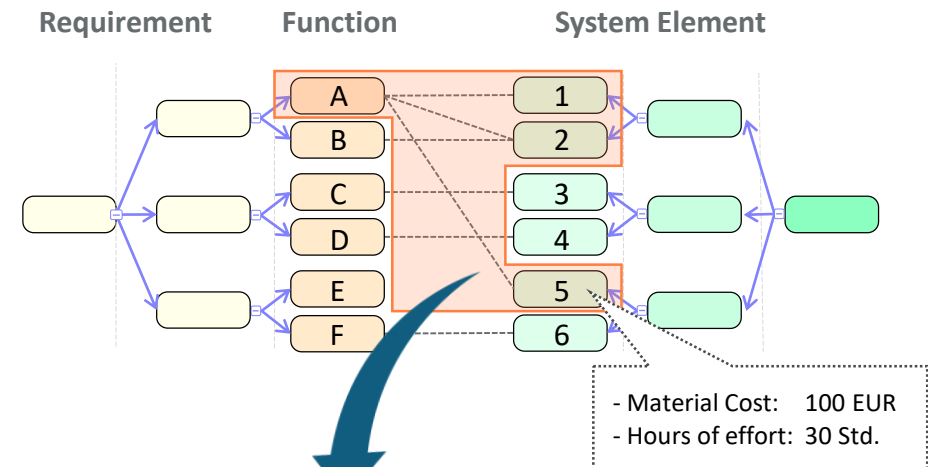
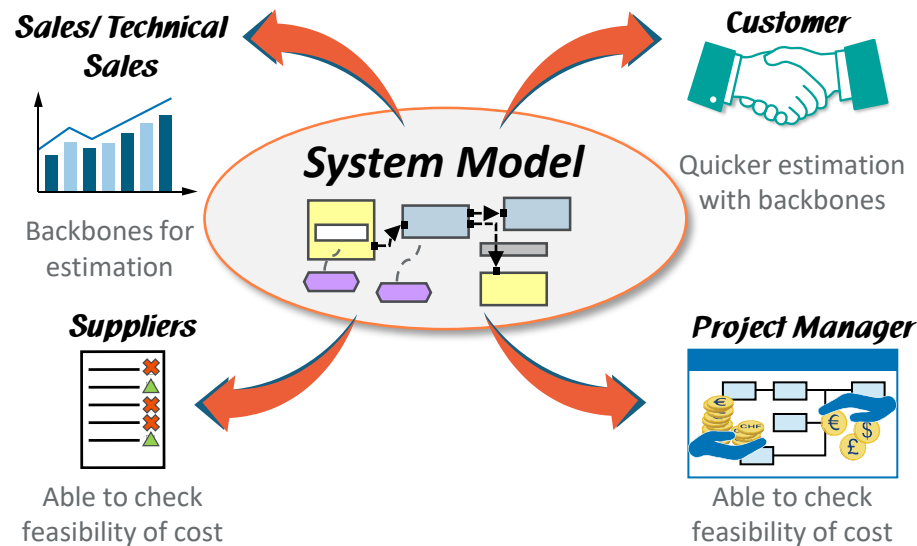
Using the System Model for additional benefit (i)

Function-based Cost Estimation

WHAT is it about?:

Conduct a quick estimation of a system in very early stage by using the system model; aggregate costs of system elements that are necessary to implement functions requested by a customer.

WHO will benefit?



Function-based cost estimation

	Mat.	Hours.
<input checked="" type="checkbox"/> A...		
1	250 €	40 h
2	500 €	120 h
5	100 €	40 h
<input type="checkbox"/> B		
<input type="checkbox"/> C		
<input type="checkbox"/> D		
<input type="checkbox"/> E		
<input type="checkbox"/> F		

Total cost: ** EUR**

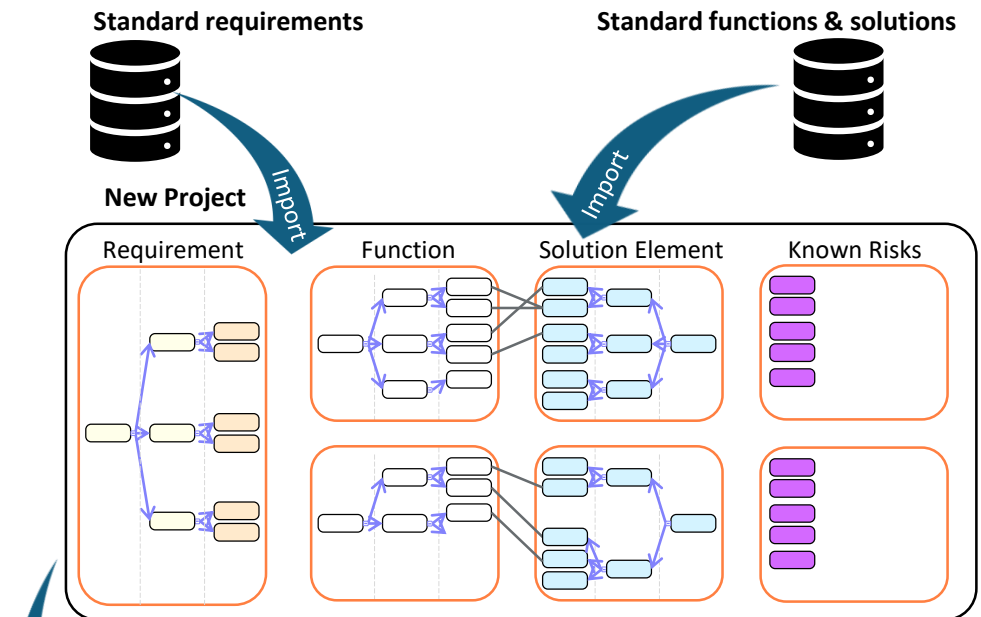
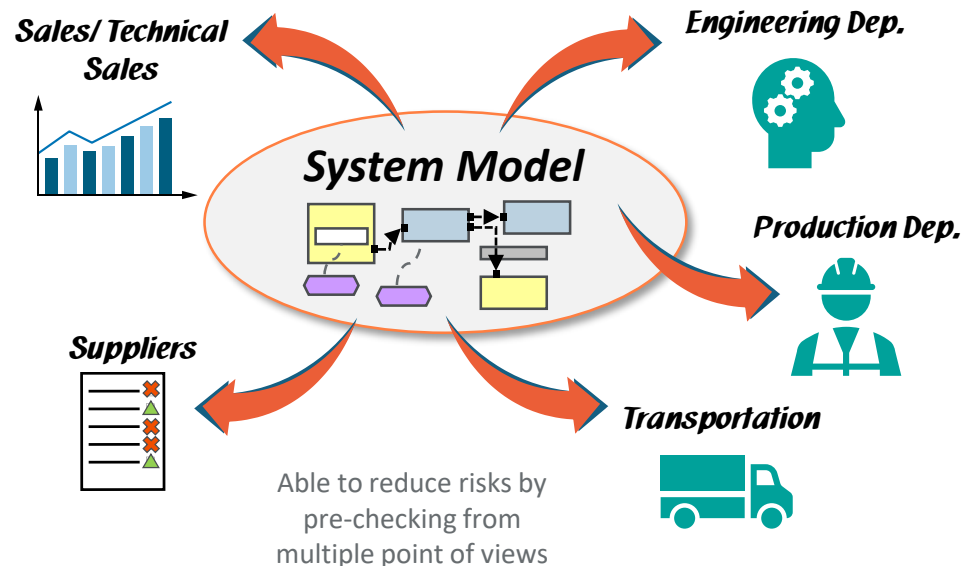
Using the System Model for additional benefit (ii)

Cross-divisional library for models and risks

WHAT is it about?:

Import standardized requirements and modules from the library, and utilize it in new development projects. Include risk analysis information from various stakeholders into the library to systematically minimize risks.

WHO will benefit?:



Checklist with known risks

Solution element	Function	Risk	Root Cause	Measure	PIC	Due	Status
Element X	Function X	Risk X	Cause X	Measure X	Eng. 1	06.07.2019	OK
Function Y	Function Y	Risk Y	Cause Y				Not solved
	Function Z	Green color is not recognized					Not solved

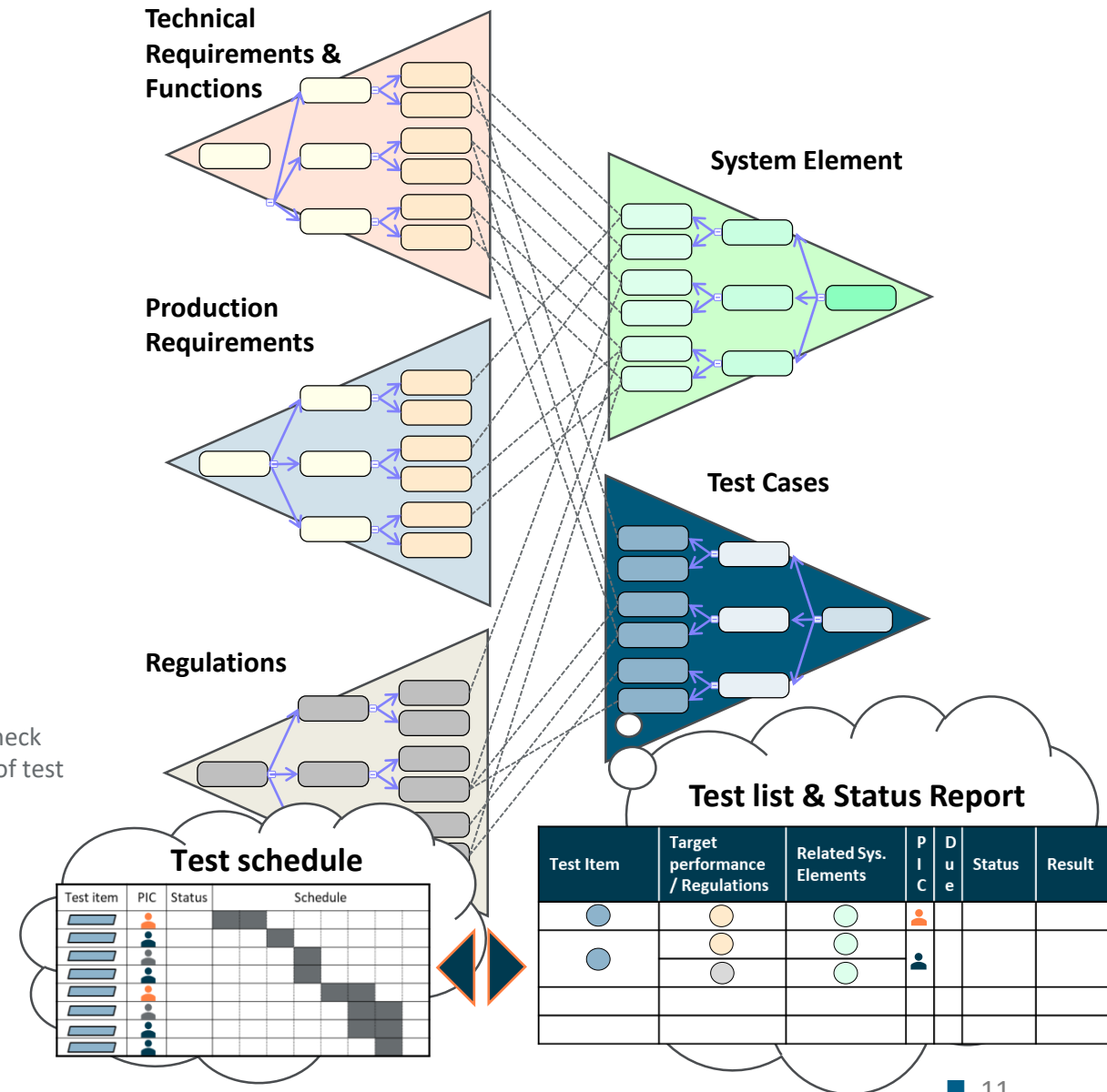
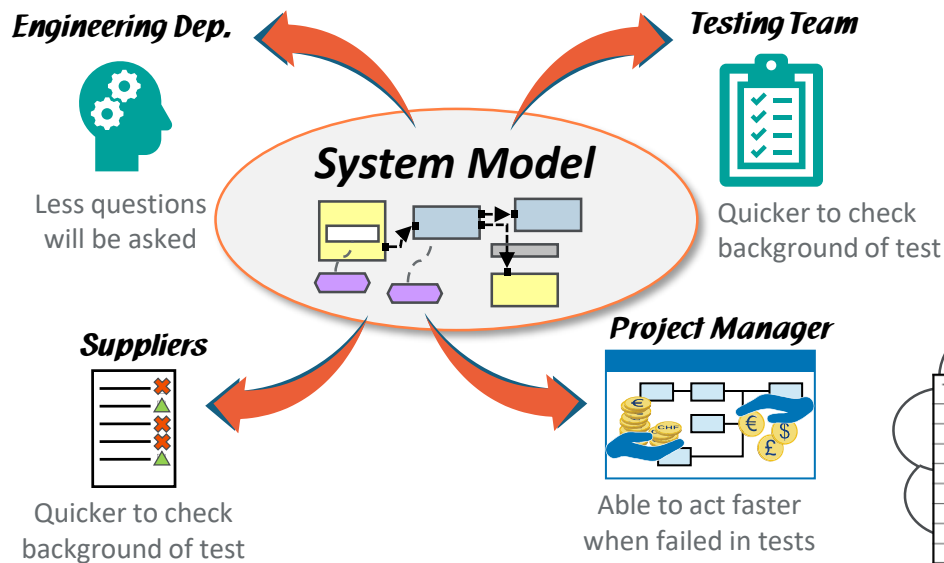
Using the System Model for additional benefit (iii)

Test Planning with a traceability

WHAT is it about?:

Test cases are derived from requirements and functions of the system. Make a clear connection of these information, and state results of the test in one database to make it easy to trace down.

WHO will benefit?:



Summary:

Increasing benefits by enriching system models to empower projects

Cost Estimation

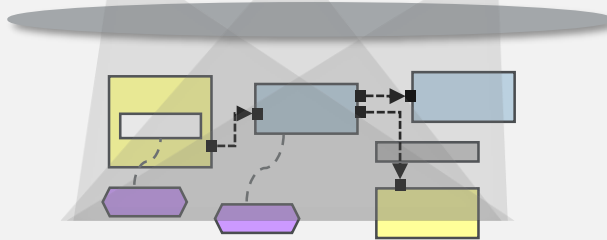
Element Name	Target Cost	Actual Cost	Cost analysis Flag
Ball System	20.00	20.00	OK
Toolknife	50.00	55.00	More than planned
Workplace holder	30.00	24.00	OK
Drive module	200.00	220.00	More than planned
Power distribution	950.00	950.00	OK
Valve	20.00	20.00	OK
User Interface	50.00	50.00	OK
Coating system	30.00	30.00	OK
Carving structure/ housing	200.00	200.00	OK
Tool	550.00	550.00	OK
Control unit	40.00	40.00	OK
Output systems	80.00	80.00	OK

Create system models

Requirement Communication Sheet

Requirement Name	Comments	Requirement Status	Requirement Name	Comments	Requirement Status
Requirement 1		Open	Requirement 2		Open
Requirement 3		Open	Requirement 4		Open
Requirement 5		Open	Requirement 6		Open
Requirement 7		Open	Requirement 8		Open
Requirement 9		Open	Requirement 10		Open
Requirement 11		Open	Requirement 12		Open
Requirement 13		Open	Requirement 14		Open
Requirement 15		Open	Requirement 16		Open
Requirement 17		Open	Requirement 18		Open
Requirement 19		Open	Requirement 20		Open
Requirement 21		Open	Requirement 22		Open
Requirement 23		Open	Requirement 24		Open
Requirement 25		Open	Requirement 26		Open
Requirement 27		Open	Requirement 28		Open
Requirement 29		Open	Requirement 30		Open
Requirement 31		Open	Requirement 32		Open
Requirement 33		Open	Requirement 34		Open
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Requirement 49		Open	Requirement 50		Open
Requirement 51		Open	Requirement 52		Open
Requirement 53		Open	Requirement 54		Open
Requirement 55		Open	Requirement 56		Open
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Requirement 85		Open	Requirement 86		Open
Requirement 87		Open	Requirement 88		Open
Requirement 89		Open	Requirement 90		Open
Requirement 91		Open	Requirement 92		Open
Requirement 93		Open	Requirement 94		Open
Requirement 95		Open	Requirement 96		Open
Requirement 97		Open	Requirement 98		Open
Requirement 99		Open	Requirement 100		Open

SYSTEM MODELS with meta data



Communication among stakeholders increases

Bring value data based on stakeholders' concerns

Test Planning



Stakeholders involve more in SE artefacts

Benefits increases for stakeholders

QFD

Customer Requirements	Technical Requirements	Weighting	Target	Weighting	Weighted
1. Low cost	1.1.1. Material	10	1.1.1.1. Steel	10	100
2. High quality	2.1.1. Surface finish	15	2.1.1.1. Polishing	15	225
3. Fast delivery	3.1.1. Lead time	20	3.1.1.1. Inventory	20	400
4. Low maintenance	4.1.1. Lubrication	10	4.1.1.1. Grease	10	100
5. High reliability	5.1.1. Failure rate	25	5.1.1.1. Redundancy	25	625
6. Easy to use	6.1.1. Training time	10	6.1.1.1. Manuals	10	100
7. Safe	7.1.1. Safety features	15	7.1.1.1. Emergency stop	15	225
8. Flexible	8.1.1. Changeover time	10	8.1.1.1. Quick change	10	100
9. Durable	9.1.1. Lifetime	20	9.1.1.1. Wear parts	20	400
10. Quiet	10.1.1. Noise level	10	10.1.1.1. Soundproofing	10	100
11. Compact	11.1.1. Footprint	10	11.1.1.1. Space saving	10	100
12. Energy efficient	12.1.1. Power consumption	15	12.1.1.1. Energy saving	15	225
13. Easy to maintain	13.1.1. Accessibility	10	13.1.1.1. Easy access	10	100
14. High accuracy	14.1.1. Precision	15	14.1.1.1. Calibration	15	225
15. Low vibration	15.1.1. Vibration level	10	15.1.1.1. Vibration dampening	10	100

Risk Analysis

Risk ID	Description	Impact	Probability	Severity	Owner	Status
R001	Material shortage	High	Medium	High	John	Open
R002	Supplier delay	Medium	High	High	Jane	Open
R003	Quality control issues	Low	Low	Low	Mike	Open
R004	Production cost increase	High	Low	High	Sarah	Open
R005	Equipment failure	Medium	Medium	Medium	David	Open
R006	Staff turnover	Low	High	Medium	Emily	Open
R007	Change in requirements	High	Medium	High	John	Open
R008	Compliance issues	Medium	Low	Medium	Jane	Open
R009	Market competition	High	High	High	Mike	Open
R010	Technology obsolescence	Medium	Low	Medium	Sarah	Open
R011	Logistics problems	Low	Medium	Low	David	Open
R012	Customer dissatisfaction	High	Medium	High	Emily	Open
R013	Regulatory changes	Medium	Low	Medium	John	Open
R014	Financial instability	High	Low	High	Jane	Open
R015	Reputation damage	Medium	High	Medium	Mike	Open
R016	Intellectual property issues	High	Low	High	Sarah	Open
R017	Environmental concerns	Low	Medium	Low	David	Open
R018	Geopolitical risks	High	Low	High	Emily	Open
R019	Supply chain volatility	Medium	High	Medium	John	Open
R020	Energy price fluctuations	Low	Medium	Low	Jane	Open

Meet us at
booth 9
(1st floor)

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with us



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Two Pillars

Thank you for
your kind attention!

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MODEL-BASED SYSTEMS ENGINEERING



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