29th Annual INCOSE international symposium

Orlando, FL, USA
July 20 - 25, 2019

BRIDGING DESIGN AND SYSTEMS ENGINEERING

Inclusion of Human Values in the Specification of Systems

www.incose.org/symp2019

Why?

#1

There is a strong need to ensure the integration of human values when applying SE to design complex systems to foster innovation .

(Falk et al., 2016).

Image source: Clem Onojeghuo on Unsplash

Why?

#2

The belief that a good balance between business, human values and technology will result in projects that are more innovative and successful.

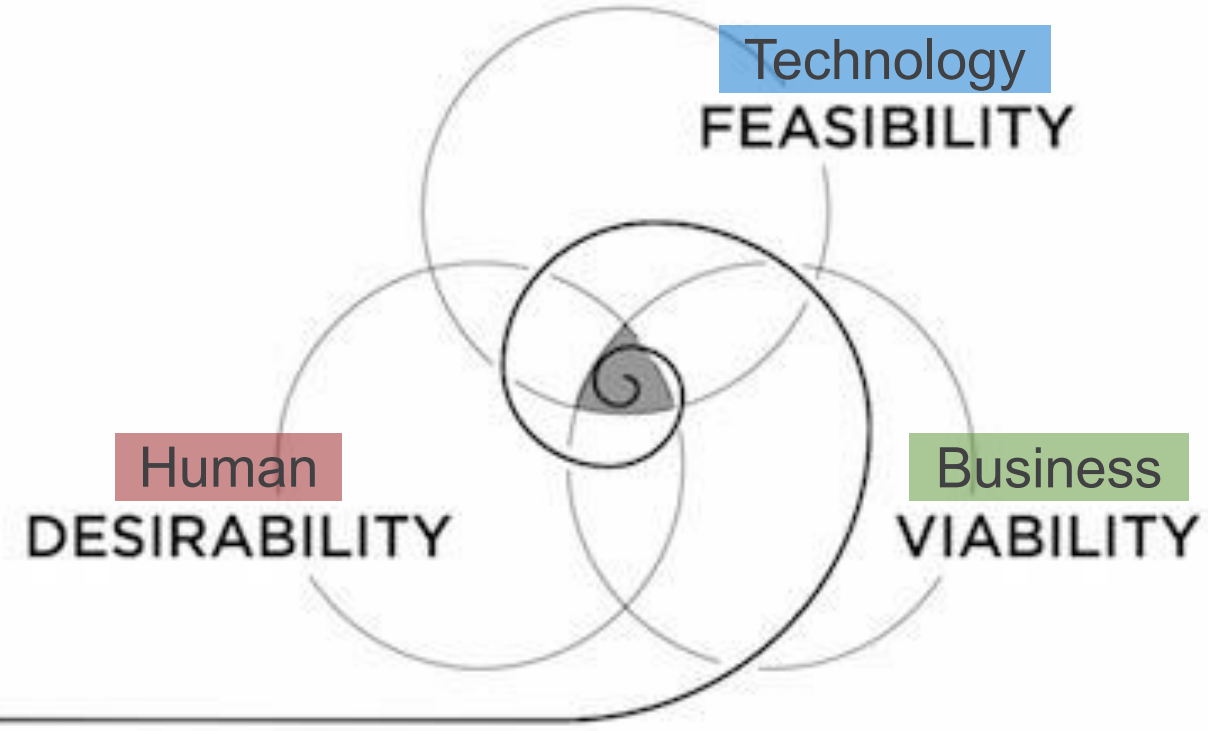


Image source: ideo.com

Why?

#3

Systems engineers specify the human values as ergonomic and HSE requirements.

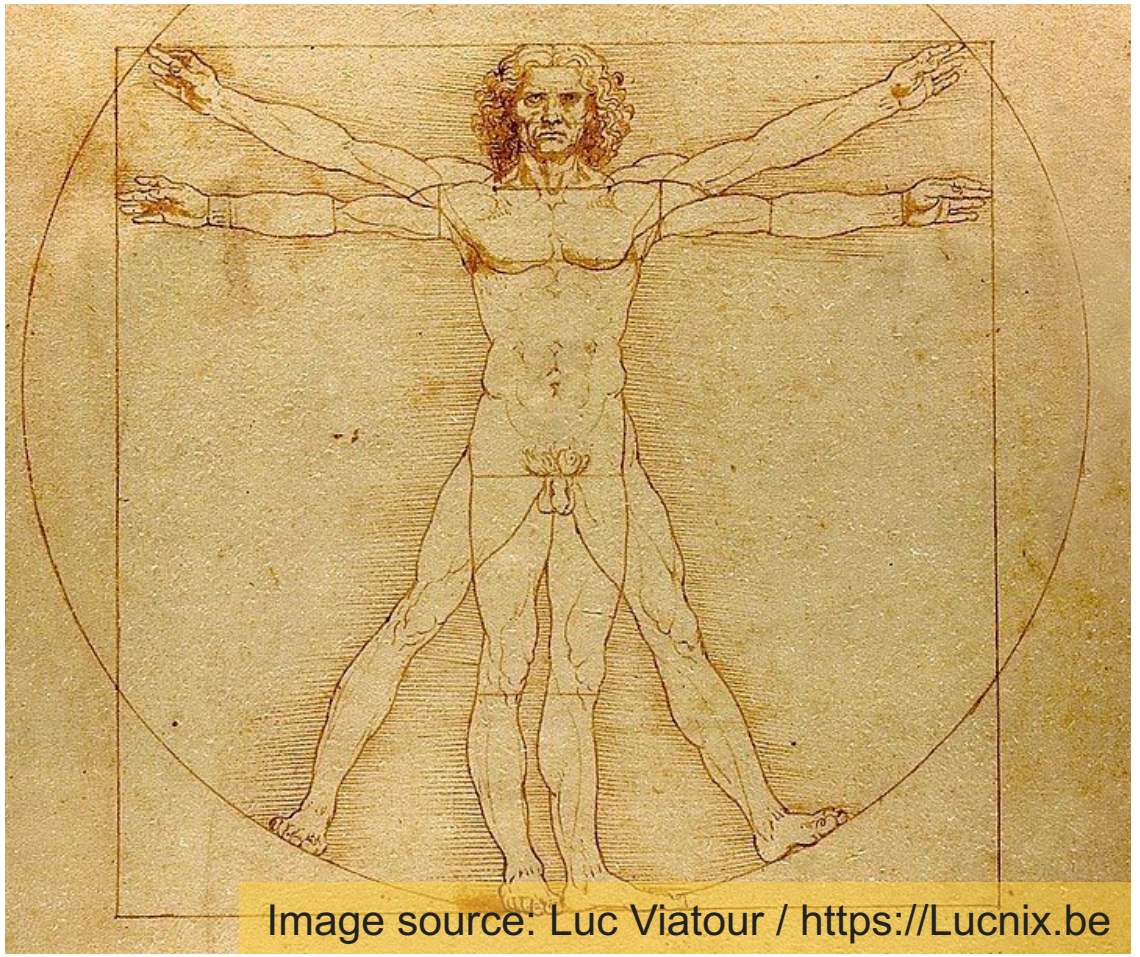


Image source: Luc Viatour / https://Lucnix.be

Reserach question

“How to ensure that systems engineers include human values in the early specification of systems?”

How to ensure that systems eng…?

Applying the **design thinking framework** to create a tool that facilitates the **design thinking approach.**

1. Created a tool to analyze human stakeholders and describe use case scenarios;

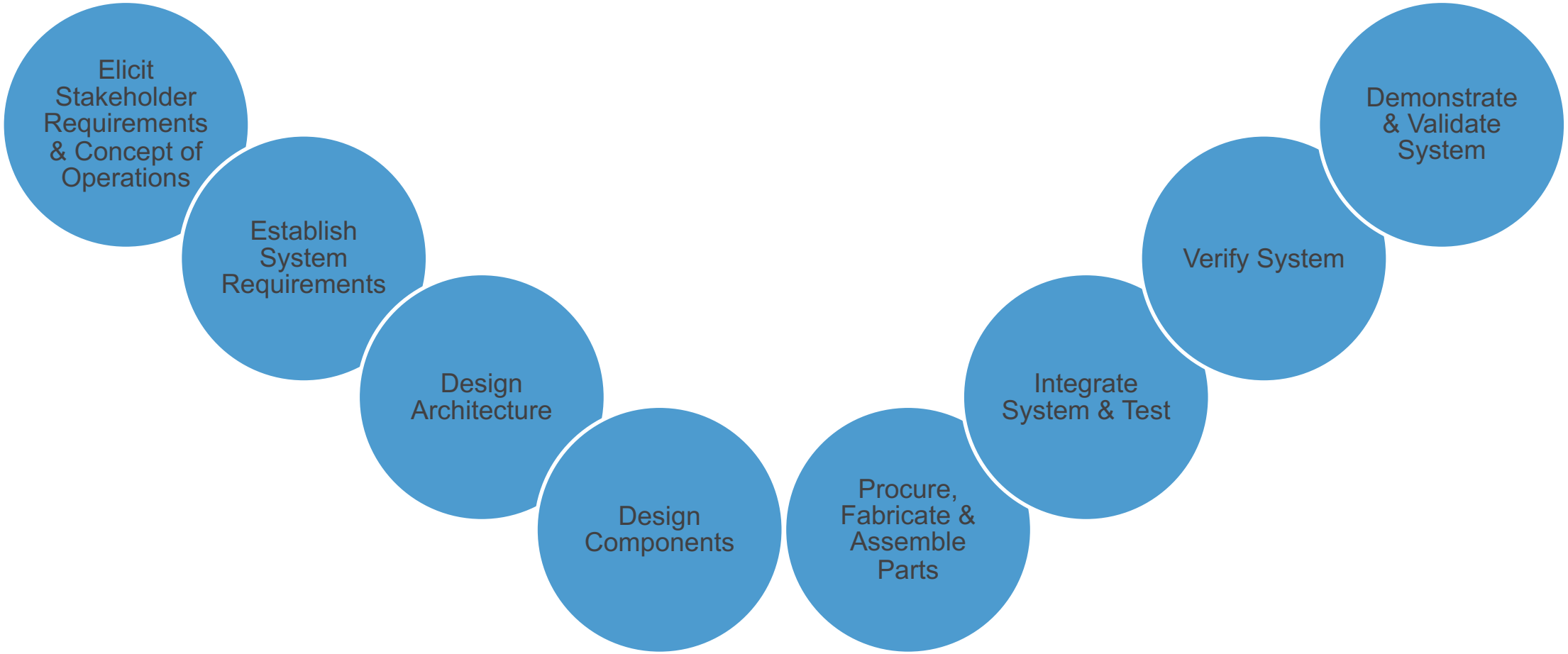
2. Re-analyze human stakeholders and re-describe the use case scenarios with the new tool;

3. Generated requirements based on the results of the previous step.

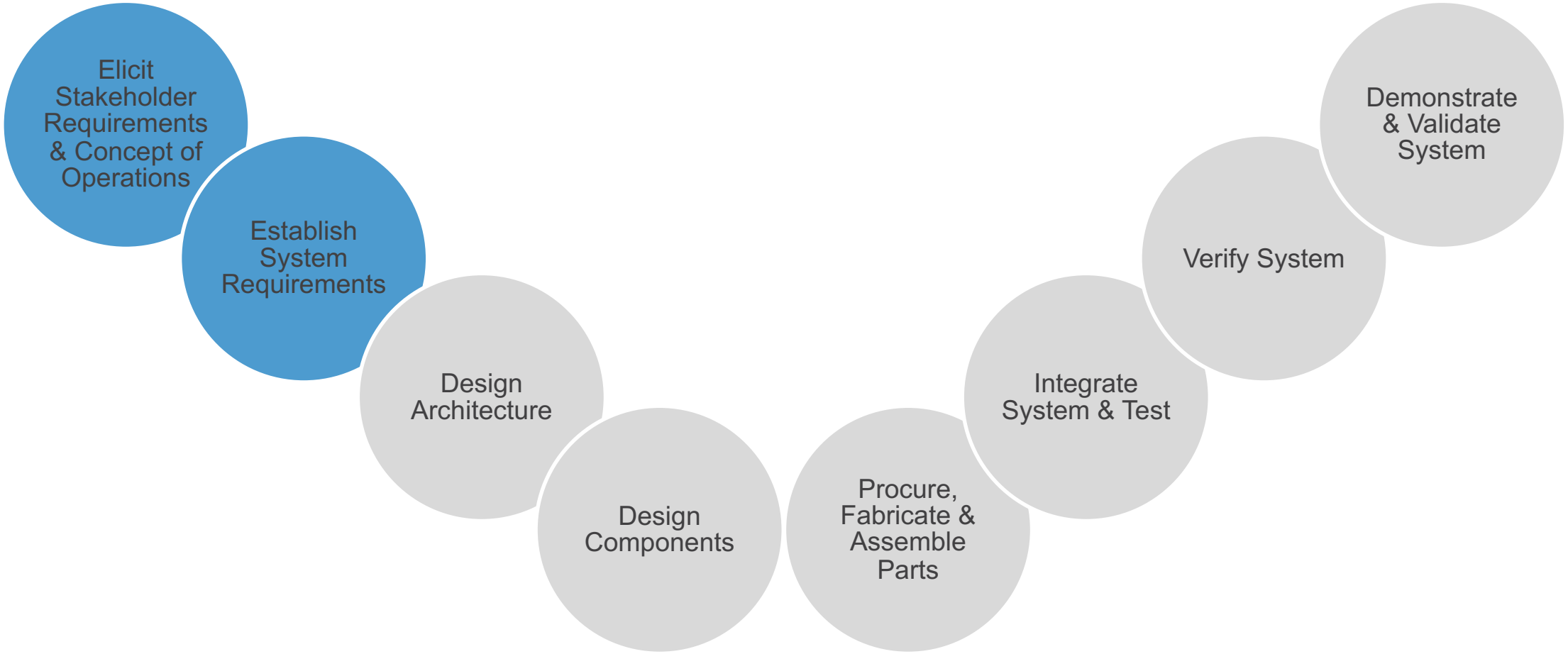
Systems Engineering vs Design Thinking

SYSTEMS ENGINEERING	DESIGN THINKING
• structured, • prescriptive, and • analytic	• generative, • adaptive, and • dynamic
• “objectively measure” results	• “subjectively perceived” results

SE at the researched company



SE at the researched company



Methodology and Study Case

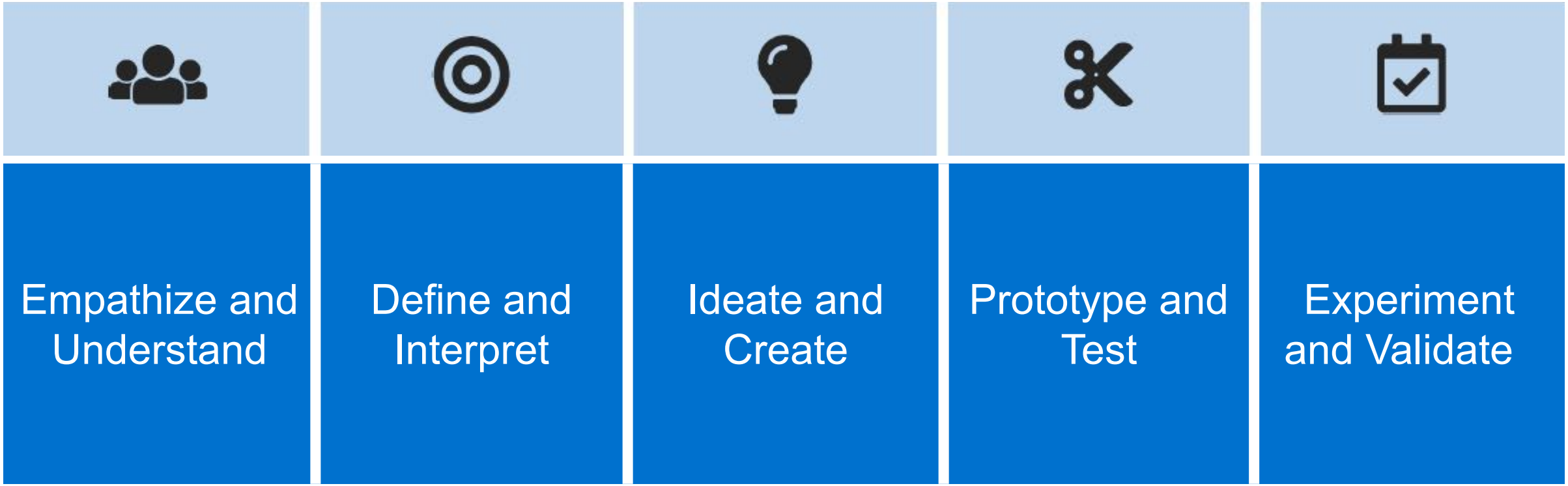
The complete solution (own by the client)

Service, Infrastructure and Logistics (out of the study case scope of work)

High Performance Hard Coating (out of the study case scope of work)

Autonomous Maintenance of Coated Surfaces – the Study Case

Design Thinking Framework



Design Thinking Framework

Empathize and Understand

FINDINGS:

- System engineers overlook human aspects when specifying and developing systems
- When considered, these are specified in ergonomic terms
- *“I know I should take ‘more’ the human values into the specification, but it is just very easy not to…”*

(Systems Archcitectt)

Design Thinking Framework

Define and Interpret

FINDINGS:

- The approach of system engineers is mainly functional and aims for objectively-measured results
- **The lack of awareness of the significance of well-defined human values**

Lack of awareness was key.

“I know I should take ‘more’ the human values into the specification, but it is so easy not to…”

The system architect of the project

“Systems engineers are educated to ignore the subjective, fluffy requirements!”

The program manager, responsible for the SE approach at the company

Lack of awareness was key.

Lack of awareness was key.

It’s easy to miss something you’re not looking for

Lack of awareness was key.

Look out for human values.

Hypothesis

If it is specified it will be designed and delivered.

Design Thinking Framework

Ideate and Create

Results:

A set of two one-page graphic structures that prescribe a new way to analyze stakeholders and to describe use case scenarios.

- Digital versions that are suitable to print on A3 paper sheets.
- Consistent with the A3 tool protocol.
- Visually complying with the design guidelines.

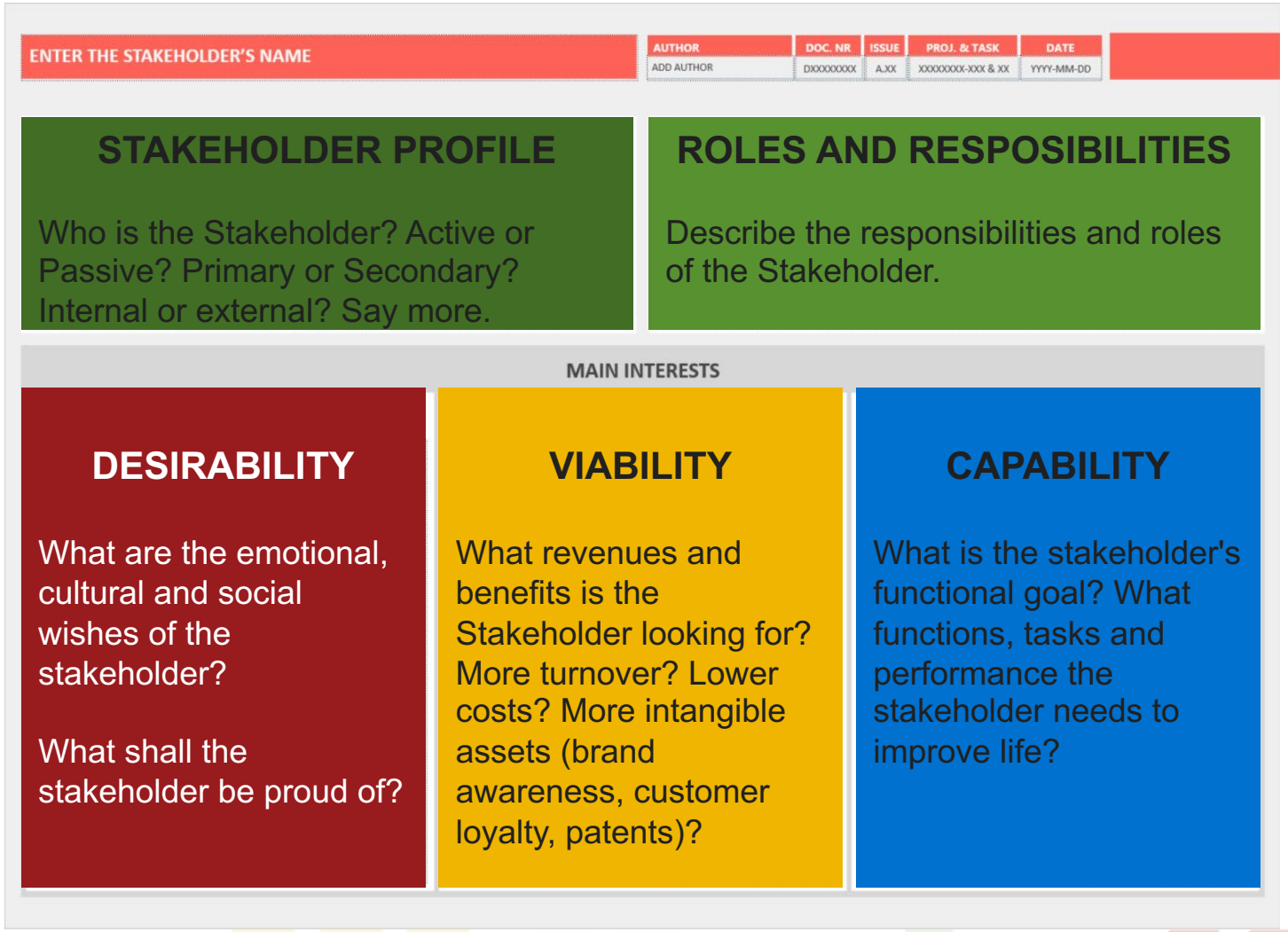
Design Thinking Framework

Prototype and Test

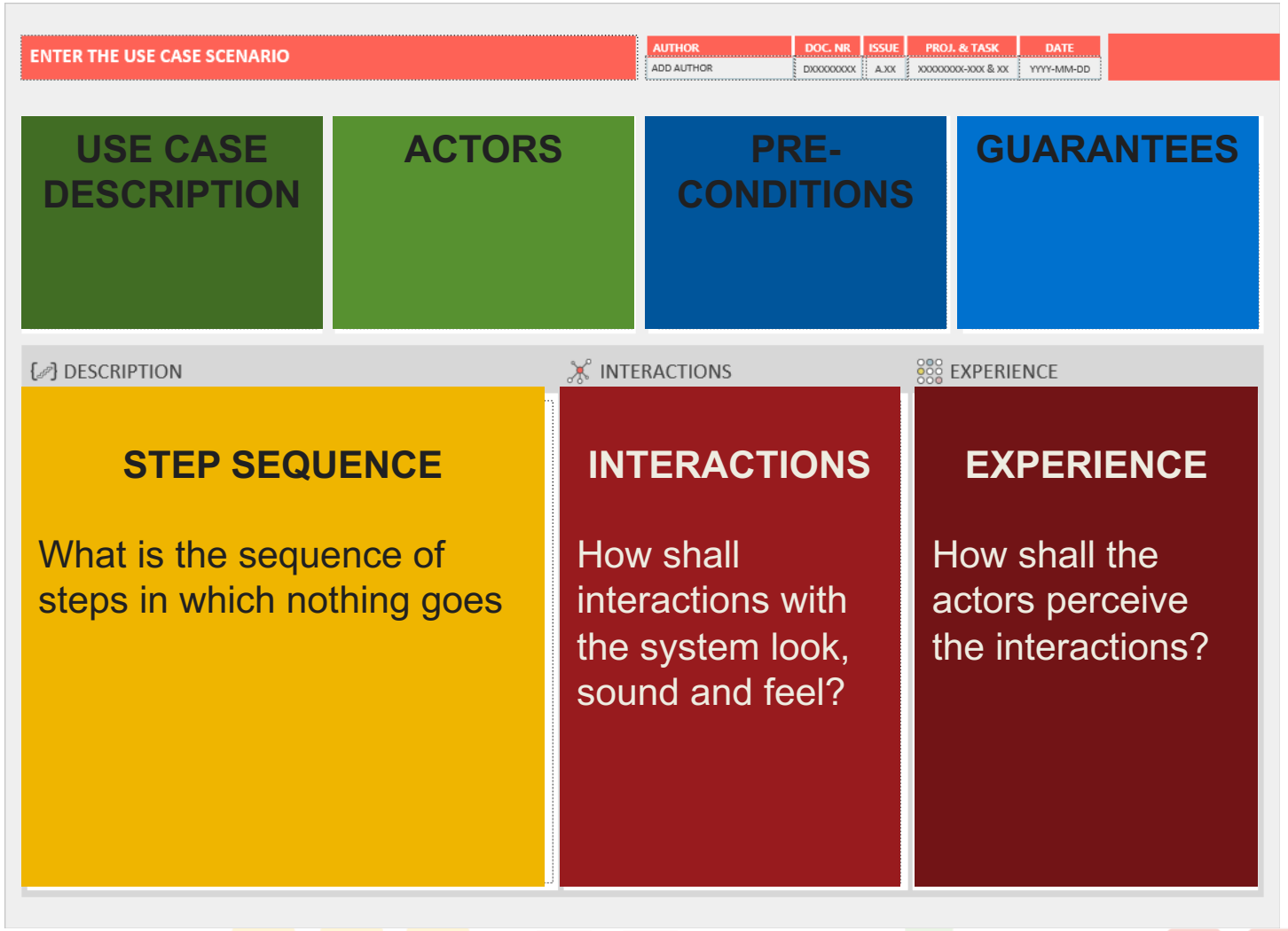
Results:

The canvasses were improved, taking into account the observations and findings of the training.

Human Stakeholder Canvas



Use Case Scenario Canvas



Schwartz Values Theory

1) Values are beliefs
2) Values refer to desirable goals
3) Values transcend specific actions and situations
4) Values serve as standards or criteria
5) Values are ordered by importance and
6) The *relative* importance of multiple values guides action.

Human Values questions

1) What are the emotional, cultural and social wishes of the stakeholder?
2) What shall the stakeholder be proud of?
3) How shall the interactions with the system look, sound and feel?
4) How shall the actors perceive the interactions?

Design Thinking Framework

Experiment and Validate

Validation:

1. *Application of the tool* – analyze the human stakeholders and describe the use case scenarios, and;
2. *Generate requirements* based on the content created with the tool.

Results

- The new tool
  1. Human Stakeholder Canvas
  2. Use Case Scenario Canvas
- Generated requirements and
- Feedback received from participants.

Results: generated requirements

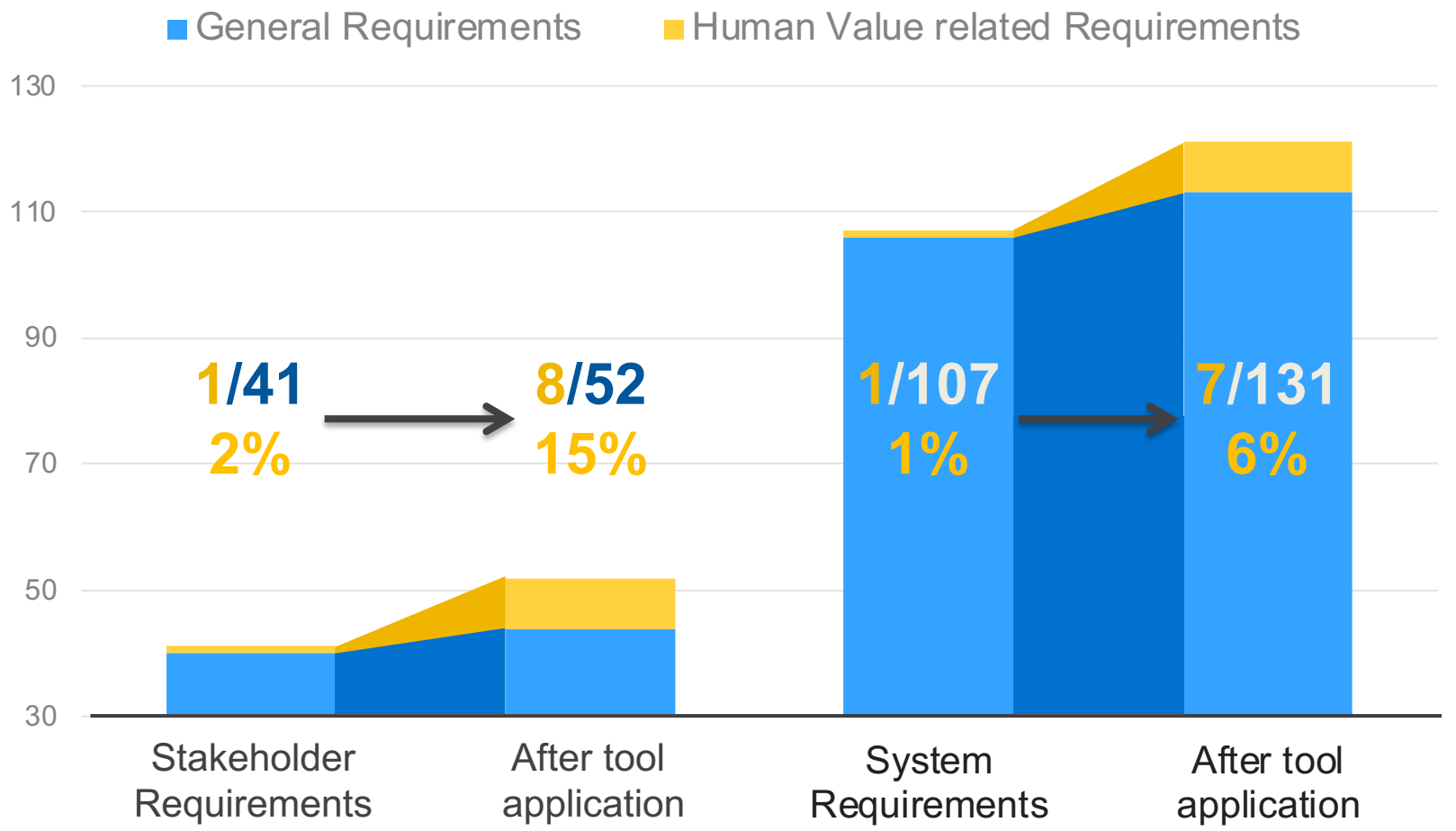
Text-based requirement	Origin	Source	Valid?	Human values?
The system needs to be perceived as a Green-solution in the global market	Stakeholder (The Client)	Desirability	YES	YES
The solution needs to make service and support available 24/7	Stakeholder (The Client	Capability	YES	NO
It must be possible to lift the containers on to vessel's deck	Use case scenario (Handling, Storage and Transport)	Steps	YES	NO
The HMI and the GUI must be user-friendly, ensure clear communication and provide information easy to read	Use case scenario (Run Start-up Procedures)	Human Interaction	NO	NO
Status of booking must be possible to check at all times	**Use case scenario (Scheduling of Inspection & Cleaning)**	**Experience**	**YES**	**YES**

Results: participants feedback

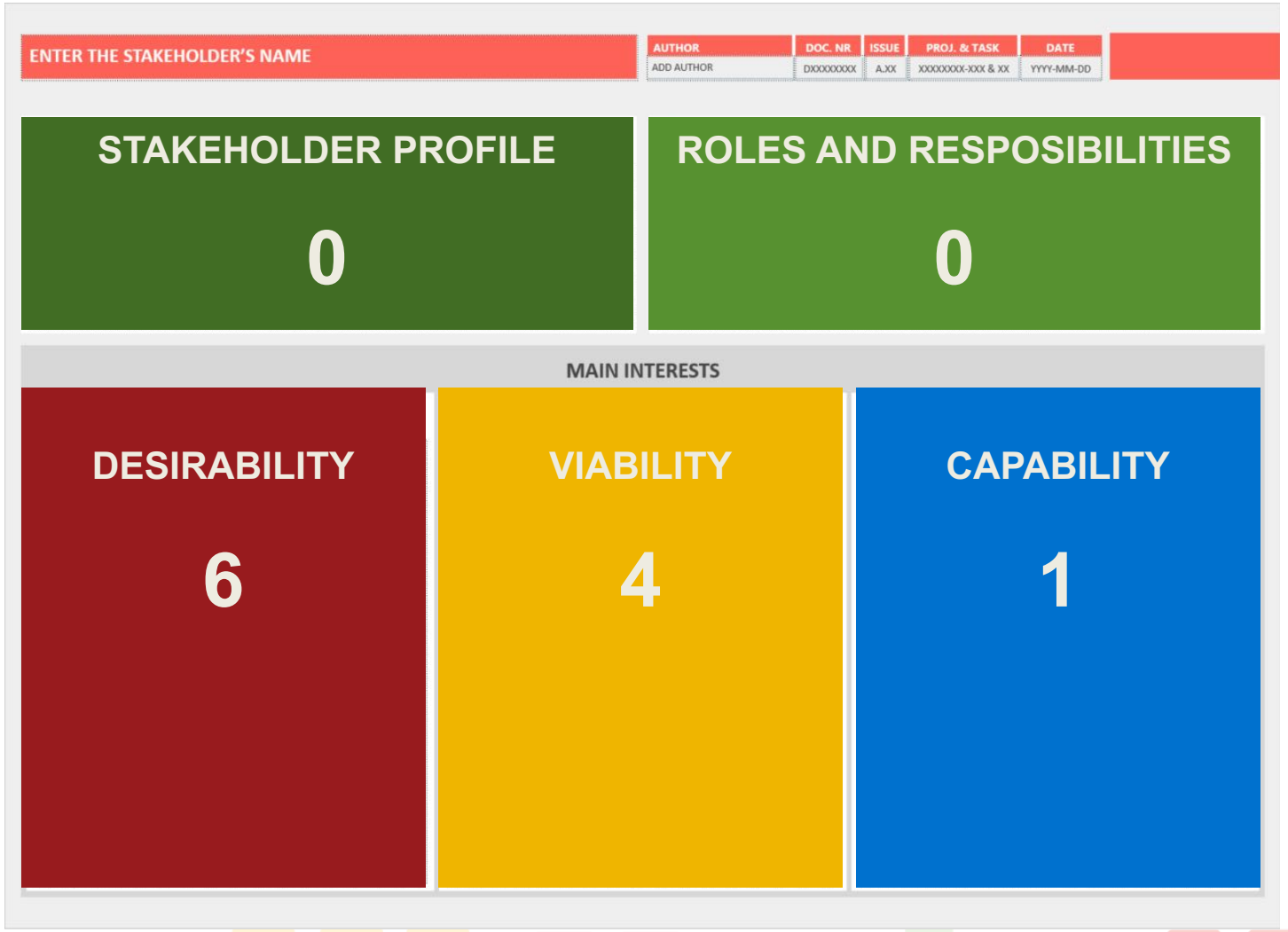
Yes, the feedback was good, the tool was deployed and has been in use since then.

Conclusions

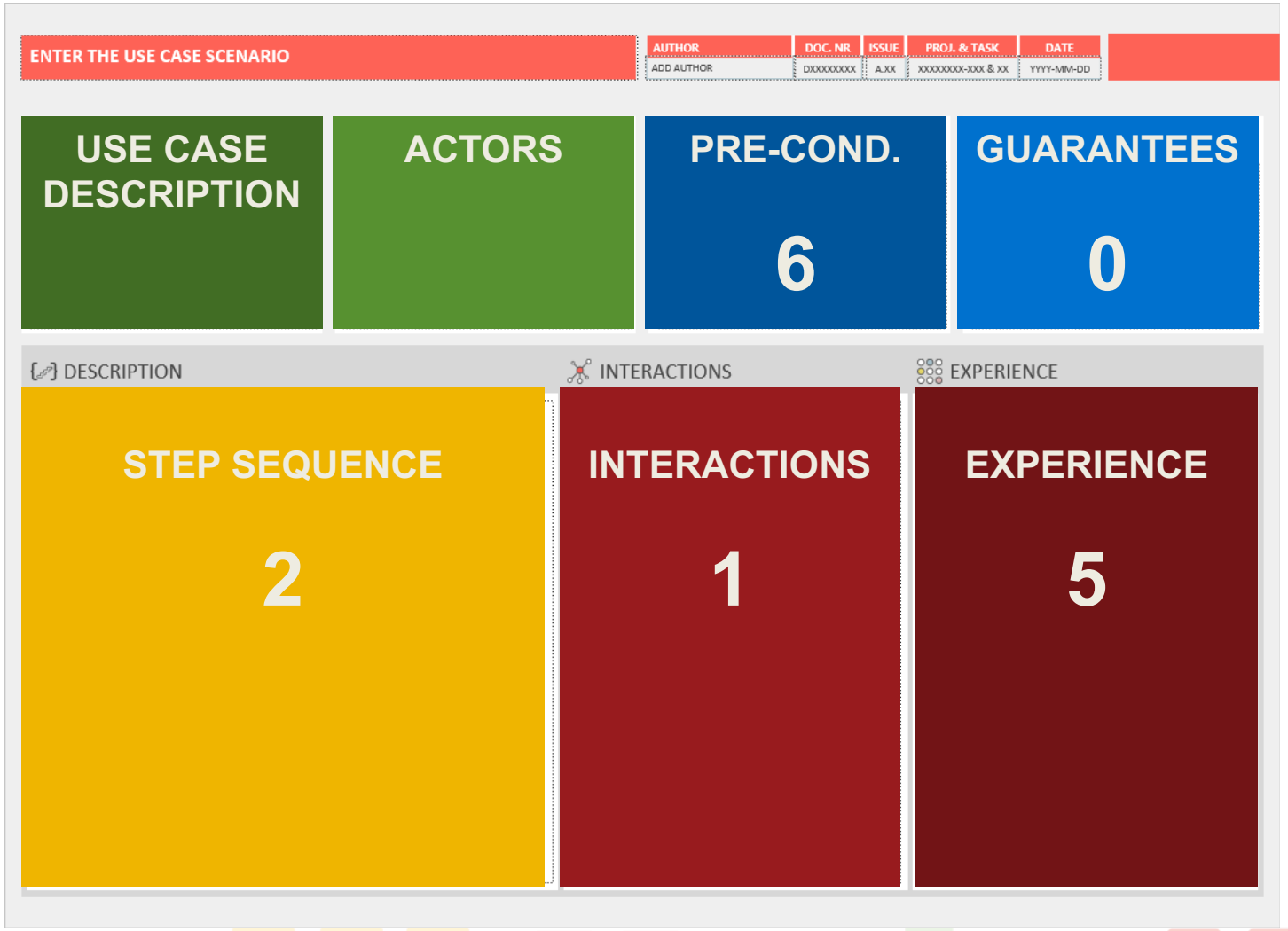
Conclusions: Number of Requirements



Conclusions: Stakeholder Requirements



Use Case Scenario Canvas



Discussion: the «human» *mindset*

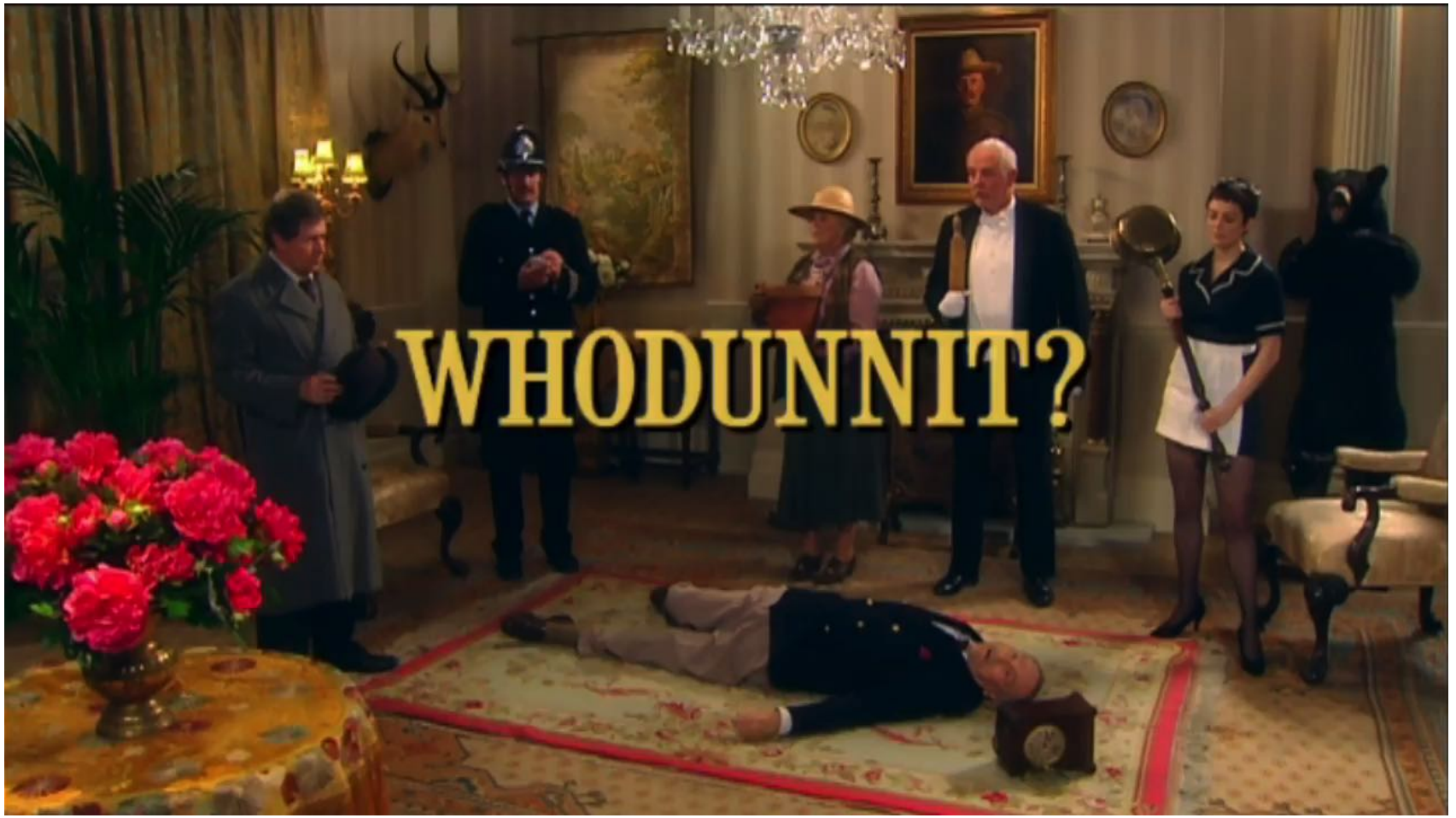
Requirement *"The solution needs to make service and support available 24/7"* was a new requirement and added but not as related to human values.

Why not?

Lack of awareness is key.

Look out for changes.

Lack of awareness is key.



Thank you.

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