How to set up the Technical value chain

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ITEA 3

Collaborative innovation projects
Objective

- The **objective** of collaborative innovation projects is:
  - to join knowledge, know-how, technologies etc. and deliver **functional capabilities**
  - to generate a **desired value differentiation** w.r.t the State-of-the-Art (SotA)
  - for a **well-defined user/customer & use-case**
- The objective of the Project Outline (**PO**) is to clarify the **WHAT**:
  - What is the **innovation**?
  - What is delivered **to the market / users**?
- The objective of the full project proposal (**FPP**) is to clarify the **HOW**:
  - How will the innovation be achieved, e.g. **activity** organisation and dependencies, **effort** allocation, detailed activities and **work packages** description
- Two main assets allow capturing and analysing the **what** & **how**:
  - The **solution concept**, to capture the shared vision of the solution
  - The **technology value chain**, to identify how the challenges will be addressed

Solution Concept
Design

informal

- A **solution concept** = **abstract representation** of innovation
- Identification of **technologies** & **interfaces**
- Explanation of **how** unique capabilities are delivered by **organisation** of technologies

formal

- A **solution concept** reveals **how technical elements** are linked to generated user **value**
- **But** technical elements cannot be perceived by a user, only the **functions** they deliver
- The combination of **functions** generates **essential properties** of the innovation that a user can experience & value

analysis

- Capturing value of a solution concept in two steps:
  - **Functional analysis**
  - **Value analysis**

Solution Concept
Analysis

Functional analysis

- Suh Matrix 1 (M1) allows the **identification and coupling** of:
  - the **technical elements** of the solution concept – (lines in M1),
  - the **functions** produced combining technical elements – (columns in M2),
  - and **which** technical elements contribute to which functions – (arrows).

Matrix M1:

FUNCTIONAL ANALYSIS	Function 1	Function 2	Function 3
Technical element 1	↗		↗
Technical element 2	↗	↗	
Technical element 3			↗

Value analysis

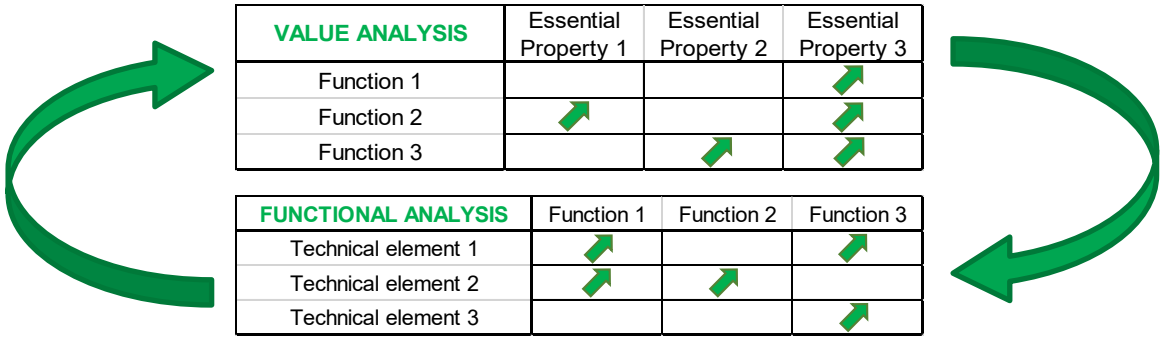
- Suh Matrix 2 (M2) captures the **causality links** between:
  - the **functions**, as identified in M1– (lines in M2),
  - and the **essential properties** associated to the whole solution, defined from the user perspective as its **tangible benefits** (columns in M2).

Matrix M2:

VALUE ANALYSIS	Essential Property 1	Essential Property 2	Essential Property 3
Function 1			↗
Function 2	↗		↗
Function 3		↗	↗

Solution Concept
Essential Properties

- The links/feedback between the two analysis blocks allow to **scope the project**, up front and during the whole project lifetime



VALUE ANALYSIS	Essential Property 1	Essential Property 2	Essential Property 3
Function 1			↗
Function 2	↗		↗
Function 3		↗	↗

FUNCTIONAL ANALYSIS	Function 1	Function 2	Function 3
Technical element 1	↗		↗
Technical element 2	↗	↗	
Technical element 3			↗

- An **essential property** answers positively to the next questions:
  - Is it a **benefit** of the solution concept? Does it have a **value** for the **user**?
  - Does this benefit **differentiates** the solution concept from existing ones?

- The clear definition of the essential properties helps to describe a **unique selling proposition** compared to the competition and means both a **high value** for the **proposal** as well as for the future **business**

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Technology Value Chain: Design (1/3)

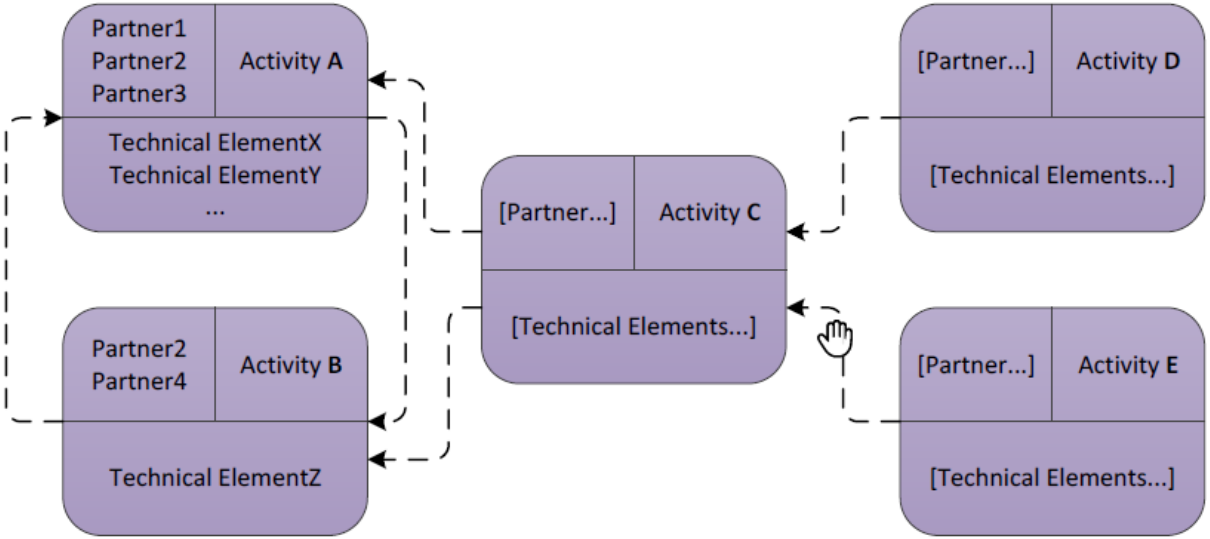
- After formulating the solution concept, it is necessary to **identify the challenges**, technical or scientific, to be studied and tentatively solved, in a **specific order**, depending on their impact on each other.
- The objective of the **technology value chain** is to capture this **web of dependencies** in a synthetic way for all project's **technical activities**.
- A technology value chain diagram is a **partially orientated graph** where each node represents a project activity targeting one or more technical elements of the solution concept.
- The final graph captures **all the technical activities** that must be performed to address the challenges as well as their (eventually even bidirectional) **dependencies**.
- Note: a dependency does **NOT** capture exact **timing** information: activities depending on each other can still run in **parallel** and **exchange** knowledge and results.

Technology Value Chain
Design

- After the solution concept **identify the challenges** in a **specific order,** depending on the impact on each other
- The technical value chain
  - Captures the **web of dependencies** for all project's **technical activities**
  - Is represented as a **partially orientated graph** where each node represents a project activity that targets one or more technical elements of the solution concept
- Final graph captures **all the technical activities** that must be performed to address the challenges as well as their **dependencies**
- Note: a dependency does **NOT** capture exact **timing** information

Technology Value Chain
Scheme

- Schematic representation of a technology value chain, linking the **technical elements** from the Suh matrix to the **project activities**:



- Note: The **scope** of the activities which are captured is **only technical**, not including dissemination, project management etc.

Technology Value Chain
Description

- The graph must be completed by a **textual description**:
  - what is the partners´ purpose in the activity execution,
  - what is the goal of the activity,
  - what are the specific challenges raised w.r.t the state of the art and
  - how they relate to the different technical elements mentioned in the node.

Activity name:	[Name]		
Activity goal:	[Goal description]		
Technological / scientific challenge:	[Challenge description]		
Involved technical elements:	[List of technical elements from the solution concept]		
Partner name:	[Name]	Partner purpose in the task:	[Description]
Partner name:	[Name]	Partner purpose in the task:	[Description]

- Note: The **activities** of a **technology value chain** map very nicely to **work packages** of a project workplan (max 10, usually 4 to 6).

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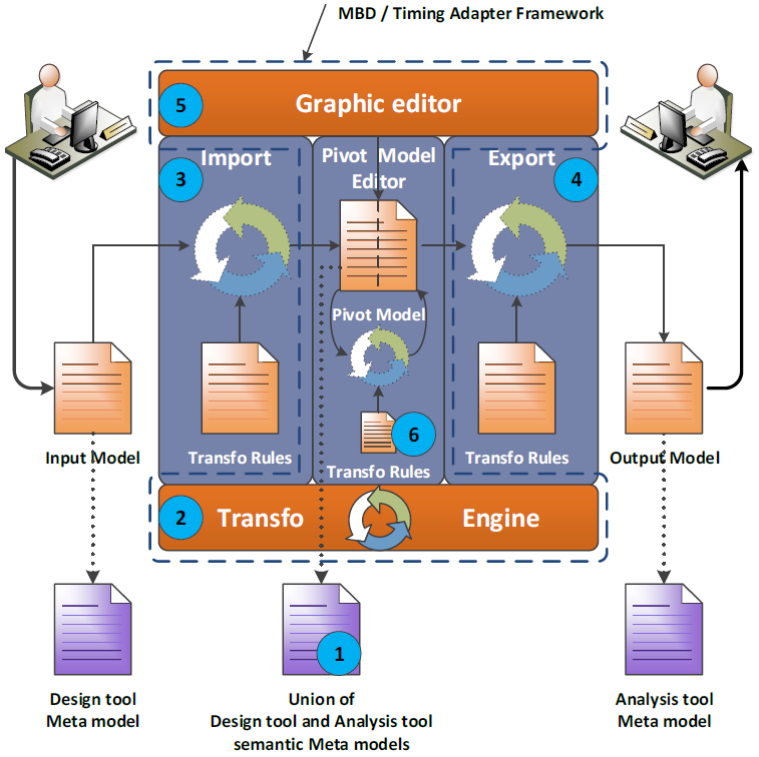
Example: Timing Analysis Adapter (1/3)

Solution concept: Software adapter



- Capability: interfacing **model-based** design environments (3) to **timing analysis** tools (4), without them sharing the same semantic for graphical notations.
- Two **key components**:
  - A **transformation engine** (2), to transform models from one semantic to another.
  - A **pivot model** (6) to integrate both semantics (1) (import and export) into a single **intermediate representation**.

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Example: Timing Analysis Adapter (2/3)

Functional analysis

		Function				
	Timing analysis adapter	Editor of temporal performance model	Design model import	Temporal analysis model export	Semantic Gap Resolution	Timing semantic configurability
Technical element	Metamodel + semantic for pivot model	↗	↗	↗	↗	
	Transformation engine		↗	↗	↗	↗
	Import: importer lib + extension from design tool		↗			
	Export: exporter lib + extension for analysis tool			↗		
	Graphical editor: Graphical editor plug-in + extension for pivot model edition	↗				
	Transfo rule of pivot model editor: Transformation semantic rule package from input MM to output MM + execution order				↗	

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Example: Timing Analysis Adapter (3/3)

Value analysis

		Essential property				
	Timing analysis adapter	Needless training on timing analysis	Automatic production	Errorless temporal design	Genericity & flexibility	Configurability to design environments & analysis tools
Function	Editor of temporal performance model				↗	
	Design model import		↗			
	Temporal analysis model export		↗			
	Semantic Gap Resolution	↗	↗	↗		
	Timing semantic configurability				↗	↗

Solution Concept & Technical value chain
Implementation rules

	Free style graphical representation & explanation	**Functional analysis + Value analysis** matrices & explanations	**Technology Value Chain**	**Activity** description
PO	X	X		
FPP	Revised version (if necessary)	Revised version (if necessary)	X	X

Thank you for your attention

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