

IAMC Toolkit

Innovative approaches for the Sound Management of Chemicals and
Chemical Waste

PHASE III (b) BRAINSTORMING INNOVATION

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Company guide

B13_2



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Introduction

Brainstorming Innovation – Objective

This document provides an overview of tools to be used in Phase 2 ‘Assess Chemicals Management Hotspots and Customer Unmet Needs’ and Phase 3 ‘Generate Options’.



[B12_1_Assess cm hotspots](#)



[B12_2_Assess customer unmet needs](#)



[B13_1_Generate innovative options](#)

The tools provided are suitable to:

- Analyze the causes of existing problems
- Generate innovative solutions

They can be used as part of any brainstorming workshop or as a stand-alone tool.

Worksheet Cause Analysis and Generation of Innovative Options Template (1)

This template can help the innovation team to summarize the following aspects:

- Underlying causes of each selected innovation target area (e.g. waste or emission streams, chemical/energy consumption or safety issues)
- All generated innovative options addressing selected hotspots

Worksheet Cause Analysis and Generation of Innovative Options Template (2)

Hotspot	Cause	Innovative option
1. Description of waste stream 1	a. Cause 1 of the waste stream	Option 1 to cause 1 of waste stream 1
		Option 2 to cause 1 of waste stream 1
		Option 3 to cause 1 of waste stream 1
	b. Cause 2 of the waste stream	Option 1 to cause 2 of waste stream 1
Option 2 to cause 2 of waste stream 1		
2. Description of chemical consumption		
3. Description of Chemical of High Concern used in product XYZ		
4. Description of accidents related to chemicals handling		
5. Description of accidents related to operations		

Source: OSD Engineers, Switzerland / ISSPPRO, Germany

Tool Instructions

- Tool 1: Asking “Why” Five Times
- Tool 2: Fishbone Diagram
- Tool 3: Nine Windows

Tool 1: Asking “Why” Five Times (or More)

Tool objective	Provide a structured approach to analyzing sustainability impacts by asking “Why” as many times as is necessary to arrive at the root cause of the problem
Who should contribute	Intended for use by the innovation team during a brainstorming session at an innovation workshop and, where appropriate, with other relevant stakeholders (suppliers, customers, etc.)
Input	Sustainability impacts identified and data gathered during Phase 2
Results	Root causes of the problem to generate innovative solutions addressing the chemicals management hotspots

Tool 1: Asking “Why” Five Times

Example for a company manufacturing and painting metal parts:

- Why are we using so much water?
The parts need to be cleaned before painting.
- Why do the parts need to be cleaned?
The parts fail quality checks if they aren't cleaned before being painted.
- Why do painted parts fail quality checks?
The paint does not adhere when part surfaces are not properly prepared.
- Why do the surfaces of the parts need to be prepared?
The surfaces get contaminated with oils in the previous process.
- Why are oils used in the previous process?
The oils are used to prevent corrosion during storage.

Source: “The Lean and Environment Toolkit”, EPA, USA

Tool Instructions

- Tool 1: Asking “Why” Five Times
- Tool 2: Fishbone Diagram
- Tool 3: Nine Windows

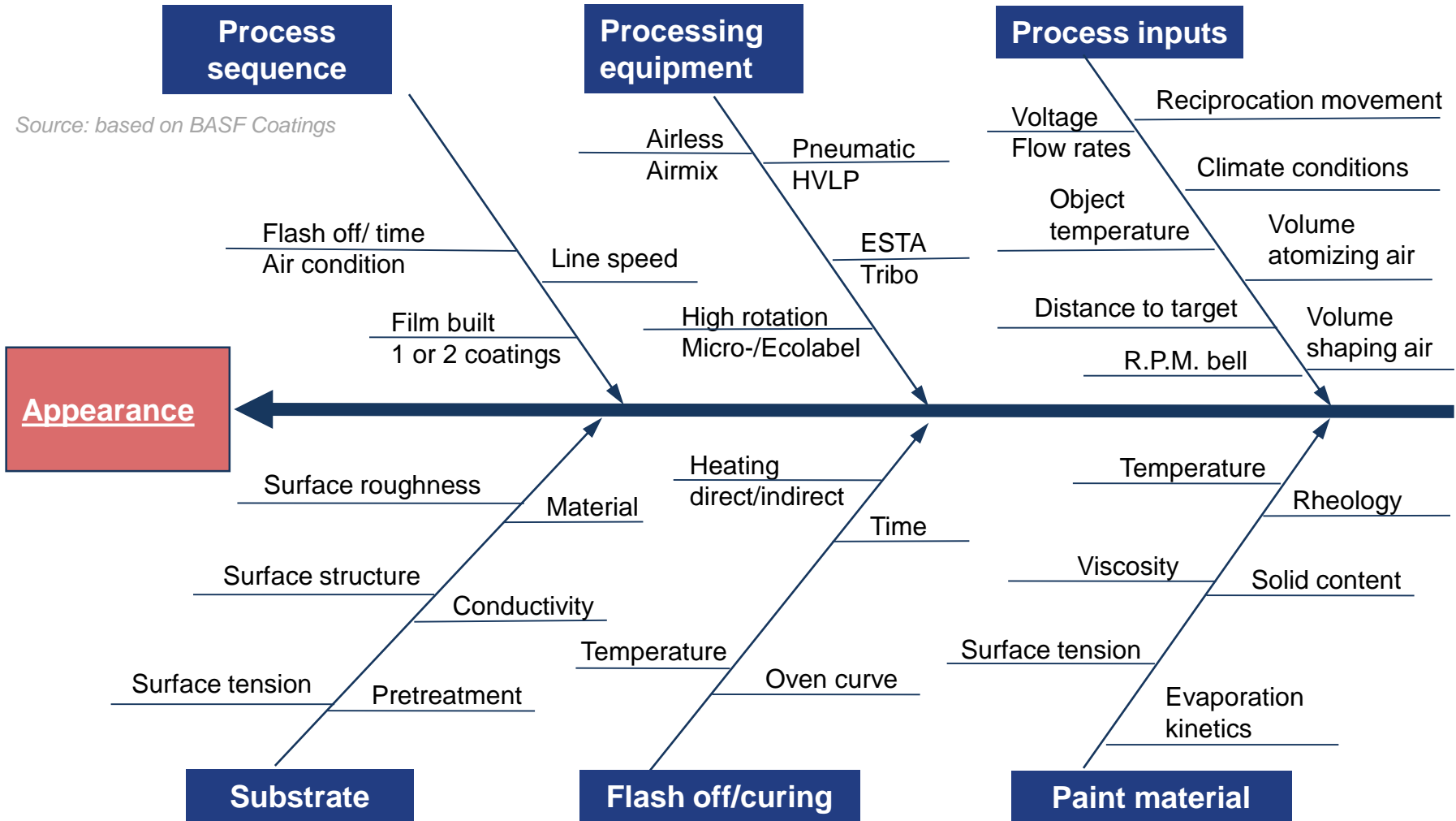
Tool 2: Fishbone (Ishikawa) Diagram

Tool objective	Assist in considering all possible causes of a problem rather than just the most obvious ones
Who should contribute	Intended for use by the innovation team during a brainstorming session at an innovation workshop and, where appropriate, with other relevant stakeholders (suppliers, customers, etc.)
Input	Sustainability impacts identified and data gathered during Phase 2
Results	Root causes of the problem to generate innovative solutions addressing the chemicals management hotspots

Fishbone (Ishikawa) Diagram: Instructions

- Identify the problem and write it in a box on the left-hand side of the diagram.
- Work out the major factors involved, e.g. systems, equipment, materials, external forces, persons involved in the problem, etc.
 - Draw a line off the spine of the diagram for each factor and label each line.
- Brainstorm possible causes of the problem for each factor.
- Analyze your diagram and generate innovative options.

Example: Fishbone Diagram for Paint Application



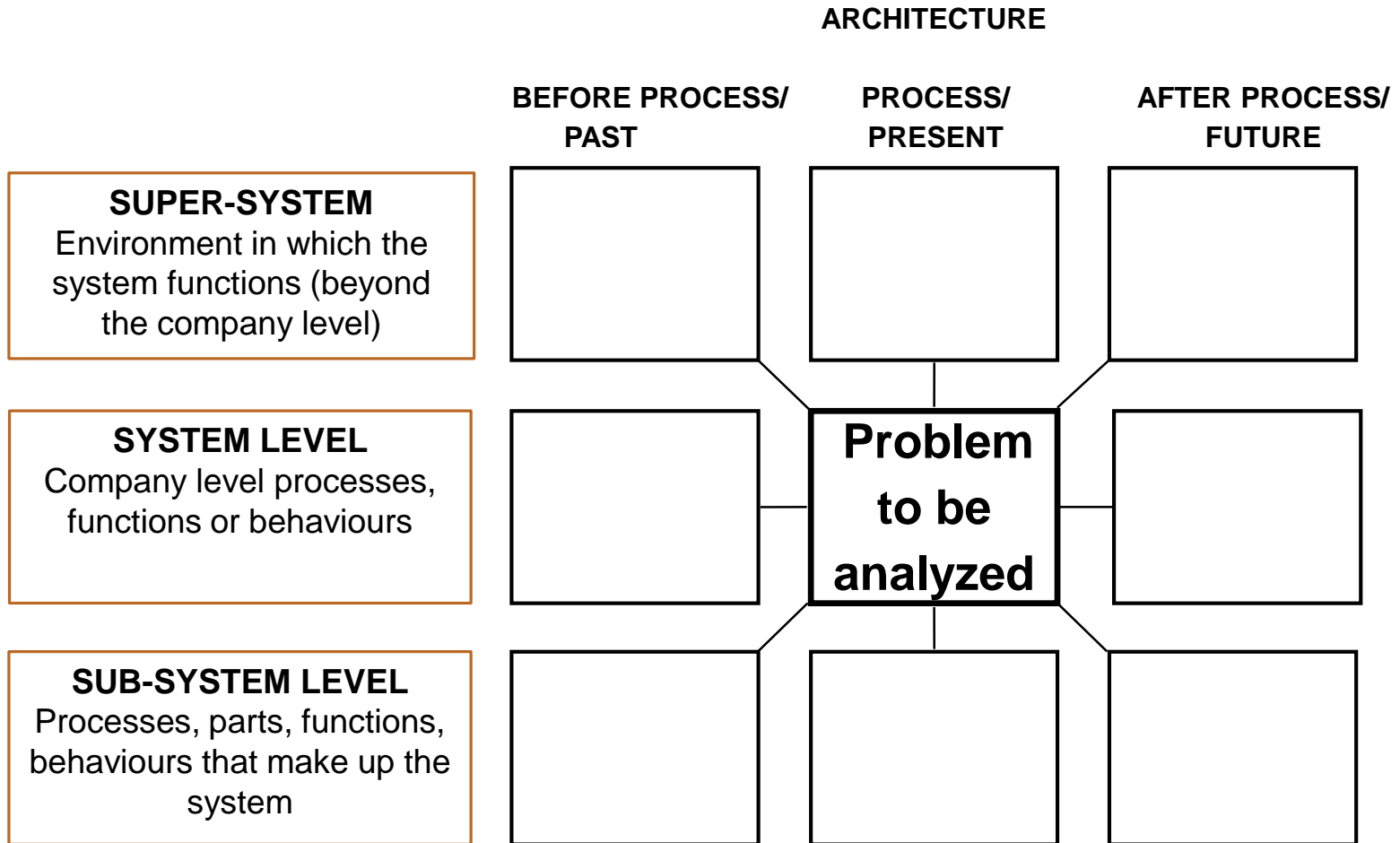
Tool Instructions

- Tool 1: Asking “Why” Five Times
- Tool 2: Fishbone Diagram
- Tool 3: Nine Windows

Tool 3: Nine Windows

Tool objective	Analyze opportunities for innovation across the dimensions of time (past, present, future) or process steps (before, during and after the process) and at the system level (super-system, system, sub-system). The structured approach enables you to view a problem from eight different perspectives and provides support in deciding how and where to innovate.
Who should contribute	The innovation team and, where appropriate, other relevant stakeholders (suppliers, customers, etc.)
Input	Description of the problem and the system, sub-system and super-system
Results	Understanding how the system operates at the super-system and sub-system levels; identifying system areas where innovation and innovative options can be applied

Nine Windows: Template



Source: based on UNEP

Nine Windows: Instructions (1)

1. Draw the nine windows matrix and fill in the centre box with the problem definition and current situation.
2. Fill in the sub-system and super-system boxes above and below the centre box with the following questions:
 - Super-system: What larger system/process contains the system/object/process?
 - Sub-system: What components and properties make up the system/object/process in its present form?
3. Fill in the past (before process) and future (after process) boxes. Consider the following:
 - What did the system look like before? What will it look like in future?
 - What preceding processes (past) or subsequent processes (future) impact the current problem?
 - How can these system inputs be modified to eliminate, reduce or prevent the harmful function, event or condition from impacting the output?

Nine Windows: Instructions (2)

4. Complete the matrix for the remaining four corners of the super-system and sub-system.
5. Look for innovation opportunities at the system level and the time dimension. Sometimes, it will be obvious where to focus innovation.
6. Generate options for each of the nine windows by creating a table with a row for each window as follows:
 - Nine window labels (e.g. present system, future super-system)
 - Architecture content (e.g. factors, functions and behaviours affecting the problem)
 - Generated options

Where to Find More Information

- UNIDO Cleaner Production Toolkit Chapter 5 on Innovation, Creativity and Option Generation:
<http://www.unido.org/en/resources/publications/energy-and-environment/industrial-energy-efficiency/cp-toolkit-english.html>
- Cause and Effect Analysis, Mind Tools website:
http://www.mindtools.com/pages/article/newTMC_03.htm
- 9 windows of the world use instructions, UNEP Eco-innovation Manual Tools:
http://www.unep.org/resourceefficiency/Portals/24147/documents/UNEP_Eco-Innovation%20Manual_Tools%20Instructions_17Dec14.pdf
- Examples of application of 9 windows of the world, TRIZ journal article:
<http://www.triz-journal.com/innovation-tools-tactics/incremental-innovation-tools/evaluate-solve-problem-9-windows/>

Sources

Sources

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- BASF Coatings, Basics of Coating Technology, Germany, 2007
- Peter L. King, Lean for the Process Industries, USA, 2009
- Silverstein et al., The Innovator's Toolkit Second Edition, John Wiley & Sons Inc., New Jersey, 2012
- UNEP, Eco-innovation Manual, 2014

Images

- ISSPPRO, Germany, 2015

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