

P 1.7 – Option generation

How can the causes of material and energy inefficiencies responsible for economic losses and pollution generation be addressed?



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- Open the scope of possible solutions
- Utilise preventive techniques first
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Overview of Step 1.7

Inventory of priority material and energy inefficiencies/pollution sources and related causes

List of preliminary ideas of improvement options

Internal and external knowledge

Generate and record improvement options using preventive techniques.

Compile options to improve the consistency of information system on flows

Long list of improvement options for feasibility analysis in step 1.8

Inputs

Activities

Outputs



Goal

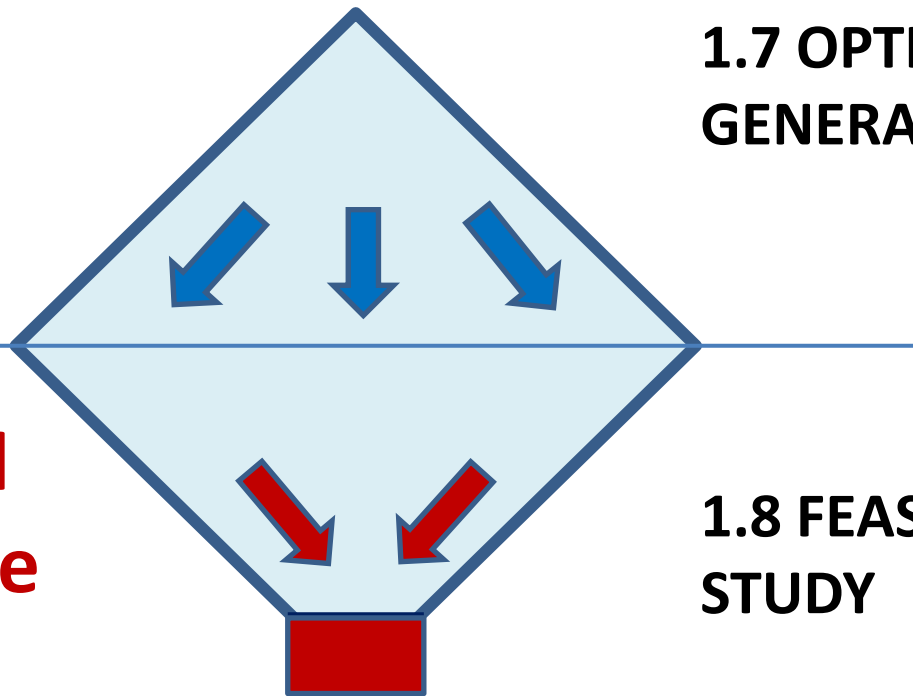
To open the
scope of
potential
solutions

in order to get

**an optimised
set of feasible
measures**

**1.7 OPTION
GENERATION**

**1.8 FEASIBILITY
STUDY**



OPEN THE SCOPE OF POSSIBLE OPTIONS



Creativity

Options should not be evaluated at this stage,
but the scope of potential solutions should be
as open as possible

and traditional „idea killers“ should be
overcome



Ideas killing your creativity

1. Don't forget, we have to make money, too.
2. You will never be able to sell these ideas to the management.
3. Let's think about the details later.
4. I know that it won't work.
5. We are too big/too small for this.
6. We have tried/thought about this before.
7. This is bound to be too expensive.
8. This is neither the time nor the place for such a discussion.
9. It means work.
10. We have always done it like this – why should we change now?
11. You don't seem to get the problem.
12. Let's discuss this later.



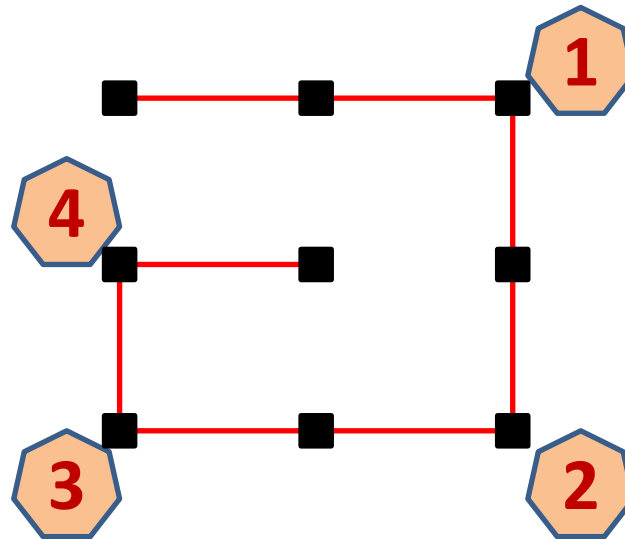
Ideas killing your creativity

13. Our company (our situation) is different.
14. Let somebody else try this first.
15. This does not fit in our long-term plans.
16. Talk to such and such, that's his task.
17. We have already overspent/used up this year's budget.
18. It won't work and it is against our strategy.
19. We have no time to lose for this.
20. It sounds good in theory, but in practice it is another story ...
21. We don't have enough/not the right employees.
22. We are not ready for this idea yet.
23. It is too late to change now ...



EXERCISE: „9 dots“

Link the 9 dots with straight lines, which are connected. Your goal is to minimise number of turns as they are cause of inefficiency within this system. Here is an example of existing system with 4 turns. Your first target is to reduce the number of turns to 3. Ideal („zero waste“) situation would be to identify solution with zero turns.



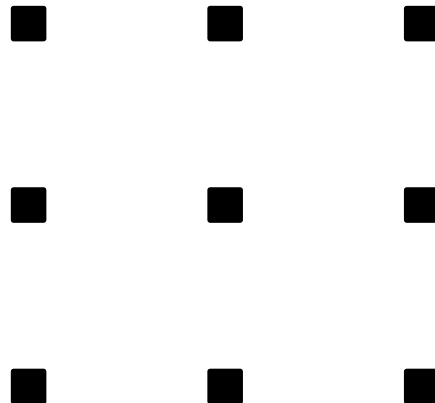
EXERCISE: „9 machines“

hand out

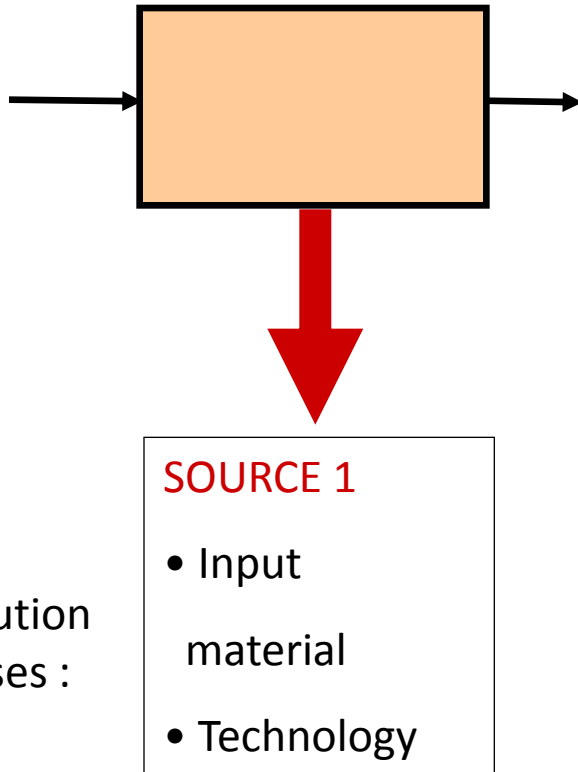
Link the 9 machines (symbolised by black squares) with straight lines, which are connected. It is not possible to move the rounds on the paper.

Your goal is to minimise number of turns connecting particular lines as these turns cause inefficiency within this system.

Your first target is to reduce the number of turns to 3. Ideal („zero waste“) situation would be to identify solution with zero turns.



For each pollution cause



Pollution source	Pollution causes	CP options
1	1.1 1.2	1.1.1 1.1.2 1.1.3 1.2.1 Etc.
n	n.1 n.2	n.1.1 n.1.2. Etc.

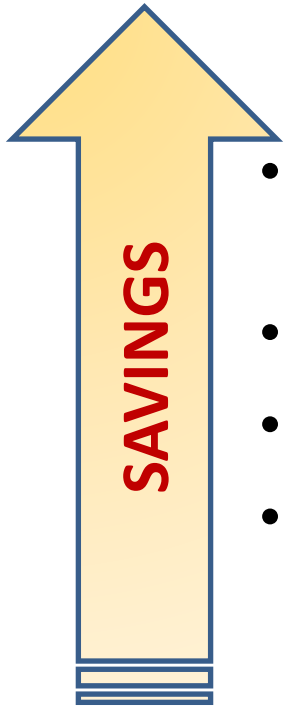
generate as many CP options as possible

UTILISE PREVENTIVE TECHNIQUES FIRST



Techniques to address sources of losses (pollution)

A hierarchy of 4 LEVELS:



- LEVEL I - Reduction of production inputs and waste generation at Source
- LEVEL II – Internal recycling and product valorization
- LEVEL III – External recycling and product valorization
- LEVEL IV – End of Pipe

Preventive techniques



LEVEL I:

Reduction of process consumption levels and waste stream generation at source

- 1) Good housekeeping
- 2) Raw and process materials substitutions
- 3) Better process controls and production planning
- 4) Technology upgrades
- 5) Technology/process modifications

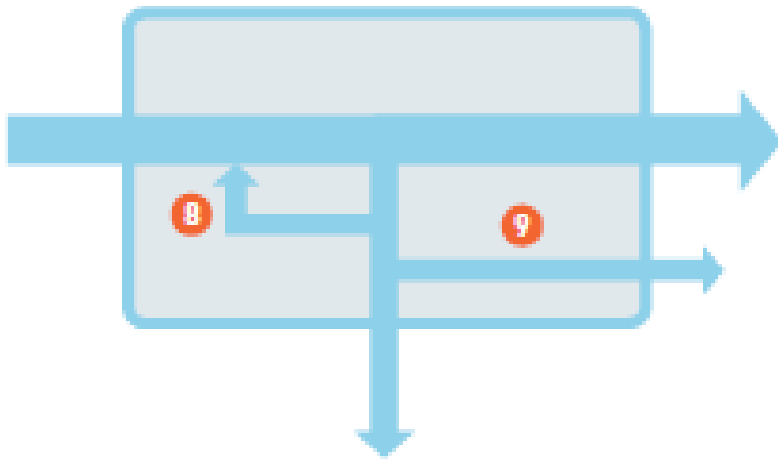
Product modification:

- 6) Product modifications
- 7) Packaging modifications

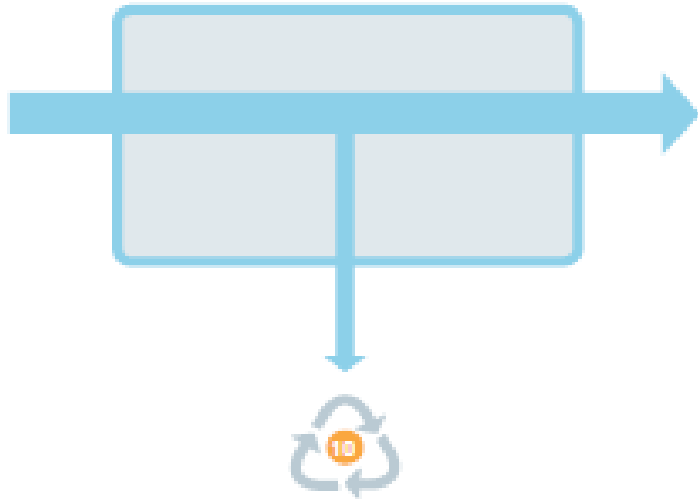
LEVEL II:

Internal recycling and by-product valorisation:

- 8) Internal recycling
- 9) Valorisation of by-products



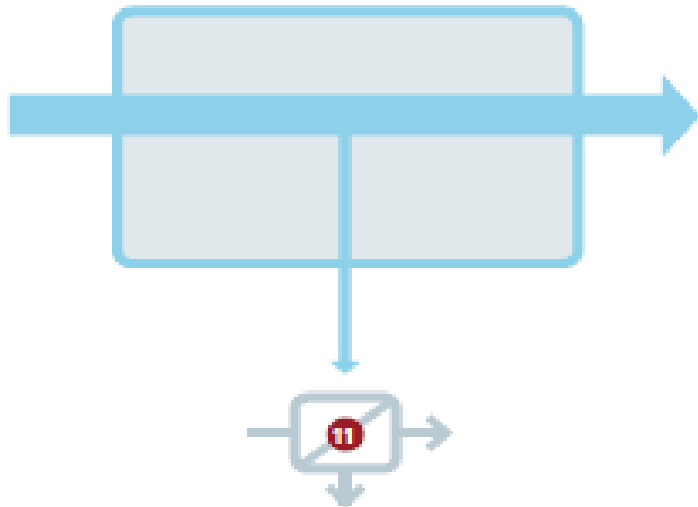
Other techniques



LEVEL III:

External recycling and product valorisation

- *no NPO reduced*
- *no neatural resources saved at the source*



LEVEL IV:

End-of-pipe technology

- *last chance how to meet environmental regulations*
- *economically non productive*
- *shifting pollution among environmental media*

Best Available Techniques (BATs)

Definition (EU-IPPC Directive): The techniques with highest environmental performance that can be combined with:

- As many positive associated environmental trade-offs as possible (cross-media effects balance)
- No negative effects on product quality
- No major difficulties to apply it (distinguish between new and existing situation)
- Lowest possible costs – reasonably available for an operator

References

- **EU BREFs –**

- Best Available Techniques Reference Documents**

- <http://eippcb.jrc.ec.europa.eu/reference/>

- State of the art by sector
 - BATs
 - Emerging technology

- **IFC Industry Sector Guidelines**

- http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehs_guidelines



CHECK LIST FOR SPECIFIC PREVENTIVE TECHNIQUES



Product and packaging change

- Substitute the product
- Increase the product life-time
- Change the materials
- Change the product design
- Use recycled materials
- Avoid critical components
- Reconsider packaging



Good housekeeping

- Improve information
- Change dosage/concentration
- Increase the utilization of process capacities
- Check cleaning and maintenance period
- Foster standardization/automation
- Improve purchasing, storage and distribution
- Carry out a material flow analysis



Technological modification

- Substitute thermo-chemical processes by mechanical alternatives
- Use counter current cascades instead of single-static rinse techniques
- Manage separate waste and wastewater streams
- Improve process conditions
- Foster recovery and reuse of materials
- Increase life time of chemicals/materials
- Reduce the infiltration of impurities
- Ensure airtight sealing of equipment



Internal (on-site) recycling

- Reuse materials (solvents, etc.)
- Reuse materials for different purposes (paper, solvents for lower-quality use, e.g. pre-cleaning, etc.)
- Close internal loops (water)
- Use returnable systems (packaging materials)
- Reclaim materials with high value



Waste logistics

Separation of waste and wastewater to:

- Set up closed cycles
- Facilitate recovery and re-utilization
- Minimize quantities of hazardous waste
- Minimize disposal costs
- Minimize cleaning expenses
(wastewater, exhaust gases, etc.)



EXERCISE

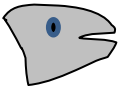


Option generation - EXERCISE

- Select source of pollution
- List causes of pollution generation
- Generate as many options as possible (utilising preventive techniques)
- Do not criticise options generated –

GOAL OF EXERCISE IS TO GENERATE AS MANY OPTIONS AS POSSIBLE



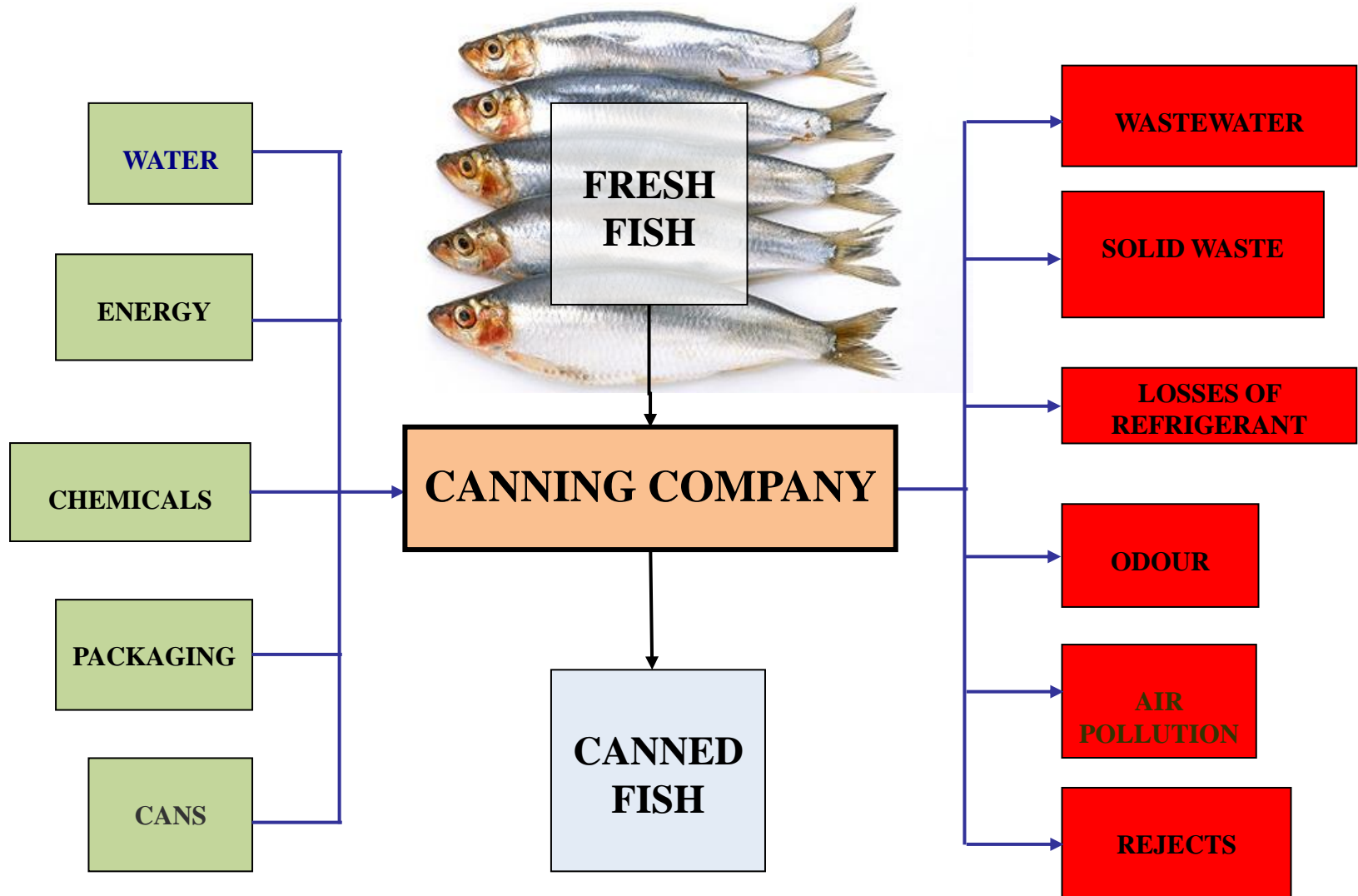
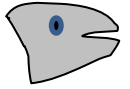


EXERCISE

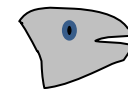
Production of canned fish



Qualitative balance of a fish canning company



EXERCISE: Major inputs and outputs of the canning process (per 1t of fish)



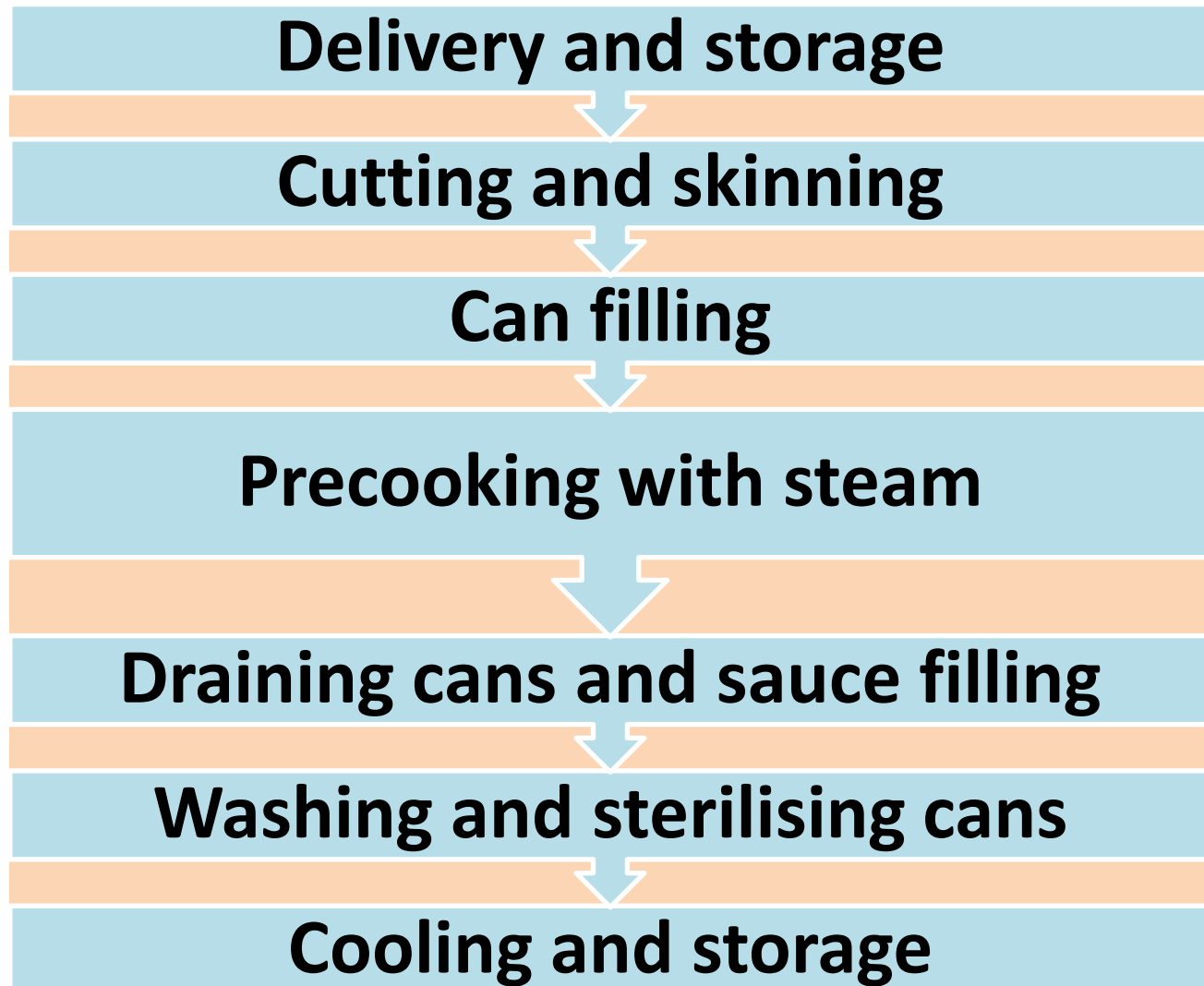
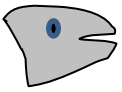
Other INPUTS:

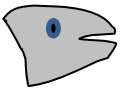
- Water 15m³
- Energy 150-190 KWh
- Chemicals

NPOs:

- Solid waste
 - 250kg heads/entrails
 - 100-150kg bones
- Wastewater
 - BOD 52 kg; COD 116 kg, N 3 kg

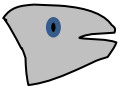
Process flow diagram of the canning process





STARTING SITUATION

- Following the detailed analysis based on NPOs costs, major losses are associated to raw material (fish) and energy flows and the **precooking of fish was identified as the priority area.**
- Pre-cooking is done by steam in open cans. Cooking equipment is open and it is not well insulated (there are visible high losses of steam). The liquid generated from the cooking process contains dissolved proteins and oil (there is processed fat fish with 7 g of oil per kilogram of fish). Cooking liquours are discharged into the waste water (there is an effective drainage within the cooking room which collects all waste water with high oil content, the fat is regularly removed by stream of water and manually).



STARTING SITUATION

Priority flows (and goals):

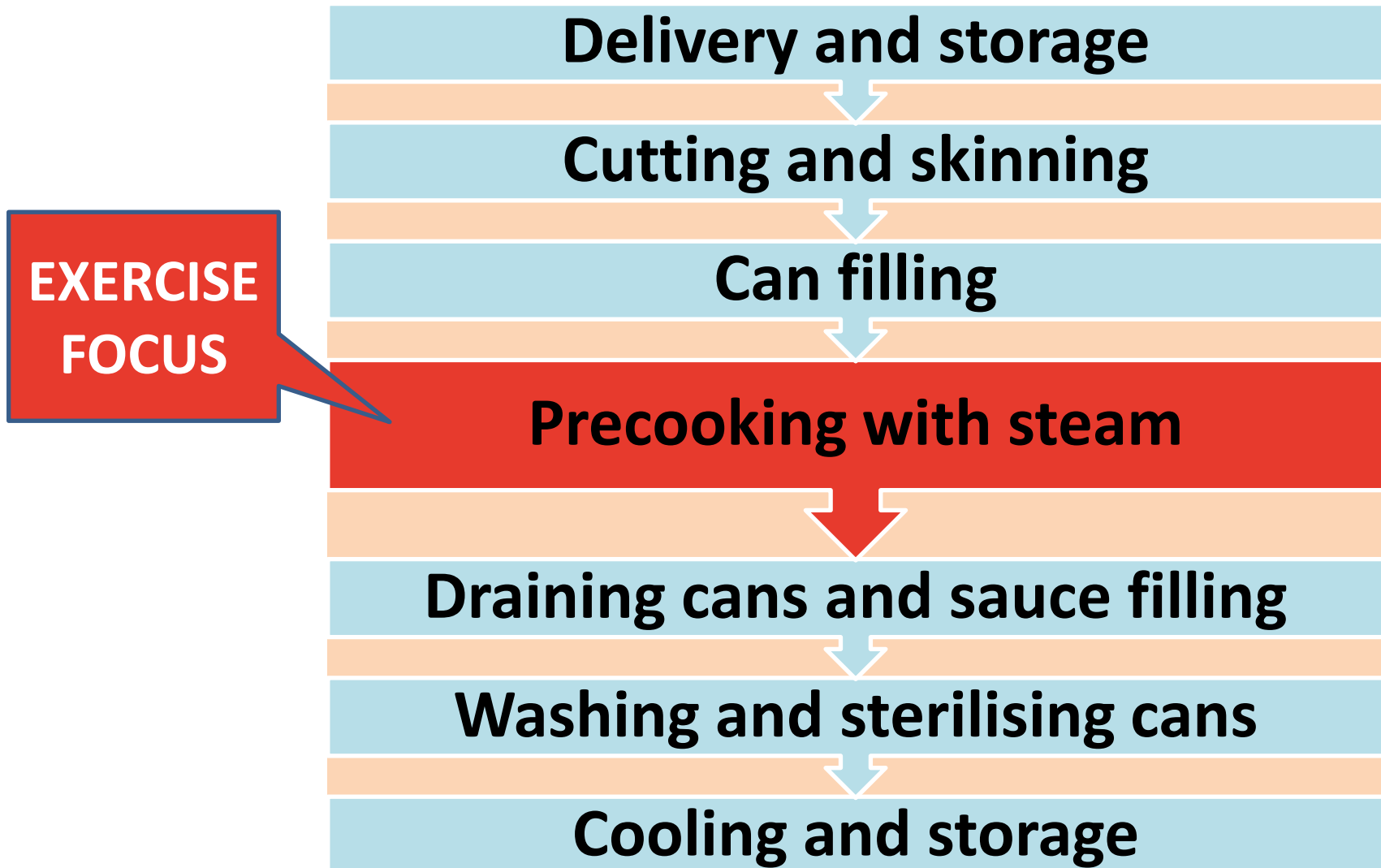
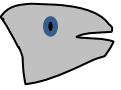
- Steam and electricity (increase energy efficiency)
- Fish (decrease losses of raw material)

Priority area:

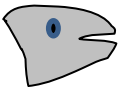
- Precooking



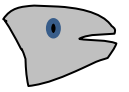
Process flow diagram of the canning process



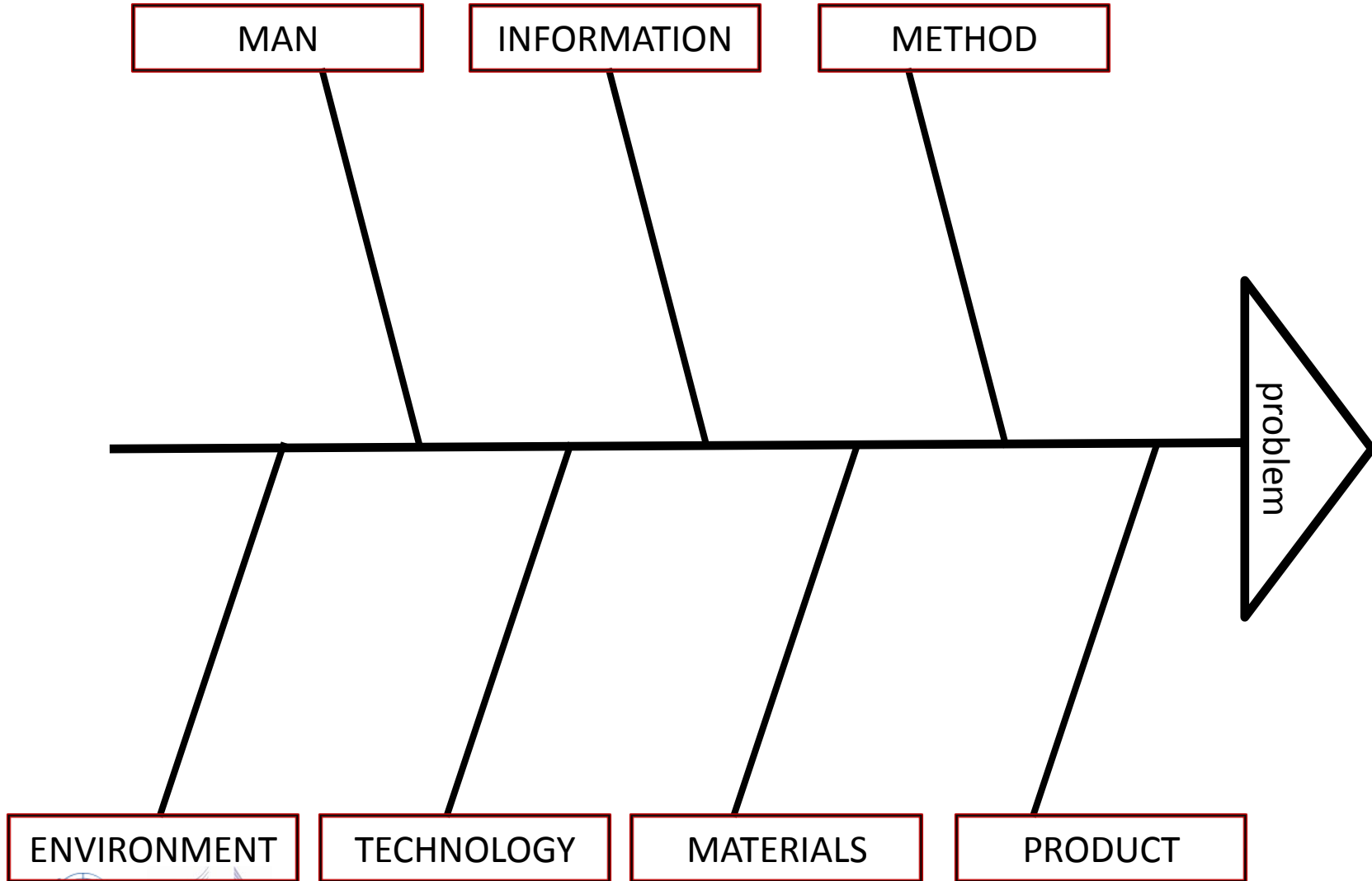
Tasks

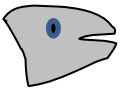


- Split into groups
- **Identify causes of losses within the focus area (pre-cooking process)** with focus on raw material (fish) and energy flows (utilize the fish bone template)
- **Generate options for reduction of losses for each cause identified in the previous step, within the focus area. YOUR GOAL AT THIS STAGE IS NOT TO FIND FEASIBLE MEASURES BUT TO GENERATE AS MANY OPTIONS AS POSSIBLE**
- Discuss your experience in a plenary



Cause and Effect Analysis in Resource Efficiency





Inspiration for plenary discussion

- What is value added of option generation within a broader team? Did you inspired each other? Did some clearly unrealistic idea brought some new option which could be potentially feasible?
- Did you succeeded to generate options without criticising specific ideas? Why is it difficult to be creative without criticising new ideas?

Linkages with EMS

EMS
Not in place

- A management system protocol could be put in place that identifies and develops improvement options using preventive techniques

EMS
In place

- The existing EMS/EnMS documentation could be reviewed to integrate a procedure for generating improvement options using preventive techniques

Conclusions

- Some ideas for improvement options are usually already available from the previous TEST steps, but it is important to focus on exploring additional options
- The focus during this step should be on the quantity of options: More options lead to better measures
- Brainstorming is an effective and recommended technique for option generation
- Preliminary ideas for improving the information systems could be also recorded here



Thank YOU for your Attention

