

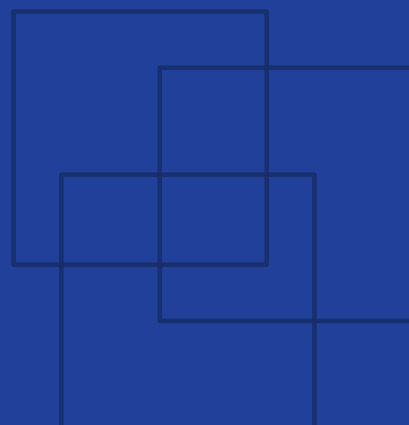


International
Labour
Organization

Cleaner production

2 – Reducing waste and pollution

Production systems



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First published 2019

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ISBN: 9789220326954 (web pdf)

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Printed in Thailand

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Factory Improvement Toolset

The Factory Improvement Toolset (FIT) is an innovative self-facilitated, activity-based learning approach designed by the International Labour Organization (ILO) to create more decent and sustainable employment. FIT supports manufacturers in global supply chains to improve productivity, competitiveness and working conditions by upgrading production systems and factory practices.

FIT has been developed to be a sustainable, time- and cost-efficient option for supporting factories to enhance productivity through improved business practices and working conditions. FIT focuses on areas of production improvement and actions to be taken specific to each participating factory. It can be utilized as stand-alone learning tools or to complement other training programmes.

With each module lasting no more than 2.5 hours, FIT enables factories to train personnel, whilst minimizing interference with production realities. The easy-to-use methodology makes it possible to rapidly scale the implementation to reach a large cohort of trainees across multiple production facilities.

Working in small groups, participants review real-life situations and engage in discussions to determine improvements to be made in factory without an external trainer or specialist. This self-facilitated, activity-based and highly participatory learning approach positions participants as both student and teacher and makes the toolset self-tailored to the needs and interests of each group.

About this module

This FIT module “Cleaner production 2 – Reducing waste and pollution” is a training for garment manufacturers to become familiar with the concept and mechanisms of cleaner production. Participants will work on implementing cleaner production strategies to reduce waste and pollution in their factory. This module takes about 2.5 hours to complete.

Upon completion of the training, participants should have:

- Learnt how to identify and eliminate toxic materials in the factory.
- Learnt how to identify sources of waste and pollution (what) in the production process (when) and how to identify their root causes (why).
- Learnt how to generate and select cleaner production solutions to address root causes.

The **Factory Improvement Toolset** of the **International Labour Organization (ILO)** are developed and provided by the ILO's **Enterprises Department**.

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Guidelines for successfully using the training tool

Read out-loud

The FIT tool is designed for participants to take turns reading the instructions in the modules out loud to the group. At least one member of the group should be selected in the beginning of the session to take this responsibility.

Work as a group

Always work in groups of 5-7 during a FIT session. The programme will not be successful if participants work independently or do not collaborate with each other.

Be active

Encourage everyone in the group to actively contribute to the discussion. Ensure that no group member dominates the discussion or does not participate at all.

Monitor the time

Select one member of the group to monitor the time for each activity and remind the group when it is time to move to the next exercise.

Complete the action plan

Complete the action plan at the end of the session. This will help ensure that FIT results in improvements in the factory. Review the plan a while after the session to make sure that actions in the plan has been completed accordingly.

Icons

A set of icons is used throughout the modules to provide easy to recognize reference points for different tasks within each session and activity.



Read out loud

One member of the group should read out loud to the rest of group.



Knowledge link

Knowledge and skills are linked to other FIT learning resources and support.



Time allotted

Indicates how much time each sessions and activity should take.



Supplies needed

Indicates that supplies may be necessary to complete the session.



Begin step-by-step instructions

Indicates that the step-by-step instructions for an activity are beginning.



Think about it

Indicates additional information for the participants to think about.

Measuring your performance

Measuring operational efficiency is a key aspect of running a productive factory. The box(es) below guides you in understanding which measurement indicator(s) can be used to measure and evaluate the performance of your factory in relation to the topic of this FIT module.

| | |
|--------------------|---|
| Indicator 1 | Material waste (Kg) |
| Definition | The amount of material (fabric, thread, trims, cardboard, packaging, etc.) wasted in your factory over a certain period of time (such as one month). |
| Purpose | To understand how much material gets wasted in your factory, set a material waste reduction target, and begin to identify ways to reduce material waste in the factory. |
| Calculation | Pick up all material waste and store it in different bins (fabric, trims, others) in each production room (sampling, cutting, sewing, finishing, packing), then weigh it daily or weekly and record the quantities. |
| Frequency | Calculate and record monthly. |
| Responsible | Department managers & Designated administrative staff |

| | |
|--------------------|--|
| Indicator 2 | Water consumption per unit of production / per employee (Ltrs) |
| Definition | The amount of water used in your factory over a certain period of time to produce one piece of garment, or for each employee. |
| Purpose | To understand how efficiently water is used in your factory, set a water consumption target, and begin to identify ways to reduce water consumption and water costs in the factory. |
| Calculation | If you are a washing plant: Total water used in litres / total # of garments produced If you are a garment manufacturer: Total water used in litres / total # of workers in the factory |
| Frequency | Calculate and record monthly. |
| Responsible | Production manager / Designated administrative staff |



Session 1

Business case study

Goals

Preparing you for the type of discussions you will have with other group members throughout the learning module and understanding the benefits of being exposed to different perspectives.

Understanding the importance and benefits of cleaner production for the factory.

Session 1

Overview



One member should read the full session out loud to the rest of group



15 minutes



Learning manual, pens, markers and poster paper

A business case study presents a real-life situation for learners to reflect on and discuss with other group members. By discussing the case, students learn from others' ideas and perspectives, and develop an understanding of the topic at hand within the workplace.



One group member reads the case study out loud



The whole group discusses the case study



Everyone develops a deeper understanding of the topic

Activities

Activity

1



15 minutes

Case study review and respond

The case study below presents a situation that could happen in real life.



Instructions:

- 1) As a group, listen to one member read the case study below while following along in your learning module.

Sita is a new production manager at the HS garment factory. She hears that the factory has polluted the nearby river by releasing polluted waste water into it, and must pay a large fine to the government. This also causes a lot of waste as water is not re-used, which costs the factory a lot of money. What's more, Nola, the OSH manager, tells Sita that many cutting and sewing room workers complain of eye and skin irritation. Nola has found out that this is due to harmful chemicals sprayed on the textile to protect it.

To avoid pollution, the Management installs filters and treatment tanks to treat the polluted water. But, Sita thinks that this is not enough to avoid waste. She consults with all supervisors and workers in the washing unit to discuss solutions to reduce water waste. They decide that treated water will be re-used for housekeeping. Chemicals used for washing are replaced with less harmful bio-degradable products. Machine leaks are repaired. Workers are instructed to use only as much water as is needed. Nola coordinates with suppliers through Merchandisers to avoid toxic chemicals being sprayed on new fabrics, and replace them by other non-harmful options.

As a result, no more polluted water is discharged into the river, and the factory avoids a shut-down. Water costs go down, and investments in installing tanks and equipment soon pay off. Workers' health is also protected as they are not exposed to toxic chemicals anymore.

- 2) Together, discuss Sita's situation by answering the three questions in table 1 on the next page.

Table 1. Questions about Sita's situation

1. What problems did Sita identify in the factory? What impact do these problems have on 1) the factory, 2) the environment and 3) the workers?
2. What solutions did Sita, the supervisors and workers find after discussing the issues?
3. What are the results of the solutions found by workers, supervisors and Sita for 1) the factory, 2) the environment and 3) the workers?

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Session 2

Learning about the topic

Goals

Identifying ways to eliminate toxic materials by replacing them with less harmful ones in the factory.

Learning how to identify sources of waste and pollution for each step of the production process, and how to identify their root causes.

Understanding common cleaner production solutions, and how to select the best solutions for your factory.

Session 2

Overview



One member should read the full session out loud to the rest of group

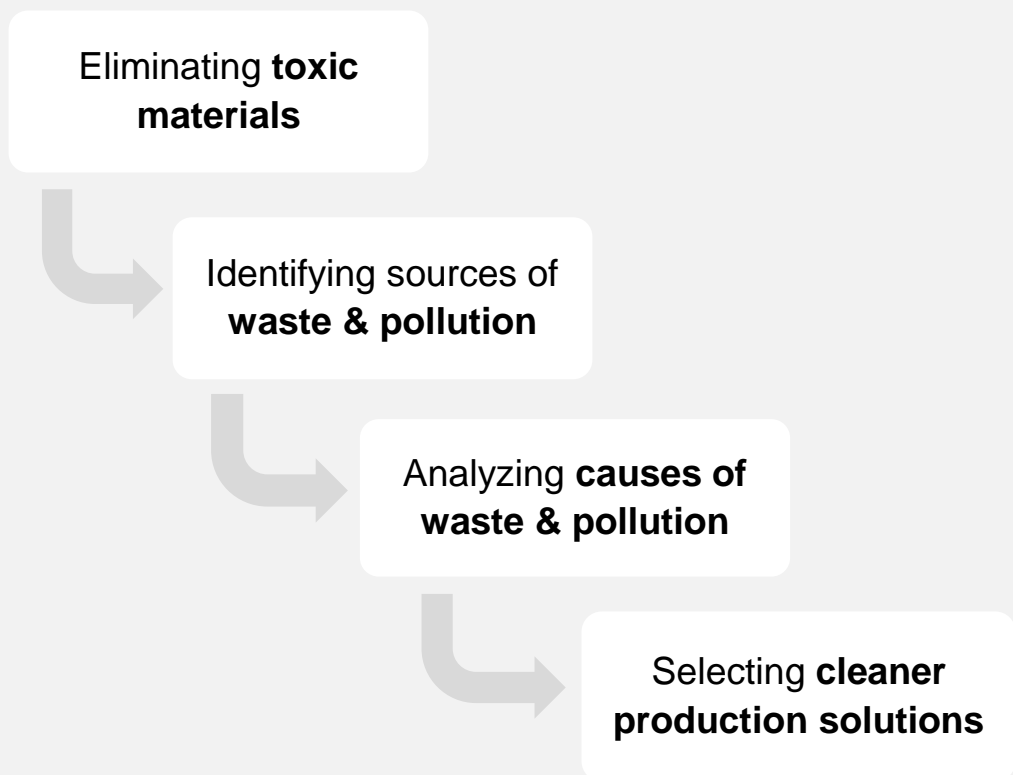


105 minutes



Learning manual, pens, and markers

This training module helps you improve the way your factory operates by focusing on cleaner production. Cleaner production is a strategy to keep waste and pollution to a minimum, and to use less resources (materials and energy) during production. This helps you increase productivity and protect people and the environment from health risks. Throughout this module, you will work on the four steps below.



First, you will learn more about how to eliminate toxic materials in your factory. Then, you will work towards identifying sources of waste and pollution in your factory, and analysing root causes for each source. Finally, you will select appropriate cleaner production solutions to address each cause.

Activities

Activity

2a



10 minutes

Cleaner production

Cleaner production is a strategy to keep waste and pollution to a minimum and to minimize the use of resources used in production. It can be applied to any factory. In this activity, you will discuss cleaner production.



Instructions:

- 1) Together, discuss:
 - How does cleaner production improve productivity?
 - How does cleaner production protect people and the environment?
- 2) Together, discuss: Why is cleaner production important for your factory? Then, have a participant read aloud the text box below.



Cleaner production includes three pillars:

1. Saving inputs (raw materials and energy).
2. Eliminating toxic raw materials.
3. Reducing the quantities and toxicity of waste / emission.

In this module, you will focus on #2 & #3. To learn more about #1, ask for the “Cleaner production 1” module!

Activity

2b



20 minutes

Eliminating toxic materials

An important way to avoid pollution is to **eliminate** toxic or harmful raw materials and replace them with other materials that cause no or less damage to factory staff and the environment. In this activity, you will identify ways to eliminate toxic materials in your factory.



Instructions:

- 1) Have a participant read aloud the scenario in table 2. Then, discuss the three questions in the table.
- 2) Together, look at the list of common toxic materials in table 3 (left column), and circle those that you may be using in your factory.
- 3) Together, look at the solutions for eliminating toxic materials in table 3 (right column), and match each with the toxic materials it helps address by drawing a line. Solutions are at the bottom of the page.

Table 2. Raw materials

Scenario: Factory T. recently had a shipment rejected in Europe, as garments contain large quantities of lead, a toxic metal often found in dyes which can lead to poisoning. This is a big loss for factory T., and will reduce buyers' trust. What's more, factory T. was recently fined by the government for releasing polluted water containing toxic detergents and bleach into a nearby river. The river is now unsafe to fish in and water crops with, and children who swam in the water suffer from skin irritation. In factory T., workers in the cutting room often complain of throat, eye and skin irritations. This is due to formaldehyde, a chemical which is added to textile. It is released during cutting and inhaled by workers, causing irritations.

1. What were the consequences of using toxic materials for the environment and the nearby community?

2. What were the consequences of using toxic materials for the workers?

3. What were the consequences of using toxic materials for the factory? What may the consequences have been for consumers?

Table 3. Toxic & harmful materials

| Materials | Solutions |
|--|--|
| 1. Fabrics with certain chemicals on them | A. When possible, use enzyme wash as it is the safest. Avoid bleach and acid wash. Never use PP (potassium permanganate) spraying! It is extremely harmful to workers. |
| 2. Plastic wrapping, polybags, etc. | B. Avoid using dyes containing lead, or azo dyes. Sometimes, those can be replaced by natural dyes. |
| 3. Toxic cleaning chemicals | C. Avoid fabric detergents containing NPE (nonylphenol ethoxylates). Replace them by “green” fabric detergents”. |
| 4. Toxic dyeing chemicals | D. Consult buyers to agree on how to replace plastic packaging with paper, cardboard, or biodegradable plastic. |
| 5. Toxic textile / fabric detergents | E. For housekeeping, use “green” cleaning products, which are less toxic to people and the environment, and often cheaper. |
| 6. Toxic washing chemicals (for finishing) | F. Consult your suppliers to know what chemicals are added to the fabric. Some, such as formaldehyde, should be avoided and replaced with less harmful ones. |

Solutions: 1. F; 2. D; 3. E; 4. B; 5. C; 6. A.

Activity

2c



25 minutes

Sources of waste and pollution

To reduce waste and pollution, it is important to **identify their sources** in your factory (what is wasted, where). Waste is any liquid, emission or material that is left over or discarded during or after production. It is often polluting. In this activity, you will learn how to identify sources of waste and pollution.



Instructions:

- 1) Together, look at the word cloud of outputs in table 4, and circle those that are generated in your factory. If you can think of other outputs, add them to the table.
- 2) Together, fill in table 5 by listing outputs (waste & pollution) produced in each step of the production process in your factory.
- 3) Together, discuss and estimate the monthly quantity of waste produced in each step of production (in kg, litres, metres, etc.), and write it down in the third column in table 5.
- 4) Together, discuss the three questions in table 5.

Table 4. Outputs

Outputs (Waste & pollution produced by production)

| | | | |
|-----------------------------------|-----------------------|-----------------------------------|---------------------------|
| Smoke / gas | Waste water | Leftover fabric / Fabric waste | Used paper / cardboard |
| Leftover thread / Thread waste | Leftover trims | Used plastic | Steam / heat |
| Chemical waste | Wasted electricity | Defective garments | Unshipped garments |
| | | | |
| | | | |



Although it is important to address all sources of waste and pollution in the factory, you should prioritize addressing the main sources (those that produce the most waste / pollution).

Table 5. Your outputs

| Steps | Outputs (waste & pollution) | Quantity |
|--------------------------------|--|--|
| Storing | | |
| Cutting | Example: Fabric waste, plastic waste (wrapping), paper waste from samples / markers. | 20 mtrs fabric 10 kg plastic 10 kg paper |
| Sewing | | |
| Washing & finishing | | |
| Packing & shipping | | |

Your main sources

1. What is the main sources of waste and pollution in your factory (the one that produces the most waste/pollution)? Example: Fabric wasted during cutting.
2. For this source: What do you do with the waste?
3. For this source: Is any polluting, toxic or dangerous waste produced?

Activity

2d



20 minutes

Analyzing root causes

Once you have identified your main source of waste and pollution, you can **analyse its root causes** (why waste / pollution is produced). This will help you come up with better solutions. In this activity, you will learn how to identify the root causes of waste and pollution.



Instructions:

- 1) Together, look at table 6 showing 14 questions that can help you identify causes of waste and pollution. Then, discuss: Do you ever ask yourself these questions in your factory?
- 2) Together, fill in table 7 by identifying the root cause(s) for your main source of waste and pollution identified in the previous activity. Use the questions in table 6 to guide yourself. Remember, there is often more than one root cause!

Table 6. Identifying causes of waste

| Category | Questions you need to ask |
|--------------|---|
| Raw material | <ol style="list-style-type: none">1. Do you use unnecessary raw materials that could be eliminated?2. Is there excessive material ordering by Merchandising?3. Are you using any polluting or toxic materials that could be replaced? |
| Process | <ol style="list-style-type: none">4. Is sampling carried out accurately?5. Is marker planning / marker making carried out efficiently?6. Are there any polluting or wasteful washing or finishing processes?7. Are cutting and sewing processes carried out with quality? |
| Equipment | <ol style="list-style-type: none">8. Are there old, outdated sewing machines that consume a lot of electricity or seep oil onto the garment during sewing?9. Is there inefficient or poorly maintained equipment in cutting and finishing?10. Are machines and equipment used properly?11. Do you have proper lighting (direction, position, necessary lux illumination) at the point of work? |
| Workforce | <ol style="list-style-type: none">12. Is the workforce aware of the need to reduce waste and pollution?13. Is the workforce trained on how to reduce waste and pollution?14. Is the workforce aware of the monthly waste numbers (e.g. monthly fabric waste, thread waste)? |

Table 7. Analyzing root causes

| Outcome | Root cause(s) |
|---|---|
| <p>Example 1: Wasted water</p> | <p>Equipment: The washing machines have leaks. Workforce: Staff don't fill each machine up to maximum capacity. Process: The clean waste water is not being reused, just discharged into the river.</p> |
| <p>Example 2: Polluted water</p> | <p>Material: The water is full of harmful chemicals used for washing. Process: Water is not treated before being released or discharged.</p> |
| <p>Your main source of waste / pollution:</p> | |



Remember that cleaner production aims to prevent pollution and waste before they are even generated, not only disposing of it or controlling it! To do so, you need to address the **causes** of waste / pollution rather than just treat the symptoms.

Activity

2e



20 minutes

Cleaner production solutions

Once you have identified the root causes of sources of waste and pollution, you can **select solutions** to prevent it. Cleaner production solutions address root causes of waste and pollution. In this activity, you will learn about different cleaner production solutions.



Instructions:

- 1) Together, look at the eight cleaner production solutions in table 8, and put a ✓ on the right if you think it could be applied in your factory.
- 2) Together, match each example in table 8 with the corresponding solution by writing down its number on the right. Solutions are at the bottom of the page.
- 3) Together, fill in table 9 by brainstorming at least two solutions for each root cause identified in activity 2d. An example has been given to guide you.

Table 8. Cleaner production solutions

| Solutions | ✓ |
|--|---|
| 1. Good housekeeping: Keeping materials and workspaces clean, tidy and orderly, and repairing what needs repairing. | |
| 2. Better process control: Ensuring processes are efficient by monitoring e.g. temperature, pressure, pH, time, and speed. | |
| 3. Material substitution: Replacing toxic materials by less harmful ones, or buying better quality materials to increase efficiency. | |
| 4. Equipment modification: Adjusting existing equipment so that less material / resources are wasted, for instance by adjusting speed, heat, etc. | |
| 5. New process technology: Purchasing and installing more modern, more efficient equipment to improve process efficiency and reduce waste. | |
| 6. Onsite recovery and reuse: Collecting unavoidable waste, and reusing it in the same or a different part of the production process. | |
| 7. Creation of by-products: Collecting unavoidable waste to make another product, or selling it so that different products can be made. | |
| 8. Changing packaging: Reducing packaging while still keeping the garments well-protected. | |
| Examples | # |
| Adjusting the temperature of the dryer to avoid energy waste. | |
| Using fabric waste to make smaller size garments (e.g. cutting a S size from a M panel). | |
| Repairing all leaks in tanks and machines to save water and energy. | |
| Reusing rinsing water for dark colour fabrics in the washing process. | |
| Replacing toxic chemicals for washing by environment friendly chemicals. | |
| Installing a new jet-drying machine to save time and electricity during drying. | |
| Adjusting the speed of the cutting knife to reduce fabric waste from defects. | |
| Using recycled paper bags instead of plastic bags for packaging. | |

Solutions: 2, 7, 1, 6, 3, 5, 4, 8

Table 9. Selecting solutions

| Outcome | Cause(s) | Solutions |
|--|---|---|
| Example: Water waste | Water is not being re-used as there are too many chemicals in it. | 1. Treat then re-use water. 2. Use less harmful chemicals & re-use water |
| | Washing machines have leaks. | 3. Repair leaks. 4. Upgrade to new machine. |
| | Machine overflow after bleaching, during rotation. | 5. Increase rotation speed. 6. Adjust water level based on amount of garments. |
| Your main source of waste / pollution: | | |

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Session 3

Your action plan

Goals

Summarizing and revising the new knowledge gained.

Identifying concrete applications of the new knowledge that benefit your factory.

Session 3

Overview



One member should read the full session out loud to the rest of group



20 minutes



Learning manual, pens, and markers

Throughout this module you have gained knowledge on how to eliminate toxic materials, identify sources of waste and pollution, analyse their causes, then select adequate cleaner production solutions.

Eliminating **toxic materials**

Identifying sources of **waste & pollution**

Analyzing **causes of waste & pollution**

Selecting **cleaner production solutions**

In this session you will think of ways to apply your new knowledge by reviewing best practices, and drafting your own cleaner production action plan.

Activities

Activity

3a



5 minutes

Best practices checklist

In this activity, you will review best cleaner production practices as a next step for evaluating your own and implementing improvements.



Instructions:

- 1) Together, look at the list of best practices in table 10, and put a ✓ in the column on the right if you use these practices in your factory.

Table 10. Cleaner production 2

| Best practices | ✓ |
|--|---|
| 1. Factory management systematically identifies sources of waste and pollution throughout the production process and in the factory. | |
| 2. Factory managers quantify the identified waste as appropriate (kg, ltrs, etc.) daily or weekly and record this quantity. | |
| 3. Factory management systematically identifies the root causes of each source of waste / pollution prior to selecting solutions. | |
| 4. Factory management selects and implements cleaner production solutions with time lines to address the root causes of pollution and waste. | |
| 5. Managers identify and replace toxic materials by less harmful ones whenever possible. | |



To learn more on how to further reduce energy and resource consumption in your factory, ask for the “Cleaner production 1 – Reducing resources use” module.

Activity

3b



15 minutes

Your action plan

In this activity, you will think of ways to apply your new knowledge to implement cleaner production in your factory by drafting your own action plan.



Instructions:

- 1) Together, fill in the action plan (table 11) on the next page. Identify a key problem that you want to solve and write down the solutions you identified while working on this module.

Table 11. Cleaner production 2 – Action Plan

| Problem identified | | | | |
|-----------------------------|------------------------------|---------------------------|-----------------|---|
| Solutions identified | Action(s) to be taken | Person responsible | By when? | How will improvements be measured? |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Cleaner production 2

The Factory Improvement Toolset (FIT) is an innovative self-facilitated, activity-based learning approach designed by the International Labour Organization (ILO) to create more decent and sustainable employment. FIT supports manufacturers in global supply chains to improve productivity, competitiveness and working conditions by upgrading production systems and factory practices.

FIT is being piloted in Asia under the regional Decent Work in the Garment Sector Supply Chains in Asia project funded by the Government of Sweden.

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ISBN: 9789220326954 (web pdf)