International Labour Organization

Cleaner production

1 – Reducing resources use

Production systems

Factory Improvement Toolset

First published 2019

ISBN: 9789220326930 (web pdf)

Photos: © ILO
Printed in Thailand

Table of Contents

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 'Introduction to cleaner production' is a training for garment manufacturers to become familiar with the concept and mechanisms of cleaner production. Participants will work on understanding and applying cleaner production strategies to save materials and energy in their factory. This module takes about 2 hours to complete.

Upon completion of the training, participants should have:

- Understood what cleaner production is and what its benefits are for the factory, people and the environment.
- Identified ways to save materials and energy during production.
- Learnt how to monitor input consumption and efficiency in the factory.

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

Authors: Alix Machiels, Sara Andersson, Charles Bodwell, Jayantha R. de Silva.

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	**Energy consumption per unit of production (kWh)**
Definition	The amount of energy (electricity) consumed in your factory over a certain period of time (such as one month) to produce one piece of garment.
Purpose	To understand how efficiently energy is used in your factory, set an energy consumption target, and begin to identify ways to reduce energy consumption and energy costs in the factory.
Calculation	Total energy used / total # of garments produced For electricity, consumption should be measured in kilowatts (kWh).
Frequency	Calculate and record monthly.
Responsible	Production manager / 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. When looking at the expenses for the last few months, she sees that material costs are very high – 70% of total costs! She also finds electricity and water costs high, especially since the factory does not wash garments in-house. However, no one has monitored (recorded) how much material, electricity and water is actually used each month, so she is not sure whether the factory just produced more, or if resources are used inefficiently and wasted, causing higher costs.

Sita talks to the administration department. Together, they agree to start monitoring how much water, electricity and material the factory uses each month, to understand why costs are so high. Then, Sita suggests measures to save more water and electricity, such as collecting rainwater for housekeeping, and automatically turning off the power during the lunch break. The managers of each production department also meet to discuss how they could save more material during production, for instance by reducing defects and making more efficient markers.

Very quickly, Sita sees water and electricity costs going down, which saves the factory a lot of money. Material costs stay high, but less waste is produced.

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 the factory and its workers?
2. What solutions did Sita and the other managers find after discussing the issues?
3. What are the results of the solutions found by Sita and the other managers for the factory and its workers?

This page has been intentionally left blank and can be used for note taking.

Session 2

Learning about the topic

Goals

Understanding what cleaner production is, its benefits for the factory, workers and the environment, and how it differs from other pollution reduction strategies.

Discussing measures to save energy and materials to reduce resources use in the factory.

Learning how to monitor energy and material use in the factory and the associated costs and efficiency.

Session 2

Overview

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

100 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 employees and the environment from health risks. Throughout this module, you will work on the three steps below.

Understanding cleaner production

Reducing inputs
(materials, water, energy)

Monitoring inputs

First, you will learn more about cleaner production and its benefits. Then, you will discuss ways to save inputs (energy and raw materials) in the factory. Finally, you will learn how to monitor energy use and cost in the factory.

Activities

Activity
2a

15 minutes

Understanding cleaner production (1)

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 learn more about cleaner production and its benefits.

Instructions:

1) Have a participant read aloud the text box below, and make sure everyone understands. Then, look at the image below the text box.

2) Together, look at the word cloud of inputs and outputs in table 2, and circle those that are used / generated in your factory. If you can think of other inputs / outputs, add them to the table.

3) Together, look at the benefits of cleaner production in table 3, and tick ✓ on the right if you think it is important for your factory.

Cleaner production is a strategy to:

1. Use as few resources (Inputs) as possible for production.
2. Keep waste and pollution (Outputs) to a minimum.

…while producing the same amount of or more garments than before, and protecting the environment! Cleaner production is a step towards Green production.

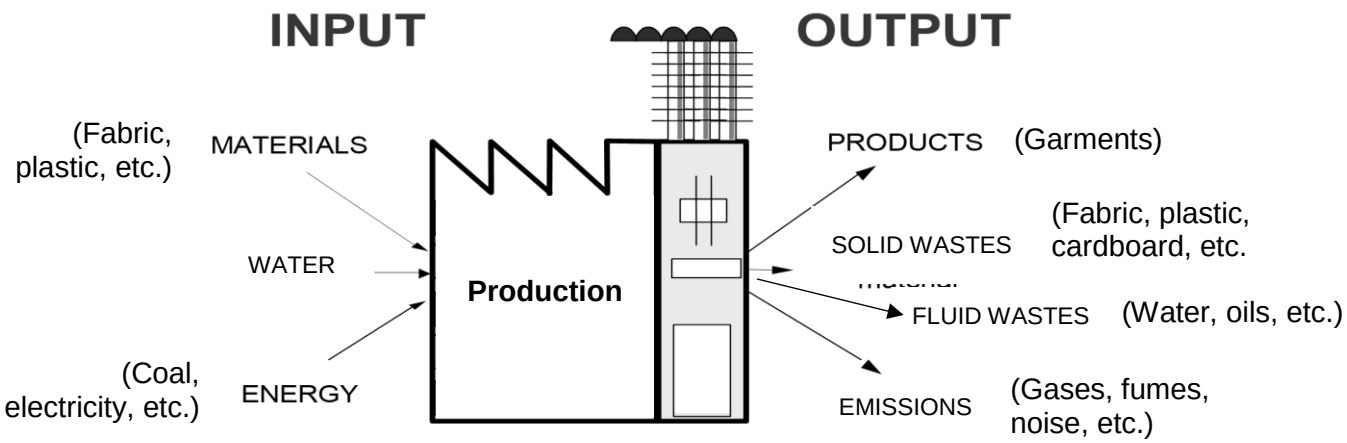

Table 2. Inputs & outputs			
Inputs Resources / materials needed for production		**Outputs** Waste & pollution produced by production	
Fabric	Chemicals	Leftover fabric / Fabric waste	Used paper / cardboard
Thread	Trims	Used plastic	Steam / heat
Fuel / oil	Electricity	Smoke / gas	Waste water
Plastic bags / wrapping	Water	Leftover thread / Thread waste	Leftover trims
Cardboard / paper	Coal	Wasted electricity	Chemical waste
		Defective garments	Unshipped garments

This module will focus on Inputs (how to reduce resources use). To learn more on how to reduce Outputs (waste & pollution) in your factory, ask for the “Cleaner production 2” module!

Table 3. Benefits of cleaner production	
Benefits	✓
1. Improving health and safety at work by reducing health risks.	
2. Avoiding pollution to the surrounding community and environment.	
3. Lowering material and energy costs.	
4. Improving production efficiency and productivity.	
5. Increasing profitability by reducing costs.	
6. Improving production processes in the factory.	
7. Improving the image of the factory to attract workers and buyers.	
8. Avoiding the risk of getting fined or shut down for breaking the law.	

Activity

2b

20 minutes

Understanding cleaner production (2)

Cleaner production is different from other pollution reduction strategies because it helps avoid waste and pollution before it is even generated. In this activity, you will learn more about this approach.

Instructions:

1) Together, look at table 4, then discuss: Which step(s) do you apply in your factory? Then, have a participant read aloud the text box on the next page.

2) Have a participant read aloud the three scenarios in table 5. For each scenario, indicate which step(s) the factory implemented by ticking ✓ in the right column. Then, discuss the two questions in the table. Solutions are at the bottom of the page.

3) Have a participant read aloud the text box below table 5.

Table 4. Steps of pollution & waste reduction

Step 1	Step 2	Step 3
Reduce waste <u>before</u> it is generated.  Examples: - Reducing water and electricity use - Eliminating polluting chemicals	**Re-use waste <u>after</u> it is generated.**  Examples: - Re-using boxes in good state to ship new orders - Reusing rinsing water for washing	**Re-cycle waste <u>after</u> it is generated.**  Examples: - Selling old unusable cartons to a paper mill - Using leftover materials to make other products

Resources that cannot be reduced, re-used or re-cycled should be disposed of responsibly! You have a responsibility and the legal obligation to do so. If you pay someone to dispose of waste, you should also ensure that they dispose responsibly.

Table 5. Cleaner production scenarios			
Three factories want to reduce water waste and pollution:	**Step 1**	**Step 2**	**Step 3**
Factory A takes measures to reduce water consumption by installing sub meters to measure water use and timers to shut it off automatically. It also installs a water treatment tank, and replaces toxic cleaning chemicals with less harmful versions.			
Factory B also installs water treatment tanks, but most of the treated water is now re-used for washing garments. As a result, water costs decrease further, and this soon covers the cost of the treatment tanks.			
Factory C also treats and re-uses water, and tries to reduce consumption. Water that cannot be re-used to wash garments is used for housekeeping. Water that cannot be re-cycled is discharged responsibly. After treatment, chemical levels are checked before it is discharged to the public drain.			
1. Which factory was the most successful in reducing waste and pollution and why?			
2. Which factory(ies) became more productive and profitable thanks to cleaner production?			

Cleaner production includes three pillars:

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

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

Solutions: Factory A → Step 1; Factory B → Step 1&2, Factory C → Step 1, 2, 3.

Activity

2c

10 minutes

Saving energy

To prevent waste and pollution before it is generated, you should start with **reducing inputs** (energy, water, materials), by using less inputs more efficiently. In this activity, you will learn ways to save energy.

Instructions:

1) Together, discuss: Which sources of energy do you use in your factory? Circle them in table 6. Then, discuss: Do you know how much energy you use every month, and how much you spend on energy monthly?

2) Together, look at table 7 listing measures that help save energy, and put ✓ on the right if you think it is applicable in your factory.

Table 6. Sources of energy

Water	Electricity	Coal
Fuel / Oil	Gas	Solar energy

Table 7. Saving energy

Good practices	✓
1. Do regular maintenance on all machines.	
2. Install individual switches to shut off machines when not in use.	
3. Use a central switch for total electricity shut-off in each line / section / room.	
4. Switch off all lights and machines at night and during lunch breaks.	
5. Install switches on local lighting to switch them off when not in use.	
6. Switch to machines, lighting fixtures and bulbs that consume less energy.	
7. Install clear roofing sheets in common areas to maximize natural light.	
8. Adjust lighting height and placement to provide enough light in the right direction (while keeping workers safe).	

Activity

2d

10 minutes

Saving water

To prevent waste and pollution before it is generated, you should start with **reducing inputs** (energy, water, materials), by using less inputs more efficiently. In this activity, you will discuss ways to save water.

Instructions:

1) Together, discuss:

- What do you use water for in your factory?
- Do you know how much water you use every month?
- How much do you spend on water monthly?

2) Together, look at table 8 listing some measures that can be taken to save water, and put ✓ in the right column if you think it is applicable in your factory.

Table 8. Saving water

Measures	✓
1. Install nozzles (device attached to a water pipe) to limit the flow of water.	
2. Repair all leaks as soon as they are identified.	
3. Install automatic valves that shut off the flow of water past a certain volume.	
4. Install sub water meters that measure the flow of water to avoid using too much.	
5. Install push taps for canteens and wash rooms.	
6. Collect rainwater to use for housekeeping or others.	

Activity

2e

20 minutes

Saving materials

To prevent waste and pollution before it is generated, you should start with **reducing inputs** (energy, water, materials), by using less inputs more efficiently. In this activity, you will discuss ways to save materials.

Instructions:

1) Together, discuss: What raw materials do you use in your factory? Write your answers down in table 9.

2) Together, discuss: Do you know how much material is used and how much is wasted in your factory every day / month?

3) Together, look at table 10 listing some measures that can be taken to save materials, and put ✓ in the right column if you think it is applicable in your factory.

Table 9. Raw materials

What raw materials do you use in your factory? Think of all the steps of production.
Example: Zippers.

To learn more on how to save raw materials and improve material productivity, ask for the “Material productivity” module!

Table 10. Saving raw materials	
Measures for saving materials	✓
1. Calculate material consumption during production planning, and use it for ordering. Limit excess ordering to about 3%.	
2. Unload, tag and store materials with care and in a systemic way to avoid materials getting lost or damaged.	
3. Inspect at least 10% of new materials, report defective quantities and types of defects, and accept or reject new materials based on inspection results.	
4. Issue stored materials, cut parts and garments with care and in a systemic way (using records) to avoid materials getting lost or damaged.	
5. Draw markers to match fabric widths. Draw short or mini markers with leftover fabric to avoid wasting it.	
6. Calculate fabric & marker utilization (during production) in the cutting room for each marker to maximize efficiency.	
7. Return leftover fabric to the stores. Record leftover fabric quantities, tag and store them for later use.	
8. Inspect cut parts and sewn garments methodically, and report defective quantities and defect types to work towards improving quality.	
9. Reserve specific areas for materials storage in each room, and always use bins or trolleys to transport them. Never place them on the floor.	
10. Ensure good housekeeping practices and check the factory regularly for dampness, sunlight, dust and others to avoid materials getting damaged.	

It is important to start monitoring how efficiently material is used in the factory using indicators such as total material waste (Kg), fabric / marker utilization (%) and order-to-ship or cut-to-ship ratio. To learn more, ask for the “Measuring productivity” module!

Activity

2f

25 minutes

Monitoring inputs

Energy and material use in the factory should be **monitored** (recorded) regularly. This helps you understand how much you use, and whether your solutions to reduce energy and material use are working. In this activity, you will identify ways to monitor inputs in your factory.

Instructions:

1) Together, look at the monitoring form in table 11, and make sure everyone understands. Then, discuss: Do you monitor resource and use and costs in your factory? If yes, how?

2) Have a participant read aloud the text box below. Together, answer the five questions in table 11 using the information in the monitoring form. Solutions are at the bottom of the page.

3) Together, look at the indicators of material efficiency in table 12 (left column), then discuss and write down in which production area this indicator should be used. Solutions are at the bottom of the page.

It is important to monitor how efficiently resources are used – and not just how much you use. Here are two important measures:

- **Water consumption per worker =** Total water consumption / total number of factory employees
- **Energy consumption per unit of production** = Total energy consumption / total number of garments produced

Table 11. Monitoring form						
Time period	Jan to June 2020		**Responsible**		Head of Admin.	
Resource:	Electricity		**Unit:**		Kilowatts (kWh)	
Time period	Jan 20	Feb 20	Mar 20	Apr 20	May 20	June 20
Garments produced	16,000	15,000	14,000	14,000	20,000	20,000
Usage	7,012	8,452	5,734	6,325	9,938	9,846
Cost ($)	3,049	3,239	2,746	2,953	3,854	3,784
kWh / unit	0.44		0.41	0.45	0.50	0.49
$ / unit	0.19		0.20	0.21	0.19	0.19
Time period	Jan to June 2020		**Responsible**		Head of Admin.	
Resource:	Water		**Unit:**		Liters (Ltrs)	
Time period	Jan 20	Feb 20	Mar 20	Apr 20	May 20	June 20
Workers	800	820	820	815	805	810
Usage	4,031	5,719	4,823	5,365	4,217	3,974
Cost ($)	2,012	2,905	2,411	2,724	2,108	1,842
Ltrs / worker	5.04		5.88	6.58	5.24	4.91
$ / worker	2.51		2.94	3.34	2.62	2.27

Questions to discuss

1. What is the energy consumption per unit of production for February?
   _____kWh / _____ pieces = _____ kWh per unit of production

2. What is the energy cost per unit of production for February?
   _____$ / _____ pieces = _____ $ per unit of production

3. Did the factory use more electricity in February or in May? Did the factory use electricity more efficiently in February or in May? Why?

4. What is the water consumption per worker for February?
   _____ ltrs / _____ workers = _____ ltrs per worker

5. What is the water cost per worker for February?
   _____$ / _____ workers = _____ $ per worker

Table 12. Material efficiency

Indicator	Production area(s)
1. **Material waste:** The amount of material waste produced, in weight (Kg).	Cutting, Sewing, Finishing, Packing
2. **Marker efficiency** (fabric utilization): The proportion of spread fabric used to make garments for each marker.	
3. **Marker efficiency** (marker utilization): The proportion of the marker used to make garments for each marker.	
4. **Re-cuts:** The percentage of garments that need to be re-cut due to being defective.	
5. **Thread consumption:** The amount of thread used to complete a style order (per garment).	
6. **Defects per Hundred Units:** The amount of defects found per hundred garments inspected.	
7. **Cut-to-Ship Ratio:** The proportion of cut garments that were actually shipped to the buyer.	

Solutions: 1) 0.56 kWh / unit; 2) 0.21$ / unit; 3) May; May, because energy consumption per garment is lower. 4) 6.97 ltrs / worker; 5) 3.54$ / worker

Solutions: 1) 0.56 kWh; 2) 0.50 kW; 3) May; 4) May, because energy consumption per garment is lower.


CAUTION WATER(WET)
5 S's

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 what cleaner production is, and on how to monitor and save energy and raw materials to reduce resources use in the factory and become more productive.

Understanding cleaner production

Reducing inputs
(water, materials & energy)

Monitoring inputs

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.

A resources monitoring form template is available online for you to print out and use in your own factory. To obtain it, contact your factory's FIT coordinator!

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 13, and put a ✓ in the column on the right if you use these practices in your factory.

Table 13. Cleaner production 1

Best practices	✓
1. The factory implements cleaner production as a strategy to prevent waste and pollution before it is even generated in the factory.	
2. The factory identifies and implements measures to save energy and water in the factory.	
3. The factory identifies and implements measures to save materials before and during production.	
4. The factory monitors energy, water and material usage and costs in a monitoring form.	
5. The factory calculates water and energy use per worker / per unit of production to understand resource efficiency.	

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 14) 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 14. Cleaner production 1 – Action Plan				
Problem identified				
Solutions identified	**Action(s) to be taken**	**Person responsible**	**By when?**	**How will improvements be measured?**

Cleaner production 1

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.

Decent Work Technical Support Team for East and South-East Asia and the Pacific

United Nations Building, 10th Floor
Rajdamnern Nok Avenue,
Bangkok 10200, Thailand
Tel.: 662 288 1234 Fax. 662 288 3058
Email: BANGKOK@ilo.org

ISBN: 9789220326930 (web pdf)