International Labour Organization

Managing machinery

Factory systems

Factory Improvement Toolset

First published 2019

ISBN: 9789220327012 (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

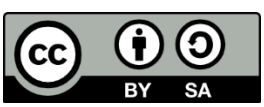
The FIT module on Managing machinery is a training for garment manufacturers to improve systems that support the factory. Participants will work on improving machine maintenance and safety to improve machine efficiency in the factory. This module takes about 2.5 hours to complete.

Upon completion of the training, participants should have:

- Understood the benefits of machine maintenance and safety for efficiency and safety.
- Learnt how to implement preventive machine maintenance in the factory, and record all maintenance activities.
- Discussed machine-related hazard and good practices for ensuring machine safety.
- Discussed how to train workers in machine maintenance and safety, and how to involve all staff in managing machinery more efficiently.

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	**Order cycle time / lead time (Days)**
Definition	The average amount of time in days that it takes you to process an order, from receiving the confirmed order to shipping the order.
Purpose	To understand how efficiently your factory operates, set a target for improvement, and begin to identify ways to process orders faster in the factory.
Calculation	Record the order cycle time (or lead time) for each order, then calculate the average. Note: You can also calculate your production cycle time to understand how long it takes to produce an order. Record the production cycle time for each order (from start of cutting to order shipping), then calculate the average.
Frequency	Calculate for each order, then calculate the average at the end of each year.
Responsible	Merchandiser / Production planning

Indicator 2	**Number of accidents and near-misses**
Definition	The number of accidents and near-misses (accidents that almost happened) that took place in the factory over a certain period of time.
Purpose	To understand how often accidents happen or almost happen in your factory, what type and where, and which measures to take to avoid future accidents.
Calculation	Record every accident and near-miss happening in the factory (separately in each department), and consult records every month to calculate the total.
Frequency	Calculate monthly
Responsible	HR manager / OSH manager

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 better why efficient machinery management is important in 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

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.

Ashish is a new Chief mechanic at the HS garment factory. Ashish reads factory records, and sees that machine breakdowns and injuries caused by needles happen frequently. After discussing with the mechanics, managers and several workers, he finds out that machine maintenance is only carried out when they break down, and there are no records of when the last maintenance was carried out. This causes production delays and sewing defects. Workers explain that needle injuries happen because many machines do not have guards. Or, workers remove the guard as it prevents them to see the needle point clearly.

To solve these problems, Ashish makes several changes. First, with each department, he sets up an annual maintenance plan for all machines. Mechanics prepare history cards and maintenance records for each machine, that show when the machine was maintained, repaired, or parts changed. Workers are trained in doing basic maintenance tasks such as oiling and dusting every day. All breakdowns are recorded in a new form. Then, he sets up a team of mechanics, sewing operators and supervisors to test a new needle guard that does not block visibility. New guards are added to machines that do not have one, and workers are told to never remove them.

Thanks to these changes, machines are kept clean and in good condition. Breakdowns happen less often, which reduces delays and defects. Machines are safer. There have not been any needle injuries over the last three months.

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

Table 1. Questions about Ashish's situation
1. What problems have Ashish and other staff members identified? What impact do these problems have on the factory and its workers?
2. What do Ashish and other staff do or change in order to solve these problems?
3. What are the results of these solutions 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

Discussing efficient machine management, its benefits, and how to measure it in the factory.

Understanding the importance of preventive machine maintenance and learning how to implement it and record maintenance activities in the factory.

Identifying machine-related hazards in the factory and discussing good practices to improve machine safety.

Discussing how to train and involve all staff in maintenance and safety processes.

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 will help you improve the organization of your factory by managing machinery more efficiently. Machines are resources which should be used as efficiently as possible by ensuring proper maintenance and safety. Breakdowns, malfunctions or accidents create order delays and quality defects, and threaten both productivity and your workers' health and safety. Throughout this module, you will work on the three topics below.

Machine **maintenance**

Machine **safety**

Involving **all staff**

First, you will discuss efficient machinery management and how to measure it in your factory. Then, you will learn how to organize preventive maintenance and make machines safer for all. Finally, you will discuss how to involve your workers in machine maintenance and safety.

This training module is based on the **Total Productive Maintenance** (TPM) system. TPM is an internationally recognized method for improving productivity in the workplace through better equipment maintenance and management.

Activities

Activity
2a

25 minutes

Machine efficiency

Machines are a type of resource. By using them **more efficiently**, you can avoid waste (of materials and resources), reduce defects and improve productivity. In this activity, you will discuss the TPM method, then assess your own factory situation and learn how to measure it.

Instructions:

1) Have a participant read aloud the text box on TPM below. Then, together, go through table 2 listing 12 benefits of TPM, and tick ✓ on the right if you believe it is important.

2) Together, go through the self-assessment in table 3 by answering the six questions. Then, discuss: How many "Yes" did you get? Do you think your factory could improve its machine management?

3) Have a participant read aloud the information on measurement in table 4 and make sure everyone understands. Then, discuss the three questions below the table.

Total Productive Maintenance (TPM) is a system that helps you manage and use machinery more efficiently by:
(1) ensuring regular machine maintenance,
(2) ensuring and promoting machine safety, and
(3) involving all staff in these processes.
The goal is to achieve zero breakdowns, zero accidents and zero defects in the factory.

Machine efficiency can also be improved through more efficient use of resources needed to operate them (electricity, water, etc.). To learn more, ask for the "Cleaner production 1" module!

Table 2. Benefits of TPM	
1. Less delays caused by machine breakdowns.	
2. Less resources wasted due to machines breaking down.	
3. Less materials wasted by machine misuse of malfunction.	
4. Productivity increases in all departments of the factory.	
5. Manufacturing costs are reduced.	
6. Less defects caused by machine breakdown, misuse or malfunction.	
7. Higher customer satisfaction (better quality, no delays).	
8. There are less, or no accidents caused by machines.	
9. Less pollution caused by machines (noise, dust, oil, etc.).	
10. Better teamwork at all levels of the factory.	
11. The workplace is kept cleaner, more orderly.	
12. Workers feel safer and more confident when using machines.	

Table 3. Self-assessment		
In your factory…	**Response**	
1. Are there sometimes delays or bottlenecks caused by machine breakdown or malfunction?	Yes ☐	No ☐
2. Have any machines been out of use in the past week or month due to breakdowns or malfunctions?	Yes ☐	No ☐
3. Do any machines operate slowly because they are old or not well maintained?	Yes ☐	No ☐
4. Are machines dirty, dusty or covered in objects and materials?	Yes ☐	No ☐
5. Are workers scared or hesitant to use certain machines because they find them unsafe?	Yes ☐	No ☐
6. Have machine guards been removed or destroyed?	Yes ☐	No ☐

Table 4. Measuring machine efficiency

To assess machine efficiency and safety in your factory, and evaluate improvements over time, it is important to measure these three things:

Number of breakdowns: Number of machine breakdowns in all areas of the factory over a certain amount of time (one week, one month, etc.).

Number of accidents: Number of accidents (from minor to severe) caused by machines over a certain amount of time (one week, one month, etc.).

Number of defects: Number of defects caused by machine malfunction in all areas of the factory over a certain amount of time (one week, one month, etc.).

1. Do you measure the monthly number of machine breakdowns in all departments of your factory?

   If so, what is the approximate number of machine breakdowns for last month?

   If not, how could you measure it from now on? Who should do it?

2. Do you measure the monthly number of accidents (caused by machines) in all departments of your factory?

   If so, what is the approximate number of accidents for last month?

   If not, how could you measure it from now on? Who should do it?

3. Do you measure the monthly number of defects (caused by machines) in all departments of your factory?

   If so, what is the approximate number of defects for last month?

   If not, how could you measure it from now on? Who should do it?

For better measurement, involve everyone in the measurement process. Encourage workers to report all breakdowns, accidents and defects. One person in each department should be responsible for recording all instances, and reporting the numbers to management monthly.

Activity

2b

20 minutes

Machine maintenance

Machine breakdowns or malfunctions create delays and defects, and can cause serious accidents. **Preventive maintenance** is necessary to make machines work better and longer, and protect your workers from harm. In this activity, you will learn how to implement preventive maintenance in your factory.

Instructions:

1) Have a participant read aloud the information on maintenance in table 5. Then, discuss: In your factory, what kind of maintenance do you carry out and why? Who is in charge of it?

2) Together, go through table 6 listing good practices for machine maintenance, and put a ✓ on the right if you apply it in your factory. Then, summarize what you could do to improve maintenance.

Table 5. Preventive maintenance

There are two types of maintenance:

(1) **Breakdown maintenance** is carried out when the equipment fails or malfunctions.
(2) **Preventive maintenance** is regular (e.g. monthly) maintenance (cleaning, oiling, inspection, etc.) to keep the equipment in good condition and prevent failure.

Machine cleaning should be scheduled daily as part of the manufacturing day. This helps prevent breakdowns and malfunctions, which reduces machine downtime, defects and accidents, and saves costs.

Machine maintenance should be part of a system to keep the factory clean, orderly and dust-free. To learn more, ask for the “Maintaining the factory” module.

Table 6. Machine maintenance	
Good practices	✓
1. Allocate time for machine cleaning in the daily production schedule, coordinating with supervisors and workers.	
2. Supply all workers with a basic tool kit for preventive maintenance (tweezers, small screwdriver, machine brush, cloth wipes).	
3. Train all workers in basic preventive maintenance tasks such as changing broken needles, bobbins, machine cleaning, adjusting thread tensions, etc.	
4. Train workers in basic troubleshooting skills (identifying the issue, its root cause and the correct solution).	
5. Other maintenance tasks should be carried out by qualified mechanics or technicians. A mechanic team should be set up if you do not have one.	
6. Machines should be cleaned and dusted daily. Dust accumulation can cause them to break down and harm workers' health when inhaled.	
7. Machines should be covered when they are not in use (during lunch breaks and overnight). Covers can be made using leftover fabric.	
8. The Chief Mechanic should prepare an Annual Maintenance Plan, showing which machines need to be serviced when.	
9. Each machine should have its own maintenance record, and its own machine history card, posted directly on the machine.	
10. Always keep utilization manuals for all machines and refer to them for maintenance steps, schedules, and repair instructions.	

Activity

2c

25 minutes

Keeping records

Maintenance activities should always be **scheduled and recorded** for each machines. Breakdowns should be recorded and analysed to improve maintenance. Each machine should have an identification code, written on the machine. In this activity, you will learn how to schedule and record maintenance.

Instructions:

1) Have a participant read aloud the text box below. Then, discuss: Do you use similar documents in your factory? Why, or why not?

2) Together, look at the maintenance plan (table 7) with examples. Discuss, then fill in the plan by listing five machines used in your factory, how frequently they should be maintained and when.

3) Together, look at the maintenance record (table 8) and history card (table 9) and make sure everyone understands. Then, discuss: Is machine #8476 in a good condition? Why or why not?

4) Together, look at the breakdown record in table 10, then discuss: Are breakdowns common in your factory? How long do they last?

Note: The information in table 7, 8, 9 is only used as an example, and does not necessarily reflect the reality!

To manage and maintain machinery efficiently, you need:

(1) **Annual maintenance plan**: Calendar prepared by the Chief Mechanic, showing which machine needs maintenance when, based on the manufacturer's recommended frequency.

(2) **Machine Maintenance Record**: Shows when each machine was last maintained and when maintenance is next due. It should be attached on the machine.

(3) **Machine History Card**: Shows when each machine was repaired or parts replaced. It should be attached on the machine.

(4) **Machine Breakdown Record**: Lists all breakdowns, with duration, machine type and cause. This to be analysed monthly.

Table 7. Annual Maintenance Plan

Chief mechanic: Jayanath S | **Approved:** 03 / 01 / 2019 | **Year:** 2019

		Month	January				February				March				April				May				…	
		Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	…
ID#	Type	Frequency																						
461	Lockstitch	Monthly	✓				✓				✓				✓				✓				✓	
253	Overlock	Monthly		✓				✓				✓				✓				✓				✓
336	Fusing	2 months			✓								✓								✓			
641	Washer 2kL	2 months				✓								✓										
945	Round knife	3 months							✓												✓			

Table 8. Maintenance Record

Servicing due: Every 30 days

Type: Overlock 4T		**Machine ID** #: 8476
Due on	✓	**Mechanic**
24 / 11 / 19	✓	Pat
24 / 12 / 19	✓	Pat
24 / 01 / 19	✓	Joao
24 / 02 / 19	✓	Tom
24 / 03 / 19		
24 / 04 / 19		
24 / 05 / 19		
24 / 06 / 19		

Table 9. Machine History Card

Servicing due: Every 30 days

Type: Overlock 4T	**Machine ID#:** 8476	
History	**Date**	**Mechanic**
Screw replaced	15 / 11 / 19	Joao
Lever repaired	20 / 12 / 19	Tom
Spring replaced	27 / 01 / 20	Tom
Jammed	12 / 02 / 20	

Table 10. Machine Breakdown Record

Chief Mechanic: Jayanath S. **Time period:** December 2019

Date	**Machine type**	**Machine ID#**	**Duration**	**Cause**
15 / 11 / 19	Overlock 4T	8476	½ day	Defective screw
24 / 02 / 19	Button attach	2842	1 day	Stuck button
05 / 03 / 19	Washing machine	3928	2 days	Water leak

To go further, analyze your maintenance records to identify common types of machine breakdowns and their causes. This can help you identify how to improve maintenance to further reduce breakdowns.

Activity

2d

20 minutes

Machine safety

All machines can cause accidents. Besides maintaining machines, there are many things you can do to improve **machine safety** and protect workers. In this activity, you will learn how to address machine safety hazards to better protect your workers' health and safety.

Instructions:

1) Together, look at the list of the three most common factory machine hazards in table 11 (left column). Then, discuss: Do these happen often in your factory? Can you think of other machine hazards?

2) Have a participant read aloud the text box below. Then, brainstorm measures to prevent each common hazard, and write down your ideas in table 11 (right column).

3) Together, go through table 12 listing good practices for machine safety, and put a ✓ on the right if you apply it in your factory. Then, summarize what you could do to improve machine safety.

All sewing machines are hazards due to the presence of a needle. Therefore, precautions should be taken, such a putting a needle guard or wearing protective glasses.

Table 11. Common machine hazards

Hazard	Measures
Cut fingers in the cutting room	
Needle prick (needle in the finger)	

Burns from steam irons	

To learn more about how to systematically identify and address hazards in your factory, ask for the “Introduction to Safety and Health” module.

Table 12. Machine safety	
Good practices	✓
1. Ensure workers are adequately trained on machine handling and machine safety before using new machinery.	
2. <u>All</u> machines must have an appropriate safety guard. If they don’t, you can make improvised guards using metal thread or hard plastic for instance.	
3. Workers should be trained to understand the importance of guards, and should never remove them or twist them out of the way.	
4. Guards should be properly maintained, and should not impair visibility by reflecting light or getting scratched over time.	
5. <u>All</u> sewing machines must have a needle guard. Also consider belt guards and eye guards depending on the machine (e.g. button attaching).	
6. <u>All</u> cutters should wear a metal mesh glove on the hand that holds the fabric. Gloves also increase cutting accuracy (wearers can cut closer to the line).	
7. Purchase safe, good quality machines. When ordering a new one, ensure that it is equipped with guards and other safety features.	
8. If you buy second-hand machines, ensure that they come with a guard, or make sure to add one.	

Activity

2e

15 minutes

Involving all staff

Workers are in contact with machines every day. T**raining and involving staff** is key to ensure that machine maintenance and safety systems are followed and respected. In this activity, you will discuss how to train and involve all staff in machine maintenance and safety.

Instructions:

1) Together, think about what you learned in the previous activities, then discuss the following questions:

- What should staff be trained in?
- Who should be trained? Everyone? Only some staff?
- When should trainings take place?

2) Together, read the two suggestions for involving staff in table 13. For each suggestion, answer the listed question.

Table 13. Involving staff in your factory

Set up a maintenance department to oversee all machine maintenance and safety operations. Each line should have a Mechanic.

1. What would the maintenance department's responsibilities be?

In each production department, make one person responsible for coordinating with the maintenance department to ensure proper maintenance, communicate issues and organize trainings.

2. Who could be made responsible in each department in your factory?

Session 3

Action items

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 gained new knowledge on how to manage machinery more efficiently through better maintenance and safety, with your workers' participation.

Machine **maintenance**

Machine **safety**

Involving **all staff**

In this session, you will think of ways to apply your new knowledge to improve machine management in your factory by reviewing best practices and drafting your own action plan.

Annual maintenance plan, machine history card, maintenance card and breakdown record templates are 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 machine management practices as a next step for evaluating your own and implementing improvements.

Instructions:

1) Together, look at the list of best practices in table 14, and put a ✓ in the column on the right if you use these practices in your factory.

Table 14. Managing machinery

Best practices	✓
1. The number of breakdowns and machine-related accidents and defects are recorded and measured regularly to assess machinery management.	
2. The factory aims to carry out zero breakdown maintenance by prioritizing preventive maintenance and scheduling it into the manufacturing day.	
3. The Chief Mechanic prepares an annual maintenance plan for all machines, showing when each machine needs to be maintained.	
4. Mechanics keep and update maintenance records and history cards for each machine. The card is attached to the machine.	
5. Managers, supervisors and workers work together to identify health & safety hazards for all machines and measures to address these hazards.	
6. All machines are equipped with appropriate guards of good quality. If guards are not enough, workers wear protective equipment.	
7. All workers are properly trained in good machine handling practices, machine safety and basic machine maintenance and troubleshooting.	

Activity

3b

15 minutes

Your action plan

In this activity, you will think of ways to apply your new knowledge to improve your machine management systems by drafting your own action plan.

Instructions:

1) Together, fill in the action plan (table 15) 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 15. Managing machinery – Action Plan				
Problem identified				
Solutions identified	**Action(s) to be taken**	**Person responsible**	**By when?**	**How will improvements be measured?**

Managing machinery

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: 9789220327012 (web pdf)