UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO Shop Floor Assistance Guidelines

GUIDELINES

FROM LEAN MANAGEMENT
TO DIGITAL KAIZEN

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Vienna, Austria
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Content

1

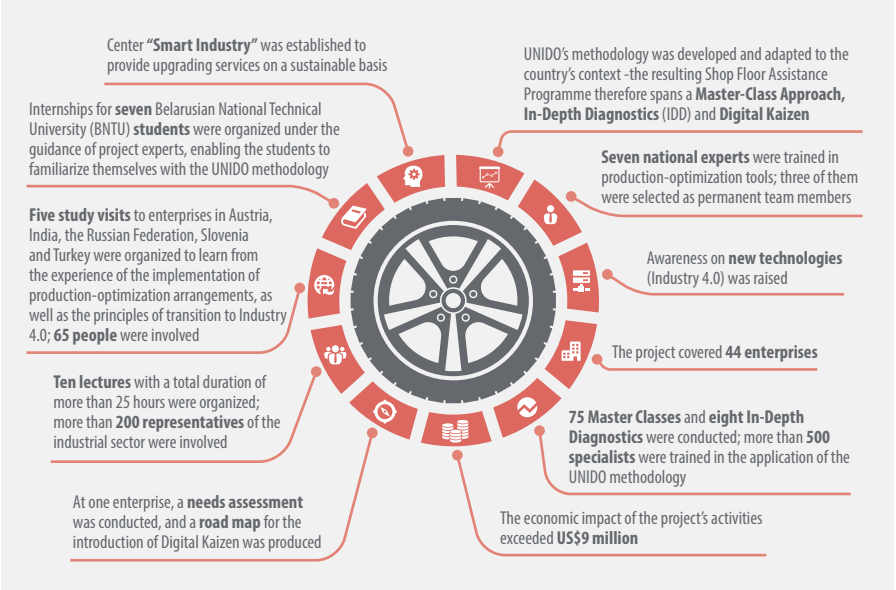
Introduction

In order to compete in a global marketplace, small and medium-sized enterprises (SMEs) in emerging economies, and countries in transition, need to make significant improvements in their approach to manufacturing. The need to ensure that improvements not only focus on efficiency gains, but also align with the greater focus on corporate social responsibility requires a wholesale review of manufacturing in many of these countries. Important factors include keeping production costs low, enhancing productivity and developing linkages to sustainable supplier networks. In this respect, UNIDO provides services that aim to improve the competitiveness of enterprises through clustering and networking, cost reduction and increased productivity, while developing sustainable supplier networks and seeking new markets.

A number of external and internal factors play a critical role in the performance and competitiveness of companies. Factors related to business environment and support institutions are as important as the internal factors that influence the production and growth of companies. UNIDO has focused its technical assistance on two interrelated levels: (a) a direct shop floor assistance programme for pilot companies to showcase practical examples of upgrading services; and (b) capacity-building of support and advisory institutions to deliver enterprise-upgrading services on a sustainable basis.

These guidelines outline UNIDO's approach to the Shop Floor Assistance Programme on Lean, implemented within the UNIDO project, Institutional Strengthening and Policy Support to Upgrade the Component Manufacturers in the Automotive Sector in the Republic of Belarus, which was funded by a voluntary contribution from the Russian Federation to the UNIDO Industrial Development Fund. The approach is based on the tools and instruments of Lean methods and has been implemented successfully in other UNIDO projects around the globe. Lean tools are widely known, and many publications and manuals have been produced about them. The current guidelines summarize UNIDO's experience on the Belarus project, using open sources.

The project obtained a number of significant results, as illustrated below.



Lean manufacturing is a worldwide proven approach for the improvement of production processes through the optimization of production and elimination of waste. The goals are better quality, lower costs and shorter lead times. Lean methods are still successfully exploited in industry and although they originated in the 1950s, they still are very relevant to business improvement. The requirement for companies to react rapidly to changes in demand and the relative simplicity of the approach mean that Lean implementation remains of significant benefit to any manufacturing or non-manufacturing business.

2

The Concept of Lean

The management concept of Lean is a series of tools and principles that can minimize waste (and thereby maximize value) in any business process and enable businesses to become more fit or resilient when addressing the changes in the business context. It includes some basic principles and outlines a series of logical steps to analyse and improve both manufacturing and non-manufacturing businesses. One of the core elements is that Lean engages the workforce to visualize, discuss and solve problems in the business in order to increase productivity, improve quality, reduce lead times and make better use of resources.

The best applications of Lean though extend beyond these tangible benefits to promote a culture of continuous improvement where employees are empowered to challenge the status quo, work together to solve and prevent problems recurring, and implement quality and productivity improvements. Companies, such as Toyota, where Lean has been the way of life for decades, enjoy the benefits of a Lean culture that permeates from the leadership right through to the workforce, and enables them to stay ahead of competition. Companies frequently choose Lean because it offers many of, or all, the benefits outlined in Figure 1.

2.1 BENEFITS OF LEAN MANUFACTURING

Non Lean	Lean Organisation	Benefits
Unclear or proprietary processes	Transparent processes	**Better cross-functional understanding and visibility**
Individual problem solving	Collaborative problem solving	**Higher-quality operational solutions**
Reactive employees	Proactive employees raise issues and concerns as they occur	**'No blame' environment means problems raised and fixed promptly**
Management-directed changes	Employee-directed changes	**Faster change, more responsive to customer needs, less time required from management**

Figure 1 – The benefits of a Lean Culture: Source: Applied Lean Consulting

2.2 LEAN MANUFACTURING ORIGINS

In the 1950s, Toyota was struggling to compete with GM's and Ford's mass-production techniques, with which high volumes of similar products could drive cost per piece to an affordable level. However, Toyota simply could not afford to replicate Ford and GM's approach with the lower volume, mixed product lines required for its local market. Instead, Taiichi Ohno, a plant manager at Toyota, took some of the concepts from GM and Ford and adapted them around a series of practical and cultural initiatives to create the Toyota Production System (TPS). TPS has since formed the basis of Lean production globally, which has progressively been rolled out from its roots in car manufacturing into all manufacturing, warehousing and service businesses; from multinational businesses employing thousands of employees through to SMEs with less than 30. The same principles apply and the fundamental way to implement Lean remains the same.

3

Main Techniques and Tools

It is important to understand some of the main Lean techniques and tools, in order to know how and when to apply them. These include:

- TAKT TIME
- ONE-PIECE FLOW
- PULL SYSTEMS
- VALUE STREAM MAPPING
- KANBAN
- STANDARDIZATION
- VISUAL MANAGEMENT
- THE 8 WASTES
- 5 S
- SINGLE MINUTE EXCHANGE OF DIE
- TOTAL PRODUCTIVE MAINTENANCE

The goal is to reach a situation in a production or service environment in which every employee knows “WHAT do I work on next?”, “WHERE do I get my work from?”, “HOW LONG will it take me to do my work?”, “WHERE will I send it?” and “WHEN do I send it?”.

The employees should know all of this information without a schedule, without a dispatch or expedite list, and without a supervisor or manager needing to tell them what to do.

3.1 TAKT TIME

WHAT

- Rate at which customers require finished units
- Origins are the German word *Taktzeit*, meaning ‘pace’ of ‘cycle time’

WHEN

- Used in production planning (and building service capacity in non-manufacturing)
- Precisely match production time with customer demand

WHY

- The pace of production is important: too slow will not meet customer demand and too fast will result in excess output
- Allows flexibility in the workforce based around customer demand

HOW

- Divide available work time per shift by customer demand per shift
- React by demand levelling, putting in additional resources or re-engineering the process to correct the issue

Takt Time is the pace of customer demand expressed as a unit of time. In manufacturing, you need to be able to match the pace of production to the customer demand, either by speeding up the process or by employing more people who work together to keep the output rate at the right level. In service businesses, for example an insurance company handling claims from customers, Takt Time is less critical as a rate-determining tool but helps ensure you have the capacity in place to meet customer demand. So, in the insurance claim example, and with a customer demand of 70 claims in 20 working days, you would design your process with a capacity to meet 3.5 claims a day, or about one claim every 2 hours.

3.2 ONE-PIECE FLOW

WHAT

- Making and moving once piece at a time in a continuous flow
- Providing the next process step only what is needed and when it is needed

WHEN

- When there are multiple steps and multiple work stations in any process (manufacturing or service)

WHY

- Reduces inventory (unnecessary work in process)
- Reduces waiting time
- The first product is completed sooner
- Takes up less space
- Focuses on quality versus quantity

HOW

- Link processes together
- Reduce batch sizes
- Re-arrange work stations in a sequential set up
- Minimise part flow, with the goal of moving one part at a time

One-piece flow (also known as continuous flow or single-piece flow) is ideal for Lean systems in manufacturing in order to achieve an uninterrupted flow of goods between workstations, something that results in reduced lead time and less work in progress (WIP). If you were to think of water flowing down a hill, any rocks in its way are going to slow it down and create diversions, and there is likely to be a build-up of water behind the rocks. By identifying and removing the problems (or rocks) and modifying the production layout, it is often possible to link processes together and remove steps (and hence reduce time and WIP).

One-piece flow can be difficult to achieve. It is often prevented by issues such as those listed in Table 1 below.

- Poor layout / Process reversals
- Shared resources – e.g. specific machines become a bottleneck
- Specialist skills – only certain people can do certain jobs
- Unbalanced process times: sequential machines working at different paces

Table 1 – Typical issues preventing one-piece flow achievement

One-piece flow promotes other benefits in your Lean system too. If batch sizes are reduced, to one piece at a time, a quality problem will be identified immediately and can be dealt with easily. By contrast, in batched production, a quality error will require the scrapping or reworking of the entire batch. Additionally, linking work steps together into cells, and reducing the WIP between steps, reduces the space needed in the production facility.

3.3 PULL SYSTEMS

WHAT

- Creates a link to customer demand
- Replenishes only what the next process has consumed

WHEN

- You want to reduce inventory, cycle time or lead time

WHY

- Improves flow of information and materials
- Minimises inventory
- Allows bottlenecks to become visible

HOW

- Implement small localized supply of materials (or 'supermarket') for batches
- Implement a Kanban (signalling) system

When you can not create one-piece flow, pull systems link customer demand directly back to your process. By implementing a supermarket of stock in your system and controlling the amount in it via a Kanban (clear signal to replenish), you can control in-system inventory and reduce lead times effectively.

3.4 VALUE STREAM MAPPING

Value stream mapping allows you to view the value and the waste in your process. Value stream maps (VSMs) log both the information and the product flows in your production process, from entering a customer's order into your scheduling system, to orders placed with major suppliers and the movement of goods through your facility—from receipt through to dispatch. There is a conventional order to how VSMs are drawn, as shown in Figure 2 below. An example of a VSM is presented in Figure 3, below.

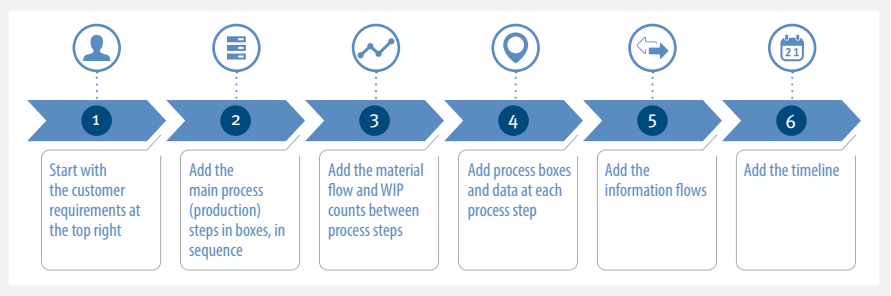


Figure 2 – Conventional order to how VSMs are drawn

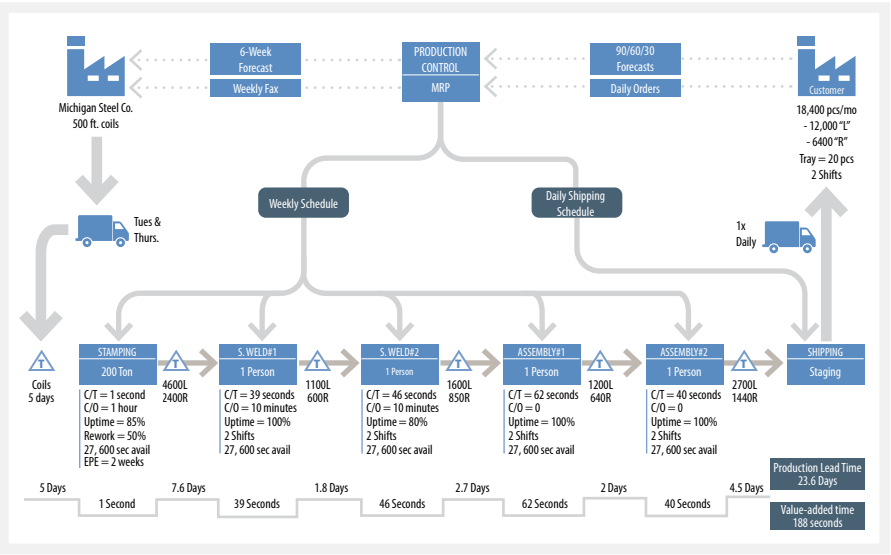


Figure 3 – Production Value Stream Map (from *Learning to See: Rother and Shook*)

The benefit of a VSM is that it maps both the information flow and the product flow through your business, identifying problems and waste, both at system and individual process levels. (For more information about waste, see Section 3.8). VSM simulation packages exist today to simulate productivity of various production process set-ups (vision of the future process, i.e improved process). But VSM should take into account the limitations in the production process, available infrastructure and ROI calculations within financial availabilities.

3.5 KANBAN

WHAT	WHEN
▪ Japanese term for 'signal board' ▪ A signal that replenishment is required directly in response to a customer 'pull'	▪ When we need to limit Work in Progress ▪ When replenishment of stock is required—especially in manufacturing
WHY	**HOW**
▪ Ensures the production line is adequately filled and line stoppage is prevented ▪ But also regulates the level of inventory (supermarkets) along the line	▪ Two-bin system (full and empty); level indicator; Kanban card exposed ▪ Signal indicates reorder quantities (and often supplier details), reorder quantities, etc.

Kanban systems are used extensively in production processes to limit WIP and provide a clear and unequivocal signal for replenishment. Some of the most commonly used signals are listed in Table 2 below.

Most production plants rely on an Entreprise Resource Planning (ERP) or Materials Requirements Planning (MRP) system to predict what needs to be produced, based on historical demand and forecasts. A Kanban system, however, is linked directly to customer demand and can therefore give a more certain indication of market requirements.

A good place to start when considering introducing Kanban is 'consumables'. These tend to lie outside the 'bill of material' calculations and will enable you to build confidence in your system.

Kanbans can also work effectively in non-manufacturing environments, for example, indicating when more paper or office supplies are required: here, placing a Kanban reorder card between the last two boxes of paper will indicate when it is time to reorder.

3.6 STANDARDIZED WORK

WHAT	WHEN
▪ List of detailed standard operating procedures required to conduct a task or series of tasks	▪ When you want to create a standard baseline operation for improvement ▪ You want to help operators improve against their KPIs
WHY	**HOW**
▪ Ensures all workers are operating in the same way ▪ Reduces the chance of error and ensures consistent quality ▪ Allows planning of resources needed ▪ Provides a training document for new employees	▪ Work with each operator to record how work is currently managed in process steps with pictures and time allowed ▪ Some standard work documents can be very detailed, including number of steps taken, location of tools, etc.

The basis for Lean is standard work. If operators do things in a different way each time, then you can only manage by results and not by how effectively the work is done. Standard work demonstrates that there is a process in place for all operations and, in the event of a performance shortfall, puts the blame on the process not the operator.

Standardization helps to create consistency in quality and rate of production, and identifies where skill shortages are or training is required.

If employees always work in the same way, they can develop improvements to the standard and create the basis for continuous improvement. One of the criticisms often levelled at standard work is 'we are not machines' and that standard work takes responsibility away from the operator. However, in practice, standard work empowers the operator by giving them the comfort of a stable state to work to and the opportunity to improve the process, with resulting gains in quality, reliability and throughput.