

## LEAN PRODUCTION

Lean production utilises the PDCA cycle (Plan – Do – Check – Act).

**FPC is guided by the following principles in developing and improving its lean production technologies:**

- customer focus
- focus on process
- production process flexibility
- standardisation
- elimination of waste
- transparency
- error proofing
- excellence.

### LEAN PRODUCTION TOOLS USED IN FPC TO ELIMINATE WASTE

**JUST IN TIME**

**5S**

**TPM (Total Productive Maintenance)**

**BRAINSTORMING**

**PARETO CHART**

**RISK MATRIX**

**INNOVATION IDEAS**

**TIME AND MOTION STUDY**

**VALUE STREAM MAPPING**

**PROCESS DESCRIPTION, DEFINING INDICATORS**

**KANBAN**

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**Tasks to be tackled by the use of lean production tools:**

- elimination of process defects and errors
- elimination of process waste
- efficient use of equipment, means of control
- reduction of process times and total cycle time
- elimination of unnecessary transportation
- reduction of excess inventory
- optimisation of warehousing and production floor space.

LEAN PRODUCTION TOOL	DESCRIPTION	PURPOSE
<b>Just In Time (JIT) system</b>	<p>Production management concept that is aimed at reducing excess inventory. Under this concept, the right parts and materials are delivered in the right quantity at the right place at the right time.</p> <p>JIT goals:</p> <ul style="list-style-type: none"> <li>• zero defects</li> <li>• zero set-up time (reduced set-up time leads to reduced production cycle and inventory)</li> <li>• zero inventory (inventory, including materials that are being processed, installed or assembled, should be near zero)</li> <li>• zero non-value-added activities</li> <li>• zero lead-time</li> </ul>	<p>The Just In Time system boosts production efficiency through eliminating waste, in particular:</p> <ul style="list-style-type: none"> <li>• issuing parts that were first to arrive to the warehouse</li> <li>• accounting for materials and spare parts resulting in orders only for the necessary spare parts</li> <li>• storing no excessive inventory</li> </ul>
<b>5S system</b>	<p>A system for efficient workplace organisation. Like other lean production tools, it contributes to the work area manageability and helps save time.</p> <p>It includes the following steps:</p> <ul style="list-style-type: none"> <li>• sort</li> <li>• set in order</li> <li>• shine</li> <li>• standardise</li> <li>• sustain.</li> </ul> <p>The 5S system helps reduce the number of errors in documents, create a comfortable working environment, and boost performance</p>	<p>The 5S system is implemented:</p> <ul style="list-style-type: none"> <li>• at workplaces in passenger carriage depots/sites</li> <li>• at spare parts and materials warehouses</li> <li>• at train crews' workplaces</li> <li>• in the offices of FPC's central administration, branches and their structural units</li> </ul>
<b>TPM (Total Productive Maintenance)</b>	<p>The concept of production equipment management aimed at boosting maintenance efficiency.</p> <p>The focus is on prevention and early detection of equipment faults that may lead to more serious issues</p>	<p>The Total Productive Maintenance method is aimed at:</p> <ul style="list-style-type: none"> <li>• stabilisation and continuous improvement of maintenance and preventive maintenance processes, ensuring Zero Defects operation</li> <li>• consistent elimination of waste causes</li> </ul>
<b>Brainstorming</b>	<p>A rapid problem solving method based on stimulation of creativity.</p> <p>This method's key advantage is in encouraging creativity, with ideas generated in a comfortable creative environment</p>	<p>Brainstorming is aimed at creating an environment where discussion participants can generate ideas as equals, which helps unlock creative freedom, intuition, imagination, originality, and thinking outside the box</p>
<b>Pareto chart</b>	<p>A tool that helps spread the effort to solve problems and identify key root causes of defects</p>	<p>Building a Pareto chart starts with defining a list of defects that impact the process. After that, methods such as brainstorming and 5 Whys are used to identify root causes for problems in each process, and the problems are weighed by severity of consequences. Identification and elimination of 20% of defects deemed the most severe leads to an 80% reduction in reject rates</p>
<b>Risk matrix</b>	<p>A tool within FPC's risk management system used to reduce the Company's losses</p>	<p>The risk matrix enables ranking and reflecting risks through identifying their probability and severity</p>

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<b>Time and motion study</b>	A method for studying working time through observing and measuring the working time, usually throughout one shift (or any part of a shift)	<p>This method helps:</p> <ul style="list-style-type: none"> <li>• study the work process and equipment utilisation in high detail</li> <li>• obtain absolute (in seconds, minutes, hours) and highly accurate data</li> <li>• identify actual working time throughout the study period and obtain data on the sequence of process elements</li> <li>• identify rational approaches to work and relevant methods, causes for waste and suboptimal use of time</li> </ul>
<b>Value stream mapping</b>	Analysing and visualising the material flow and the relevant information flow throughout the value stream between the supplier of materials to the customer	<p>This tool makes it possible to:</p> <ul style="list-style-type: none"> <li>• visualise the entire value stream</li> <li>• identify causes of waste in the value stream</li> <li>• use the value stream map as a common language for discussing production processes between specialists</li> <li>• make many solutions related to the value stream clear, coherent, and easy to discuss</li> <li>• integrate lean production concepts and methods that help avoid “missing the forest for the trees”</li> <li>• use the value stream mapping tool as a base for a lean production implementation plan</li> <li>• demonstrate relations between the information and material flows</li> </ul>
<b>Innovation ideas</b>	A powerful tool to boost the Company's efficiency and performance through unlocking the staff's creative potential	<p>Innovation activities help:</p> <ul style="list-style-type: none"> <li>• kickstart and develop FPC employees' technical creativity</li> <li>• provide legal protection for innovations and inventions</li> <li>• boost FPC employees' commitment to their work through financial and non-financial stimulation of technical creativity</li> </ul>
<b>Process description, defining indicators</b>	A process is a sequence of interdependent and/or interacting activities that use inputs to achieve a planned result. In order to be manageable, a process needs to be described and its indicators need to be defined. The indicators should reflect the performance and efficiency of the process	Process description is a key tool for identifying areas of process improvement
<b>Kanban</b>	The most widespread type of the Just in Time system, Kanban ensures a continuous material flow with zero inventory: material is supplied in small batches to the production process where it is needed	Kanban Cards are used in business units to avoid cluttering storage and work areas with spare parts stored in advance

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