Appendix S: Lean Templates

Contents

Appendix S - L.E.A.N. Strategy Templates and Tools

Introduction

This appendix provides practical templates, forms, and tools to support implementation of L.E.A.N. (Least Effort Achieves Nothing) strategies in CNC manufacturing environments. These templates are designed to be customizable for your specific shop needs and can be adapted for different scales of operation.

Complete Contents:

Section 1-5: Value Stream Mapping and Waste Analysis - Value Stream Mapping (VSM) Templates (Current & Future State) - Eight Wastes (DOWNTIME) Assessment Tools - Spaghetti Diagrams - Process Observation Sheets - Takt Time Calculators

Section 6-10: Pull Systems and Kanban - Just-In-Time (JIT) System Design - Kanban Card Templates and Calculations - Supermarket Planning and Management - Heijunka (Production Leveling) - Pull System Metrics

Section 11-14: Reliability and Continuous Improvement - SMED (Setup Reduction) Templates - TPM (Total Productive Maintenance) Tools - Poka-Yoke (Error-Proofing) Design - Kaizen Event Planning and Execution

Section 15-20: Visual Management and Implementation - Visual Management Systems and Andon - Standardized Work Templates - Lean Metrics Dashboards - A3 Problem Solving - Lean Implementation Roadmap - Annual Planning Tools

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1. Value Stream Mapping (VSM) Templates

1.1 Current State VSM Template

Purpose: Document the current flow of materials and information from customer order to delivery.

VSM Symbol Legend

```
+-------------+
|  CUSTOMER   |  = External customer or supplier
+-------------+

+-------------+
```

```
|   PROCESS   |  = Manufacturing process step
+-------------+

[PUSH]  →       = Push arrow (scheduled production)
        →       = Physical material flow
- - - →         = Information flow (electronic)
═══►            = Information flow (manual)

                 = Supplier or external source
                 = Inventory (triangle with quantity/days)
⚡              = Kaizen burst (improvement opportunity)
                 = Data box (cycle time, changeover, uptime, etc.)
```

Current State VSM Worksheet Product/Product Family: _____ **Completed By:** _____ **Date:** _____ **Team Members:** _____

Step 1: Identify Customer Requirements - Annual Demand: _____ pieces/year - Daily Demand: _____ pieces/day (working days: _____) - Order Frequency: _____ - Delivery Requirements: _____ - Packaging Requirements: _____

Step 2: Document Process Steps (Left to Right)

Step #	Process Name	Cycle Time (sec)	Changeover Time (min)	Uptime %	# Operators	Available Time (sec/shift)	EPE/Batch Size
1							
2							
3							
4							
5							

Step 3: Document Inventory Between Steps

Location	Quantity (pieces)	Days of Inventory	Storage Method
Raw Material			
After Step 1			
After Step 2			
After Step 3			
Finished Goods			

Step 4: Document Information Flow

- **Customer Order Entry Method:** _____
- **Production Scheduling Method:** _____
- **Schedule Frequency:** _____
- **Material Release Method:** _____
- **Communication Between Steps:** _____

Step 5: Calculate Timeline

Metric	Calculation	Value
Total Cycle Time	Sum of all process cycle times	_____ sec
Total Lead Time	Sum of cycle times + inventory wait times	_____ days
Process Time	Total cycle time only	_____ sec
Value-Added Ratio	Process time ÷ Lead time × 100%	_____ %

Step 6: Identify Waste and Improvement Opportunities

Mark kaizen bursts ( ) on your VSM for: - Excessive inventory - Long changeover times - Poor communication - Rework or quality issues - Excessive transportation - Waiting or delays

1.2 Future State VSM Template

Purpose: Design the ideal flow with waste eliminated and lean principles applied.

Future State Design Questions:

1. **What is the Takt Time?**
   - Takt Time = Available Time ÷ Customer Demand
   - Takt Time = _____ sec/piece
   - *This is the pace at which you must produce to meet customer demand*
2. **Where Can We Implement Continuous Flow?**
   - Can operations be combined or relocated?
   - List process steps that can flow continuously: _____
3. **Where Do We Need Supermarkets (Pull Systems)?**
   - Which processes must remain disconnected?
   - Supermarket locations: _____
4. **What Is the Pacemaker Process?**
   - Which single point will be scheduled?
   - Pacemaker: _____
5. **How Will We Level Production (Heijunka)?**
   - Product mix strategy: _____
   - Volume leveling approach: _____
6. **What Process Improvements Are Required?**

Improvement Area	Current State	Future State	Actions Required
Changeover Time			
Cycle Time			
Uptime/Reliability			
Quality (FPY)			
Batch Size			

Future State Timeline:

Metric	Current State	Future State	Improvement
Total Lead Time	_____ days	_____ days	_____ %
Process Time	_____ sec	_____ sec	_____ %
Value-Added Ratio	_____ %	_____ %	_____ %
Inventory (days)	_____ days	_____ days	_____ %

1.3 VSM Implementation Plan

Future State Target Date: _____

Kaizen/Improvement	Responsible	Target Date	Resources Needed	Status

---

2. Eight Wastes (DOWNTIME) Assessment Tools

2.1 DOWNTIME Waste Identification Checklist

Assessment Date: _____ **Assessed By:** _____ **Area/Process:** _____

Rate each waste area: - **0** = Not present - **1** = Minor issue - **2** = Moderate issue - **3** = Significant issue - **4** = Critical issue

D - DEFECTS

Observation	Rating (0-4)	Notes/Examples
Scrap rate exceeds target		
Rework is common		
Customer returns/complaints		
Inspection failures		
Material waste from defects		
Time lost to sorting/rework		
TOTAL DEFECTS SCORE	**/24**	

Top Defect Issues: 1. _____ 2. _____
3. _____

O - OVERPRODUCTION

Observation	Rating (0-4)	Notes/Examples
Making parts before needed		
Producing more than ordered		
Running large batches “just in case”		
Accumulating WIP inventory		
Making parts faster than downstream can consume		
Producing to keep people/machines busy		
TOTAL OVERPRODUCTION SCORE	**/24**	

Top Overproduction Issues: 1. _____ 2. _____ 3. _____

W - WAITING

Observation	Rating (0-4)	Notes/Examples
Machines idle waiting for material		
Operators waiting for machines		
Waiting for inspection/approval		
Waiting for information/drawings		
Waiting for tooling or fixtures		
Waiting for maintenance/repairs		
Waiting for previous operation		
TOTAL WAITING SCORE	**/28**	

Top Waiting Issues: 1. _____ 2. _____ 3. _____

N - NON-UTILIZED TALENT

Observation	Rating (0-4)	Notes/Examples
Skilled workers doing unskilled tasks		
Ideas and suggestions ignored		
No involvement in problem-solving		
Limited training or development		
Narrow job definitions		
Underutilized expertise		
TOTAL NON-UTILIZED TALENT SCORE	**/24**	

Top Talent Utilization Issues: 1. _____ 2. _____ 3. _____

T - TRANSPORTATION

Observation	Rating (0-4)	Notes/Examples
Excessive material movement		
Multiple handling of same parts		
Long distances between operations		
Inefficient layout		
Manual material handling		
Searching for materials		
TOTAL TRANSPORTATION SCORE	**/24**	

Top Transportation Issues: 1. _____ 2. _____ 3. _____

I - INVENTORY

Observation	Rating (0-4)	Notes/Examples
Excess raw material inventory		
High WIP (work in progress)		
Excess finished goods		
Obsolete inventory		
Poor inventory accuracy		
Inventory consuming floor space		
Tied-up capital in inventory		
TOTAL INVENTORY SCORE	**/28**	

Top Inventory Issues: 1. _____ 2. _____ 3. _____

M - MOTION

Observation	Rating (0-4)	Notes/Examples
Excessive walking/reaching		
Poor workstation ergonomics		
Searching for tools		
Bending, twisting movements		
Unnecessary handling of parts		
Poor tool/material organization		
TOTAL MOTION SCORE	**/24**	

Top Motion Issues: 1. _____ 2. _____ 3. _____

E - EXCESS PROCESSING

Observation	Rating (0-4)	Notes/Examples
Tighter tolerances than needed		
Over-inspection		
Redundant operations		
Unnecessary features		
Poor tooling/methods		
Excessive paperwork		
TOTAL EXCESS PROCESSING SCORE	**/24**	

Top Excess Processing Issues: 1. _____ 2. _____ 3. _____

2.2 DOWNTIME Summary and Prioritization

Overall Waste Assessment:

Waste Type	Score	Percentage	Rank	Priority Action
Defects	/24	%		
Overproduction	/24	%		
Waiting	/28	%		
Non-Utilized Talent	/24	%		
Transportation	/24	%		
Inventory	/28	%		
Motion	/24	%		
Excess Processing	/24	%		
TOTAL	**/200**	**100%**		

Prioritization Matrix:

Plot your top 3-5 waste issues on this matrix:

```
HIGH IMPACT
    |
    |   PRIORITY 1        PRIORITY 2
    |   (Do First)        (Plan & Do)
    |
----+---------------------------
    |
    |   PRIORITY 4        PRIORITY 3
    |   (Eliminate if     (Quick Wins)
    |    possible)
LOW IMPACT

    LOW EFFORT ----------► HIGH EFFORT
```

Priority 1 Improvements (High Impact, Low Effort): 1. _____
2. _____ 3. _____

Next Steps: - Form kaizen teams for Priority 1 items - Set target completion dates - Assign ownership - Track progress

---

3. Spaghetti Diagram Template

3.1 Purpose

Document the physical path of materials, operators, or information through the shop to identify transportation and motion waste.

3.2 Instructions

1. **Select Subject:** What are you tracking?
   - ☐ Operator movement
   - ☐ Material flow (specific part)
   - ☐ Tool movement
   - ☐ Information flow (paperwork)
2. **Draw Shop Layout:** Create a simple floor plan showing:
   - Machines and equipment
   - Work areas
   - Storage locations
   - Desks/offices
   - Receiving/shipping
3. **Track and Mark Movement:** Follow the subject for a complete cycle and draw the path with a colored line
4. **Measure:** Use a measuring wheel or estimate distances
5. **Analyze:** Identify unnecessary movement and plan improvements

3.3 Spaghetti Diagram Worksheet

Subject Tracked: _____ **Date:** _____ **Tracked By:** _____ **Time Period:** _____ to _____

Observations:

Step	From Location	To Location	Distance (ft)	Reason for Movement	Value-Added?
1					[ ] Yes [ ] No
2					[ ] Yes [ ] No
3					[ ] Yes [ ] No
4					[ ] Yes [ ] No

Step	From Location	To Location	Distance (ft)	Reason for Movement	Value-Added?
5					[ ] Yes [ ] No
6					[ ] Yes [ ] No
7					[ ] Yes [ ] No
8					[ ] Yes [ ] No
9					[ ] Yes [ ] No
10					[ ] Yes [ ] No

Summary: - **Total Distance Traveled:** _____ feet - **Number of Movements:** _____ - **Value-Added Distance:** _____ feet (_____%) - **Non-Value-Added Distance:** _____ feet (_____%) - **Estimated Time Spent Moving:** _____ minutes

Improvement Ideas:

1. _____
2. _____
3. _____
4. _____

Future State Goal: - **Target Total Distance:** _____ feet (____% reduction) - **Target Movement Time:** _____ minutes (____% reduction)

_____

4. Process Observation Sheet

4.1 Purpose

Conduct detailed observation of a process to identify cycle time, waste, and improvement opportunities.

4.2 Process Observation Form

Process Name: _____ **Part Number:** _____ **Operation:** _____ **Observer:** _____ **Date:** _____ **Time:** _____ **Operator:** _____ **Machine:** _____

Setup Information

- **Batch Size:** _____ pieces
- **Setup Time:** _____ minutes
- **First Piece Inspection Time:** _____ minutes

Cycle Time Observation (observe 5-10 cycles)

Cycle #	Start Time	End Time	Cycle Time (sec)	Notes/Issues
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Cycle Time Statistics: - **Average Cycle Time:** _____ sec - **Fastest Cycle:** _____ sec - **Slowest Cycle:** _____ sec - **Standard Deviation:** _____ sec - **Consistency:** [ ] High [ ] Medium [ ] Low

Time Element Breakdown (for one representative cycle)

Element Description	Time (sec)	Value-Added?	Category
Load part in fixture		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Position and clamp		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Start cycle		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Machine cutting time		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Inspection (in cycle)		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Unload part		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Deburr		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Place in container		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Get next part		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait
Other:		[ ] Yes [ ] No	[ ] Setup [ ] Run [ ] Wait

Summary: - **Total Cycle Time:** _____ sec - **Value-Added Time:** _____ sec (_____%) - **Non-Value-Added Time:** _____ sec (_____%)

Waste Observations DOWNTIME Checklist:

Waste Type	Observed?	Description
Defects	[ ] Yes [ ] No	
Overproduction	[ ] Yes [ ] No	
Waiting	[ ] Yes [ ] No	
Non-Utilized Talent	[ ] Yes [ ] No	
Transportation	[ ] Yes [ ] No	
Inventory	[ ] Yes [ ] No	
Motion	[ ] Yes [ ] No	
Excess Processing	[ ] Yes [ ] No	

Safety and Ergonomics Observations

Issue	Observed?	Severity	Notes
Awkward posture	[ ] Yes [ ] No	[ ] High [ ] Med [ ] Low	
Repetitive motion	[ ] Yes [ ] No	[ ] High [ ] Med [ ] Low	
Heavy lifting	[ ] Yes [ ] No	[ ] High [ ] Med [ ] Low	
Reaching	[ ] Yes [ ] No	[ ] High [ ] Med [ ] Low	
Safety hazards	[ ] Yes [ ] No	[ ] High [ ] Med [ ] Low	

Improvement Opportunities **Quick Wins (can implement immediately):** 1. _____ 2. _____ 3. _____

Moderate Improvements (require planning/resources): 1. _____ 2. _____ 3. _____

Long-Term Improvements (significant investment): 1. _____ 2. _____ 3. _____

Estimated Improvement Potential: - **Cycle Time Reduction:** _____% (from _____ sec to _____ sec) - **Setup Time Reduction:** _____% (from _____ min to _____ min) - **Quality Improvement:** _____

Follow-Up Actions:

Action Item	Responsible	Target Date	Status

5. Takt Time Calculator

5.1 Purpose

Calculate the pace of production required to meet customer demand.

5.2 Takt Time Calculation Worksheet

Product/Family: _____ **Calculated By:** _____ **Date:** _____

Step 1: Determine Available Time **Per Shift:** - Total shift length: _____ hours × 60 = _____ minutes - Breaks: _____ minutes - Lunch: _____ minutes - Team meetings: _____ minutes - Planned maintenance: _____ minutes - Other downtime: _____ minutes - **Total Planned Downtime:** _____ minutes

Available Time Per Shift: _____ minutes

Per Day: - Shifts per day: _____ - **Available Time Per Day:** _____ minutes × _____ = _____ minutes

Per Week: - Working days per week: _____ - **Available Time Per Week:** _____ minutes × _____ = _____ minutes

Per Month: - Working days per month: _____ (typically 20-22) - **Available Time Per Month:** _____ minutes × _____ = _____ minutes

Step 2: Determine Customer Demand **Monthly Demand:** - Total units ordered per month: _____ pieces

Daily Demand: - Units per day: _____ pieces ÷ _____ days = _____ pieces/day

Hourly Demand: - Units per hour: _____ pieces ÷ _____ hours = _____ pieces/hour

Step 3: Calculate Takt Time **Takt Time Formula:**

Takt Time = Available Time ÷ Customer Demand

Takt Time (minutes): _____ minutes per day ÷ _____ pieces per day = _____ minutes/piece

Takt Time (seconds): _____ × 60 = _____ seconds/piece

5.3 Takt Time Interpretation

Your Takt Time: _____ seconds/piece

This means: You must complete one unit every _____ seconds to meet customer demand.

Comparison to Current Performance:

Metric	Current	Required (Takt)	Gap	Status
Cycle Time	_____ sec/pc	_____ sec/pc	_____ sec	[ ] OK [ ] Problem
Capacity per day	_____ pcs	_____ pcs	_____ pcs	[ ] OK [ ] Problem

Status Interpretation: - [check] **Cycle Time < Takt Time:** You have capacity to meet demand (GOOD) - □ **Cycle Time > Takt Time:** You cannot meet demand at current pace (PROBLEM) - □ **Cycle Time ≈ Takt Time:** No buffer, vulnerable to disruptions (RISK)

Recommendations:

If cycle time > takt time: - Reduce cycle time through process improvement - Add shifts or overtime - Add capacity (machines/operators) - Negotiate longer lead times with customer

If cycle time < takt time: - Operate at takt pace (don't overproduce) - Use extra time for maintenance, training, improvement - Consider accepting more work

5.4 Takt Time Example

Example: Machine Shop Part

Available Time: - 8-hour shift = 480 minutes - Breaks: 20 minutes - Lunch: 30 minutes - Available: 480 - 20 - 30 = **430 minutes/shift** - Two shifts per day = 860 minutes/day

Customer Demand: - 200 pieces per day

Takt Time Calculation: - 860 minutes ÷ 200 pieces = **4.3 minutes/piece = 258 seconds/piece**

Interpretation: - Must complete one part every 258 seconds (4 minutes, 18 seconds) - If current cycle time is 210 seconds □ OK, have buffer - If current cycle time is 300 seconds □ Problem, cannot meet demand

---

Next Steps

Use these templates and tools to:

1. **Map your current state** with Value Stream Mapping
2. **Identify waste** using the DOWNTIME assessment
3. **Document movement** with spaghetti diagrams
4. **Observe processes** in detail to find improvements
5. **Calculate takt time** to understand required pace

Continue to Part 2: Just-In-Time, Kanban, and Pull System templates

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This appendix is designed to support Module 24: L.E.A.N. Strategies. Adapt these templates to your specific shop environment and scale.

Contents

This section covers: - Just-In-Time (JIT) and Pull System Templates - Kanban Card Designs and Implementation - Supermarket Setup and Management - Production Leveling (Heijunka)

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6. Just-In-Time (JIT) System Templates

6.1 Pull System Design Worksheet

Purpose: Design a pull system for a specific product or process.

Product/Family: _____ **Designer:** _____ **Date:** _____

Step 1: Identify the Pacemaker Process The pacemaker is the single point where production is scheduled. All upstream processes respond to pull signals.

Pacemaker Process: _____

Criteria for Selection: - [ ] Closest to customer - [ ] Stable cycle time - [ ] Creates predictable demand for upstream - [ ] Manageable variation

Step 2: Identify Supermarket Locations Supermarkets are buffers of inventory that enable pull between disconnected processes.

Supermarket Location	Replenished By	Consumed By	Parts/SKUs	Typical Quantity

Step 3: Define Continuous Flow Cells Which processes can flow continuously without supermarkets?

Flow Cell 1: _____ - Processes included: _____ - Takt time: _____ sec - Operators: _____

Flow Cell 2: _____ - Processes included: _____ - Takt time: _____ sec - Operators: _____

Step 4: Establish Pull Signals How will each process know what to produce?

Process	Pull Signal Type	Trigger Point	Response Time
	[ ] Kanban [ ] Electronic [ ] Visual		
	[ ] Kanban [ ] Electronic [ ] Visual		
	[ ] Kanban [ ] Electronic [ ] Visual		

Step 5: Set Inventory Levels Calculate buffer inventory for each supermarket.

Formula: Buffer = (Demand during Lead Time) + Safety Stock

Supermarket	Daily Demand	Replenishment Lead Time	Safety Stock	Total Buffer
	___/day	___ days	___ pcs	___ pcs

Supermarket	Daily Demand	Replenishment Lead Time	Safety Stock	Total Buffer
	___/day	___ days	___ pcs	___ pcs
	___/day	___ days	___ pcs	___ pcs

6.2 JIT Implementation Checklist

Implementation Phase: [ ] Planning [ ] Pilot [ ] Expansion [ ] Optimization

Prerequisites

- ☐ Processes are stable and predictable
- ☐ Quality is consistently high (>95% FPY)
- ☐ Setup times are reasonable or improving
- ☐ Maintenance program ensures uptime
- ☐ Team is trained on pull concepts
- ☐ Management is committed

Infrastructure

- ☐ Supermarket locations identified and prepared
- ☐ Kanban cards designed and printed
- ☐ Visual management boards installed
- ☐ Material handling equipment available
- ☐ Storage containers/bins standardized
- ☐ Replenishment routes established

Rules and Procedures

- ☐ Pull rules documented and posted
- ☐ Kanban handling procedures trained
- ☐ Responsibility for replenishment assigned
- ☐ Response time targets established
- ☐ Inventory counting procedures defined
- ☐ Troubleshooting process documented

Launch

- ☐ Initial inventory established in supermarkets
- ☐ Kickoff meeting with all stakeholders
- ☐ “Go-live” date communicated
- ☐ Support plan for first week
- ☐ Daily check-ins scheduled

Sustain and Improve

- ☐ Metrics tracked daily
- ☐ Visual boards updated

- ☐ Weekly review meetings
- ☐ Continuous adjustment of buffer levels
- ☐ Problem-solving for disruptions
- ☐ Celebrate successes

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7. Kanban Card Templates

7.1 Standard Production Kanban Card

```
+-------------------------------------------------+
|                  PRODUCTION KANBAN              |
|-------------------------------------------------|
| Part Number: _________________                  |
| Part Name: ____________________                 |
|                                                 |
| Produce At: ___________________                 |
| Store At: _____________________                 |
|                                                 |
| Container Capacity: __________ pieces           |
| Min Order Qty: __________ pieces                |
|                                                 |
| Card # _____ of _____ total cards               |
|                                                 |
| +----------+                                    |
| |          |  [QR CODE]                         |
| | PHOTO or |  or Bar Code                       |
| | DRAWING  |  for scanning                      |
| |          |                                    |
| +----------+                                    |
+-------------------------------------------------+
```

Card Details to Include: - Part number and description - Where to produce (workstation/machine) - Where to store (supermarket location) - Container size/quantity - Card sequence number (1 of 3, 2 of 3, etc.) - Optional: QR code for electronic tracking - Optional: Photo of part for quick ID

7.2 Withdrawal Kanban Card

```
+-------------------------------------------------+
|                WITHDRAWAL KANBAN                |
|-------------------------------------------------|
| Part Number: _________________                  |
| Part Name: ____________________                 |
|                                                 |
| Pick Up From: _________________                 |
| Deliver To: ___________________                 |
|                                                 |
| Container Capacity: __________ pieces           |
```

```
|                                                |
| Route: _____________________________           |
| Frequency: _____________________________       |
|                                                |
| Card # _____ of _____ total cards              |
+------------------------------------------------+
```

Use Case: Signals material handler to move parts from one location to another.

7.3 Kanban Calculation Worksheet

Purpose: Calculate the number of kanban cards needed for a part.

Part Number: _____ **Description:** _____ **Calculated By:** _____ **Date:** _____

Input Data

1. **Daily Demand (D):** _____ pieces/day
2. **Lead Time (L):** _____ days
   - (Time from signal to replenishment completion)
3. **Safety Factor (S):** _____ %
   - Typically 10-20% for stable processes
   - Higher for unstable processes or critical parts
4. **Container Capacity (C):** _____ pieces
   - Standard container size for this part

Kanban Calculation Formula **Number of Kanbans = (D × L × (1 + S)) ÷ C**

Calculation:

Number of Kanbans = (_____ × _____ × (1 + _____)) ÷ _____

Number of Kanbans = _____ (round UP to nearest whole number)

Inventory Implications **Total Inventory in System:** - Maximum Inventory = Number of Kanbans × Container Capacity - Maximum = _____ cards × _____ pcs/card = _____ pieces - Days of Inventory = _____ pieces ÷ _____ pcs/day = _____ days

Comparison: - Before Kanban: _____ pieces (_____ days) - With Kanban: _____ pieces (_____ days) - Reduction: _____%

Example Calculation **Example:** - Daily Demand: 50 pieces/day - Lead Time: 2 days (from trigger to completion) - Safety Factor: 20% (0.20) - Container Capacity: 25 pieces

Number of Kanbans: = (50 × 2 × (1 + 0.20)) ÷ 25 = (50 × 2 × 1.20) ÷ 25 = 120 ÷ 25 = 4.8 → **5 kanbans**

Inventory: - Max Inventory: 5 × 25 = 125 pieces - Days of Inventory: 125 ÷ 50 = 2.5 days

7.4 Kanban Board Template

Visual Kanban Management Board

```
+-------------------------------------------------+
|         KANBAN STATUS BOARD - [WORK CENTER]      |
|-------------+--------------+--------------------|
|   READY     |  IN PROCESS  |      COMPLETE      |
|  (To Do)    |  (Producing) |      (Done)        |
|-------------+--------------+--------------------|
|             |              |                    |
|  [Card 1]   |   [Card 4]   |      [Card 7]      |
|  Part A     |   Part D     |      Part G        |
|  Qty: 50    |   Qty: 100   |      Qty: 75       |
|             |              |                    |
|  [Card 2]   |   [Card 5]   |      [Card 8]      |
|  Part B     |   Part E     |      Part H        |
|  Qty: 25    |   Qty: 50    |      Qty: 30       |
|             |              |                    |
|  [Card 3]   |   [Card 6]   |                    |
|  Part C     |   Part F     |                    |
|  Qty: 100   |   Qty: 200   |                    |
|             |              |                    |
|-------------+--------------+--------------------|
| RULES:                                          |
| • Move card when starting production            |
| • Complete oldest card first                    |
| • Return completed card to supermarket          |
| • Maximum 2 cards in "In Process" at once       |
+-------------------------------------------------+
```

Board Specifications: - Location: Visible at workstation - Size: 24” × 36” minimum - Pockets: Clear plastic for card visibility - Update: Continuously by operators

---

8. Supermarket Design Templates

8.1 Supermarket Planning Worksheet

Supermarket Name/ID: _____ **Location:** _____ **Planner:** _____
Date: _____

Purpose and Scope **What does this supermarket buffer?** - Upstream Process: _____ - Downstream Process: _____ - Reason for Buffer: [ ] Long changeover [ ] Unreliable process [ ] Different cycle times [ ] Other: _____

Parts Stored: - Number of different parts (SKUs): _____ - Product family: _____

Space and Layout **Physical Requirements:**

Parameter	Specification
Floor space needed	_____ sq ft
Shelving/racking type	[ ] Flow rack [ ] Static shelf [ ] Floor storage [ ] Other
Number of shelves/positions	_____
Accessibility	[ ] Both sides [ ] One side
Aisle width	_____ inches
Height	_____ feet

Location Criteria: - [ ] Near consuming process - [ ] Easy access for replenishment - [ ] Visible to operators - [ ] Protected from damage/contamination - [ ] Adequate lighting

Inventory Planning Per Part Inventory Calculation:

Part #	Daily Demand	Replenish Lead Time	Safety %	Container Size	# Kanbans	Max Inventory

Total Supermarket Inventory: - Maximum total pieces: _____ pieces - Maximum total value: $_____ - Total days of inventory: _____ days (average)

Material Flow Replenishment Process: 1. Signal: How is replenishment triggered? - [ ] Kanban card in collection box - [ ] Visual min/max trigger - [ ] Electronic signal - [ ] Scheduled route check

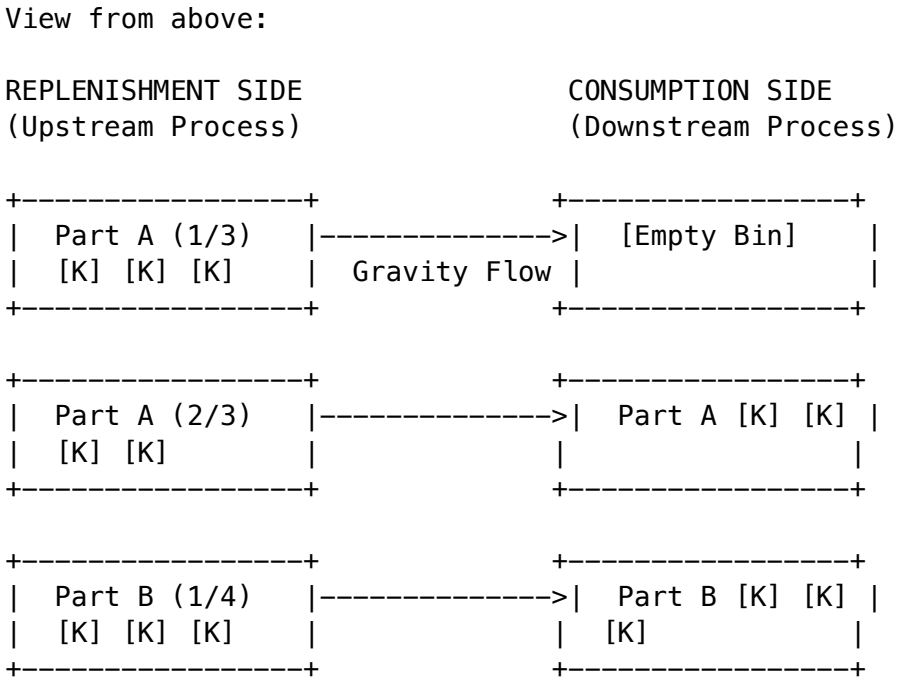
2. Frequency: How often is supermarket replenished?
   - ☐ Continuous (as cards arrive)
   - ☐ Scheduled routes (every ___ hours)
   - ☐ Once per shift
   - ☐ Once per day
3. Responsibility: Who replenishes?
   - ☐ Material handler
   - ☐ Producing operator
   - ☐ Dedicated runner
   - ☐ Other: _____

Withdrawal Process: 1. Who withdraws: _____ 2. When: [ ] As needed [ ] Scheduled route [ ] Other: _____ 3. Signal: [ ] Withdrawal kanban [ ] FIFO lane [ ] Other: _____

Visual Management Visual Controls Needed: - [ ] Location labels (part numbers) - [ ] Quantity labels (min/max levels) - [ ] FIFO lanes marked - [ ] Kanban card holders - [ ] Status indicators (full/empty) - [ ] Refill priority markers - [ ] Replenishment schedule posted

8.2 Supermarket Layout Example

FIFO Flow Rack Supermarket



How It Works: 1. Downstream operator removes container from right side (consumption) 2. Kanban card goes to collection box 3. Upstream process receives kanban signal 4. New container loaded on left side (replenishment) 5. Container flows to right side by gravity (FIFO ensured)

8.3 Supermarket Audit Checklist

Audit Date: _____ **Auditor:** _____ **Supermarket:** _____

Organization (Score: /25)

Item	Score 0-5	Notes
All locations clearly labeled		
No unmarked parts		
FIFO maintained		
Aisles clear and accessible		
Cleanliness and housekeeping		
TOTAL	**/25**	

Inventory Accuracy (Score: /25)

Item	Score 0-5	Notes
Actual matches kanban quantity		
No excess inventory		
No stockouts		
Proper container quantities		
Correct number of kanbans		
TOTAL	**/25**	

Visual Management (Score: /25)

Item	Score 0-5	Notes
Min/max levels visible		
Status clear at a glance		
Kanban cards properly attached		
Instructions/procedures posted		
Metrics displayed		
TOTAL	**/25**	

Process Compliance (Score: /25)

Item	Score 0-5	Notes
Pull rules followed		
Timely replenishment		
Proper kanban handling		
No overproduction		
Documentation up to date		
TOTAL	**/25**	

Overall Score: _____/100

Rating: - 90-100: Excellent - 80-89: Good - 70-79: Acceptable - <70: Needs Improvement

Action Items: 1. _____ 2. _____
3. _____

_____

9. Heijunka (Production Leveling) Templates

9.1 Heijunka Box Template

Purpose: Level production by scheduling mixed models in a repeating pattern.

Heijunka Box Structure:

TIME PERIODS (columns) →

PRODUCTS (rows) ↓	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00
MONDAY	[K] A	[K] B	[K] A	[K] C	[K] A	[K] B	[K] A	[K] C
TUESDAY	[K] D	[K] E	[K] D	[K] F	[K] D	[K] E	[K] D	[K] F
WEDNESDAY	[K] G	[K] H	[K] G	[K] I	[K] G	[K] H	[K] G	[K] I
THURSDAY	[K] J	[K] K	[K] J	[K] L	[K] J	[K] K	[K] J	[K] L

How to Use: 1. Each row = different product or model 2. Each column = time period (pitch) 3. Kanban cards placed in slots according to schedule 4. Material handler picks cards left to right, top to bottom 5. Creates level, mixed-model production

9.2 Pitch Calculation Worksheet

Purpose: Determine the production interval (pitch) for moving work.

Product/Family: _____ **Calculated By:** _____ **Date:** _____

Step 1: Calculate Takt Time

- Available time per shift: _____ minutes
- Customer demand per shift: _____ pieces
- **Takt Time** = _____ min ÷ _____ pcs = _____ minutes/piece

Step 2: Determine Pack-Out Quantity **Pack-out quantity** = standard container or shipping quantity

- Standard container/box holds: _____ pieces
- Or shipping quantity: _____ pieces
- **Pack-Out Quantity:** _____ pieces

Step 3: Calculate Pitch **Pitch** = Takt Time × Pack-Out Quantity

Pitch = _____ min/pc × _____ pcs = _____ minutes

Round to practical interval: _____ minutes (Common: 10, 15, 20, 30 minutes)

Step 4: Determine Pitches per Shift **Pitches per Shift** = Available Time ÷ Pitch

Pitches per Shift = _____ min ÷ _____ min = _____ pitches

Example **Example Calculation:** - Available time: 450 minutes/shift - Demand: 225 pieces/shift - Takt time: 450 ÷ 225 = 2 minutes/piece - Pack-out quantity: 10 pieces/box - Pitch: 2 min/pc × 10 pcs = 20 minutes - Pitches per shift: 450 ÷ 20 = 22.5 **22 pitches**

Interpretation: - Every 20 minutes, one box of 10 pieces should be completed - 22 boxes per shift = 220 pieces (close to demand of 225) - Material handler checks every 20 minutes - Visual management tracks on-time vs. behind

9.3 Production Leveling Planning Worksheet

Purpose: Create a level schedule mixing volume and variety.

Planning Period: _____ (week, day, shift) **Planner:** _____ **Date:** _____

Step 1: Gather Demand Data

Product	Weekly Demand	Daily Demand	Takt Time	Batch Pref.
A				
B				
C				
D				
E				

Step 2: Calculate Ideal Frequency **Every Product Every (EPE)** = How often should we make each product?

EPE Calculation:

EPE = (Available Time × Batch Efficiency) ÷ (Setup Time × Number of Products + Total Run Time)

Simplified Approach:

Product	Daily Demand	Setup Time	Run Time/Unit	Total Time	Production Freq.
A	100	30 min	2 min	230 min	Daily
B	50	30 min	2 min	130 min	Every 2 days
C	200	45 min	1.5 min	345 min	Daily
D	25	30 min	2 min	80 min	Weekly

Step 3: Create Leveled Schedule Pattern Daily Pattern Example:

Time	Product	Quantity	Duration
7:00-7:30	A	25	30 min
7:30-8:00	C	40	30 min
8:00-8:30	A	25	30 min
8:30-9:00	B	15	30 min
9:00-9:30	C	40	30 min
…	…	…	…

Pattern Characteristics: - [ ] Even mix throughout day (not all A's first, then all B's) - [ ] High-runners produced multiple times per day - [ ] Low-runners produced less frequently - [ ] Setup time minimized by grouping similar products - [ ] Demand for all products met

Step 4: Validate Schedule Capacity Check:

Resource	Available	Required	Utilization %	Status
Machine Hours				[ ] OK [ ] Over
Labor Hours				[ ] OK [ ] Over
Material Avail.				[ ] OK [ ] Short

Smoothness Check: - [ ] Workload relatively even throughout day - [ ] No large peaks and valleys - [ ] Material demand on suppliers is leveled - [ ] Shipping demand is leveled

---

10. Pull System Performance Metrics

10.1 Pull System Metrics Dashboard

Week of: _____

Inventory Metrics

Metric	Target	Monday	Tuesday	Wednesday	Thursday	Friday	Trend
WIP Inventory (pcs)	<500						[ ] □ [ ] □ [ ] □
WIP Days	<2.0						[ ] □ [ ] □ [ ] □
Supermarket Stock (pcs)	Target						[ ] □ [ ] □ [ ] □

Metric	Target	Monday	Tuesday	Wednesday	Thursday	Friday	Trend
Stockouts	0						[ ] [ ] [ ]
Overstock In-stances	0						[ ] [ ] [ ]

Flow Metrics

Metric	Target	Monday	Tuesday	Wednesday	Thursday	Friday	Trend
Kanban Cycle Time (hrs)	<24						[ ] [ ] [ ]
On-Time Replen-ishment %	>95%						[ ] [ ] [ ]
Pitch At-tainment %	100%						[ ] [ ] [ ]
Lead Time (days)	<5						[ ] [ ] [ ]

Compliance Metrics

Metric	Target	This Week	Notes
Kanban Rules Followed	100%		
Heijunka Box Updated	Daily		
Supermarket Audits	1/week		
Visual Board Current	100%		

10.2 Kanban System Health Check

Check Date: _____ **Evaluator:** _____

Health Indicator	Healthy	Warning	Unhealthy	Score
Stockouts per week	0	1-2	3+	
Overstock locations	0	1-3	4+	
Kanban card accuracy	100%	95-99%	<95%	
Replenishment response	<4 hrs	4-8 hrs	>8 hrs	
WIP vs. target	On target	+/-10%	>10%	

Health Indicator	Healthy	Warning	Unhealthy	Score
Operator compliance	100%	90-99%	<90%	
Visual board updated	Always	Usually	Rarely	

Overall System Health: [ ] Healthy [ ] Needs Attention [ ] Critical

Action Plan: 1. _____ 2. _____
3. _____

Next Steps

Use Part 2 templates to:

1. **Design pull systems** with appropriate supermarkets and signals
2. **Implement kanban** with properly calculated quantities
3. **Set up supermarkets** with visual controls
4. **Level production** using Heijunka methods
5. **Track metrics** to ensure system health

Continue to Part 3: SMED, TPM, Poka-Yoke, and Continuous Improvement templates

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This appendix is designed to support Module 24: L.E.A.N. Strategies. Adapt these templates to your specific shop environment and scale.

Contents

This section covers: - SMED (Single-Minute Exchange of Dies) Templates - TPM (Total Productive Maintenance) Tools - Poka-Yoke (Error-Proofing) Design - Kaizen Event Planning and Execution

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11. SMED (Setup Reduction) Templates

11.1 SMED Analysis Worksheet

Purpose: Document and analyze current setup process to identify improvement opportunities.

Machine/Process: _____ **Part/Setup:** _____ **Analyst:** _____ **Date:** _____

Current State Setup Time

Measurement	Time
Average setup time	_____ minutes

Measurement	Time
Best setup time	_____ minutes
Worst setup time	_____ minutes
Who performs setup	[ ] Operator [ ] Setup specialist [ ] Both

Setup Element Documentation **Instructions:** Observe 2-3 complete setups. Document every activity with video if possible.

Step	Activity Description	Time (min)	Internal or External?	Value-Add?	Category
1			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
2			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
3			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
4			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
5			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
6			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
7			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
8			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure
9			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure

Step	Activity Description	Time (min)	Internal or External?	Value-Add?	Category
10			[ ] I [ ] E	[ ] Y [ ] N	[ ] Search [ ] Move [ ] Adjust [ ] Measure

Definitions: - **Internal:** Must be done while machine is stopped - **External:** Can be done while machine is running - **Value-Add:** Directly contributes to changeover (customer would pay for it)

Current State Analysis **Time Breakdown:**

Category	Time (min)	Percentage
Internal activities		%
External activities		%
TOTAL		**100%**

Activity Type Breakdown:

Type	Time (min)	Percentage	Examples
Searching/gathering tools		%	Looking for wrenches, fixtures, programs
Moving/transporting		%	Getting tools, bringing parts
Unfastening/fastening		%	Bolts, clamps, screws
Adjusting/measuring		%	Offsets, alignments, test cuts
Cleaning		%	Chip removal, coolant cleanup
Trial runs		%	First piece inspection, adjustments
Other		%	
TOTAL		**100%**	

11.2 SMED Improvement Ideas Checklist

Stage 1: Separate Internal and External

Goal: Perform as much as possible while machine is running.

- ☐ Pre-stage next tooling at machine (external)
- ☐ Pre-heat tools while machine running (external)
- ☐ Prepare fixtures and workholding ahead (external)
- ☐ Gather all tools/wrenches before stopping machine (external)
- ☐ Load program and verify before stopping machine (external)

- ☐ Pre-position material at machine (external)
- ☐ Organize all setup components in cart/kit (external)
- ☐ Complete paperwork while running (external)
- ☐ Post-setup cleanup after starting new job (external)

Estimated Time Savings: _____ minutes (____%)

Stage 2: Convert Internal to External

Goal: Redesign so activities can be done while running.

- ☐ Standardize tool heights (eliminate touch-off during setup)
- ☐ Quick-change tool holders (eliminate manual tool changes)
- ☐ Duplicate work holding (swap while running)
- ☐ Standardized work offsets (eliminate offset setup)
- ☐ Pre-proven programs (eliminate on-machine editing)
- ☐ Fixture carts (roll on/off without disassembly)

Estimated Time Savings: _____ minutes (____%)

Stage 3: Streamline Internal Activities

Goal: Make remaining internal activities faster.

Eliminate Adjustments: - [ ] Standardized heights and positions - [ ] Reference surfaces and hard stops - [ ] Preset tooling systems - [ ] Gage blocks for standard setups - [ ] Visual guides and indicators

Eliminate Fasteners: - [ ] Replace bolts with clamps - [ ] Replace multiple fasteners with one - [ ] Quick-release mechanisms - [ ] Pear-shaped holes for sliding - [ ] Cam locks instead of threads - [ ] Magnets instead of clamps (where appropriate)

Parallel Operations: - [ ] Two people setup (where it makes sense) - [ ] Simultaneous positioning of multiple elements - [ ] Pre-assembled subcomponents

Standardization: - [ ] Common tooling across similar setups - [ ] Standardized part orientations - [ ] Consistent work holding methods - [ ] Repeatable coordinate systems - [ ] Standard procedures documented

Estimated Time Savings: _____ minutes (____%)

11.3 SMED Action Plan

Setup: _____ **Target Reduction:** _____% (from _____ to _____ minutes)

Improvement	Type	Responsibility	Resources Needed	Cost Est.	Target Date	Status
	[ ] S1					
	[ ] S2					
	[ ] S3					
	[ ] S1					
	[ ] S2					
	[ ] S3					

Improvement	Type	Responsibility	Resources Needed	Cost Est.	Target Date	Status
	[ ] S1 [ ] S2 [ ] S3					
	[ ] S1 [ ] S2 [ ] S3					

Legend: S1=Separate Internal/External, S2=Convert to External, S3=Streamline Internal

11.4 Standard Setup Procedure Template

Machine: _____ **Setup:** _____ **Target Time:** _____ min

Tools/Equipment Required: - _____ - _____ - _____

Pre-Setup (External - Before Stopping Machine):

Step	Action	Time	Notes
1			
2			
3			

Setup (Internal - Machine Stopped):

Step	Action	Time	Photos/Diagrams	Critical Points
1				
2				
3				
4				
5				

Post-Setup (External - After Starting New Job):

Step	Action	Time	Notes
1			
2			

Total Target Time: _____ minutes (_____ internal + _____ external)

Revision History:

Date	Rev	Changes	Approved By

12. TPM (Total Productive Maintenance) Templates

12.1 Overall Equipment Effectiveness (OEE) Tracking

Purpose: Measure true equipment productivity considering availability, performance, and quality.

Machine: _____ **Week of:** _____

Daily OEE Calculation OEE = Availability × Performance × Quality

Monday:

Metric	Calculation	Value
Availability		
Planned Production Time	Shift time - breaks - planned stops	_____ min
Actual Run Time	Planned time - downtime	_____ min
Availability %	(Run time ÷ Planned time) × 100	_____%
Performance		
Ideal Cycle Time	Engineering standard	_____ sec/pc
Total Pieces Produced	Count	_____ pcs
Actual Production Time	Run time	_____ min
Performance %	(Pieces × Ideal time ÷ Run time) × 100	_____%
Quality		
Total Pieces Produced		_____ pcs
Good Pieces	No defects	_____ pcs
Quality %	(Good ÷ Total) × 100	_____%
OEE		
OEE %	Avail. % × Perf. % × Quality %	_____%

Downtime Details (for Availability loss):

Reason	Duration (min)	Category
		[ ] Breakdown [ ] Setup [ ] Adjustment [ ] Other
		[ ] Breakdown [ ] Setup [ ] Adjustment [ ] Other
		[ ] Breakdown [ ] Setup [ ] Adjustment [ ] Other

Repeat for Tuesday through Friday

Weekly Summary

Day	Availability	Performance	Quality	OEE	Comments
Mon	_____%	_____%	_____%	_____%	
Tue	_____%	_____%	_____%	_____%	
Wed	_____%	_____%	_____%	_____%	
Thu	_____%	_____%	_____%	_____%	
Fri	_____%	_____%	_____%	_____%	
AVG	_____%	_____%	_____%	_____%	

OEE Benchmarks: - World Class: 85%+ - Good: 65-85% - Needs Improvement: <65%

Current Status: [ ] World Class [ ] Good [ ] Needs Improvement

12.2 Six Big Losses Analysis

Machine: _____ **Analysis Period:** _____

Loss Category	Impact	Time/Cost Lost	% of Total	Priority
1. Breakdowns Equipment failure, unplanned stops	Availability		%	
2. Setup/Adjustments Changeovers, warmup, adjustments	Availability		%	
3. Small Stops Jams, minor stops (<5 min)	Performance		%	
4. Reduced Speed Running slower than designed	Performance		%	
5. Startup Rejects Scrap/rework during warmup/setup	Quality		%	
6. Production Rejects Scrap/rework during normal production	Quality		%	
TOTAL LOSSES			**100%**	

Top 3 Losses to Address: 1. _____ 2. _____ 3. _____

12.3 Autonomous Maintenance Checklist

Machine: _____ **Operator:** _____ **Date:** _____

Daily Checks (5-10 minutes) **CLEANING:** - [ ] Remove chips from machine surfaces - [ ] Clean coolant tank and strainer - [ ] Wipe down ways and covers - [ ] Clean work area around machine

INSPECTION: - [ ] Check fluid levels (oil, coolant, hydraulic) - [ ] Listen for unusual noises - [ ] Check for leaks (oil, coolant, air) - [ ] Inspect air pressure gauge - [ ] Check safety devices (guards, e-stop)

LUBRICATION: - [ ] Check auto-lube system operation - [ ] Manual lube points if required

DOCUMENTATION: - [ ] Record any issues found - [ ] Tag for maintenance if needed

Time Spent: _____ minutes **Issues Found:** [ ] None [ ] See notes below

Notes/Issues: _____
_____

12.4 Planned Maintenance Schedule Template

Machine: _____ **Year:** _____

Maintenance Task Matrix

Task	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oil change	Quarterly	[check]			[check]			[check]			[check]		
Belt inspection	Monthly	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]
Level check	Semi-annual	[check]						[check]					
Ball screw inspect	Quarterly	[check]			[check]			[check]			[check]		
Spindle maintenance	Annual							[check]					
Way lube check	Monthly	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]	[check]

Planned Downtime Budget: - Total hours per year: _____ hours - Cost per hour: $_____ - Total PM budget: $_____

12.5 TPM Improvement Log

Machine: _____ **Period:** _____

Date	Problem/Opportunity	Action Taken	Cost	Time Saved	Responsible	Status
						[ ] Open [ ] Complete

Date	Problem/Opportunity	Action Taken	Cost	Time Saved	Responsible	Status
						[ ] Open [ ] Complete
						[ ] Open [ ] Complete

Summary: - Total improvements: _____ - Total cost: $_____ - Total time saved: _____ hours/year - Payback period: _____ months

---

13. Poka-Yoke (Error-Proofing) Templates

13.1 Error-Proofing Opportunity Assessment

Process: _____ **Assessed By:** _____ **Date:** _____

Error Identification

Step	Potential Error	Frequency	Severity	Detection	Risk Score
		[ ] High [ ] Med [ ] Low	[ ] High [ ] Med [ ] Low	[ ] Hard [ ] Med [ ] Easy	/9
		[ ] High [ ] Med [ ] Low	[ ] High [ ] Med [ ] Low	[ ] Hard [ ] Med [ ] Easy	/9
		[ ] High [ ] Med [ ] Low	[ ] High [ ] Med [ ] Low	[ ] Hard [ ] Med [ ] Easy	/9

Risk Scoring: - Frequency: High=3, Medium=2, Low=1 - Severity: High=3, Medium=2, Low=1 - Detection: Hard=3, Medium=2, Easy=1 - Risk Score = Frequency × Severity × Detection - Prioritize scores >12

13.2 Poka-Yoke Design Worksheet

Error to Prevent: _____ **Designer:** _____ **Date:** _____

Error Analysis **Where does error occur?** _____ **How does error happen?** _____ **Why can this error occur?** _____ **Who makes the error?** [ ] Operator [ ] Setup [ ] Inspection [ ] Other: _____ **What is the consequence?** _____

Poka-Yoke Principle Selection Choose approach:

[ ] **Elimination** - Design out the possibility of error - Example: Asymmetric design so part only fits one way

[ ] **Replacement** - Substitute unreliable process with reliable one - Example: Barcode scanning instead of manual entry

[ ] **Facilitation** - Make correct action easier than incorrect - Example: Color-coding, clear labeling

[ ] **Detection** - Identify error before it proceeds - Example: Sensor detects missing part

[ ] **Mitigation** - Reduce impact of error - Example: Breakaway feature prevents damage

Poka-Yoke Method Type: - [ ] **Contact** - Physical detection (shape, dimension) - [ ] **Fixed-Value** - Counting method (must have exact number) - [ ] **Motion-Step** - Sequence detection (steps must occur in order)

Control Function: - [ ] **Control** - Stops process when error detected (preferred) - [ ] **Warning** - Alerts operator to error (less reliable)

Design Details Description of Poka-Yoke: _____
_____ _____

Sketch/Photo: [Attach drawing or photo]

Components Needed: - _____ - _____
- _____

Installation Requirements: - _____ - _____

Cost Estimate: $_____ **Implementation Time:** _____ hours

Validation Plan How will effectiveness be tested? _____

Success Criteria: - [ ] Error completely eliminated, or - [ ] Error reduced by _____% - [ ] 100% detection rate

Testing Results: - Test date: _____ - Trials: _____ - Errors prevented: _____ - Effectiveness: _____%

13.3 Common Poka-Yoke Examples for CNC

Loading Errors:

Error	Poka-Yoke Solution
Part loaded backwards	Asymmetric fixture, pins at different positions
Wrong part loaded	Gage check before clamping, vision system
Part not fully seated	Proximity sensor detects seating
Forgot to remove previous part	Sensor confirms empty before cycle start

Setup Errors:

Error	Poka-Yoke Solution
Wrong tool loaded	Tool ID chip, length measurement check
Tool in wrong position	Coded tool holders (can only fit correct pocket)
Wrong program selected	Barcode on setup sheet auto-loads program
Offset not set	Automatic tool measurement system
Forgot probe calibration	Software forces calibration before first cycle

Process Errors:

Error	Poka-Yoke Solution
Missed operation	In-process gaging verifies features present
Wrong feed/speed	Program limits prevent dangerous parameters
Part moved during cut	Mid-cycle clamp pressure monitoring
Coolant not flowing	Flow sensor stops cycle if no coolant

Inspection Errors:

Error	Poka-Yoke Solution
Forgot to inspect	Gage station blocks access to shipping
Wrong gage used	Color-coded gages match part drawing
Inspection incomplete	Checklist with all features must be signed
Gage out of calibration	Gage locks when calibration due

---

14. Kaizen Event Planning Templates

14.1 Kaizen Charter

Event Name: _____ **Dates:** _____ to _____

Problem Statement **Current Condition:** _____
_____

Goal/Target Condition: _____
_____

Gap: _____

Business Impact: - Cost: $_____ /year wasted or $_____ savings potential - Quality: _____ defects/week or _____% improvement potential - Delivery: _____ late orders or _____ days lead time reduction potential - Safety: _____ incidents or _____ hazards

Scope In Scope: - _____ - _____ - _____

Out of Scope: - _____ - _____

Boundaries: - Start point: _____ - End point: _____

Team

Role	Name	Department	Availability
Sponsor			[ ] Full [ ] Part-time
Team Leader			[ ] Full [ ] Part-time
Facilitator			[ ] Full [ ] Part-time
Team Member			[ ] Full [ ] Part-time
Team Member			[ ] Full [ ] Part-time
Team Member			[ ] Full [ ] Part-time
Team Member			[ ] Full [ ] Part-time

Subject Matter Experts (as needed): - _____

Targets

Metric	Current	Target	Stretch Goal

Resources Budget: $_____ **Tools/Equipment Needed:** _____ **Support Needed:** _____

Approvals: - Sponsor: _____ Date: _____ - Management: _____ Date: _____

14.2 Kaizen Week Schedule

Day 1 - Monday: Orientation and Current State

Time	Activity	Responsibility
8:00-9:00	Kickoff meeting, introductions, charter review	
9:00-10:00	Training on tools/methods	
10:00-12:00	Gemba walk, process observation	
12:00-1:00	Lunch	
1:00-3:00	Current state mapping (VSM, spaghetti, etc.)	
3:00-4:00	Data collection and analysis	
4:00-5:00	Day 1 wrap-up, homework assignments	

Day 2 - Tuesday: Analysis and Future State Design

Time	Activity	Responsibility
8:00-8:30	Day 1 review, day 2 preview	
8:30-10:00	Root cause analysis (5 Whys, fishbone)	
10:00-12:00	Generate improvement ideas (brainstorming)	
12:00-1:00	Lunch	
1:00-3:00	Prioritize ideas, create future state design	
3:00-4:30	Action plan development	
4:30-5:00	Day 2 wrap-up	

Day 3 - Wednesday: Implementation

Time	Activity	Responsibility
8:00-8:30	Day 2 review, day 3 preview	
8:30-12:00	Implement improvements (hands-on)	
12:00-1:00	Lunch	
1:00-4:30	Continue implementation	
4:30-5:00	Day 3 wrap-up, adjust plans	

Day 4 - Thursday: Implementation and Testing

Time	Activity	Responsibility
8:00-8:30	Day 3 review, day 4 preview	
8:30-12:00	Complete implementation	
12:00-1:00	Lunch	
1:00-3:00	Test and refine improvements	
3:00-4:30	Document new procedures	
4:30-5:00	Day 4 wrap-up, prepare presentation	

Day 5 - Friday: Validation and Report Out

Time	Activity	Responsibility
8:00-8:30	Day 4 review, day 5 preview	
8:30-10:00	Final validation and measurement	
10:00-11:30	Prepare presentation materials	
11:30-12:30	Lunch	
12:30-2:00	Rehearse presentation	
2:00-3:00	**Report out to management**	
3:00-4:00	Celebration, recognition, next steps	

14.3 Kaizen Report Out Template

Presentation Structure (30-45 minutes):

Slide 1: Title - Event name - Team members - Dates

Slide 2: Problem Statement - Current condition - Business impact - Why we did this event

Slide 3: Goals/Targets - Metric targets - Scope

Slide 4: Current State - Process map, VSM, or photos - Key data/metrics - Waste identified

Slide 5: Analysis - Root causes identified - Tools used (5 Whys, fishbone, etc.)

Slide 6: Future State Design - New process map - Key changes

Slide 7: Improvements Implemented - List with photos - Before/after comparisons

Slide 8: Results - Metrics achieved vs. targets - Improvements summary

Slide 9: Financial Impact - Cost to implement - Annual savings - Payback period

Slide 10: Lessons Learned - What went well - What was challenging - Recommendations

Slide 11: Sustain Plan - How will gains be maintained? - Ownership - Follow-up dates

Slide 12: Next Steps - Remaining action items - Future kaizen opportunities - Thank you/questions

14.4 Kaizen Follow-Up Checklist

30-Day Follow-Up - [ ] All action items completed or on track - [ ] Metrics still at target levels - [ ] Team members satisfied with changes - [ ] No unintended consequences - [ ] Procedures documented and trained

90-Day Follow-Up - [ ] Sustained results (data review) - [ ] Financial benefits realized - [ ] Lessons applied to other areas - [ ] Recognition and celebration - [ ] Kaizen event closed

---

Next Steps

Use Part 3 templates to:

1. **Reduce setup times** with SMED methodology
2. **Improve equipment reliability** with TPM practices
3. **Prevent errors** with poka-yoke designs
4. **Run kaizen events** for focused improvement

Continue to Part 4: Visual Management, Metrics, and Implementation Planning templates

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This appendix is designed to support Module 24: L.E.A.N. Strategies. Adapt these templates to your specific shop environment and scale.

Contents

This section covers: - Visual Management and Andon Systems - Standardized Work Templates - Lean Metrics and Dashboards - Lean Implementation Roadmap - A3 Problem Solving

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15. Visual Management Templates

15.1 Visual Management Hierarchy

Level 1: Information Displays - Makes current status visible at a glance - Examples: Labels, signs, floor markings, shadow boards

Level 2: Performance Displays - Shows performance metrics and targets - Examples: Production boards, OEE displays, quality charts

Level 3: Control Displays - Enables quick response to abnormalities - Examples: Andon lights, alarm systems, problem boards

15.2 Production Status Board Template

```
+------------------------------------------------------------+
|           PRODUCTION STATUS BOARD - [WORK CENTER]           |
|                    Week of: _____________                  |
|------------------------------------------------------------|
|                                                            |
|  TARGET vs ACTUAL                      HOUR-BY-HOUR        |
|                                                            |
|  Daily Target: _____ pcs             Time  | Plan | Actual |
|  Current: _____ pcs                  7:00  |  20  |   18   |
|  % to Target: _____%                 8:00  |  20  |   22   |
|                                      9:00  |  20  |   19   |
|  Status: [ ] ON TRACK                  10:00 |  20  |   --   |
|          [ ] BEHIND                    11:00 |  20  |   --   |
|          [ ] AHEAD                     12:00 |  20  |   --   |
|                                     1:00  |  20  |   --   |
|-------------------------------------|  2:00  |  20  |   --   |
|                                     |  3:00  |  20  |   --   |
|  DOWNTIME LOG                       |                       |
|                                     +-----------------------+
|  Time   | Reason      | Duration    |                       |
|  8:15   | Tool Break  | 15 min      |  QUALITY STATUS       |
|  ------ | ----------- | -------     |                       |
|  ------ | ----------- | -------     |  First Piece: ☑ PASS  |
|                                      |  In-Process: [ ] Issues |
|-------------------------------------|  Rejects Today: __2__  |
|                                     |                       |
|  CURRENT JOB                        |  SAFETY                |
|                                     |                       |
```

```
|  Part #: _____________                |  Days w/o incident: __|
|  Customer: ___________                |  Near misses: ____     |
|  Qty Ordered: ________                |                        |
|  Due Date: ___________                |                        |
|                                       |                        |
+---------------------------------------------------------------+
```

Board Specifications: - Size: 48” × 36” minimum - Location: Visible from all positions in work area - Update: Every hour by operator or team leader - Review: Daily huddle at start of shift

15.3 Andon System Design

Purpose: Real-time alert system for problems requiring attention.

Signal Light Colors (Standard)

```
+----+
| □  |  RED = Problem/Stop (immediate help needed)
|----|
| □  |  YELLOW = Caution/Attention (minor issue)
|----|
| □  |  GREEN = Normal Operation (all OK)
|----|
| □  |  BLUE = Material/Support Needed
+----+
```

Andon Response Procedure When Light Activates:

Color	Meaning	Who Responds	Max Response Time	Actions
□ RED	Critical problem	Supervisor, Maintenance	2 minutes	Immediate assistance, solve or escalate
□ YELLOW	Minor issue	Team Leader	5 minutes	Check status, provide support if needed
□ GREEN	Normal	N/A	N/A	Continue production
□ BLUE	Material needed	Material Handler	10 minutes	Deliver material, refill supplies

Andon Board Template Work Center Andon Board

```
+-------------------------------------------------+
|              SHOP ANDON STATUS BOARD            |
|------+---------+--------+---------+-------------|
| Wk   | Machine | Status | Time    | Issue       |
| Ctr  | ID      | Light  | Elapsed | Description |
|------+---------+--------+---------+-------------|
| A1   | Mill-01 |   □    |   --    | Normal      |
|------+---------+--------+---------+-------------|
| A2   | Lathe-3 |   □    |  3 min  | Tool break  |
|------+---------+--------+---------+-------------|
| A3   | Mill-02 |   □    |  8 min  | Need bar    |
|------+---------+--------+---------+-------------|
| B1   | Lathe-1 |   □    |   --    | Normal      |
|------+---------+--------+---------+-------------|
| B2   | VMC-05  |   □    |  2 min  | Part inspect |
+------+---------+--------+---------+-------------+

RESPONSE TIMES TODAY:
Average: _____ min  |  Target: <5 min  |  Status: ________
```

15.4 Shadow Board Template

Purpose: Visual tool organization - every tool has a designated place.

Shadow Board Design Principles: - [ ] Outline of tool painted or taped on board - [ ] Tool name labeled at location - [ ] Missing tools immediately obvious - [ ] Most-used tools at easiest reach - [ ] Color coding by frequency (daily, weekly, rarely) - [ ] Damaged/calibration due tools marked differently

Example Layout:

```
+-----------------------------------------------------+
|              TOOL SHADOW BOARD – MILL 3              |
|-----------------------------------------------------|
|                                                     |
|   ╔═══════╗    ╔═══════╗    ╔═══════╗              |
|   ║       ║    ║       ║    ║       ║              |
|   ║ 6" Adj ║    ║ 8" C  ║    ║ Hammer ║              |
|   ║ Wrench ║    ║Wrench ║    ║       ║              |
|   ╚═══════╝    ╚═══════╝    ╚═══════╝              |
|                                                     |
|   +--------+    +------+    +-------+    +-------+ |
|   |  Hex   |    |Allen |    | Torx  |    | Screw | |
|   |  Key   |    | Set  |    |  Set  |    |Driver | |
|   |  Set   |    |      |    |       |    |  Set  | |
|   +--------+    +------+    +-------+    +-------+ |
|                                                     |
|   [═══════]    [══════]    [═══════════]            |
|   12" Scale    6" Scale    Digital Caliper          |
```

```
|                                                          |
+----------------------------------------------------------+

LEGEND:  Daily Use = GREEN    Weekly = YELLOW    Rare = RED
```

15.5 Floor Marking Standards

Purpose: Create visual workplace with clear pathways, locations, and boundaries.

Color Standards (OSHA-based)

Color	Meaning	Examples
YELLOW	Caution, traffic lanes	Aisles, walkways, forklift paths
WHITE	Production areas	Work cells, machine locations
RED	Safety, fire equipment	Fire extinguishers, emergency stops, defect areas
BLUE	Information, storage	Raw material, WIP holding, tool storage
GREEN	Finished goods, safety	Completed parts, first aid stations, safety equipment
ORANGE	Hazardous areas	Machine hazard zones, pinch points
BLACK/YELLOW STRIPE	Permanent hazards	Columns, protruding structures, height clearances

Floor Marking Plan Template Area: _____ **Designer:** _____ **Date:** _____

Location	Marking Type	Color	Purpose	Size/Spec
	[ ] Solid line [ ] Dashed [ ] Shape			__” width
	[ ] Solid line [ ] Dashed [ ] Shape			__” width
	[ ] Solid line [ ] Dashed [ ] Shape			__” width

Standards: - Main aisles: 4” yellow lines - Work cells: 2” white lines - Storage locations: 2” blue shapes/borders - Safety zones: 2-4” red or orange - Arrows: Show direction of flow

---

16. Standardized Work Templates

16.1 Standardized Work Chart

Process: _____ **Part #:** _____ **Rev:** ____ **Date:** ____

Takt Time: _____ sec | **Cycle Time:** _____ sec | **WIP:** _____ pcs

Work Sequence

Step	Work Element	Time (sec)	Wait Time (sec)	Walk Distance (ft)	Quality Check	Safety
1					[ ]	[ ]
2					[ ]	[ ]
3					[ ]	[ ]
4					[ ]	[ ]
5					[ ]	[ ]
6					[ ]	[ ]
7					[ ]	[ ]
8					[ ]	[ ]
9					[ ]	[ ]
10					[ ]	[ ]

Total Manual Time: _____ sec **Total Auto Time:** _____ sec **Total Cycle Time:** _____ sec

Critical Quality Points: 1. _____ 2. _____
3. _____

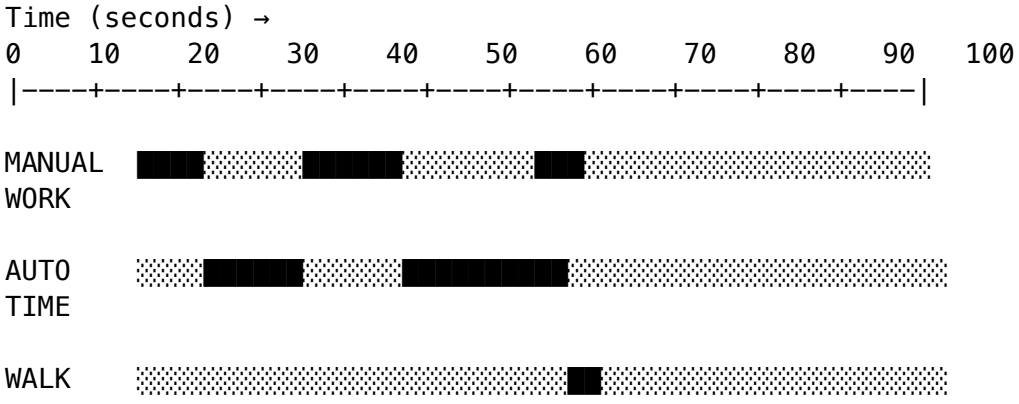
Safety Cautions: 1. _____ 2. _____

16.2 Standardized Work Combination Sheet

Purpose: Balance operator time with machine auto time.

Process: _____ **Part #:** _____ **Operator:** ____

Timeline Chart:



Analysis: - Total cycle time: _____ sec - Takt time: _____ sec - Status: [ ] Under takt (OK) [ ] Over takt (Problem) [ ] Close to takt (Risk) - Operator utilization: _____% (Manual time ÷ Cycle time) - Idle time: _____ sec per cycle

Improvement Opportunities: - _____ - _____

16.3 Job Instruction Sheet

Job: _____ **Part #:** _____ **Revision:** ____ **Date:** ____

Tools/Equipment Required: - _____ - _____

Safety Equipment Required: [ ] Safety glasses [ ] Gloves [ ] Hearing protection [ ] Other: _____

Detailed Instructions

Step	Key Point	Reason	Photo/Diagram
1			[Reference]
2			[Reference]
3			[Reference]
4			[Reference]
5			[Reference]

Key Point: Critical technique, dimension, or detail that ensures quality/safety **Reason:** Why this key point matters

Quality Checks:

What to Check	How to Check	Frequency	Specification

Common Mistakes to Avoid: 1. _____ 2. _____ 3. _____

Troubleshooting:

Problem	Likely Cause	Solution

Approved By: _____ **Date:** _____ **Training:** [ ] Complete

_____

17. Lean Metrics Dashboard

17.1 Shop-Level Lean Metrics

Month: _____ **Year:** _____

Primary Metrics

Metric	Target	This Month	Last Month	YTD	Trend
On-Time Delivery %	95%				[ ] [ ] [ ]
Overall OEE %	75%				[ ] [ ] [ ]
First Pass Yield %	98%				[ ] [ ] [ ]
Inventory Turns	12/yr				[ ] [ ] [ ]
Lead Time (days)	<7				[ ] [ ] [ ]
Setup Time Avg (min)	<30				[ ] [ ] [ ]

Supporting Metrics

Metric	This Month	Last Month	Target
WIP Inventory			<2% sales
$()\|\|\|\|\|DaysofWIP\|\|\| < 3\|\|RawMaterialTurns\|\|\| > 24/yr\|\|FinishedGoodsTurns\|\|\| > 52/yr\|\|AverageBatchSize\|\|\|Decreasing\|\|DefectRate(PPM)\|\|\| < 5,000\|\|ScrapCost()$			
Equipment Downtime %			<5%
Safety Incidents			0
Near Misses Reported			>5/month
Kaizen Events			2/month
Improvement Ideas Submitted			10/month

17.2 Value Stream Performance Metrics

Value Stream: _____ **Month:** _____

Flow Metrics Lead Time Analysis:

Stage	Days	% of Total
Order Entry		%
Material Procurement		%
Queue/Wait		%

Stage	Days	% of Total
Production		%
Inspection		%
Shipping		%
TOTAL LEAD TIME		**100%**

Value-Added Ratio: - Total Lead Time: _____ days - Value-Added Time: _____ days (actual processing) - VA Ratio: _____% (Target: >10%)

Pull System Health

Indicator	Status	Notes
Kanban stockouts	[ ] None [ ] Few [ ] Many	
Overstock situations	[ ] None [ ] Few [ ] Many	
Pull rule compliance	[ ] 100% [ ] >90% [ ] <90%	
Replenishment responsiveness	[ ] Good [ ] OK [ ] Poor	

17.3 Continuous Improvement Metrics

Kaizen Activity Tracking:

Month	Events Held	Participants	Ideas Generated	Ideas Implemented	Savings ($)
Jan					
Feb					
Mar					
YTD					

Improvement Project Pipeline:

Status	Count	Total Savings Potential
Ideas Submitted		$
Under Evaluation		$
Approved/In Progress		$
Completed This Month		$
Completed YTD		$

---

18. A3 Problem Solving Template

18.1 A3 Report Structure

A3 Title: _____ **Owner:** _____ **Date:** _____ **Status:** [ ] In Progress [ ] Complete

1. Background / Problem Statement (Top Left)

What is the problem? _____
_____

Where/when does it occur? _____

Why is it important? _____

2. Current Condition (Top Right)

Current performance data: - Metric: _____ (current) vs _____ (target) - Frequency: _____ - Cost impact: $_____

Visual representation (chart, graph, photo): [Attach visual]

3. Goal / Target Condition (Middle Left)

What does success look like? _____

Specific, measurable targets: - _____ - _____

By when: _____

4. Root Cause Analysis (Middle Left)

What analysis was done? [ ] 5 Whys [ ] Fishbone [ ] Pareto [ ] Data analysis [ ] Other: _____

Root causes identified: 1. _____ 2. _____
3. _____

[Attach analysis diagrams]

5. Countermeasures / Solutions (Middle Right)

Countermeasure	Addresses Root Cause	Impact	Feasibility	Priority
		H/M/L	H/M/L	
		H/M/L	H/M/L	
		H/M/L	H/M/L	

Selected solution(s): _____

6. Implementation Plan (Bottom Left)

Action	Responsible	Resources	Target Date	Status
				[ ] [ ] [ ]
				[ ] [ ] [ ]
				[ ] [ ] [ ]

7. Follow-Up / Results (Bottom Right)

Results after implementation: - Metric: _____ (before) _____ (after) - Improvement: _____% or _____ units - Cost impact: $_____ saved/avoided

Lessons learned: _____

Standardization plan: [ ] Procedure updated [ ] Training completed [ ] Metrics tracking

Horizontal deployment opportunities: _____

---

19. Lean Implementation Roadmap

19.1 Lean Journey Phases

Phase 1: Foundation (Months 1-3)

Goals: - Build lean knowledge - Stabilize basics - Create foundation for improvement

Activities: - [ ] Leadership lean training (2 days) - [ ] 5S implementation (all areas) - [ ] Visual management basics - [ ] Standard work for key processes - [ ] TPM basics (autonomous maintenance) - [ ] Metrics dashboard established - [ ] First kaizen event

Success Criteria: - 5S audit scores >80% - Visual boards in all areas - 3+ standard work documents created - Metrics tracked weekly - 1 completed kaizen event

---

Phase 2: Flow and Pull (Months 4-9)

Goals: - Reduce lead time - Implement pull systems - Improve flow

Activities: - [ ] Value stream mapping (2-3 value streams) - [ ] Setup reduction (SMED) on bottleneck machines - [ ] Kanban pilot for 1-2 product families - [ ] Cell/flow design for high-runner products - [ ] Leveled scheduling (heijunka) pilot - [ ] 2-3 kaizen events per month - [ ] Error-proofing (poka-yoke) implementations

Success Criteria: - Lead time reduced 30% - WIP reduced 40% - Kanban functioning for pilot products - 3+ SMED improvements completed - 6+ kaizen events completed

---

Phase 3: Optimization (Months 10-18)

Goals: - Expand pull systems - Optimize equipment reliability - Develop problem-solving culture

Activities: - [ ] Expand kanban to all products - [ ] Advanced TPM (planned maintenance, OEE tracking) - [ ] Continuous flow expansion - [ ] Supplier integration/pull - [ ] A3 problem-solving training and practice - [ ] Hoshin Kanri (policy deployment) introduction - [ ] 2-3 kaizen events per month sustained

Success Criteria: - OEE >75% - Pull systems operational shop-wide - On-time delivery >95% - 20+ kaizen events completed YTD - Employee engagement in improvement >70%

Phase 4: Culture and Excellence (Months 18+)

Goals: - Embed continuous improvement culture - Pursue operational excellence - Self-sustaining improvement

Activities: - [ ] Daily huddle systems at all levels - [ ] Leader standard work - [ ] Advanced metrics and analytics - [ ] Value stream management - [ ] Cross-training and skill development - [ ] Innovation and advanced improvement methods

Success Criteria: - Self-directed improvement teams - Idea implementation rate >60% - World-class metrics (OEE >85%, OTD >98%) - Lean assessment score >4.0/5.0 - Recognized as lean model shop

19.2 Lean Assessment Scorecard

Assessment Date: _____ **Assessor:** _____

Rate each category: 1=Beginning, 2=Developing, 3=Established, 4=Advanced, 5=World Class

Category	Score (1-5)	Evidence	Priority Actions
5S and Visual Workplace			
Standardized Work			
Setup Reduction (SMED)			
TPM/Equipment Reliability			
Quality at Source			
Pull/Kanban Systems			
Flow/Cell Design			
Continuous Improvement Culture			
Problem Solving (A3, kaizen)			
Metrics and Performance Management			
Leadership and Management System			
Employee Engagement			
TOTAL SCORE	**/60**		

Overall Lean Maturity: - 12-20: Beginning Journey - 21-35: Developing Capability - 36-47: Established System - 48-55: Advanced Performance - 56-60: World Class

19.3 Annual Lean Plan Template

Year: _____ **Prepared By:** _____ **Approved:** _____

Strategic Objectives

1. _____
2. _____
3. _____

Key Metrics Targets

Metric	Current	Target	Improvement
Lead Time	___days	___days	___%
OEE	___%	___%	___pts
On-Time Delivery	___%	___%	___pts
Inventory Turns	___	___	___
First Pass Yield	___%	___%	___pts

Major Initiatives

Initiative	Owner	Timeline	Resources	Expected Impact
		Q1 Q2 Q3 Q4		
		Q1 Q2 Q3 Q4		
		Q1 Q2 Q3 Q4		

Kaizen Event Calendar **Target:** _____ events for the year (monthly schedule)

Month	Event Focus	Facilitator	Status
Jan			[ ] Planned [ ] Complete
Feb			[ ] Planned [ ] Complete
Mar			[ ] Planned [ ] Complete
Apr			[ ] Planned [ ] Complete
May			[ ] Planned [ ] Complete
Jun			[ ] Planned [ ] Complete
Jul			[ ] Planned [ ] Complete
Aug			[ ] Planned [ ] Complete
Sep			[ ] Planned [ ] Complete
Oct			[ ] Planned [ ] Complete
Nov			[ ] Planned [ ] Complete
Dec			[ ] Planned [ ] Complete

Training Plan

Training Topic	Target Audience	Frequency	Provider
Lean Fundamentals	All employees	Annual	Internal
5S Training	New hires	Onboarding	Supervisor
Standard Work	Leads, supervisors	Quarterly	Internal
SMED	Setup specialists	Semi-annual	Consultant
A3 Problem Solving	Engineers, leads	Semi-annual	Internal
Kaizen Facilitation	Leaders	Annual	External

Resource Budget

Category	Budget ($)
Training	
Consulting	
Capital (equipment, tools)	
Supplies and materials	
Events and recognition	
TOTAL	

---

20. Summary and Usage Guide

Template Selection Guide

Starting Out? → Use Part 1: VSM, DOWNTIME assessment, Takt time calculator

Implementing Pull? → Use Part 2: Kanban design, supermarket planning, Heijunka

Improving Reliability? → Use Part 3: SMED, TPM, Poka-yoke, Kaizen event planning

Creating Visual Management? → Use Part 4: Visual boards, standardized work, metrics dashboards, A3

Implementation Sequence Recommendation

1. **Start with 5S and visual management** - Creates foundation
2. **Develop standard work** - Documents current best practice
3. **Map value streams** - Understand current state, identify waste
4. **Implement pull systems** - Reduce inventory, improve flow
5. **Reduce setup times (SMED)** - Enable smaller batches
6. **Improve reliability (TPM)** - Stabilize processes
7. **Error-proof (Poka-yoke)** - Prevent defects
8. **Run kaizen events** - Accelerate improvement
9. **Measure and visualize** - Track progress
10. **Problem-solve systematically (A3)** - Build capability

Customization Tips

- Adapt all templates to your shop's terminology and culture
- Simplify for smaller shops (you don't need all fields)
- Digitize when helpful, but paper works fine for many tools
- Focus on usefulness, not perfection
- Involve team in template design for buy-in

Additional Resources

Recommended Books: - "Learning to See" (Rother & Shook) - VSM workbook - "Quick Changeover for Operators" (Productivity Press) - SMED - "Creating Continuous Flow" (Rother & Harris) - Flow design - "The Toyota Way Fieldbook" (Liker & Meier) - Practical implementation

Software Tools: - **Free:** Excel, Google Sheets for tracking - **Low-Cost:** iAuditor (checklists), Trello (kaizen boards) - **Mid-Range:** Minitab, Power BI (analytics) - **Enterprise:** ERP systems with lean modules

Associations: - Lean Enterprise Institute (LEI) - Society of Manufacturing Engineers (SME) - Association for Manufacturing Excellence (AME) - Shingo Institute

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Conclusion

These templates provide a complete toolkit for implementing L.E.A.N. strategies in your CNC manufacturing operation. Remember:

[check] **Start small** - Pilot before rolling out shop-wide [check] **Engage people** - Improvement is everyone's job [check] **Be patient** - Lean is a journey, not a destination [check] **Measure results** - Data drives improvement [check] **Sustain gains** - Standardize successful changes [check] **Keep learning** - Continuous improvement applies to your lean system too

Final Thought: Lean isn't about the templates–it's about developing people who see problems, solve them systematically, and continuously improve. Use these tools to enable that culture.

This completes Appendix S: L.E.A.N. Strategy Templates and Tools. These templates support Module 24: L.E.A.N. Strategies and provide practical implementation guidance for CNC shops of all sizes.

Appendix S Parts: - Part 1: VSM, DOWNTIME, Process Observation - Part 2: JIT, Kanban, Pull Systems, Heijunka - Part 3: SMED, TPM, Poka-Yoke, Kaizen Events - Part 4: Visual Management, Standard Work, Metrics, A3, Implementation

Total Pages: ~85 pages of practical lean tools and templates