

USED IN REAL IMPROVEMENT WORK

When a machine fault wasn't a machine fault

Joe Campbell, Operations Manager, completed SimplicityHub's Green Belt course and used 16 templates and 4 calculators to run a structured improvement project on a live manufacturing problem.

CSSC REVIEW ★★★★★

·Green belt course was really decent! Very thorough content and I also have really decent tools to take away and use in my place of work, brilliant for the price!·

Joe Campbell, Operations Manager · Verified on CSSC · 19 August 2026



1. Problem

Recurring machine jams and repeated reactive fixes.



2. Root cause

Data and Gemba observation exposed the damp-floor and draught pattern.



3. Fix

A simple no-cost change stopped the recurring jams.

THE PROBLEM

A labelling machine on Line 2 kept jamming. Maintenance replaced the sensor, replaced the feed motor and recalibrated twice. After three weeks of repeated downtime and a significant parts bill, the underlying cause still had not been identified.

THE BREAKTHROUGH

The team plotted when the jams happened using a structured data-collection template. The machine jammed almost every Tuesday and Thursday morning. Those were the early cleaner's mopping days: the floor was still damp, a side door was propped open, and the draught lifted the edge of the label stock as it fed through.

"We have had this issue for months and couldn't figure out what it was, as I was going through the Green Belt course I had a urge to put what I was learning to the test and low and behold, by applying the correct methods we figured it out!"

— Joe Campbell, Operations Manager

The result

The fix was simple: move the mop rota and stop propping the door open.

The change cost nothing, and the machine has not jammed since.

COUNTERMEASURE

Move the mop rota away from the production window and stop propping the side door open.

OUTCOME

No further machine jams have been reported since the change.

The toolkit in action

Joe used the following 16 templates and 4 calculators during his DMAIC investigation. The resources below show exactly how each one supported the project.

DEFINE

Frame the problem

Problem Statement, Project Charter and SIPOC clarify the recurring Line 2 jams without assuming the machine is at fault.



MEASURE

Find the pattern

Data Collection Plan, Simple Tally Sheet and a Run Chart help reveal when jams cluster. The Gemba Walk Checklist and Process Observation Sheet support direct observation while collecting evidence.



ANALYSE

Trace the cause

Fishbone Diagram, Process Map Template, Cause Validation Matrix and 5 Whys trace the issue from lifted label stock back to the mop rota.

IMPROVE

Choose the fix

Impact vs Effort Matrix and Cost Benefit Analysis support a simple, no-cost intervention.



CONTROL

Keep it fixed

Control Plan and Before and After Comparison provide a way to check that the improvement holds over time.

CALCULATORS USED

Joe used these SimplicityHub calculators during the investigation described in this case study:

- Pareto Chart Calculator — identify the biggest contributor in a list of symptoms.
- Cost of Poor Quality Calculator — make downtime, maintenance, parts and labour costs visible.
- OEE Calculator — examine equipment availability and performance.
- Cycle Time Calculator — quantify the effect of delays on the process.

THE LESSON

The root cause had nothing to do with the machine. Structured methodology helped the team investigate when the problem happened, observe the process at Gemba and trace the issue back to its source.

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TEMPLATES IN THIS STAGE

1. Problem Statement
2. Project Charter
3. SIPOC

The completed evidence pages for this DMAIC stage follow.

SIMPLICITYHUB



SIMPLICITYHUB® PROBLEM STATEMENT

PRACTICAL TEMPLATE

Define the problem before jumping to solutions.

PROBLEM STATEMENT

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Director	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS PROBLEM STATEMENT?

A Problem Statement clearly defines what is wrong, where it occurs, when it happens, who is affected and what the impact is — without jumping to solutions. It aligns the team on what you are solving.

1. WHAT is the problem?

What is wrong? What is happening that should not be?

The Line 2 labelling machine repeatedly jams during production, causing unplanned downtime and repeated maintenance intervention. The sensor and feed motor were replaced and the machine was recalibrated twice, but the fault persisted.

2. WHERE does it occur?

Which process, area, system, team or location?

Line 2 labelling machine, specifically the label-stock feed area.

3. WHEN does it occur?

How often? Any trends, patterns or triggers?

Jams were concentrated in Tuesday and Thursday mornings during the observation period. The issue recurred over approximately three weeks and was associated with repeated downtime.

4. WHO is affected?

Which customers, employees, stakeholders or departments?

Line operators, maintenance and production output on Line 2; downstream production is affected whenever the machine stops.

5. What is the IMPACT?

What does it cost in time, money, quality or satisfaction?

Unplanned downtime, replacement parts and maintenance effort. The case study describes a significant parts bill. Exact financial loss is not stated.

6. What is NOT the problem?

What is explicitly out of scope? What are you not solving?

Permanent redesign/replacement of the labelling machine, unrelated machine faults, and broader production-line performance are outside the immediate problem definition.

COMPLETED PROBLEM STATEMENT

The Line 2 labelling machine is experiencing repeated jams, concentrated on Tuesday and Thursday mornings, causing unplanned downtime and maintenance cost. The project will identify and remove the root cause of the recurring jams without assuming the machine itself is faulty.



SIMPLICITYHUB® PROJECT CHARTER

PRACTICAL TEMPLATE

Define your project purpose, scope, team and success criteria in one place.

PROJECT CHARTER

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Director (assumed)	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS A PROJECT CHARTER?	A Project Charter formally authorises a project. It captures the problem, objective, scope, team and timeline — giving everyone a shared understanding before work begins.
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PROBLEM STATEMENT	What issue are we solving and why does it matter?
The Line 2 labelling machine repeatedly jams. Maintenance replaced the sensor, replaced the feed motor and recalibrated the machine twice, but the problem continued for around three weeks. The repeated stops created downtime and a significant parts bill.	

PROJECT OBJECTIVE	What does success look like? Be specific and measurable.
Identify and eliminate the recurring root cause of Line 2 labelling-machine jams, with a target of zero repeat jams after the countermeasure is implemented and sustained.	

BUSINESS CASE	Why is this project worth doing now?
Reduce unplanned Line 2 downtime, avoid unnecessary parts replacement and maintenance intervention, and demonstrate a repeatable structured problem-solving approach using observation and data rather than assumptions.	

PROJECT SCOPE	What is and is not included in this project	
	IN SCOPE	OUT OF SCOPE
Line 2 labelling machine and label-stock feed		Other machine faults or unrelated production issues
Jam events and conditions surrounding the jams		Major machine redesign or capital replacement
Operator observations, Gemba observations and cleaning/door conditions		Broader cleaning-system redesign
Countermeasure: adjust cleaning rota and stop propping the side door open		Other production lines
Verification of sustained no-jam performance		Exact financial costing where source data is unavailable

PROJECT TEAM		
NAME	ROLE	DEPARTMENT
Joe Campbell	Project Owner / Operations Manager	Operations
Line 2 Operator	Process Expert	Production
Maintenance Technician	Technical Support	Maintenance
Cleaner / Cleaning Lead	Process Stakeholder	Facilities / Cleaning
Site Manager	Sponsor / Decision Maker (assumed)	Operations

KEY MILESTONES		
MILESTONE	TARGET DATE	OWNER
Define problem and scope	Week 1	Joe Campbell
Collect jam timing/frequency data	Week 1–2	Line 2 Operator
Gemba observation and root-cause analysis	Week 2	Joe Campbell + team
Implement cleaning/door countermeasure	Week 3	Facilities + Production
Verify sustained zero jams	Following weeks	Joe Campbell

RISKS & CONSTRAINTS	Key risks, assumptions and project constraints
Risk: team assumes the machine is the root cause because of previous maintenance actions. Mitigation: use timing data and Gemba observation before selecting a solution. Constraint: exact downtime and cost figures are not stated in the published case study.	

NOTES & ASSUMPTIONS	Any additional context or working assumptions
RECONSTRUCTED WORKING EXAMPLE (due to gdpr): populated from the published Joe Campbell case study. Joe's original documents were data protected, so figures, timings, scores and wording are best-guess assumptions for illustration and must not be represented as Joe's exact records.	

Map the end-to-end process by identifying Suppliers, Inputs, Process steps, Outputs and Customers.

SIPOC DIAGRAM

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Director (assumed 1.0		Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS A SIPOC?	A SIPOC is a high-level process map used to define the key components of a process before detailed improvement work begins. It helps teams align on scope, inputs, outputs and who is involved.
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SUPPLIERS Who provides the inputs?	INPUTS What goes into the process?	PROCESS Key steps from start to end	PROCESS DESCRIPTION What happens at each step?	OUTPUTS What does the process produce?	CUSTOMERS Who receives the outputs?
Production planning / Line 2	Production schedule, label specification	1. Prepare line	Line 2 is set up for scheduled production	Line ready to run	Production team
Label-stock supplier / stores	Correct label stock and packaging materials	2. Load label stock	Label stock is loaded into the labelling machine	Label stock available at feed	Line operator
Cleaner / facilities	Floor-cleaning activity and side-door condition	3. Run labelling process	Machine feeds label stock and applies labels during production	Labelled product	Production / customer
Line operator	Machine status and jam observations	4. Respond to jam	Operator stops/restarts process and clears the jam	Jam cleared / production resumed	Production / maintenance
Maintenance / operations	Jam history and intervention records	5. Monitor and improve	Team reviews patterns, observes conditions and implements countermeasures	Stable process with no recurring jams	Operations / site management

NOTES AND ASSUMPTIONS
RECONSTRUCTED WORKING EXAMPLE (due to gdpr): populated from the published Joe Campbell case study. Joe's original documents were data protected, so figures, timings, scores and wording are best-guess assumptions for illustration and must not be represented as Joe's exact records. The exact supplier/customer definitions were not provided, so this is a process-level SIPOC rather than Joe's original wording.

TEMPLATES IN THIS STAGE

1. Data Collection Plan
2. Simple Tally Sheet
3. Run Chart
4. Gemba Walk Checklist
5. Process Observation Sheet

CALCULATORS USED

- Pareto Chart Calculator
- OEE Calculator
- Cycle Time Calculator



SIMPLICITYHUB® DATA COLLECTION PLAN

PRACTICAL TEMPLATE

Define what data to collect, from where, how and how often.

DATA COLLECTION PLAN

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Direct	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				Joe Campbell

WHAT IS DATA COLLECTION PLAN?	A Data Collection Plan defines exactly what data to collect, from which source, using which method, how often, by whom and in what format. Completing this before data collection begins ensures consistency and credibility.
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DATA COLLECTION REGISTER		Define each metric before collection begins					
Metric / Data	Operational Definition	Data Source	Collection Method	Collector	Frequency	Sample Size	Recording Format
Jam event count	Count each unplanned stop caused by label stock/feed jamming	Line 2 operator log	Tally each event at time of occurrence	Line operator	Each shift	All events	Tally sheet
Day/time of jam	Calendar day and approximate time window when jam occurred	Operator log / observation	Record date, day and time for every jam	Line operator	Each event	All events	Date/time log
Cleaning activity present	Whether floor-cleaning activity occurred before/during jam window	Cleaning rota + Gemba observation	Compare jam timing with cleaning rota	Joe / team	Each relevant day	All relevant days	Observation sheet
Side door position	Open/propped or closed during jam window	Gemba observation	Direct observation at machine	Joe / team	Each observation	All observations	Gemba checklist
Floor condition	Dry / damp / wet near labelling machine	Gemba observation	Direct observation	Joe / team	Each observation	All observations	Process observation sheet
Label-stock movement	Normal feed / edge lift / misalignment during jam	Operator + Gemba observation	Observe feed path during run/jam	Joe / operator	Each jam/observation	All observed jams	Observation notes
Downtime minutes	Minutes of production lost per jam	Line 2 downtime log	Record stop-to-restart time	Operator / maintenance	Each jam	All events	Downtime log
Post-change jam count	Number of jams after countermeasure	Line 2 operator log	Continue some tally method after change	Line operator	Daily / weekly	All events	Before-after tracker

SimplicityHub® — Simple Tally Sheet

Count how often something happens using a basic tally format so the team has real numbers to work with.

Stage: Measure | Level: Beginner | Best for: Quick data collection when you just need to count occurrences over a set period.

Item / Category	Mon	Tue	Wed	Thu	Fri	Weekly Total	Notes
Label-stock/feed jam	0	4	0	3	0	7	Pattern concentrated on Tue/Thu mornings
Other machine jam	0	0	0	0	0	0	No comparable pattern identified
Jam after cleaning activity	0	3	0	2	0	5	Illustrative association; validate original records
Jam with side door propped open	0	4	0	3	0	7	Illustrative association; validate original records

RECONSTRUCTED WORKING EXAMPLE: populated from the published Joe Campbell case study. Joe's original documents were data protected, so figures, timings, scores and wording are best-guess assumptions for illustration and must not be represented as Joe's exact records.

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WHAT IS RUN CHART?

A Run Chart plots individual data points over time and adds a median line. It is used before control charts to detect obvious trends, shifts and patterns. A 'run' of 8+ points above or below the median signals a non-random pattern.

CHART CONFIGURATION	Define what is being plotted
Metric being plotted	Number of Line 2 labelling-machine jams recorded per day
Unit of measurement	Jam events
Target value	0

DATA POINTS	25 working-day observations; 5-day baseline + 4-week verification			
#	Observation	Jam events	vs Median	
1	Pre-change Mon	0	0	
2	Pre-change Tue	4	4	
3	Pre-change Wed	0	0	
4	Pre-change Thu	3	3	
5	Pre-change Fri	0	0	
6	Test W1 Mon	0	0	
7	Test W1 Tue	0	0	
8	Test W1 Wed	0	0	
9	Test W1 Thu	0	0	
10	Test W1 Fri	0	0	
11	Test W2 Mon	0	0	
12	Test W2 Tue	0	0	
13	Test W2 Wed	0	0	
14	Test W2 Thu	0	0	
15	Test W2 Fri	0	0	
16	Test W3 Mon	0	0	
17	Test W3 Tue	0	0	
18	Test W3 Wed	0	0	
19	Test W3 Thu	0	0	
20	Test W3 Fri	0	0	
21	Test W4 Mon	0	0	
22	Test W4 Tue	0	0	
23	Test W4 Wed	0	0	
24	Test W4 Thu	0	0	
25	Test W4 Fri	0	0	
MEDIAN			0	Median of all 25 daily observations

EVIDENCE / ASSUMPTION NOTE	Baseline data available: one documented Mon-Fri tally = 7 jams (Tue 4, Thu 3). The case study says the problem recurred for about three weeks, but it does not publish separate weekly totals for those earlier weeks. The chart therefore does not invent those missing values. The four post-change weeks are represented as 20 working-day observations at zero because the case study states the machine has not jammed since the change.
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Observation	Baseline jams	Post-change jams	Median
Pre-change Mon	0		0
Pre-change Tue	4		0
Pre-change Wed	0		0
Pre-change Thu	3		0
Pre-change Fri	0		0
Test W1 Mon		0	0
Test W1 Tue		0	0
Test W1 Wed		0	0
Test W1 Thu		0	0
Test W1 Fri		0	0
Test W2 Mon		0	0
Test W2 Tue		0	0
Test W2 Wed		0	0
Test W2 Thu		0	0
Test W2 Fri		0	0
Test W3 Mon		0	0
Test W3 Tue		0	0
Test W3 Wed		0	0
Test W3 Thu		0	0
Test W3 Fri		0	0
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Test W4 Tue		0	0
Test W4 Wed		0	0
Test W4 Thu		0	0
Test W4 Fri		0	0

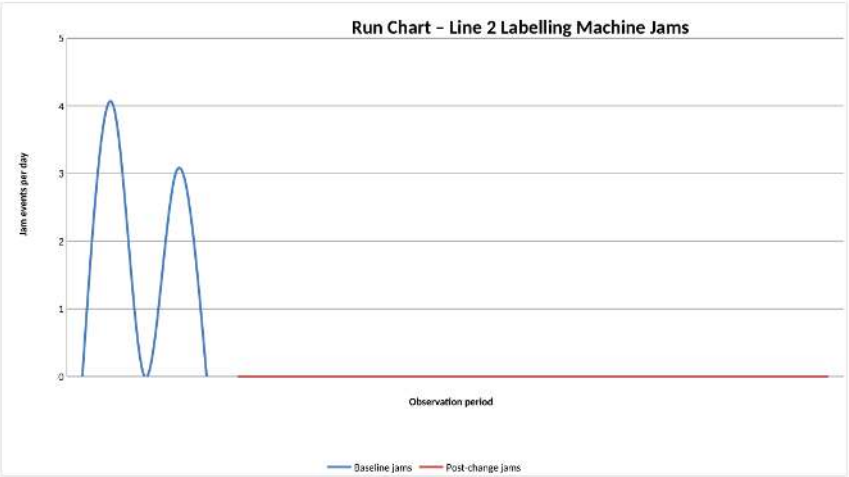
0

Source / evidence Simple Tally Sheet + case study + Control Plan

Baseline Documented Mon-Fri tally: 0, 4, 0, 3, 0 = 7 jams

Pre-change context Case study: recurring issue over approximately three weeks; no separate weekly totals published

Post-change verification Four weeks; case study reports no jams since the countermeasure



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SIMPLICITYHUB® GEMBA WALK CHECKLIST

PRACTICAL TEMPLATE

Go to where the work happens. Observe the process, note good practice, surface concerns and assign follow-up actions.

GEMBA WALK CHECKLIST

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Director (assumed)	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS GEMBA WALK CHECKLIST?

A Gemba Walk is a structured visit to where the work happens — to observe the process directly rather than relying on reports or assumptions. For each area and category, record what you observed, any good practice noted, concerns or issues identified, the follow-up action required and the owner. Always go with curiosity, not to find fault.

GEMBA DETAILS

Area / Process Observed	Line 2 labelling machine / label-stock feed area				
Observer	Joe Campbell				
Date	Not stated in case study				
Accompanying Team	Line 2 operator; maintenance; cleaner/facilities representative (assumed)				

OBSERVATIONS

Category	Observation	Good Practice Noted	Concern / Issue	Action Required	Owner
People	Operator responds consistently to jams and can describe when they occur	Operator knows machine and jam location	Attention had focused on machine components rather than surrounding conditions	Ask operator to identify timing patterns and recent changes	Joe Campbell
	Existing machine setup is familiar		Maintenance		
Overall summary: Gemba shifted the investigation from machine components to process/environmental conditions. The strongest observation was the coincidence of Tuesday/Thursday morning jams, cleaning activity, a damp floor and an open side door creating a draught at the label feed.					
Environment	Floor can remain damp after mopping; side door can be propped open	Area is routinely cleaned	Draught can lift label-stock edge while feeding	Keep side door closed and ensure floor is dry	Facilities / Line 2
Measurement	Jam timing showed Tue/Thu morning pattern	Simple data collection revealed repeatable pattern	Previous troubleshooting lacked structured timing/condition data	Continue tally and verify zero recurrence	Joe Campbell

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Gemba Walk Checklist | PRACTICAL TEMPLATE

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Time each process step across multiple cycles, classify value add, calculate averages and identify waste.

PROCESS OBSERVATION

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Director (assumed)	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS PROCESS OBSERVATION?	A Process Observation Sheet is used to time each step of a process across multiple cycles and classify each step as Value Added (VA), Non-Value Added (NVA), or Necessary but Non-Value Added (NNVA). Timing multiple cycles reveals variability and identifies opportunities for standardisation. The VA ratio shows how much of the total cycle time is genuinely adding value.
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OBSERVATION DETAILS	
Process Name	Line 2 labelling process and response to feed jams
Area	Line 2 labelling area
Observer	Joe Campbell
Date	Not stated in case study
Cycles Observed	5

STEP TIMINGS		All times in minutes								
Process Step	T1	T2	T3	T4	T5	Avg (min)	VA/NVA	Activity Type	Notes / Observations	
Normal machine run / label feed	0.5	0.6	0.5	0.5	0.5	0.52	VA	Run	Normal machine operation; issue reported more frequently on Tue/Thu.	
Operator checks label alignment	0.3	0.4	0.3	0.5	0.4	0.38	NNVA	Check	Routine alignment check.	
Clear label/feed jam	0.8	0	0	0	0	0.16	NVA	Jam response	Illustrative timing only; exact duration was not stated in the case study.	
Maintenance intervention / downtime	4.5	0	0	0	0	0.9	NVA	Maintenance	Repeated downtime; maintenance intervention had previously been required.	
Restart and verify feed	1.5	1.3	1.7	1.4	1.6	1.5	NNVA	Restart	Normal after jam cleared.	
Check environment / cleaning condition	2	2.5	2	2.2	2.4	2.22	NNVA	Observation	Damp floor and open side door identified during Gemba.	

SUMMARY	Observation sheet cleaned: footer/callout content
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Reconstructed observation indicates the jam/recovery portion is the major source of non-value-added time. Exact timings are not in the case study, so these values are illustrative rather than Joe's original measurements.

Pareto Chart Calculator – Results

Identifying when production jams occur

Calculators / Pareto Chart Calculator

QUALITY & SIX SIGMA

Pareto Chart Calculator

Paste your defect or cost data, rank the categories from largest to smallest, and instantly visualise the Pareto principle — with descending bars, a cumulative percentage line, and the 80% threshold highlighted.

PDF Guide

Simulation Lab

WAS THIS USEFUL?

Yes

No



Enter your values

Data (one per line: category, value)

Enter each category and its count or cost on a new line, separated by a comma. Order doesn't matter — we'll rank them for you.

Monday mornings, 0
Tuesday morning, 4
Wednesday mornings, 0
Thursday morning, 3
Friday mornings, 0
Saturday mornings, 0
Sunday mornings, 0

Calculate

Reset

VITAL FEW

2

of 7 categories cause 80%

TOTAL OBSERVATIONS

7

TOP CATEGORY SHARE

57.1% (Tuesday morning)

Cumulative cover at 80%

Moderately concentrated



RANKED CATEGORIES

1. Tuesday morning	4 (57.1%)
2. Thursday morning	3 (42.9%)
3. Monday mornings	0 (0.0%)
4. Wednesday mornings	0 (0.0%)
5. Friday mornings	0 (0.0%)
6. Saturday mornings	0 (0.0%)
7. Sunday mornings	0 (0.0%)

WHAT THIS MEANS

Moderately concentrated — a few categories drive most of the impact, but the tail still matters. Of 7 categories, just 2 account for 80% of the total. Tackling those vital few — starting with "Tuesday morning" at 57.1% — will deliver the largest improvement for the least effort.

Category (Day/Time)	Count (Number of Jams)
Monday mornings	0
Tuesday morning	4
Wednesday mornings	0
Thursday morning	3
Friday mornings	0
Saturday mornings	0
Sunday mornings	0
Total Observations	7

Interpretation

The Pareto analysis shows that 2 out of 7 time periods (28.6%) account for 80% of the production jams. Tuesday morning is the highest contributor with 4 jams (57.1%), followed by Thursday morning with 3 jams (42.9%).

The remaining five time periods recorded 0 jams during the observation period.

Conclusion

Focus improvement efforts on Tuesday and Thursday mornings, as these are the key contributors to the problem and will deliver the greatest impact for the least effort.

OEE Calculator – Results

Measuring equipment effectiveness in manufacturing

Calculators / OEE Calculator

LEAN & MANUFACTURING

OEE Calculator

Calculate Overall Equipment Effectiveness by breaking performance down into Availability, Performance and Quality — so you know exactly where the losses are hiding and how far you are from the world-class 85% benchmark.

PDF Guide

Simulation Lab

WAS THIS USEFUL?

Yes

No



Enter your values

TIME — USE THE SAME UNIT FOR ALL TIME FIELDS (E.G. MINUTES)

Planned production time

Total time the machine was scheduled to run

480

Run time

Actual operating time after unplanned stops

420

UNITS

Total units produced

All units including defective ones

800

Good units produced

Units meeting quality standard first time

780

SPEED

Ideal cycle time

The fastest possible time to produce one unit — in the same unit as your time fields above

0.5

Calculate

Reset

OVERALL EQUIPMENT EFFECTIVENESS

81.2%

OEE

GOOD

0% 40% poor 60% typical 85% world class 100%

AVAILABILITY

87.5%

Run time + Planned time

PERFORMANCE

95.2%

Speed vs. ideal rate

QUALITY

97.5%

Good + Total units

WHAT THIS MEANS

An OEE of 81.2% is around the typical average for many manufacturing operations. There is meaningful room to improve. All three components — Availability, Performance and Quality — are at or above their respective world-class thresholds. The focus should be on sustaining this level through robust maintenance and process control.

Data Entered into the Calculator

Input	Value
Planned production time	480
Run time	420
Total units produced	800
Good units produced	780
Ideal cycle time	0.5

Interpretation

The OEE calculator shows an Overall Equipment Effectiveness (OEE) of 81.2%. This is made up of:

- Availability: 87.5% (run time vs. planned time)
- Performance: 95.2% (speed vs. ideal rate)
- Quality: 97.5% (good units vs. total units)

This indicates the line is performing well but is slightly below the world-class benchmark of 85%, suggesting there is still opportunity to improve.

Conclusion

The production line is operating at a good level of efficiency (81.2% OEE). Continued focus on reducing downtime and optimising performance could help achieve world-class levels ($\geq 85\%$).

Cycle Time Calculator – Results

Measuring process speed and comparing to takt time

SimplicityHub

LEARN APPLY IMPROVE

Calculators / Cycle Time Calculator

LEAN & PLANNING

Cycle Time Calculator

Measure how long it actually takes your process to produce one unit, then compare against takt to spot bottlenecks and overproduction risks.

PDF Guide

Simulation Lab

WAS THIS USEFUL?

Yes

No



Enter your values

Net production time

Total available time after planned breaks, changeovers and downtime

420

minutes

Units produced in that time

Number of good units actually completed during the production period above

800

Takt time (optional)

If you know your takt time, enter it in seconds to see the cycle vs takt comparison

36

Calculate

Reset

CYCLE TIME

0.53

minutes per unit

UNITS PER HOUR

114.3 units

UNITS PER 8-HR SHIFT

914 units

Cycle vs Takt



Balanced to takt

WHAT THIS MEANS

Cycle time is well-balanced to takt time. The process is producing exactly at the rate of customer demand. At 31.5 seconds per unit, this process produces about 114.3 units per hour or 914 units per 8-hour shift.

Data Entered into the Calculator

Input	Value
Net production time (minutes)	420
Units produced in that time	800
Takt time (seconds, optional)	36

Interpretation

The cycle time calculator shows a cycle time of 0.53 minutes per unit (31.5 seconds). This equates to 114.3 units per hour, or approximately 914 units per 8-hour shift.

With a takt time of 36 seconds, the process is well-balanced to customer demand, indicating good alignment between production speed and market requirements.

Conclusion

The production line is operating at a cycle time of 31.5 seconds per unit, which meets customer demand (36 second takt). Continued monitoring is recommended to maintain this performance and identify any future risks of overproduction or bottlenecks.

TEMPLATES IN THIS STAGE

1. Fishbone Diagram
2. Process Map
3. Cause Validation Matrix
4. 5 Whys

The completed evidence pages for this DMAIC stage follow.

SIMPLICITYHUB



SIMPLICITYHUB® FISHBONE DIAGRAM

PRACTICAL TEMPLATE

Identify root causes across six key categories using a cause-and-effect structure.

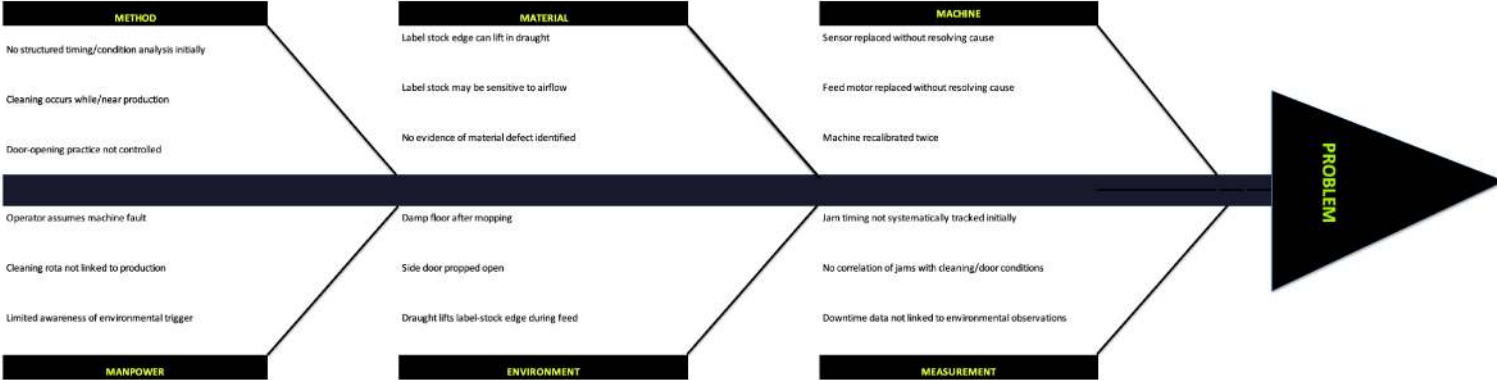
FISHBONE DIAGRAM

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine J	Joe Campbell	Site / Operations Director (assume 1.0		Reconstructed example due to GDPR	Reconstructed example due to GDI
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS FISHBONE DIAGRAM?

A Fishbone Diagram (Ishikawa / Cause-and-Effect Diagram) identifies potential causes of a problem across six categories: People/Man, Machine, Method/Process, Material, Measurement and Environment. Use it in the Analyse phase to organise root cause thinking before validation.

Problem / Effect	Line 2 labelling machine repeatedly jams during production				
CAUSES BY CATEGORY					
Enter causes identified for each of the six categories					
Category	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5
People / Man	Operator assumes machine fault	Cleaning rota not linked to production	Limited awareness of environmental trigger		
Machine	Sensor replaced without resolving cause	Feed motor replaced without resolving cause	Machine recalibrated twice		
Method / Process	No structured timing/condition analysis initially	Cleaning occurs while/near production	Door-opening practice not controlled		
Material	Label stock edge can lift in draught	Label stock may be sensitive to airflow	No evidence of material defect identified		
Measurement	Jam timing not systematically tracked initially	No correlation of jams with cleaning/door conditions	Downtime data not linked to environmental observations		
Environment	Damp floor after mopping	Side door propped open	Draught lifts label-stock edge during feed	Tuesday/Thursday morning cleaning pattern	



This fishbone diagram will auto populate as you enter in data into the blank cells in the blank template

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SIMPLICITYHUB® PROCESS MAP

PRACTICAL TEMPLATE

Document each step, role, input, output and cycle time.

PROCESS MAP

PROJECT TITLE

PROJECT OWNER

SPONSOR

VERSION

DATE

UPDATED BY

Line 2 Labelling Machine Jam Reduction

Site / Operations Director (assumed)

Ops director

1.0

Reconstructed example due to GDPR

Reconstructed example due to GDPR

BUSINESS AREA

Manufacturing / Line 2

WHAT IS PROCESS MAP?

A Process Map documents the sequence of steps that turn inputs into outputs. Recording each step's role, inputs, outputs and cycle time enables teams to identify waste, bottlenecks and improvement opportunities.

PROCESS STEPS

Enter each step -- Step Type key: Start | Process | Decision | Document | End

#	Step Name	Role / Swimlane	Type	Description	Inputs	Outputs	Cycle Time	Issues / Waste
1	Prepare Line 2	Production	Start	Line is prepared for scheduled production	Schedule, materials	Line ready	~10 min	No issue identified
2	Load label stock	Operator	Process	Correct label stock is loaded and threaded through feed	Label stock, machine	Label stock feeding	~5 min	Feed alignment/stock condition can affect edge stability
3	Run labelling machine	Operator	Process	Machine feeds label stock and labels product	Running line, label stock	Labelled product	Continuous	Recurring jams observed
4	Jam occurs?	Operator	Decision	Operator checks whether label stock has jammed in feed	Machine status	Continue OR Jam response	<1 min	Jams concentrated Tue/Thu mornings
5	Stop and clear jam	Operator / Maintenance	Process	Machine is stopped and jam is cleared	Jam, tools	Machine restarted	~5-15 min	Repeated downtime; maintenance previously replaced parts
6	Jam cleared?	Operator	Decision	Operator checks whether label stock has jammed in feed	Machine status	Continue OR Jam response	<1 min	Jams concentrated Tue/Thu mornings
7	Investigate conditions	Operations	Process	Check timing, cleaning activity, door position and label-stock feed	Jam record, observations	Potential cause identified	~15 min	Camera observation reveals damp floor/draught
8	Implement countermeasure	Facilities / Production	Process	Move mop rota and stop propping side door open	Cleaning rota, door practice	Dry floor / stable airflow	No production cycle time	Zero-cost change
9	Verify no recurrence	Operations	End	Monitor subsequent production for repeat jams	Jam log	Sustained no-jam result	Ongoing	No jam reported since countermeasure

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Process Map | PRACTICAL TEMPLATE

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Score potential causes against key criteria to identify and prioritise root causes.

CAUSE VALIDATION MATRIX

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Dire	1.0	Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				

WHAT IS CAUSE VALIDATION MATRIX?

The Cause Validation Matrix scores each potential cause against four criteria: strength of data evidence, degree of control, testability and impact if addressed. The combined score (out of 20) produces an objective priority ranking to guide root cause investigations.

VALIDATION MATRIX									
Score each cause 1 (weak/low) to 5 (strong/high) per criterion – total score out of 20									
#	Potential Cause	Category	Data Evidence (1-5)	In Our Control (1-5)	Can We Test? (1-5)	Impact if Addressed (1-5)	Total Score (/20)	Evidence / Notes	Priority
1	Damp floor after Tue/Thu cleaning	Environment	5	5	5	Jam timing coincides with cleaning days; Gemba observed damp floor near machine	15	Gemba walked process	
2	Side door propped open / draught	Environment	5	5	5	Open door observed; airflow provides plausible mechanism	15		
3	Label-stock edge lifted by draught	Material / Environment	5	5	5	Observed feed behaviour supports mechanism	15		
4	Sensor fault	Machine	2	3	4	Sensor replaced but jams continued	10		
5	Feed motor fault	Machine	2	3	4	Motor replaced but jams continued	10		
6	Machine calibration issue	Machine	2	3	3	Recalibration twice did not remove recurring pattern	9		
7	Cleaning timing creates environmental trigger	Method / Environment	5	5	5	Repeatable Tue/Thu pattern aligns with cleaner schedule	15		
8	Other label-stock defect	Material	2	3	3	No specific evidence; retained as alternative	9		

Drill down from symptom to root cause by asking 'Why?' five times in sequence.

5 WHYS TEMPLATE

PROJECT TITLE	PROJECT OWNER	SPONSOR	Ops Director	DATE	UPDATED BY
Line 2 Labelling Machine Jam Reduction	Joe Campbell	Site / Operations Directo 1.0		Reconstructed example due to GDPR	Reconstructed example due to GDPR
BUSINESS AREA	Manufacturing / Line 2				
WHAT IS 5 WHYS TEMPLATE?	The 5 Whys technique drills below surface symptoms to find the root cause of a problem by repeatedly asking 'Why?'. Work through each chain until you reach the true underlying cause, then define a corrective action to address it.				

CHAIN 1: Why does the labelling machine jam on Tue/Thu mornings?

Why 1	Because the edge of the label stock is lifted or disturbed as it enters the feed.
Why 2	Because a draught is affecting the label stock at the machine.
Why 3	Because the side door is propped open during the relevant period.
Why 4	Because the door is routinely left open around cleaning/early-morning activity.
Why 5	Because the cleaning routine and door-opening practice were not considered part of the machine process risk.
Root Cause	Environmental airflow is destabilising the label-stock feed during the Tuesday/Thursday cleaning window.
Action	Move the mop rota away from the production window and stop propping the side door open; verify no further jams.

CHAIN 2: Why did previous maintenance actions not stop the jams?

Why 1	The sensor and feed motor were treated as likely causes.
Why 2	The fault appeared to be a machine fault when viewed only at the point of failure.
Why 3	No structured comparison of jam timing against surrounding conditions had been made.
Why 4	No one had initially observed the process at Gemba during the recurring window.
Why 5	The investigation started with component replacement rather than pattern identification and direct observation.
Root Cause	The investigation method did not initially connect failure timing with environmental/process conditions.
Action	Use structured data collection and Gemba observation before replacing components.

CHAIN 3: Why did the problem stop after the countermeasure?

Why 1	The label stock was no longer exposed to the same draught/damp-floor conditions.
Why 2	The side door was kept closed and cleaning timing was changed.
Why 3	The environmental trigger was removed without changing the machine.
Why 4	The root cause was external to the machine components.
Why 5	The countermeasure addressed the actual failure mechanism rather than the symptom.
Root Cause	The recurring jam was caused by environmental/process conditions rather than a defective machine component.
Action	Standardise the cleaning/door practice and include the condition in the control plan.

TEMPLATES IN THIS STAGE

1. Impact vs Effort Matrix
2. Cost Benefit Analysis

CALCULATORS USED

- Cost of Poor Quality Calculator

The completed evidence pages for this DMAIC stage follow.

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SIMPLICITYHUB® IMPACT VS EFFORT MATRIX

PRACTICAL TEMPLATE

Classify solutions by impact (1-10) and effort (1-10) to prioritise using the quick wins / major projects / fill-ins / hard slogs framework.

IMPACT VS EFFORT MATRIX

PROJECT TITLE

PROJECT OWNER

SPONSOR

Ops Director

DATE

UPDATED BY

Line 2 Labelling Machine Jam Reduction

Joe Campbell

Site / Operations Director (assumed)

1.0

Reconstructed example due to GD

Reconstructed example due to GDPR

BUSINESS AREA

Manufacturing / Line 2

WHAT IS IMPACT VS EFFORT MATRIX?

The Impact vs Effort Matrix places each potential solution into one of four quadrants based on its impact (1-10, higher = better) and effort required (1-10, higher = more effort). Quick Wins (high impact, low effort) should be actioned first. Hard Slogs (low impact, high effort) should be deprioritised or dropped.

QUADRANT GUIDE

Quick Wins

High impact, low effort — do first

Major Projects

High impact, high effort — plan and resource carefully

Fill-Ins

Low impact, low effort — do if time and resource allow

Hard Slogs

Low impact, high effort — deprioritise or drop

IDEA DATA TABLE

Impact = benefit if implemented (1 low → 10 very high) - Effort = resource / difficulty required (1 easy → 10 ver

#	Solution / Idea	Impact (1-10)	Effort (1-10)	Quadrant
1	Move mop rota away from production window	10	1	Quick Wins
2	Stop propping side door open	10	1	Quick Wins
3	Keep side door closed during production	9	1	Quick Wins
4	Add a simple door/cleaning check to the start-up routine	8	2	Quick Wins
5	Change label-stock specification	4	6	Fill-Ins
6	Replace label feed assembly	3	8	Hard Slogs
7	Replace sensor again	2	6	Hard Slogs
8	Replace feed motor again	2	7	Hard Slogs

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Impact vs Effort matrix | PRACTICAL TEMPLATE

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Quantify all benefits and costs over a 3-year horizon to calculate net benefit, ROI and payback period.

COST BENEFIT ANALYSIS

PROJECT TITLE

PROJECT OWNER

SPONSOR

Ops Director

DATE

UPDATED BY

Line 2 Labelling Machine Jam Reduction

Joe Campbell

Site / Operations Director (assumed) 1.0

Reconstructed example due to GDPR

Reconstructed example due to GDPR

BUSINESS AREA

Manufacturing / Line 2

WHAT IS COST BENEFIT ANALYSIS?

A Cost Benefit Analysis quantifies the expected financial benefits and costs of implementing a solution over a defined time horizon. One-time items appear only in Year 1; recurring items appear in Years 1–3. The summary calculates net benefit per year, cumulative net, 3-year ROI and payback period.

BENEFITS					
Quantify one-time and recurring financial benefits by year					
Description	Type	Year 1 (£)	Year 2 (£)	Year 3 (£)	
Avoided downtime from recurring jams	Recurring	2400	2400	2400	
Avoided replacement parts / maintenance interventi	Recurring		1500	1500	1500
Avoided production disruption / rework	Recurring	1000	1000	1000	
Avoided disruption / secondary production impact	Recurring	500	500	500	
One-time avoided repeat maintenance spend	One-time	1000	—	—	
Total Benefits		£6,400.00	£5,400.00	£5,400.00	
SUMMARY					
Calculated from the benefits and costs entered above					
Cost / Benefit	Type	Year 1 (£)	Year 2 (£)	Year 3 (£)	
Physical countermeasure implementation	One-time	0	—	—	
Staff briefing / implementation	One-time	0	—	—	
Initial monitoring setup	One-time	250	—	—	
Ongoing monitoring	Recurring	100	100	100	
Contingency for minor environmental adjustment	One-time	250	—	—	
Total Costs		£600.00	£100.00	£100.00	
Total 3-Year Benefit		£17,200.00			
Total 3-Year Cost		£800.00			
Net Benefit (3 yr)		£16,400.00			
ROI (3-year)		2050.0%			
Payback Period		Year 1			
ANNUAL NET BENEFIT					
Metric	Year 1 (£)	Year 2 (£)	Year 3 (£)	Cumulative (£)	
Benefits	£6,400.00	£5,400.00	£5,400.00	£17,200.00	
Costs	£600.00	£100.00	£100.00	£800.00	
Net Benefit	£5,800.00	£5,300.00	£5,300.00	£16,400.00	
Assumptions: Exact downtime, parts cost, labour rate and production-loss data are not stated in the case study. Figures are deliberately illustrative only. The case study states that the physical countermeasure cost nothing. Reconstructed due to GDPR.					

Cost of Poor Quality Calculator – Results SimplicityHub

Quantifying the financial impact of defects

LEARN APPLY IMPROVE

Calculators / Cost of Poor Quality Calculator

QUALITY & SIX SIGMA

Cost of Poor Quality Calculator

Quantify the true financial impact of defects by combining internal failure, external failure, appraisal and prevention costs — so leadership can see quality losses in pounds, not percentages.

PDF Guide

Simulation Lab

WAS THIS USEFUL?

Yes

No



Enter your values

Annual revenue (£)

Used to express COPQ as a percentage of revenue

1000000

Internal failure costs (£/year)

Scrap, rework, downtime, re-inspection — caught before reaching the customer

3900

External failure costs (£/year)

Warranty, returns, complaints, recalls, lost customers — escaped to the customer

0

Appraisal costs (£/year)

Inspection, testing, audits, calibration — the cost of checking

0

Prevention costs (£/year)

Training, planning, supplier development, process design — the cost of preventing defects

0

Calculate

Reset

TOTAL COPQ

£3,900

£ per year

% OF REVENUE

0.39%

WORLD-CLASS GAP

0.0 pts above 2%

COPQ vs world-class ($\leq 2\%$)

World-class

COST CATEGORY BREAKDOWN

Internal failure £3,900 (100%)

External failure £0 (0%)

Appraisal £0 (0%)

Prevention £0 (0%)

WHAT THIS MEANS

Excellent — COPQ is at world-class level. At £3,900 per year (0.39% of revenue), the gap to a 2%-of-revenue benchmark is £0. Most of your COPQ is failure cost — shifting some spend toward prevention is likely to pay back fastest.

Data Entered into the Calculator

Input	Value
Annual revenue (£)	1,000,000
Internal failure costs (£/year)	3,900
External failure costs (£/year)	0
Appraisal costs (£/year)	0
Prevention costs (£/year)	0

Interpretation

The Cost of Poor Quality (COPQ) calculator shows a total quality cost of £3,900 per year, which is 0.39% of the assumed annual revenue of £1,000,000.

All of the cost is currently within internal failure costs (100%), with no external failure, appraisal or prevention costs recorded.

Conclusion

The organisation is operating at a world-class COPQ level ($\leq 2\%$ of revenue). However, there is an opportunity to further reduce costs by investing in prevention to avoid future failures.

TEMPLATES IN THIS STAGE

1. Control Plan
2. Before and After Comparison

The completed evidence pages for this DMAIC stage follow.

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SIMPLICITYHUB® CONTROL PLAN

PRACTICAL TEMPLATE

Specify how each CTQ will be measured, controlled and what the reaction plan is if it goes out of specification.

CONTROL PLAN

PROJECT TITLE

PROJECT OWNER

SPONSOR

Ops Director

DATE

UPDATED BY

Line 2 Labelling Machine Jam Reduction

Joe Campbell

Site / Operations Director (assume 1.0)

Reconstructed example due to GDPR

Reconstructed example due to GDPR

BUSINESS AREA

Manufacturing / Line 2

WHAT IS CONTROL PLAN?

A Control Plan documents how each Critical-to-Quality (CTQ) characteristic will be measured, monitored and controlled after improvement. For each process step, define the CTQ, the specification or target, how it is measured, how frequently, the sample size, the control method (e.g. control chart, CRM alert, audit), the owner, and the reaction plan to follow if the CTQ goes out of specification.

CONTROL PLAN REGISTER

Complete one row per CTQ / process step

Process Step	CTQ / Characteristic	Specification / Target	Measurement Method	Frequency	Sample Size	Control Method	Owner	Reaction Plan (if out of spec)
Cleaning before Line 2 run	Floor condition	Floor dry before production starts	Visual Gemba check	Each Tue/Thu cleaning day	1 check before run	Checklist / audit	Production / Facilities	If floor is damp: dry area before run and record deviation
Side-door management	Door position	Door closed while labelling machine is running	Visual check	Each shift	1 check per shift	Standard work / audit	Production	If door is open: close immediately and record deviation
Labelling machine operation	Repeat jam rate	0 recurring jams	Jam log + Gemba check	Weekly first 4 weeks, then monthly	All Line 2 runs	Run chart / trend review	Operations Manager	Any jam: record conditions and perform root-cause / Gemba review
Cleaning schedule review	Cleaning timing	Cleaning activity does not overlap production window	Review cleaning rota	Weekly	1 rota review	Schedule review / audit	Operations Manager / Facilities	If overlap occurs: adjust rota before next run
Sustained result	Repeat jam rate	0 recurring jams	Weekly jam log	Weekly first 4 weeks, then monthly	All Line 2 runs	Run chart / trend review	Operations Manager	Any recurrence triggers root-cause review

Control Plan note: monitor the process weekly for the first 4 weeks after the countermeasure, then monthly. The case study confirms the countermeasure was to move the mop rota and stop propping the side door open; the machine has not jammed since the change.Assumption: exact inspection timing and ownership beyond the case-study facts are practical control-plan definitions for implementation. They can be edited without affecting the structure of the register.Reconstructed due to GDPR.

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Control Plan | PRACTICAL TEMPLATE

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SimplicityHub® — Before & After Comparison

Document what the process looked like before and after the change so improvements are clearly visible.

Stage: Improve | Level: Beginner | Best for: Showing stakeholders the difference an improvement has made in a simple side-by-side view.

Process Area	Before (Current State)	After (Future State)	Improvement	How Measured	Evidence
Machine fault investigation	Sensor replaced; feed motor replaced; recalibrated twice; jams continued	Timing data + Gemba + root-cause tools used before component replacement	Shift to structured problem solving	Review project records	Case study: three weeks of repeated downtime
Jam pattern	Problem treated as recurring machine fault	Jams linked to Tuesday/Thursday morning cleaning window	Environmental/process trigger identified	Jam tally + day/time log	Case study states Tue/Thu pattern
Floor condition	Damp floor after cleaning	Mop rota moved so floor is dry during production	Remove environmental trigger	Gemba observation	Case study description
Side door	Side door propped open	Side door kept closed	Remove draught at label feed	Gemba check / standard work	Case study description
Machine jams	Repeated jams and downtime	No jams reported since change	100% elimination reported	Jam tally / downtime log	Case study: machine has not jammed since
Countermeasure cost	Parts and maintenance expenditure	Physical countermeasure cost £0	Avoided unnecessary machine spend	Cost review	Case study: change cost nothing