

Turn fishbone branches into testable hypotheses

Convert a list of possible causes into competing, testable explanations with explicit evidence states.



Three branches, zero verified causes

Fictional case: seam-width variation at Cedar Fabrication prompts three suggestions: fixture positioning differs, observers measure differently, or material thickness changes. The core fishbone preserves these three hypotheses and zero verified causes. Facilitator Elena must turn the discussion into a useful test plan without allowing agreement to become proof.

Your role and the reference condition

Improvement facilitator with measurement and process specialists

Normal: The effect has a defined scope; observations and hypotheses use different labels; a proposed test predicts what would differ under competing explanations.

Gap: The team votes fixture positioning as the root cause because it is the most familiar explanation. No comparison or corroborating record has been supplied.

Work within these conditions

1. The scenario contains no authorized repair or production-setting instruction.
2. A supported cause remains bounded by the conditions and uncertainty of the evidence.

Fictional teaching case. Supplied observations support the exercise; proposed actions are not verified customer results.

See how the method works

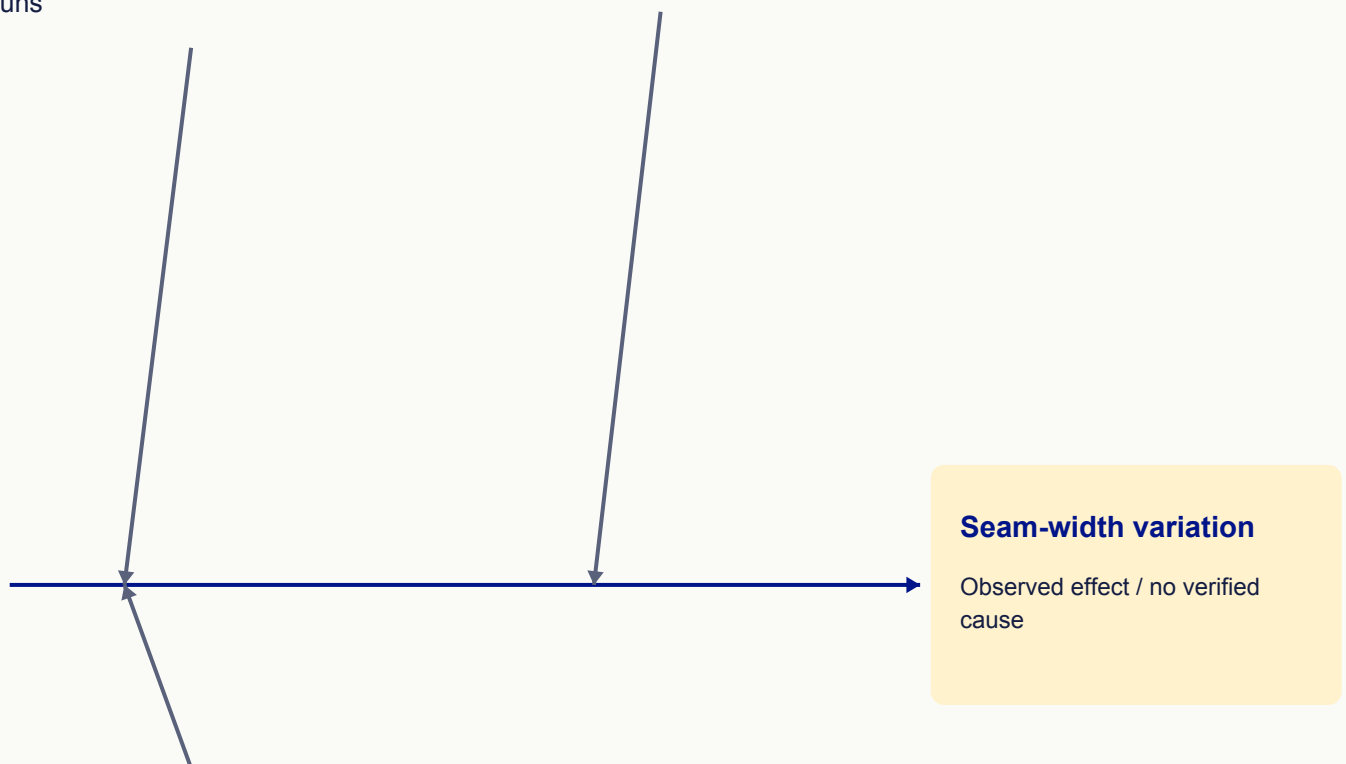
The branches of a fishbone are hypotheses. Begin with one observable effect and a useful scope, then invite several explanations without promoting consensus into proof. Categories help organize discussion; they do not require every branch to be filled or make the resulting list exhaustive. Select important hypotheses and state an observation or test that could distinguish each from an alternative. Mark evidence as observed fact, hypothesis, test result or supported cause. When a test contradicts a branch, update the picture rather than defending the original workshop. A causal conclusion should explain the evidence and survive a relevant verification.

Method

Fixture positioning differs between runs

Material

Input material thickness differs



Measurement

Measurement technique differs between observers

All branches are unverified hypotheses

Choose competing explanations and define an authorized comparison with different predicted outcomes.

A fishbone diagram connects the observed seam-width variation to three unverified hypotheses: fixture positioning under Method, input thickness under Material and observer technique under Measurement. The branches organize possible explanations; no cause has been verified.

Follow the evidence and decisions

Inspect the supplied case inputs

Evidence item	Current status
Effect	Seam-width variation observed; quantify scope before testing
Fixture positioning	Hypothesis
Observer technique	Competing measurement hypothesis
Material thickness	Competing input hypothesis
Verified causes	Zero initially

01 / Define the effect without a cause inside it

Elena writes the seam-width condition, affected product/period and measurement method. She avoids "variation caused by poor setup", which embeds the desired conclusion in the problem statement.

Why: A neutral effect allows rival explanations to be evaluated. An imprecise effect makes nearly any story appear to fit.

Evidence / check: A bounded effect statement separates what was observed from why it may have happened.

02 / Keep branches provisional

The group records the three suggestions as hypotheses and notes who can supply relevant evidence. Category labels such as method, measurement and material organize thinking but do not add proof.

Why: The fishbone is a hypothesis organizer. The number of people agreeing with a branch is not evidence of the causal mechanism.

Evidence / check: Every branch is labelled unverified; no "confirmed" color or check mark appears.

03 / Choose a discriminating comparison

For the measurement hypothesis, Elena asks qualified observers to measure the same retained seam samples under a defined method with identity concealed as appropriate. In parallel she preserves fixture and material records.

Why: If observers disagree on the same physical sample, measurement variation deserves attention. If agreement is adequate for the task, that result weakens this particular explanation but does not prove the fixture branch.

Evidence / check: The plan states rival predictions, sample identity, method and authorized owner.

04 / Record evidence that could contradict the favorite

Before results exist, the team writes that a fixture explanation would be weakened if comparable seam variation persists under verified identical positioning and measurement conditions. It identifies uncontrolled factors that could still confound the comparison.

Why: Predictions written in advance reduce the temptation to reinterpret every outcome as support. A failed prediction is useful learning, not a reason to delete a row.

Evidence / check: The test card contains both supporting and contradicting outcomes.

05 / Update the state and choose the next test

Elena leaves outcomes blank until observations are made. After a reviewed test, the group can label the evidence as supporting, contradicting or inconclusive and decide the next action.

Why: A planned test is not a completed test. Correction or trial action must follow the evidence and relevant authority rather than the appeal of a completed-looking fishbone.

Evidence / check: The record includes result, limitations, decision and next owner without invented observations.

Completed hypothesis-to-test planning record

Hypothesis	Discriminating evidence	Current decision
Observer technique	Same retained samples measured under a defined comparison	Test planned; no outcome supplied
Fixture positioning	Verified positioning records and controlled comparison	Preserve evidence; not proven
Material thickness	Traceable thickness/source records matched to seam observations	Investigate comparability
Overall	No completed tests in supplied case	Zero verified causes

A test result is inconclusive

Observers disagree, but the comparison used different sample locations and unclear measurement instructions.

Decision

Record the result as inconclusive for the intended hypothesis and repair the test method before attributing the effect to operators.

Reasoning

The comparison changed more than the intended factor. An ambiguous test cannot fairly support a specific blame or corrective action.

What would change the decision?

The next plan identifies the same measurand, location and procedure.

Practise with a changed case

Build a rival explanation for missing labels

New fictional issue: labels are missing from some cartons. The team proposes an empty label reel or a scanner that fails to detect missing labels. Supplied facts are a reel-change timestamp and three retained carton IDs; no test has been run.

Item	Supplied fact
Reel change	Recorded at 14:20
Cartons	Three retained IDs; exact times to retrieve
Scanner test	Not performed

Your task

1. Distinguish a possible occurrence cause from a possible escape cause.
2. Design one observation or authorized test for each with a predicted contrary outcome.
3. State how many causes are currently verified.

Use the next page to record your reasoning before reading the answer.

Your practice worksheet

Build a rival explanation for missing labels

Observed effect

Occurrence hypothesis

Escape hypothesis

Predicted evidence

Contrary outcome and status

Complete your reasoning before turning to the answer. Use the separate learner workbook for group practice.

Check your reasoning and transfer it

1. An empty reel could explain label absence; missed detection could explain escape. Either or both may be relevant, but neither is verified by this record.
2. Match carton timing to reel status and inspect the authorized application record. Separately use the approved detection challenge procedure with controlled test pieces; define what a successful or failed challenge would show without releasing test pieces as product.

Suggested completed record

Branch	Question	State
Occurrence	Was label supply/application absent at the affected time?	Unverified
Escape	Could the approved detection check find the missing condition?	Unverified
Total verified causes	No completed discriminating evidence	0

Plausible wrong turns

1. An escape cause is not necessarily the occurrence cause.
2. A fishbone vote is not verification.

Evidence of a sound answer

1. Keep facts separate from hypotheses.
2. Predict a contrary outcome.
3. Avoid inventing a completed test.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Investigation owner with process and measurement specialists
Record	Hypothesis, prediction, test result and decision log
Review	After each completed comparison
Verification evidence	Traceable observations and a bounded inference, including contrary evidence
If unresolved	Revise the test or investigate another branch; do not rename an inconclusive result as proof.

Help someone else apply the method

Prepare

1. Blank hypothesis/test cards
2. Three original branch cards
3. Retained-case fact sheet

Minutes	Activity and coaching prompt
5	Write the neutral effect Does the statement already blame something?
8	Design a rival test What result would weaken the favorite?
10	Apply occurrence and escape Can the carton become wrong and then escape for different reasons?
5	Debrief uncertainty When is inconclusive the correct answer?

Debrief

1. Reward an explicit evidence gap rather than a confident unsupported cause.
2. Require an authorized test boundary for equipment or product challenges.

Individual or remote practice

Write two rival predictions and leave results blank until evidence is supplied.

Connect the method and check its boundaries

Before application

1. One observable effect
2. Access to observations for testing

Outside this lesson

1. Verified causes from brainstorming alone
2. An exhaustive list of every possible cause

ASQ: Fishbone diagram

ASQ: Fishbone diagram

Organize possible causes of a defined effect for investigation; the diagram structures ideas rather than proving them.

Public primary-source summary; underlying paid standards/forms are not reproduced.

[Open this lesson and its visual aids](#)