

The hidden cost of instrument entropy

How lost know-how erodes the value of every installed instrument, and how OEMs can win it back.

Run your own numbers 8 min read • October 2026

£15,900

lost per instrument, every year

£15.2m

a year across a typical installed base

£7.2m

recovered a year with Envoke, net

It's 7:45 on a Monday morning. The analyser that went live eighteen months ago is starting its daily QC, and it's running late again. The two people who were trained by your application specialist have both moved on. The newest member of the team learned the start-up routine from a colleague who learned it from someone else. Samples are already stacking up in the rack.

Nothing is wrong with the instrument. It is exactly as capable as it was on installation day. What has changed is the know-how around it.

We call this **instrument entropy**. Labs are being asked to do more with fewer, less experienced people, so entropy is no longer a minor irritation. It quietly erodes the value of every system in your installed base, and most manufacturers never see it on a report.

What is instrument entropy?

Instrument entropy is the gap between how a system performed at go-live and how it performs today, caused by the steady loss of operator know-how. It doesn't show up as a fault code or a service ticket marked "entropy". It shows up as maintenance that takes longer than it should, avoidable support calls, and new starters who take months to reach full speed.

Three forces drive it:

01

Staff churn

A lab with 20 trained users and 20% annual turnover replaces four people every year. Each new starter is trained by colleagues, not by the people who installed the system, and something is lost at every handover.

02

Incomplete training

Finishing a training course is not the same as being competent. New users typically start well below full speed and take weeks to close the gap.

03

Software updates

Every release resets part of what the lab knows. Every user has to retrain, often on the live instrument, and the days after go-live run slower.

One of these alone is manageable. Together, and repeated across every site in your installed base, they add up to a substantial cost.

The high cost of entropy

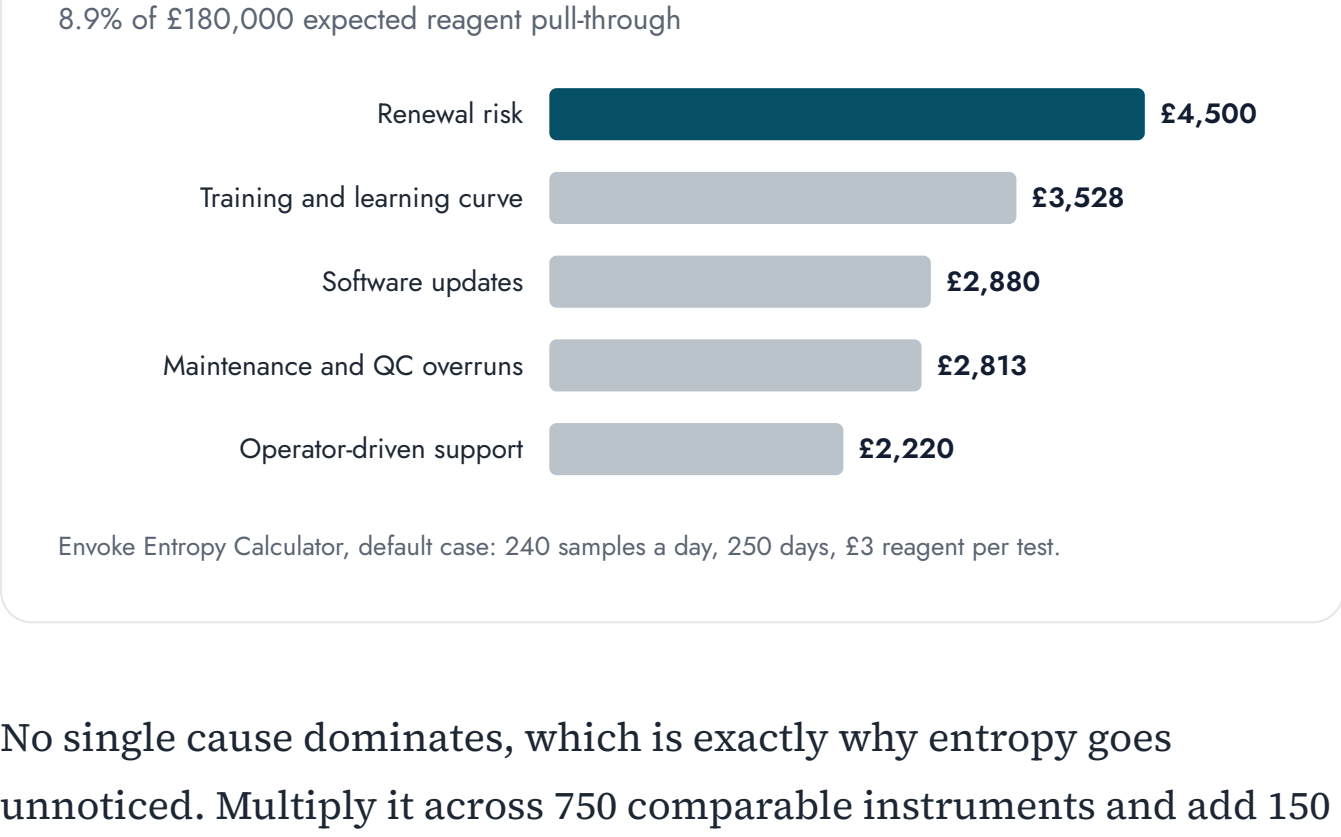
The workforce trends behind entropy are not going away. The [ASCP 2024 Vacancy Survey](#) covered more than 18,600 US laboratory employees. It found vacancy rates still above pre-COVID-19 levels, reaching 28.5% in anatomic pathology. [Ten of the 17 departments surveyed](#) reported rising retirement rates. Experienced operators are leaving, and the people replacing them have less time to learn.

46–68% of laboratory errors happen before the instrument runs a single test.

Plebani, [Clinical Chemistry and Laboratory Medicine](#), 2006

Operator know-how matters because most laboratory mistakes are not made by the analyser. They happen in the sample handling and preparation done by people.

To put a number on what this costs a manufacturer, we built the Entropy Calculator. In its default case, an instrument expected to bring in £180,000 a year in reagent revenue loses about £16,000 of it to entropy.



No single cause dominates, which is exactly why entropy goes unnoticed. Multiply it across 750 comparable instruments and add 150 new placements a year, each running at half volume for its first 12 weeks. The total is about £15.2m a year.

Impact on the lab, its patients and your business

The lab feels entropy first. In the default case, each site loses about 600 staff hours a year. Most of that goes on getting new users up to speed, and the rest on maintenance overruns, fixing operator errors and retraining after updates. That time comes out of a team that is already short-staffed.

Patients feel it next. When QC overruns or a new operator hesitates over an alarm, samples wait. Every hour of avoidable delay adds to turnaround time, and that is the number clinicians and patients judge a lab by.

Then the manufacturer feels it. Tests that never run mean reagent that never bills. Operator mistakes turn into support calls and field visits that look like product problems. And when a contract comes up for renewal, the lab remembers how hard the system was to live with, not how well it performed in the demo. In our model, a 0.5% annual chance of losing a five-year contract over usability or training costs £4,500 per instrument every year. Renewal risk is the single biggest driver of the entropy bill.

How can OEMs reduce entropy?

Most manufacturers put their training effort into installation. An application specialist spends a few days on site, trains a handful of key users and signs off. From then on, keeping that knowledge alive is left to the lab.

That made sense when lab teams were stable. It doesn't now. Turnover is high, updates are frequent, and the people who were trained at go-live are often gone within two years. Without ongoing support, every site slides down the same entropy curve.

Reducing entropy means treating operator competence as a shared responsibility for the whole life of the contract, just like uptime. The question for the OEM is not "did we train them?" but "are they still performing as well as on day one?"

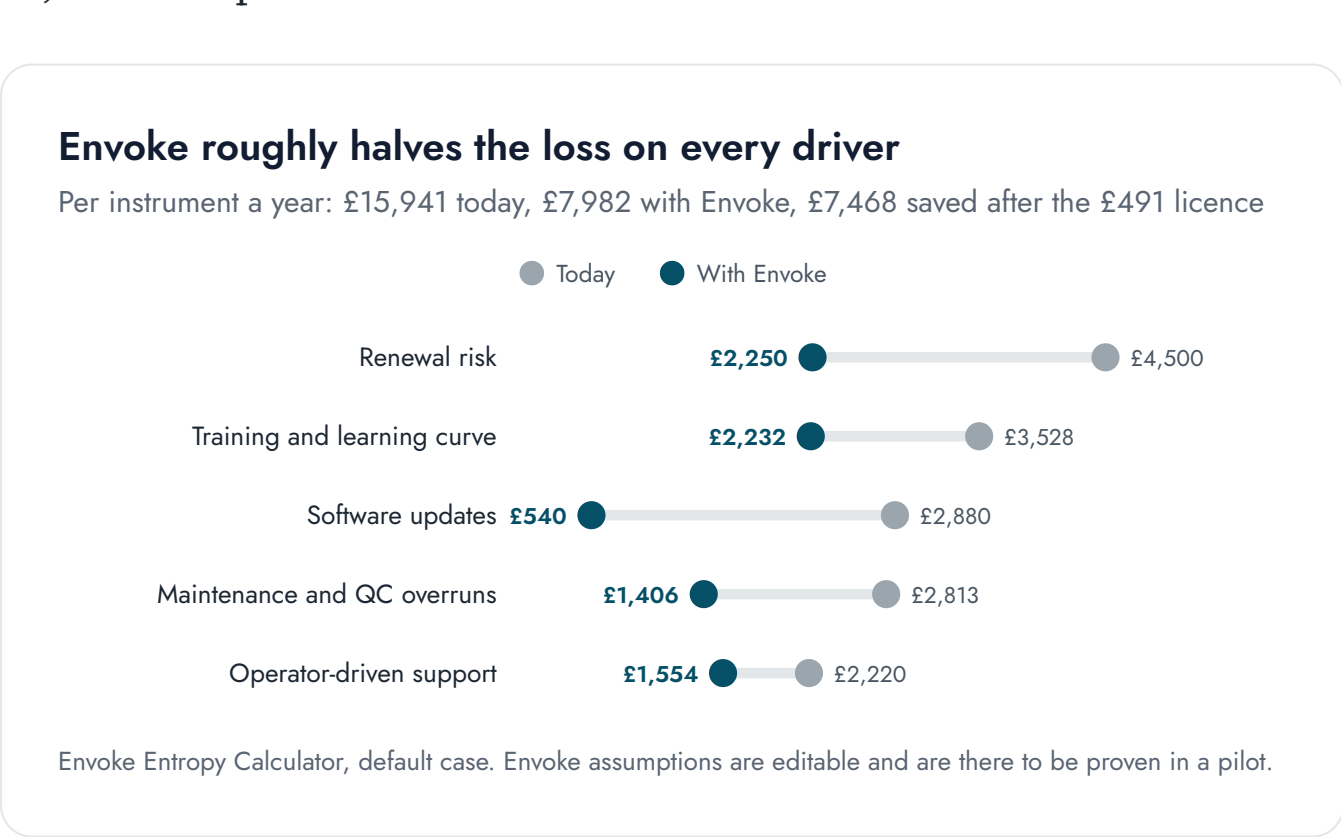
Five ways to stop entropy across your installed base

- 1 Measure it.** You can't manage a loss you haven't sized. Compare estimated and actual maintenance times, tag support calls caused by operators, and record why sites don't renew. Start with one typical instrument before you scale up.
- 2 Train for competence, not attendance.** Judge training by how quickly new users reach full speed, not by how many days they spent in a session.
- 3 Take practice off the live instrument.** Every hour a trainee spends on the real system is an hour it isn't running patient samples. Give users somewhere safe to make their first mistakes.
- 4 Rehearse every software update.** Let users try out new workflows before release day, so go-live isn't the first time they see them.
- 5 Stay present after go-live.** Give every site, and every new starter, the same quality of training the first users got, whenever they need it.

Keeping every instrument at day-one performance

Envoke builds interactive 3D replicas of your instruments that stay with every lab long after go-live. New starters practise loading, start-up, QC and alarm handling before they touch the real system. Users rehearse each software update on the replica rather than the live instrument. The lab gets back the knowledge it loses with every leaver, without taking an instrument out of service.

In the calculator's default case, Envoke-trained users start at 85% of full speed instead of 60%. They reach full speed in 8 weeks rather than 12, and new placements hit full volume in half the time.



Across 750 instruments and 150 new placements a year, that means about £7.2m a year recovered, after licence costs. Each lab also gets back around 370 staff hours a year.

ENTROPY CALCULATOR

What will entropy cost you?

These are our default figures. Your installed base will be different. Nine questions about one typical instrument, about five minutes, and a PDF report of your own numbers. When you have your figure, talk to us about proving it with a pilot.

Start the calculator Talk to Envoke



Sources

1. [ASCP Publishes Results of 2024 Vacancy Survey](#), AAB8, October 2025.
2. [ASCP 2024 Vacancy Survey coverage](#), Dark Daily.
3. Plebani M. Errors in clinical laboratories or errors in laboratory medicine? Clin Chem Lab Med, 2006.
4. Envoke Entropy Calculator, default case. Figures are working assumptions to test against real service and contract data.