SEM Academy
STRATEGIC ENGINEERING MATRIX

IKAR Solutions OÜ
Tartu, Estonia

A BROCHURE FOR PLANT MANAGEMENT, PROJECT MANAGEMENT, OPERATIONS, AND QUALITY

STRATEGIC ENGINEERING MATRIX · ENGINEERING RIGOR FOR TECHNICAL ESCALATIONS

The customer report is due Friday

Your team learns the seven escalation steps with SEM: a course on real cases, four weeks in the app, and SEM Scout at the machine.

Get in touch **sem@ikarsolutions.com**



GETTING STARTED

1 course day

at your own plant, for one team of up to eight participants

4 weeks

in the app afterward, about ten minutes a day

3 levels

contribute, run the analysis, build your own structures

ABOUT THIS BROCHURE

SEM grew out of more than 30 years of practice in the plant



For more than 30 years, I have worked with injection molding machines and molds, and in meetings where a customer was waiting for an answer. Together with plant teams, I developed a fixed structure for the analysis.

This became the Strategic Engineering Matrix, SEM for short. It sets out which explanations are on the table, which measurement decides between them, what happens next, and how the customer is kept informed.

SEM applies the rigor a design engineer brings to a tolerance stack-up: name every explanation, justify every measurement, and prove the effect of every intervention. At the SEM Academy, your team learns this on real cases and then teaches it internally.

INGO KONRAD DENTZ

1994	Setup technician, hot runner applications engineer, tooling project manager, production manager
2006	Independent consultant with IKAR Solutions, more than 200 industrial projects for Tier 1 suppliers and OEMs
Today	Simulation with Moldflow and FEA, developer of SEM and head of the SEM Academy

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THE ESCALATION IN SEVEN STEPS

The seven steps of an escalation and what SEM contributes to each

SEM complements 8D, Ishikawa, and 5-Why and gives your team a fixed structure for every step.

1
STEP

Secure deliveries

The customer keeps getting good parts while the cause is still open.

In SEM, the interim solution is an intervention type of its own. Your team puts it in place right away and records that it secures deliveries while the cause is still open.

2
STEP

Capture the situation

What exactly the defect is, where, since when, on which parts, and what is fixed: deadline, SOP, budget, mold.

SEM Scout captures the defect pattern, material, and settings at the machine. Every analysis starts with the symptom and the context, described without interpretation.

3
STEP

Set up communication with the OEM

One fixed contact, a fixed rhythm, the first response in the 8D.

Everyone works from the same analysis, from the setup technician to the OEM's quality engineer. The customer report is generated from the same file.

4
STEP

Put every possible cause on the table

Material, mold, process, geometry, and environment stand side by side.

In the SEM workspace, at least three mechanisms stand side by side. Measurements focus on what separates them, and every finding is weighed against all mechanisms.

5
STEP

Prove the cause

A cause is proven when the hypothesis has a supporting finding of its own and findings have lowered or ruled out the other mechanisms.

The result is the documented evidence for D4 to D6 of your 8D report.

6
STEP

Present interventions for a decision

Several options with cost, time, and risk, on one page.

Because every mechanism has been assessed, the interim solution, the robustness solution, and the optimal solution are all options, alone or combined. Deadline and budget limit the options. The cause stays the same.

7
STEP

Implement, prove, hand over

The intervention works in the pilot run, the OEM closes the escalation, and the documents are updated.

An intervention is verified when it acts on the mechanism. The report, 8D, FMEA, and control plan are generated from the analysis.

BENEFITS

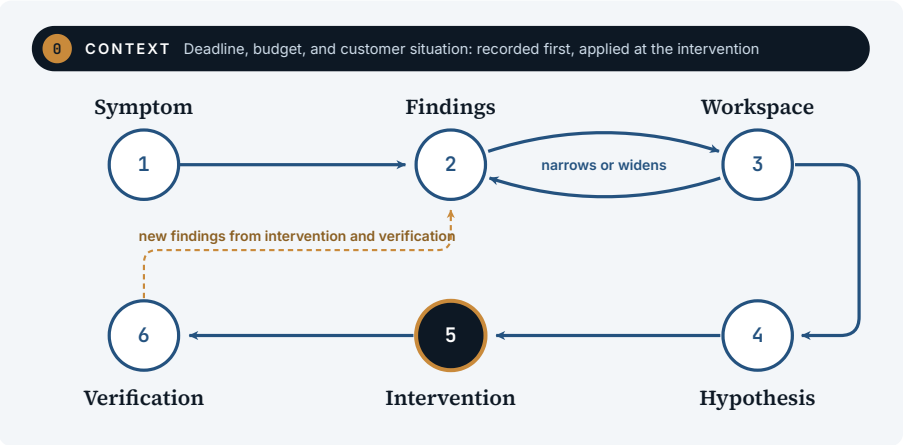
What your company gets

THE CUSTOMER	They see what has been checked, what is still open, and why an intervention was chosen.
MANAGEMENT	Management decides from one page covering the situation, findings, interventions, and recommendation, before spending on molds or a material change.
THE PLANTS	The plant and the central analysis team work on the same case, even across borders (page 7).
THE TEAM	Each level has a defined role in the seven steps, and every graduate can teach the level below internally (page 9).

THE SEM LOOP

The SEM loop leads from the symptom to a proven effect

In steps 2 and 4 through 7, your team works in the SEM loop. Its fields use the same numbers as the fields on the SEM Whiteboard.



Read the loop from 1 to 6.

0 CONTEXT	Deadline, budget, customer situation. It can block interventions; it never changes the mechanism.
1 SYMPTOM	The failure, described without interpretation.
2 FINDINGS	Measurements and trials that tell the explanations apart.
3 WORKSPACE	Every mechanism that could explain the symptom, at least three.
4 HYPOTHESIS	The mechanism that comes out on top once the findings are in.
5 INTERVENTION	Interim, robustness, or optimal solution, chosen deliberately or combined.
6 VERIFICATION	Proof that the intervention acts on the mechanism.

A CASE ON THE SEM WHITEBOARD

A hinge arm warped 4.2 millimeters. The mold stayed.

A few weeks before the customer's audit, the hinge arm of an exterior flap warps. The whiteboard shows the case in the seven fields of the loop. B stands for finding and M for mechanism; the arrows show whether a finding supports a mechanism or counts against it.

0 Context

Pre-production, a few weeks before the audit. The frame allows process and material changes. The mold stays as is; its warp compensation is about 3.5 mm.

1 Symptom

Hinge arm made of PP-GF50 with about 80% recycled content. It warps by about 4.2 mm, and the flush fit is out of spec.

2 Findings

B1 Simulation of the warpage contributions: fiber orientation 2.8 mm, shrinkage 2.3 mm, cooling 0 mm. The contributions act in different directions and do not add up.

B2 Trial run of six material candidates in the same mold: one long-glass grade shows low, stable warpage.

B3 In the scans, the production material with recycled content shows wide scatter.

3 Workspace

M1	Anisotropic shrinkage and fiber orientation	B1↑ B2↑ B3↑	leads, confidence high
M2	High volumetric shrinkage		confidence low
M3	Thermal imbalance in the mold	B1↓	confidence low

Other mechanisms remain visible in the workspace.

4 Hypothesis

The material accounts for most of the warpage, the gate for a smaller share.

5 Interventions

A · PC-SAN-GF30

1.2 mm, the lowest warpage. Misses the minimum tensile strength and the warp compensation target.

excluded

B · Long-glass PP-GF50, without recycled material

3.5 mm, stable. Matches the warp compensation, meets the tensile strength requirement, and the mold stays as is.

chosen

C · Move the gate

3.8 mm, the scatter remains. Changing the mold is outside the frame.

blocked by the context

6 Verification

Parts made from the new material are within the customer specification and have run in production without issues for a year. This verifies the intervention at the mechanism level and against the target set by the warp compensation.

Anonymized case using the values measured and calculated at the time. Details in the series "SEM before SEM," part 2, on sem.ikarsolutions.com. The metrics on your own cases show what the method saves in time and trials at your plant (page 11).

TWO TOOLS, ONE CASE

The plant and the analysis work on the same case

SEM Scout captures what can only be seen at the machine. SEM Desktop drives the case: it determines what gets measured, which intervention fits the frame, and whether it worked.

AT THE PLANT · SEM SCOUT

IN THE ANALYSIS · SEM DESKTOP

1 **Capture the defect**
Symptom, material, and settings

2 **Define the measurement request**
Which measurement separates the mechanisms

3 **Measure and report back**
Values and photos, across shifts

4 **Choose the intervention**
Within deadline and budget

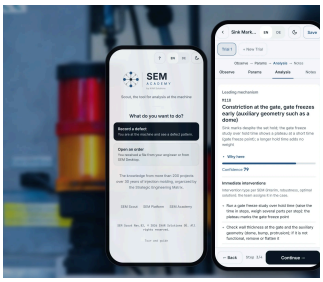
5 **Implement the intervention**
Report the effect from the machine

6 **Verification and report**
For the customer, the 8D, and management

Each handoff is a file that travels through whatever channel your IT specifies. No server stores your data.

SEM Scout

AT THE PLANT, FREE



For setup and process technicians, on a phone at the machine. SEM Scout checks the settings against the processing windows for 17 plastics, suggests mechanisms and checks, and accepts requests from the analysis.

It also works on its own as a notebook for your own trial series, in the browser with no account. The data stays on the device until you send it yourself.

SEM Desktop

IN THE ANALYSIS

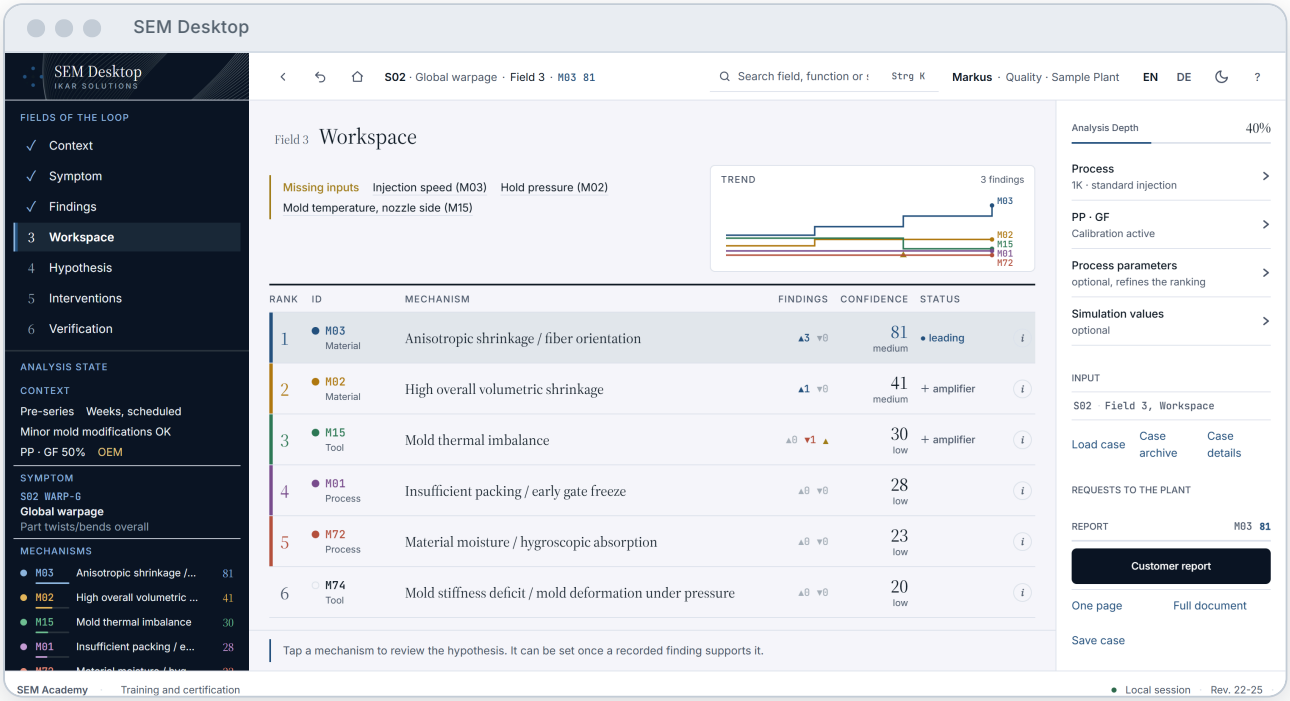
For the analysis lead, at your own plant or at another site. SEM Desktop takes the case through the SEM loop, sends measurement and intervention requests, reads in the responses, and writes the report (page 8).

Both tools share the same knowledge base; Scout uses the part needed at the machine.

IN THE ANALYSIS

Mechanisms, findings, interventions, and report in one file

SEM Desktop is the method's analysis software. For every value, it shows which findings it came from.



SEM Desktop in the Workspace field. On the left, the fields of the SEM loop; in the middle, the mechanisms with their findings; on the right, inputs, requests to the plants, and reports.

THE ANALYSIS

The knowledge base covers 64 symptoms and 83 mechanisms. With its checks, it leads from the mechanisms to the hypothesis and stages the interventions within the frame set by your context.

THE CUSTOMER

The customer report shows the situation, hypothesis, interventions, and remaining uncertainty, as a one-pager or as the full document.

CONFIDENCE

The confidence value in Scout and Desktop is a ranking based on fixed rules of the knowledge base. It is not a probability.

AVAILABILITY

SEM Desktop is part of the courses from Practitioner level and above. For your analysis department, we will prepare a license quote.

AT YOUR PLANT OR REMOTELY · ENGLISH OR GERMAN · UP TO 8 PARTICIPANTS

Three levels, each with a defined role in the escalation

The levels build on each other and end with an exam and a diploma. Every graduate can teach the level below internally and so train the whole team.

1
LEVEL 1

SEM Foundation

For the whole team, from the setup technician to quality.

Afterward, participants contribute to all seven steps as part of the team and help build the structure of the case: capture the situation, collect findings, and track mechanisms side by side.

1 course day and ½ final day, exam and diploma

2
LEVEL 2

SEM Practitioner

For analysis leads and project managers.

Afterward, participants run the entire SEM analysis, all seven steps with SEM Desktop, and communicate with the customer. Internally, they teach the Foundation course.

2 course days and ½ final day, exam and diploma

3
LEVEL 3

Certified Escalation Engineer

For everyone responsible for escalations.

Afterward, participants build their own escalation structures for the company and present them to the customer and senior management. Internally, they teach the Practitioner course.

2 to 3 course days and project work, board review and diploma

EVERY COURSE

30 to 40 minutes of preparation with the book *SEM: Thinking Under Pressure*, course days working through cases and the SEM Whiteboard, then four weeks in the app at about ten minutes a day. The course pack contains templates and required assignments for each level.

ONE-DAY COURSES · THEN FOUR WEEKS IN THE APP

Two one-day courses for everyone involved

ONE-DAY COURSE

Technical leadership in injection molding escalations

For everyone involved: project management, process, tooling, quality, and engineering.

In one day, we walk through the seven steps in condensed form, using an escalation with an existing mold. Afterward, everyone knows their part in each step.

1 course day, then four weeks in the app, certificate

ONE-DAY COURSE

Understanding and assessing 3D injection molding simulation

For project management, engineering, tooling, process, and quality; technical buyers are welcome to join.

On one customer order, start to finish, we work out what a simulation shows, what it leaves open, and how it supports decisions on material, gating, cooling, and mold trials. Afterward, participants use it to choose trials and assess interventions.

1 course day, then four weeks in the app, certificate

OVERVIEW

Which course covers which steps

	1	2	3	4	5	6	7	ROLE
Foundation	◐	◐	◐	◐	◐	◐	◐	contributes, helps build the structure
Practitioner	●	●	●	●	●	●	●	runs it, talks to the customer
Escalation Engineer	●	●	●	●	●	●	●	builds own structures
Technical leadership	○	○	○	○	○	○	○	everyone involved, condensed
Simulation				●		●		choose trials, assess interventions

1 Secure deliveries · 2 Capture the situation · 3 Communication with the OEM · 4 Every cause on the table · 5 Prove the cause · 6 Present interventions · 7 Implement and hand over. ● runs, ◐ contributes, ○ overview.

FROM THE FIRST CONVERSATION TO TRAINING WITH YOUR OWN INSTRUCTORS

Getting started: one course day at your own plant

It starts with a conversation and one course day for one team. You build up the rest at your own pace, until your own engineers teach the courses.

1 CONVERSATION	We discuss your plants and what prompted your inquiry, review last year's escalations with you, and agree on which of them serve as the baseline. Then we set the course, participants, date, and language, and define the metrics: time to the leading mechanism, trials per escalation, and plant scrap.
2 ONE DAY FOR ONE TEAM	Your team starts with a Foundation day or a one-day course for up to eight participants at your plant, followed by four weeks in the app. Afterward, we review with you the metrics and the cases the team has handled since then, and summarize the results on one page.
3 THE NEXT LEVELS	Then you build up the levels at your own pace. The plants work with SEM Scout from day one.
4 YOUR OWN INSTRUCTORS	Your engineers teach the courses themselves once they hold the diploma of the next higher level and have completed a teaching demonstration.
MULTIPLE PLANTS	With multiple plants, the machines work with SEM Scout, the central analysis team with SEM Desktop, and each site has its own instructors. We answer your IT department's questions on operation, data storage, and network connections in writing before you commit.

THE NEXT STEP

One course day at your own plant. Then let your numbers decide.

Whether further levels follow is up to you,
based on the metrics from your own cases.

Next steps

1. **Try it.** Use SEM Scout free of charge at www.ikarsolutions.com/scout. The book's reading sample and the case series are on sem.ikarsolutions.com/en.
2. **Get in touch.** Email or call us. You will receive a proposal within two business days.
3. **Get started.** Your team begins with a Foundation day or a one-day course at your own plant.

YOUR CONTACT

Ingo Konrad Dentz

sem@ikarsolutions.com
+372 5685 8955

SEM ACADEMY ONLINE

sem.ikarsolutions.com/en

SEM Academy · IKAR Solutions OÜ
Tartu, Estonia · sem.ikarsolutions.com/en

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