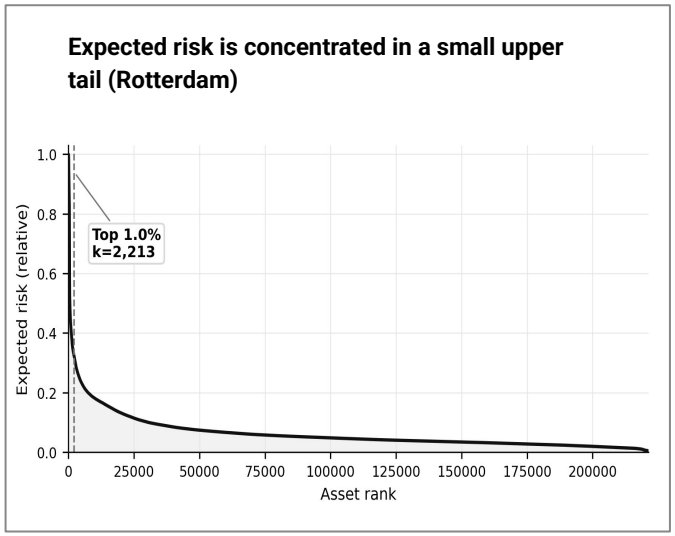
Which high-risk decisions are actually unreliable?

Most prioritisation systems produce a single deterministic ranking.

But they provide little information about which decisions remain reliable under uncertainty.

Habnetic estimates posterior decision stability to identify the small subset of decisions whose prioritisation is genuinely uncertain.



CITYWIDE OVERVIEW - ROTTERDAM

Top-k membership probability
(k = 2,213)

1.0
0.5
0.0

Rotterdam
221,324 buildings
Top-priority set: 1%
Yellow ≈ uncertain boundary
(P(i ∈ top-k) ≈ 0.5)

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TAKEAWAY

Risk is concentrated.
Decision uncertainty is even more concentrated.

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Prioritisation itself can be treated as a probabilistic object

Habnetic combines exposure and hazard indicators in a Bayesian framework to estimate the stability of prioritisation decisions under uncertainty.

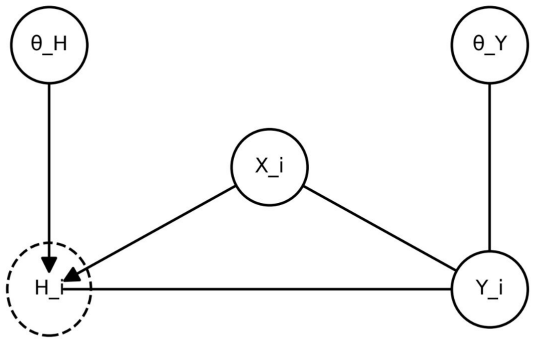
The output is not a risk score or a fixed ranking, but posterior decision metrics that quantify the stability of prioritisation decisions.

PROBABILISTIC FRAMEWORK

Exposure and hazard indicators are combined within a Bayesian model.

Output:
Posterior decision metrics

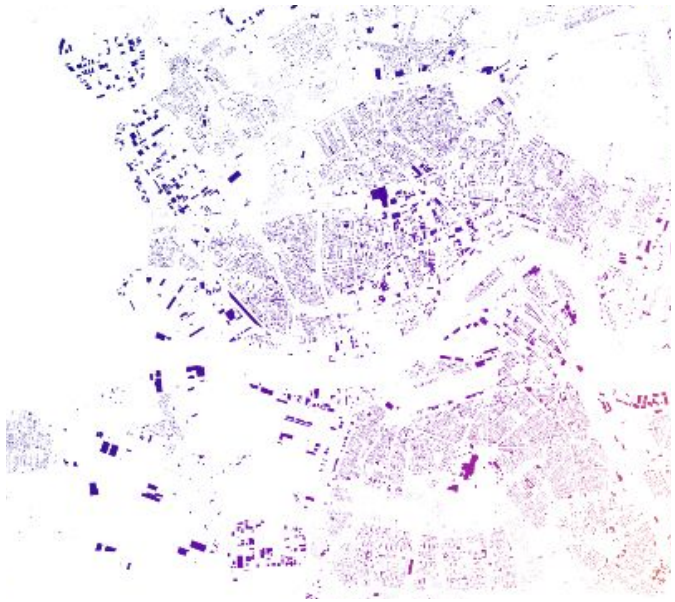
Xi Exposure indicators
Ii Hazard proxy
Yi Impact measure
θH Hazard parameters
θY Impact parameters



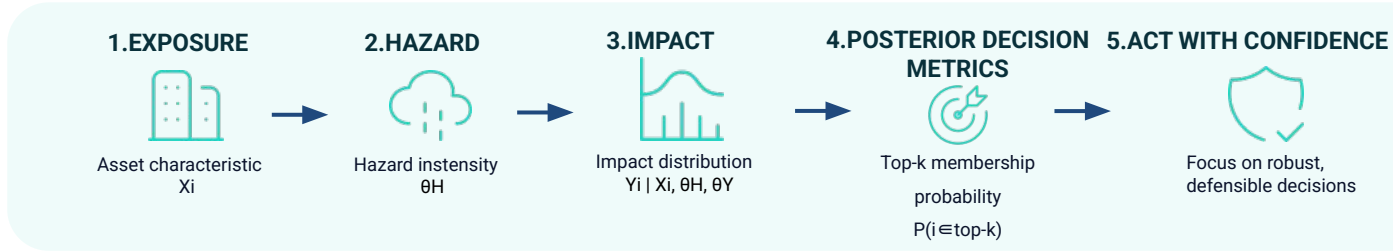
EXPOSURE INDICATOR

RTM – Distance to water [m]

HAZARD INDICATOR



RTM – Pluvial hazard proxy [mm]



TAKEAWAY

Inputs become posterior decision metrics.

Habnetic derives posterior decision metrics rather than deterministic rankings.

Where does decision uncertainty concentrate?

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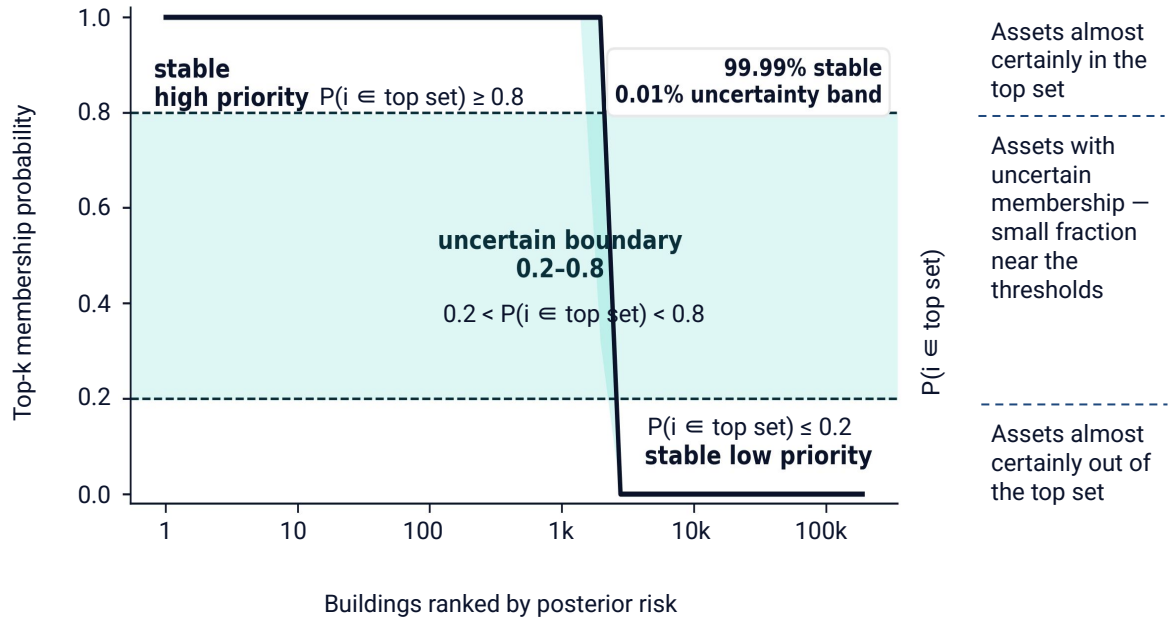
Posterior decision stability reveals where prioritisation is robust and where decisions remain uncertain. Most assets remain stable, while uncertainty concentrates near the prioritisation boundary.

Habnetic reveals that only a small subset of boundary assets remains uncertain.

Decision stability is the probability that an asset remains in the selected top-priority set across posterior simulations.

POSTERIOR STABILITY STRUCTURE

Rotterdam baseline • top-priority set = 1.0% of buildings • k = 2,213



TAKEAWAY

99.99% of buildings remain stable. Decision uncertainty concentrates near a narrow decision boundary.

Only boundary assets remain uncertain.

Review only boundary decisions.

Prioritise robust decisions.

Decision stability remains robust under perturbation

Hazard perturbation increases uncertainty, but it remains concentrated near a narrow decision boundary rather than spreading across the system.

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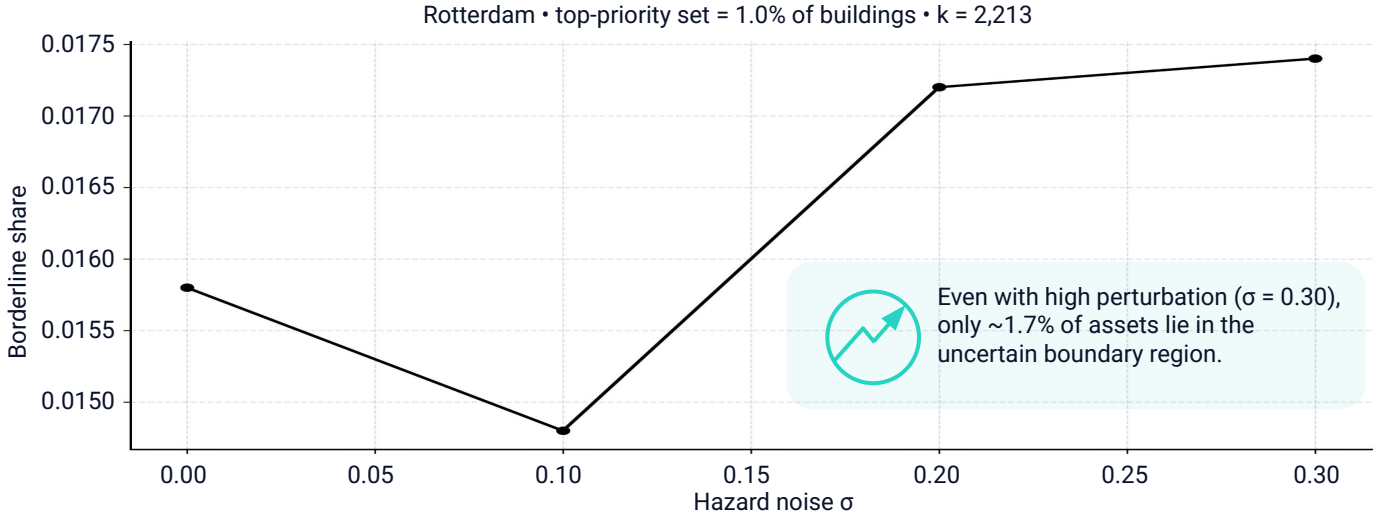
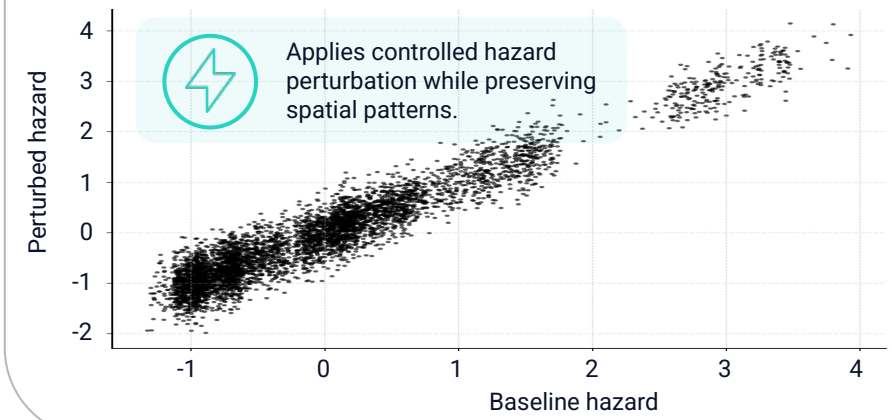
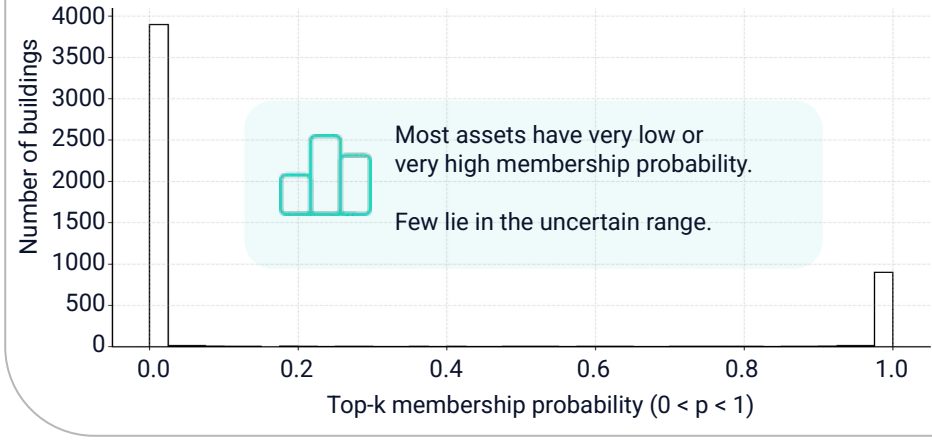
BOUNDARY SHARE UNDER HAZARD PERTURBATION



EXAMPLE: HAZARD PERTURBATION (σ = 0.10)



POSTERIOR DECISION PROBABILITIES REMAIN CONCENTRATED



TAKEAWAY

Decision stability remains robust under substantial hazard perturbation.

Hazard perturbation increases variation...

...but instability stays concentrated...

...preserving confidence in top-set decisions.

Decision stability structure transfers across cities

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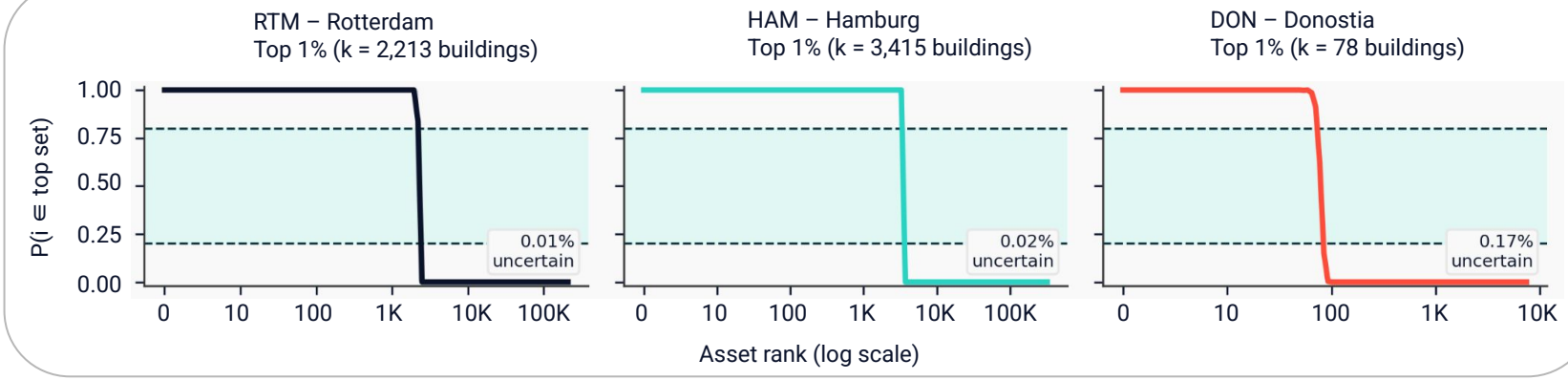
TAKEAWAY
Decision-stability structure remains consistent across cities.
Uncertainty remains concentrated near a narrow boundary.

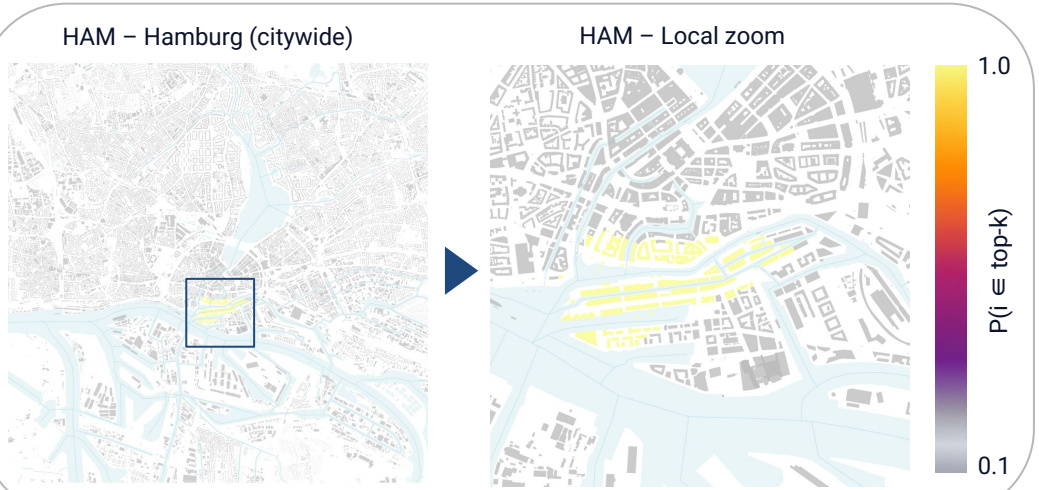
The same probabilistic specification preserves the overall decision stability structure across cities, while distributional shift produces only moderate broadening of the uncertainty boundary.

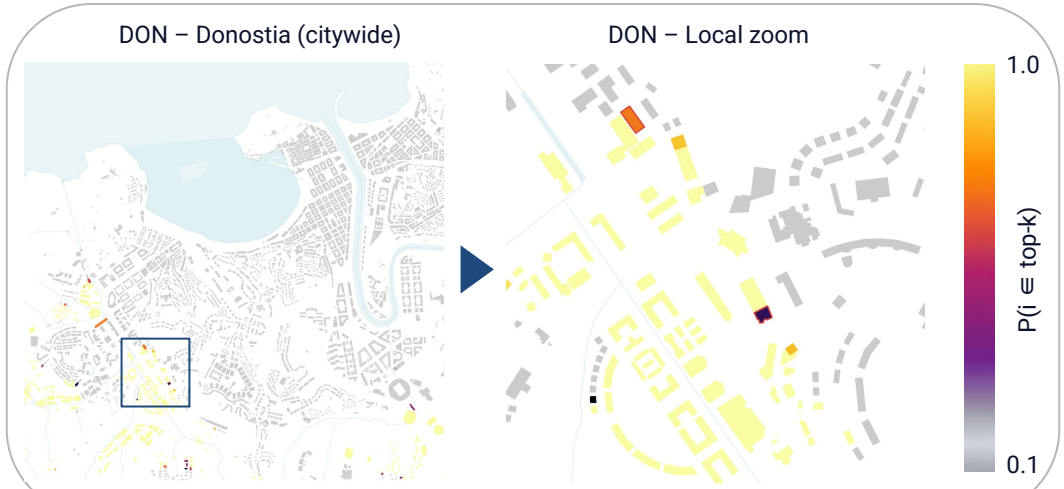
The uncertainty boundary remains narrow in every city.

STABILITY STRUCTURE BY CITY (TOP-SET = 1.0% OF BUILDINGS)



UNCERTAINTY REMAINS LOCALISED IN EVERY CITY





TAKEAWAY

Decision-stability structure remains consistent under fixed-specification transfer

Stable classifications are preserved.

Uncertain boundary broadens modestly.

Uncertainty stays localised near the decision boundary.

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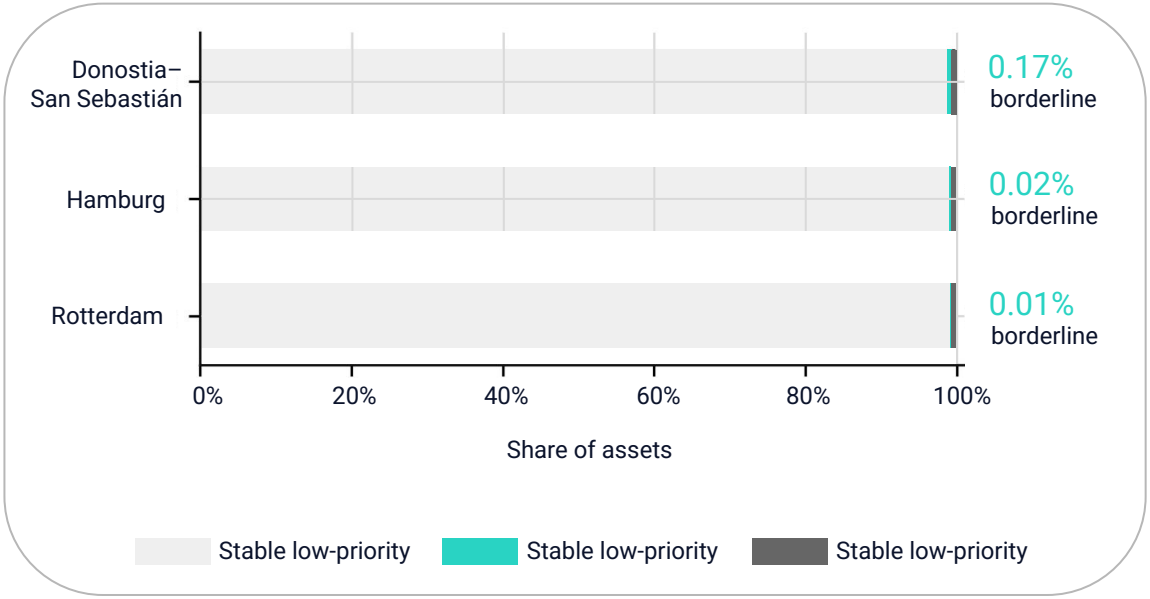
The unstable boundary is where attention should go

Posterior decision stability supports uncertainty-aware prioritisation, targeted review, and robustness assessment under distributional shift.

Rather than reviewing every asset, attention can be focused on the small subset of boundary assets whose prioritisation remains uncertain.

MOST PRIORITISATION DECISIONS REMAIN STABLE ACROSS CITIES



TAKEAWAY

The uncertain boundary is consistently very small, from 0.01% to 0.17% of assets across cities.

FROM REVIEWING EVERYTHING (INEFFICIENT)

TO FOCUSING THE BOUNDARY (EFFECTIVE)

TO ACTING WITH CONFIDENCE (RELIABLE)

TAKEAWAY

Decision uncertainty is concentrated in a small boundary that can be reviewed explicitly.

Focus review effort on the boundary, not the entire portfolio.

Targeted review improves efficiency while preserving confidence.

Greater confidence where it matters. Less effort where it doesn't.

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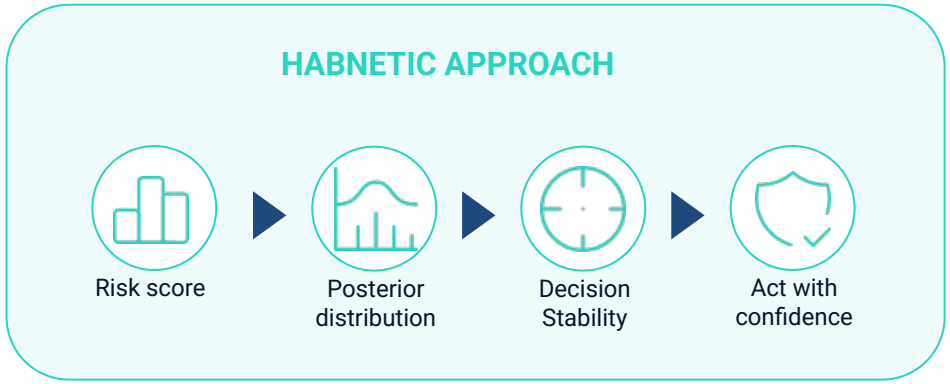
From ranking to uncertainty-aware prioritisation

Traditional prioritisation systems produce a ranking and implicitly assume the ranking is reliable.

Habnetic treats prioritisation as a probabilistic object, estimating how stable decisions remain under uncertainty.

The objective is not to eliminate uncertainty, but to identify where decisions remain structurally reliable and where they do not.



DECISION STABILITY ENABLES

- Targeted review
- Robust prioritisation
- Transferability assessment
- Explicit uncertainty communication
- Defensible resource allocation

TAKEAWAY

The objective is not to eliminate uncertainty.
The objective is to identify where decisions remain reliable and where they do not.

Decision stability | Targeted review | Defensible decisions | Transferable framework