Distinguishing AI from Automation in HEOR: Lessons from Other Industries

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KEY MESSAGE

Effective HEOR modernization requires distinguishing deterministic automation from learning-based AI.
Automation excels for rule-bounded, traceable tasks (e.g., SLR de-duplication, structured data extraction), while AI is suited to data-rich, weakly structured problems (e.g., RWD mining, survival extrapolation). Cross-industry benchmarking reveals a practical decision rule: sequence automation for compliance-critical workflows and layer AI only where adaptive inference solves genuine evidence gaps.

BACKGROUND

As Artificial Intelligence (AI) adoption increases in Health Economic and Outcomes Research (HEOR), the terms AI and automation are often used interchangeably despite referring to distinct technological paradigms.[1]

Key Definitions:

- AI: A machine-based system that infers from inputs how to generate predictions, content, recommendations, or decisions [2]
- Automation : Executes pre-specified, repetitive, rule-based tasks without adaptive inference.

This distinction is critical in HEOR because evidence submitted to Health Technology Assessment (HTA) bodies must be transparent, reproducible, and methodologically robust. Real-world data use requires explicit evaluation of data provenance, fitness-for-purpose, and analytic validity [3].

OBJECTIVES

1. Propose a practical framework to distinguish deterministic automation from learning-based AI
2. Draw lessons from AI-mature industries (finance, aviation, manufacturing, logistics, insurance)
3. Translate cross-industry findings to common HEOR workflows (Structured Literature Review (SLR) screening, data curation, economic modelling, Real World Evidence (RWE) generation)
4. Evaluate each technology class on adaptability, transparency, and error propagation
5. Identify task characteristics that determine appropriate technology use
6. Develop a practical decision rule for AI vs automation in HEOR

Decision Checklist

When choosing between AI vs Automation, ask:

1. Is the task rule-bounded and repetitive? → Use automation
2. Does it require full traceability? → Use automation
3. Is the data weakly structured or noisy? → Consider AI
4. Does the problem require adaptive inference? → Consider AI

Practical HEOR Applications

1. Automation: SLR de-duplication, structured data extraction, template formatting
2. AI: RWD mining, survival extrapolation, phenotype identification
3. Hybrid: AI-assisted screening with rule-based audit trails

METHODS

A cross-industry benchmarking exercise was conducted comparing robotic process automation in finance, autopilot systems in aviation, programmable logic control (PLC) in manufacturing, warehouse and routing automation in logistics, and rule-based engines in insurance with applications of machine learning and generative AI. These tasks were mapped onto similar HEOR activities like systematic literature review (SLR) screening, data curation, economic model development, and real-world evidence generation. Each technology class was evaluated on adaptability to unstructured data, transparency of decision logic, and the magnitude and reversibility of error propagation.

Operational Definitions

Deterministic Automation
Outputs fully governed by explicit instructions, stable thresholds, and predefined workflows.

Learning-Based AI
Outputs depend on statistical pattern recognition or generated inferences that may change with data/prompts.

HEOR Mapping & Frameworks

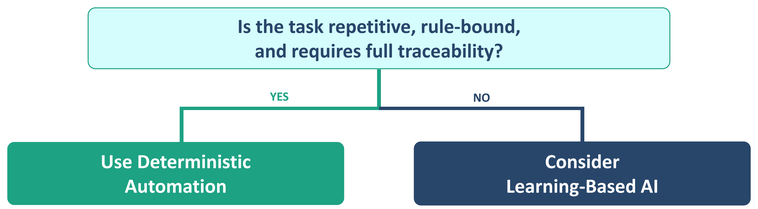
Tasks mapped to HEOR activities:

- SLR screening, data curation, economic model development, RWE generation
- Anchored to PRISMA, NICE HTE guidance, NICE RWE framework, FDA & ISPOR RWD frameworks.
- Evaluated on: adaptability to unstructured data, transparency of decision logic, magnitude & reversibility of error propagation.

Industry Selection Rationale

Industry	Rationale
Finance	Structured, standardized transactions; canonical high-value Robotic process automation (RPA)
Aviation	Safety-critical; reliability & auditability prioritized
Manufacturing	PLC-based repeatable real-time control
Logistics	Split between codified ops & adaptive analytics
Insurance	Adjudication rules vs. fraud detection under changing conditions

Decision Framework: When to Use Automation vs. AI



RESULTS

Automation vs. AI: Cross-Industry & HEOR Mapping

Industry	Deterministic Automation	Learning-Based AI
Finance	Trade reconciliation, straight-through processing	Fraud detection, market anomaly spotting
Aviation	Standard flight phases (autopilot)	Predictive maintenance
Manufacturing	Assembly-line PLC control	Computer-vision Quality Check (QC)
Logistics	Parcel sorting, warehouse routing	Demand & congestion forecasting
Insurance	Eligibility checks, adjudication	Claims fraud detection
HEOR Equivalent	Where deterministic behavior and reproducible audit trails are required for HTA submissions: SLR de-duplication, structured data extraction, templated formatting	Learning-based AI is reserved for noisy, weakly structured problems: RWD mining, outcome imputation or extrapolating long-term survival from short-term surrogates

DISCUSSION

Practical Decision Rule:

- Prefer automation when the task is repetitive, rule-bounded, and requires full traceability.
- Consider AI when the problem is data-rich, weakly structured, and materially benefits from adaptive inference despite residual uncertainty.

Governance Implication:

- Use deterministic systems for workflow control and compliance-critical transformations.
- Layer learning-based models only where they solve a genuine evidence problem that rules cannot address transparently.
- The same AI adaptability that is valuable for noisy problems also increases the need for validation, calibration, and documentation of model assumptions before payer-facing or regulatory use.

Key Insight

Failure to distinguish AI from automation also risks deploying opaque, probabilistic models where transparent, rule-based logic is ethically and scientifically feasible. AI adaptability increases the need for validation, calibration, documentation, and human oversight before use in payer-facing or regulatory contexts.

References

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