Decision Engineering for Real World Supply Chains

Build for Chaos, Not for Comfort.

Introduction

Supply chains today operate under the one-two punch of VUCA — volatility, uncertainty, complexity, and ambiguity — not just circumstantially, but structurally. However, the way we make decisions hasn't caught up. We still break the supply chain into design, planning (APS), and execution, as if there were tidy little boundaries.

That's the lie— The truth?

Decisions span the entire time-to-plan horizon — some play out over years, others demand responses in minutes. But our systems and architectures still assume the world is neat and predictable. That is like trying to organize a food fight by table number.

We live in a world of relentless change and constant reconfiguration. We don't live in "standard deviation land" anymore. Customers shift. Tariffs shift. Policies shift. Networks shift. And yet we still use the end-to-end process models that were built for a slower, simpler era to make decisions today.

It's time we called this out for what it is: a failure of imagination and a failure of architecture.

Why Decision Engineering?

Decision Engineering in supply chains isn't a theoretical abstraction—it's a practical survival skill. It's about engineering the ability to make good decisions in the face of uncertainty, across time, and functions. It's about architecting the ability to decide well, not just once, but over and over again. Strategic decisions, tactical ones, operational ones — all stitched together with cause and effect clearly in mind. Decision Engineering isn't a luxury. It's the new table stakes. If you can't build and adapt good decisions under pressure, your supply chain doesn't stand a chance.

Here's the rub: supply chains are hyper-specialized, federated ecosystems. You don't solve them with a generic AI in a slick UX wrapper. You solve them with a composable reference model tailored to the messiness of real-world operations — one that accepts portfolio complexity as a given and doesn't pretend complexity in your supply chain can be tamed by pushing a few buttons on a pretty console.

What we need is a way to engineer decisions that are:

- Risk-aware
- Time-aware
- Outcome-driven
- Composable & Compostable
- Built for the world as it is, not as we wish it were

That's Decision Engineering.

Composable = building systems and tools from independent, reusable components that can be combined and reconfigured to meet specific problem sets

Compostable = Designed to be used, discarded, or repurposed. Solutions or components that deliver value now, can be reconfigured or replaced later, and aren't meant to live forever. Allowing systems to adapt over time, solving today's problems while leaving room for better answers tomorrow.

What We're Not Saying

We're not here to wage war against decision intelligence. We're all for it—let the data scientists and AI engines do their thing. But without grounding in the laws of supply chain physics — visibility, variability, velocity — intelligence becomes noise.

Before Building New Systems, Get Back to Fundamentals

Funny thing about fundamentals: they don't make headlines, but they never go out of style. When the latest buzzwords fade and the PowerPoint promises dry up, it's the basics that keep the doors open and the supply chains moving. Fortunately, there are time-tested solutions that don't require moonshot budgets or blind faith in black-box AI. These include design of experiments, discrete event simulation, and structured decision modeling. They offer powerful ways to explore trade-offs, quantify risk, and prepare intelligently for whatever's next. These methods aren't relics—they're the very foundation for resilience.

To be clear: AI and ML do have a place in decision engineering. Some decisions can and should be augmented—or even automated—by artificial intelligence. But you cannot build a skyscraper without a solid foundation. First, your organization must build its supply chain awareness. Then, build an architecture that supports intelligent decisioning.

What Comes Next

To navigate this new world, we must trade our rearview mirror for radar. Stop looking at decisions as static outcomes and start seeing them as dynamic systems that must be evaluated, recomposed, and re-evaluated — again and again. No perfect answers. Just a continuous process of adapting with speed, grace, and science.

Which brings us to the Principles of Decision Engineering — our starting point. These principles offer a reference model for how to think, decide, and adapt across the full time-to-plan horizon. They are not dogma, but directional anchors in a world where the only constant is change.

Principles of Decision Engineering

Before we rethink our systems, we must rethink the ground rules. These principles offer a directional model for how to think, decide, and adapt across the full time-to-plan horizon.

1. **Supply chains are complex, adaptive, distributed systems that are always changing:** this requires new processes, new methods, new math, and systems architectures and interfaces to support continuous re-composition and adaptation. (vs today's ERP and APS taxonomies). Form needs to follow function (la forme suit la fonction) and the system's architecture and interfaces must support composability and compostability.

2. **There are no perfect answers:** Decisions in supply chain are about tradeoffs between cost, service, profit, and risk. Most answers change as conditions change over time. Recognize that decision-making is an iterative process requiring constant revisions of decisions based on new information, changing circumstances, and continuous surveillance inputs from external parties. Lora Cecere's "outside-in reference model" is quite helpful in these regards. Continuous iteration is the key to enhancing the effectiveness of decision-making over time.

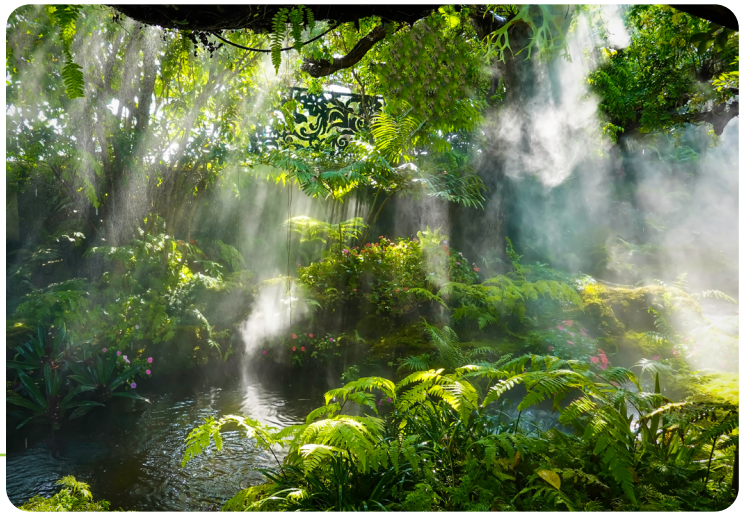
3. **Embrace volatility & uncertainty:** Acknowledge and account for uncertainty and risk in the decision-making process. This includes identifying potential risks, assessing their likelihood and impact, incorporating risk management strategies into the decision-making process, and building in confidence intervals to meet a range of performance levels. Understanding the system's design and its dynamics under this uncertainty is key to responsive adaptation.

4. **Competing stakeholder interests must be reconciled:** Consider multiple perspectives and stakeholders' interests when making decisions. Ensure transparency in the decision-making process by documenting the rationale behind decisions, including the criteria used, the alternatives considered, and the reasoning behind the final choice. This helps promote accountability and allows for scrutiny and learning from past decisions. Decision engineering involves collaborative decision-making processes that consider the competing objectives and viewpoints of various stakeholders

5. **Decisions can (should) be engineered and (re) composable.** One size does not fit all. Specific problems require specific solutions. Decision Engineering principles are based on choosing the right methods (not method) for the specific decisions. Data analytics, statistical methods, AI/ML, optimization engines, solvers, heuristic algorithms, and visualization tools can and should interoperate for certain problems and conditions. Harnessing multiple tools and methods to compose unique solutions for specialized problems is a cornerstone of decision engineering.

6. **Harness systems dynamics and scientific methods** to systemically evaluate decision scenarios and alternate conditions to create a clear understanding of the cause and effect of the decisions on the systems and their dynamics. Decisions can be systemically evaluated (see Warren Powell's sequential decision-making framework as an excellent example), and alternate scenarios can be scientifically evaluated, generating a clear understanding of the cause and effect of design decisions and policy decisions and their impacts.

7. **Ethical considerations:** Consider ethical implications and moral values when making decisions, especially in situations where decisions may have significant social, environmental, or humanitarian consequences, such as supplier surveillance, labor, and ESG perspectives, along with carbon footprint as examples.



The Future Belongs to the Decision Engineers

Supply chains won't be saved by better dashboards or buzzwords. They'll be rebuilt by leaders who embrace decision engineering—who understand that dynamic environments require dynamic decision-making. Those who reimagine their architectures around flexibility, intelligence, and true cause-and-effect awareness will not just survive—they will set the pace for the next era of supply chain performance.

At GAINS, we're proud to collaborate with visionary leaders who are ready to engineer what's next.

Learn More

Ready to rethink your supply chain for a world in constant motion?

Visit GAINS at the Gartner Supply Chain Symposium/Xpo or schedule a conversation with one of our supply chain experts. Discover how Decision Engineering and GAINS' composable solutions can help your organization thrive through uncertainty.