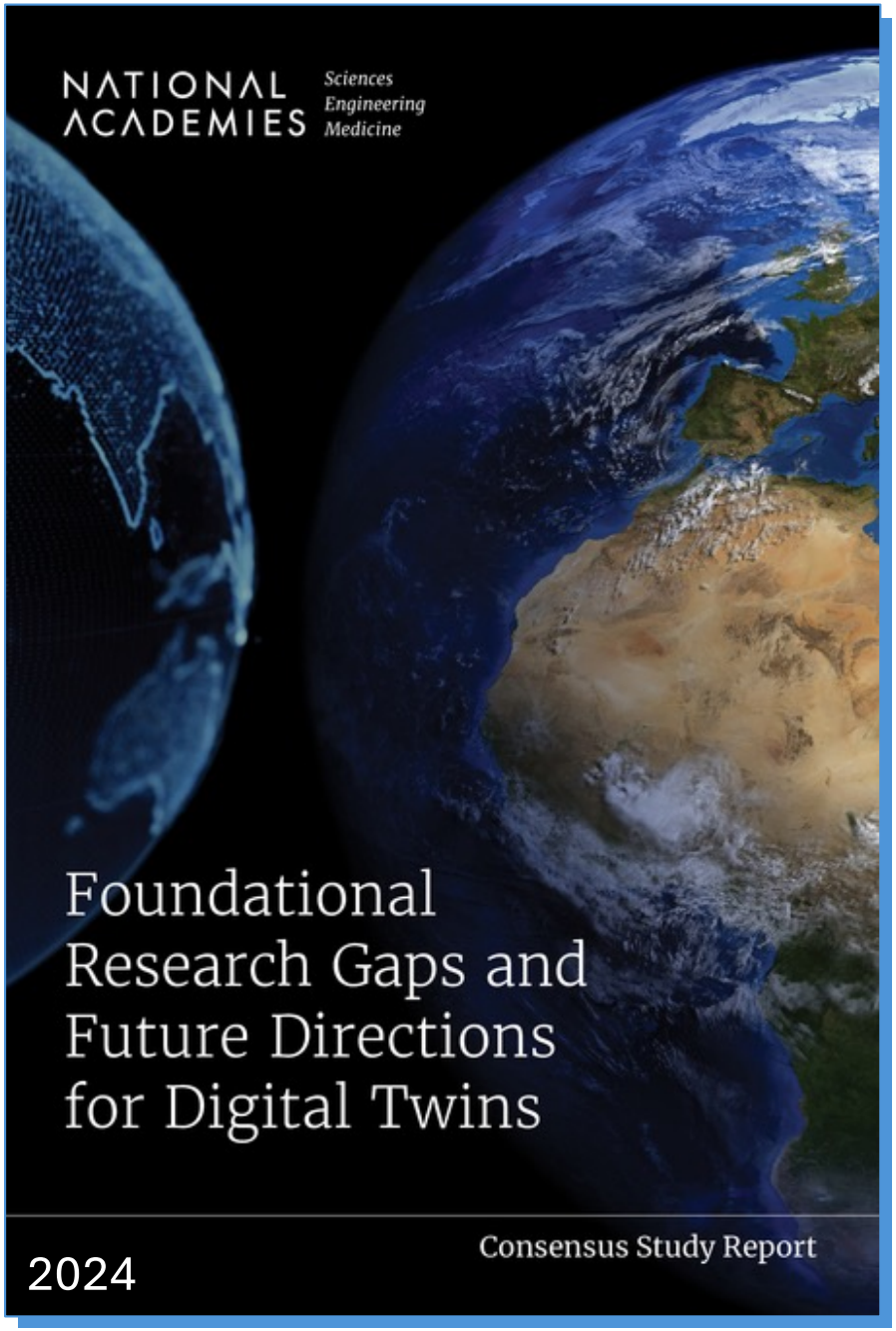
Digital Twins:
What are they and how do we use them?

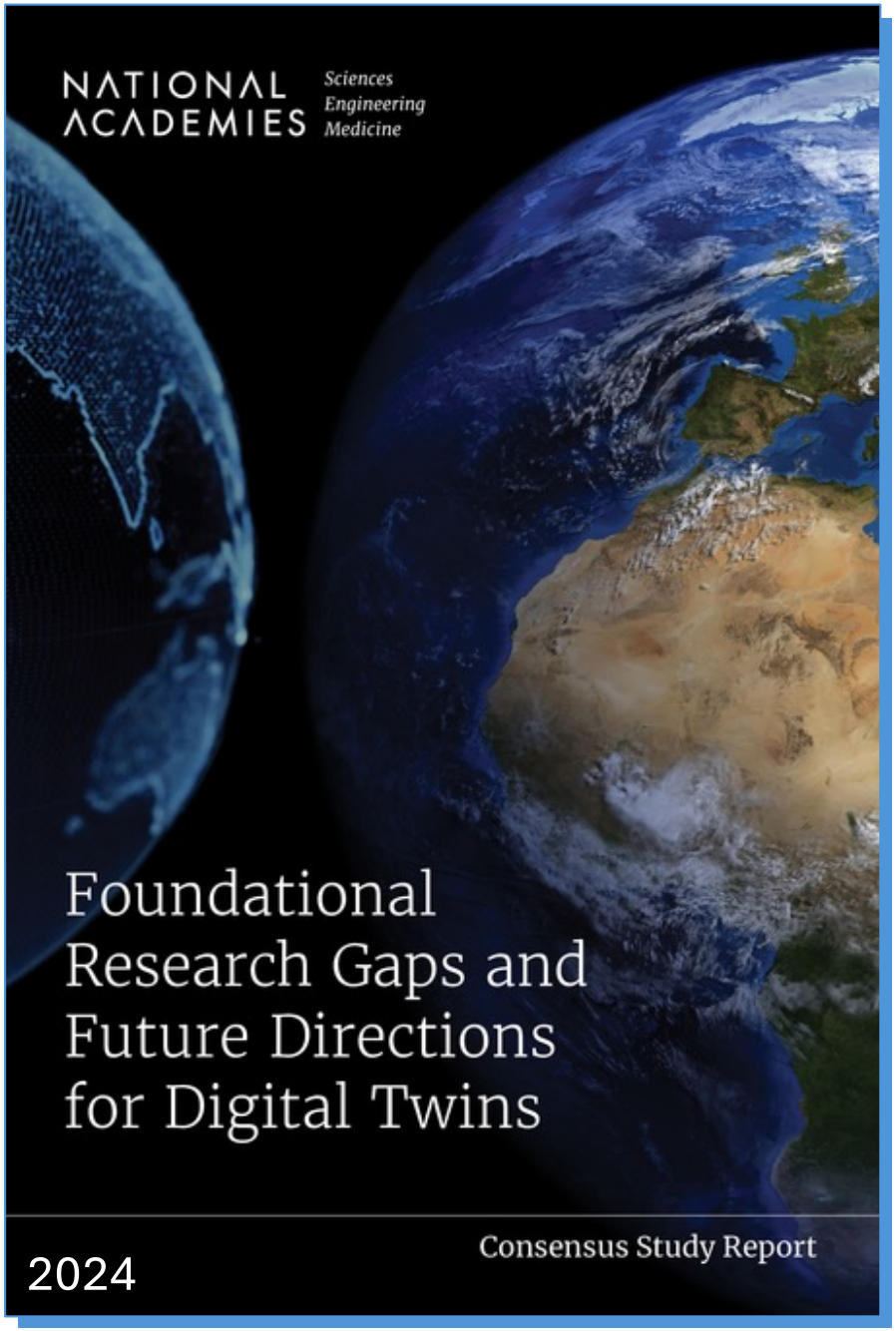
J. Chris White

Co-Founder & CEO

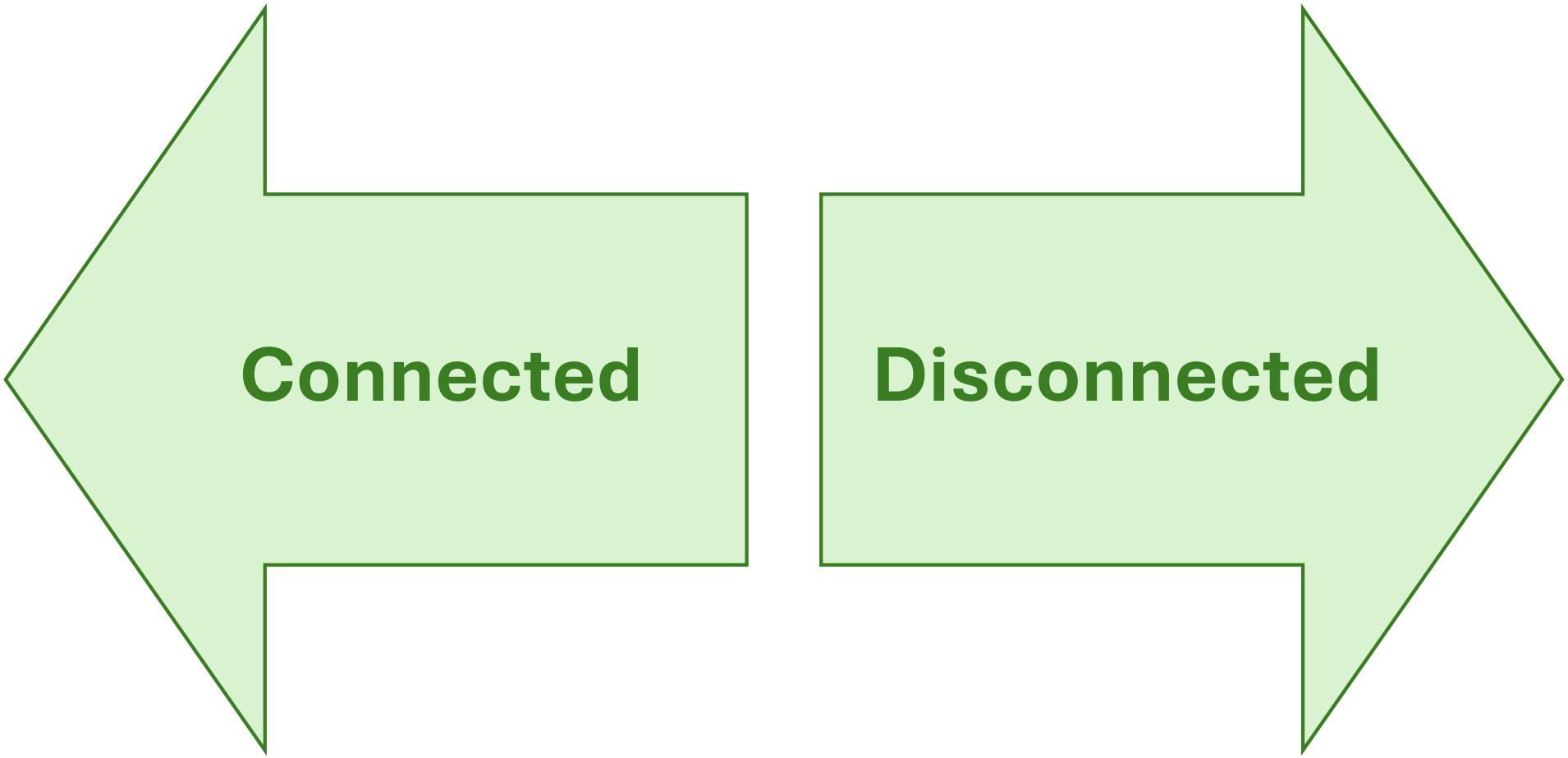
scmBLOX

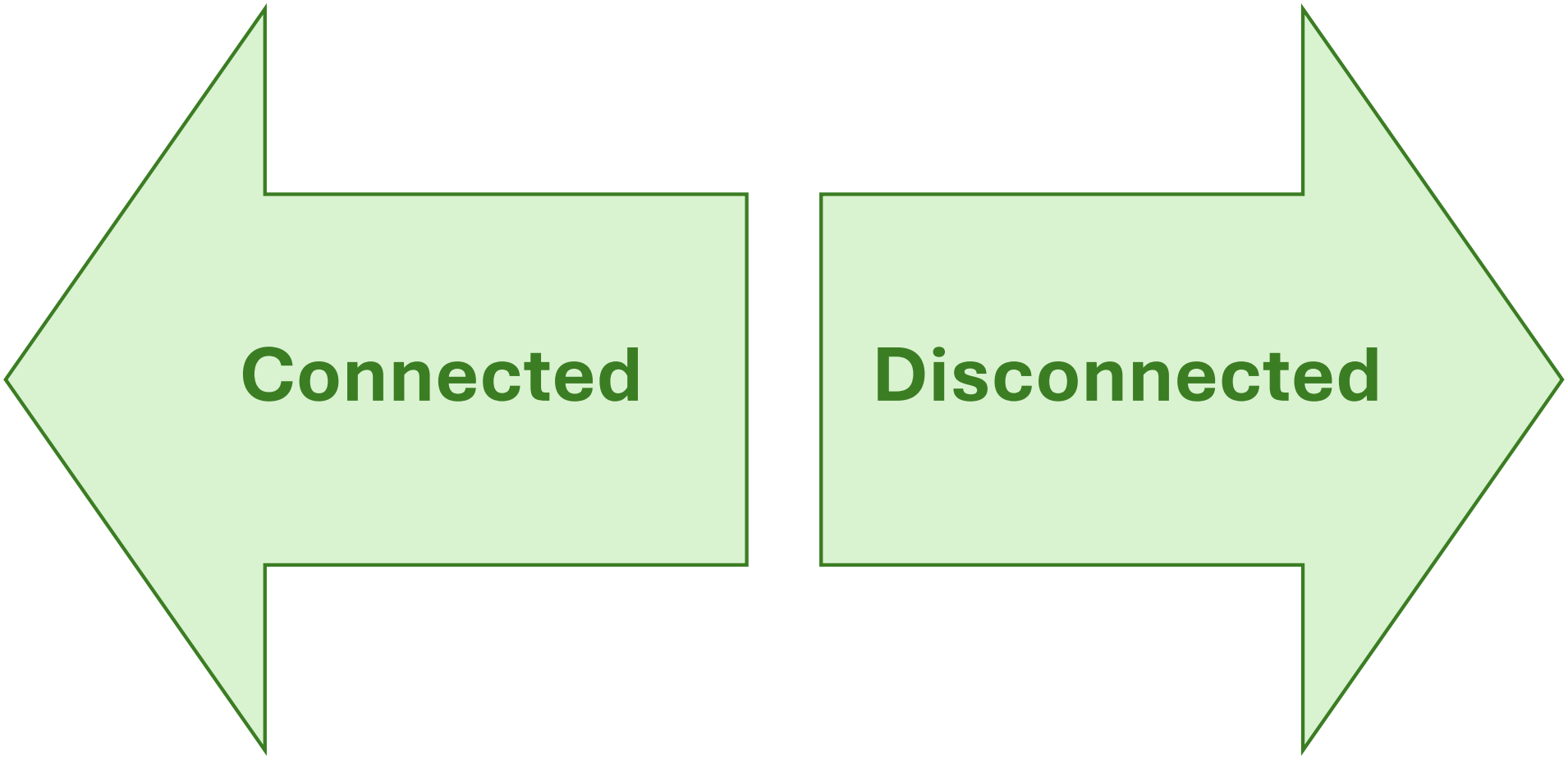


A digital twin is a set of virtual information constructs that mimics the structure, context, and behavior of a natural, engineered, or social system (or system-of-systems), is dynamically updated with data from its physical twin, has a predictive capability, and informs decisions that realize value. The bidirectional interaction between the virtual and the physical is central to the digital twin.



*A digital twin is a set of **virtual** information constructs that **mimics** the structure, context, and behavior of a natural, engineered, or social system (or system-of-systems), is **dynamically updated** with data from its physical twin, has a **predictive capability**, and informs decisions that realize value. The **bidirectional interaction** between the virtual and the physical is central to the digital twin.*


Connected
Disconnected



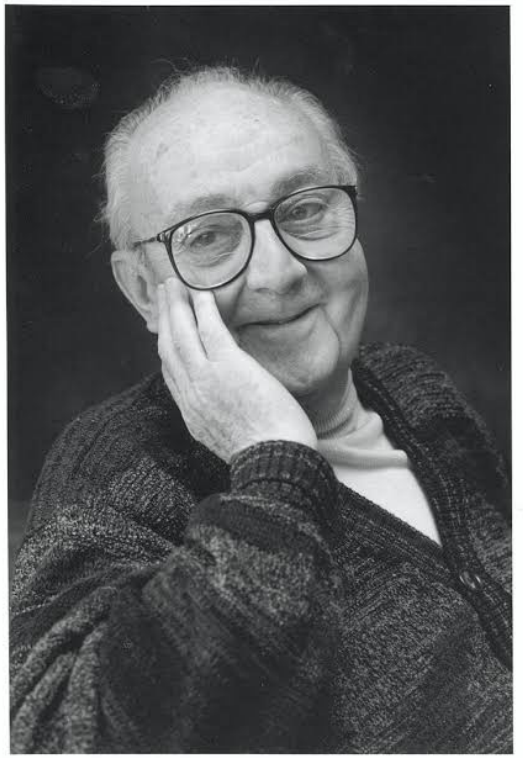
More Data

Less Data

What is a “model?”

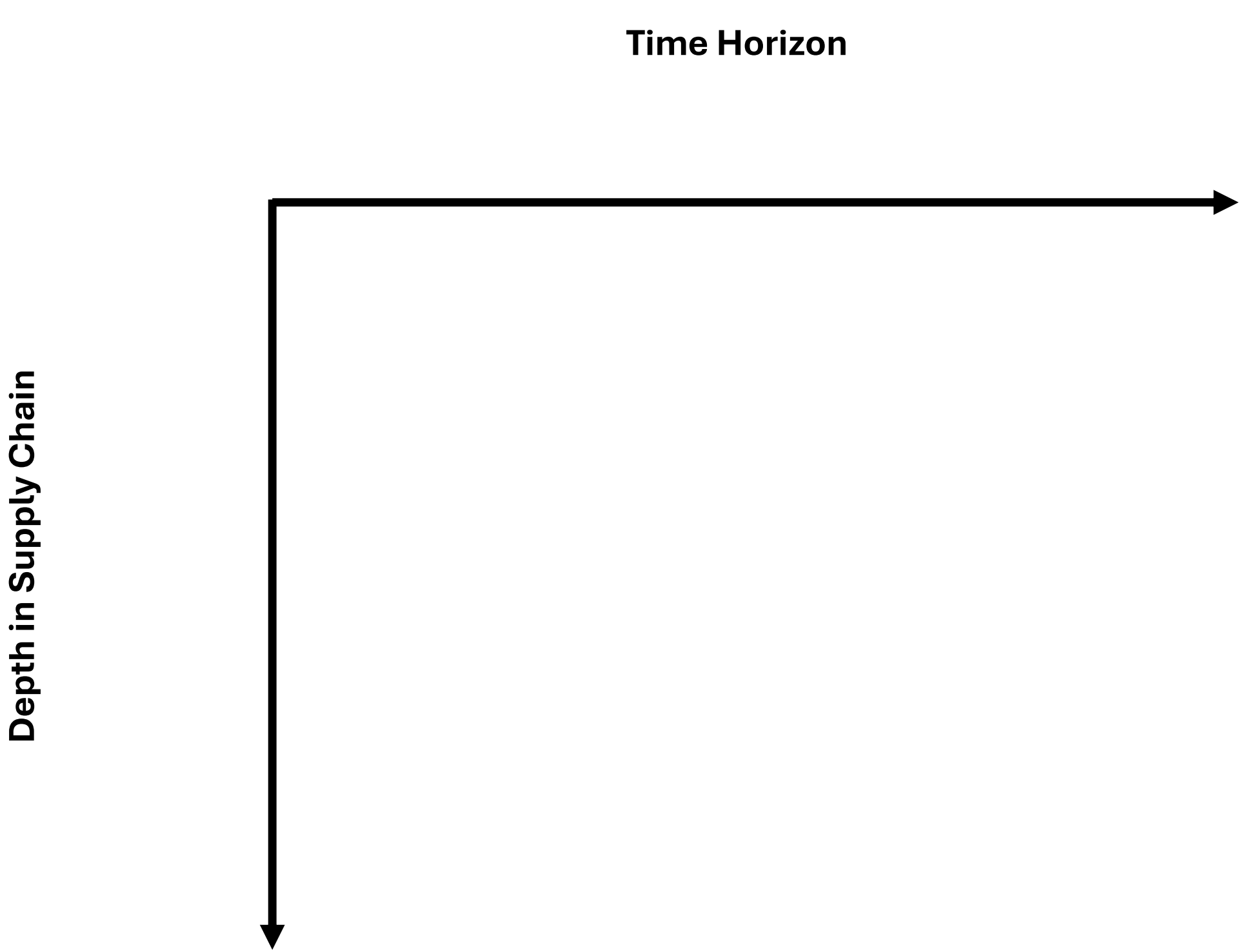
“All models are wrong,
but some are useful.”

George Box



- A model is a physical, virtual, or mathematical representation of something in the real world.
- All models are simplifications (i.e., not the real thing).
- All models are designed for a purpose and to address a specific range of issues.
- The better question: How wrong can a model be to still remain useful?

The “Landscape” for the Supply Chain Domain



Time Horizon

Depth in Supply Chain

END CUSTOMER

DISTRIBUTION

YOUR COMPANY

Time Horizon

Depth in Supply Chain

END CUSTOMER

DISTRIBUTION

YOUR COMPANY

WAREHOUSING

TIER 1

Time Horizon

Depth in Supply Chain

END CUSTOMER

DISTRIBUTION

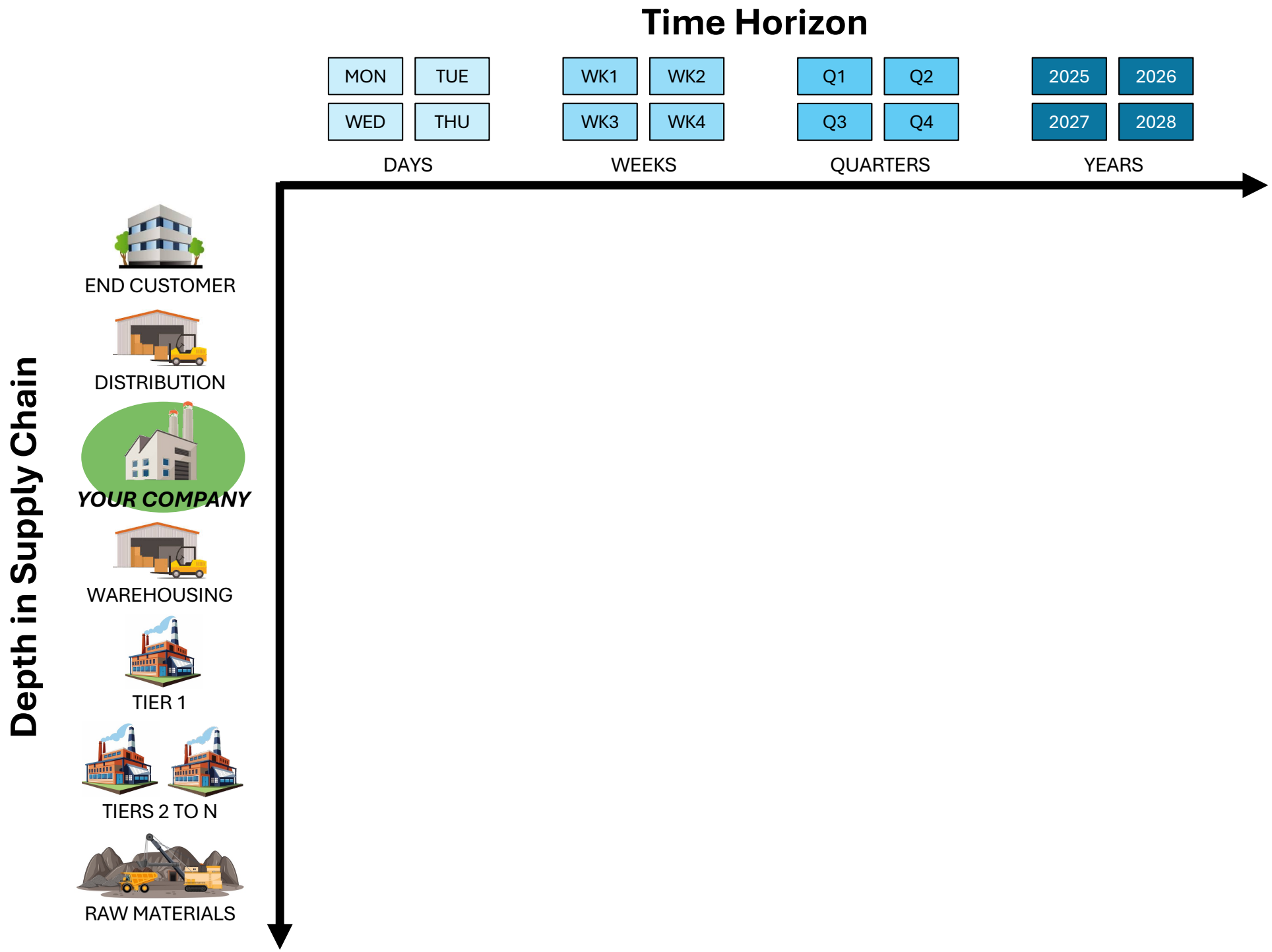
YOUR COMPANY

WAREHOUSING

TIER 1

TIERS 2 TO N

RAW MATERIALS



S-T-O Timeframes

Time Horizon

DAYS		WEEKS		QUARTERS		YEARS	
MON	TUE	WK1	WK2	Q1	Q2	2025	2026
WED	THU	WK3	WK4	Q3	Q4	2027	2028

Depth in Supply Chain

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Operations

Tactics

Strategy

Major Quadrants

Time Horizon

DAYS		WEEKS		QUARTERS		YEARS	
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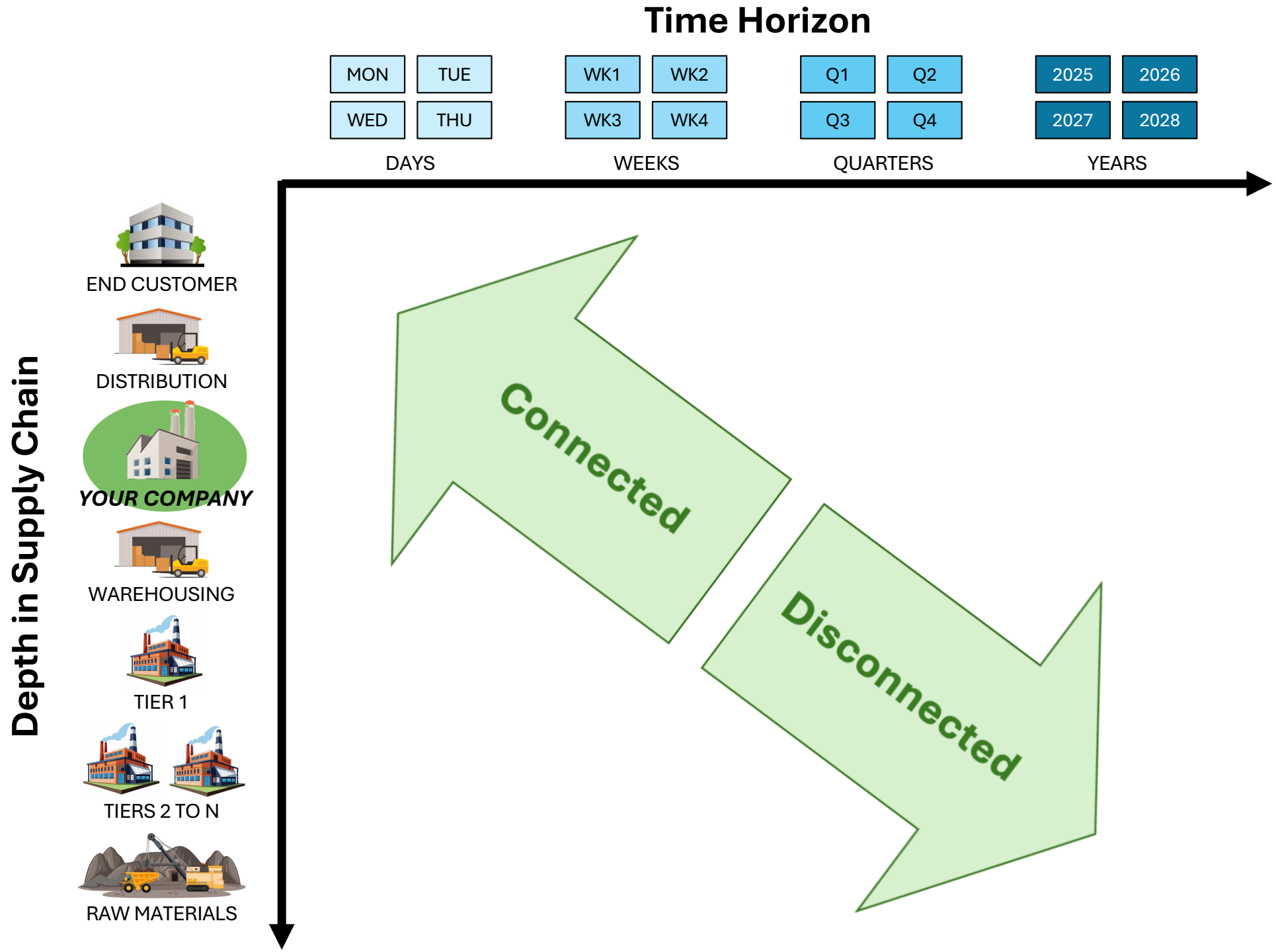
Shallow, Short-Term	**Shallow, Long-Term**
Deep, Short-Term	**Deep, Long-Term**



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Operations

Tactics

Strategy

Types of Problems

Time Horizon

DAYS		WEEKS		QUARTERS		YEARS	
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RAW MATERIALS

Order Fulfillment

Distribution

Production Control

Inventory Control

PO Tracking

Capital Equipment

Product Design

Facility Construction

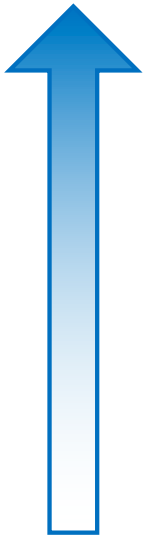
Supply Chain Design Changes

Strategic Sourcing

Nearshore/ Offshore

3 Main Classes of Models

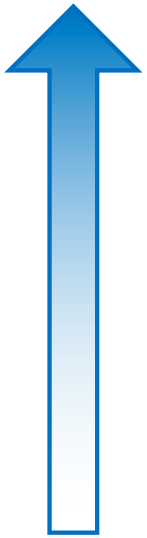
High Fidelity



Low Fidelity

3 Main Classes of Models

High Fidelity

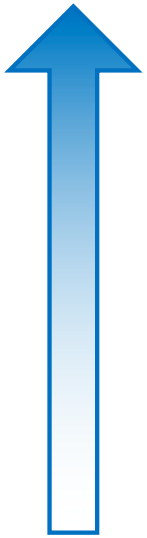


Low Fidelity

Ad Hoc **(Free Form)**	**No consistent methodology or approach. "Quality" of model varies greatly by developer and situation.**

3 Main Classes of Models

High Fidelity

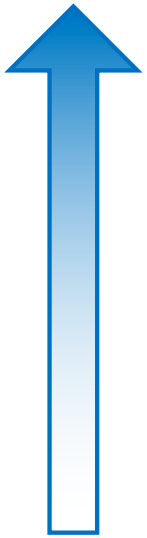


Low Fidelity

Analytical **(Mathematical)**	**Equations (e.g., trends, correlations) are used to calculate projections. Focuses on data and statistics.**
Ad Hoc **(Free Form)**	**No consistent methodology or approach. "Quality" of model varies greatly by developer and situation.**

3 Main Classes of Models

High Fidelity



Low Fidelity

Operational **(Activity-Based)**	**Models the execution of processes and activities to generate projections. Focuses on structure and connections.**
Analytical **(Mathematical)**	**Equations (e.g., trends, correlations) are used to calculate projections. Focuses on data and statistics.**
Ad Hoc **(Free Form)**	**No consistent methodology or approach. "Quality" of model varies greatly by developer and situation.**

High Fidelity

Low Fidelity

		General Description
Operational (Activity-Based, Simulations)	Agent-Based, System Dynamics	Focuses on structure/policies of "system" and not data; incorporates feedback and adaptations over time
	Discrete Event Simulations	Captures operational activities; links activities to understand overall performance; requires detailed data
Analytical (Mathematical, Calculations)	Network Models	Elements are network nodes; various methods for how work flows through nodes; LP; optimal path
	Parametric Models	Makes projections by fitting curves to historical data; relies heavily on lots of "clean" data for accurate curve
Ad Hoc (Free Form, Unstructured)	Spreadsheets	Adds some structure to estimation; build-up approach; factored approach; most common approach
	Best Guess	Projections based on analogous efforts; unstructured; relies on instinct or "gut feeling;" back of napkin

High Fidelity

Low Fidelity

		Benefits	Disadvantages
Operational (Activity-Based, Simulations)	Agent-Based, System Dynamics	Captures feedback loops; relates cause to effect	Aggregate approach; not for detailed problems
	Discrete Event Simulations	Captures details of activities; relates cause to effect	Lacks feedback among variables
Analytical (Mathematical, Calculations)	Network Models	Excellent for understanding relations among activities	Cumbersome when used for high-level problems
	Parametric Models	Well-accepted; many tools available	Data dependent; assumes future will be same as past
Ad Hoc (Free Form, Unstructured)	Spreadsheets	Little training required; easy to understand	Applies to unique problem; dependent on model builder
	Best Guess	Easiest and quickest to use	Typically inaccurate; often difficult to defend

Classes of Models

Time Horizon

MON | TUE | WED | THU — DAYS

WK1 | WK2 | WK3 | WK4 — WEEKS

Q1 | Q2 | Q3 | Q4 — QUARTERS

2025 | 2026 | 2027 | 2028 — YEARS

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Ad Hoc (Unstructured)

Analytical (Calculations)

Operational (Simulations)

Types of Digital Twins

Time Horizon

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Spreadsheets

ERP

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RAW MATERIALS

Spreadsheets

ERP

LP

Network Models (Design & Opt)

LLM, AI

Parametric Models (Statistical)

Types of Digital Twins

Time Horizon

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WK1 | WK2 | WK3 | WK4 — WEEKS

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RAW MATERIALS

Spreadsheets

ERP

LP

Network Models (Design & Opt)

Discrete Event Sim

AI / ML

Parametric Models (Statistical)

Agent-Based Sim

System Dynamics Sim

The Key:

Don’t focus on specific vendor tools. Focus on using the right technology or approach for the problem you’re trying to solve.