Using technology to drive life sciences supply chain resilience

October 2022

Building a better working world

Agenda

1	2	3	4
Introduction	Key challenges for the pharmaceutical supply chain	Solutions to drive supply chain resiliency	Q&A

Topic

Introductions

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- EY Americas Life Sciences Supply Chain Leader
- Principal and Global Manufacturing Capability Leader at EY US
- Over 30 years of experience working with clients in supply chain strategy and execution efforts
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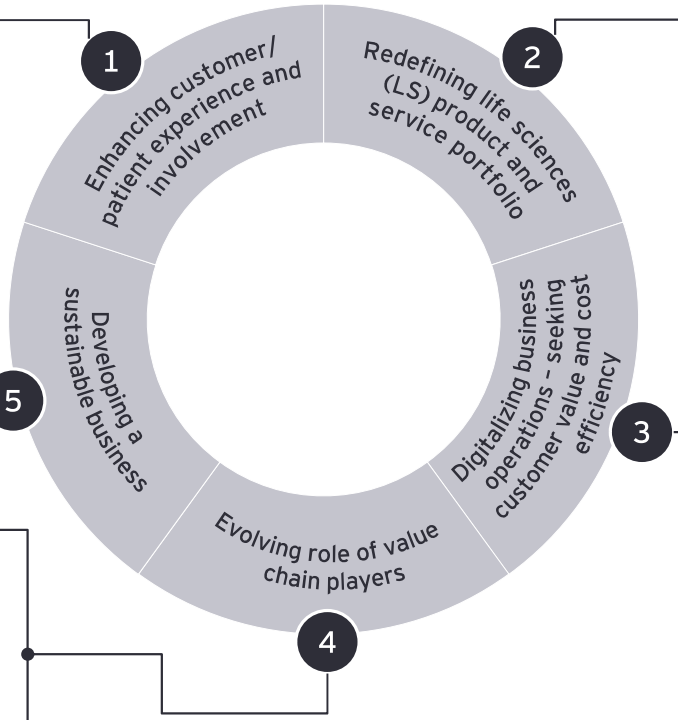
- Leader within the EY US global network strategy and design team
- 20 years of supply chain modeling and analytics experience in both industry and consulting across multiple sectors
- Has led numerous global network designs and supply chain transformations for Fortune 500 companies
- Background in industrial and systems engineering from Georgia Tech

Life sciences companies are facing significant industry challenges as they prepare for a supply chain of 'tomorrow'

- Enhance **online platforms and services**
- Engage in customer/patient experience and prepare for new **individual medical treatments** and treatment tracking
- Closely **collaborating with partners** in R&D/product development (ecosystems)



- **Technology driving collaboration** and conceptualization
- **New personalized products** in cell and gene therapy **leads to** smaller patient focus populations
- **Offering new services** combined with products – **individualized treatments and disease therapies**

- **Sustainability as core strategic pillar**
- **Recyclable packaging** (reduction in use of plastic, recycling processes)
- **Sustainable partner network and contracting**

- **Online ordering**; business-to-business and direct-to-patient "omnichannel" selling
- **Data analytics** for dynamic pricing, demand planning, inventory management and patient/consumer services
- **Cloud**-based solutions providing **data integration and decision support**
- **Information technology (IT)/operational technology (OT) integration** and integrated end-to-end (E2E) supply chain
  - Supply chain visibility, lights-out planning and risk management
  - Smart factories, warehouses, logistics
  - Hardware and software robotics
- **Smart contracts** leveraging b**lockchain**

- **E2E value chain integration** and transparency (flexibilization, individualization)
- New **individualized therapies**, new technologies as **rare diseases** require **specific, individualized supply chains** (smaller patient populations)
- **Partnering and supplier collaboration** within ecosystem (e.g., in R&D, planning and services)
- **Master data management** as one key success factor

Supply chain investment is at the start of a multiyear investment super cycle as organizations look to tackle key challenges

1. Fragile cost-optimized linear supply chains
2. Ongoing shipping disruption
3. Poor visibility, resilience and agility
4. Excessive supply concentration risk
5. Inflation cost pressure
6. Multi/omnichannel requirements
7. Competition for talent
8. Tax/cross-border trade complexity
9. Legacy on-premise IT support expiring
10. Green/ESG agenda
11. Legislation on critical industry reshoring

Traditional supply chains are lean and linear; new world challenges highlight the need for greater resilience, autonomy and agility to rebound during crises

Future of supply chain

Shifting from rigid and linear to agile, networked ecosystems on the path to an autonomous future

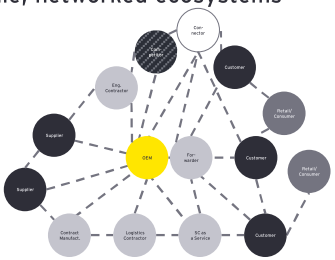
Now.

Cost-optimized, manual, rigid and linear

Value-creation within entities, on-premises IT, slow to respond

Next.

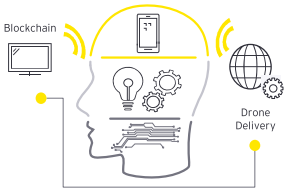
Agile, networked ecosystems



The new world: Industry 4.0 with ecosystems on cloud-enabled platforms

Beyond.

Autonomous



Self-driving supply chains

1

"Network 2.0"

Implement a resilient physical footprint that reflects the changing global dynamics and industry needs

2

Digital plant-to-patient thru E2E visibility

Use E2E visibility, digital twin and autonomous planning capabilities to transform supply chains

3

AI-/ML-driven demand forecasting

Leverage artificial intelligence (AI)/machine learning (ML) to get a better view of demand patterns to better predict and react to changes in the marketplace

Network 2.0: a resilient physical footprint

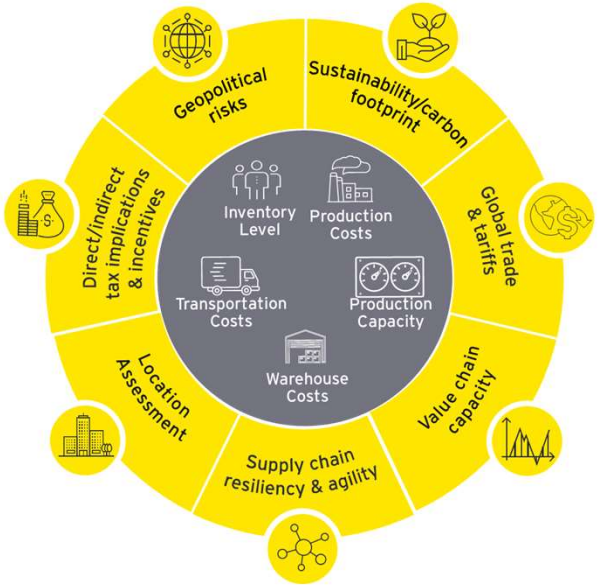
Network 2.0

Supply chain network design

It helps to understand the strategic and financial implications to a supply chain before embarking on capital-intensive long-term projects.

It's an analytical approach to help make key decisions about the future of a supply chain; it uses data to construct a supply chain network model and evaluate alternatives.

Run "what-if" scenarios and compare them to understand trade-offs and benefits in cost, service, investment, sustainability and resiliency of a future supply chain network.



Traditional network design
Focused on traditional supply chain cost trade-offs

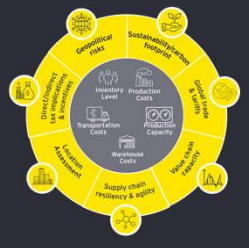
Expanded – Network 2.0
Network 1.0 integrated with additional considerations to enable a more holistic solution

Better insights.
Better hypotheses.
Better scenarios.
+
More factors considered in the model/ optimization
+
More comprehensive evaluation of results with a balanced scorecard
=
Better outcomes

Network 2.0 addresses critical issues and drives value for your business

Why Network 2.0?

- Prepare for global disruptive events
- Build resiliency and agility into the supply chain
- Meet cost-reduction priorities
- Address sustainability goals
- Meet changing customer demands
- Mitigate internal and external risks



What can it help with?

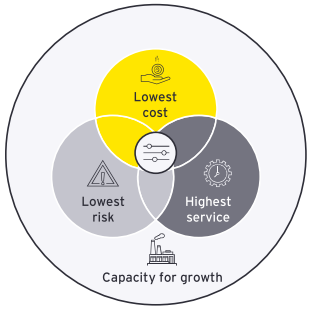
- Footprint optimization (site open/close/consolidation)
- Optimized use of constrained resources (raw materials, components, production capacity, logistics)
- Risk mitigation and planning
- Cost reduction
- Revenue maximization
- Resiliency and agility improvement
- Carbon footprint reduction

What is the potential value?*

- Reduce risk and improve **resiliency** to global disruption
- Reduce operating costs **5%-15%**
- Reduce inventory **5%-20%**
- Tax, tariff and incentive savings of **1%-5%**
- Avoid **lost sales**
- Reduce network **complexity**
- Improve carbon footprint by **2%-4%**
- Provide a comprehensive and **balanced** network design that aligns with goals

* Based on previous EY client experience

Example



	Baseline	Scenario 1: Cost optimal	Scenario 2: Highest service	Scenario 3: Most resilient	Scenario 4: Most sustainable
Composite score	6.7	8.1	7.0	6.6	9.1
OPEX	$250m	$230m ↓	$300m ↑	$290m ↑	$250m –
CAPEX	$100m	$120m ↑	$110m ↑	$100m –	$100m –
Tariff spend	$20m	$10m ↓	$15m ↓	$25m ↑	$15m ↓
Service level	85%	80% ↓	95% ↑	95% ↑	87% ↑
Agility/resiliency	50%	55% ↑	44% ↓	25% ↑	50% –
Carbon footprint	30kt CO_2	25kt CO_2 ↓	50kt CO_2 ↑	35kt CO_2 ↑	15kt CO_2 ↓
Geopolitical risk	Medium	High ↑	Medium –	Low ↓	Low ↓

Digital plant to patient through E2E visibility

E2E visibility with digital twin capability allows supply chains to move from reactive to self-correcting, autonomous ecosystems

Descriptive → Predictive → Prescriptive → Autonomous

Functional visibility

Characteristics

- Functional E2E ecosystem visibility and synchronous collaboration
- Clear reporting and analytics
- Balance cost optimization, risk mitigation and growth

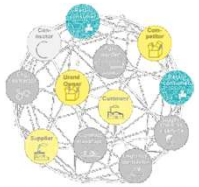
E2E visibility & control tower

- Integrated end-to-end visibility with cross-functional real-time dashboards
- Synchronized parameter setting and optimization
- Early-warning system with clearly defined alerts
- Respond to global shocks and shifting customer demands

Digital twin

- Design flexible, cost-effective and resilient supply chain ecosystems
- Prescriptive recommendations based on AI
- Scenario capabilities spanning the entire supply chain
- Integrated optimization tools to optimize key supply chain parameters in real time

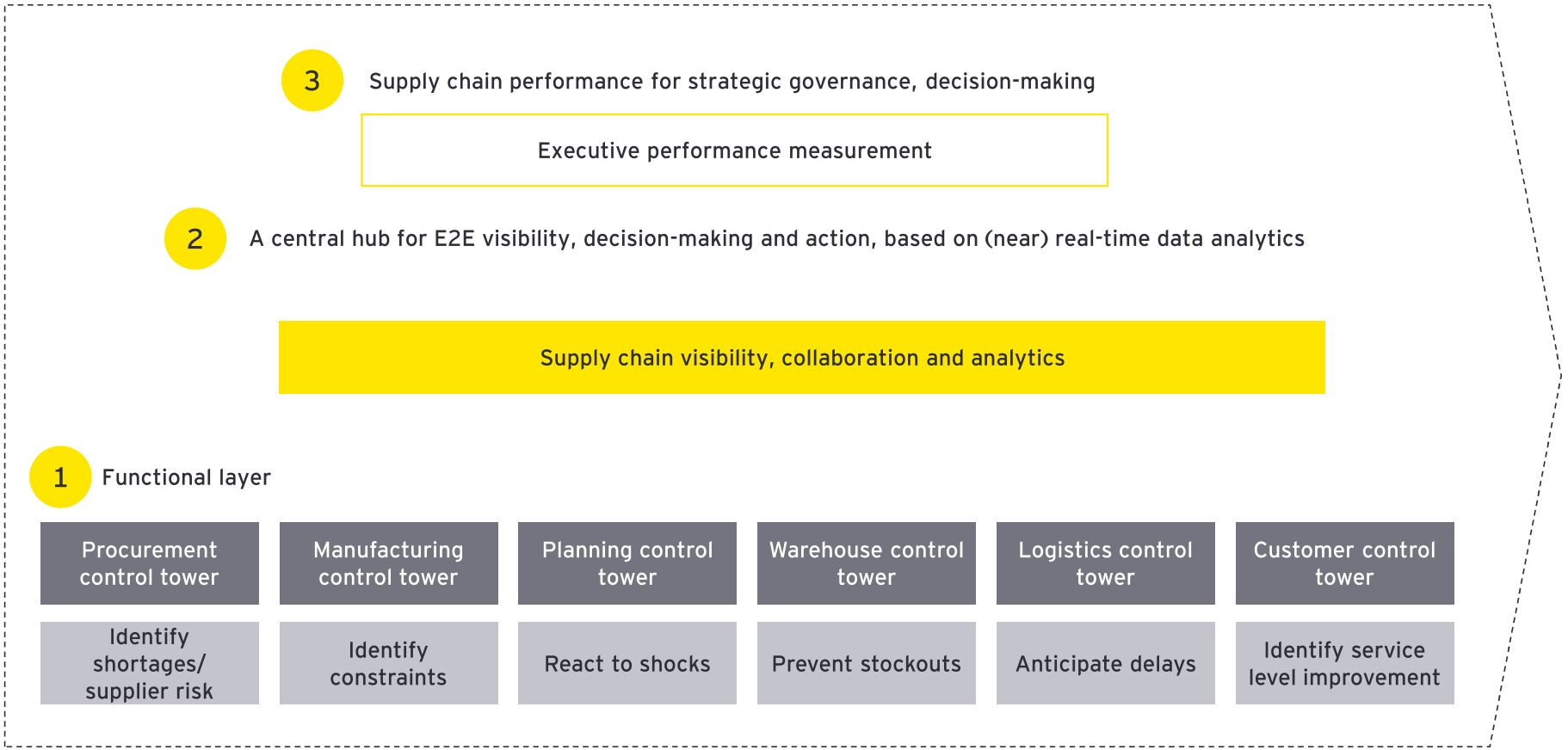
Digitally enabled & autonomous



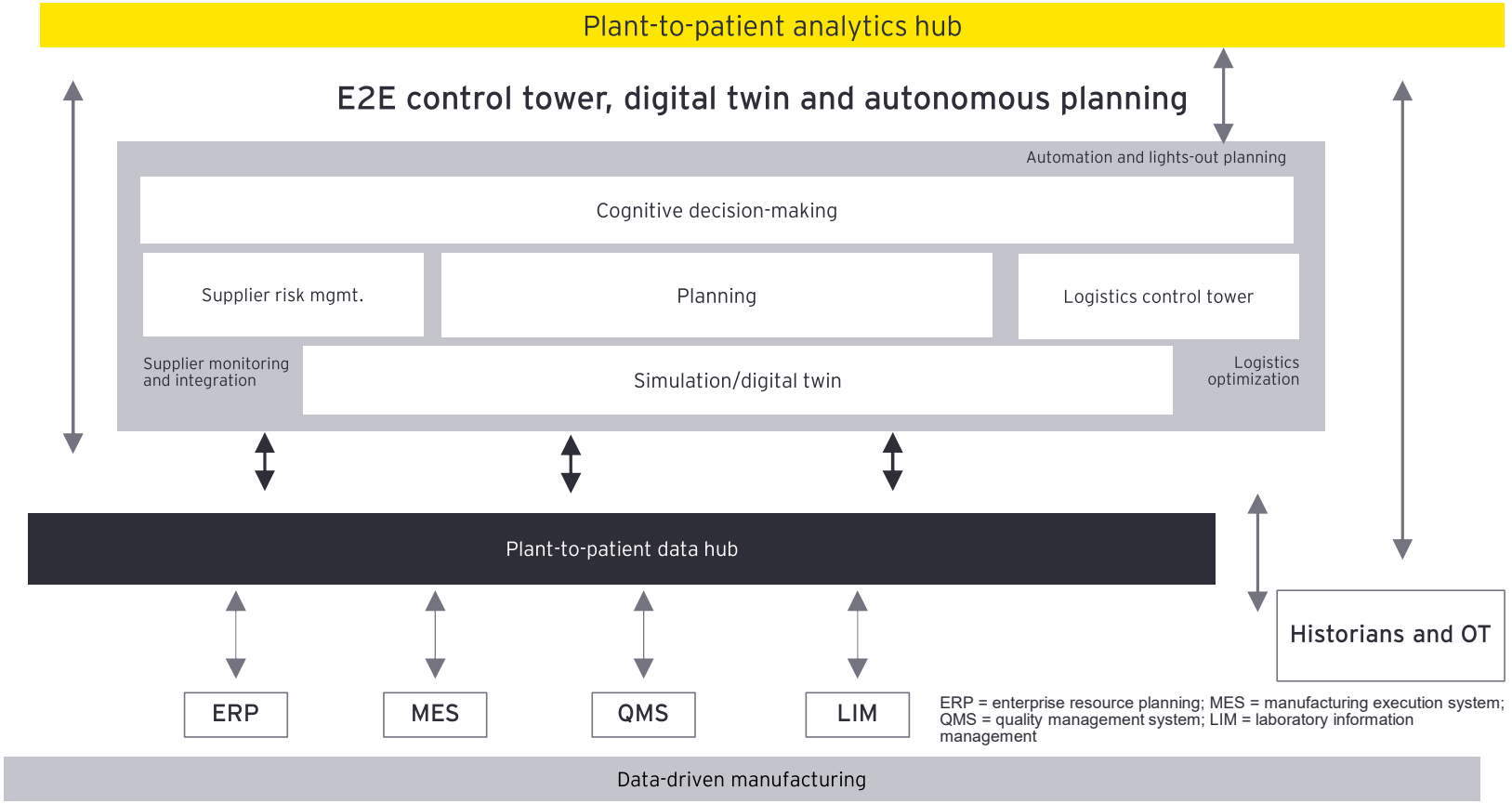
- "Light-out planning"
- Self-healing master data and planning parameters
- Digital twin orchestration of supply chain with continuous planning
- Enterprise-level digital twin

Linear supply chain → Networked ecosystem

The E2E control tower enables visibility, decision-making and action at multiple levels



Digital plant to patient: enabled by E2E control tower, digital twin and autonomous planning across the supply chain



Why the drive for E2E visibility to deliver digital plant to patient?

Why?

Disruption is the new normal that is abolishing traditionally linear supply chains and resetting performance measures.

We want to …

- Agilely respond to global shocks and shifting customer demands
- Balance cost optimization, risk mitigation and growth
- Design flexible, cost-effective and resilient supply chain ecosystems

1% to 2%

Revenue growth

- Increased fill rates (OTIF)
- Increased speed to market
- Increased strategic sales

25% to 60%

Fulfillment efficiency

- Decreased manual intervention, duplication of efforts

5% to 10%

Increased throughput

- Revenue growth
- Improved on-time delivery
- Improved working capital

10% to 30%

Reduced expenses

- Reduced expedited logistics costs
- Reduced returns
- Reduced fines from shipment delays

10% to 30%

Planning efficiency (SG&A)

- Decreased manual intervention, duplication of efforts

10% to 20%

Inventory write-off

- Reduced excess, obsolete, damaged inventory

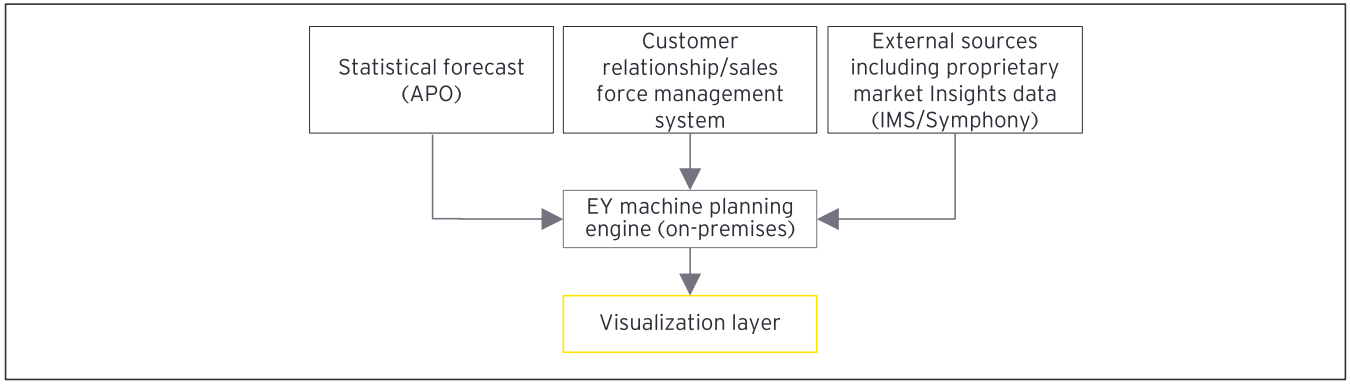
* Based on previous EY client experience

AI-/ML-enhanced demand forecasting

Using AI/ML to augment traditional forecasting methods can dramatically improve supply chain performance

The concept:

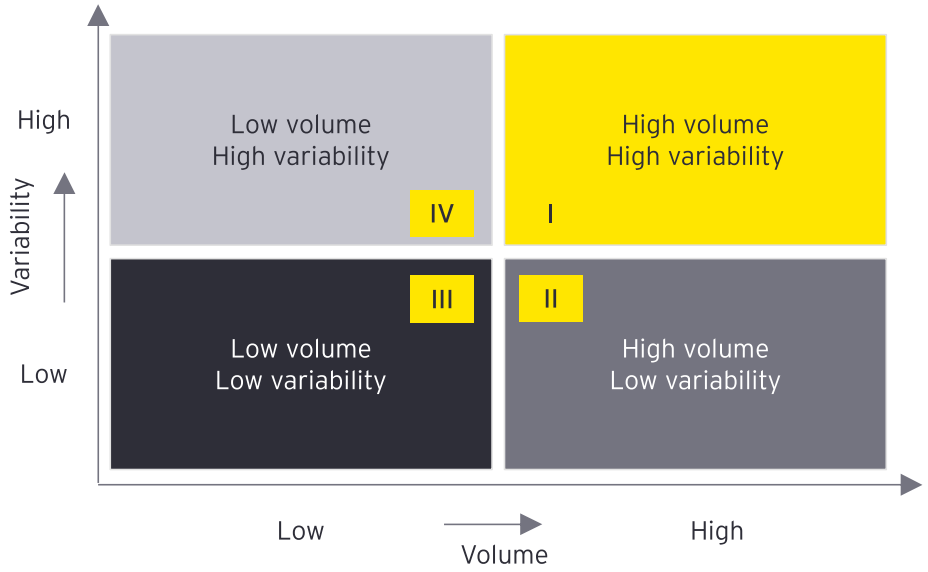
Leverage AI/ML capabilities and a combination of internal and external market factors to automate and dramatically improve consensus-based forecast results at a global pharmaceutical manufacturer

	Data sources: Internal	Data sources: External	Input parameters/ drivers	Model outputs/ deliverables	Key stakeholders
Design elements	▸ 3-5 years of historical net sales by market and SKU ▸ 2-4 years of historical forecast ▸ Patent expiry ▸ Product launches ▸ Marketing spend/ sales force interaction	▸ Market activity ▸ Promotions/timing ▸ Public relations and media ▸ Change of seasons ▸ Regulatory policy ▸ Competitor stock out ▸ Prescriptions ▸ Other macro-economic data	▸ Market ▸ Product (SKU) ▸ Statistical forecast from advanced planning system (PDF)	▸ CDF for 12 months at the market, SKU level in units ▸ Model accuracy ▸ Machine models with algorithms ▸ Visualizations hosted on EY platform	▸ Steering committee ▸ Regional and global demand planning users
In-scope products	Top 25-50 SKUs from selected priority markets – North America, Latin America, Middle East				
Proposed architecture					

CDF = consensus demand forecast

Where to focus efforts to deliver value

Critical to prioritize and drive value quickly



III	▸ High level of PDF usage ▸ Acceptable forecast error
IV	▸ High forecast error ▸ Supplemented by inventory (days of supply)

I	▸ Focus of CDF and brand review meeting ▸ External intelligence-driven, high-value SKUs
II	▸ Driven by PDF ▸ Low forecast error

The machine learning models reduced forecast error by up to 50% and generated up to $46m in reduced inventory cost*

Significant improvement in forecast accuracy …

Market	Brands represented	Average forecast error	
		Before	After
Mexico	Brand A Brand B Brand C	65.1%	48.6%
US	Brand D Brand E Brand F	35.2%	20.6%
Brazil	Brand G Brand H Brand I	23.5%	11.7%
Taiwan	Brand J Brand K Brand L	16.1%	9.6%

* Based on previous EY client experience

… unlocked immense working capital value

- Actual forecast accuracy improved compared to current consensus demand forecast for all chosen SKUs/markets
- Forecast accuracy improvement provided finished-good inventory reduction across eight Quadrant 1 markets totaling $19m-$46m
- Additional benefits included:
  - Raw material and work-in-progress (WIP) reduction
  - Reduced non-value-add planning
  - Transportation and warehousing savings

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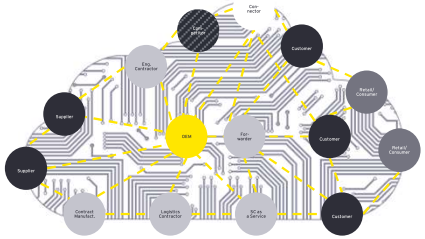

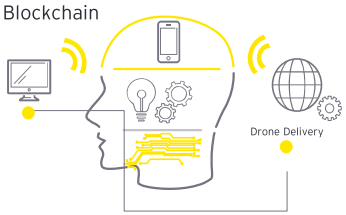

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