BCG

Executive Perspectives

Outperforming Through Volatility: AI in Refining

Refining

April 2026

Introduction

We meet often with CEOs to discuss AI, a topic that is both fascinating and rapidly evolving. After working with more than 2,000 clients over the past two+ years, we are sharing our latest insights in a new series designed to help CEOs navigate AI. For refining leaders, the question is no longer whether AI matters, but how to use it to outperform through volatility and create durable competitive advantage.

The refining sector is under structural pressure. Long-term demand is expected to decline, while net refining capacity could still grow by 2030, even after closures, sustaining pressure on margins. At the same time, geopolitics, sanctions, regulation, and trade dislocations are amplifying volatility. AI offers a new set of levers—moving refineries from periodic, siloed optimization to real-time, margin-driven decisioning and closed-loop workflows across planning, operations, logistics, maintenance, and safety. **For a reference mid-quartile player, that can translate into ~$0.5–1.2/bbl of EBIT uplift by 2030.** Against this backdrop, three questions matter most:

- What does it mean to operate as an AI-first refinery end to end?
- Where are leading refiners already creating value today in planning and scheduling, operations, logistics and trading, maintenance and reliability, turnarounds, and HSSE?
- What pragmatic steps should companies take to move from isolated pilots to scaled transformation?

Advances in AI, generative AI, and agentic AI are enabling refiners to shift from **isolated tools to embedded capabilities**

In this Executive Perspective, we outline how AI-first refineries can outperform in a structurally challenged and volatile market

Executive summary l AI-first refineries will outperform in a structurally challenged and volatile market

WHY
AI adoption is now critical for refineries facing structural pressures

- The **refining outlook is tightening**, long-term **demand is expected to decline**, while net refining **capacity could grow by 2030**—even after closures—sustaining pressure on margins. **Geopolitics, sanctions, regulation**, and trade dislocations are amplifying volatility.
- At the same time, **recent advances in AI and computing are opening new value pools** that were previously inaccessible. For a reference mid-quartile player, AI can **unlock ~$0.5–1.2/bbl of EBIT uplift** by 2030.

WHAT
AI is already shaping core refinery workflows, from optimization to autonomous decisioning

- **AI is moving refineries** from periodic, siloed optimization to **real-time, margin-driven decisioning** and **closed-loop workflows** across planning, operations, logistics, maintenance, and safety.
- The **impact is already visible** across the value chain: **planning and scheduling can deliver ~$0.15–0.30/bbl, operations ~$0.1–0.5/bbl**, logistics/trading ~$0.2–0.3/bbl, and maintenance/reliability ~$0.05–0.1/bb.
- **Proven deployments show material results, including +$80M from a ~300 kbpd refinery** in operations, >$80M annual margin opportunity in logistics/trading, and **5%-15% maintenance cost reduction** with 62% inspection-efficiency gains.

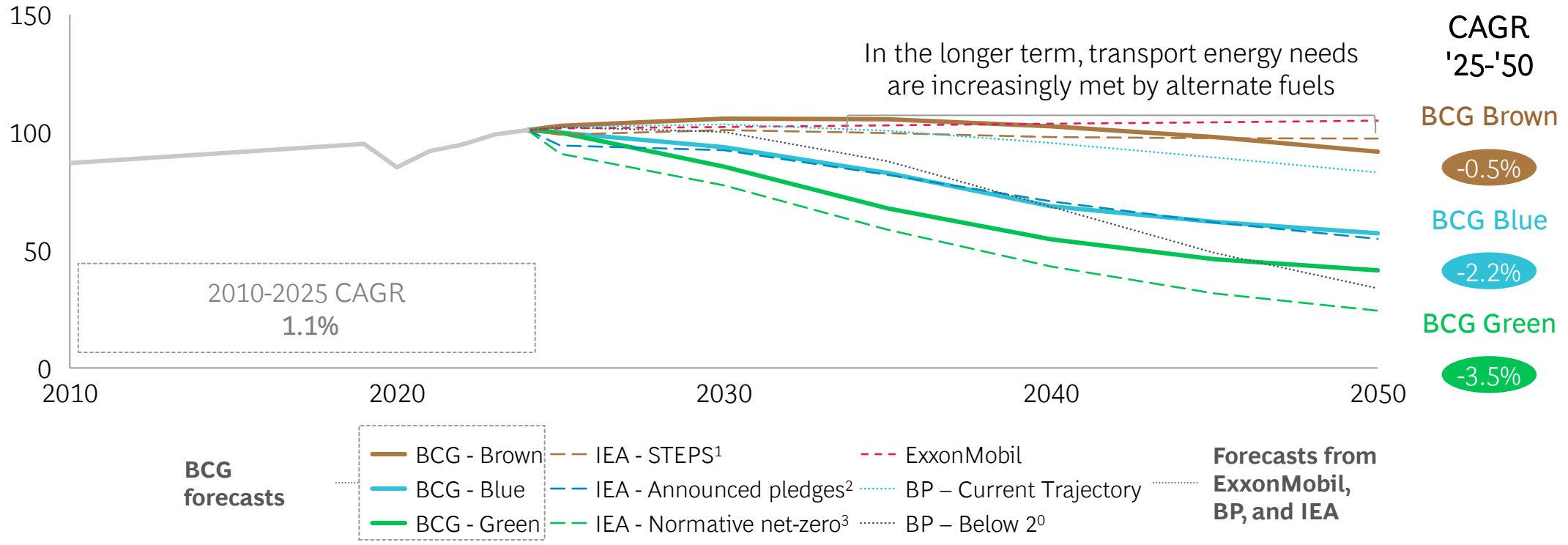
HOW
Winning refineries anchor AI in P&L impact through focused formations

- **Start with the highest-value workflows**—planning and scheduling, operations, and maintenance and reliability—where AI directly improves margin and reduces value leakage.
- **Build the foundations to scale**: standardized data, digital twins, enterprise platforms, and workflow integration are critical to embed AI into day-to-day execution.
- **Redesign processes and the operating model**—don't just deploy tools—to capture value at scale, with governance, value tracking, and capability building embedded from day one.

1. AI impact in G&A functions and related examples are excluded from this report.

Long-term oil demand is set to decline across a spectrum of scenarios

Refined products global demand (Mbpd)

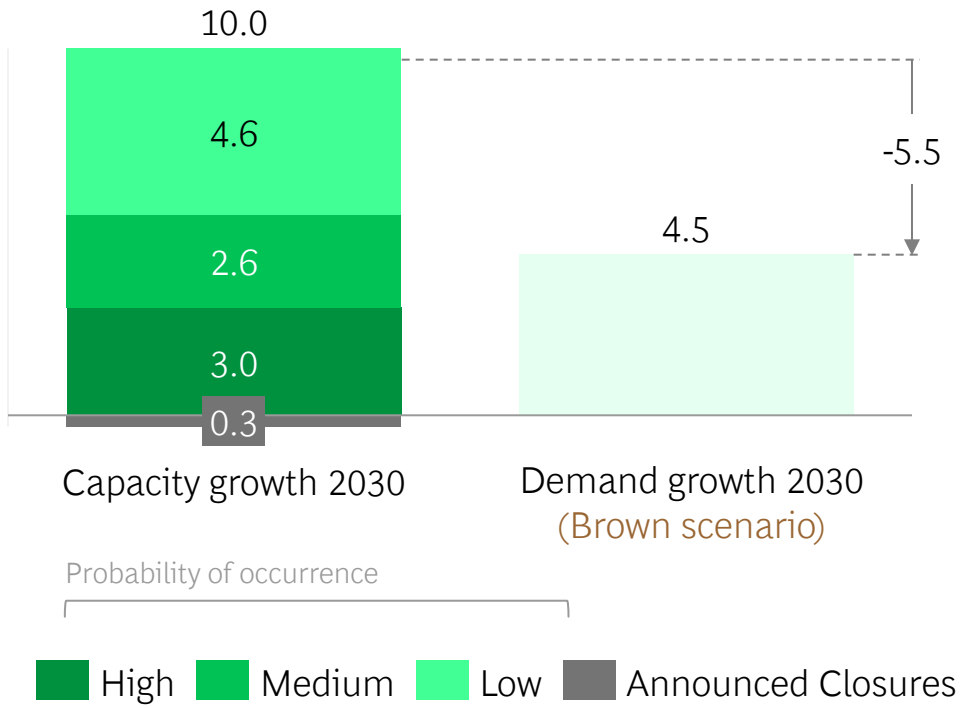


Actual demand and mix will be defined by future regulations and how pledges translate into policies

1. IEA STEP scenario. 2. IEA APS scenario, emission reduction is from 2022 to 2050. 3. Scenario slope of IEA NZE has been adjusted in order to reflect a stronger emission reduction effort from 2030. Temperature rises and CO2 reduction for cases 2 and 3 are approximate and derived by linear interpolation from IEA STEPS and IEA APS scenarios, not bottom-up climate modeling.
Source: IEA WEO 2024; IEA WEO 2025; BP; ExxonMobil; BCG Oil Long Term Model; BCG analysis.

Refinery capacity growth is set to outpace demand, putting sustained pressure on the margins

Net refining capacity growth 2026-2030[1,2,3] (Mbpd)



1. Not probability weighted. 2. CDU + Condensate. 3. Including both expansion projects of existing refineries and new refineries, including projects that roll over from 2025, and excluding capacity added or closed in 2025.
Note: Excluding greenfield refinery projects under approval or prior stages. Probability category attribution subject to available information at the time of elaboration of the slide.
Source: GlobalData 2025; IEA WEO 2025; Wood Mackenzie; BCG Oil Long Term Model; BCG Global Refining Model; BCG Analysis.

Supply exceeds demand even in the conservative Brown scenario, where demand decline is minimal

Even if we exclude capacities with "low" probability, supply exceeds most optimistic demand growth scenario

Supply-demand dynamics de-averaged by refined product (e.g., jet fuel, naphtha demand more resilient)

However, margins are expected to be highly volatile in the near term

	Electrification of transport	Chinese exports	Global growth and tariffs	Evolving Russian sanctions	New capacity startups	IMO MEPC83[1]
Market dynamic	Faster **EV and hybrid** uptake…	Potentially higher **export quotas**…	Uneven economic growth and **trade barriers** across regions …	US **sanctions** on Rosneft/Lukoil and the EU's 2026 **product ban**…	Accelerating **startups of large-scale refining** capacity….	Tightening **emissions standards**[2] across the global fleet…
Margin impact	… **erodes gasoline demand** and caps margin upside	… pressure regional margins through **oversupply and price competition**	…create margin volatility from **uneven demand and product flows**	…potentially **disrupt trade** and amplify margin volatility	…**exacerbates oversupply** and compresses margins	… require **operational reinvestments** with **penalties** for non-compliance

1. International Maritime Organization Marine Environment Protection Committee. 2. Carbon intensity cuts of 20%–30% by 2030 and 70%–80% by 2040 vs 2008 levels.
Source: BCG analysis

Rapid advances in AI and high-performance computing have the potential to fundamentally transform the refining industry

Not exhaustive

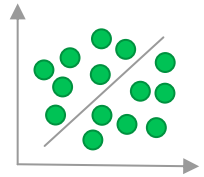
Deterministic — **Probabilistic**

Rules-based

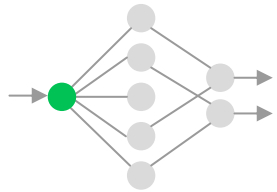
Systems **follow a programmed set of rules**

When column pressure exceeds threshold, system triggers predefined shutdown or alarm

Machine Learning



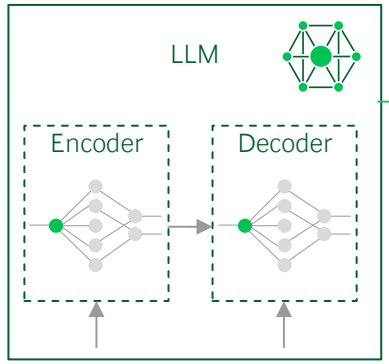
Deep Learning
(via multi-layer neural networks)



Systems automatically **learn from data without being explicitly programmed** (e.g., to predict values or identify correlations)

ML models predict heat exchanger fouling or compressor failure weeks in advance, enabling planned intervention

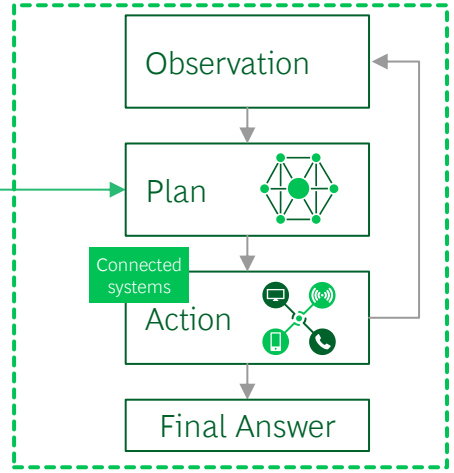
Generative AI
(e.g., via transformer-based model)



Systems **use existing content to create new variations**

GenAI synthesizes sensor trends, lab assays, and shift logs to recommend optimal crude blends and operating envelopes

Agentic AI
(e.g., using GenAI and tools)



Systems **respond to environments** and prompts, to plan then **auto-execute tasks**

Agentic AI continuously monitors unit constraints and margins, selects optimal setpoints, and makes adjustments via control systems

AI is already driving a step-change in the efficiency and efficacy of core functions of the refining value chain

Not exhaustive

	From…	To…
Planning and Scheduling	• **Periodic constraint-based planning** using LP models and offline simulations, with limited response to real-time disruptions	• **Real-time, AI-driven planning continuously reoptimizing** production, logistics, and product slate using live plant and market data
Operations	• Advanced process control **optimizing individual units with manual, cross-unit coordination** • **Conservative blending** and **manual quality checks**	• **Autonomous, plant-wide closed-loop optimization,** AI-driven blending **optimizing** quality, yield, and cost **in real time**
Logistics and Trading	• Deterministic planning with static **demand and inventory assumptions** with reliance on **buffers**	• AI-enabled stochastic optimization **dynamically balancing inventories and logistics** across scenarios to maximize margin
Maintenance and Reliability	• Predictive **maintenance based on historical data and expert judgement**	• AI agents **orchestrating maintenance end-to-end** predicting failures and prioritizing interventions
Turnarounds and Projects	• Capex decisions based on **deterministic business cases and static schedules, updated periodically**	• AI **continuously stress-testing scope and sequencing across thousands of scenarios** identifying optimal paths much more quickly
HSSE[1]	• Safety managed through **audits, procedures, and lagging/ leading indicators** • **Rules-based energy management** and emissions tracking **driven by expert judgment**	• AI-enabled **continuous risk sensing and incident prediction** • **Model-driven, scenario-based optimization** under real-time constraints

1. Health, Safety, Sustainability, and Environment.
Note: Business support functions are excluded.
Source: BCG analysis

AI is unlocking several high-impact applications across the refining value chain

1 Planning and Scheduling

- AI-driven crude slate and margin optimizer
- AI-based short-interval scheduling optimizer
- Automated plan-to-actual root cause diagnosis and learning
- Automated multi-scenario refinery planning and feasibility

2 Operations

- AI-assisted real-time optimization, control room
- Lab and quality analytics for spec giveaway prevention
- AI energy management optimizer

3 Logistics and Trading

- AI inventory reconciliation and loss detection
- Integrated logistics network and transport optimization
- Market structure prediction for proactive trades

4 Maintenance and Reliability

- Predictive maintenance platform
- Risk-based inspection and integrity analytics
- AI maintenance planning and scheduling optimizer
- AI-driven equipment strategy optimizer

5 Turnarounds and Projects

- Integrated turnaround planning and resource scheduler
- Turnaround execution control tower
- AI-assisted inspection planning and execution
- MOC and compliance co-pilot

6 HSSE

- Predictive safety risk and incident detection
- Carbon intensity analytics, reporting automation

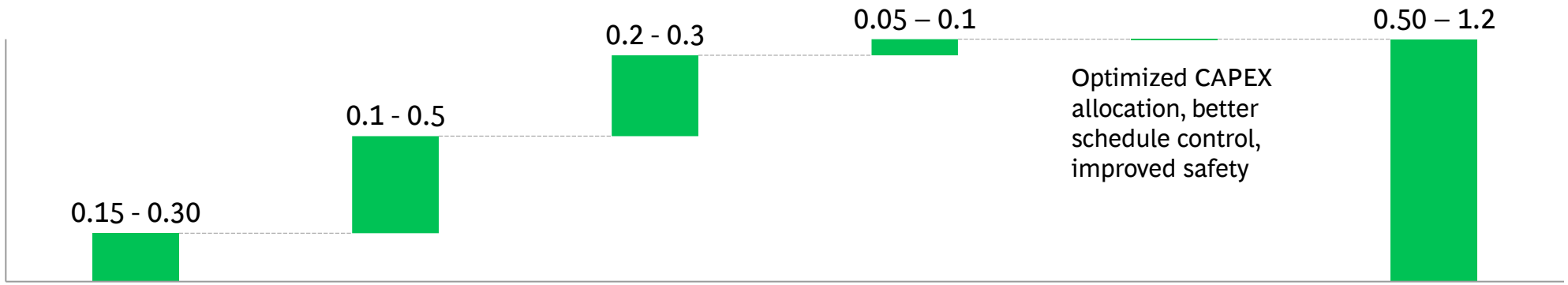
Common business support functions (legal, HR, IT, procurement)
Material opportunities exist in these functions as well, but are not Chemicals-specific and therefore out of scope of this report

Source: BCG analysis

Core functions | Enablers | Deep-dives to follow

AI has potential to improve refining EBIT by over 50% by 2030

2030 AI impact on EBIT[1] ($/bbl)



Largest value levers

Planning & Scheduling	Operations	Logistics & Trading[2]	Maintenance & Reliability	Others (turnaround, HSSE etc)	Total uplift
• Netback from slate and blend choices • Molecule allocation across units and products • Plan-to-actual adherence	• Yield performance and spec giveaway • Throughput within safe operating limits • Energy and utility cost intensity	• Demurrage exposure from tank and terminal congestion • Inventory working capital • Distribution cost-to-serve	• Availability of units • Intelligent tradeoff between utilization and downtime • Spares availability without excess inventory	• Turnaround outage duration • Turnaround cost and schedule overrun risk • Process safety risk exposure	Potential five-year AI impact as % of 2025 EBIT (of ~ $2/bbl): **+~50%**

1. For a reference player- mid-quartile. Examples of AI-levers in refining: gross margin (e.g. AI-driven real-time prescriptive input of optimal operating points, maximizing throughputs and yields value and optimal scheduling plan generation with AI algorithms), energy and utilities (e.g., real-time utility network monitoring and optimization to minimize energy and H2 cost), maintenance (e.g., LLM-based agents to support maintenance operators in end-to-end execution including work order generation, image-based unit diagnostics, repair instructions, and log and report automation), CapEx run and maintenance (e.g., capital deployment optimization based on risk-based optimization of project selection supported by AI algorithms). 2. Logistics, maintenance, G&A.

AI improves margin and operational performance through adaptive scheduling that rapidly reoptimizes under changing conditions

The challenge

At a Southeast Asian refiner, short-term scheduling was constrained by:

- High complexity across units, tanks, logistics, and time
- Manual/Excel-based scheduling focused on feasibility over value maximization
- Slow response to disruptions leading to margin leakage

The Impact

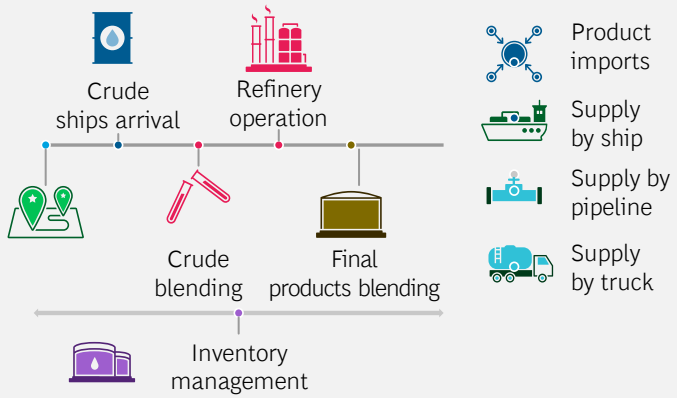
~0.15 – 0.30 $/bbl
Margin uplift

How AI played a role

AI scheduler runs a digital twin to dynamically reoptimize short-term refinery operation schedule as operational variability occurs

Live Detailed Digital Twin

AI uses the digital twin as the executable model of refinery state, flows and constraints



Operational Variability

Case 1 A crude ship arrives later than scheduled

Case 2 A refinery unit suddenly shuts down

AI reoptimizes routing, blending, inventory, and dispatch in minutes, **dynamically updating the 30-60 day plan** to be as close as LP as conditions evolve

Updated detailed 30-60 day plan ▲ **LP plan (long term)**

- Increased throughputs
- Improved yields and giveaway
- Access to opportunity crudes
- Optimized Inventory management
- Minimized demurrage cost

Objective coefficients as optimization levers

Source: BCG analysis

AI pinpoints margin leakage and analyzes root causes across the integrated value chain to protect refinery margin

The challenge

At a European downstream major, operational performance analysis was challenged

- Traditional backcasting focused on isolated KPIs, not total margin
- Limited visibility into value leakage across trading, refining, and sales
- Manual, slow root-cause analysis

The Impact

~1 – 3 $/bbl
Identified opportunity[1]

How AI played a role

AI detects plan-to-actual margin leakage by comparing actual performance with reference scenarios and surface actionable drivers

Capture

Unify Data and Codify Logic

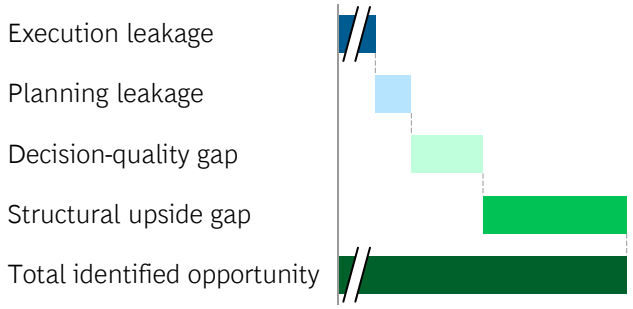
Ingest diverse internal, cloud, and external data sources

Internal Data | Cloud Data | External Data

- Integrate trading, refining, and sales data with standardized margin calculation logic
- Establish baseline for plan and reference scenarios

Analyze

Advanced Analytics + Cloud Architecture



- Compare scenarios with plan and actual performance to size $/bbl margin leakage
- Automate root causes analysis across leakages

Act

Optimize Margins

- Surface margin improvement opportunities across value chain
- Recommend actions on highest impact levers

Note: 1. Opportunity ranges indicative based on prior implementations. Identified opportunity reflects indicative margin leakage estimated through plan-to-actual and scenario analysis. Realized value will depend on follow-through actions, operational feasibility, and market conditions.
Source: BCG analysis

AI agents orchestrate real-time refinery optimization, translating plant conditions into margin actions for the control room

The challenge

At a Latin American large refiner, operational performance was constrained by:
- High operating variability (feed/utility swings, unit constraints)
- Manual, slow diagnosis and response, driving margin leakage
- Decision making was siloed, remaining unit by unit and shift by shift

The impact

+$80M from ~300 kbpd capacity

How AI played a role

AI agents orchestrate real-time refinery optimization by combining plant data, KPIs, alerts, and historical knowledge to detect issues early, optimize trade-offs, and guide control room actions.

Data layer

- **Real-time plant data**
- **Operating KPIs**
- **Alerts and events feed**
- **Knowledge base (historical reports, expert inputs)**

Intelligence layer

Workflow orchestration

24/7 multi-agent advisors answer questions and guide action using data and knowledge

Optimization Engine across 100+ critical variables for better operating settings/trade-offs

Early warning and real-time guidance to recommend corrective moves

Action layer

AI control room center
with single view that consolidates KPIs, alerts, recommendations for leadership

Source: BCG analysis

AI predicts market structure to unlock margin from physical assets by shifting trading from reactive coverage to proactive capture

The challenge

At an American refiner, trading performance was challenged due to:

- Reactive execution focused on near-term cost minimization to meet volume commitments
- Physical markets difficult to predict outside of 5- to 10-day windows
- Trader insight/tribal knowledge not codified, making decision logic inconsistent

The Impact

>$80M+ annual margin opportunity

Ten trades executed in two weeks, with 75% of closed positions cash-positive

How AI played a role

AI forecasts market structure and spread dynamics by combining internal proprietary signals with market feeds

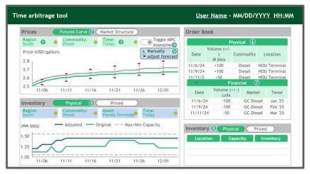
Ingest Inputs

AI aggregates a range of internal and external data sources

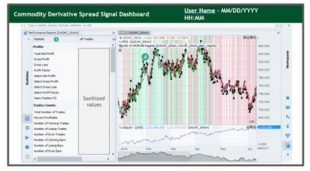
- Price indicators
- Shipping and freight rates
- Inventory levels
- Macro factors and sentiment
- Pipeline flows
- Weather conditions
- Refinery utilization
- Proprietary data

Predict market structure

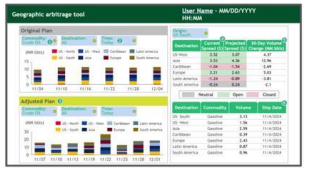
AI transforms raw data into proprietary factors and forecast distributions of commodity prices and spreads



Time arbitrage signals



Commodity spread signals



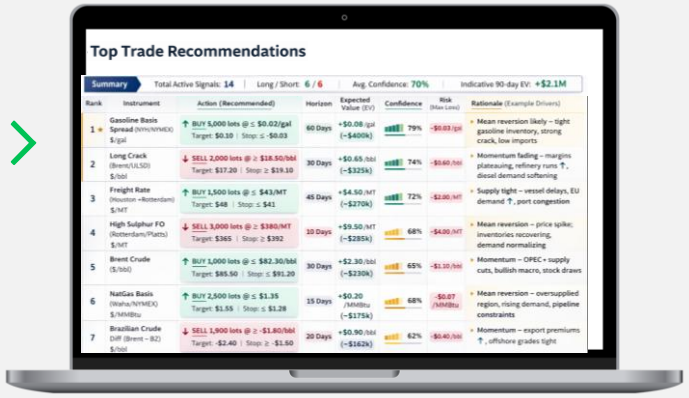
Geo arbitrage signals

AI

- Technical analysis (including mean reversion vs. momentum)
- Factor analysis and feature engineering
- Correlation analysis

Recommend Trades

AI recommends daily 'best trades' across various instruments



Closed loop: AI learns from past executed trades to improve next recommendations

Note: Opportunity ranges indicative based on prior implementations and depend on portfolio, constraints, and market conditions.
Source: BCG analysis

AI agents reduce maintenance costs by orchestrating remote inspections and risk-based interventions across assets

The challenge

At a Southeast Asian NOC's flagship refinery, asset reliability was challenged due to:

- Maintenance spend misaligned with actual risk exposure
- Limited visibility on failure probability vs economic impact
- Reactive, budget-driven inspection strategies rather than risk-based prioritization

The Impact

5%-15% Maintenance cost reduction

62% Efficiency gain in inspection workflow

How AI played a role

AI fuses unmanned inspection data and computer-vision integrity analytics to prioritize risk-based inspection and maintenance actions

Unmanned Inspection

AI agents ingest drone, robot, and sensor data across assets

- Replace manual work with remote inspection
- Lower HSE risk by limiting onsite exposure

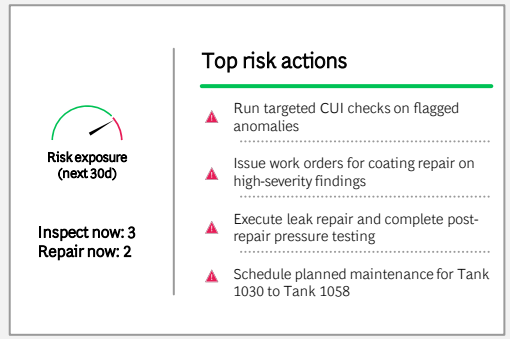
Computer Vision

AI agents detect defects, assess severity, and prioritize interventions based on risk

- Automate corrosion detections from imagery
- Quantify severity for each case

Actionable Outcomes

AI agents recommend highest-priority work orders and inspection actions



- Surface highest priority maintenance issues
- Recommend work orders for inspection/repair

Source: BCG analysis

AI turns static turnaround schedules into continuously reoptimized plans for optimized time, cost, and risks

The challenge

At a Middle Eastern NOC refinery, turnaround and capital schedules were challenged due to

- Manual sequencing struggles with high complexity across work front and dependencies
- Static plans breaking in execution, and slow to reoptimize under changing conditions
- Limited visibility into time-cost-risk trade-offs across scenarios

The impact

~10% cost reduction for routine maintenance

20%-30% reduction in backlog

How AI played a role

AI evaluates thousands of scenarios to recommend the 'best-fit' schedule – and triggers co-pilot reoptimization on disruption

INGEST DATA

AI builds a model with digital schedule and constraints

Schedule: Microsoft Project/ Primavera (mpp, xer, xml)

Constraints: Variable ranges of crews, resources, etc.

Live signals: daily progress, equipment availability, etc.

…

ANALYZE

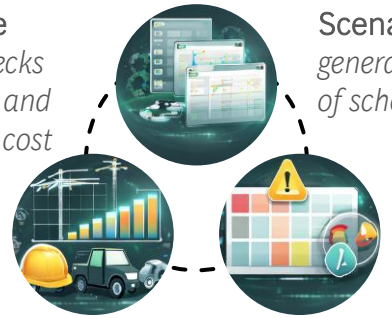
1 AI generates and ranks all feasible scenarios based on time, cost, risk

2 AI triggers re-optimization upon changes – refresh and re-rank scenarios

Resource agent *checks feasibility and estimates cost*

Scenario agent *generates thousands of schedules*

Risk agent *stress-tests uncertainty and delay probability*

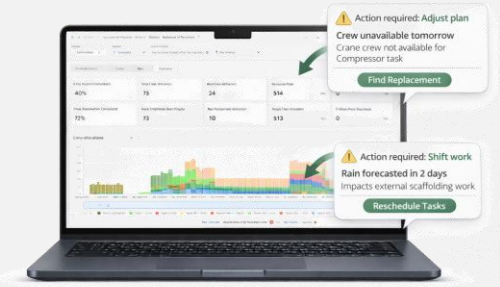


Example

task slips — *crew unavailable* — *bad weather*

ACT

AI suggests best-fit plan and recovery actions based on real-time progress



User push to:

- Approve and export schedule to P6/MSP
- Generate change log for stakeholder sign-off

AI tracks outcome to improve next recommendation

Note: Opportunity ranges are indicative, based on prior implementations, and depend on portfolio, constraints, and market conditions.
Source: BCG analysis

AI improves refinery safety by shifting from reactive incident management to real-time intervention, reducing near-misses and response time

The challenge

At a large Indian refinery, on-site safety and risk management faced gaps due to:

- Reactive incident detection, with issues identified only after escalation
- Manual monitoring unable to keep pace with operational scale and complexity in real time
- Passive CCTV systems, limited to recording without real-time risk detection or analytics

The impact

30%-50% reduction in near-miss incidents

>50% faster response time in intervention

How AI played a role

AI overlays real-time safety detection on CCTV to flag violations, escalate high-risk events, and build an incident log for trend analytics

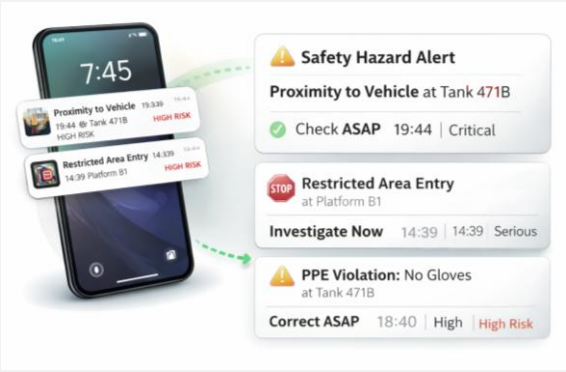
Run 20+ **real-time safety scenarios** with customizable detection parameters **to detect violations early**

Example of computer vision detection of safety violations at a refinery

Provide **continuous incident logging and safety trend analytics** to pinpoint hotspots and repeated violations

Incident log and trend analytics dashboard

Trigger real-time alerts via mobile notifications and audio alarms **to prompt immediate intervention**



Operator-ready view of active safety scenarios and alerts

Source: BCG analysis

Organizational inertia, fragmentation, and weak governance are key implementation hurdles to successful AI transformation in refineries

Fragmented priorities

Diffused priorities and agendas (across operations, maintenance, sales) with no common view of impact—**dilutes focus and funding,** creating many pilots, but limited scale-up of high-value use cases

Legacy IT systems

Plants operate on **fragmented and aging IT/OT stacks** (e.g., DCS/SCADA, SAP/CMMS) leading to gaps in data quality and integration—**slows deployment of digital and AI use cases** in control room and field

Siloed operations

Refineries make decisions by unit and function **with limited cross-unit and asset coordination,** preventing end-to-end optimization of throughput, margin, and reliability trade-offs

Inflexible operating models

Delivery model is **designed to run day-to-day operations, such as "keeping the lights on."** Talent and org not optimized with resources dedicated to fast implementation, scaling, and learning

Lack of governance

Dedicated resources and senior sponsorship required to centrally run the transformation, constantly assessing value and steering use case scaling to keep implementations on track and "fund the journey"

Source: BCG analysis

Future-built refineries overcome these hurdles through value-driven multiyear transformations

What future-built companies do differently

Pursue a multiyear strategic ambition

Reshape and reinvent for P&L impact

Implement an AI-first operating model

Secure and enable necessary talent

Use fit-for-purpose technology and data

Outperformers vs. laggards

C-suite actively engaged in AI agenda (refinery general manager, functional leaders)
More likely to appoint **chief AI and data officers**

Greater focus **on P&L impact over tool deployment**
Stronger AI **governance and value tracking**
Greater deployment and scaling of AI workflows

Strategic workforce planning for AI in place
Mature and **responsible AI guardrails** and governance
Shared **business-IT ownership** (e.g., engineering and digital) in implementation

Small number of capable AI leaders shaping requirements and vendor choices
Higher business-led ownership of AI solution design and deployment
Greater workforce enablement without building large internal AI teams

Standard templates and **enterprise-wide data models**
Synergistic, enterprise AI platform as an efficient backbone

Source: BCG Build for the Future 2025 Global Study (n = 1250).

AI agents and solutions will enable simplified human-in-loop workflows to provide necessary automation with checks and balances

Example of human-agent[1] supervision flow in refinery operations, such as crude slate, unit optimization

Strategic decision layer (L2)
Human-led

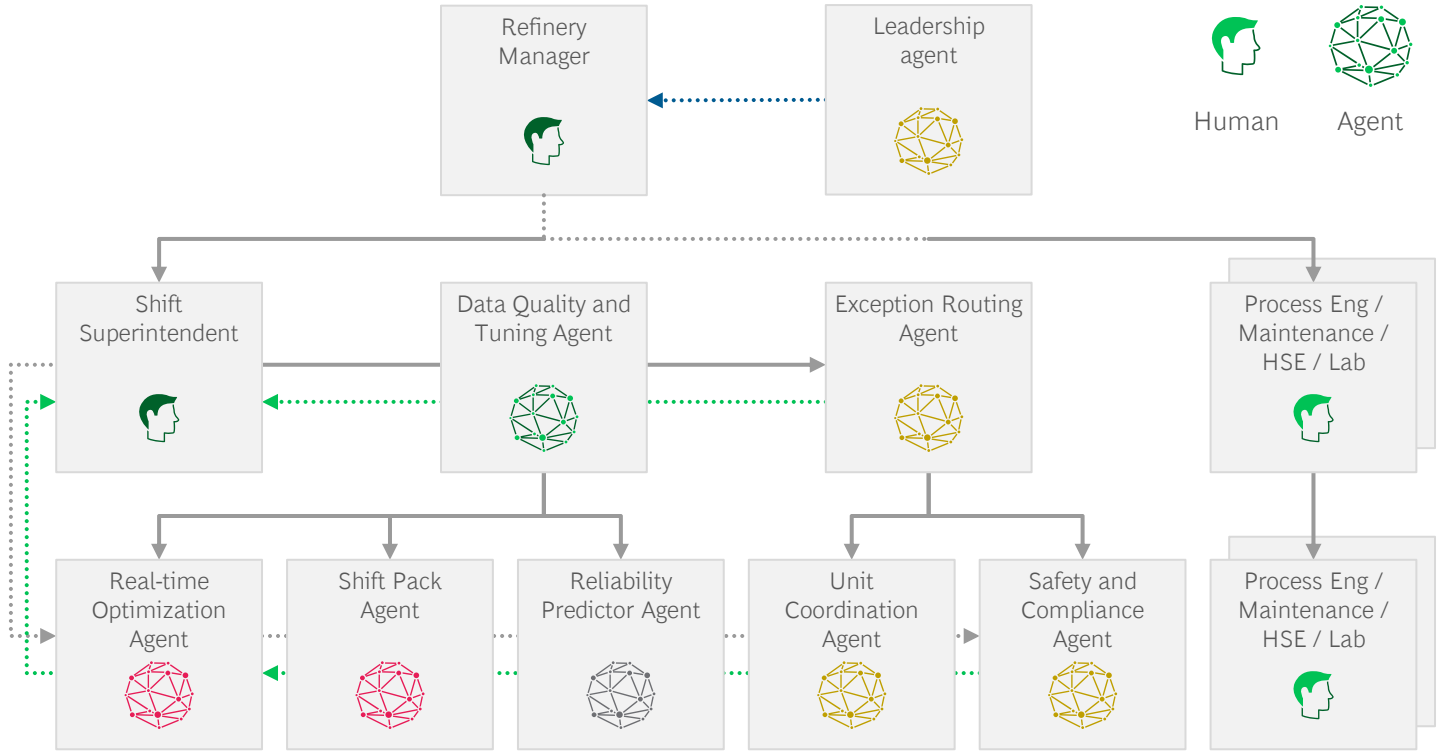
sets crude slate strategy, throughput/yield targets, product quality guardrails, emissions and safety limits

Orchestration layer (L3)
Co-led/split responsibilities

human governs critical decisions such as constraint exceptions and major rate changes; agents handle the baseline by recommending setpoints and actions based on constraints, energy cost, reliability risk

Execution layer (L4)
AI-led

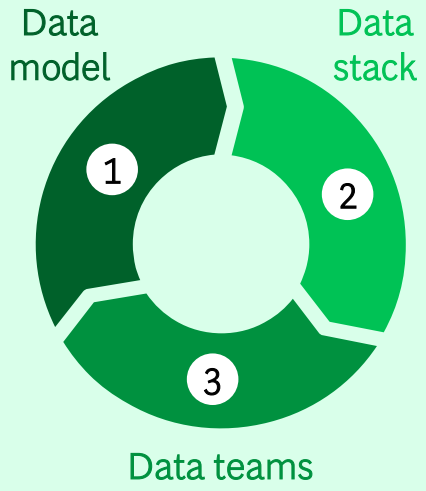
optimize unit operation and energy use, draft shift logs and work orders, monitor alarms and anomalies; detect safety, quality, and compliance triggers



Source: BCG experience

1. Agents connected to systems such as DCS/SCADA | Historian | LIMS | CMMS | LP/Scheduling.

AI-first organizations use business context fabric and easy access to structured and unstructured data to enable development of AI agents



1 Business context fabric

- Agents need more than data, they need **business context**, including:
  - **Objectives** – outcomes, not outputs
  - **Resources** – tools and data
  - **Constraints** – safety and spec limits and regulatory limits

2 Unstructured data ready for agent retrieval

- **Enable retrieval over unstructured data** by converting documents (e.g., contracts and network manuals) into searchable formats that agents can retrieve at runtime
- **Implement short- and long-term agent memory** (session and episodic or semantic) to retain and reuse interaction history

3 Data products for agents

- **APIs and model context protocol** (MCP) that agents and data teams can call autonomously to **expose data**
- **Federated data ownership**, with business teams owning data while platforms expose it via APIs for agent consumption
- **Data-driven decision-making culture**, with shared playbooks and templates to standardize high-quality agent-supported decisions

Bringing this to life across refineries

1. **Must have well-connected integration** across lab, plant, quality, and customer systems (e.g., ELN/LIMS, plant sensor, and batch data)
2. **Must mine thousands of data records daily** to surface relevant insights
3. **Users must be equipped with intuitive platforms** to interact with and supervise agents
4. **Continuous monitoring** and **enhancements** are essential to ensure the capability scales and adapts with the business

Key takeaway: Data must be treated as a critical enterprise asset. Investing in quality, governance, and management is essential for scaling agents across chemical players.

Source: BCG analysis

Building an agentic ecosystem requires a new stack on top of traditional business systems and data

Illustrative

Traditional

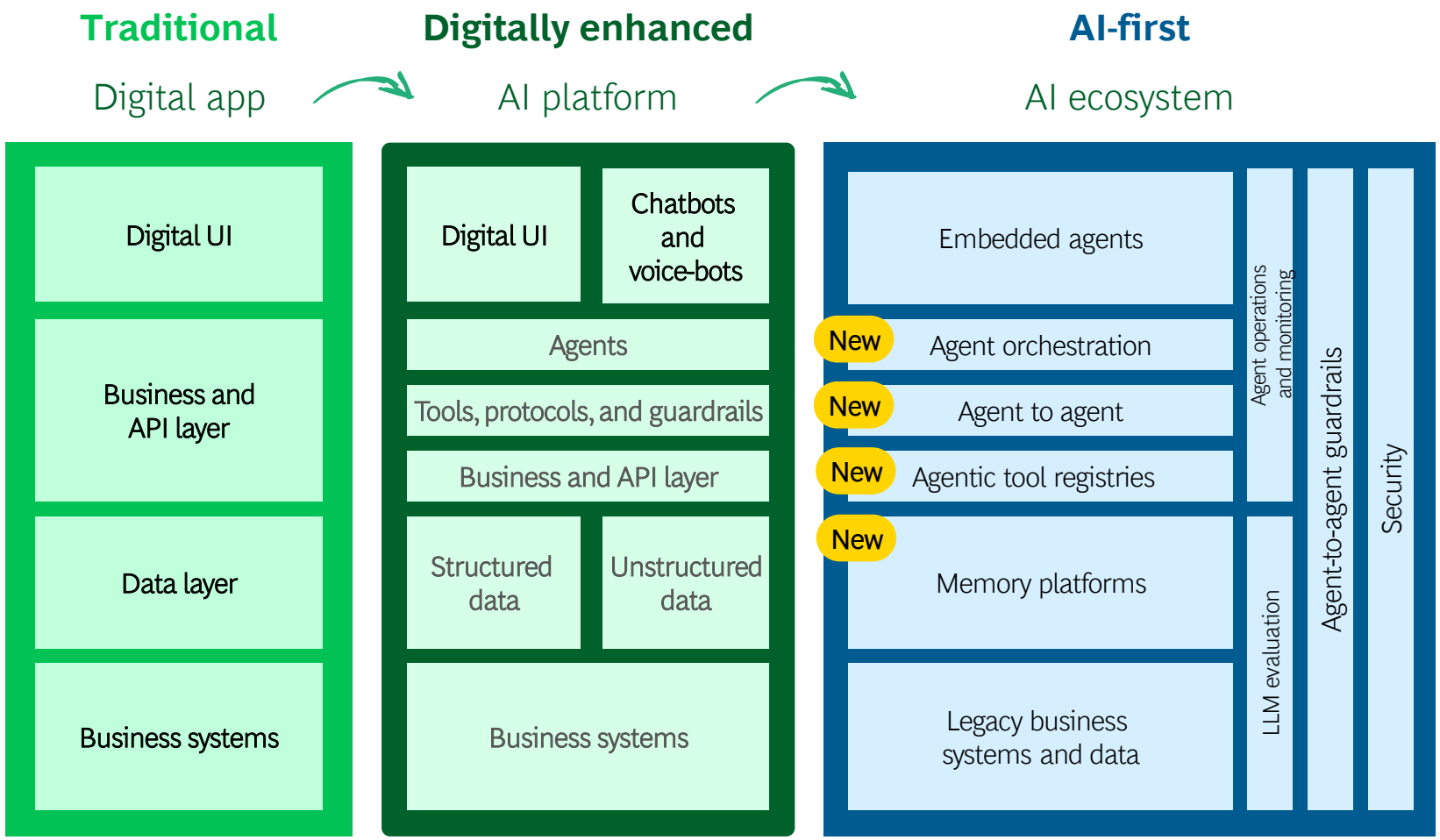
Conventional digital application architecture is organized into distinct layers with limited flexibility and integration resulting in reduced adaptability and greater rigidity

Digitally enhanced

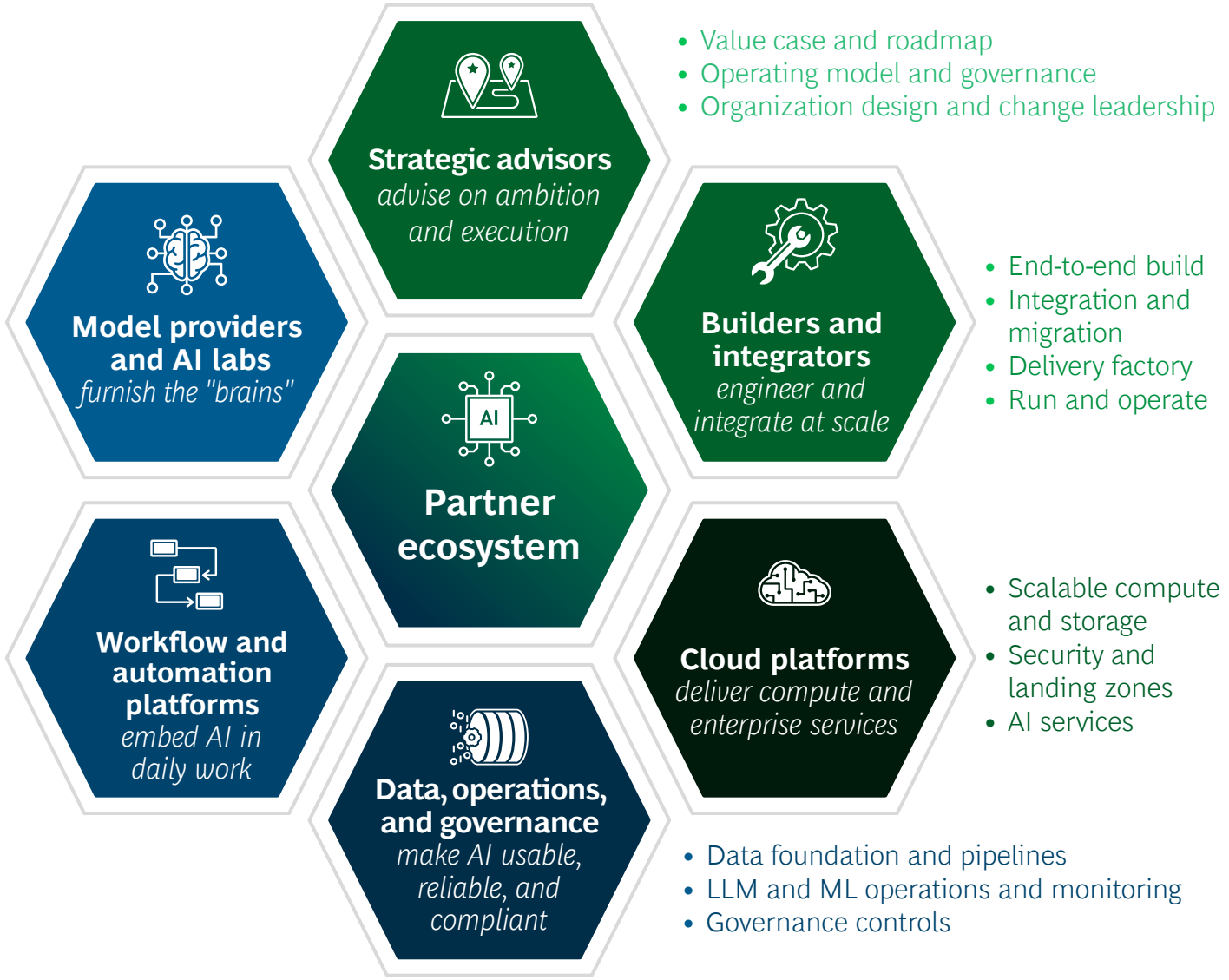
AI-driven architecture combining tools like chatbots, agents, and protocols over traditional structures. Integrates diverse data for enhanced adaptability and efficiency

AI-First

An ecosystem built around embedded AI agents, orchestrations, and tools, emphasizing secure, observable agent-to-agent interactions. Integrates legacy systems and data to boost AI-driven operations.



Best- in-class refiners strategically leverage partners to accelerate AI delivery on top of traditional platforms



- Value case and roadmap
- Operating model and governance
- Organization design and change leadership

- Foundation models
- Customization
- Safety features
- Rapid innovation cycles

- End-to-end build
- Integration and migration
- Delivery factory
- Run and operate

- Workflow orchestration
- Automation
- Adoption at scale

- Scalable compute and storage
- Security and landing zones
- AI services

- Data foundation and pipelines
- LLM and ML operations and monitoring
- Governance controls

Value proposition varies across partners. Critical to select best-in-role and orchestrate capabilities across the build-buy-partner mix

Transformation to future-built refineries requires an early focus on prioritized opportunities before expansion and scale-up

~3 months | ~12 months | ~18 months

Phase 1
Prioritizing opportunities

- Define **North Star** vision
- Prioritize value pools and identify **quick wins**
- Establish **governance**

Phase 2
Focusing on acceleration

- Address **foundational gaps** and outline people, operations, and a tech **roadmap**
- Conduct **pilots** to prove value
- **Upskill leadership** and define the shape of the organization and talent

Phase 3
Scaling lighthouse pilots

- **Transform the** prioritized scope end to end
- Institutionalize value **tracking and adoption**
- Enable large-scale **upskilling and change management**

Phase 4
Expanding and scaling

- Launch the next wave, **replicating across sites and functions**
- Move from productivity to **differentiation**
- Continuously **scale and upgrade the** foundation (including data and tech capabilities) and the workforce

Underpin the transformation journey with increasing investments in enterprise foundations including core tech and data, people, and responsible AI

Is my organization on track to be AI future-ready?
Leaders' checklist

Leadership and strategy
set the direction

AI is a strategic priority communicated to the organization

- ❑ I have a **named AI sponsor** (C-level or board level)
- ❑ AI progress is a **standing agenda item** in leadership meetings

Solutions and business value
determine priorities

We've identified functions or E2E processes where AI can create tangible value

- ❑ We **prioritize use cases identified for each function**, with target outcomes
- ❑ Each use case has a **business sponsor** with P&L accountability
- ❑ We track both business ROI and operational outcomes from AI cases

Funding and investment
back it with resources

Our leadership has a standard way to request AI funding that communicates ROI

- ❑ I have an approved **budget for AI-ready data, talent, and implementation**
- ❑ There is a defined **three-year AI investment envelope** (% of revenue)

Data and technology
build the foundation

Named data owners/stewards exist in business units or functions (e.g., operations, maintenance)

- ❑ We have an **active program** cleaning, governing, and integrating refinery data from control business systems (including DCS/SCADA, APC, MES, CMMS)
- ❑ Our critical data is AI ready (structured and labeled, accessible, compliant)

People and processes
drive adoption

Our leadership team is undergoing AI fluency training

- ❑ We have **cross-functional AI teams** that combine refinery domain experts (field operations, process engineering, maintenance) with OT/IT and Centers of Excellence
- ❑ There is a **change management plan** to address trust, compliance, and regulation
- ❑ We have an **AI talent plan** to attract, retain, and motivate talent

Governance and responsible AI
scale with trust

Wins and lessons learned from pilots communicated visibly across the organization

- ❑ We have an **AI governance council** (ethics, compliance, regulatory).
- ❑ We operate under a **responsible AI framework** (safety, explainability, bias)
- ❑ I receive a **quarterly AI impact report** with business and operational outcomes

Source: BCG analysis

BCG experts | Key contacts for refinery AI transformations

Americas	Europe, Middle East, and Africa	Asia Pacific
 Ilshat Haris	 Alex de Mur	 Arun Rajamani
 Oleg Gubin	 Alberto de la Fuente	 Asheesh Sastry
 John Florez	 Jaime Ruiz-Cabrero	 Rahool Pai Panandiker
 Buddy Myers	 Ana María Martínez	 Kashmira Jirafe
 Elisabet Assens Gibert	 Sébastien Rexhausen	 Anish Nazimudeen
 Wade Barnes	 Arthur Akhmetov	 Achraf El Ouali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