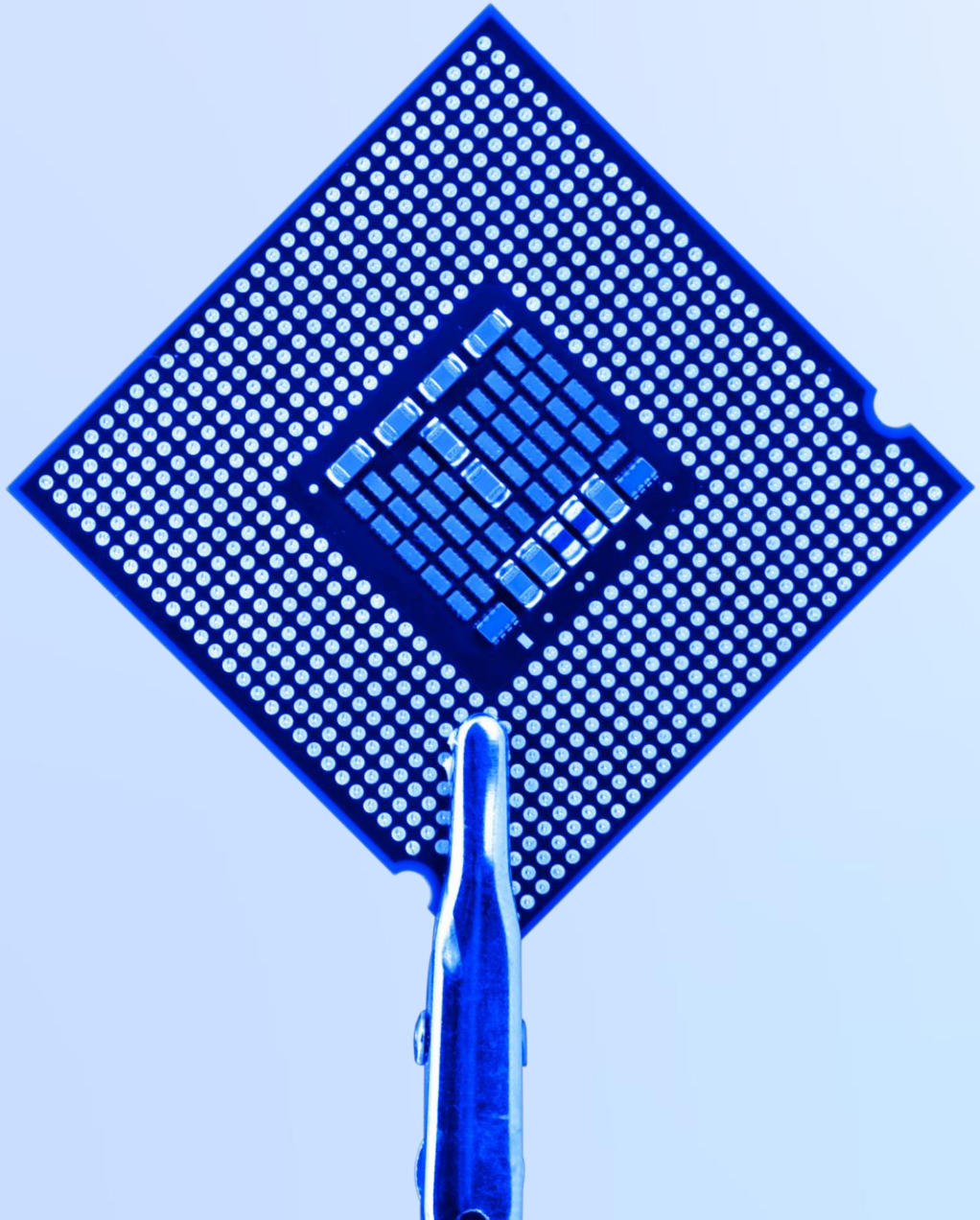
Smart Operations: A Vision of End-to-End Technology Enablement

Keynote presentation

June 2024



Have you implemented any form of Digital/AI solution in your organization?

Request a show of hands

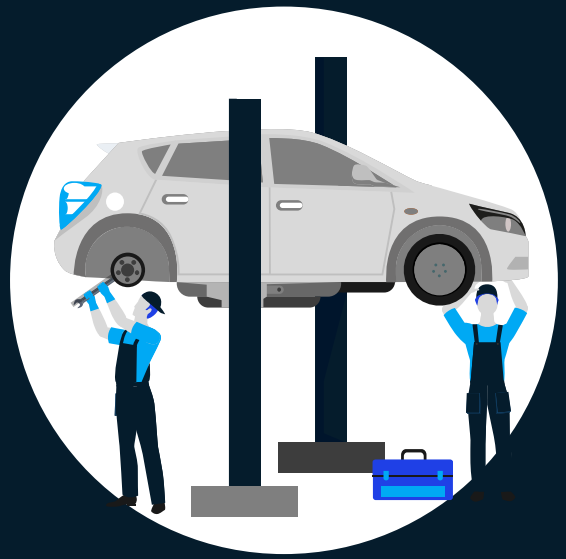
Are you clear about the value generated from Digital/AI initiatives you have undertaken so far?

Request a show of hands

Evolution of technology: The fourth industrial revolution will be unlocked by harnessing the power of data and digital tech

1.0

Mechanization, water and steam power



2.0

Mass production, assembly line and electricity

3.0

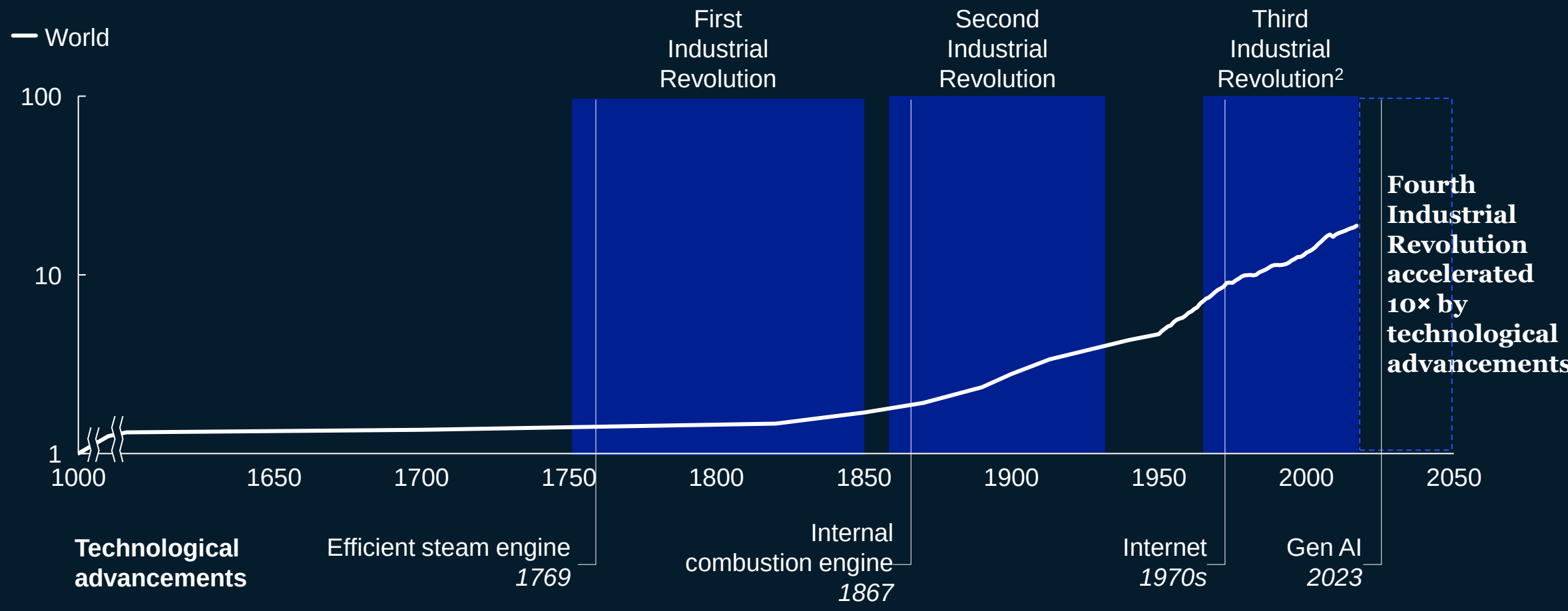
Computers and automation

4.0

Integrated digital systems

We are now at an inflection point: Tech is evolving faster than our ability to 'catch-up'

Changes in GDP per capita brought about by technological investments, 1000-2000 AD, by country, indexed[1]

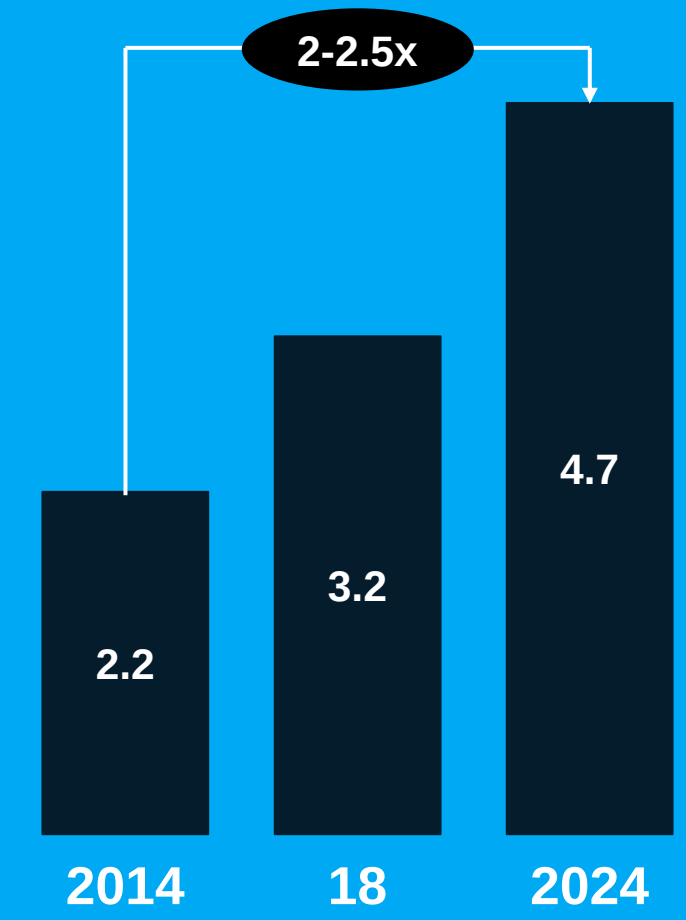


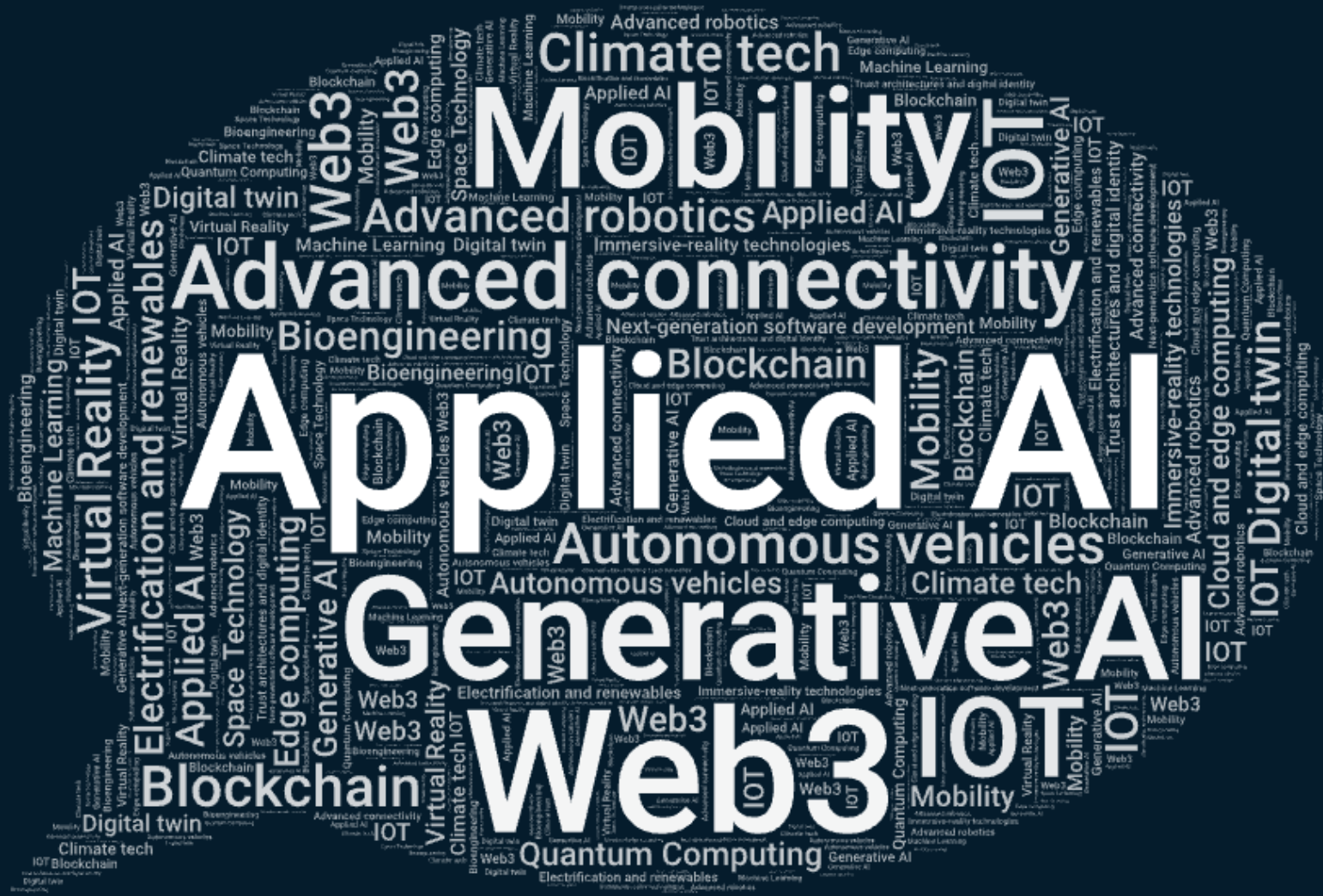
1. Estimated global GDP per capita in USD, adjusted to GDP in 1000 AD = 1; not exhaustive;
2. Includes Industry 4.0 (debate exists as to whether Industry 4.0 is seen as the Fourth Industrial Revolution or simply as the second phase of the Third Industrial Revolution).

Source: Angus Maddison, "Statistics on World Population, GDP & Per Capita GDP, 1-2008 AD," Maddison Project Database; UBS Asset Management; OECD

In IR 4.0, the global technology spend is growing rapidly on the back of several digital and tech solutions…

Global tech spend ($ Tn)





Source: Forrester, McKinsey research

…with rising innovation, adoption, and value potential from the use of these digital and technology solutions

Innovation at the edge…

2.8x
Global data creation from 2020-2025 (64 ZB in 2020 to 180 ZB in 2025)

30%
CAGR for low-code development platform market through 2030

50%
Of user touches will be augmented by AI-driven speech, written word, or computer-vision algorithms by 2024

… with rise in adoption …

50 billion
Devices connected to the Industrial IoT by 2025

70%
Of manufacturers will be using Digital Twins by 2025

31%
Increase in AI adoption in organization during FY24

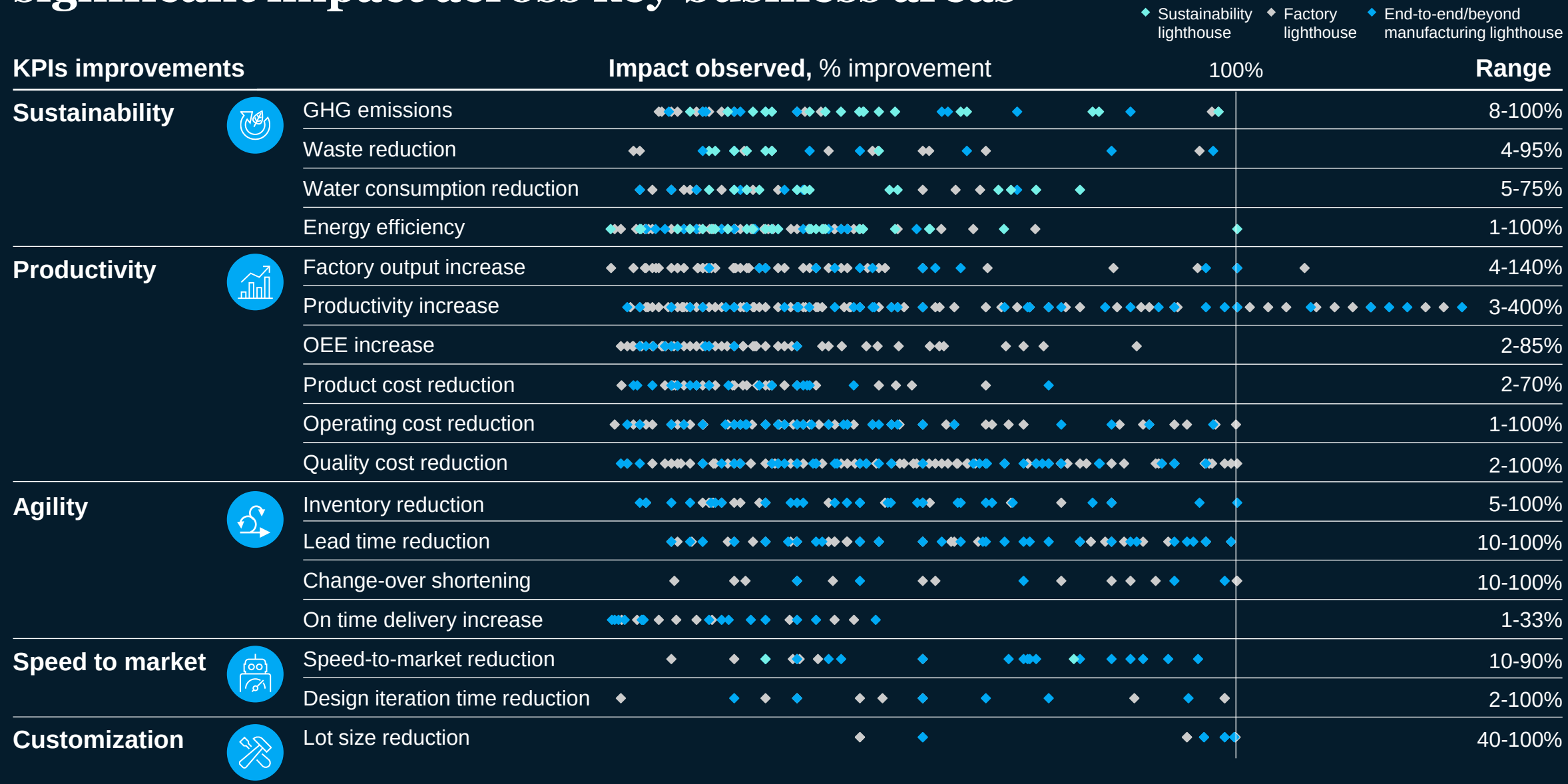
… and substantial impact potential

$1.3 trillion
EBITDA potential across Asia via cloud deployment (by 2030)

$15 trillion
Value at stake from adoption of AI solutions

Source: McKinsey Global Institute, McKinsey Digital

And lighthouses that adopted 4.0 IR and scaled have achieved a significant impact across key business areas



Source: World Economic Forum Global Lighthouse Network

Looking into Traditional AI, it has several use-cases across the pharma value chain for Gx companies

Non-exhaustive

Delivery

- **AI enabled dynamic planning and scheduling in near-real-time;** i.e., AA enabled material-machine planning to drive value-based optimization based on dynamic data, and material-machine constraints
- **Integrated digital lab-and-shopfloor performance management system (DPM)** i.e., interconnected and cascaded data system to enable agile cross-functional decision-making across levels basis near-real time performance monitoring

Quality

- **AI-enabled process capability improvement via democratized AA platform** for enabling 'golden batch' outcomes – i.e., AA based process simulation model to prescribe critical operational / process parameters for near-ideal product outcomes
- **AA-led simulations to minimize Invalid OOS;** i.e., AI algorithms to predict product-test-activities most likely to lead to Invalid OOS, and automatically optimize analyst allocation for minimum-error outcomes

Productivity

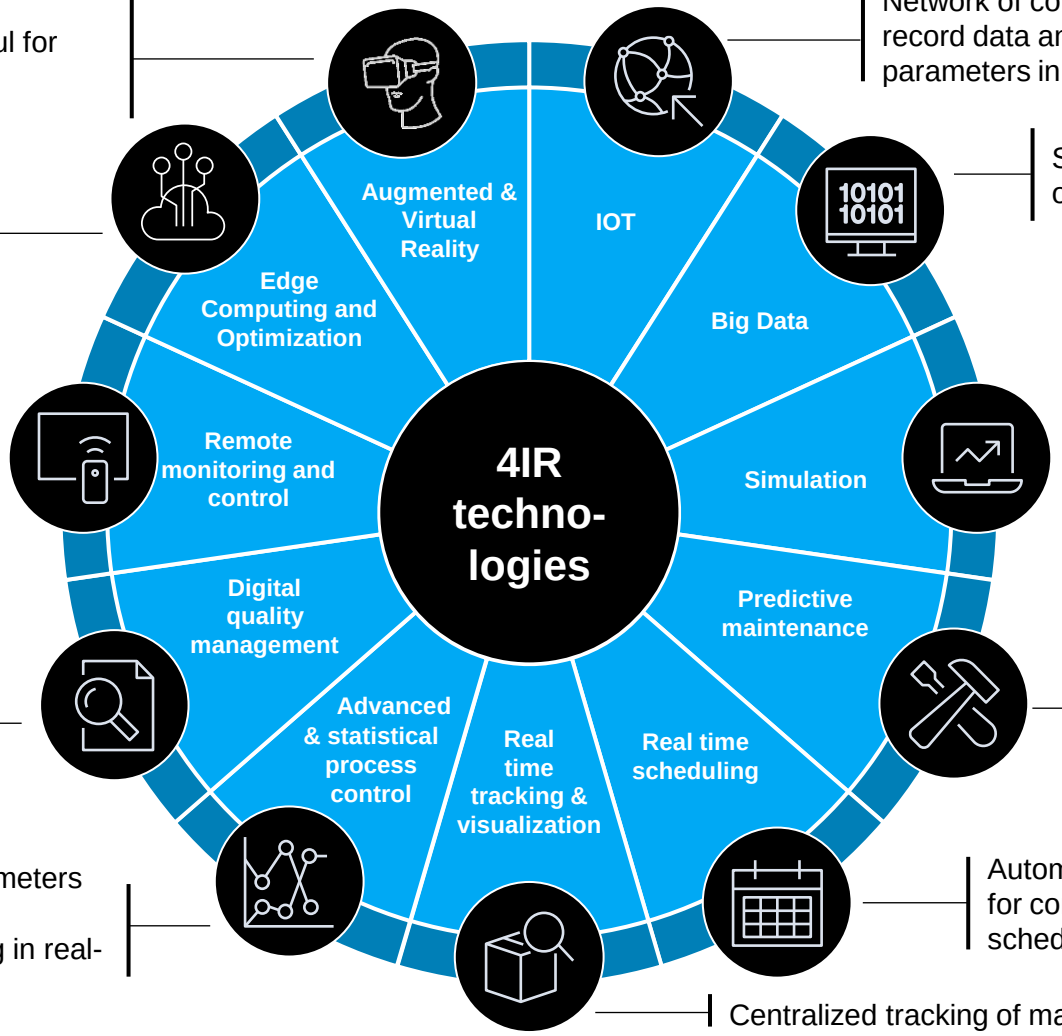
- **AA-led OEE optimization** for top products – automated algorithms continuously scan production data to identify hidden causes of loss and detect potential issues
- **Dynamic work-allocation (digital-enabled),** for near-real-time allocation of workforce basis on-site attendance, skill-levels, and any on-line adverse events

Cost Excellence

- **Yield variability reduction via democratized AI / AA platform** to run yield simulations, and recommend ideal process parameters to reduce variability and enhance overall yields
- **End-to-end digital vendor ecosystem with a Natural Language Processing (NLP)** engine to consolidate fragmented spend items in MRO, spares and consumables, and drive targeted optimization
- **AA powered chiller settings recommendation engine** for real-time energy consumption optimization

Source: Team analysis

Spectrum of 4IR technologies can be deployed to drive impact covering a breadth of Digital/AI solutions



Recreate real-life working environments virtually; Useful for virtual control of equipment, personnel training etc.

Network of connected sensors help record data and control key parameters in real-time

Data collection, computation and analysis at the equipment location, allowing for faster and more secure data systems

Systematic extraction and analysis of very large and complex data sets

Operate, control and monitor equipment remotely, to eliminate safety risks and address quality issues faster

Recreate real-life operational scenarios virtually using technologies like digital twins

Digitization of all quality activities like audit mgmt., incident tracking, complaint mgmt. etc.

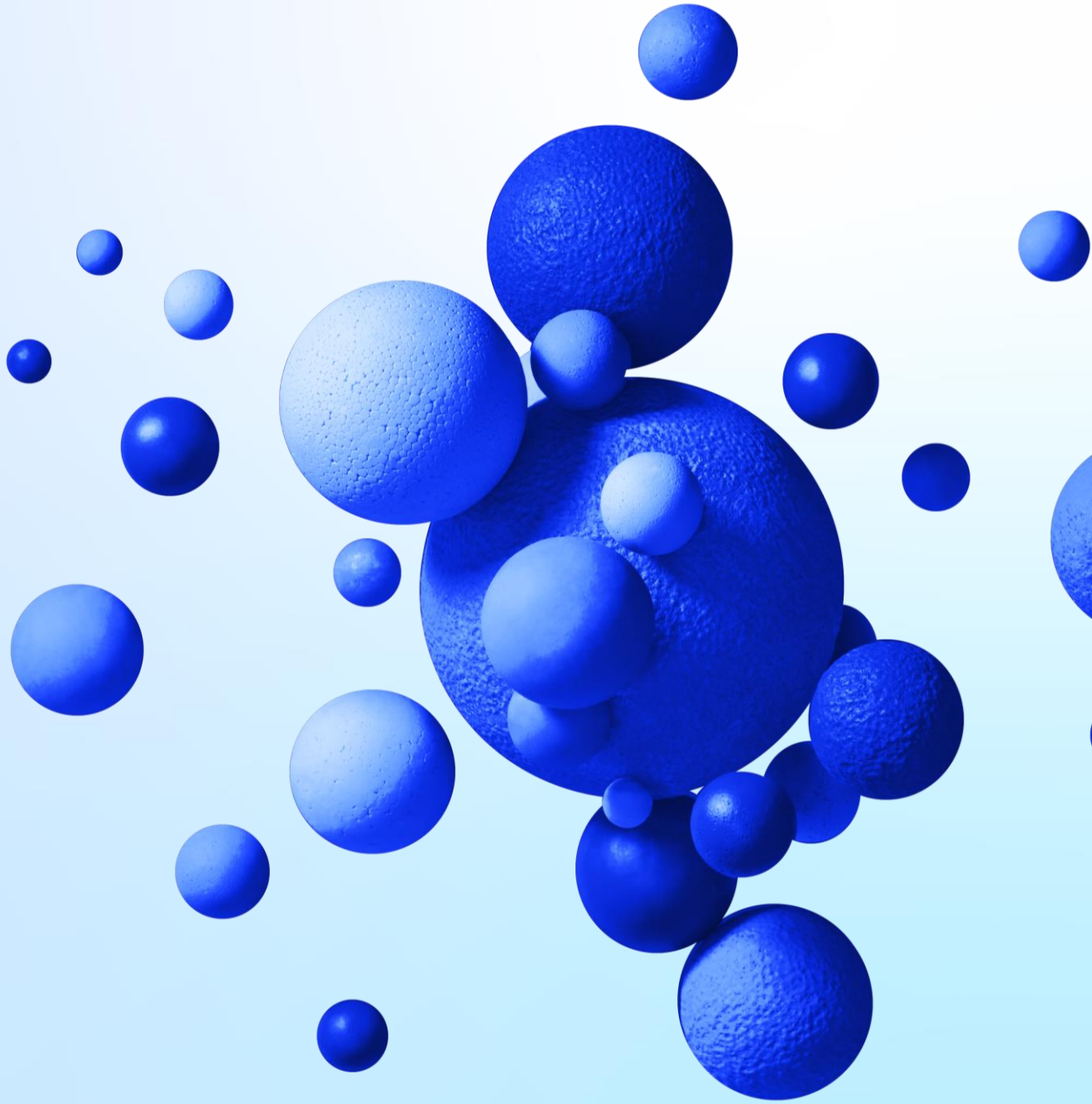
Eliminate costly repairs and quality risks by using AA models to proactively carry out maintenance activities

Control critical process parameters using advanced analytics to determine the optimal setting in real-time

Automated planning tools to account for complex workflows and optimize scheduling for highest efficiency

Centralized tracking of material movement using barcodes, RFID etc.

At the same time, new-age technologies like Gen AI are expanding the value potential at stake even further



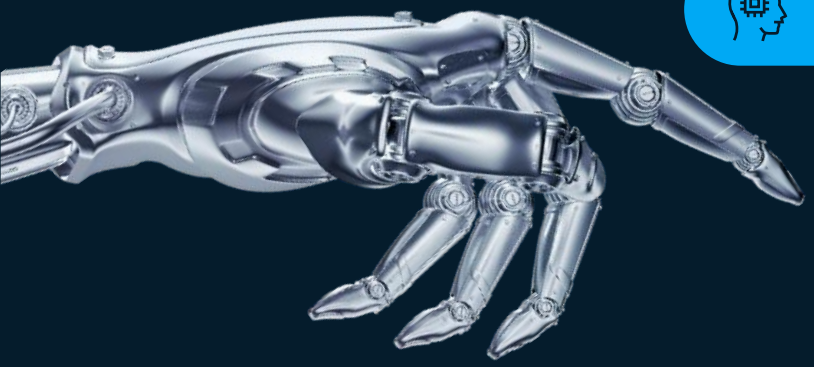
Gen AI is the next new frontier of a long AI journey

Artificial Intelligence, the science and engineering of making intelligent machines

Machine Learning, a major approach to realize AI

Deep Learning

Generative AI



1950's *1960's* *1970's* *1980's* *1990's* *2000's* *2010's* *2020's*

Artificial Intelligence

Is the broad field of developing machines that can replicate human behavior, including all aspects of **perceiving, reasoning, learning**, and **problem solving**

Machine Learning

Is a major approach to **achieve AI by teaching machines to learn relationships hidden in data, and build approximate models of real systems**

Deep Learning

is a **branch of Machine Learning** that uses '**neural networks**' to **model real systems** by mimicking how the human brain works, utilizing millions of computational 'neurons'

Generative AI

are a **branch of Deep Learning** that uses exceptionally large neural nets called **Large Language Models** (with 100's of billions of neurons) that can learn especially abstract patterns

Applying these language models to interpret and create text, images, video, and data has become known as **Generative AI**

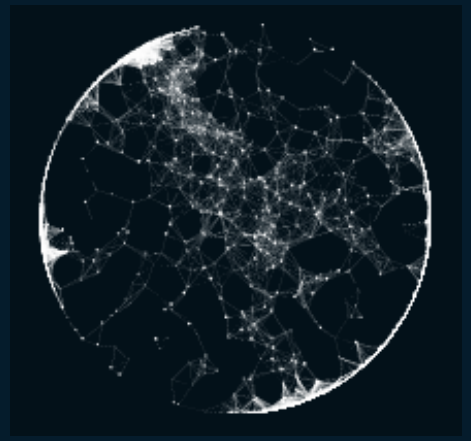
Source: Team analysis

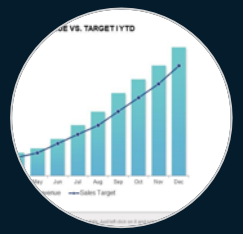
Understanding the difference between Traditional and Gen AI

Gen AI helps generate new content whereas traditional AI is largely used for problem-solving

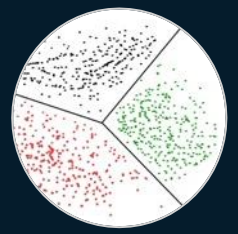
Traditional AI

Analytical AI algorithms are used to solve analytical tasks faster and more efficiently than humans — e.g., being able to classify, predict, cluster or evaluate data





Forecasting sales

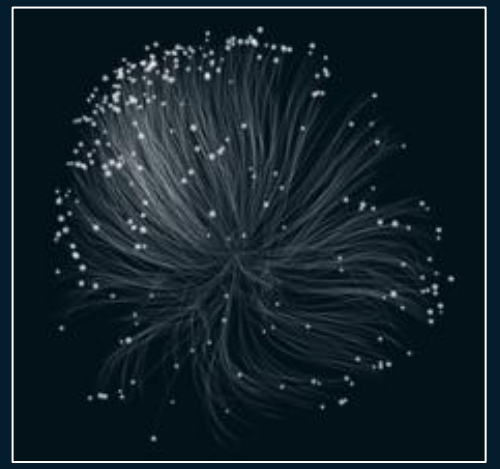


Segmenting customers

Churn prediction

Generative AI

Generative AI algorithms are used to create new content on par with humans or greatly enhancing humans — e.g., generating audio, code, images, text, and videos



Call transcription & synthesis

Marketing or social media content

Code generation

Specifically, Gen AI helps unlock 3 unique capabilities that "traditional" AI cannot

Gen AI is uniquely able to handle

1 Insight extraction
Rapidly search large corpora of text, visuals, etc. and identify relevant patterns

2 Content generation
Develop complex data tailored to specific context – in text, visual, sound, etc.

3 User interaction
'Out-of-the-box' humanlike conversational ability incl. context memory

genAI is …		While trad. AI …
Faster 	Model can be **deployed out-of-the-box** with only minimal training	Requires **use-case specific training** before application
More scalable 	Same model can be **used across multiple use-cases**	Requires **one newly trained model** for each use-case
'Humanlike' 	Model can **handle much more complex situations** and adjust its response accordingly	Is **not able create humanlike responses** beyond the core task that it is trained to do

Source: Team analysis

In Gx context, Gen AI can enable several high-impact opportunities across the value chain – *top use-cases being piloted by Gx PharmaCos*

Not exhaustive

Research & Development

- **Literature review**; Rapid review to accelerate experimentation in labs
- **Dossier generation** to automate 'version 1' dossier drafts from range of development data
- **Deficiency anticipation** to predict potential deficiencies in dossiers
- **Clinical trial acceleration** by using RWD to augment site selection/ monitoring
- **Portfolio identification / prioritization** leveraging real-time data on competitive / regulatory landscape
- **Specialty portfolio augmentation** by identifying indication expansion opportunities with RWE

Procurement & Supply Chain

- **Input cost monitoring (ICM), Parametric clean sheet and Vendor discovery** leveraging internal / external supplier data & AA/ML models for real-time insights
- **Procurement assistant** to enable value capture from negotiation, PR to PO process, contract mgmt.
- **ContractAI** to enable automatic contract analysis and generation
- **Touchless Demand & Supply Planning**; e.g., auto-mated triggers / implications for non-APS decisions, auto-generated S&OP / DP / SP as 'second opinion'
- **Supply Chain co-pilot for S&OE control tower** to enable real-time monitoring, short-term management of deviations from plan, etc.

Manufacturing & Quality

- **InvestigationsAI**; LLM enabled assistance for augmenting quality of reports and root causes
- **Image-recognition & AA led investigator** to surface 'micro-anomalies' in way of working *(e.g. sterile operations)*
- **Digital Supplier Quality suite;** e.g., real-time risk-profiling, on-line perform-ance mgmt., automated CoA generation
- **Real-time SOP assistant** to assist queries across all plant SOPs on-the-go
- **Real-time compliance engine;** i.e., LLM to crawl 483s, guidelines, third party data to identify future focus areas for compliance

Commercial & Market Access

- **Rep Co-Pilot**; i.e. Self-access tool to enhance quality of HCP detailing and effectiveness of coverage on ground
- **Digital cockpit to** improve quality of performance management in field
- **Content LLM to** automate content generation for marketing/ digital channels
- **Tender co-pilot** to enhance quality of bids in tender-driven markets (e.g. Germany, Hospital channel)
- **G2N optimizer** to minimize value leakage across tender, branded markets

Enabling corporate functions

- **Finance – automation of planning & business insighting** (e.g. earning call interpretation, industry trends, business plans)
- **HR – GenAI enabled cognitive HR agents** to resolve first line queries from employees and automate other transactional processes
- **Risk & Legal – e.g. Automation of Legal processes** (auto drafting / reviewing large bodies of legal docs, auto query answering)
- **Tech – Automated coding** to scale develop-ment; e.g., auto convert JavaScript expressions into Pythonxxxx

Source: Team analysis

Additional impact potential from Gen AI use-cases

1 **Impact potential in overall pharma Industry**

$60-$110B

2 **Manufacturing and SC cost reduction**

3-7 %

3 **Gx companies profit uplift potential[1]**

4-7 pp

1. Basis productivity improvements 3 main areas: operations, commercial and sales, and development and regulatory

Source: McKinsey Global Institute (The economic potential of generative AI), Team analysis

Talking about the digital maturity of life sciences companies, the industry has begun to capture value from digital and analytics

Progress made by life sciences companies in adopting and developing DnA[1]

55%

Pharma digital and analytics leaders have developed some applications of DnA at scale

50-130%

Increase in adoption of capabilities like data and tech architecture from 2017

15%

Of total tech investments in long term bets like Web3 and advanced connectivity

17 pp

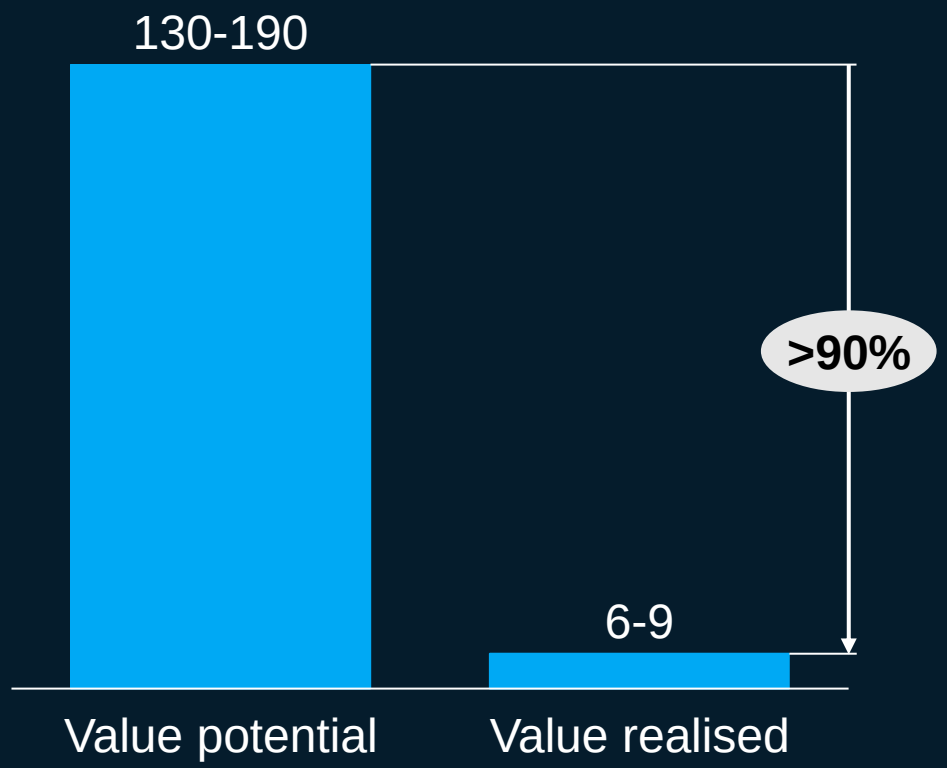
Improvement in DnA talent profile and agile operating models from 2017

Source: McKinsey Global Institute

However, more than 90% of the potential benefit from full scale technology implementation is yet to be realized…

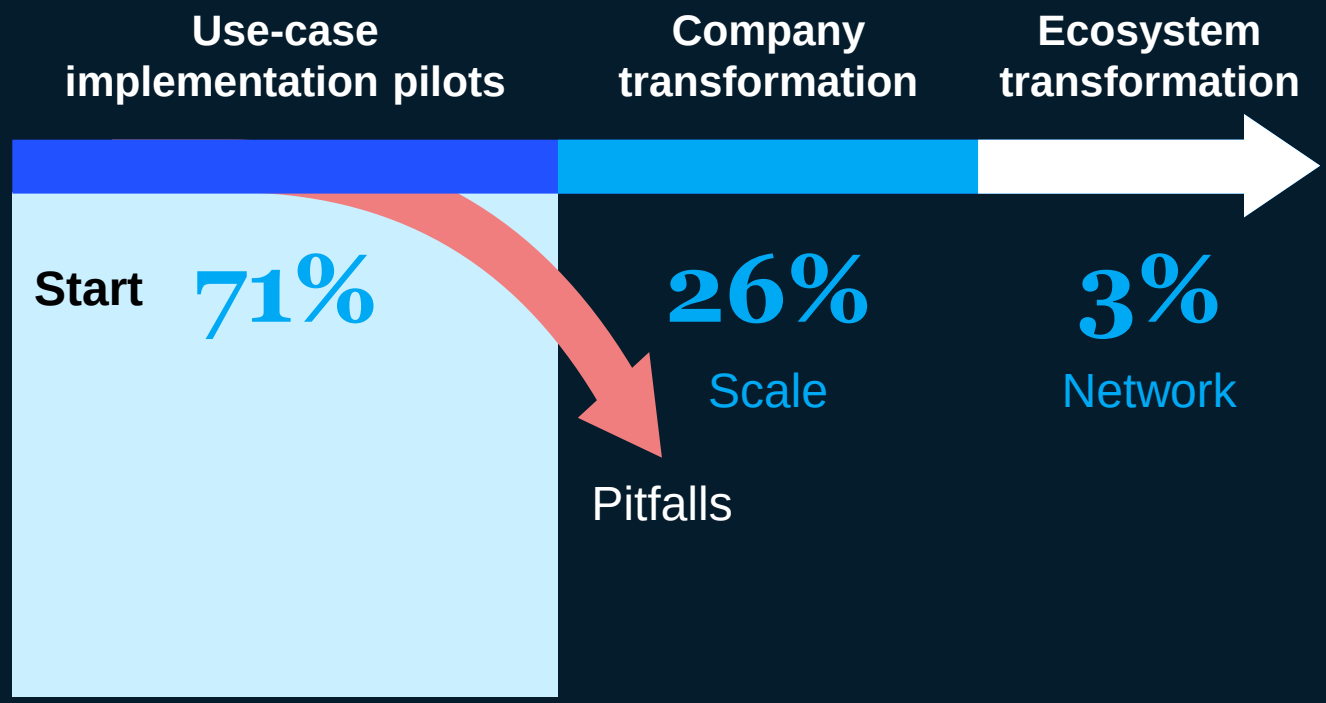
<10% of value potential from full application of DnA solutions realized…

USD Bn *(annual figures)*



…**as many tech-enabled transformations get stuck in the "pilot purgatory"**

% respondents
Companies piloting/deploying IIoT solutions

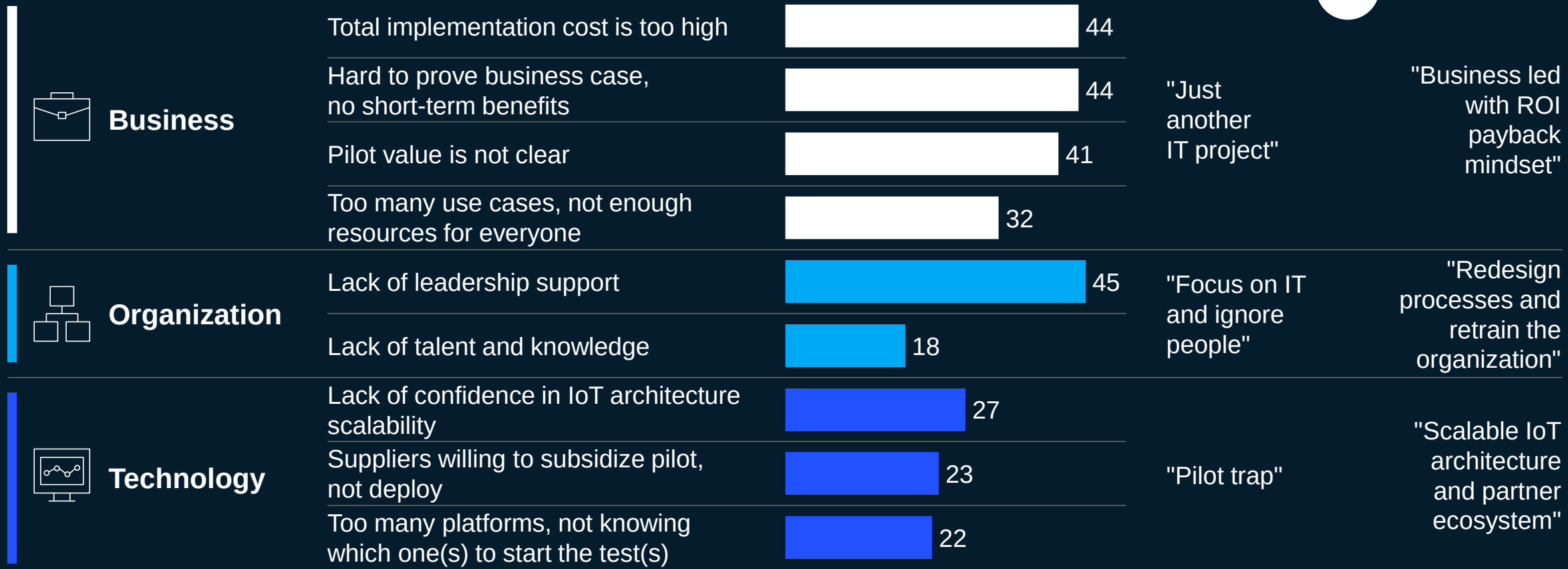


Source: McKinsey Global Institute, World Economic Forum and McKinsey; Global Industrial 4.0 Survey

...and this stems from 9 common challenges that companies confront while scaling digital transformation

Digital transformations require 3 transformations

Challenges faced by each transformation
Based on the main obstacles identified in the survey, %



Obstacles vs. **Winners**

"Just another IT project" — "Business led with ROI payback mindset"

"Focus on IT and ignore people" — "Redesign processes and retrain the organization"

"Pilot trap" — "Scalable IoT architecture and partner ecosystem"

Source: McKinsey DTS

3 principles could be considered when implementing digital and analytics in your organization

A

Follow the money

Only implement the project if it positively impacts the bottom line and ensures operational safety

B

Use equals value

Use the tech solutions deployed – otherwise, there is no value

C

20-30-50 rule

20% tech-focus, 30% process-orientation, and 50% right mindset and capabilities

Source: Team analysis

6 core enablers to "rewire" for an at-scale digital transformation

Strategy

1 Strategic roadmap

How do we align our digital transformation strategy with our overall organizational aspirations?

How should we approach the transformation in a way that ensures value capture and unlocks competitive advantage?

Capabilities

2 Talent

How do we manage talent to stay ahead of the skill gaps?

3 Op model

How do we organize ourselves and teams to deliver on our digital strategy?

4 Technology

How do we setup a scalable tech stack and infrastructure to support multiple tech/AI/Gen AI use cases and solutions?

5 Data

How do we to setup a robust data foundation to scale technology solutions across the organization?

Change Management

6 Adoption and Scaling

How do we design our scaling plan to ensure easy re-usability and scalability across the organization?

How do we deliver effective training to support skill building and manage culture change at scale?

How do we think about risk and responsible use of technology and AI solutions across the organization?

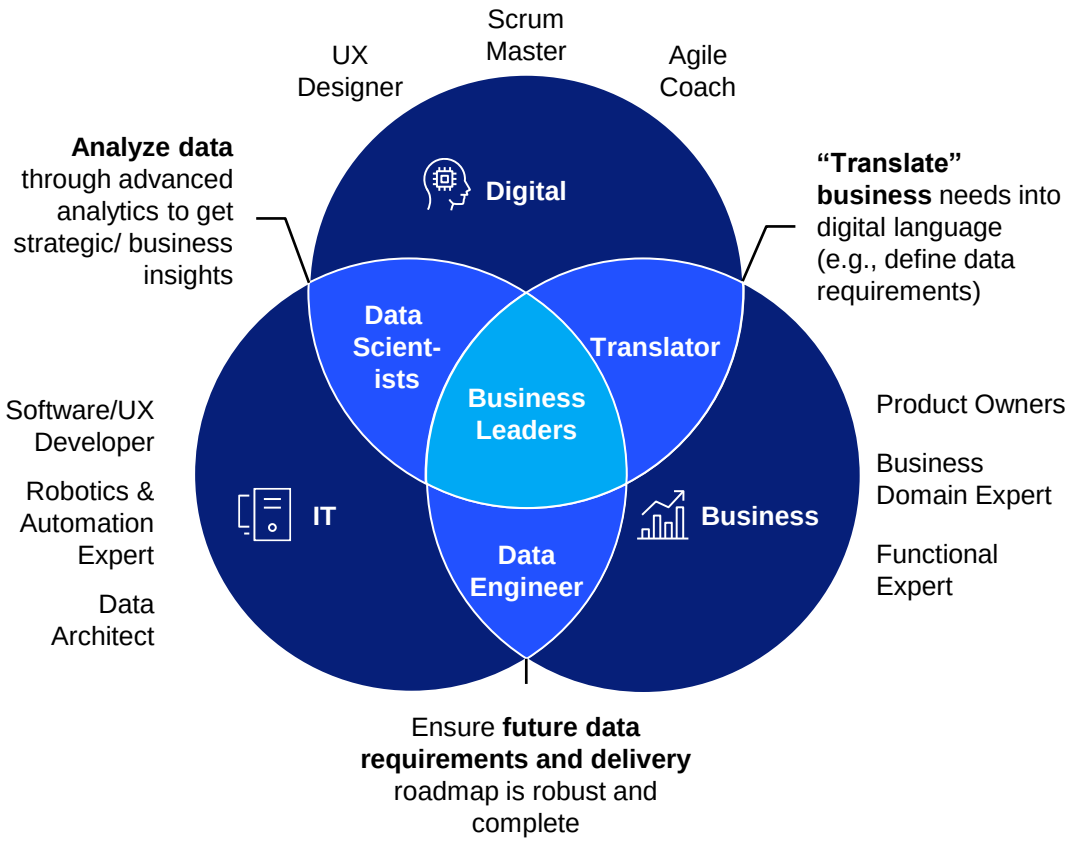
Source: Team analysis

Various roles are required to setup CoE; most of the roles already exist and requires re-deployment, only a few needs external hiring

Illustrative example

New capabilities | Easy to up-skill internally | Partially available | Limited availability, might need external hiring

Organisation blueprint



Current job		Digital role	Typical in-house availability
Senior management	Plant Leadership Manufacturing unit leads	**Digital & Advanced Analytics champion**	Minimum training required, focused on understanding of digital projects
Operational management	Production / Technology managers Team leaders (Heads) Business excellence	**Project owners**	Minimum training required, focused on understanding of digital projects
Working Units	Operations Maintenance	**Translator**	Technical employees can be easily trained to practitioners
	Instrumentation teams Automation	**Data scientist**	Several employees can be up-skilled, but additional hiring might be required
	IT and Projects team	**Data engineer**	Intensive training for limited employees; complimented by external hires

Source: End-to-end advanced analytics transformation across multiple client scenarios

2 key considerations for pharma companies looking forward

1

Ensuring **enterprise-wide scalability of your core digital solutions**

Prioritize by business domains and not use-cases; create an investment plan

Outline a **resilient data** strategy and commit to a **modern tech stack** for evolving needs

Build a dedicated **digital talent team** bench and develop **meaningful career paths**

2

Making initial **investments in technologies like gen AI to unlock its value potential**

Value-backed planning to **identify quick-win use-cases**; **then launch 1-2 pilots**

Ensure **adequate resourcing** (data/ tech/ manpower readiness) for the launch

Conduct **period check-ins** for course corrections, ensuring org. commitment

Source: Team analysis