

AI in Software Engineering: Trends, Insights and Future Directions

Philip Walsh, PhD
Director Analyst
Gartner Software Engineering Practice
September 2025

From copilot no pilot?

Here Lies the Software Engineer Role ... Rest in Peace?

“It is our job to create computing technology such that **nobody has to program**. And that the programming language is human. Everybody in the world is now a programmer. This is the **miracle** of artificial intelligence.”

Jensen Huang,
CEO of NVIDIA

“Meet Devin, the world’s first **fully autonomous** AI software engineer.”

Cognition AI
(AI startup)

“[We] are delighted to be investing \$100M in Magic.dev, which is building a **superhuman** software engineer.”

Daniel Gross (Y Combinator partner) and **Nat Friedman** (CEO of GitHub, 2018-2021)



Rumors of the demise of the software engineering role have been greatly exaggerated.



Calculators Did Not Eliminate the Need to Learn Mathematics

Likewise, AI Will Not Eliminate the Need for Skilled Software Engineers



Novelty



Complexity



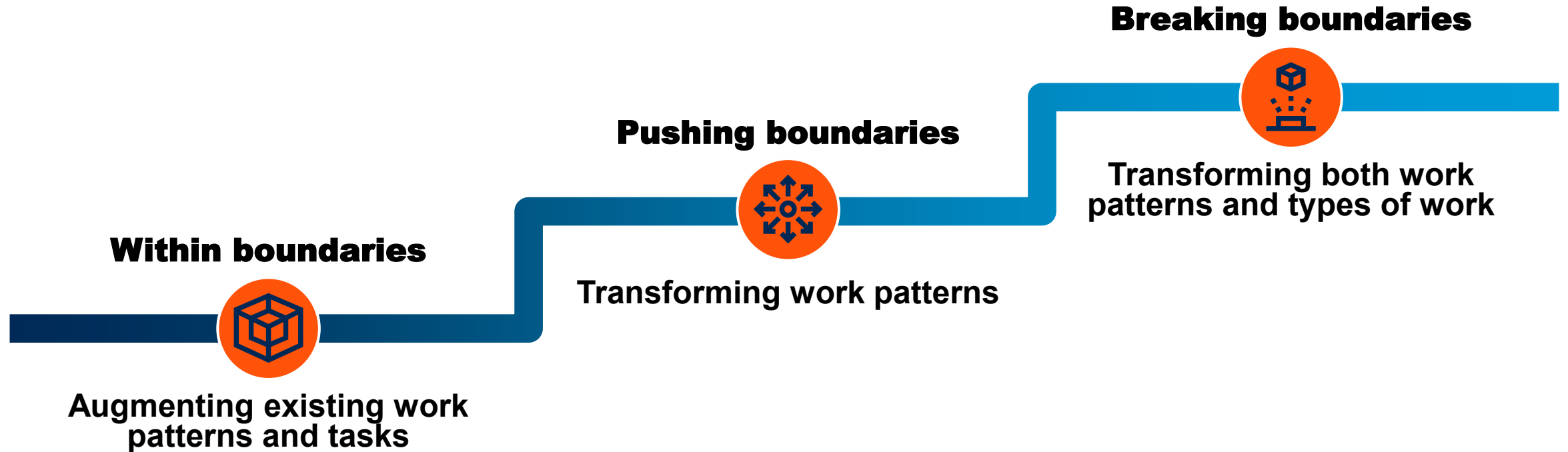
Variability

The essence of software development is **creative and critical thinking** to dissect and solve **complex problems**.

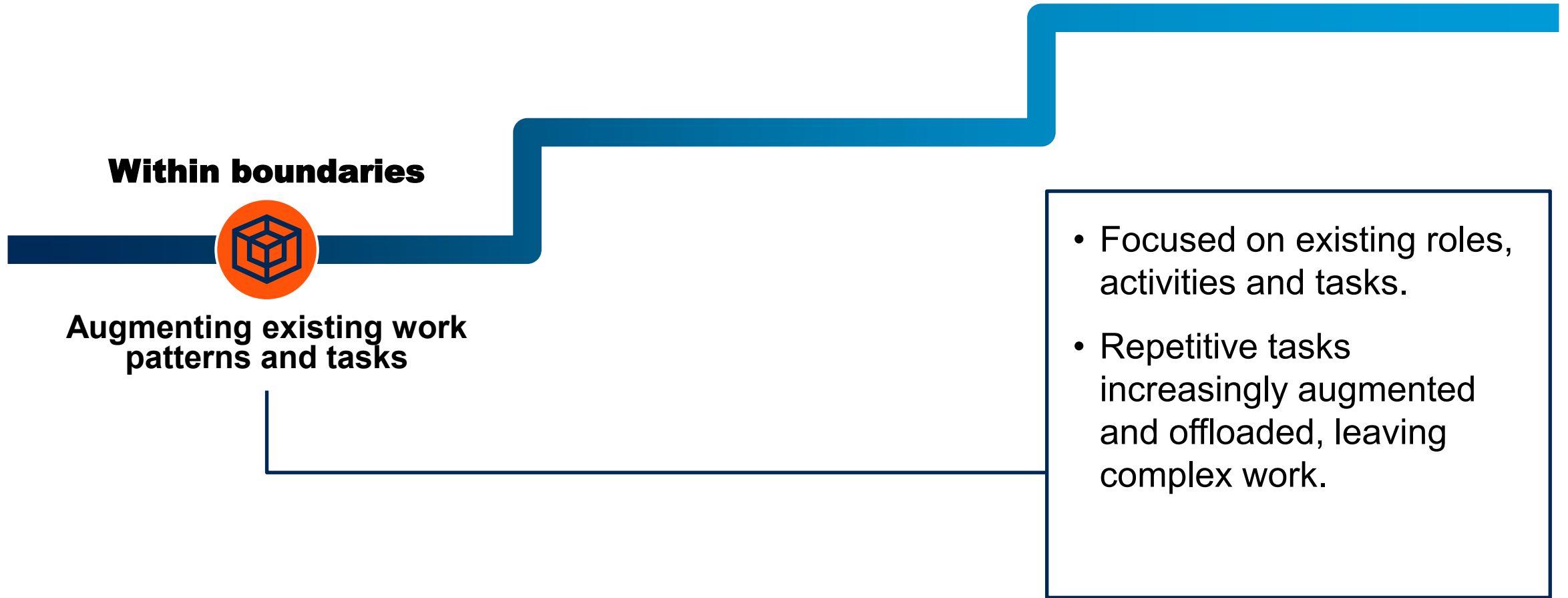
How will AI affect the future role of software engineers in my organization?

AI Disruption Spectrum

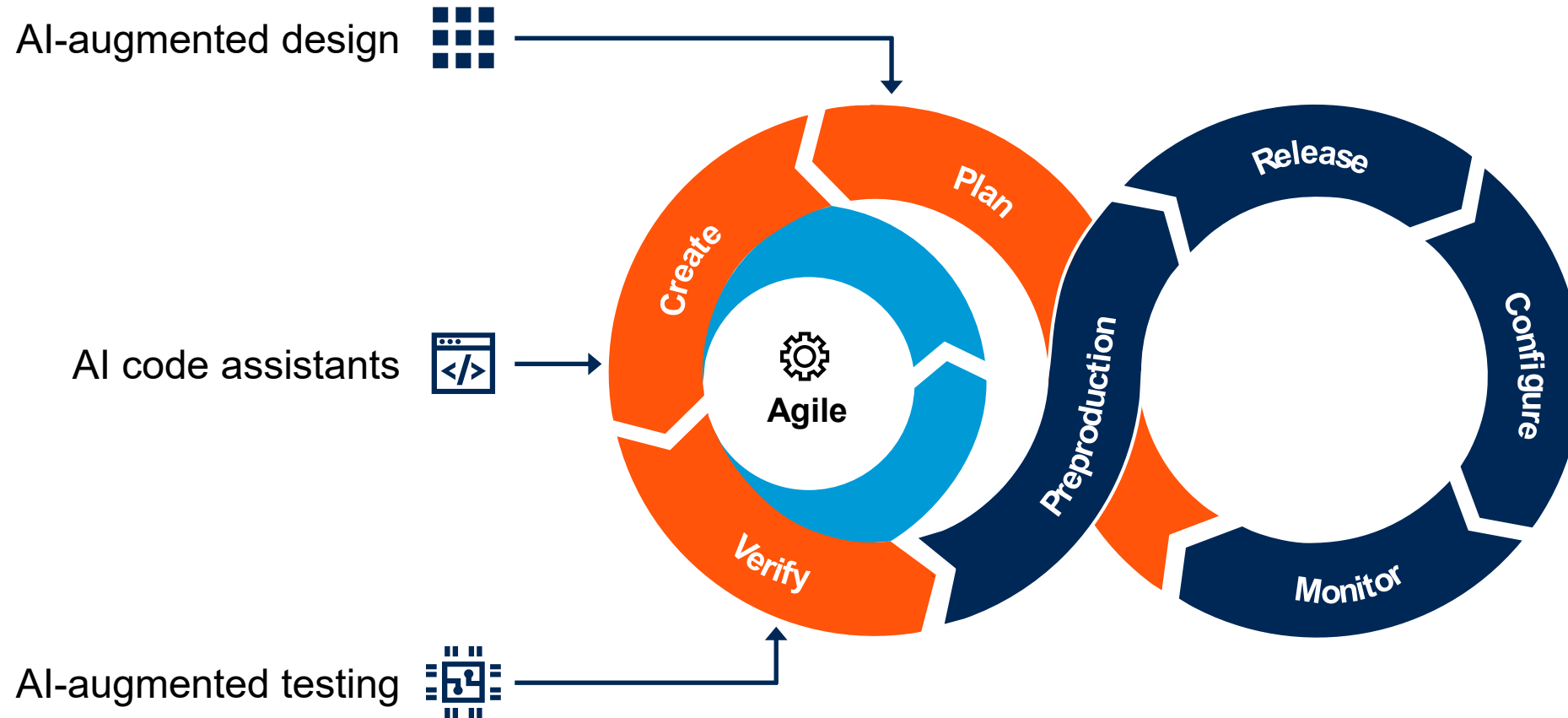
Anticipate degree of work disruption of AI investments



Within Boundaries



AI-Augmented Software Engineering



Productivity Gains are Modest Thus Far

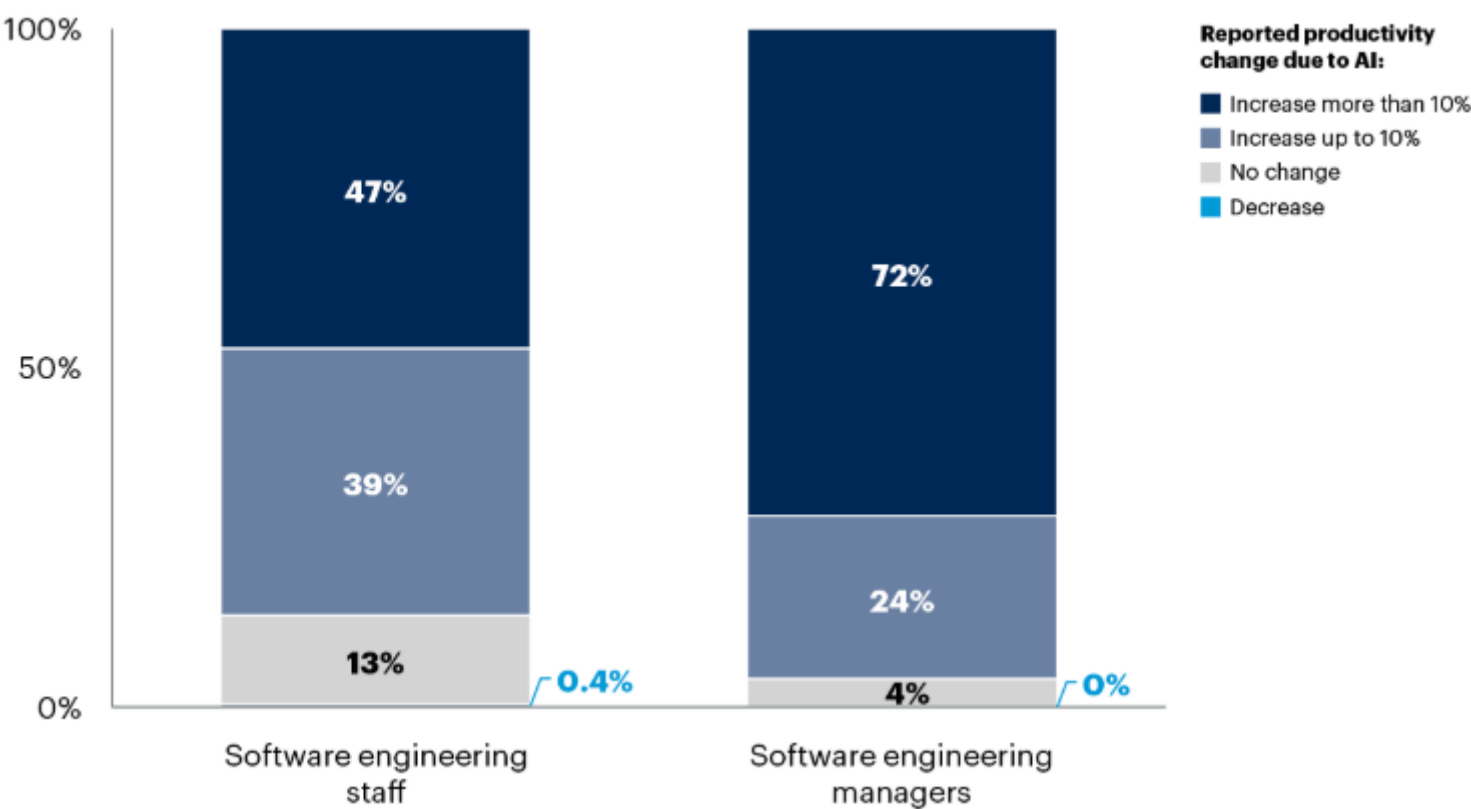
Average 10% cycle time gains. Variables seem to be:

1. The skills/experience paradox: productivity highly contingent on existing expertise.
2. Models do not help with company-specific business logic.
3. Rework fixing emitted code (vulnerabilities, hallucinations, inefficiencies, not adhering to design standards)
4. Downstream bottlenecks, such as Code Review.
5. Models not competent in the organization's language ecosystem. (e.g. legacy, niche)



Manager vs Staff Perception of the Impact of AI on Productivity

Percentage of Respondents



n= 1,653 Software Engineering Staff from 31 Organizations | 400 Software Engineering Managers
Source: Gartner Developer Experience Assessment Survey and 2024 Developer Productivity and Leadership Survey

Time Savings Through AI Coding Assistants

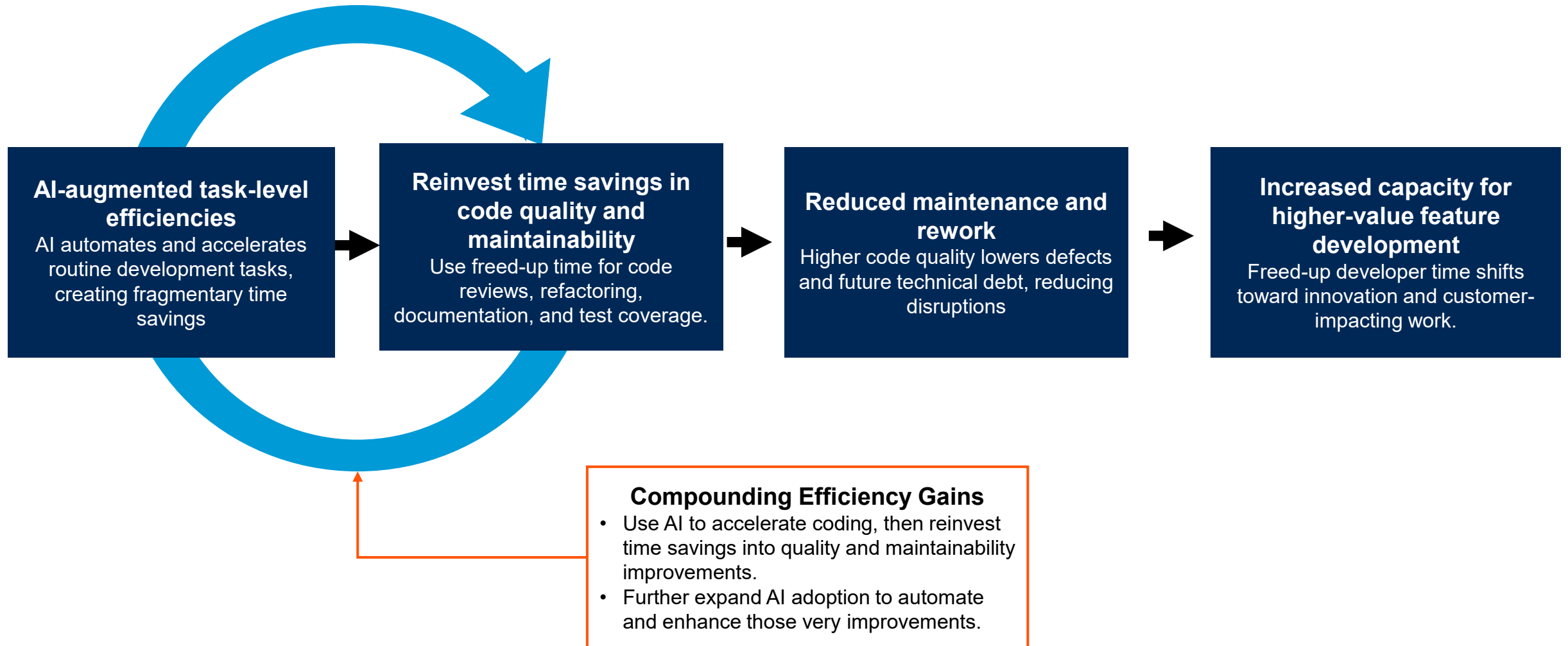


Make quality the cornerstone of your productivity strategy.

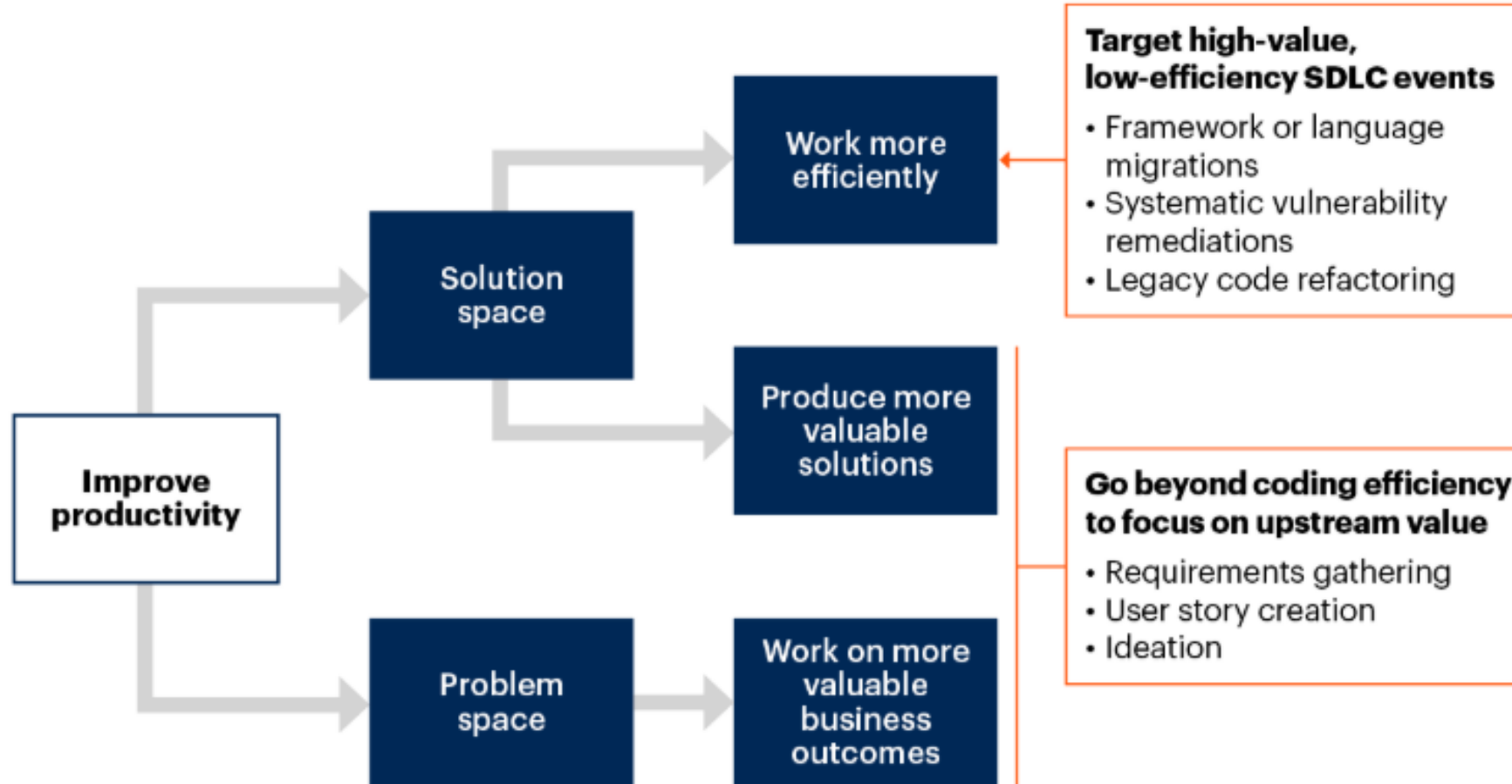


Channel time savings into improving quality to expand team capacity for high-value work.

Compounding Effect of AI Productivity Gains in the SDLC



Pathways to SDLC Productivity

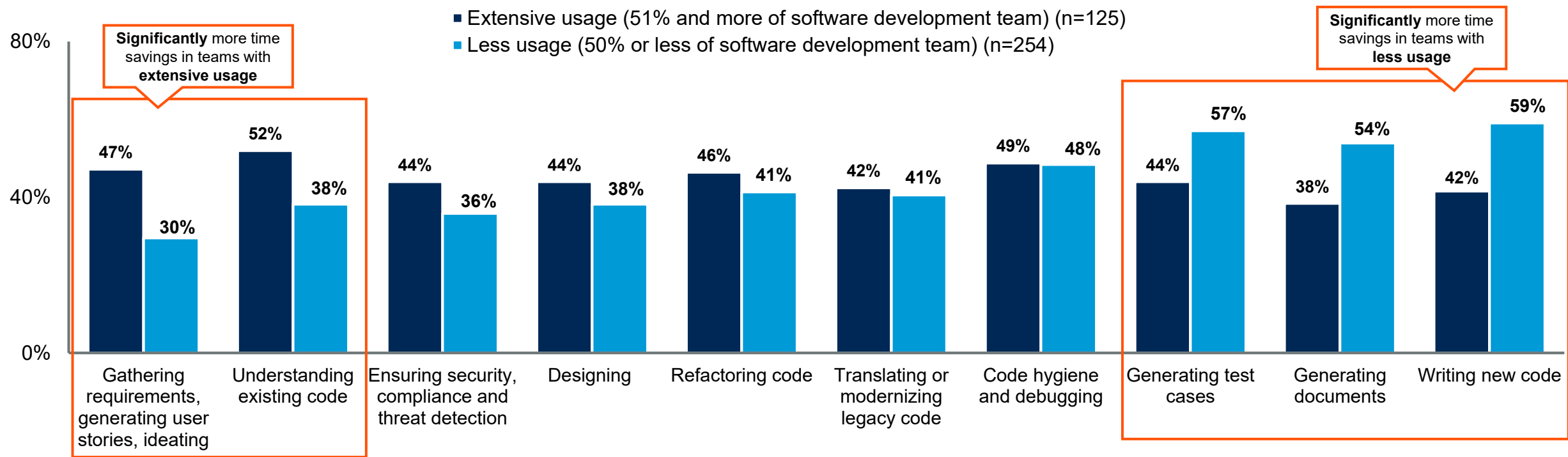


Source: Gartner
827469_C

RESTRICTED

Most prominent time savings observed significantly differ across teams that extensively use AI tools to augment workflows and teams with less usage

Software Development Stages with Maximum Time Savings from Using AI (Sum of Top 5 Ranks)
By Proportion of Teams using AI Tools to Augment Software Engineering Workflows



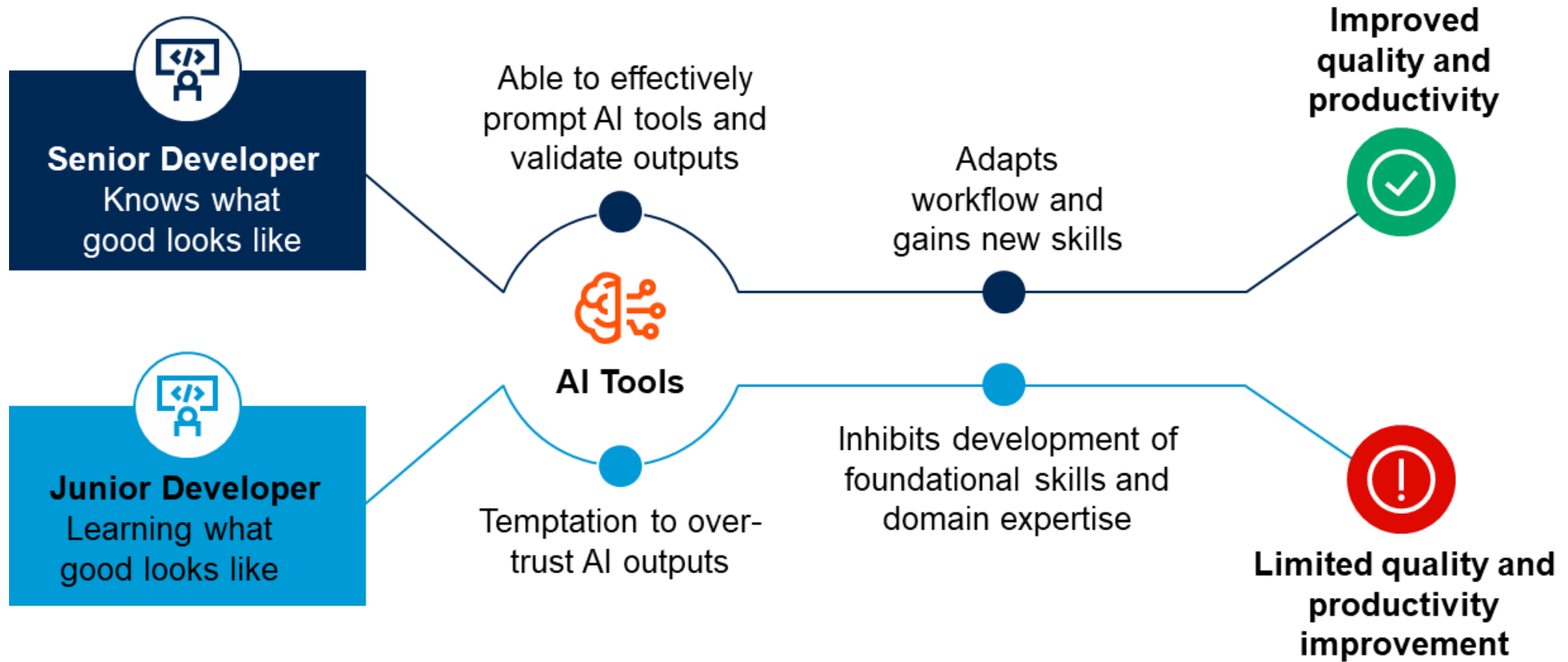
n varies; Respondents with Software development teams using AI tools to augment software engineering workflows (Q05_1), excluding Don't know
Q06B: In which parts of the software development lifecycle have you observed the biggest time savings from using AI (e.g., AI tools, AI agents, etc.)?
Q05_1: What percentage of your software development teams are... using AI tools to augment software engineering workflows (e.g., AI code assistants, AI testing tools, or design-to-code tools)?
Source: Gartner Software Engineering Survey for 2025
ID:



It's not just about WHAT tools you are using or WHAT you are using them for.

It's also about WHO is using them.

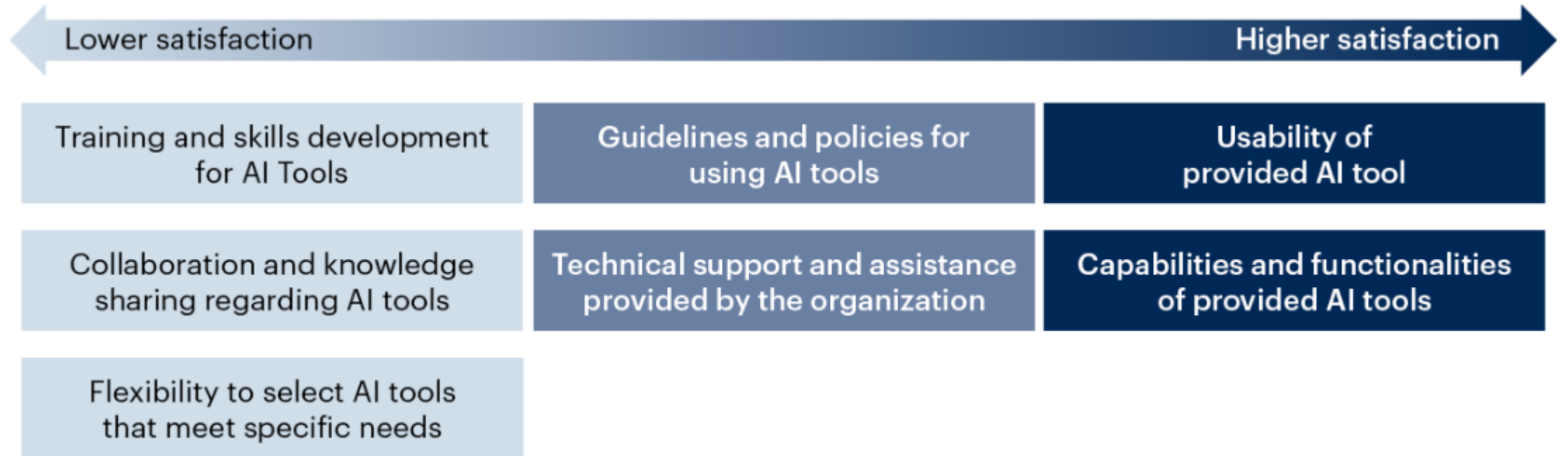
The Differentiated Impact of Generative AI on Software Engineers



Source: [AI Will Not Replace Software Engineers \(and May, in Fact, Require More\)](#)

RESTRICTED

Satisfaction with Using AI Tools/Capabilities

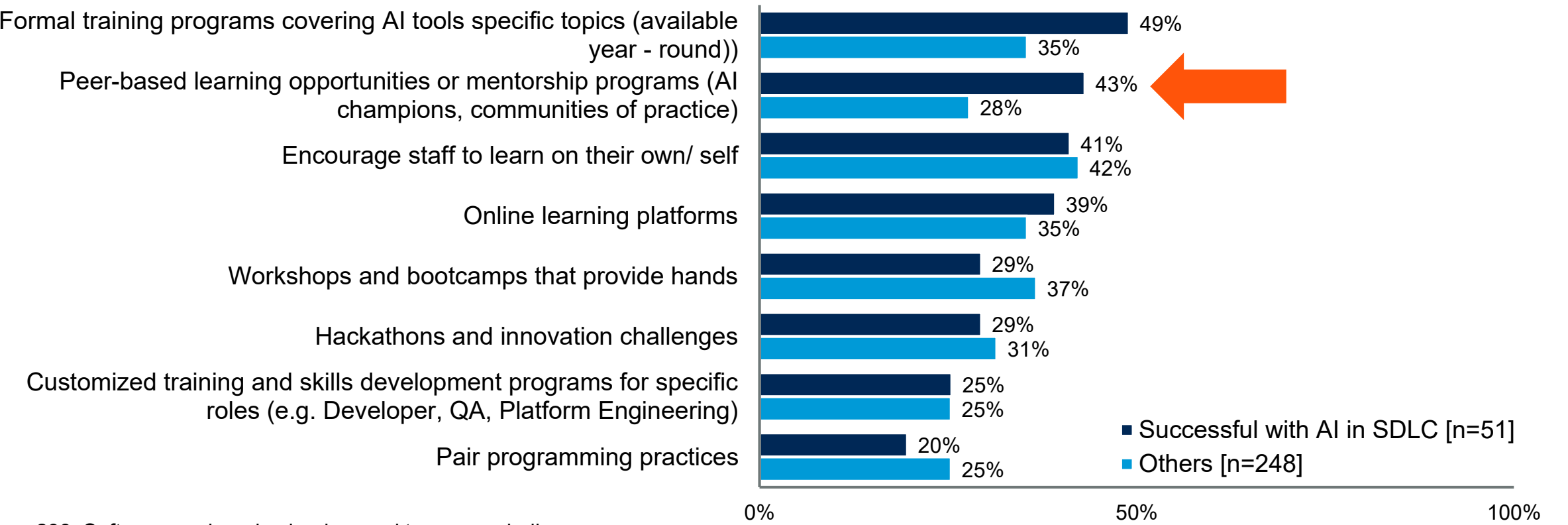


n= 1,653 Software Development Team Members from 31 Organizations | This question was only asked to respondents who indicated using AI tools/capabilities for at least one software development activity
Q: Please rate your satisfaction with the following aspects of AI tools/capabilities for software engineering work at your organization.
Source: Gartner Developer Experience Assessment Survey

Respondents from successful organizations indicate greater adoption of peer learning opportunities and mentorship programs

Strategies To Address AI Skills Gaps – by success with AI in SDLC

Sum of Top 3 Ranks



n = 299; Software engineering leaders and teams, excluding unsure

C04: Which strategies have you adopted to address skills gaps regarding use of AI tools in the SDLC in your software engineering function?

Q01, Q02: As a result of using AI tools in the Software Development Lifecycle (SDLC) within your software engineering function, please indicate any changes to the following metrics.

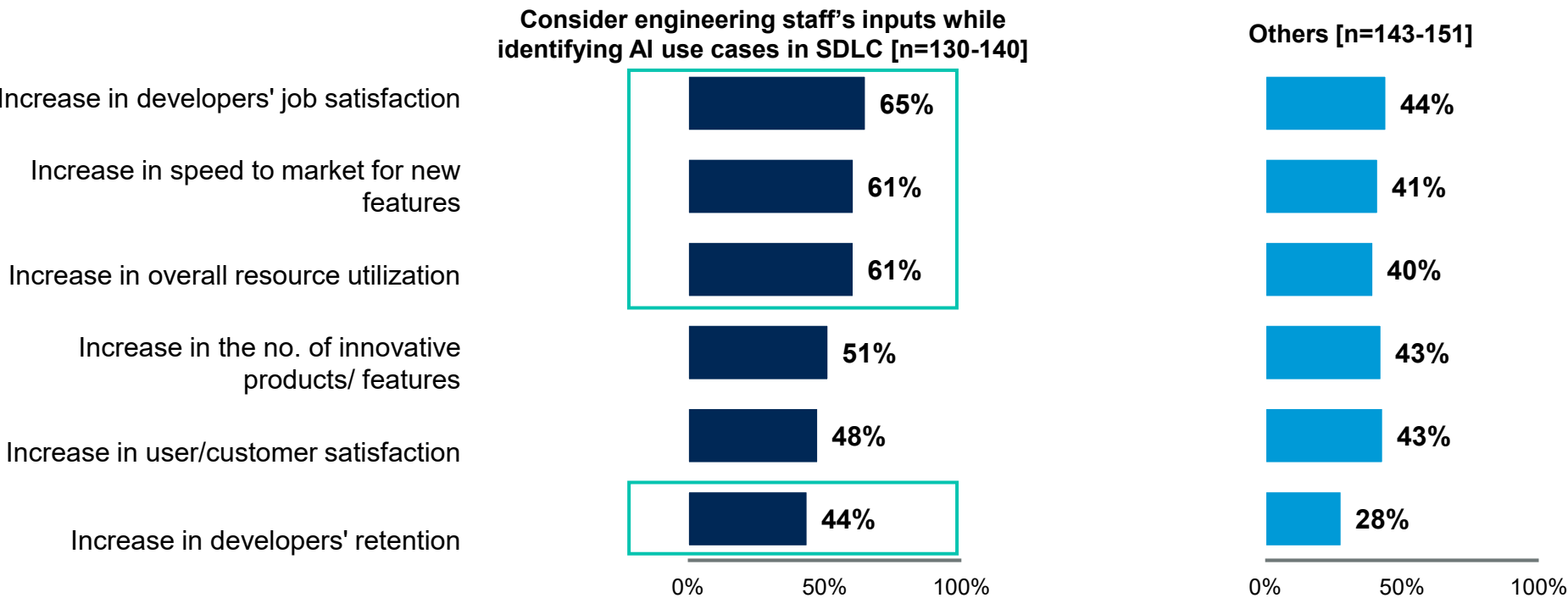
* Organizations that achieve success with AI in the SDLC are those that report an average score of 6 or higher on productivity, value, quality, cost, and developer experience metrics in Q01 and Q02

Source: 2025 Gartner AI in Software Engineering Survey

ID: RESTRICTED

Software engineering functions that offer flexibility and autonomy to staff to choose AI tools are more likely to see improvements in most business outcomes

Organizations that are successful with AI on below areas – By staff’s flexibility and autonomy in selecting tools
Percentage of respondents selecting “somewhat/significantly improved(increased for 11-25% or more)”



n varies; Software engineering leaders and teams, excluding Unsure

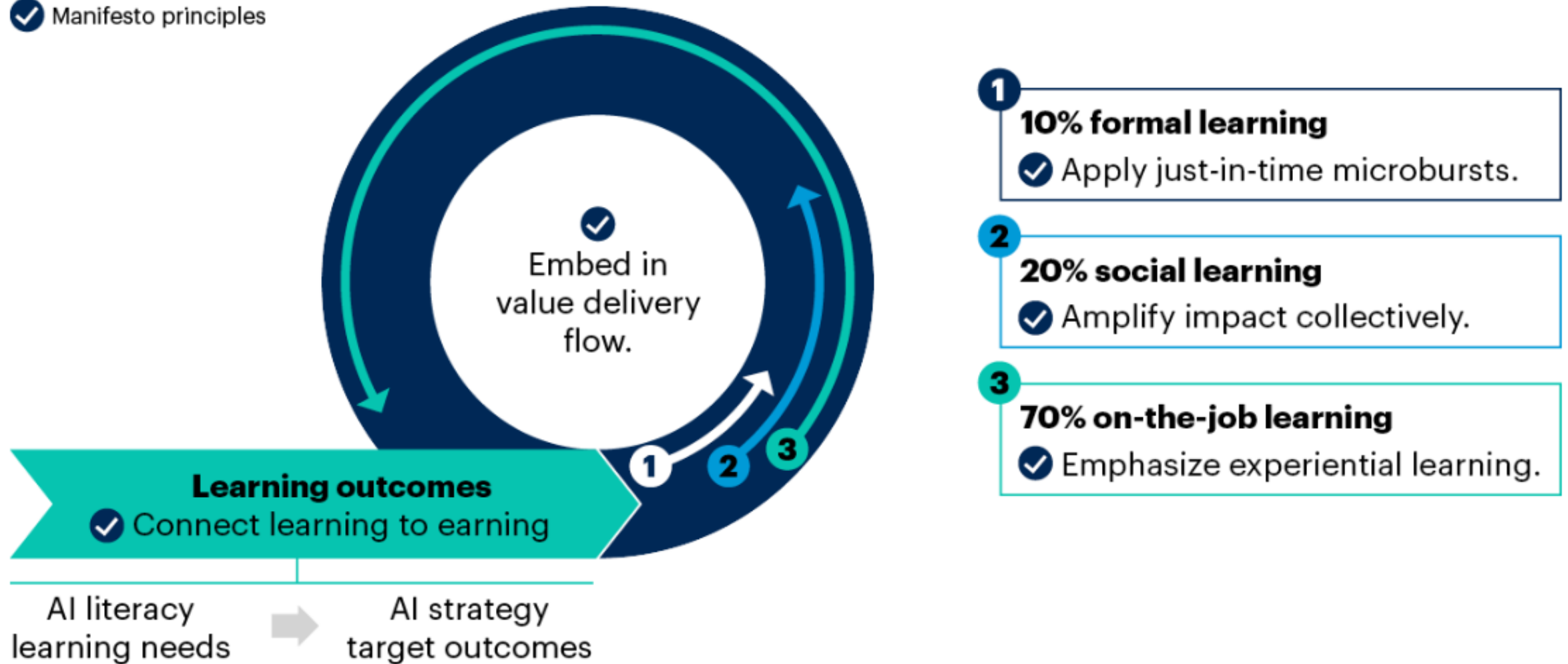
Q02: As a result of using AI tools in the Software Development Lifecycle (SDLC) within your software engineering function, please indicate any changes to the following metrics.
C09: Please state your level of agreement with the following statements regarding the use of AI tools in the SDLC within the software engineering function.: Our software engineering function ...
Source: 2025 Gartner AI in Software Engineering Survey
*Note: only include outcomes with sufficient sample sizes

Significantly more % of respondents from orgs providing staff the flexibility and autonomy than the others



Embedded Learning in Value Delivery Activities

✓ Manifesto principles



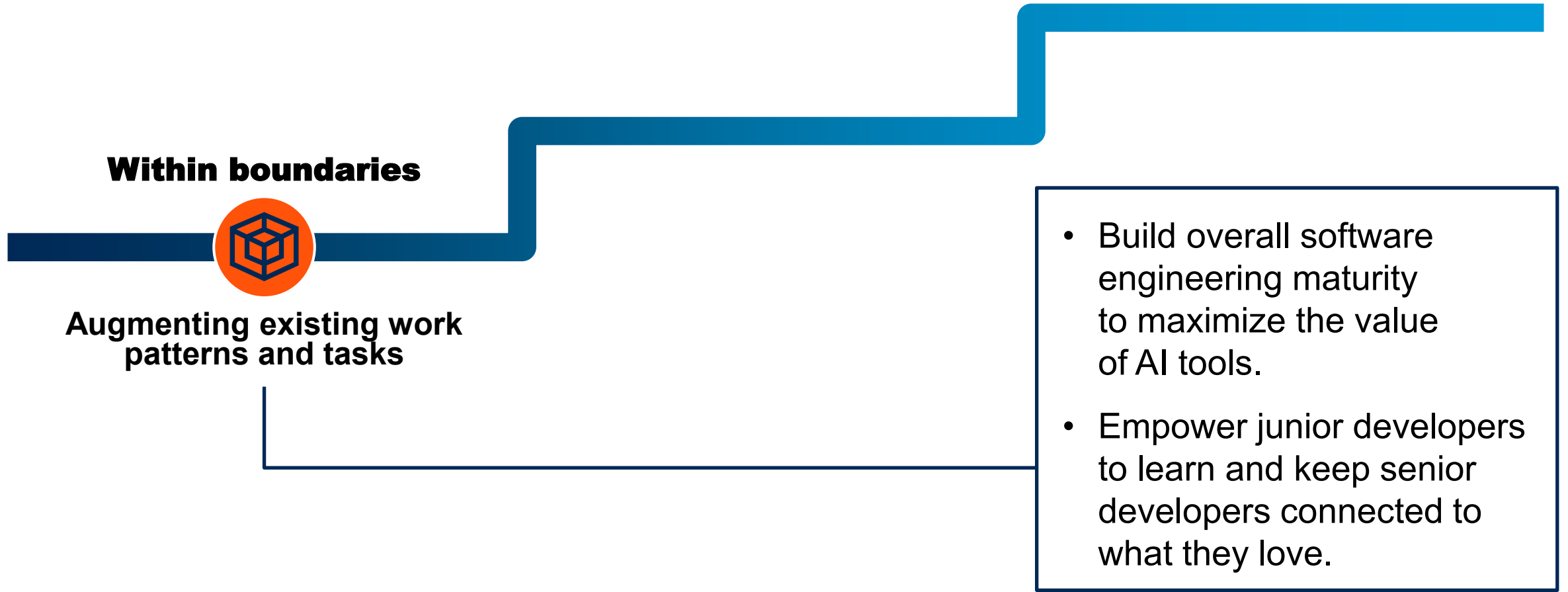
Source: Gartner

RESTRICTED

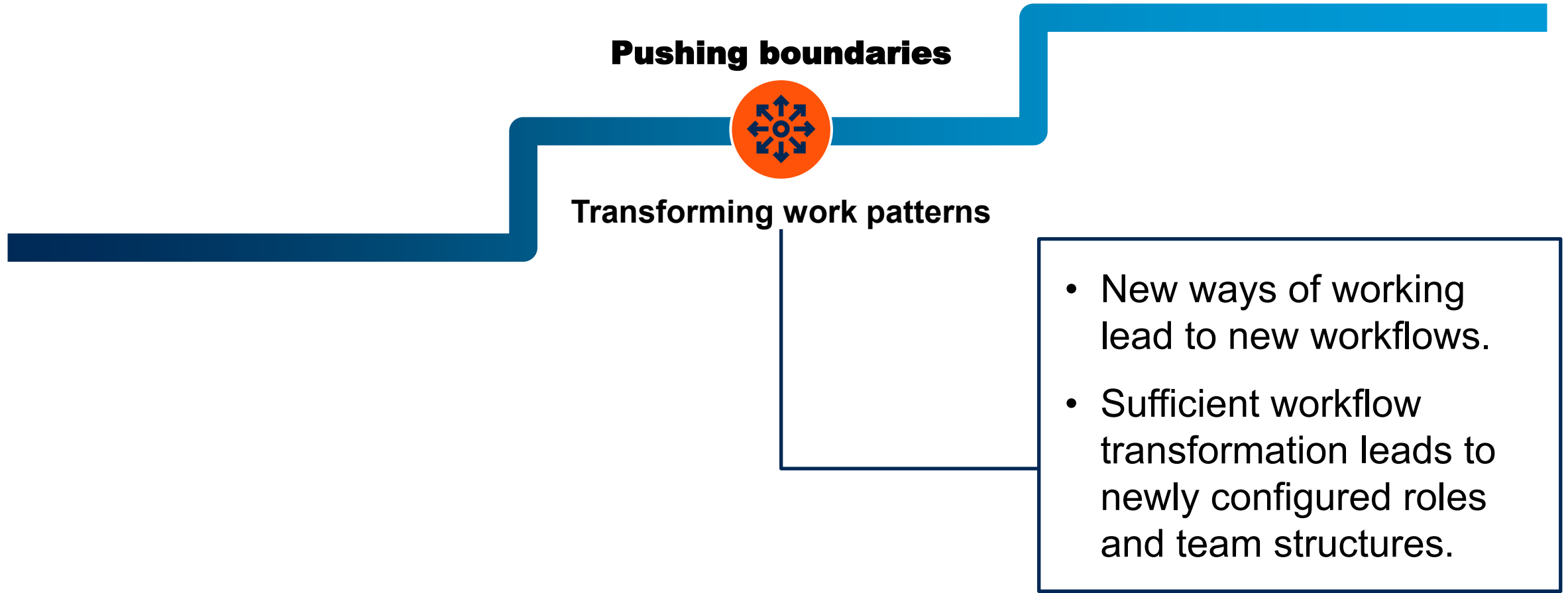


Organizations must treat **change as an investment, with associated costs and benefits, rather than something that developers are expected to absorb without consequence.**

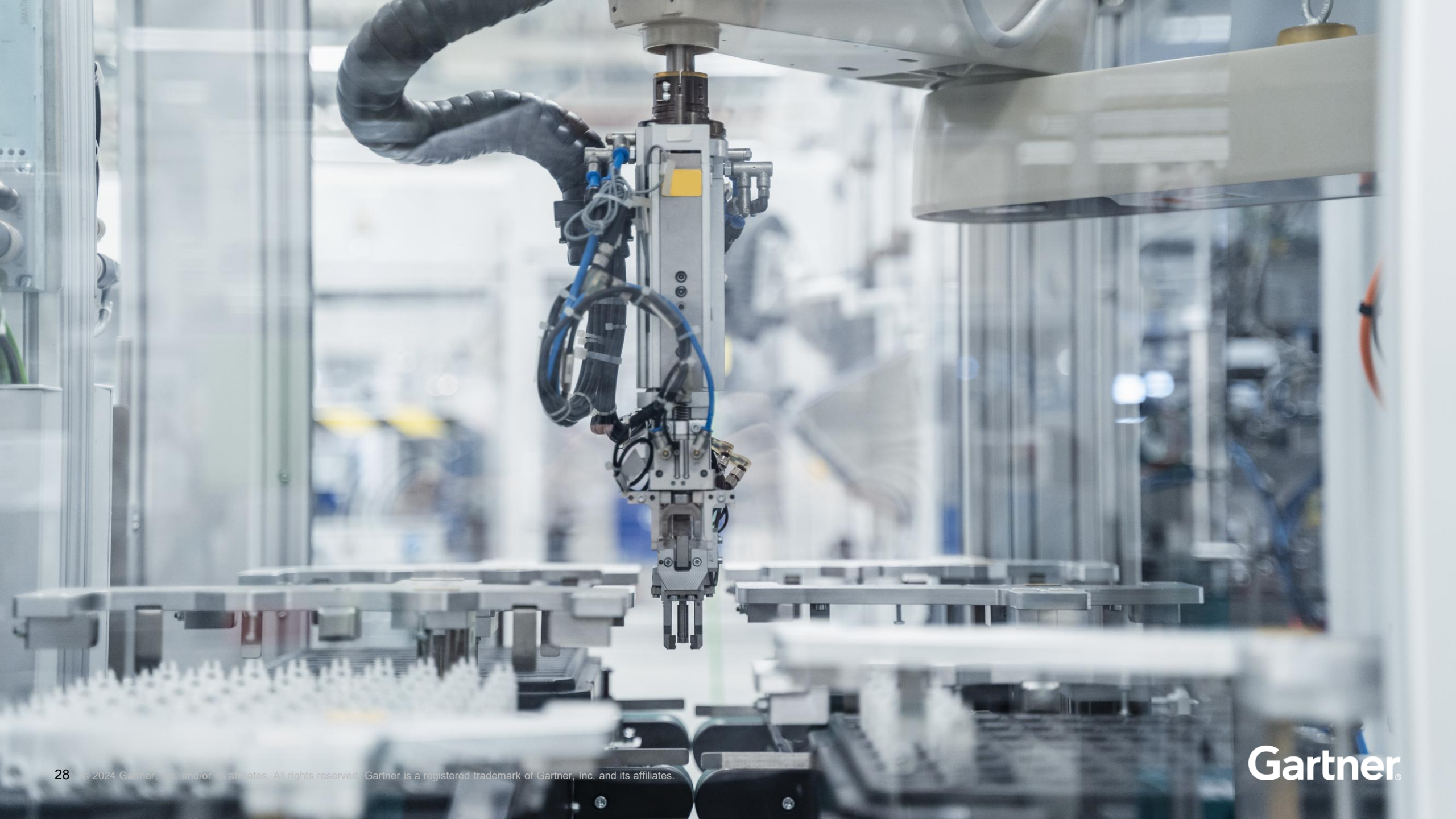
Within Boundaries



Pushing Boundaries

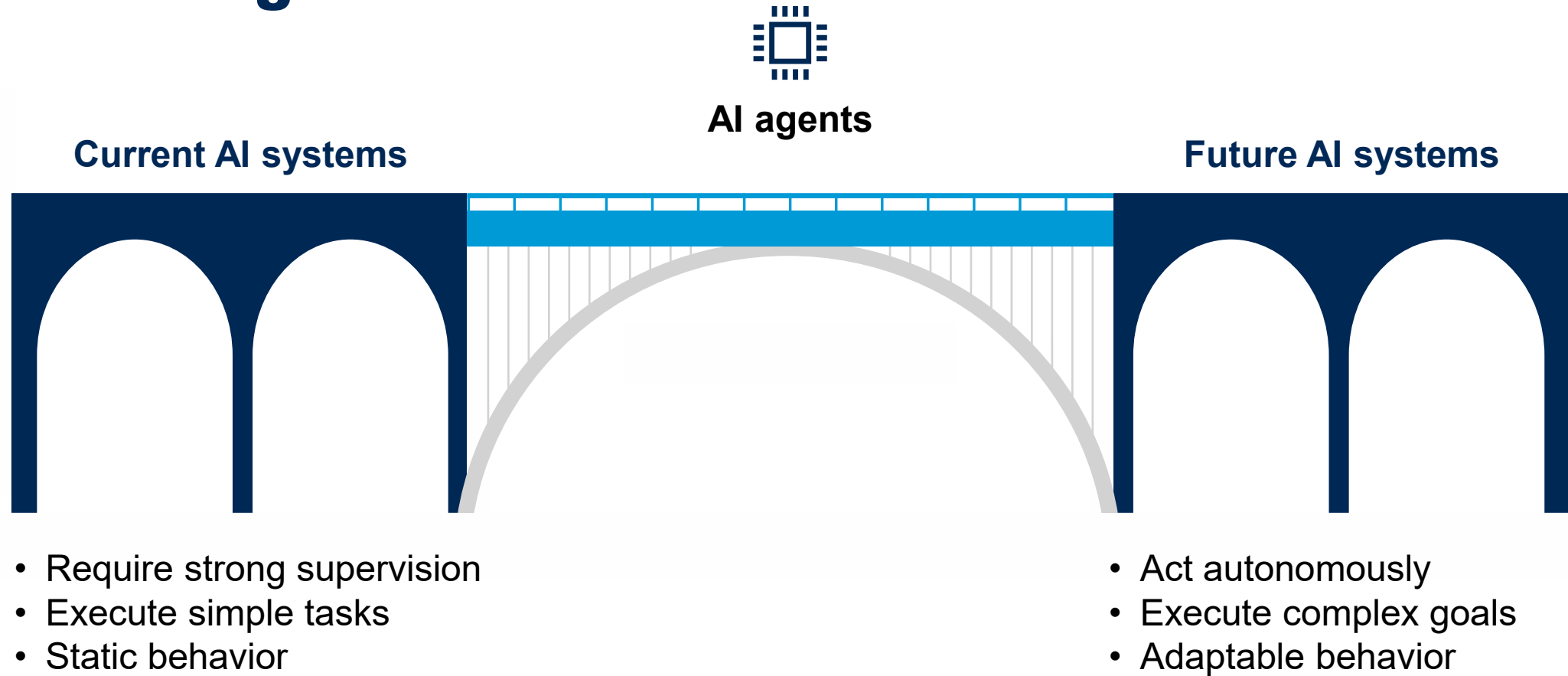




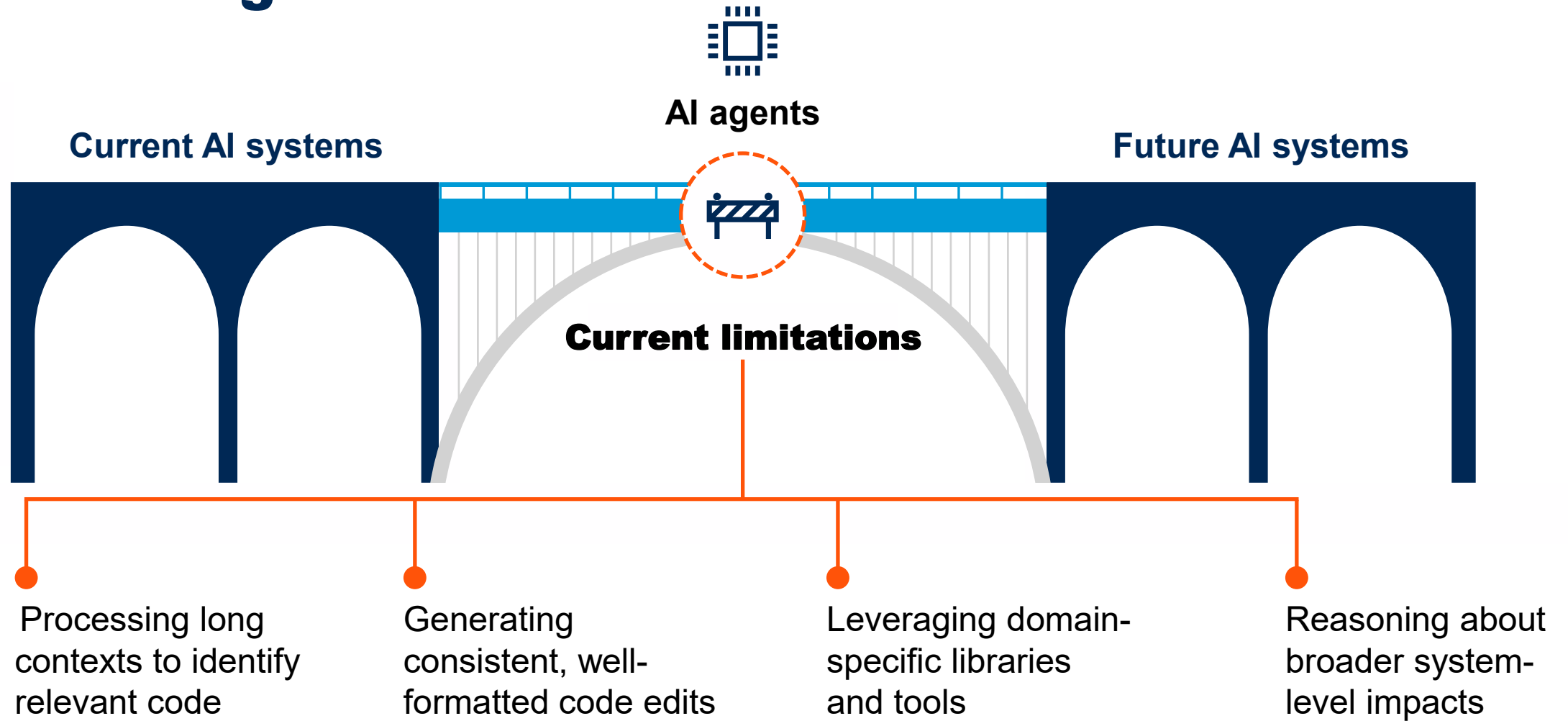




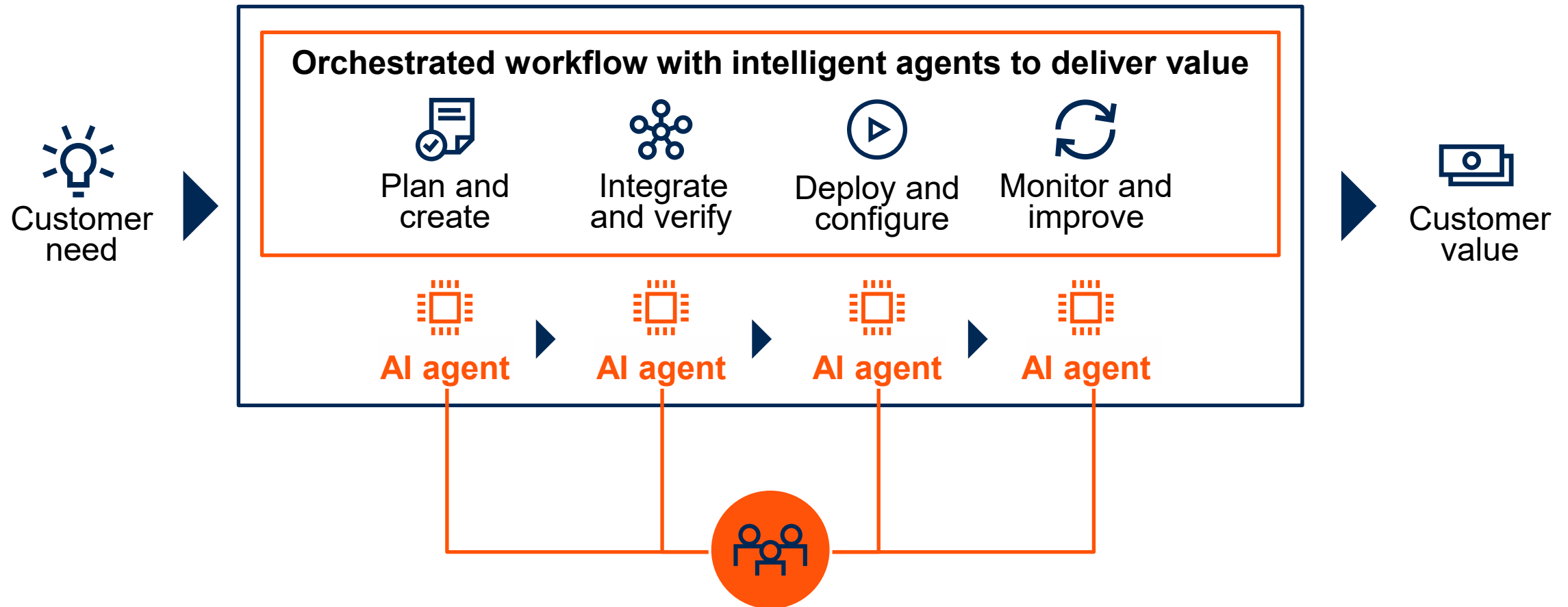
AI Agents Will Bridge the Gap From Augmentation to Offloading



AI Agents Will Bridge the Gap From Augmentation to Offloading



AI-Native Software Engineering



AI-native software engineers

Assess business need and customer feedback, frame and assign tasks, supply context, review and approve

Implications – Articulation and Orchestration



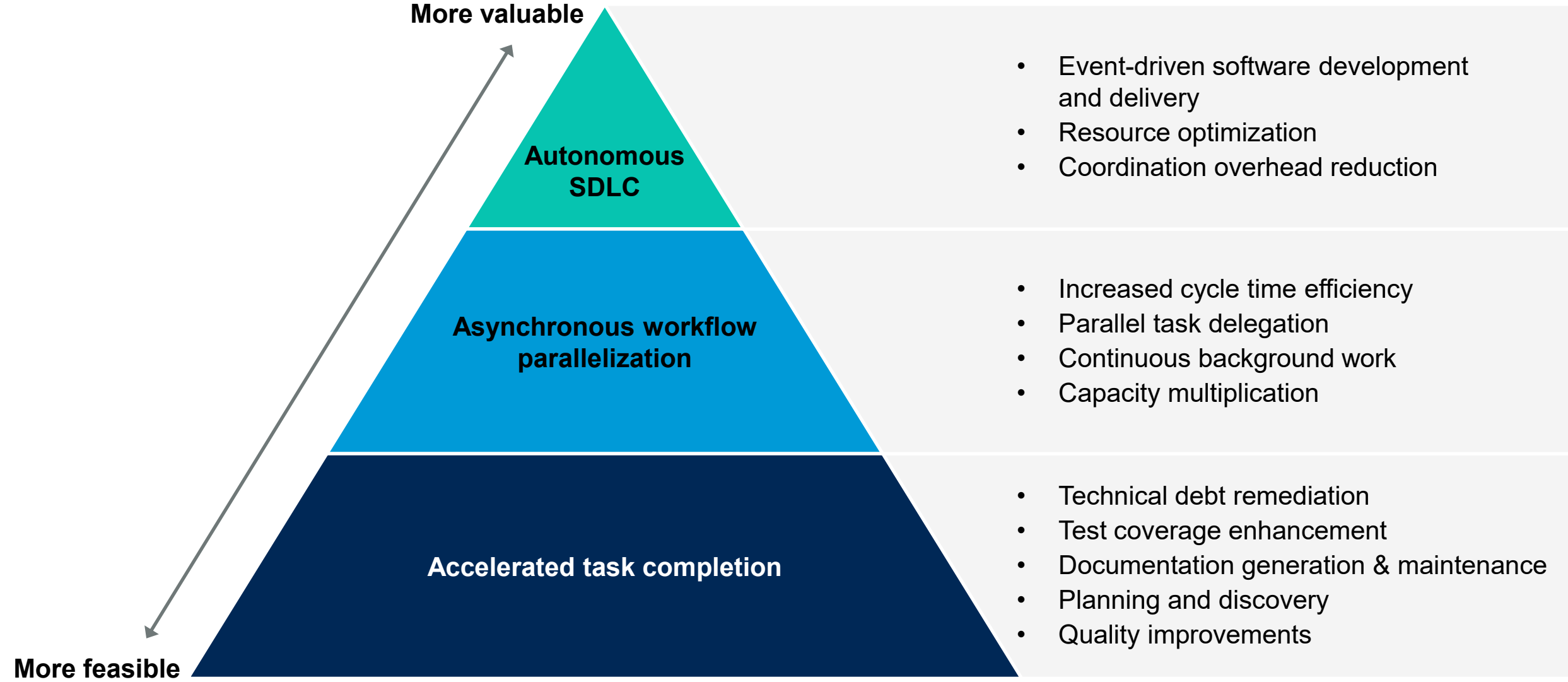
Being **articulate** becomes a ‘technical’ skill, not just a ‘soft’ skill



Developers as **conductors** orchestrating work

RESTRICTED

Three Levels of Software Engineering Agent Benefits



Software Engineering Agent Risks May Offset Productivity Gains

Illustrative

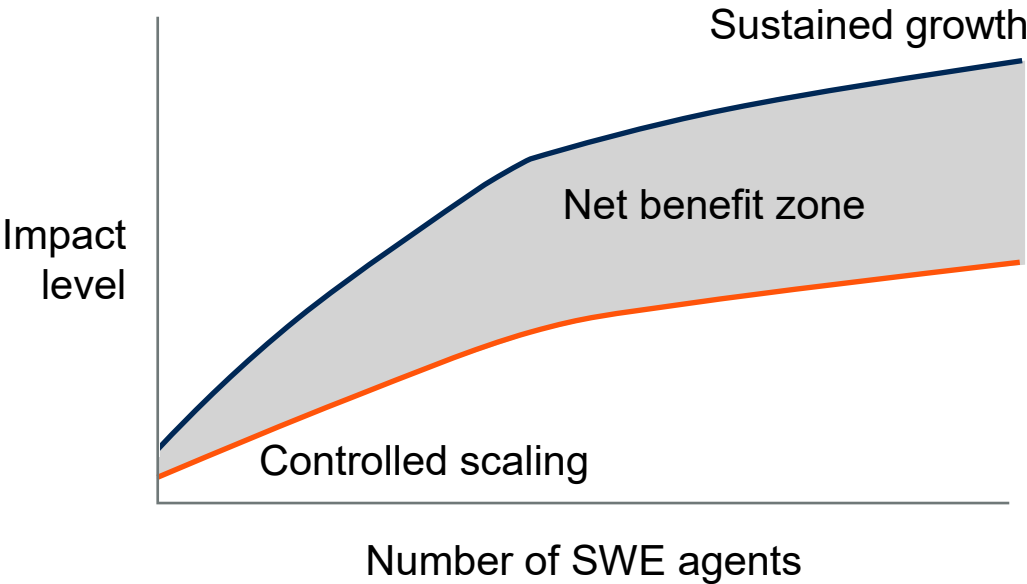
— Productivity gains — Organizational burdens



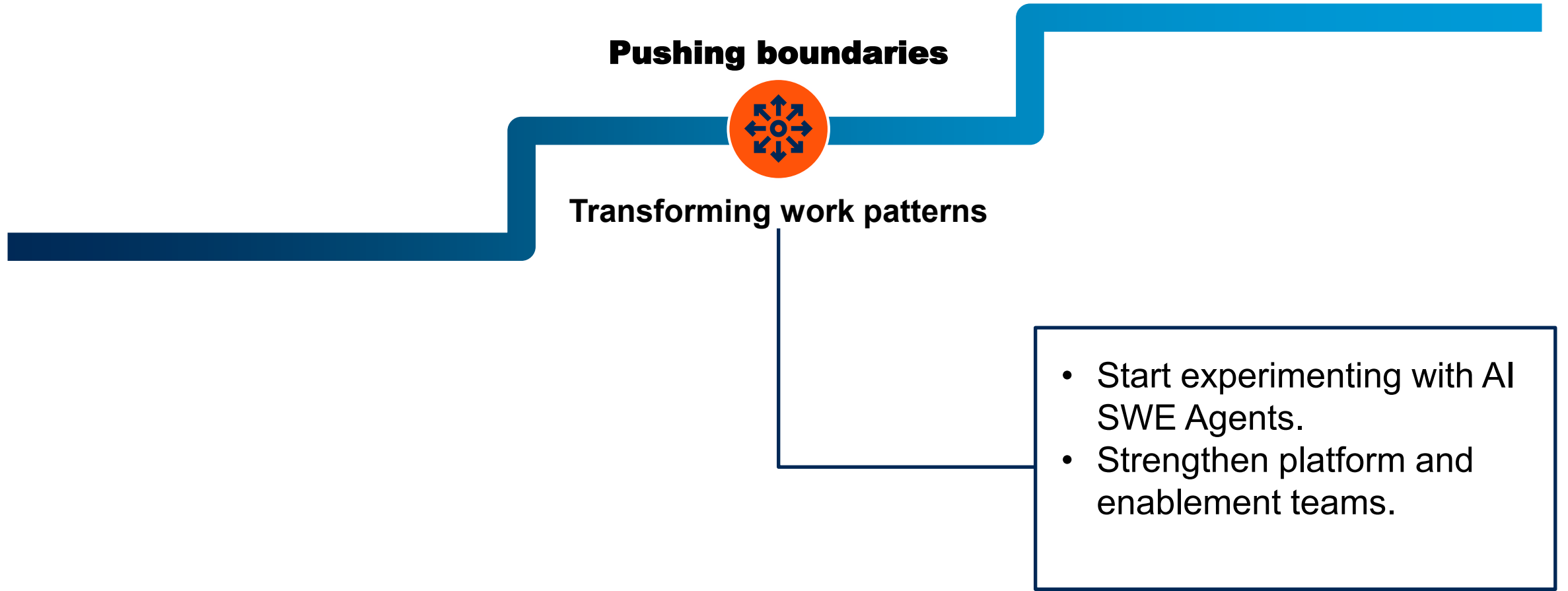
Poorly managed implementation



Well-managed implementation

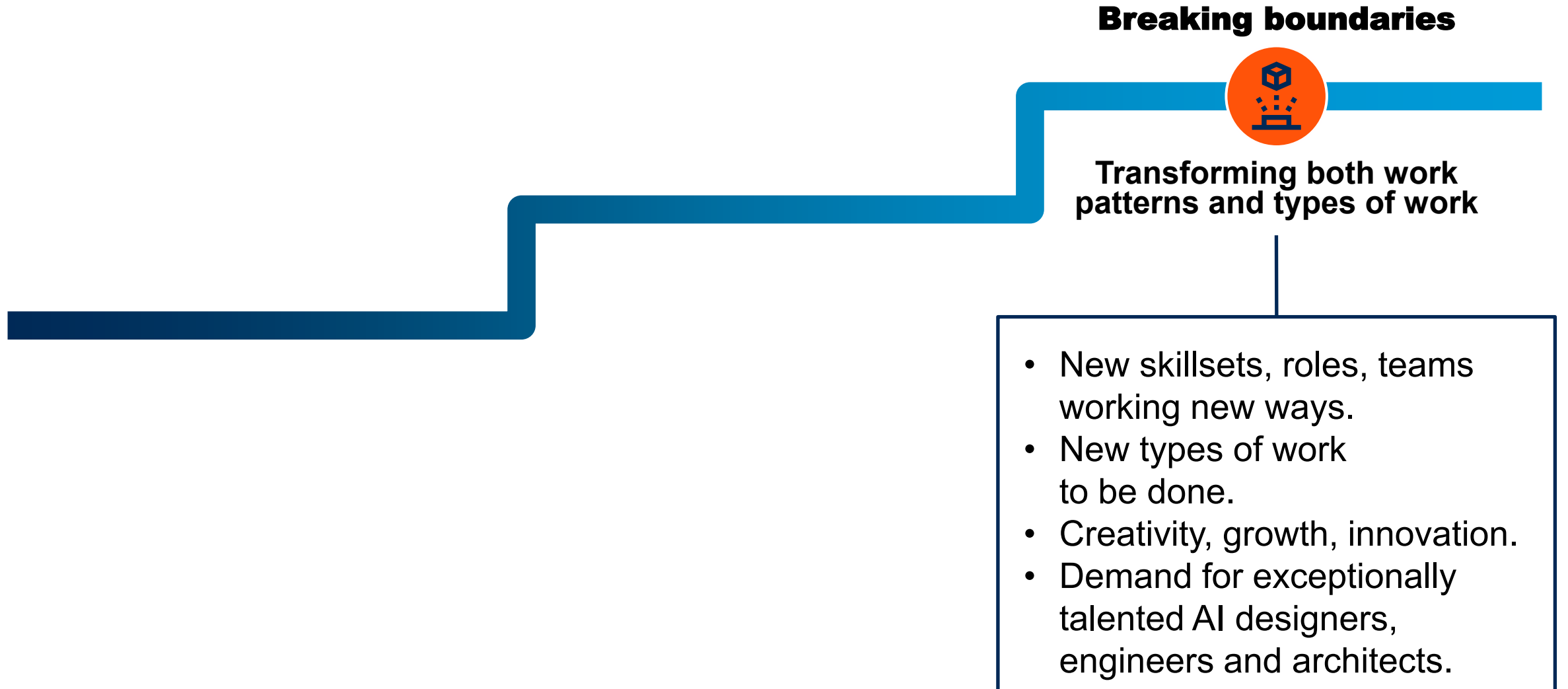


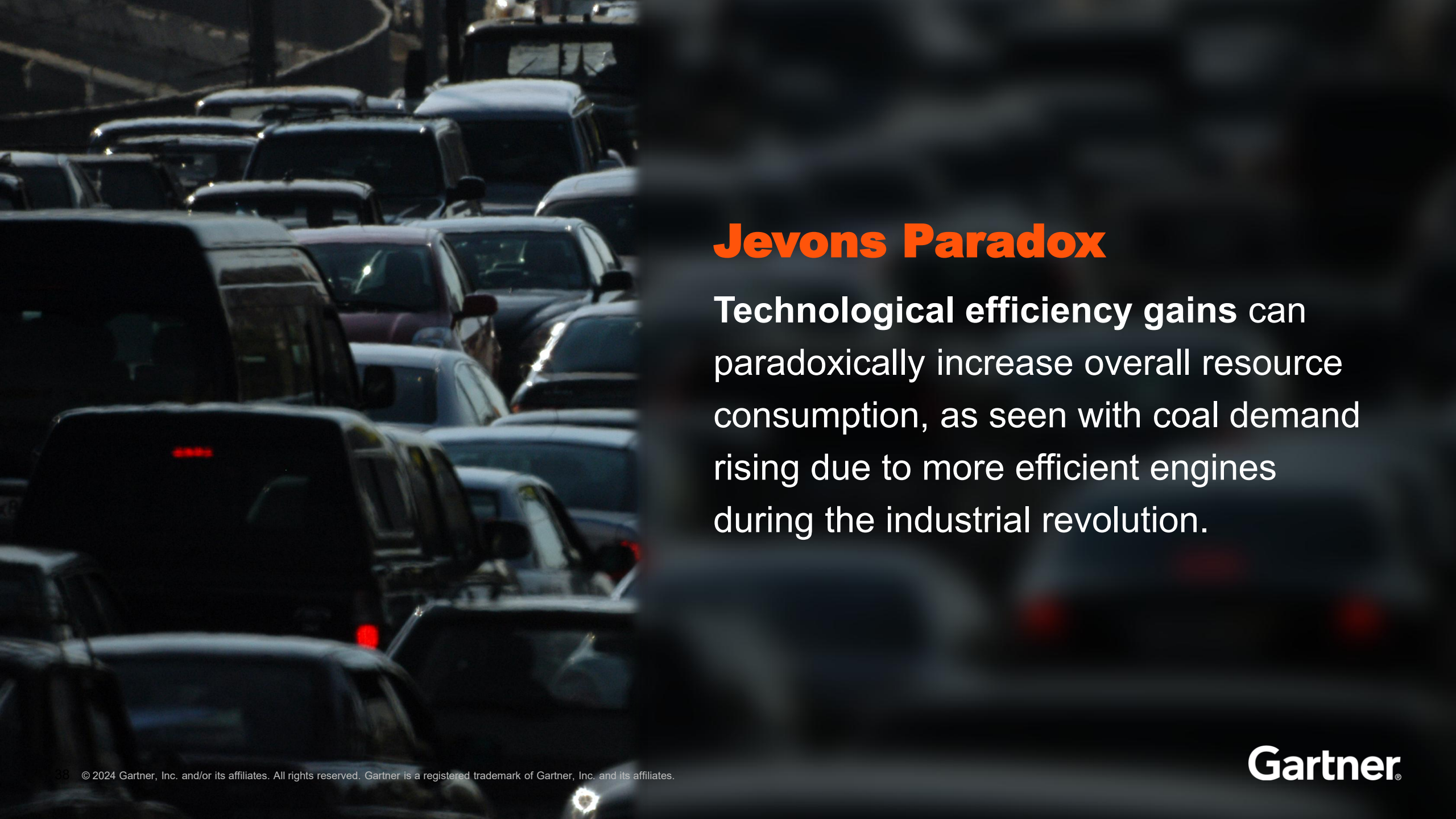
Pushing Boundaries



AI Disruption Spectrum

Anticipate degree of work disruption of AI investments



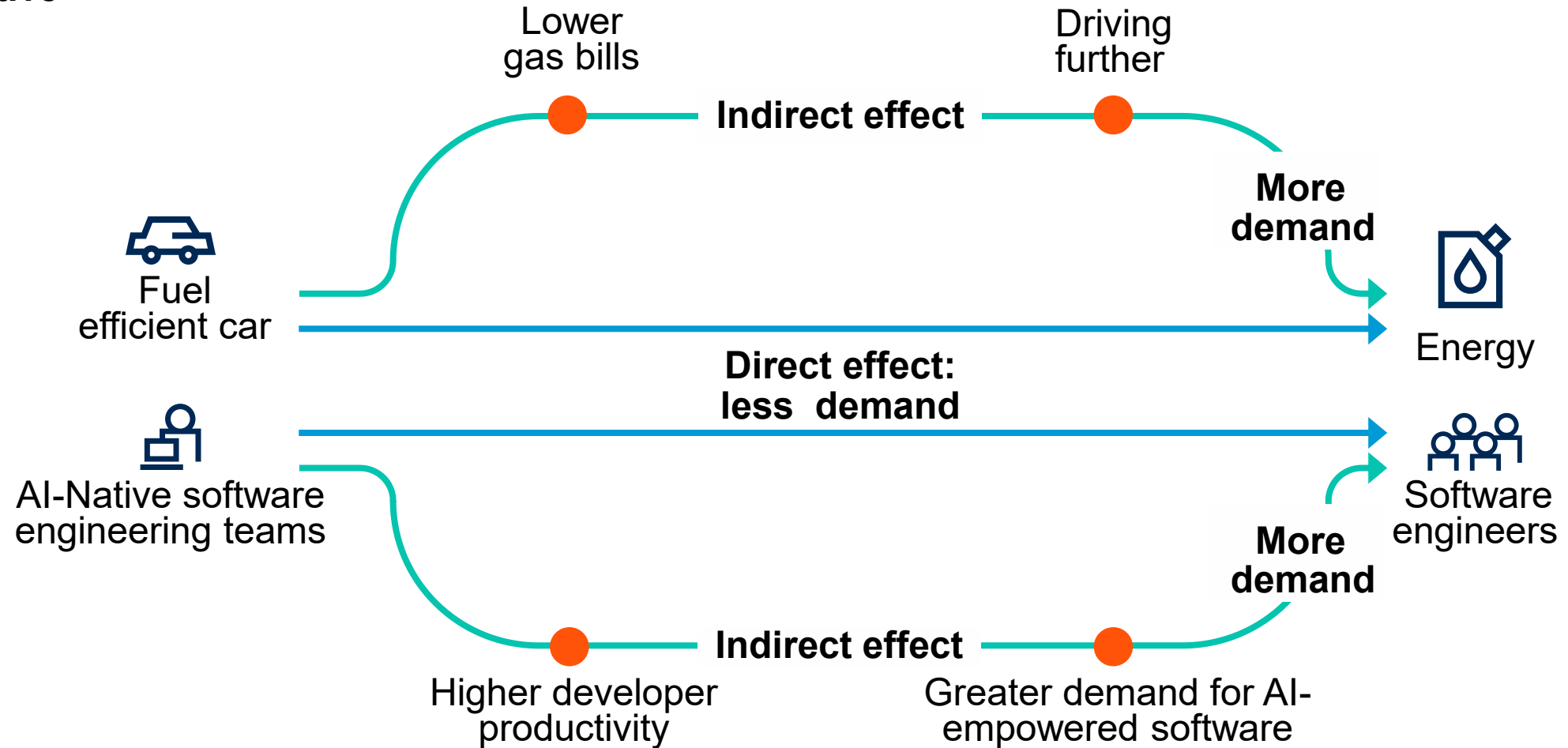
A photograph of a severe traffic jam on a multi-lane highway. Numerous cars are packed closely together, filling the frame from the foreground into the distance. The scene is captured from a slightly elevated perspective, showing the backs of many vehicles. The lighting suggests it might be late afternoon or early morning, with some cars' taillights visible. The overall image serves as a visual metaphor for the Jevons Paradox, where technological progress leads to increased resource consumption.

Jevons Paradox

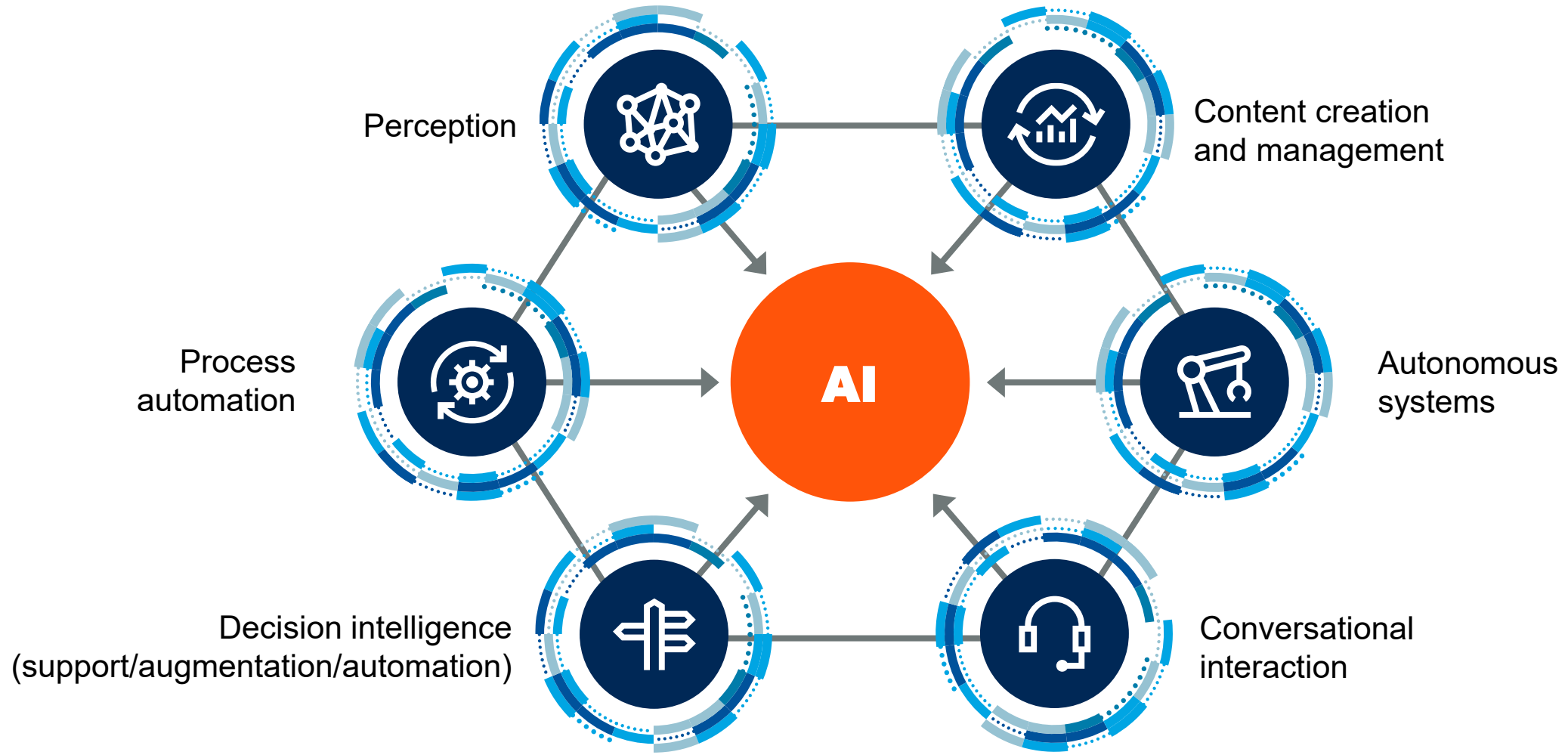
Technological efficiency gains can paradoxically increase overall resource consumption, as seen with coal demand rising due to more efficient engines during the industrial revolution.

Jevons Paradox: Improved Efficiency Leads to Greater Demand

Illustrative



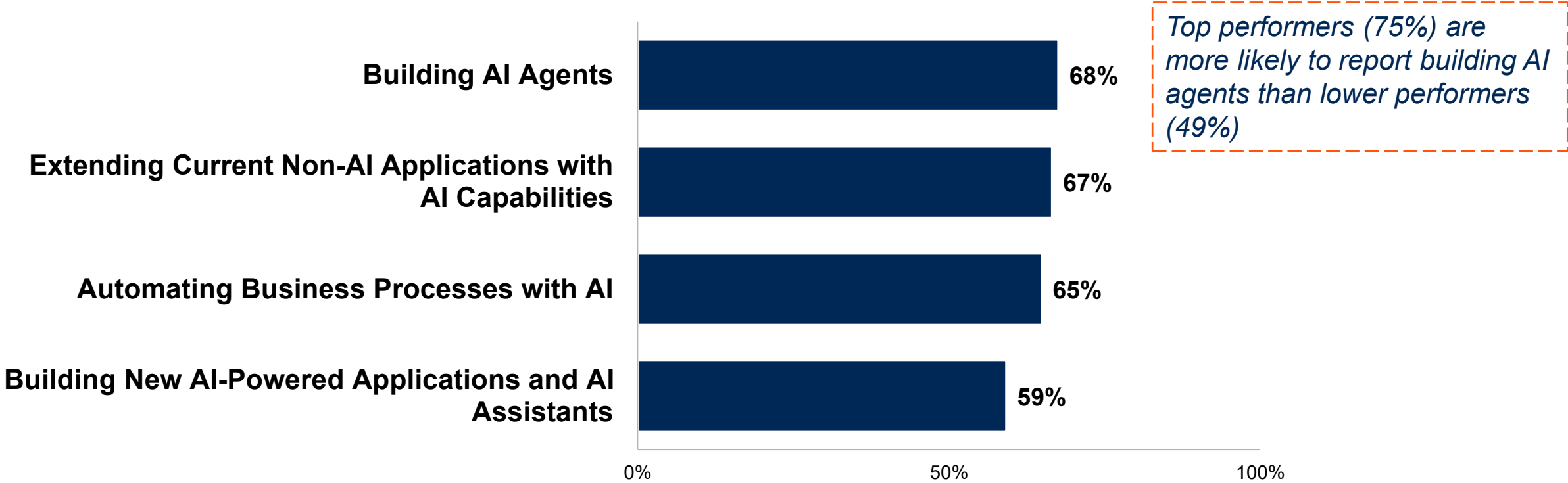
AI-Empowered Software Will Become Pervasive and Business-Critical



RESTRICTED

Majority report they are developing or have developed AI agents, especially among top performers

Types Of AI-Powered Solutions Multiple Responses

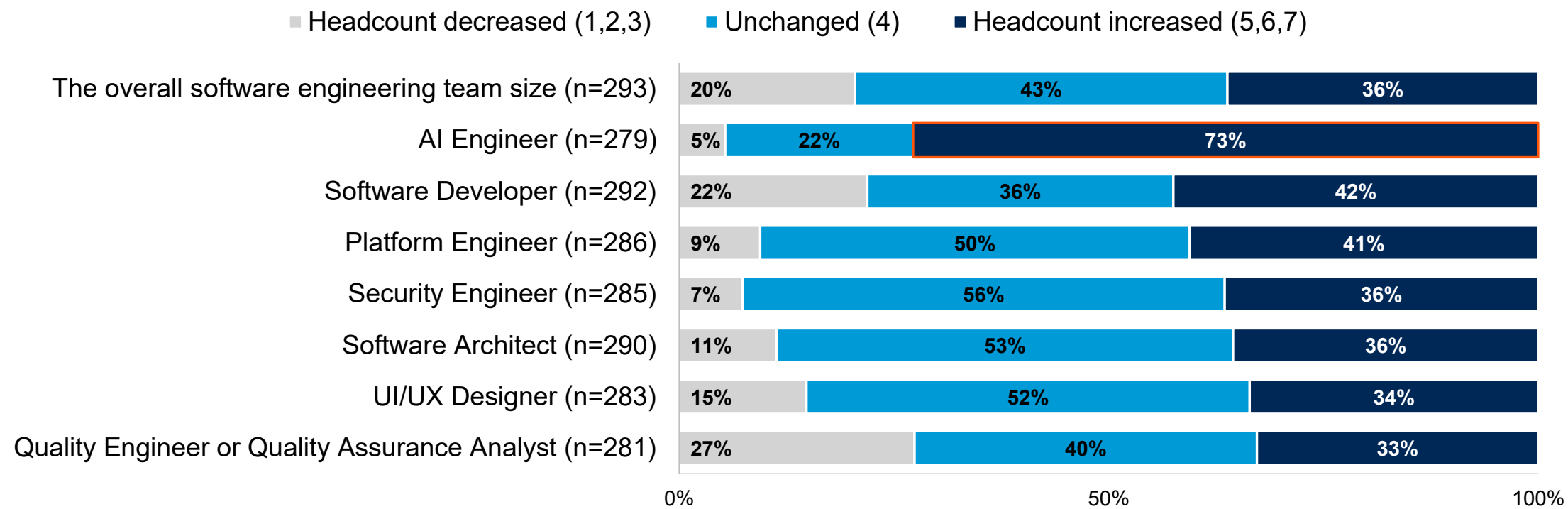


n = 299; Software engineering leaders and teams who have used AI tools in SDLC and **built AI-powered solutions**, excluding unsure
E02: What types of AI-powered solutions is your software engineering function currently developing or has already developed? (Multiple Responses Allowed)
Source: 2025 Gartner AI in Software Engineering Survey
ID:

AI Engineer Demand Rises with Increased Adoption of AI Tools

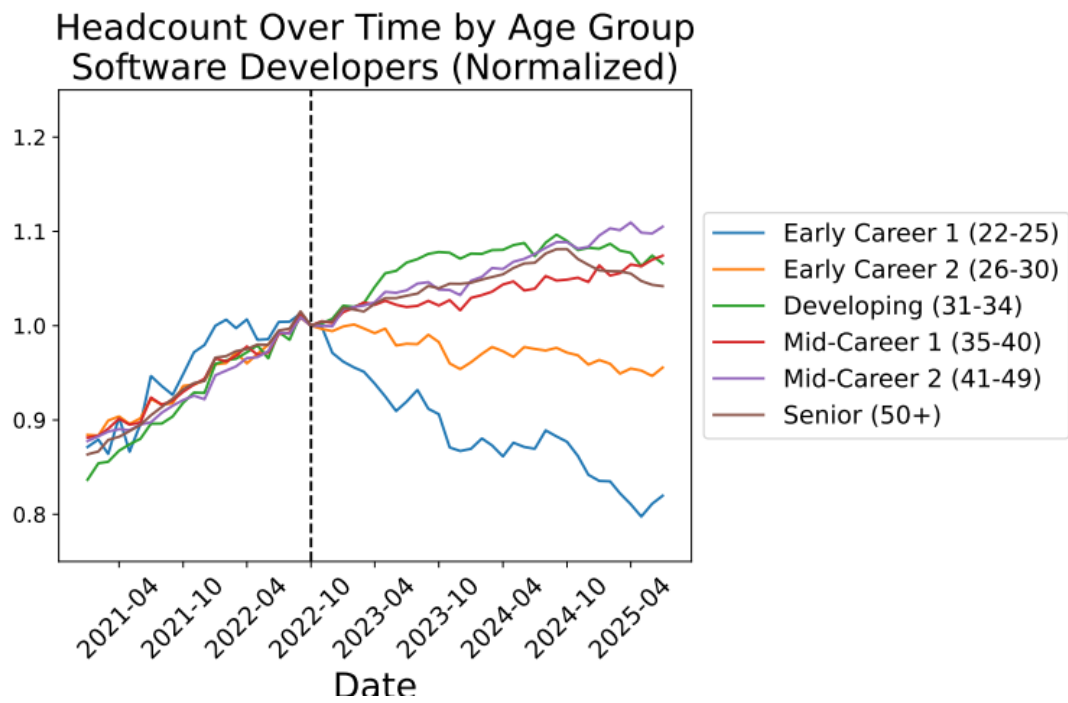
Change In Team Headcount Due To AI Adoption

1-Significantly decreased headcount (>25%) to 7-Significantly increased headcount (>25%)



n varies; Software engineering leaders and teams, excluding unsure or not applicable
C08: How has the headcount of the software engineering team changed as a result of AI tools' adoption in the SDLC?
Source: 2025 Gartner AI in Software Engineering Survey
ID:

Disproportionate Impact on Early Career Developers



Source:
https://digitaleconomy.stanford.edu/wp-content/uploads/2025/08/Canaries_BrynjolfssonChandarChen.pdf

Canaries in the Coal Mine? Six Facts about the Recent Employment Effects of Artificial Intelligence

Erik Brynjolfsson* Bharat Chandar† Ruyu Chen‡§¶

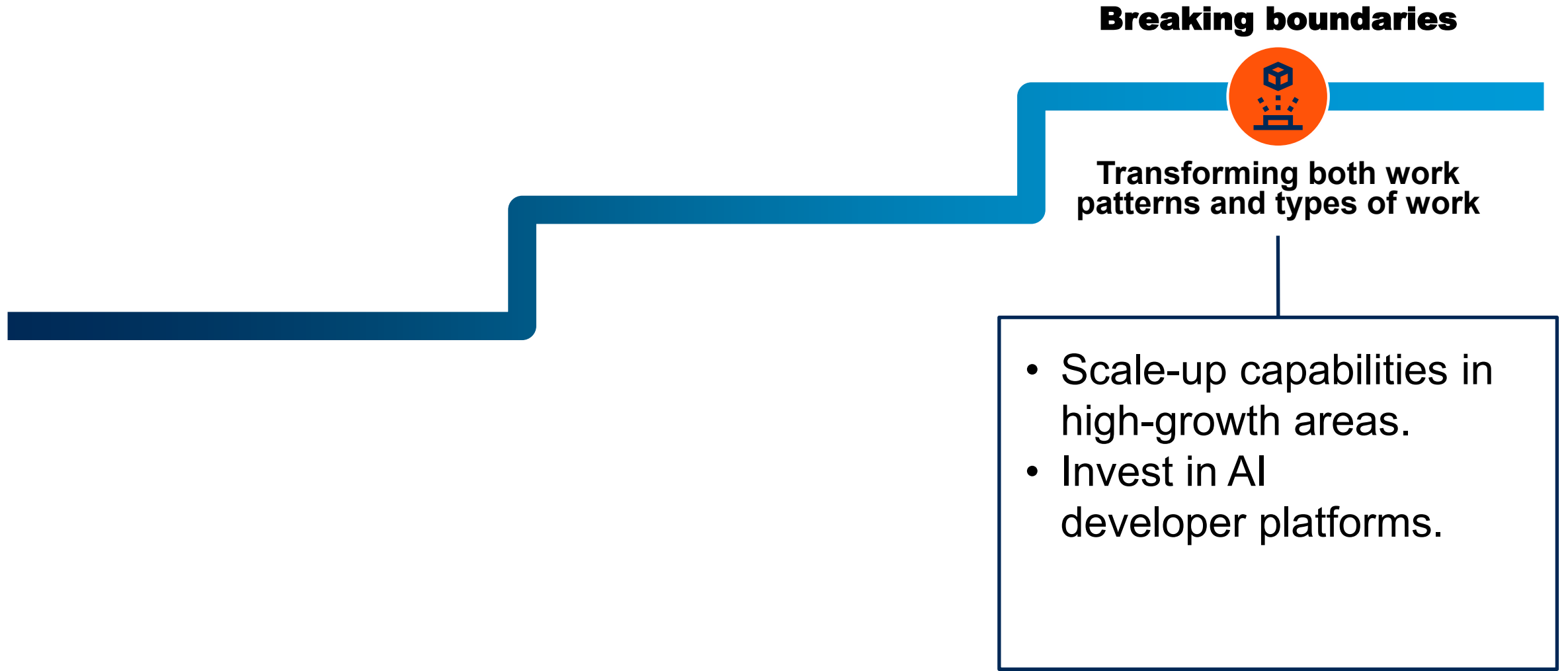
August 26, 2025



Organizations risk cannibalizing their future if they focus narrowly on AI-driven productivity gains in the short term at the expense of cultivating a pipeline of future expertise.

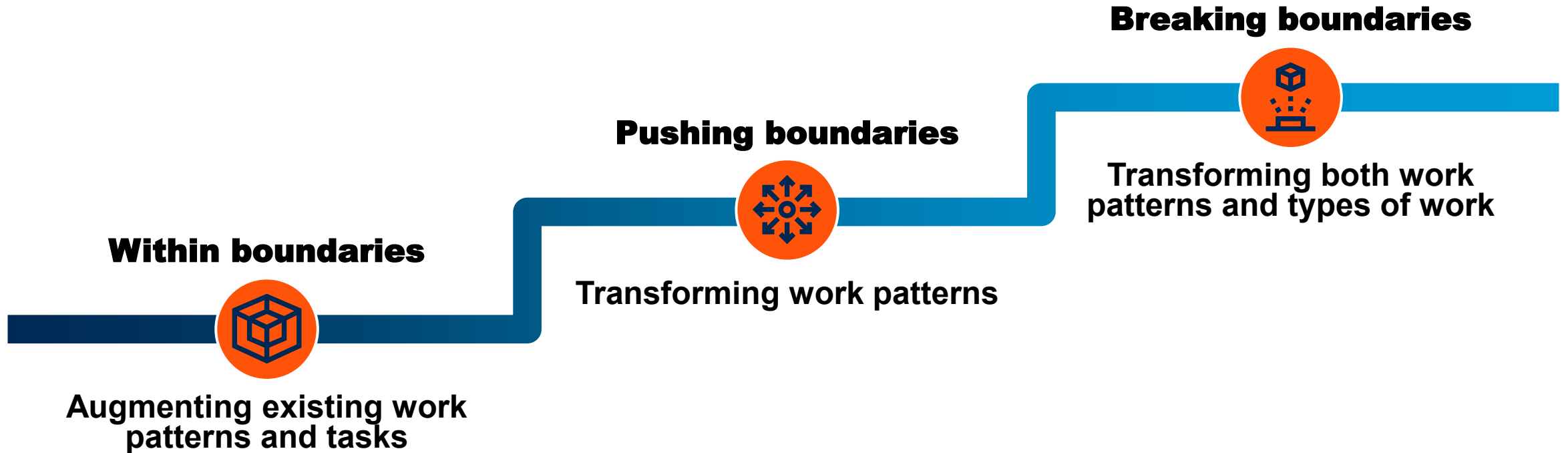
AI Disruption Spectrum

Anticipate degree of work disruption of AI investments



AI Disruption Spectrum

Anticipate degree of work disruption of AI investments





Generative AI is an earthquake that will power a tsunami of demand for highly skilled software engineers.