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Breaking barriers, building connections

Generative AI's role in the semiconductor industry.

Authors

Marco Addino

Managing Director
Semiconductor EU Lead

marco.addino@accenture.com

LinkedIn

Padampreet Singh

Managing Director
High tech Global Data & AI Lead

padampreet.singh@accenture.com

LinkedIn

Alex Olea

Managing Director,
Semiconductor NA Lead

alex.olea@accenture.com

LinkedIn

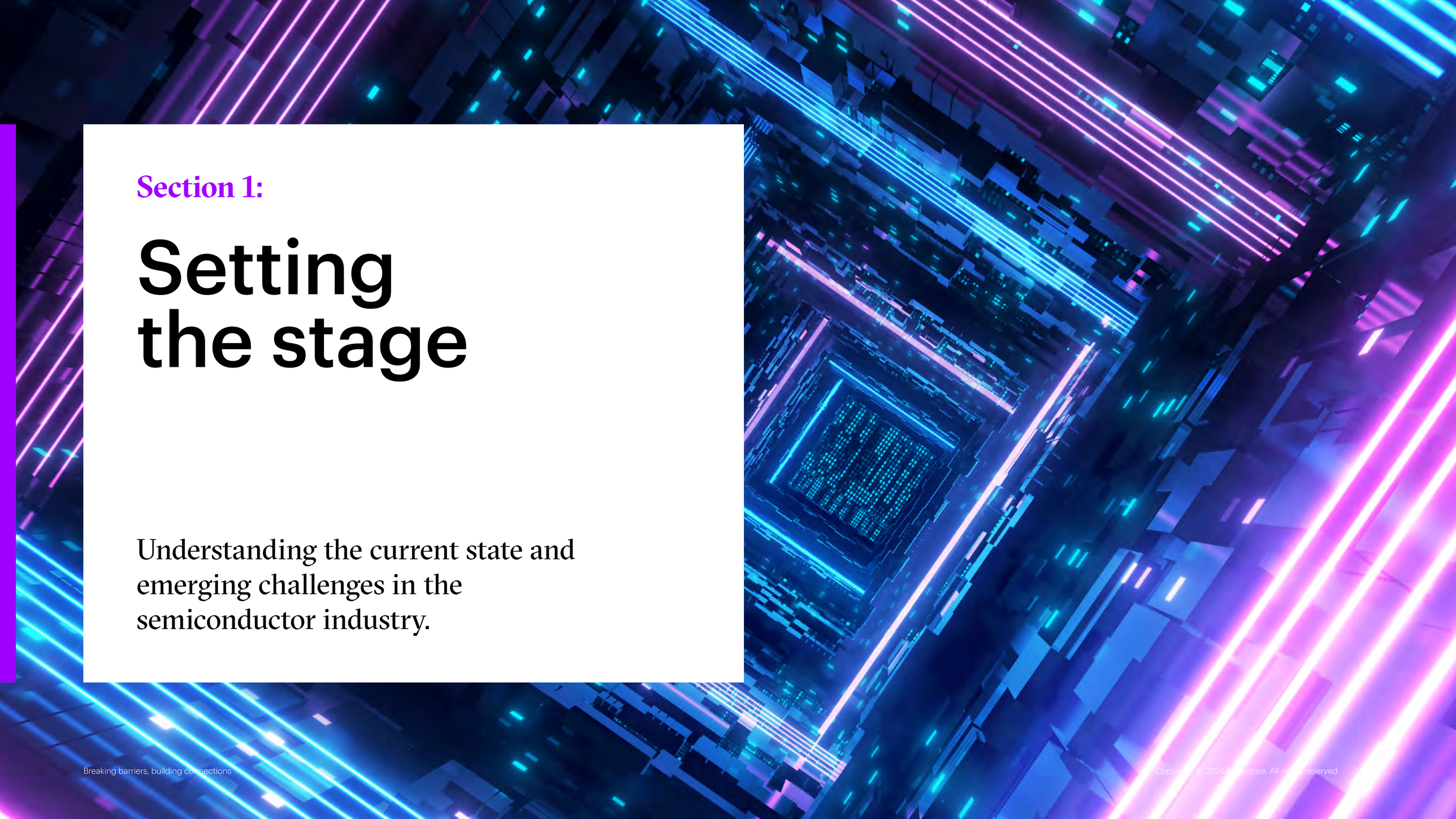
Matthew Haggerty

Manager
High tech Global Research Lead

matthew.j.haggerty@accenture.com

LinkedIn

Document Overview



Section 1:

Setting the stage

Understanding the current state and emerging challenges in the semiconductor industry.

The modern world is built on the semiconductor industry and the technologies their products enable. Our smartphones, automobiles, power stations and countless other crucial pieces of the global economy rely on continued innovation from the chips the industry designs and produces. This fact is the source and product of fierce competition between semiconductor companies who have long focused their investments on continued chip innovation.

But this path is coming up against new challenges in design, manufacturing and demand. Key talent is in increasingly short supply and chip design continues to run up against the laws of physics. Geopolitical tensions and onshored manufacturing add another layer of complexity, further clouding the future of innovation.[1]

These challenges are presenting at a time when the explosion of possibilities from generative AI has made the need for innovation urgent. We are at the forefront of a great technological moment that will unfold with unprecedented breadth, depth and speed.

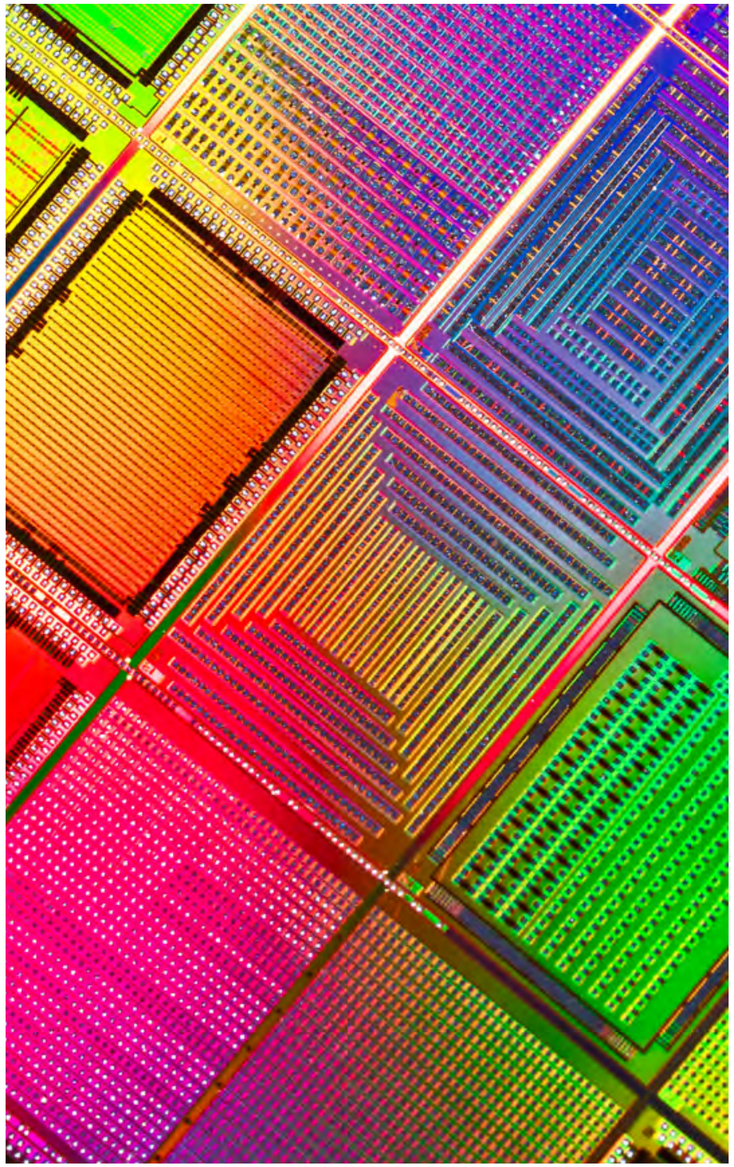
The question now for the semiconductor industry is whether it can reinvent itself for this new generative AI moment and meet the need for continued innovation. Accenture analysis found Reinventors increased revenues by 15 percentage points over other companies between 2019 and 2022.We expect that gap in revenue growth between reinventors and the rest to increase by 2.4 times to 37 percentage points by 2026.[2]

Where will semiconductor companies best focus their innovation efforts in the future? Our survey of 300 global semiconductor executives found one in three (33%) respondents believe innovation — in design and manufacturing, among others — is the top benefit that generative AI can offer to this sector.[3]

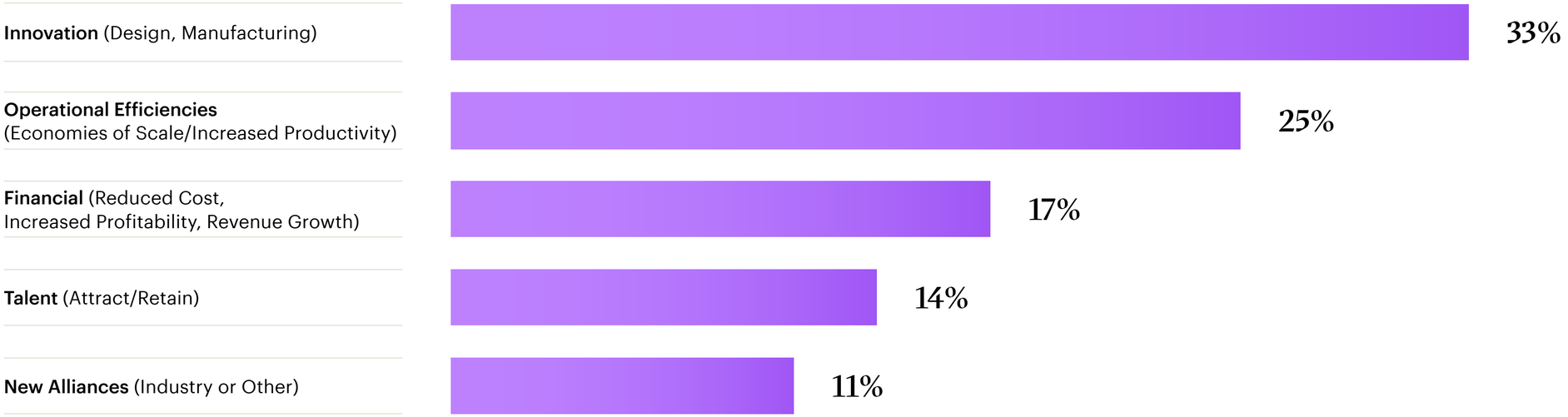
Innovation Urgency:

2.4x

expected increase in the gap in revenue growth between reinventors and the rest by 2026.



What is the top benefit that Gen AI can deliver to the semiconductor industry?



There is no single solution. Semiconductor companies should leverage generative AI across the entire value chain—from design and manufacturing, through sales and marketing, to customer service—to capitalize on opportunities for innovation in both the short- and long-term. Now is the time for a vision that embraces reinvention, breaks down barriers and unlocks boundaryless value. While the challenges to broad adoption may seem significant, the right approach and investments will allow companies in the industry to use generative AI to revolutionize its value chain and unlock transformative value.

Broad View Benefits:

Adopting a broad view across the value chain is essential for unlocking the transformative potential of generative AI in the semiconductor industry.

Section 2:

From barriers to boundaryless

Industry barriers to innovation show the need for a reinvention lens that deploys generative AI more broadly.

The semiconductor industry has some of the most complex, advanced and innovative machines on Earth in use today. Yet with this complexity comes a high operational cost to change, especially in instances of technology modernization such as with generative AI deployment.

Our research found data security, technical debt and IP considerations are among the biggest technical barriers for deploying generative AI at scale.

These findings highlight both the urgency and the challenge of successful generative AI deployment.

We also found that respondents agreed or strongly agreed with the following:

73% of respondents

IP concerns are the biggest barrier to generative AI deployment across the semiconductor industry's value chain.

71% of respondents

It will take at least three years for the semiconductor industry to deploy generative AI at scale.

74% of respondents

New fabs coming online will focus more on automation powered by generative AI.

Our recent research on the need for a reinvention-ready digital core introduces an additional consideration: the need to balance technical debt with future investments.[4] For the semiconductor industry, paying down this debt may come at the cost of current budgets and IT resources. As generative AI innovation continues to rapidly unfold, semiconductor companies need an approach that addresses both past and future.

Meeting these challenges head-on is possible with a reinvention lens that breaks down barriers across value chains. Our interviews found 75% of executives agreed or strongly agreed collaboration with industry partners via knowledge sharing and common technology platforms and IP will unlock greater value from generative AI.

Low-risk, high-value generative AI applications that companies can deploy quickly are available today, and we discuss several of them in section 4 of this paper. Quick wins can be used to generate momentum across the value chain and even across ecosystems. Successfully deploying these applications, however, depends on having the right talent in place.

Collaborative Ecosystems:

75%

of industry leaders agree collaboration through shared technology platforms enhances the value derived from generative AI.

Section 3:

Lead and learn differently to reshape the workforce

Generative AI can accelerate economic value, increase productivity and make work more meaningful.

The talent shortage in the semiconductor industry — and across high tech industries as a whole — is well known. In the United States alone, it could take approximately 16 years, according to estimates, to fill jobs stemming from the CHIPS act at current graduation rates.[5] Creating a future-ready workforce is both made possible by and essential to a successful generative AI deployment. Only by overcoming the talent gap can the semiconductor industry meet its ambitious growth goals.

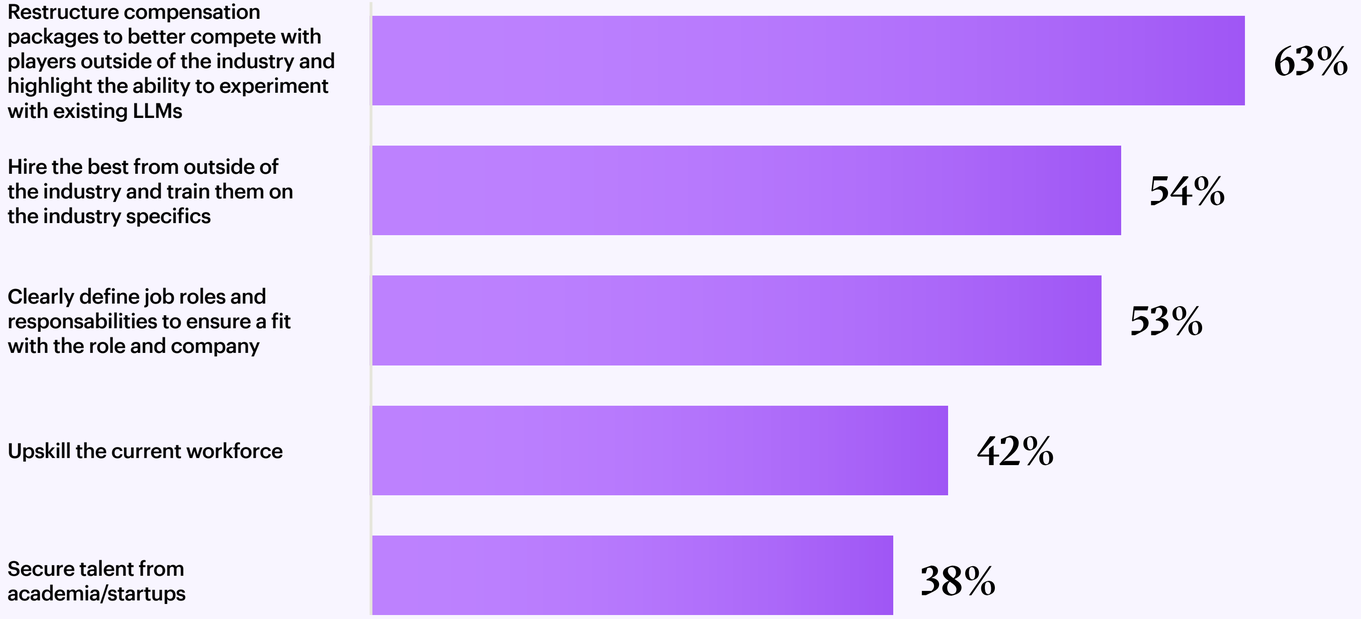
The majority of semiconductor companies have already set a strategy to deploy generative AI projects. According to our research, companies are staffing these projects in three different ways: 35% are redeploying or reallocating internal resources for these projects; 32% are leveraging third-party resources like contractors/consultants; and 32% are hiring outside the company for full-time talent.

However, this model isn't sustainable for the long term. We believe companies should look to upskill their current employees to keep critical talent. Our Work, Workforce, Workers research shows 94% of workers globally are keen to learn new AI skills.[6] Fortunately, our research found semiconductor companies are taking proactive steps to overcome their talent gap: 54% will hire from outside the industry and provide training, 63% will restructure compensation to retain staff and 42% plan to upskill their workforce.

Generative AI Empowers:

94% of employees globally eager for AI skills.

How will your organization overcome the talent gap to develop and deploy Gen AI?

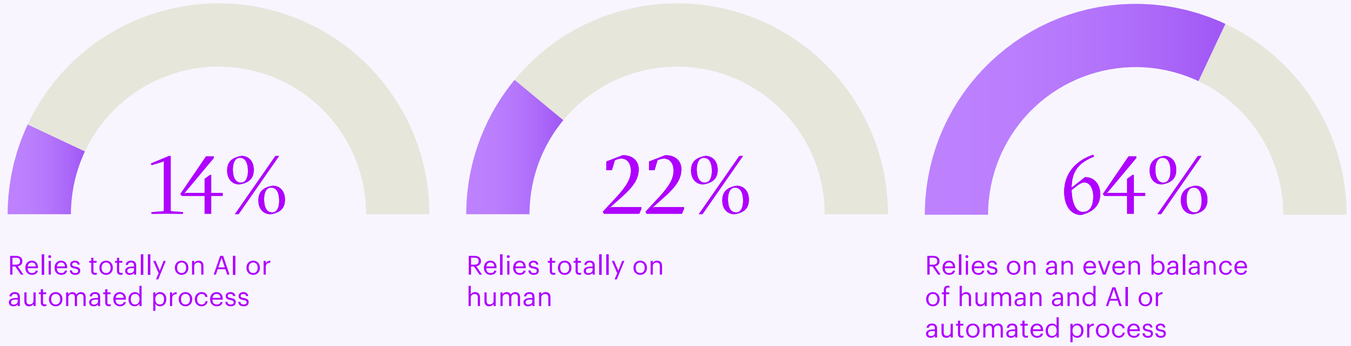


Generative AI is itself uniquely positioned to address challenges in acquiring, retaining and upskilling key talent.

Consider Micron, which has embedded generative AI in one of its Singaporean fabs, "Fab10".[7] The company runs 23 million wafer images through AI models weekly, and the results are encouraging: time-to-market for new products has been cut in half. Building on this momentum, the company's first wave of generative AI use cases are focused on worker productivity enhancements and smart manufacturing. The technology is helping workers focus on specific tasks during their daily work and guide production floor staff on how to perform an effort with specific instructions. By focusing on optimizing specific tasks today, the company can apply these learnings across the fab.

The semiconductor industry is also exploring new ways of working, with 64% of survey respondents saying their companies balance human and AI efforts equally in semiconductor development. This shows a move towards integrating human-centered changes and learning methods to responsibly scale AI technology.

Which of the following statements best describes your organization's balance of human and AI processes in semiconductor development?



Whether it's overcoming historical challenges or facing concerns over talent today, the deployment of generative AI can break the barriers to innovation, boost productivity and power collaboration.

Section 4:

No- regrets and strategic bets

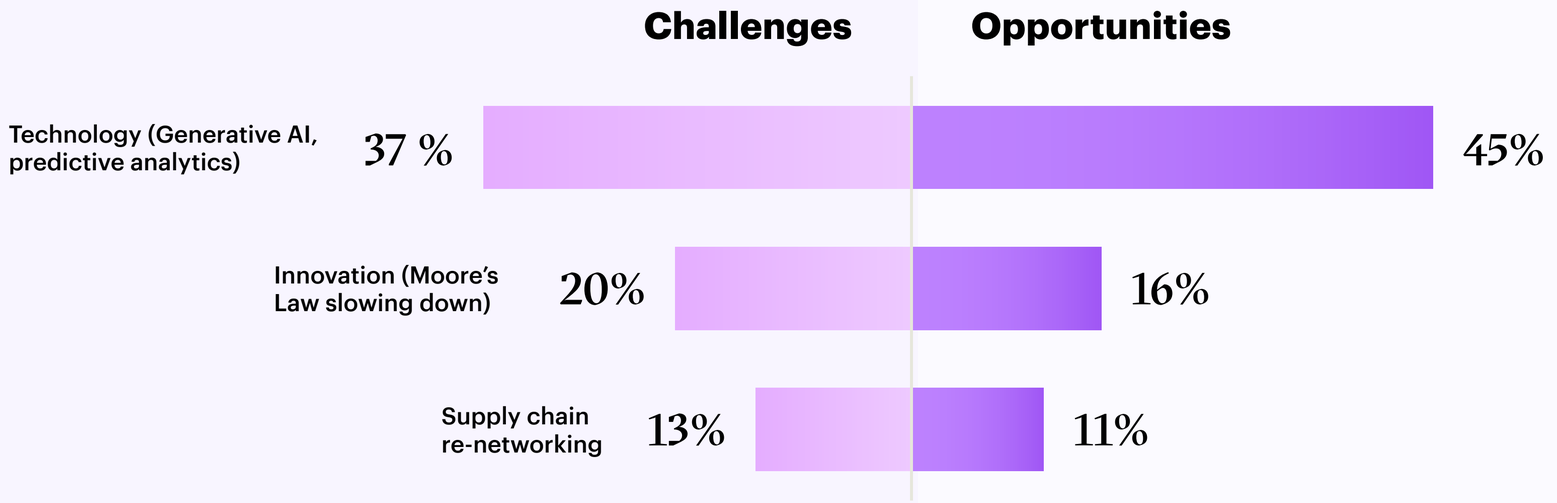
Real-world applications of generative AI are setting the stage for industry transformation.

Accenture's survey found a majority of executives believe technology is both the semiconductor industry's biggest opportunity (45%) and its biggest challenge (37%). **If that's the case, then generative AI is the most significant new challenge — and opportunity — in decades.**

How the industry moves forward will be key to the success of this journey, with no-regret and strategic bet investments as the North Star.[8] These investments will be key for CEOs to deliver quick wins while maintaining a broader strategic vision moving forward.

What is the biggest **challenge** facing the semiconductor industry today?

What is the biggest **opportunity** the semiconductor industry has today?

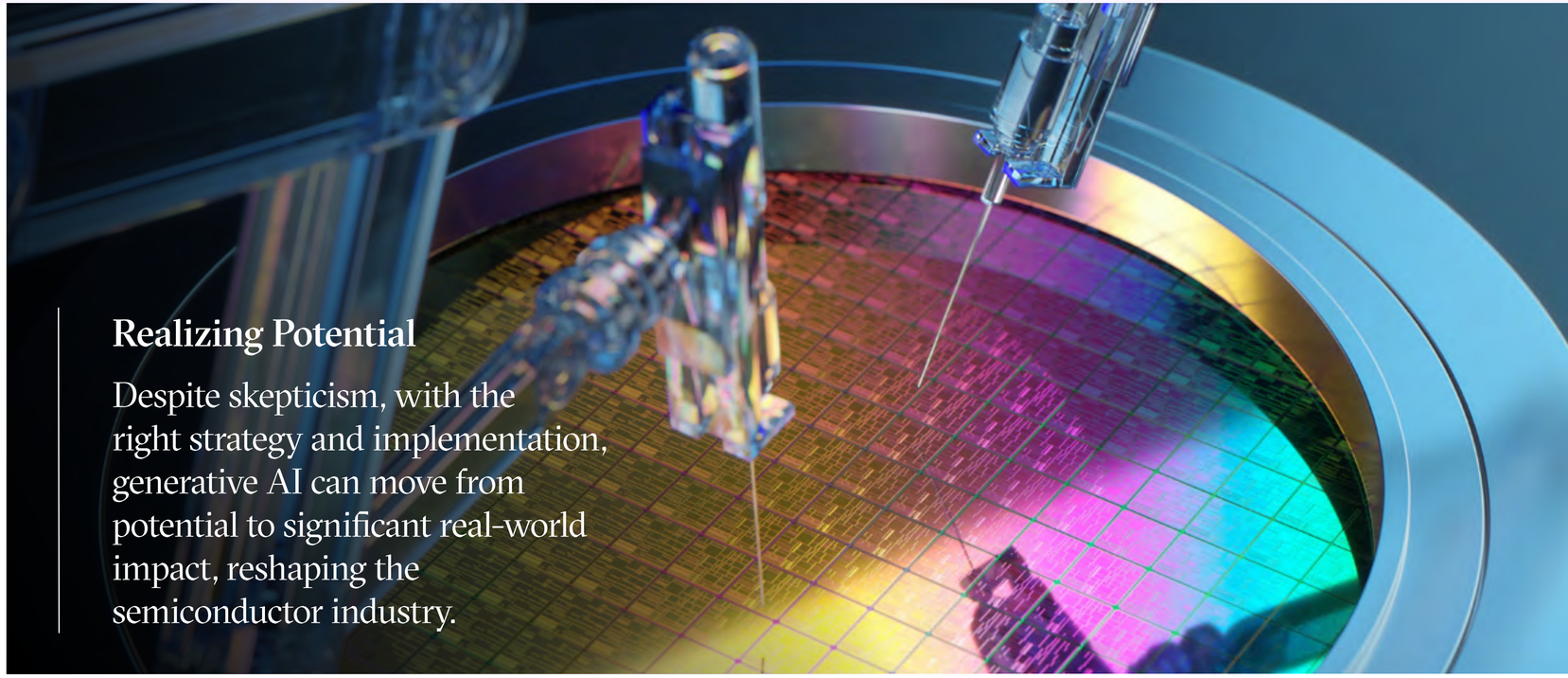


No-regret use cases are those with the highest value, shortest time and lowest risk at select points in the value chain, making them an ideal starting point for companies to gain momentum with new gen AI technologies. Many are useful across industries, and the semiconductor industry could learn from and transfer them in ways that deliver value.

Strategic bets offer truly novel competitive advantage and reshape industry operations. They have a longer timeline, but offer the highest value and results closer to the industry's core.

The topline principle is choosing the right use cases, at the right point and at the right time. Companies may fail to realize the full potential of generative AI by not investing at the right pace - or with a myopic view of the value chain.

During our research, we asked executives to score several use cases across manufacturing to marketing and sales by level of value, associated risk and time to return on investment. This surfaced several possible use cases across the value chain. These are not exhaustive, but illustrative of what these use cases look like in practice and application.



Realizing Potential

Despite skepticism, with the right strategy and implementation, generative AI can move from potential to significant real-world impact, reshaping the semiconductor industry.

No-regret use cases:

No Regret Use Case 1 › Worker Enablement

Value Chain Segment(s):

Manufacturing

Description:

Generative AI-enabled field service assistants will allow field service engineers to perform root cause analyses faster and recommend repair methods based on machine data. These assistants can assess historical parameter data with recommendations for optimal repair paths leveraging best known methods.

Time to Value:

76% of respondents said manufacturing will be enabled by generative AI in the **next 12 months.**

Benefits:

Reduces downtime and accelerates issue identification and remediation, leading to increased production and improved yield. Retains on-the-job knowledge within the company and addresses the talent gap through faster training and consistent methodology.

No Regret Use Case 2 › Marketing Content Generation

Value Chain Segment(s):

Sales and Marketing

Description:

Generative AI-enabled marketing campaigns based on automated generation of product specifications captured and inserted in relevant materials. Content can be updated in real-time based on production yields and R&D innovations as data silos are broken down.

Time to Value:

82% of respondents said sales and marketing will be enabled by generative AI in the **next 12 months**

Benefits:

Enhances the speed, flexibility and scalability of marketing material creation. Accelerates supporting research and allows for more customized content by quickly identifying and integrating market trends.

Strategic bet use cases:

Strategic Bet 1 › Manufacturing Analytics and Yield Improvement

Value Chain Segment(s):

Manufacturing

Description:

Generative AI-enabled applications that can automate wafer defect detection with enriched synthetic training data. With the development of integrated data ecosystems, yield issues can be identified holistically, faster and with better clarity of root causes. Additionally, automated defect detection can help determine specific steps within process areas to triage.

Time to Value:

74% of respondents said manufacturing will be enabled in the **next 12 months.**

Benefits:

Minimizes waste and enhances yield with improved process optimization. Boosts customer satisfaction with higher component performance and longevity. Increases defect detection accuracy and response speed to product cycle changes.

Strategic Bet 1 › Experimental Design

Value Chain Segment(s):

Process Engineering

Description:

Generative AI-enabled applications that incorporate historical process parameter data to create more efficient designs for semiconductor equipment and wafer development. These tools can use drawings, text, images and more to create customized outputs that engineers can use to augment experiments.

Time to Value:

77% of respondents said process engineering will be enabled in the **next 12 months.**

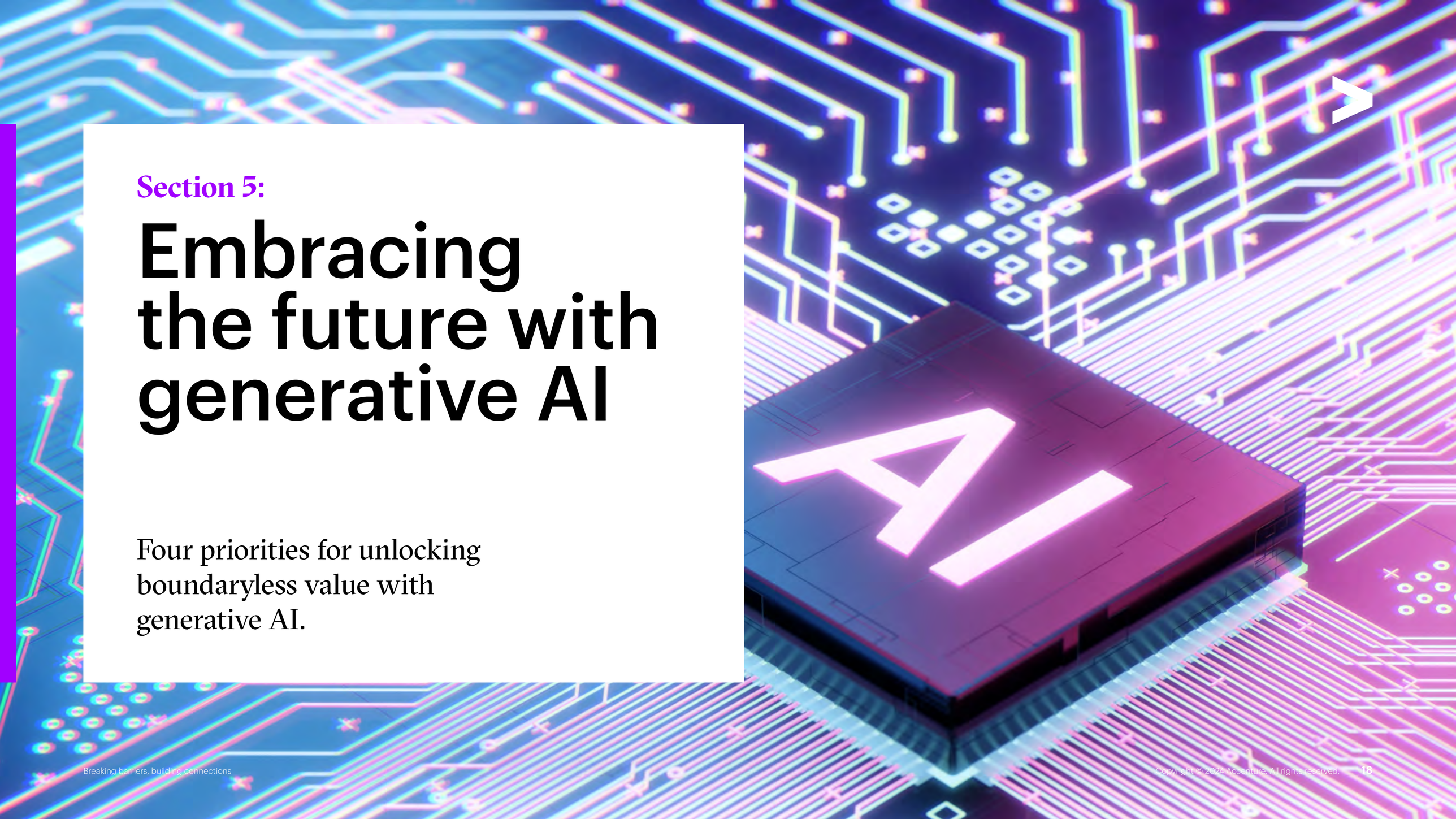
Benefits:

Improves response times in process development cycles with a more objective approach to experimental design. Enhances knowledge management by integrating process development and experimental results from a unified data source.

Section 5:

Embracing the future with generative AI

Four priorities for unlocking boundaryless value with generative AI.



We see a future where almost every role in the enterprise is either performed or supported by AI.[9] The semiconductor industry is already embracing this. Many companies are focused on well-known, no-regret initiatives that bring early wins in functions like IT, marketing, finance and customer service. Examples in these areas include adopting a coding co-pilot for software development, supporting content creation, automating financial reporting and enabling knowledge retrieval and enhanced productivity at support centers.

Our research found 85% of companies reported having a strategy to deploy generative AI projects or proofs of concept; 73% are using centers of excellence to enable them; and 35% are redeploying/allocating internal resources to drive this effort. What's more, 9 out of 10 respondents indicated they implemented many "off the shelf" generative AI tools like ChatGPT, Gemini or Copilot. We also found almost half (49%) plan to leverage foundational generative AI capabilities from their platform providers but will still build internal capabilities to link them as they move forward.

Today, generative AI efforts are focused on moving potential to reality. Our survey found 48% of respondents agreed or strongly agreed generative AI is more hype than reality, showing a split on whether effective deployment of these new technologies is possible. Executives will have to demonstrate, especially through quick wins, that generative AI can empower innovations that can live up to the "hype."

To meet these high expectations, we recommend companies set four priorities for their generative AI reinvention. These priorities will prepare companies to break down the boundaries across their organizations and realize the full potential of generative AI.

Deploying Gen AI Strategies:

85%

of companies reported having a strategy to deploy generative AI projects or POCs.

Four priorities for semiconductor executives to unlock gen AI´s value

1 Design your journey strategically

Find the right data foundation and “no-regret” initiatives that best suit your business to deliver and share quick wins. When, for example, information is stored across numerous locations — some more accessible than others — generative AI can help engineers move faster to find the right information they need, at the right time. Nvidia found 60% of a typical chip designer’s time is spent in debug or checklist-related tasks across a range of topics, meaning there’s a significant productivity boost in eliminating barriers and busywork.[10] Success fuels enthusiasm for longer-term deployments, ecosystem adoption and ongoing collaboration.

2 Leverage ecosystems to scale generative AI

Leverage internal momentum from “strategic bets” to find opportunities to collaborate with ecosystem partners. Collaboration will be key as the industry is projected to become a $1 trillion market by 2030.[11] Intel is enhancing the semiconductor industry’s ecosystem with new AI technologies that boost efficiency and reduce costs, applying its ecosystem approach to AI and generative AI.[12] Simultaneously, government support for IC design startups and advanced manufacturing investments are strengthening and enriching the AI chip sector.[13] These long-term “strategic bets” will unlock industry-wide value creation opportunities.

Four strategic priorities for harnessing Gen AI

3 Continuously reinvent

Generative AI offers a generational opportunity for reinventing work and reshaping the workforce. Continuous experimentation and ongoing partner engagement will be key to continuous growth. Today's idea may be tomorrow's innovation, and semiconductor companies need to seek and scale new growth across the value chain. Lam Research, for example, recently hosted its Lam Capital Venture Competition, seeking next-generation semiconductor innovations. AI was the strongest theme coming out of the event, according to Audrey Charles, senior vice president of corporate strategy at Lam Research and head of Lam Capital. Lam uses the platform to nurture collaboration with customers and the wider chip value chain.[14]

4 Lead and learn differently to reshape the workforce

Go beyond skilling and consider how generative AI will change the workforce. Invest in learning and identify opportunities to accelerate economic value, increase productivity and make work more meaningful. Intel's Digital Readiness program spans 28 countries with more than 100 public-private partnerships to bring AI awareness programming around the world.[15] They've also developed "AI for Workforce," which includes 500 hours of free AI content for community colleges across the US. Other companies are using algorithms to monitor and optimize the complex processes involved in semiconductor manufacturing — freeing workers to reallocate time and talent elsewhere.[16]

Every semiconductor company's generative AI journey is different, but the approaches can be similar. By starting with no-regret initiatives while moving forward with long-term strategic bets, companies can build momentum and innovate across their value chain with generative AI.

The strategy needs several defining principles: prioritize the value chain, establish a solid data foundation, prepare the talent and ensure alignment with the digital core. Once generative AI is implemented at scale, it will enhance collaboration throughout the value chain, a top benefit highlighted by many during our interviews.

Together with their partners, semiconductor companies can activate generative AI and lead into the future.

Embrace the Future:

Implementing these four priorities for generative AI integration can propel the semiconductor industry towards a future of boundaryless innovation and sustained competitive advantage.

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About the research

About the Research: In April and May 2024, Accenture conducted field research across 14 countries interviewing 300 global semiconductor executives, 57% of whom are C-level leaders. Respondents represented companies of different sizes and revenues across the value chain. Our interviews focused on three main topics: (1) the pulse of the industry; (2) the industry's view of generative AI; and (3) the industry's view and use of the technology.

Contributors

Miles Klingenberg
Senior Manager
Semiconductor Gen AI Lead
miles.klingenberg@accenture.com

Stephen Hardin
Senior Manager
High Tech Strategy
stephen.hardin@accenture.com

James Velasquez
Research Manager
Editorial Lead
james.velasquez@accenture.com

Mariel Pontow
Senior Manager
High Tech Global Content Lead
mariel.pontow@accenture.com

Palash Purohit
Research Specialist
palash.purohit@accenture.com

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