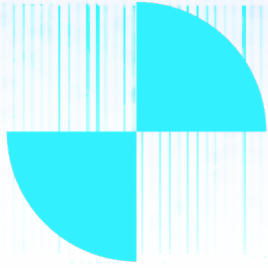


Semiconductor  
Transformation  
Study 2.0

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## State of the semiconductor industry

The semiconductor industry is amid a highly transformative time in its history, exploring and pursuing many types of transformation over a variety of objectives—from bolstering supply chain resiliency to advancing new business models to preparing for the next up cycle.<sup>1</sup>

The passing of various versions of the CHIPS Act<sup>2</sup> across the globe has also kicked off a wave of fab<sup>3</sup> construction among most major foundries<sup>4</sup> and leading-edge integrated device manufacturers (IDMs).<sup>5</sup> Even large fabless<sup>6</sup> players are trying to capitalize on the government support through foundry partnerships that enable an investment in capacity. Coupled with geopolitics, this aggressive expansion is further reshaping the entire semiconductor value chain.

From an end markets perspective, the proliferation of new trends such as generative artificial intelligence (AI)<sup>7</sup> and the already existing trends such as 5G<sup>8</sup> and Internet of Things (IoT)<sup>9</sup> will propel growth within established segments of the semiconductor industry, subsequently unveiling pathways toward new market opportunities.

Companies across the semiconductor value chain are embracing different forms of everything-as-a-service (XaaS) models encompassing offerings such as design, yield management, analytics, and software. Such business model transformation not only uncovers new markets and revenue streams, but also enhances customer experience (CX), which has become a top priority for most companies. Analogous to a classic business-to-consumer market, enhanced CX helps broaden market reach by increasing design wins over the long tail of hardware companies serving fragmented markets.

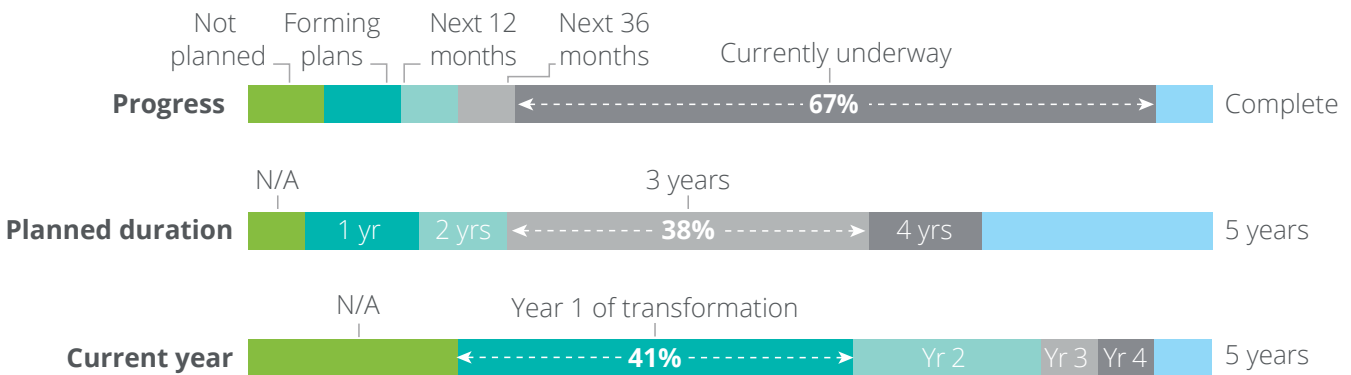
To follow our inaugural [Semiconductor Transformation Study](#) in 2021 and better understand what is driving this transformation era of the semiconductor industry, Deloitte collaborated with the Global Semiconductor Alliance (GSA) to survey 36 top industry executives from January to June 2023 (see who we surveyed at the end of this report) and develop this Semiconductor Transformation Study (STS) 2.0.

We found that two-thirds of the represented companies are actively engaged in ongoing transformation initiatives. Responses indicate that many are in the early stages (e.g., first year) of an expected three-year average transformation duration, as shown in figure 1.

More core to this STS 2.0, the results of this executive survey highlighted six primary imperatives associated with transformation in the semiconductor industry that will be explored in detail over the following pages:

- Sustaining commitment to innovation
- Strengthening core competencies
- Reshaping the semiconductor supply chain
- Advancing new business models
- Modifying operating models
- Improving efficiency and scalability

**Figure 1. State of business transformation efforts in the industry**





## Sustaining commitment to innovation: An ‘innovate or perish’ mindset

Semiconductor companies spent about 13% of revenues on research and development (R&D) in 2021.<sup>10</sup> In an industry that remains at the forefront of technology, the theme of “innovate or perish”<sup>11</sup> continues to ring true from the previous survey—reflected by 80% of respondents who identified product development, innovation, and expanding markets as being key to their transformation strategy. It is also validated by the correlation of percentage R&D spend with revenue growth.<sup>12</sup>

Intense competition among companies has driven innovation, efficiency, and process technology advancement. In our 2021 survey, half of respondents (51%) saw competitors’ moves as a primary risk that their business transformations aimed to mitigate.

Furthermore, 56% of respondents identified industry disruption and competition as key market motivators, indicating how competitive pressures drove businesses to make strategic changes.

As shown in figure 2, our 2023 survey finds competition is still a key influencer on strategic priorities. But, unsurprisingly, supply chain complexity/continuity, geopolitical concerns, and weakening consumer demand (as of the first and second quarters of 2023) have emerged as the top three prominent drivers, reflecting the fluid nature of business risks and opportunities in this industry. This underscores the importance of agility and the ability to respond effectively to a wide range of external influences.

**Figure 2. Key external factors driving evolution of strategic priorities**

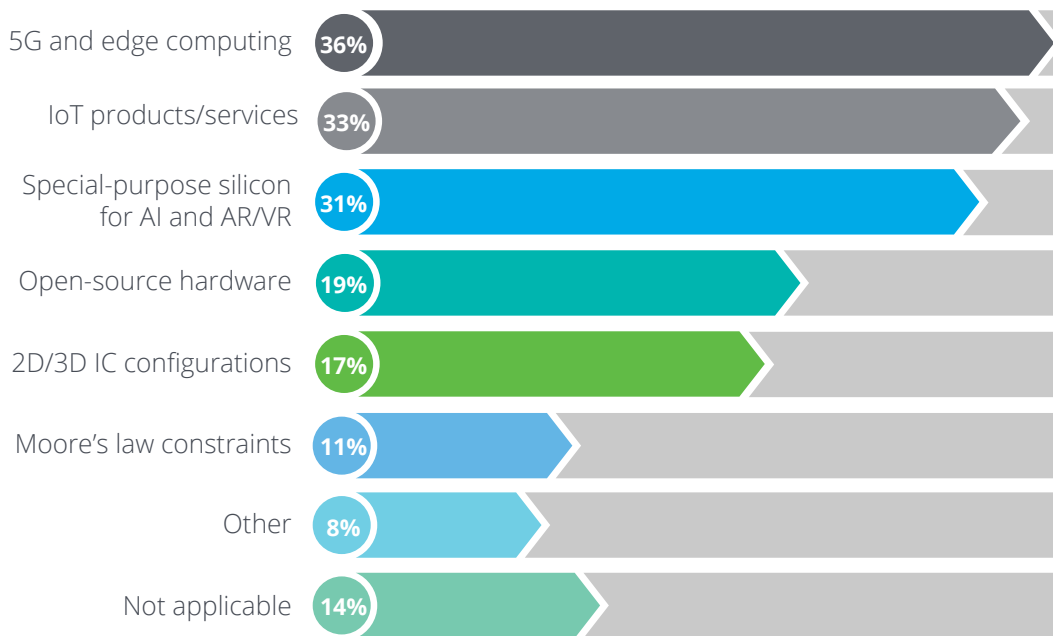
1	<b>39%</b> Supply chain complexity/continuity	6	<b>22%</b> Global trade regulations
2	<b>36%</b> Geopolitical concerns	7	<b>14%</b> Industry consolidation (M&A)
3	<b>33%</b> Weakening consumer demand outlook	8	<b>14%</b> Talent gaps
4	<b>31%</b> Competitors	9	<b>14%</b> None (only internal factors)
5	<b>25%</b> Economic pressures (e.g., rising interest rates)	10	<b>6%</b> Other

Note: Respondents could select multiple options.

Simultaneously, the semiconductor industry is susceptible to disruptive forces that serve as catalysts for change, prompting companies to reevaluate strategies, invest in R&D, and pivot to new opportunities (figure 3). For example, the need for lower latency, higher bandwidth, and greater reliability to support the demands of 5G, edge, and IoT end applications are leading factors driving business transformation among respondents. While these technologies continue to morph, their influence will persist as drivers of business transformation as semiconductor companies continue to innovate to meet end-customer needs in these areas.

As AI became more mainstream, it's no surprise that application-specific chips and open-source hardware emerged as top trends. Companies that are poised to emerge as frontrunners are those capable of producing advanced chips tailored for generative AI systems. Specialized hardware and open-source platforms, such as RISC-V, underscore the strategic importance of a collaborative ethos to foster a diverse community of developers to accelerate the evolution of AI applications. Advanced 2D and 3D packaging innovation will also be needed to support proliferation of AI and other compute and memory-intensive applications.

**Figure 3. Technology trends driving business transformation at respondents' companies**



Note: Respondents could select multiple options.



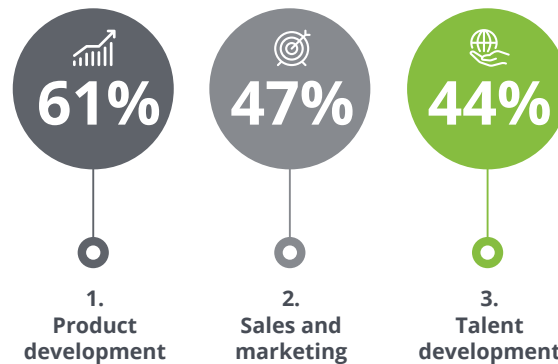
## Strengthening core competencies: A focus on core markets

Traditionally, semiconductor companies have walled off their core capabilities, deepening expertise and focusing on differentiation to offer value. Similar to what we found in our 2021 survey, our current survey shows nearly 40% of respondents are focused on growth through expansion in new markets while the remaining 60% are focused on growth through existing or core markets. Specifically, respondents indicate that they expect transformation advantages to be realized by augmenting existing solutions in their existing markets or developing new solutions for their existing markets.

Aligned with the themes of emphasizing innovation and building core competencies and consistent with the previous study, product development, sales and marketing, and talent development are identified as the top three capability areas critical to transformation strategy (figure 4). Moreover, companies are looking to organically develop or mature capabilities that are critical for their business transformations (figure 5).

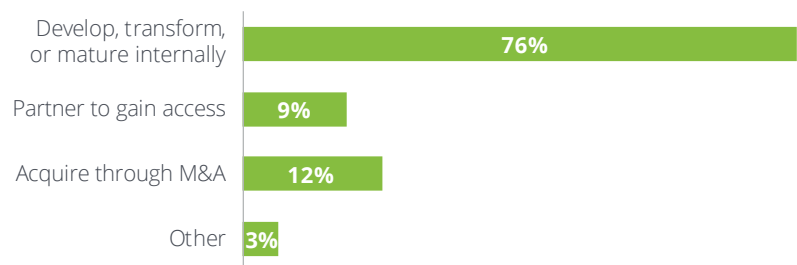
Companies say that competitive advantage (69%) and speed of implementation (47%) are the most important priorities when implementing new capabilities. Establishing a disciplined prioritization scheme aligned to strategic goals is critical to making the foregoing speed and value trade-offs, else companies risk prioritizing initiatives that alleviate immediate pain rather than those that achieve a sustained competitive advantage.

**Figure 4. Top three capability areas critical to transformation**



Note: Respondents could select multiple options.

**Figure 5. Plan (or preferred method) to obtain capabilities to support the transformation**

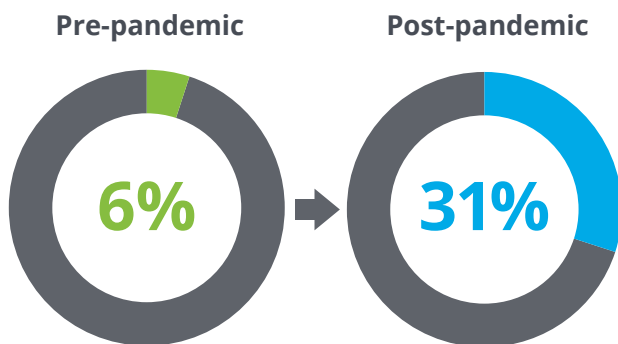


## Reshaping the semiconductor supply chain: Navigating supply chain volatility while transforming

During the pandemic, the entire semiconductor value chain from equipment manufacturers to chip manufacturers and then to consumers of such chips had to deal with unprecedented volatility. This volatility also coincided with geopolitical initiatives to establish greater control over the semiconductor supply chain as a key component of a national economic and security strategy. These macro concerns along with the ever-present waxing and waning demand-and-supply cycles that are characteristic of this industry (we are now in the seventh boom and bust since 1990) have led to an increased emphasis on building supply chain resiliency.<sup>13</sup> Survey results mirror this, with the percentage of respondents saying that supply chain resiliency is a strategic priority rising more than five times since pre-pandemic times to 31%, from 6% (figure 6).

There has been significant government action from many economies in the world, notably, the United States (CHIPS Act), China, European Union (Chips Act), Germany, India, Japan, Singapore, South Korea, Taiwan, and Vietnam, to strengthen domestic semiconductor manufacturing. The largest impact from government actions on respondents' transformation strategies was a higher level of R&D investment (39%), followed by nearshoring efforts (31%).

**Figure 6. Increased emphasis on supply chain resiliency as a strategic priority in transformation**





Proliferation of end-market applications has resulted in a substantial increase in distinct product variations to address those new applications. Demand fluctuations across these diverse end-customer product variants often trigger bullwhip effects that produce larger swings in demand further up the value chain. This situation is exacerbated by notably extended material and equipment lead times, spanning approximately six months to a year, constraining the adaptability of capacity and supply responsiveness. Moreover, escalating trade restrictions have introduced bottlenecks in established supply chains, disrupting supply fulfillment.

These unprecedented industry shifts are compelling stakeholders across the value chain to reconsider and revamp supply chain operations, with the aim of fostering greater agility while preparing better to deal with volatility in demand or supply. Not surprisingly then, survey results indicate an overwhelming 69% of respondents are considering or making substantial changes to their supply chain footprint (figure 7).

**Figure 7. Supply chain footprint will undergo transformation in the next few years**



**69%** of respondents are considering or already making changes to their supply chain footprint

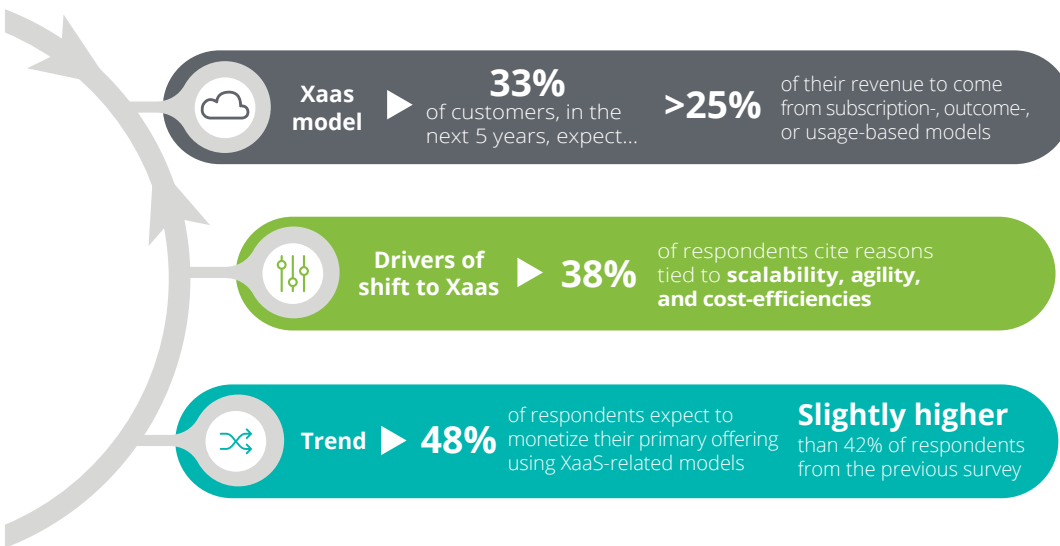
## Advancing new business models: A push toward everything-as-a-service (XaaS)

The traditional business model for the semiconductor industry has involved monetization through one-time transactions associated with the sale of a product or service. Although alternative business models are not observed everywhere, they have been gaining traction across the entire value chain from equipment manufacturers to their foundry customers to their fabless customers to their electronic design automation (EDA) providers. Equipment manufacturers are starting to offer certain software subscription services with their equipment purchases to provide benefits such as proprietary equipment data analyses. Foundries are offering turnkey services to manage post-fab manufacturing for customers whose core business is not semiconductors. We have also observed more fabless companies trying to catalyze growth by focusing on the entire system platform including software that is monetized as a subscription.

A large portion of survey respondents are expecting more than 25% of revenues to come from as-a-service business models over the next five years, as shown in figure 8. These non-traditional business models would include subscription, usage, and outcome-based models.

The shift to as-a-service models comes with its own set of challenges such as establishing new ways to forecast, tracking a new set of key performance indicators to gauge the health of the business, tracking customer adoption, managing new types of data, and other challenges. Some of these enablement-related challenges are discussed in greater detail in an April 2023 [paper](#)<sup>14</sup> titled *Unlocking new frontiers*. As companies continue advancing XaaS business models, addressing some of these challenges will be necessary for the success of their business transformations.

Figure 8. Overview of shift to XaaS—revenues, drivers, and popularity



Note: Respondents could select multiple options.



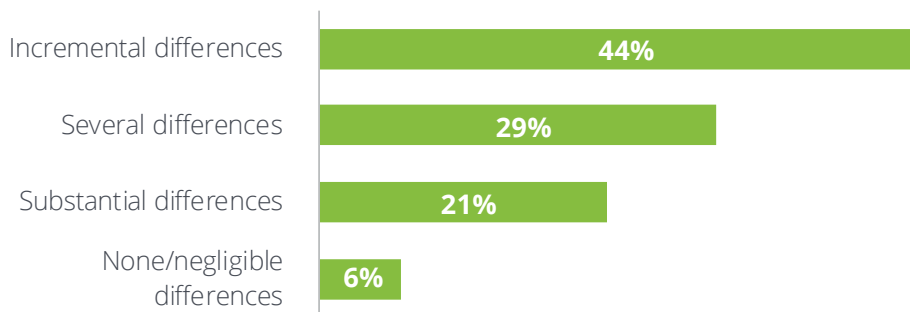
## Leveraging operating models: A lever to support transformation

Tweaks to the operating model are essential to achieve a range of different objectives associated with the transformation journey. For some companies, it can help concentrate scarce resources (such as data scientists), who are currently scattered across business areas and bring them together to better support the

company, while for others it enables a greater focus on an emerging business model. The vast majority of respondents (73%) plan to make or are already making some changes to their existing operating model but stopping short of a large overhaul (figure 9).

**Figure 9. Operating model differences post-transformation**

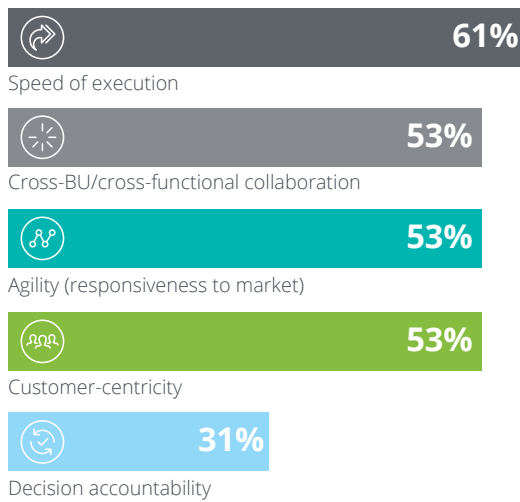
**To what degree will your post-transformation operating model be different from your current operating model?**



For the survey respondents, improvements are currently being used to ensure their operating model is adequate (figure 10). There is no single magic bullet, and the area of focus varies greatly across respondents, covering

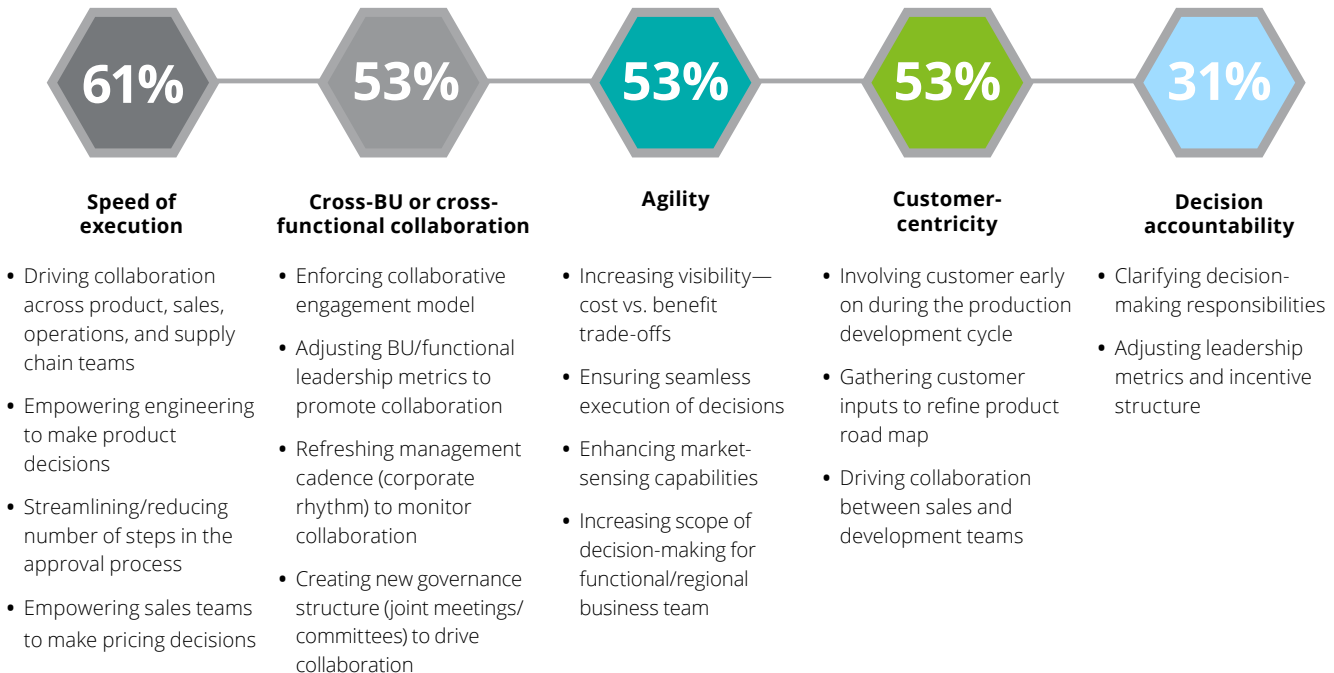
speed, collaboration, agility, customer-centricity, and accountability, as summarized in figure 11. The data shows that companies are taking a balanced, multi-objective approach to transformation.

**Figure 10. Improvements targeted to ensure operating model is adequate**



Note: Respondents could select multiple options.

**Figure 11. Deep dive: Improvements targeted to ensure operating model is adequate**

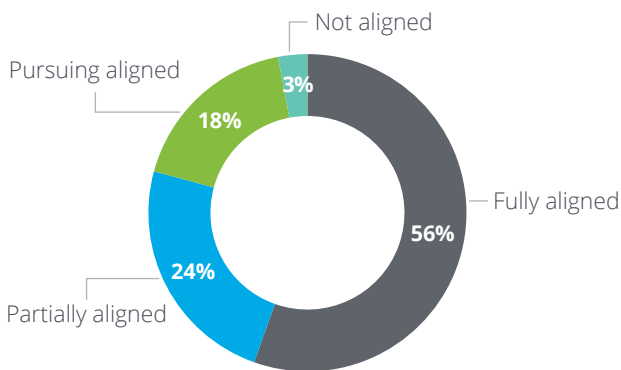


## Improving efficiency and scalability: Promoting digital DNA and talent

The semiconductor industry generates a significant quantity of data, and as companies strive to be more digital, better data management and data useability are often part of their transformation journeys. Many transformed capabilities are also enabled by new technology tools and architectures. However, IT organizations are often not fully aligned with such transformation priorities (figure 12). While the level of alignment with IT has improved significantly since the previous survey, it is only at 56% in this year's survey, up from 37% in 2021.

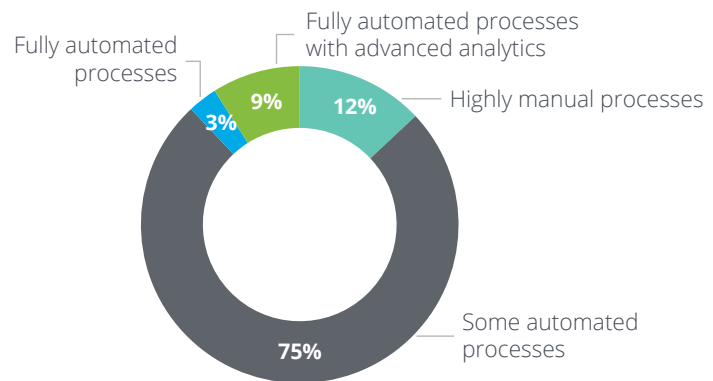
A key challenge observed during transformation initiatives is a lack of enterprisewide integration of digital proficiency—digital capabilities spanning the entire product life cycle from design to manufacturing. This is reflected in the limited level (12%) of full process automation that respondents believe currently exists, as shown in figure 13.

**Figure 12. Alignment of IT**



Note: Percentages may not total 100%, due to rounding.

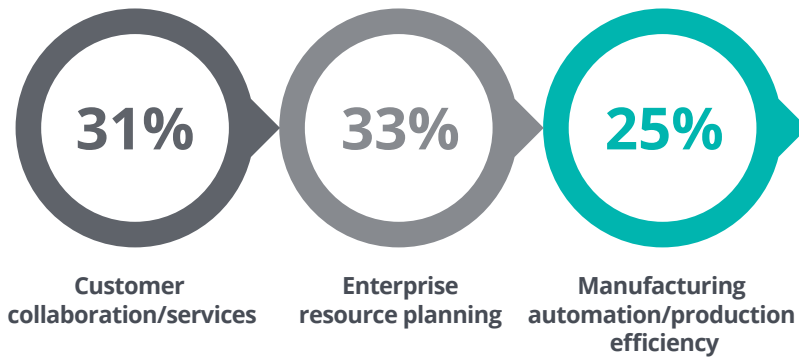
**Figure 13. Digital proficiency: Process automation**



In an industry that has traditionally been driven by manufacturing excellence, there is an emerging emphasis on technologies that improve customer collaboration and services, and this emphasis has been a consistent theme

over both survey installments. This consistency indicates the industry is evolving to cater to a diverse market of customers and application areas (figure 14).

**Figure 14. Biggest spend in IT budgets**

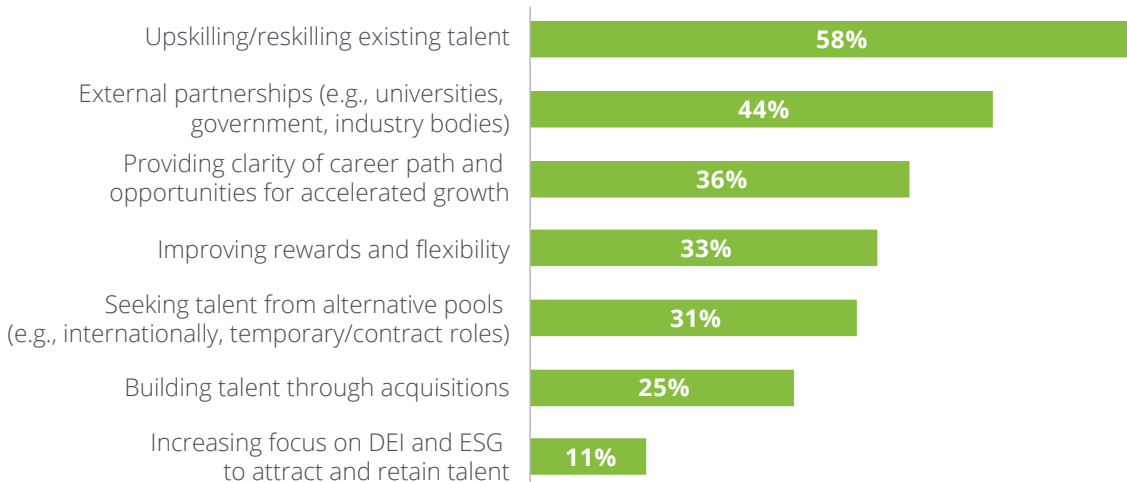


Given the semiconductor industry is heavily reliant on R&D, the talent model often revolves around engineering. The industry as a whole has an ongoing talent shortage that is expected to last for years if the growth forecasts hold true. These ongoing challenges tied to human capital-related gaps in the semiconductor industry are

discussed in the summary section. As shown in figure 15, respondents identify the top areas of focus to address the talent shortage as upskilling and reskilling existing talent and partnering with external organizations (e.g., universities, industry bodies, and government).

**Figure 15. Addressing talent shortages**

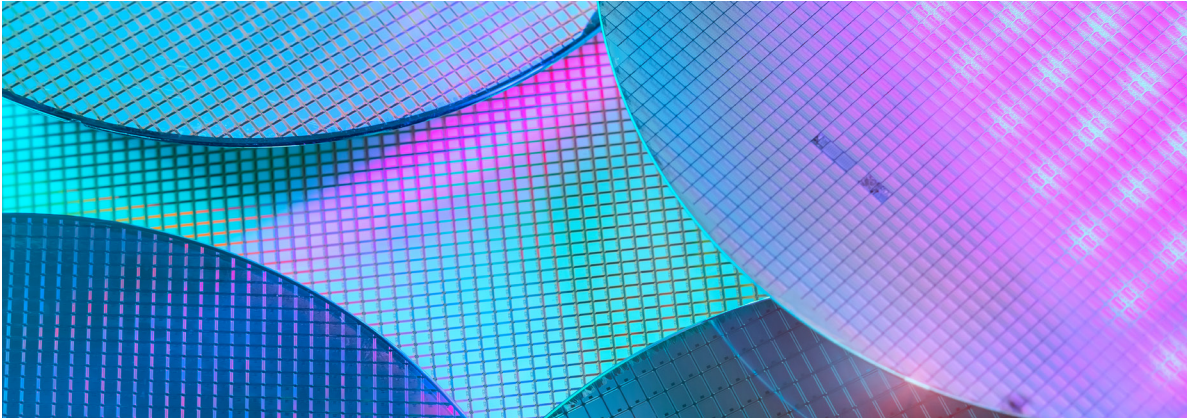
**What are your top priorities to address the talent shortages?**



Note: Respondents could select multiple options.



# Summary



In summary, the key themes from the survey bring to focus the following call to action for transformation leaders within semiconductor companies:

- 1. On innovation:** Semiconductor end-market applications and use cases are exploding with technology trends such as generative AI, 5G, and IoT.

*Are you being bold enough to push the envelope beyond traditional product offerings and collaborating across the value chain to co-create distinct offerings?*

- 2. On sustaining core competencies:** Maintaining a competitive edge remains a critical strategic objective of transformation. Identifying gaps when compared to the market and prioritizing capabilities to help sustain core competencies is a necessary first step when embarking on a transformation.

*As you move into the execution phases of a transformation journey, are you always evaluating decisions and priorities, and thereby allocation of resources, based on achieving and sustaining a competitive edge?*

- 3. On the evolving semiconductor supply chain:** A variety of market, trade, and geopolitical forces are going to significantly change the semiconductor supply chain in the next decade. Companies will need to build supply chain resiliency capabilities to inform reconfiguration of their supply networks and provide operations teams with capabilities to proactively assess and mitigate global supply risks.

*Have you defined what supply chain resilience means to your company as you adapt to external factors that are reshaping your supply chain ecosystem?*

- 4. On advancing newer business models:** The industry is also creating newer business models to tap into growth opportunities beyond their primary markets and customers. Increasing share of as-a-service revenue for traditionally hardware-focused companies will require working through enablement challenges.

*Are you investing enough on foundational groundwork with business process and associated technology changes that are needed to enable newer business models?*

- 5. On modifying operating models:** The industry is still shy of reconstructing operating models to achieve its transformation objectives. While this might be a reflection of most companies being in the first half of their transformation journey, companies need to consider operating model changes as an important lever to implement and sustain new capabilities.

*Is your transformation management office measuring the right objectives to ensure your operating model serves your strategic goals?*

- 6. On improving efficiency and scalability:** Lastly, as the industry grapples with talent shortages, growth is fueled by enabling digital capabilities that improve efficiency of business processes and thereby increase output of the workforce. The industry wants improvements across multiple digital domains, with an increasing sense of urgency.

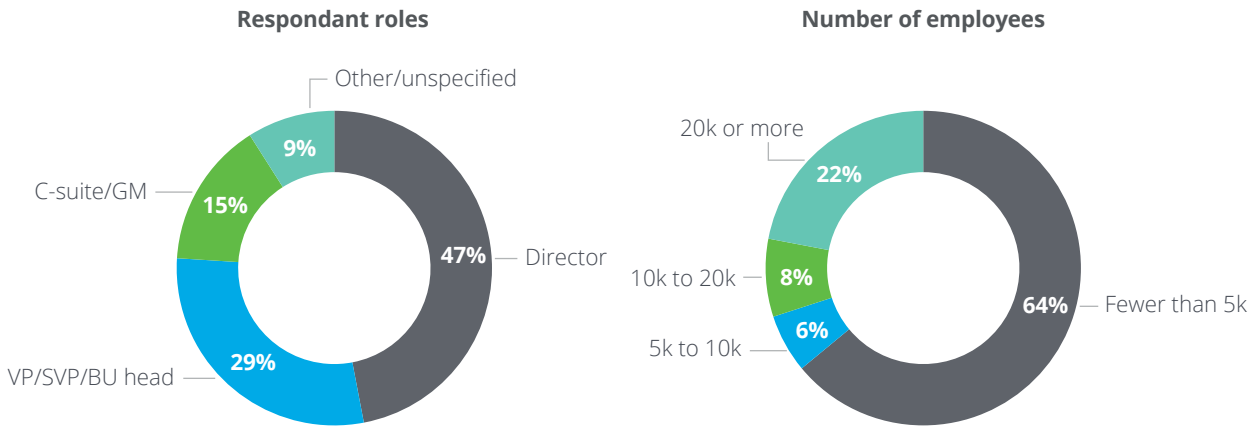
*Have you achieved cross-functional alignment with business teams and IT in prioritizing technological initiatives in your transformation?*

# Respondent profile: Who we surveyed

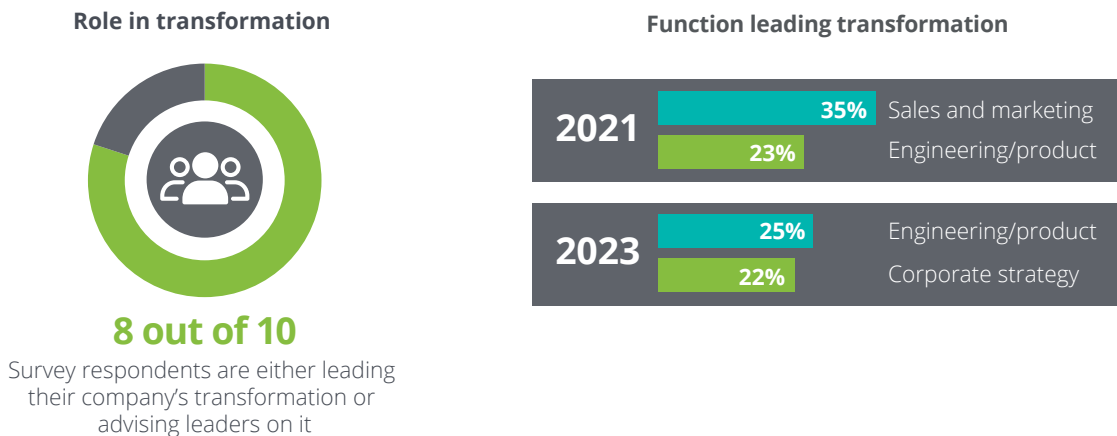
This Semiconductor Transformation Study is based on a survey conducted by Deloitte and the GSA in the first quarter of 2023. The survey was designed to gauge how company leaders across the semiconductor ecosystem viewed their own transformation and the broader transformation landscape. Survey respondents were

composed of senior leadership and the C-suite from fabless companies, IDMs, equipment suppliers, foundries, and materials suppliers from multiple geographies (figures 16 and 17). We have 36 respondents in this survey as compared to 41 to our 2021 survey.

**Figure 16. Respondents' roles and company size**



**Figure 17. Respondents' impact on transformation and functions leading transformation**



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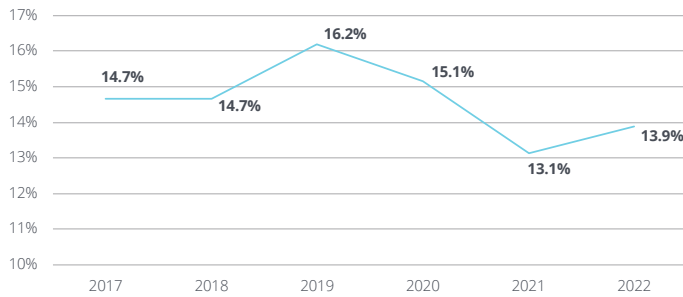
## Acknowledgments

The authors would like to thank Karthik Ramachandran and Nikhil D'Souza for their support.

# Endnotes

1. Deloitte, [2023 semiconductor industry outlook](#), 2023.
2. CHIPS Act was passed by US Congress to strengthen domestic semiconductor manufacturing, design, and research; versions of the CHIPS Act refers to equivalent versions passed by other countries globally.
3. Fab, short for fabrication, is a factory for semiconductor device fabrication.
4. A foundry is a company that provides manufacturing services; they do not design chips but help other companies fabricate their designs.
5. An integrated device manufacturer (IDM) is a company that designs and manufactures its own chips.
6. Fabless companies design and sell chips for their customers; however, they contract with foundries to manufacture their semiconductor devices.
7. Generative AI leverages models (using neural networks) to identify the patterns and structures within existing data to generate new and original content.
8. 5G is the fifth-generation technology standard for broadband cellular networks.
9. Internet of Things (IoT) is a network of interrelated devices that connect and exchange data with other IoT devices and the cloud.
10. Data from *McClean Report* cited in ["America's chip suppliers continue to dominate R&D spending,"](#) Global SMT & Packaging, July 26, 2022.
11. "Innovate or die" attributed to Peter Drucker.
12. Source: *CapIQ*

**Average percent of R&D spend across 22 large companies in entire value chain\***



13. Deloitte Insights, [Five fixes for the semiconductor chip shortage](#), December 6, 2021.
14. Deloitte, [Unlocking new frontiers: How semiconductor companies can leverage XaaS to drive value creation](#), April 2, 2023.





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