

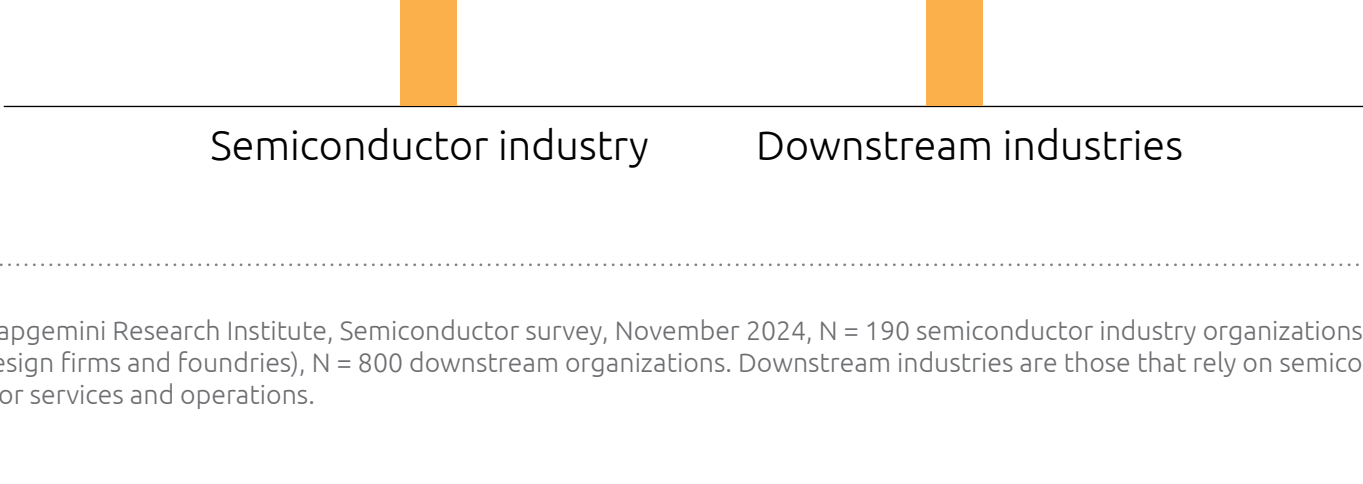
# The semiconductor industry in the AI era

Innovating for tomorrow's demands

## Organizations anticipate surging semiconductor demand

**Downstream industries estimate demand for semiconductors to increase at double the rate of the semiconductor industry's expectation**

Expected semiconductor demand increase in two years to the end of 2026

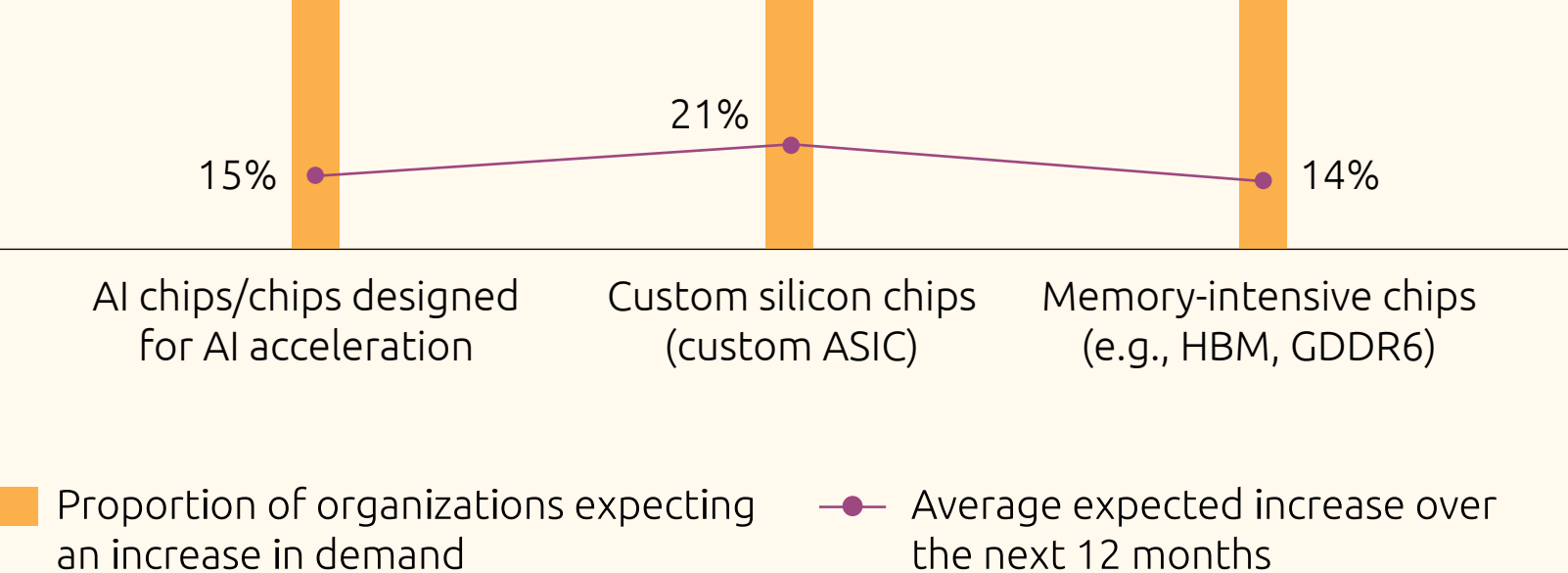


Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 190 semiconductor industry organizations (includes IDMs, Fabless design firms and Foundries), N = 800 downstream organizations. Downstream industries are those that rely on semiconductors for their products or services and operations.

**Due to Gen AI adoption, nearly three in five semiconductor organizations are seeing increased demand for NPUs, high-performance GPUs, and memory-intensive chips.**

**Nearly four out of five downstream organizations anticipate increased demand for AI chips, custom silicon chips, and memory-intensive chips over the next 12 months**

Expected demand for chips



Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 800 downstream organizations.

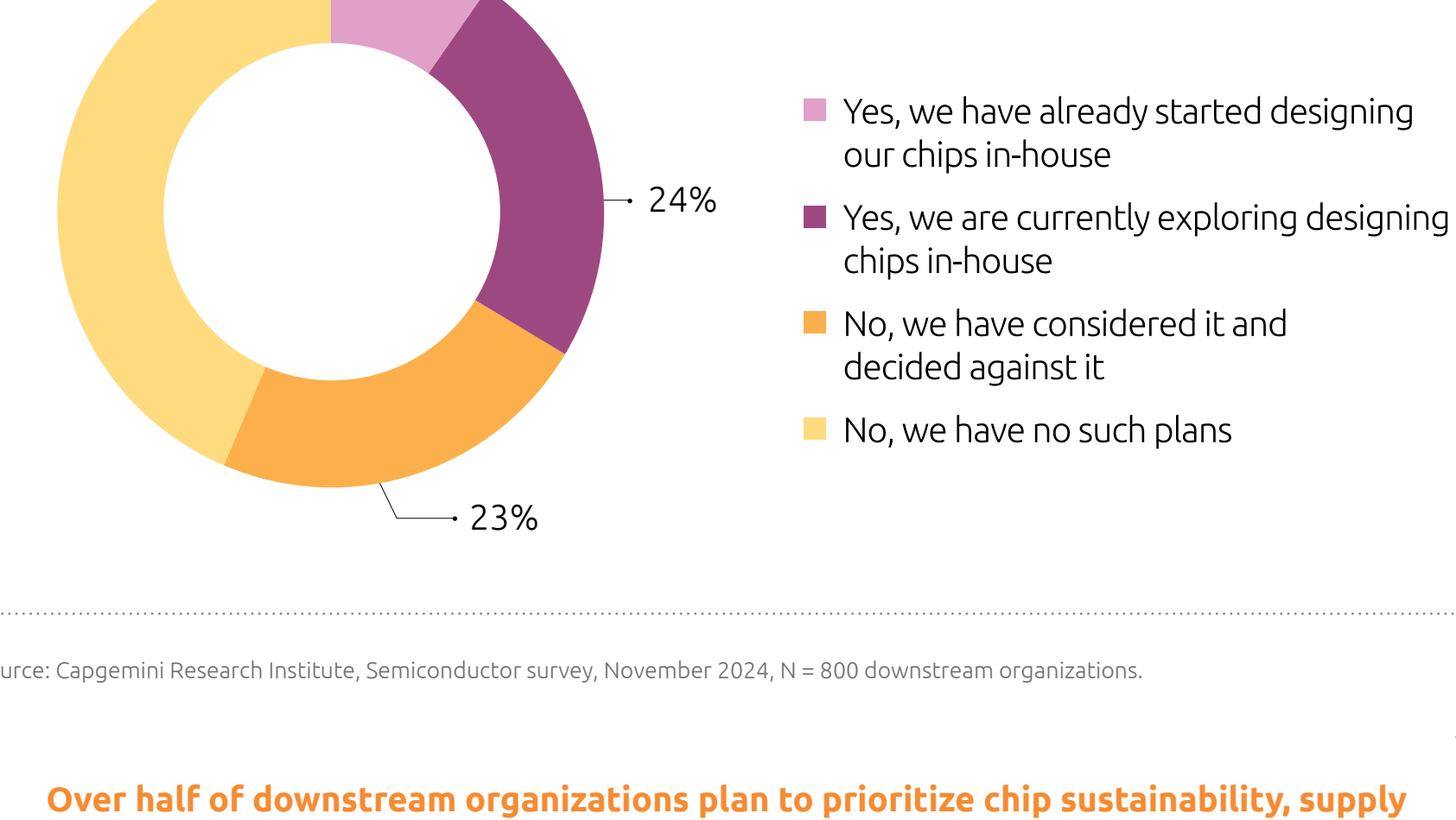
## Downstream industries express concerns over semiconductor supply

**Fewer than three in ten downstream organizations believe chip supply is sufficient.**

**Nearly half of downstream organizations are looking for enhanced customization and more comprehensive APIs and SDKs**

**One in three downstream organizations is designing chips in-house (or currently exploring the option)**

Has your organization considered/been considering designing your own semiconductor chips?



Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 800 downstream organizations.

**Over half of downstream organizations plan to prioritize chip sustainability, supply chain resilience, and cybersecurity features in the next two years.**

## The semiconductor industry is innovating but softwarization remains a challenge

Focus areas for the semiconductor industry

- Design innovation**
  - Implementation of design-for-test (DFT) and design-for-manufacturability (DFM) techniques
  - Development of 3D IC design techniques and multi-die integration
  - Exploration of new architectures (e.g., RISC-V, chiplets, heterogeneous integration)
- Packaging innovation**
  - 3D packaging techniques
  - Chiplet architecture
- Manufacturing innovation**
  - Manufacturing innovation focused on cost improvement
  - Materials research for better yield and/or productivity
  - Improving traceability of materials being issued to manufacturing to the source
- Hardware security**
  - Secure firmware and software integration (e.g., firmware updates)
  - Cryptographic protection (e.g., hardware-based encryption)
  - Authentication and access control (e.g., hardware root of trust)

Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 250 semiconductor industry organizations for design and manufacturing innovation; N = 149 IDMs and OSAT firms for the top statement and N = 197 IDMs, Fabless design firms, OSAT firms and EDA firms for the bottom statement for packaging innovation; N = 167 IDMs, Fabless design firms and EDA firms for hardware security.

**While nearly half of IDMs and fabless design firms are actively developing software-centric solutions, monetization of software remains a challenge for three in five semi-conductor organizations.**

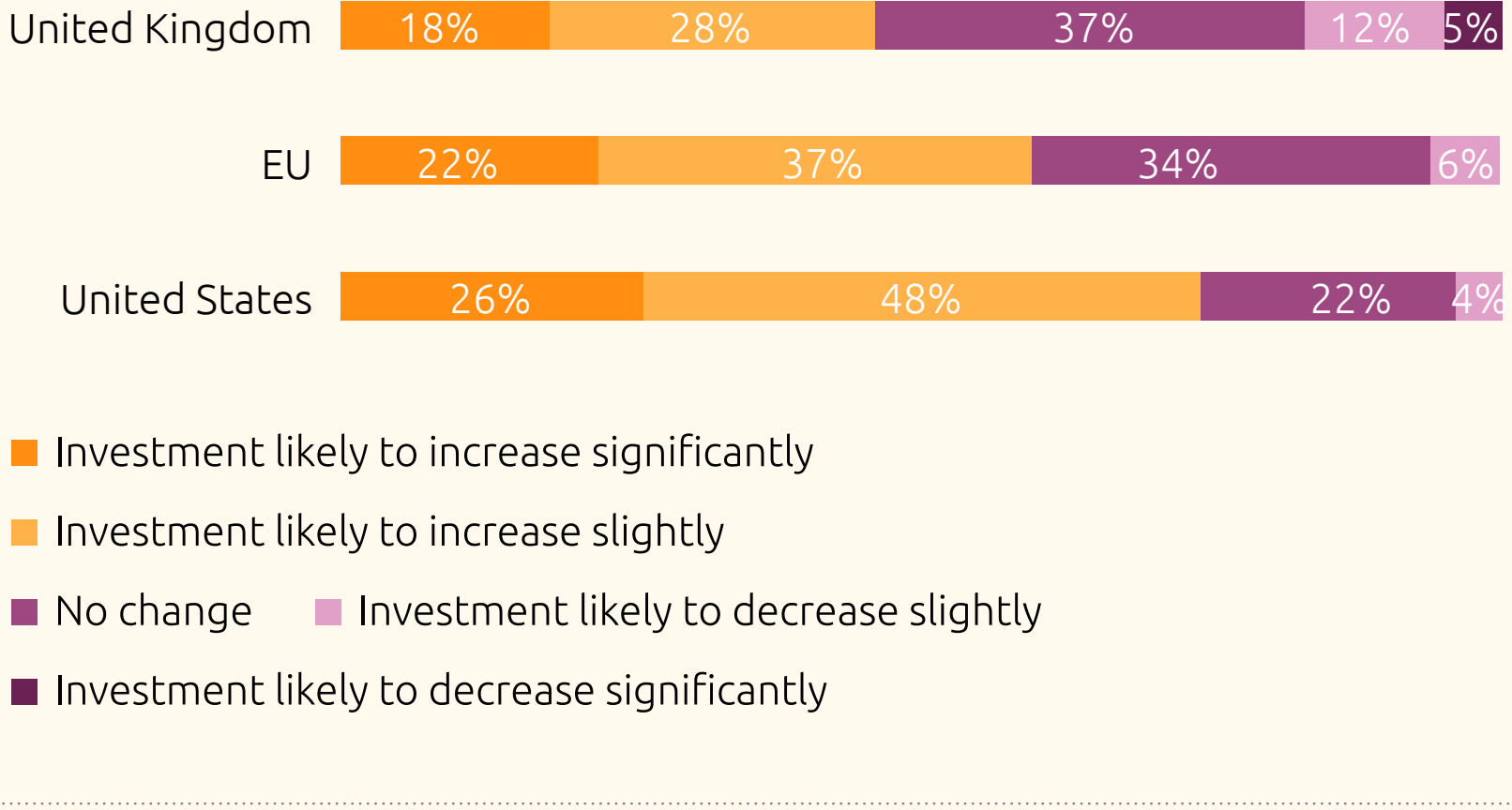
## Resilience and sustainability gather momentum

**Organizations turn to onshoring and friendshoring to enhance resilience**

**Semiconductor industry anticipates domestic sourcing to improve by 17% over the next two years**

Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 202 IDMs, Foundries, OSAT firms, capital equipment firms, material and subsystem organizations.

Investment will focus on the US and the EU over the next two years



Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 250 semiconductor industry organizations.

## The industry is making strides with various sustainability initiatives

Top three initiatives currently being deployed in each category

- Energy conservation**
  - Upgraded to energy-efficient machinery and equipment
  - Implemented energy-management systems
  - Reduced water usage
- Managing hazardous chemicals**
  - Replaced hazardous chemicals with less toxic alternatives
  - Implemented closed-loop systems for chemical reuse
  - Recycled or reclaimed chemicals for reuse in processes
- Reducing water usage and promoting water circularity**
  - Implemented water recycling and reuse systems
  - Modified processes to reduce water consumption
  - Achieved zero waste by reusing all wastewater
- Waste reduction**
  - Implemented waste-minimization programs
  - Partnered with organizations on waste-to-resource initiatives
  - Designed products and processes to reduce material use
  - Utilized end-of-life products as raw materials (closed-loop recycling)

Source: Capgemini Research Institute, Semiconductor survey, November 2024, N = 182 IDMs, Foundries, OSAT firms and semiconductor capital equipment firms.

## How the semiconductor industry can capitalize on emerging opportunities

- Invest in advanced manufacturing technologies and innovation**
  - Adopt next-generation fabrication methods
  - Accelerate research and development in emerging technologies
- Galvanize semiconductor supply chains through diversification and adoption of eco-friendly processes**
  - Diversify and secure supplier networks
  - Implement sustainable manufacturing practices
  - Minimize ecological footprint
- Harness AI and Gen AI for advanced chip design and manufacturing**
  - Automate design processes using AI
  - Use intelligent systems to improve production efficiency and yields
  - Develop AI-optimized semiconductor products
- Align with government policies and foster open innovation**
  - Coordinate strategies with regulatory frameworks
  - Collaborate and share innovation
- Protect intellectual property and enhance security measures**
  - Strengthen cyber defenses and protect data integrity
  - Safeguard proprietary technologies
- Adopt open standards to foster innovation**
  - Promote industry-wide collaboration for cross-platform interoperability
  - Encourage open-source design and development in semiconductor innovation

Source: Capgemini Research Institute analysis.

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