SPECIAL SUPPLY CHAIN REPORT

Impacts to China's Semiconductor Industry

Created by Resilinc Risk Analysis Team
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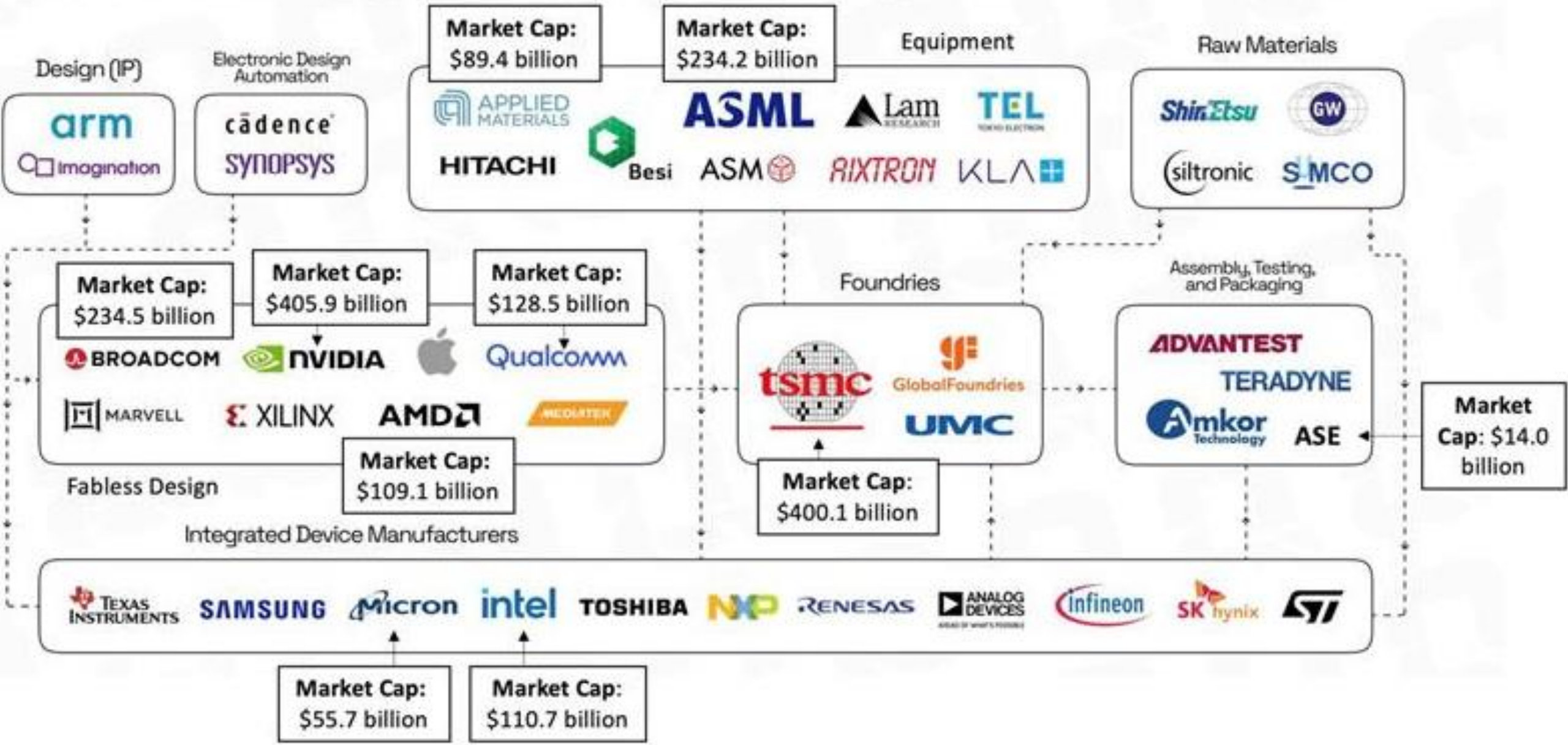
The Semiconductor Value Chain

Created by Quartr & SQUALL



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Background: US CHIPS Act

- The US Senate passed the CHIPS Act in July 2022 with aims of boosting the semiconductor industry by $54Bn by 2023
- The passing of the Act provided incentives for the global semiconductor industry to compete with China. The US called on allies and trade partners to adopt its policy
  - Akira Amari, the head of Japan's ruling party, recently explained that "we must limit imports of advanced chips that might be utilized for military reasons and pose significant security dangers"
- Under the Act, companies such as KLA Corp., Lam Research Corp., and Applied Materials Inc., were barred from providing equipment to Chinese owned advanced logic chip plants
  - Restrictions started in October 2022 when the Commerce Department prohibited semiconductor sales to Chinese companies
  - A license is needed for US chipmakers to sell AI chips to Chinese firms
  - **Without the technology from these companies, it would be nearly impossible for Chinese companies to build production lines that could make the most advanced chips**

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US Trade Statistics

Background

- The US is the biggest innovator and supplier of semiconductor technology
- The US' semiconductor capabilities will increase even more with the Netherlands and Japan on its side

Netherlands-Japan Trade

- **2022 US imports from the Netherlands:** $32Bn through November
- **2022 US imports and exports from Japan:**
  - Prices for imports from Japan rose 2.3% in 2022, the largest advance in 2011 (bls.gov)
  - Export prices dropped 2.6% in December and .6% in November, but had an overall rise of 3% across 2022

2022 US-China Trade

- Fell 2.2% in December 2022, for a 1.1% decrease across 2022
- This is the first calendar-year drop since a 1.3% decline in 2018
- The price index for Chinese exports from the US fell 2.3% in December, but remaied unchanged over 2022 (bls.gov)

US Semiconductor Imports

- **2022 US semiconductor imports**: $71.34Bn through November
  - November: $6.68M – a 1.17% drop compared to October 2022
  - Imports reached an all time high of $6.67Bn in September 2022
- **2022 US computer chip imports**: $40.15Bn through November
  - November: $3.38Bn - a 2.12% drop compared to November 2021
- Computer chips ranked No. 10 by value in November 2022 among over 1,260 commodity classifications (US Trade Numbers)
  - Ranked No. 521 by tonnage

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China Trade Statistics

Background	2022 IC Imports	2022 Chip Exports	2022 Chip Output & Production

• China is the largest semiconductor sales market
  • Chips are China's single largest import, paying the equivalent of its crude oil and iron ore imports in 2022 (SCMP)
• Trade deficit for chip trade: $261.7Bn
	• $415.6Bn by value
	  • By value, imports dropped 3.9% from 2021
	  • This means China is paying higher unit prices for imports
	• 538.4Bn units, a 15.3% drop from 2021 – a reversal from the increase of 22.1% in 2020 and 16.9% in 2021 (SCMP)
	• Highest imports fall was in November 2022, dropping by 25.3% to 40.5Bn units (SCMP)
		• 12% drop in volume YoY to 273.3Bn
		• Export value increased .3% to $153.9Bn in the same period
			• November output fell 15.2% YoY (National Bureau of Statistics)
			• November production fell to 26Bn units
			  • Slowest YoY decline over the past five months (SCMP)

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Global Chip Restrictions Against China

Background

- After the US moved forward with chip restrictions against China, other countries began following
- The Netherlands and Japan will soon limit China's access to advanced semiconductor machinery
  - **Will further hinder China's ability to improve domestic chip capabilities**
- In January, Japanese Prime Minister Fumio Kishida and Dutch Prime Minister Mark Rutte met with President Biden to talk about how to move forward with the restrictions (Bloomberg)
  - Plans were finalized by the end of January, restrictions yet to be announced due to "sensitivity". No plan for public announcement of restrictions (msn)

Current Situation

- **Limits to be created on supplies sent to Chinese companies**
  - **Actual implementation could take months**
- Japan and the Netherlands **may not go as far as the US in their restrictions**, which limits US hardware exports and prohibits US companies from collaborating with Chinese chipmakers
- If all three nations act, Beijing may lose access to the knowledge and technology required to manufacture modern chips
  - Could take China 20 years to regain lost ground (SCMP)

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New Chip Restrictions: Impacts to China

Impacts to China

- Both Japan and the Netherlands hold dominance in their respective areas due to specialized technology. Without this, China is unable to manufacture chips
- Can hurt China's offshore yuan (msn)

Export Restrictions

- Restrictions began by limiting exports of semiconductors for Chinese military usage
  - The restrictions are imposed on all technology imports and exports by the US
- Includes the machinery and required tech for chip manufacturing
  - ASML will not be able to sell some of its deep ultraviolet lithography (DUV) machines which are crucial to advanced chipmaking. Current bans already include extreme ultraviolet lithography (EUV) machines
  - Similar restrictions to be placed on Nikon

Potentially Impacted Companies

- **Japan:** Advantest Corp., Nikon Corp., Resonac Holdings Corp., Lasertec Corp., and Shin-Etsu Chemical Co. Ltd.
- **Netherlands:** ASML

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Importance of Dutch and Japanese Exports to China

Background - Netherlands

- Planning to join the US Chip project - unknown which products will be banned
  - Including but not limited to advanced lithography tools

ASML Holding NV

- Dominates the lithography technology industry
  - One of the world's leading chip production equipment manufacturers
- **Current ban includes the sale of EUV machines**
  - China needs EUV machines to create sub-5-nm chips (msn)
  - **Foundries in China have largely postponed the creation of chips below 14-nm**
- **DUV machines may also be impacted**
  - Some DUVs can make advanced node chips with enhanced processing technology (msn)
  - Ex. The Twinscan NXT 2100i immersion DUV system – it could enable 5-nm chip production

Background - Japan

- Planning to join the US Chip project by changing its foreign exchange law
  - Unknown if products like high-end photoresists will be restricted – Japan dominates this market
  - Japan will not specify China in its restrictions to reduce risk of retaliation
- Japan makes roughly one-tenth of the world's semiconductors (US News). It is a major supplier of machinery needed to make chips
  - Most are not as advanced as those made by TSMC and Samsung
- **Potentially impacted companies are unaware of what restrictions will apply to them**
  - Have not yet been contacted by Japan's Ministry of Economy

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Resilinc Outlook & Solutions

Last Updated: 2/6/23

Outlook: Impacts to China's Semiconductor Industry

Impacts to chip supplies and costs

- **Imminent shortage of high-performance chips (SCMP)**
- **Available chips have increased in costs due to the shortage**
  - Costs have increased five to six times (SCMP)
- Increased logistics costs

Company impacts

- Decreased profit margins
  - Possible decreases to R&D funds
- Pushing away potential clients due to high costs
- In the long-term, companies may have to redesign products or withdraw from the market (SCMP)
  - Weakened innovation capacity
- **Highest impact to small and medium-sized companies – risk of bankruptcy**

Long-term outlook: China's semiconductor industry

- **China will be three generations behind in chip advancement**
- A $143Bn support package is being prepared to invest in China's semiconductor industry to counter the impact of sanctions
- **Silicon-based chips to continue advancing for 15-20 years** before potential replacement technologies (SCMP)
  - Replacement technology including non-silicon chips or quantum computing

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Resilinc Solutions

Digitalized supply chain to drive predictability, greater velocity and consistent operational performance in an uncertain environment

- 80% of disruptions occur in the lower tiers of a supply chain – if you only have visibility into 20% of your supply chain – that lends itself to a lot of risk
  - For example, a shortage of 25-cent cardboard boxes delayed a shipment of modules worth $33 a piece
  - After a 3M plant was shut down in Belgium (due to ESG violations) 80% of the world's coolant supply was disrupted, impacting the global supply chain and production to large companies such as Samsung and Intel

You need to know

- Where/who you are sourcing from and what you are sourcing - companies and governments can't afford these types of mistakes
- Supply chain visibility, in the form of monitoring and supplier mapping is no longer optional
- Companies have to understand what products are being imported from countries with bans
- It all begins with DATA

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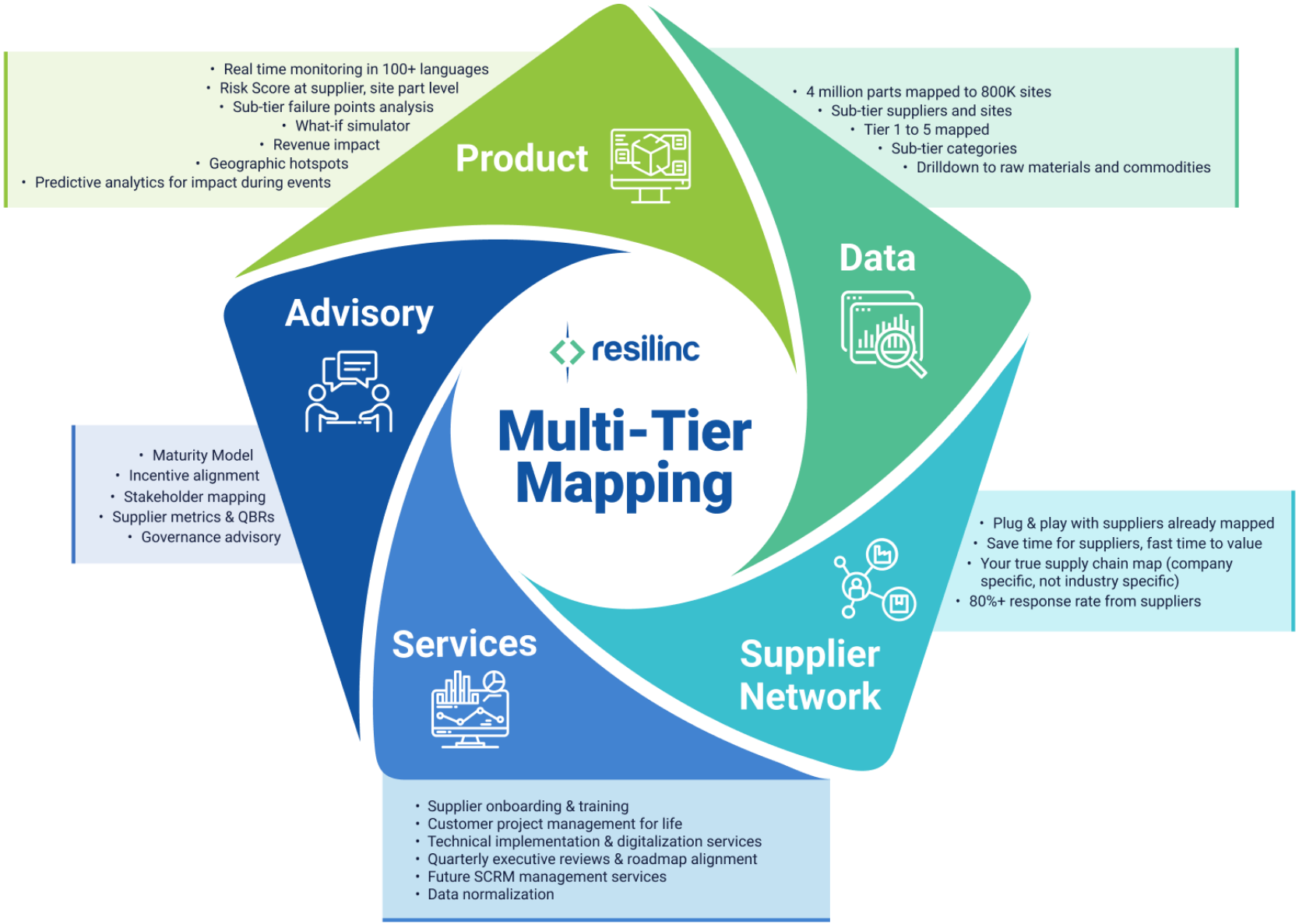
Resilinc Solutions: Multi-Tier Mapping



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Thank You!

Got feedback? We want to hear it at specialreports@resilinc.com

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