MOOV

SECONDARY SEMICONDUCTOR EQUIPMENT

MARKET TRENDS 2022

Secondary Semiconductor Equipment **Market Trends 2022**

Executive Summary

- Awareness of and interest in the secondary market for semiconductor manufacturing equipment has increased sharply over the past two years.
- Historical estimates of the size of the global secondary market for semiconductor manufacturing equipment put market size in 2022 between $5.9 billion and $11.8 billion, however; this may be an underestimate.
- A majority of semiconductor manufacturers surveyed showed willingness to resell equipment no longer in use, creating supply of pre-owned equipment.
- A majority of semiconductor manufacturers surveyed expressed intent to increase their spend on pre-owned equipment in the future.

The value of a robust secondary market for SME

BUSINESS

Increasing liquidity of capital equipment helps manufacturers to compete/adapt/respond more nimbly, especially for small-midsize manufacturers trying to compete in a consolidated industry.

CONSUMER

By enabling manufacturers to respond more nimbly to market trends and by alleviating some of the risk of investing in capital intensive assets, a secondary equipment market helps stabilize supply chains. The past two years have made even everyday consumers aware of impact of rigid supply chains in an industry that affects 200 downstream industries.

ENVIRONMENT

A secondary market encourages more environmentally sustainable manufacturing through reuse of equipment that can be difficult to decommission, breakdown, and recycle.

Introduction

The semiconductor industry, prone to periods of surplus and scarcity, has experienced a particularly tumultuous couple of years. The COVID-19 pandemic led to an unpredicted surge in demand for consumer electronics, while fabrication center (fab) closings due to stay-at-home orders and natural disasters further exacerbated supply shortages.

Pre-pandemic, the Semiconductor Industry Association (SIA) predicted a **6.3%** increase in demand for semiconductors in 2021. [1] In August 2021, demand had increased **29.7%** year-over-year. [2]

6.3%
predicted 2021 increase

29.7%
actual increase in 2021

While several factors led to the initial scarcity of supply, chip shortages became a sustained global issue due the rigidity of the semiconductor supply chain. The barrier to entry to build a new fab is high – costing billions of dollars and taking several years. Expanding capacity in existing fabs has also proven difficult in recent years as shortages of chips have led to shortages of the equipment required to produce those chips, which rely on semiconductors to operate.

As Vice President of Corporate Marketing and Market Intelligence at SEMI, Sanjay Malhotra, told Semiconductor Engineering:

> *"Chip shortages have contributed to increased lead times for fab equipment. Lead times for fab equipment were between three to six months in 2020, extending to 10 months on average in the first quarter of 2021, and even further to 14 months on average in July of 2021. For some fab equipment, the lead time exceeds two years. [3]"*

[1] Semiconductor Industry Association Report, December 3, 2019.

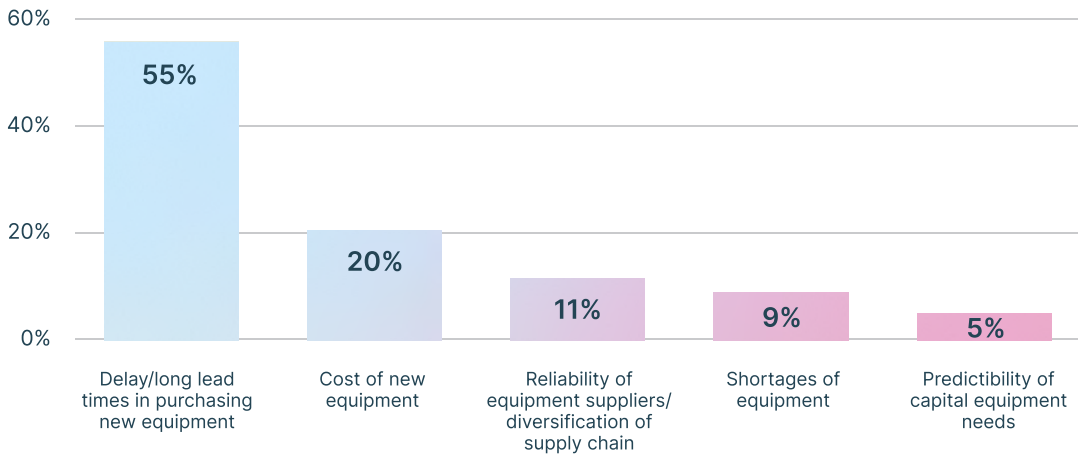
[2] "Global Semiconductor Sales Increase 29.7% Year-to-Year, 3.3% Month-to-Month in August," October 4, 2021. https://www.semiconductors.org/global-semiconductor-sales-increase-29-7-year-to-year-3-3-month-to-month-in-august/

[3] "Chipping In For Equipment Suppliers: The Equipment Multiplier Effect On The Chip Shortage," May 2, 2022. Semiconductor Engineering.

Where we will continue to see demand not met by supply is likely to be less complex chips, created on older nodes. These chips may not be bleeding edge but they are used side-by-side with bleeding edge chips in just about all modern electronics. According to a report released in January 2022 by the Department of Commerce based on a survey of all major semiconductor manufacturers and end industries, supply shortages have been most keenly felt by legacy logic chips used in medical devices and cars; analog chips used in power management, image sensors, and RF applications; and optoelectronics chips used in various types of sensors and switches. [1]

Given some of the equipment used to fabricate these components is no longer in production, it is not surprising that The White House's 100-Day Supply Chain Review found "there is currently a shortage of 200mm equipment, which shows no sign of abating."[2] Indeed, in a September 2022 survey of semiconductor manufacturers fielded by Moov, a majority of respondents indicated that equipment delays and long lead times were the top problem they faced in purchasing equipment. [3]

What is the biggest challenge you face in purchasing equipment?



With pronounced shortages of equipment for mature nodes, and newfound resolve from chipmakers to diversify their supply chains, the used semiconductor manufacturing equipment market is poised to become more important than ever to the industry.

---

[1] "Results from Semiconductor Supply Chain Request for Information," January 25, 2022. US Department of Commerce.

[2] 100-Day Supply Chain Review p. 53.

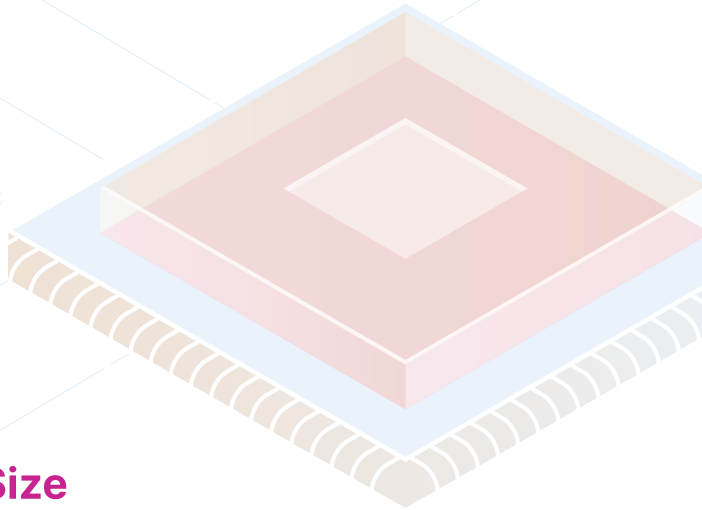
[3] Semiconductor Equipment Trends Survey. Moov. September, 2022. n=80. Top respondent titles include engineering (37.5%), procurement (30%), and fabrication center or lab manager (7.5%).

Defining the secondary market for semiconductor equipment

History

The concept of a secondary market for semiconductor equipment has been closely related to the trajectory of the 200mm process node in the past two decades. First put into production in the 1990's, in 1995 there were 65 200mm fabs globally. By 2002 there were 186 200mm fabs globally, but this number stagnated as chipmakers began migrating from 200 to 300mm, with 184 200mm fabs in 2016. However, the internet of things generated new demand for chips produced on 200mm and led to a resurgence in investment, with 200mm fabs growing from 184 in 2016 to 216 in 2022.

Prior to the resurgence of 200mm, many original equipment manufacturers (OEMs) had moved away from producing new 200mm tooling. Thus, when demand for 200mm began to increase again, manufacturers sought alternative sources for equipment turning to refurbishers and brokers to procure pre-owned systems and parts.



Challenges in Measuring Market Size

Used equipment sales can generally be thought of in terms of fab-to-fab sales (including sales through intermediary service providers and brokers) and sales of refurbished equipment directly from OEMs. The longtail of fab-to-fab sales of equipment has been difficult to track historically, with a fragmented ecosystem of brokers, service providers, and other intermediaries conducting pen-and-paper sales of 6-figure equipment. While most OEMs have equipment buy-back and refurbishing programs themselves, these public companies do not break out revenue from equipment resale in their financial reporting. For example, LAM Research includes "upgrades" and "non-leading edge equipment" in "Customer support-related revenue and other" which accounted for 35% of their revenue as of their June 2022 Quarterly Report. [1]

---

[1] https://investor.lamresearch.com/news-releases/news-release-details/lam-research-corporation-reports-financial-results-quarter-38

Applied Materials similarly folds “Legacy equipment” which includes “Comprehensive 200mm equipment and upgrades portfolio to address a full spectrum of production needs and extend tool lifetime. Applied 200mm equipment supports market inflections and new technology for a broad variety of devices including analog, power, and MEMS” into their Applied Global Services business which also includes consulting, assurance services, technology-enabled services, subfab equipment, and automation software. AGS accounted for about 22% of Applied Materials net sales in 2021. [1]

Projected Market Size

Historically, the used equipment market has been estimated to be worth **5-10%** of the primary equipment market. With global spend on equipment from OEMs projected to reach **$117.5 billion in 2022**, according to SEMI, this puts the value of the secondary market anywhere from roughly **$5.9 billion to $11.8 billion**.[2]

However, a survey fielded by Moov in September 2022 suggests these estimates could be low. Moov asked qualified respondents employed by semiconductor manufacturers what percentage of their equipment budget is spent on used equipment. Based on their responses, the secondary market for equipment could be valued at anywhere from **$12.4 billion to $28.2 billion**. [3]

Asset Composition

While 200mm equipment demand has elevated the visibility of the secondary market for semiconductor equipment, the market is not confined to sales of 200mm equipment as chipmakers purchase used equipment for various technology process nodes. Additionally, some OEMs are producing new 200mm tools, so a portion of 200mm sales includes equipment fresh off of the assembly line. [3]

On Moov’s global marketplace for pre-owned semiconductor manufacturing equipment, sales of 200mm equipment account for roughly 47% of total spend. Sales of 300mm equipment account for 22% of total spend, and sales of 150mm equipment account for 21% of total spend. **This suggests that the value of the secondary market is not intrinsically tied to a shortage of systems for a particular technology node, but instead, is a viable procurement strategy for both fabs current and mature nodes.**

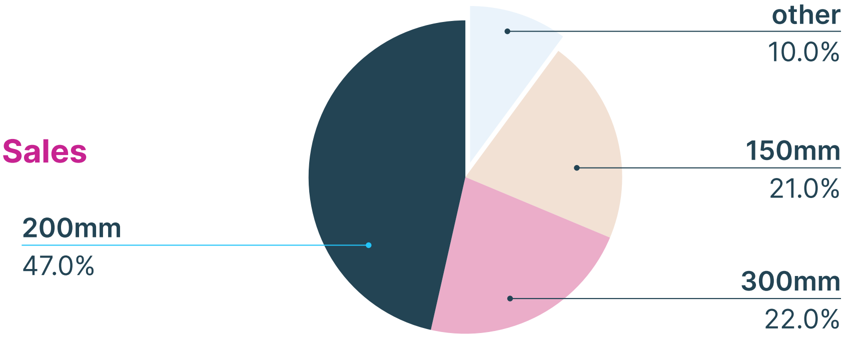
---

[1] “2021 Annual Report.” Applied Materials. https://ir.appliedmaterials.com/static-files/df09dbcf-2e31-49ec-b992-715aeaa7e503

[2] https://www.semi.org/en/news-media-press-releases/semi-press-releases/global-total-semiconductor-equipment-sales-on-track-to-record-%24118-billion-in-2022-semi-reports

[3] Semiconductor Equipment Trends Survey. Moov. September, 2022. n=80. Top respondent titles include engineering (37.5%), procurement (30%), and fabrication center or lab manager (7.5%). Total market size calculated by multiplying SEMI’s projection for 2022 equipment spend by upper and lower bounds of respondents’ indicated budget allocation for used equipment.

Moov Used Marketplace Sales by Technology Node

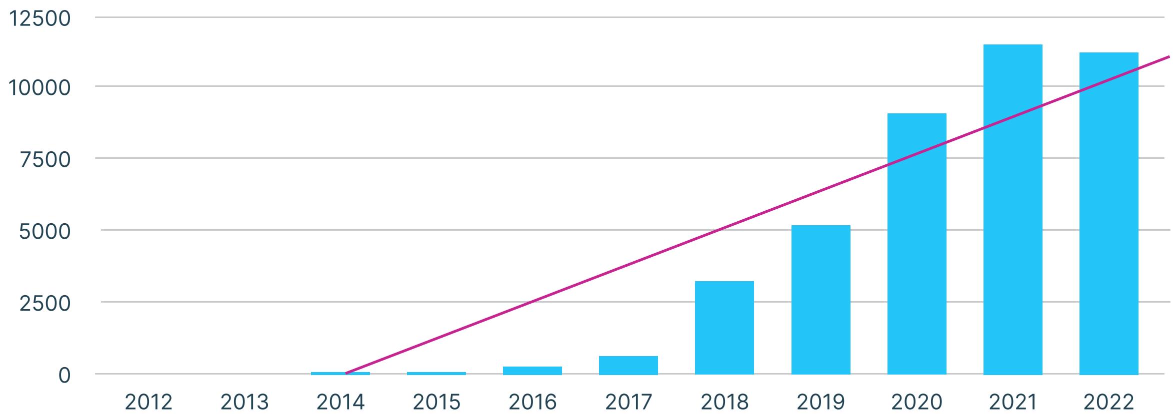


Trends in Used Equipment Supply and Demand

While calculating the overall size of the global secondary market for semiconductor manufacturing equipment may be difficult, it is possible to look at trends in market growth over time using different proxies. Google is estimated to account for over 90% of global search activity, and is one such proxy to look at awareness of the secondary equipment market and used equipment purchase intent over time.

Awareness of Used Semiconductor Equipment

Global Search Volume for Used Semiconductor Equipment

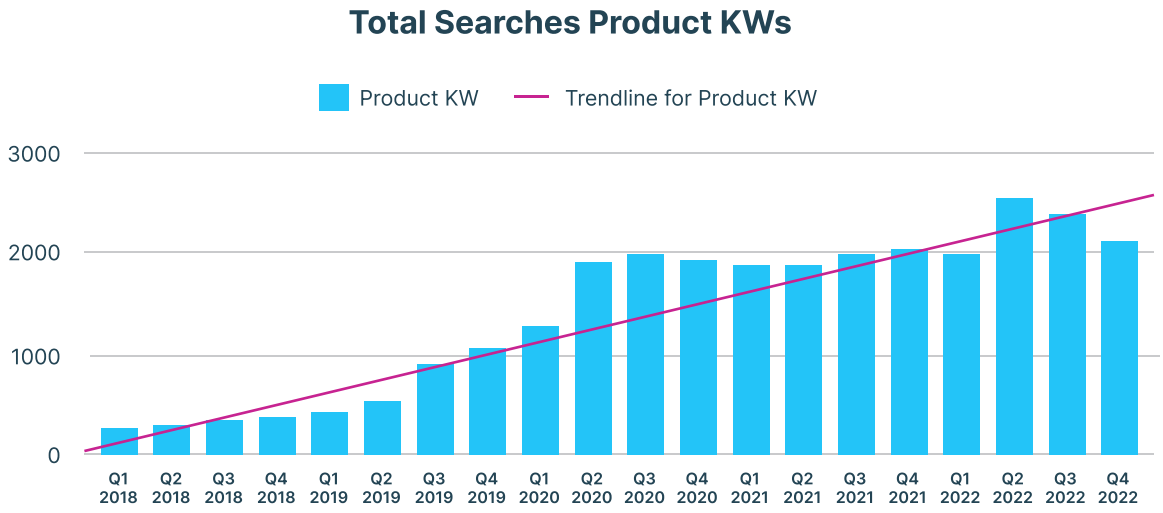


Aggregate google searches for “used semiconductor equipment” globally by quarter. Source: SEMRUSH

Using the search phrase “used semiconductor manufacturing equipment” as a proxy, there has been an upward trend in awareness of the secondary market since 2014. The sharpest annual uptick in search queries for “used semiconductor manufacturing equipment” occurred from 2019 to 2020. This uptick may correspond with the global onset of the COVID-19 pandemic. While interest in used equipment has been on the rise since 2014, potentially due to the uptick in demand for chips produced on mature nodes fueled by IoT applications, there has been a sustained level of increased awareness since 2020. This suggests that the supply chain disruptions caused by the pandemic and natural disasters has generated a sustained awareness of and interest in used semiconductor manufacturing equipment.

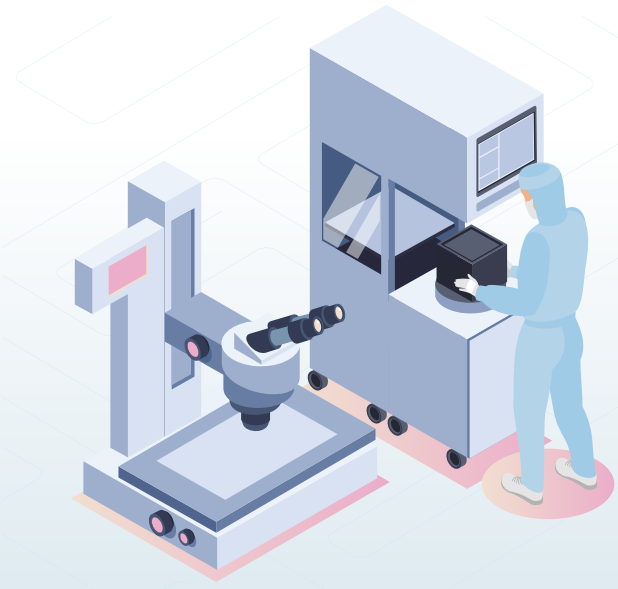
Demand for Used Semiconductor Equipment

While a generic phrase like “used semiconductor manufacturing equipment” is a good proxy for market awareness, when fabs have an immediate need for a tool they typically search for a specific make and model to find equipment. Using the top 10 most popular tools on Moov’s global marketplace for used semiconductor manufacturing equipment, we analyzed overall search volumes for these specific makes and models, used, over time based on data from Google.



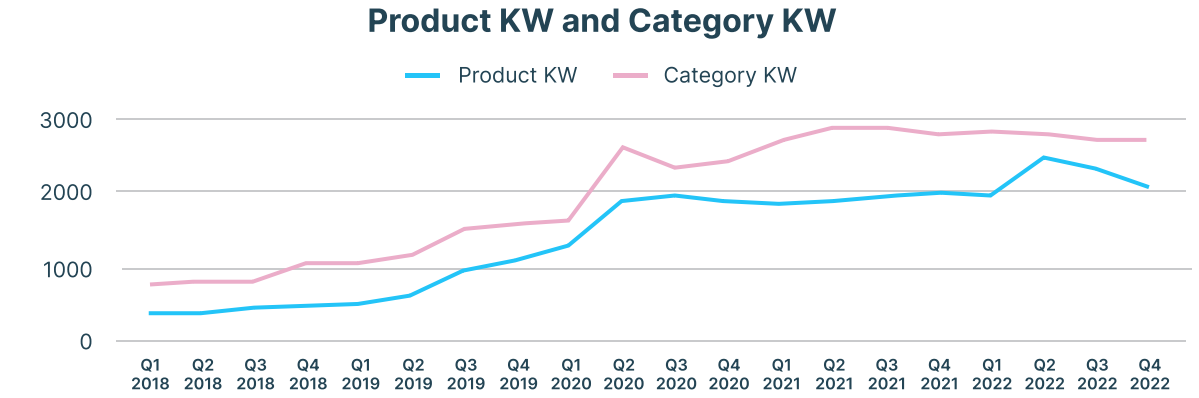
Aggregate google searches for top 10 make/model keywords globally by quarter. Source: SEMRUSH

The sharpest quarterly uptick in search queries occurred in Q2 2020 with a local peak in Q3 2020, perhaps coinciding with the realization that supply chain disruptions would not quickly resolve. Purchase intent is once again on the rise, increasing every quarter year-over-year in 2022 compared to 2021, potentially fueled by the global race and billions of dollars in government funding to secure domestic supply chains.



The Future of the Secondary Semiconductor Equipment Market

Market Growth

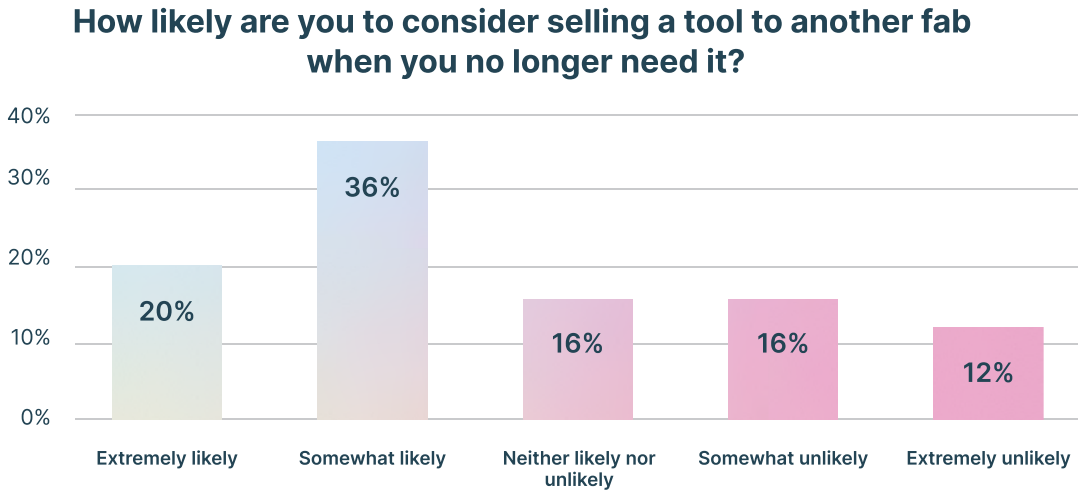


Aggregate google searches for category keywords defined as "used semiconductor equipment" and product keywords defined as top 10 make/model keywords. Source: SEMRUSH

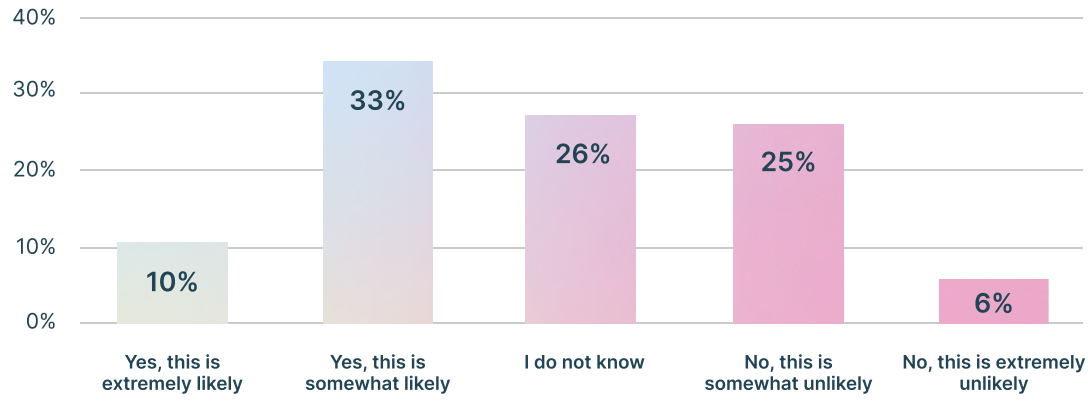
Search trends suggest growth in awareness of the secondary market (indicated in pink on the previous graph) may have plateaued in early 2021, but intent to buy used equipment spiked in Q2 2022 potentially driven by announcements of public and private funding to bolster chip manufacturing across the globe.

Another way to think about secondary market growth is to consider available supply and semiconductor manufacturers' willingness to engage in fab-to-fab sales. A majority of survey respondents (56.5%) indicated that they would be willing to sell equipment no longer in use to another fab.

Over 43% of semiconductor manufacturers surveyed by Moov indicated it is "extremely likely" or "somewhat likely" they will increase their spend on used equipment in the future.



Do you plan to increase your spend on used equipment in the future?

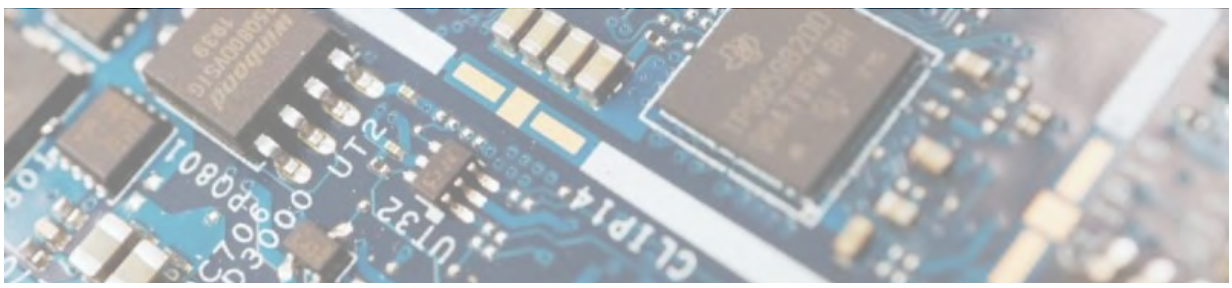


Barriers and Opportunities

The ripple effects of supply chain disruptions that persist 33-months after initial pandemic-related plant closures, at the time this report was written, are a testament to the inherent problems in the semiconductor supply chain. The extremely high barrier to entry to manufacture chips has forced consolidation in the industry. This consolidation translated into little flexibility to expand capacity in response to increased demand, especially at mature nodes, as foundries hit 90%+ utilization in 2021. As demand for manufacturing equipment also increased, chip shortages further delayed already long wait times on semiconductor manufacturing equipment that, like all modern technology, requires semiconductors to operate.

A robust secondary market for semiconductor equipment is part of the solution to manage risk in the semiconductor supply chain. Not only does a secondary market provide large manufacturers with alternative equipment sources to more nimbly expand capacity in the short term, but also it reduces the inherent risk and barrier to entry for small to midsize manufacturers allowing them to once again compete in this industry.

Historically, security, reliability and transparency have been the biggest barriers to the growth of the secondary market for semiconductor manufacturing equipment. Chipmakers big and small have horror stories to share around experiences buying used equipment from bad actors, only to have it arrive broken, missing parts, or months later than expected.



In many ways, these are supply chain problems that can be solved with technology. Moov, the largest global marketplace for used equipment, has proven it is possible to guarantee manufacturers a reliable and secure experience in buying and selling used equipment.

Two such examples include:

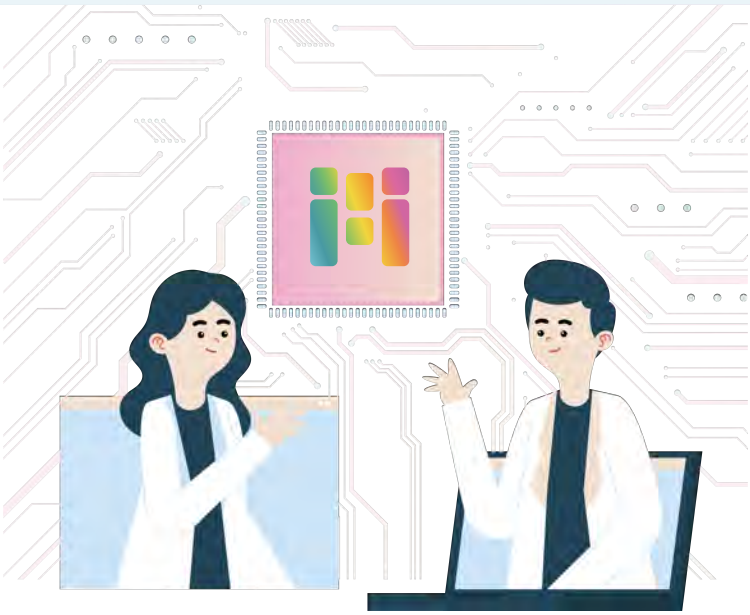
Ensuring end-to-end visibility of assets in transit:

In uncertain times, one common challenge is the ability to give customers insight into the status of their high value asset as it is being transported to them. Additionally, equipment buyers need the ability to ensure equipment is maintained in proper environmental conditions along what might be a multi-modal global journey. Moov uses telematics devices and sensors to enable full end-to-end tracking of equipment, so that buyers feel confident in knowing where their equipment is and what condition it is kept in en route.

Enabling digital inspection of high-value goods:

A challenge unique to manufacturers purchasing used equipment from various suppliers around the world is the ability to ensure the assets they are buying are what they are represented to be in the condition they are represented to be in. Finding inspection engineers able travel to inspect equipment on site when that equipment might be located across the globe from a buyer could take weeks, even months. To help buyers solve this problem, Moov employs digital inspection technology which allows for remote inspection via photographic verification.

Which is to say, technology exists to ensure reliable end-to-end procurement of used semiconductor manufacturing equipment.



Conclusion

Directional evidence suggests that the secondary market for semiconductor manufacturing equipment has been growing for some time, and has seen a new level of growth propelled by global chip and equipment shortages. Semiconductor manufacturers have expressed both a willingness to buy used equipment and sell idle equipment to other fabs. Yet, this is a market that will remain fragmented, unmeasured and easily overlooked by chipmakers, industry groups and regulators alike until it is formally measured and its size and significance understood. As Moov CEO Steven Zhou wrote in Forbes, "As an industry, we can help add transparency and legitimacy to this supply chain strategy by formally measuring and monitoring the global secondary market for semiconductor manufacturing equipment."[1]

[1] "The Solution to the Global Chip Shortage Mau Have Already Been Manufactured," Steven Zhou. Forbes. April, 2021. https://www.forbes.com/sites/forbestechcouncil/2021/04/28/the-global-chip-shortage-the-solution-may-have-already-been-manufactured/?sh=75a422f71eaf

MOOV

SECONDARY SEMICONDUCTOR EQUIPMENT

MARKET TRENDS 2022

moov.co