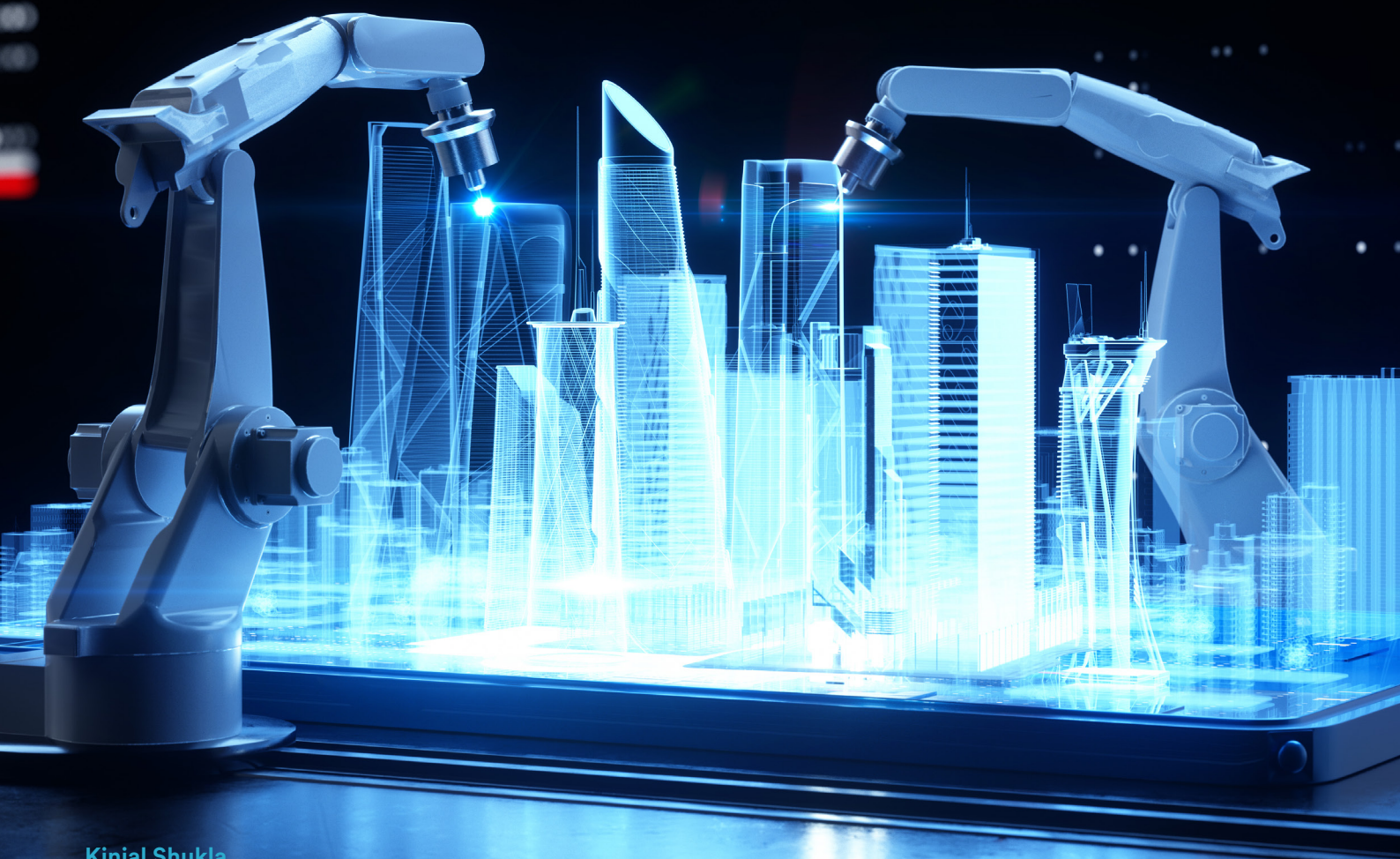


EQUITY  
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# Introducing the BlueStar® Global Robotics & 3D Printing Index

Capturing the Synergies in Automation



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 MarketVector™

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## Introduction

Throughout history, technological innovation has consistently enhanced the efficiency and convenience of our daily lives and work. With groundbreaking advancements in power and motion control, semiconductor technology, and communication networks, the focus of technological advancement is now on automation. The secular trend toward automation is reshaping our understanding and expectations of technological evolution, influencing nearly every industry.

In particular the industrial and manufacturing sectors play a significant role in bolstering global economic resilience and productivity, driven by three pivotal technologies: robotics, additive manufacturing, and computer-aided design. Together, their synergy amplifies the potential of each, creating an interconnected framework that elevates industrial efficiency and innovative capabilities.

In the era of automation, it's imperative to recognize the drivers of these technologies. Not only do they promise streamlined operations, but also present opportunities for workforce upskilling, sustainable production, and fostering a more interconnected global industrial ecosystem. Embracing these changes can lead us to a future where robotics and human ingenuity collectively drive unparalleled growth.

Moreover, as these technologies mature and intertwine, they hold the potential to democratize access to advanced manufacturing and design capabilities. Small and medium-sized enterprises (SMEs) can harness the power of automation to level the playing field, challenging larger competitors and stimulating localized innovation. This democratization not only amplifies global competitiveness but also has profound implications for job creation, regional development, and the broader distribution of technological benefits across society.

In this paper, we delve into the foundations of industrial automation technologies and demonstrate how robotics, additive manufacturing, and computer-aided design can be brought together in the [BlueStar® Global Robotics & 3D Printing Index \(BRB3D\)](#).

## Robotics Industry Drivers

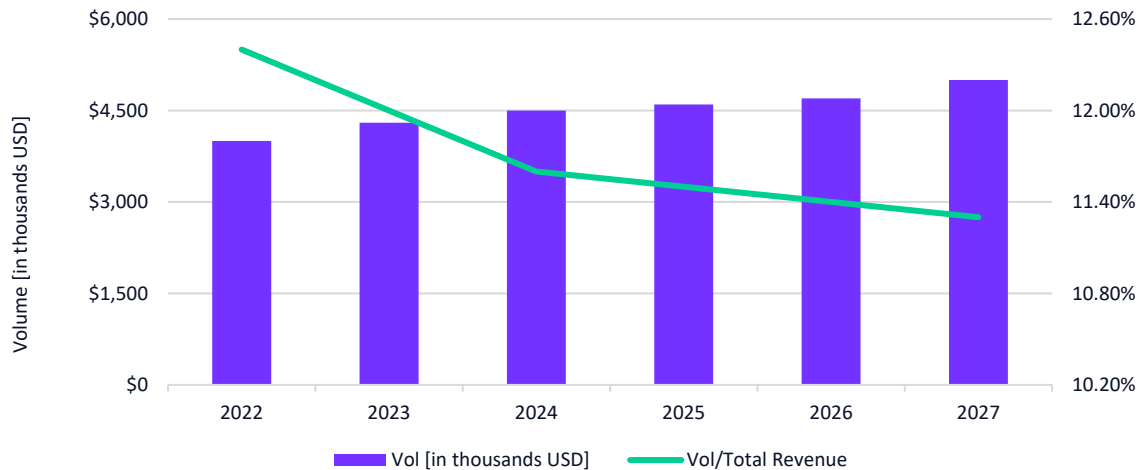
Adoption of robotics is a long-term secular trend and is rapidly becoming entrenched in companies' everyday operations, with industries such as logistics, manufacturing, and healthcare committed to increase their capital spending by up to 25%<sup>1</sup> on automation technologies over the next 5 years. Robotics companies are poised to capitalize on this growth as the robotics market is projected to reach USD 35 billion in 2023; furthermore, gross margins for the robotics industry are expected to expand as both total volumes and average selling prices are expected to rise over the coming years, as shown in Exhibit 1.

### Exhibit 1: Trend forecast for # of Robots produced worldwide along with its revenue impact<sup>2</sup>

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<sup>1</sup> "Unlocking the Industrial Potential of Robotics and Automation McKinsey." [www.mckinsey.com](https://www.mckinsey.com). May 18, 2022. [www.mckinsey.com/industries/industrials-and-electronics/our-insights/unlocking-the-industrial-potential-of-robotics-and-automation](https://www.mckinsey.com/industries/industrials-and-electronics/our-insights/unlocking-the-industrial-potential-of-robotics-and-automation).

<sup>2</sup> "Size of the global market for industrial robots from 2018 to 2020, with a forecast for 2021 through 2028", Statista, March 2023. <https://www.statista.com/statistics/760190/worldwide-robotics-market-revenue/>.



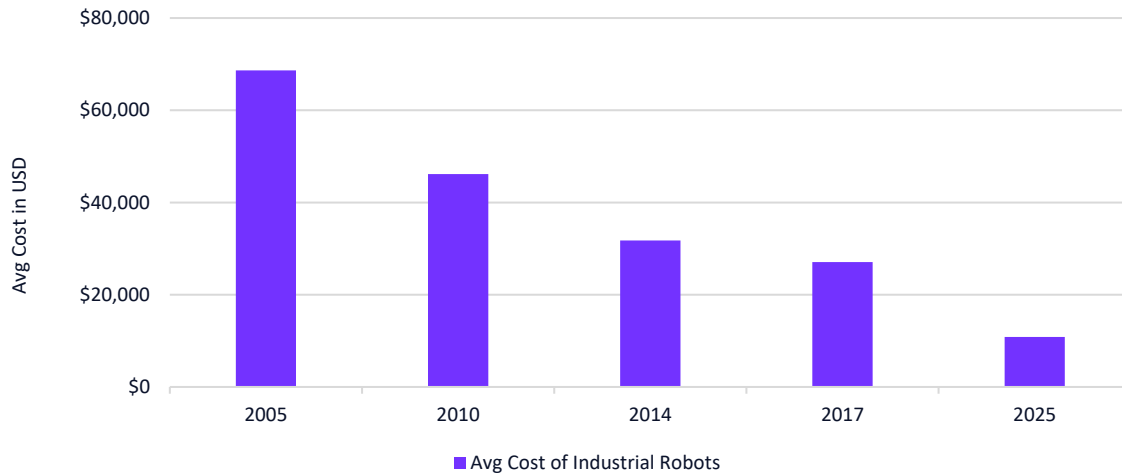
Source: Statista, March 2023.

The robotics industry can be classified into two overarching segments with distinct applications: Industrial and Service.

**Industrial Robotics:** Industrial robots are used in manufacturing and production industries to automate repetitive tasks such as assembly, welding, material handling, and quality control. These robots are often large and powerful, designed to work alongside humans or operate in hazardous environments. The industrial robotics market is projected to grow steadily at an elevated (as compared to global GDP) CAGR of around 10% from 2021 to 2027<sup>3</sup>. Additionally, the average cost to produce industrial robots worldwide has steadily declined from about 69,000 U.S. dollars in 2010 to 27,000 U.S. dollars in 2017. This trend is expected to continue through 2025 as economies of scale pave the way for improved costs.

<sup>3</sup> Owens, T. "Industrial Robots - average cost". Statista, January 5, 2023.  
<https://www.statista.com/statistics/1120530/average-cost-of-industrial-robots/>.

**Exhibit 2: Average cost of industrial robots in selected years from 2005 to 2017 with a forecast for 2025.**



Source: Statista, January 5, 2023.

**Service Robotics:** Service robots are designed to interact with and assist humans in various situations. These robots are equipped with sensors, AI, and often mechanical arms to perform their designated functions. Examples include robots used in healthcare (like surgeries or rehabilitation), robots for domestic tasks (cleaning and home automation), and robots in hospitality (tasks for food delivery or customer service). As technology continues to advance, service robots are poised to revolutionize industries by increasing efficiency, reducing human workload, and providing innovative solutions to a wide array of tasks and challenges. The Service Robotics market is expected to witness substantial growth, with a projected CAGR of over 22% from 2022 to 2027<sup>4</sup>.

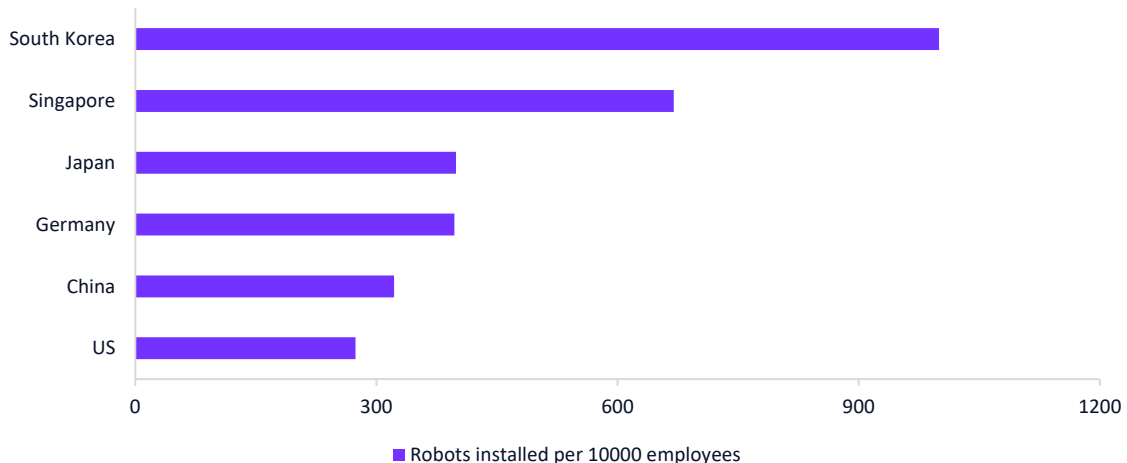
**Global Market:** The robotics industry has a worldwide market with Singapore and South Korea as leaders in its adoption evidenced by high robot densities and a focus on industrial, healthcare, and companion robots. Germany is well recognized for its expertise in industrial automation, especially in automotive production. Likewise, the United States has a vibrant robotics ecosystem, with a strong emphasis on research, development, and commercialization, particularly in autonomous vehicles and healthcare robotics. China is rapidly expanding its robotics industry and investing heavily in research and development, aiming to become a global leader in robotics.

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<sup>4</sup> Service Robotics Market. Yahoo Finance, June 2023. <https://finance.yahoo.com/news/robotics-market-grow-cagr-22-011500392.html#:~:text=NEW%20YORK%2C%20July%206%2C%202023,22.75%25%20during%20the%20forecast%20period/>.

The adoption of industrial robots in factories worldwide is rapidly gaining momentum, with the new average global robot density in manufacturing industries reaching 126 robots per 10,000 employees. This figure is nearly twice as high as it was five years ago, when it stood at 66 units in 2015. The below exhibits display robot density which is one of the key metrics to determine the adoption rate shows that Rep of Korea is leading in 2022 with 1000 robots per ten thousand employees.

### Exhibit 3: Robots density rate in manufacturing industry<sup>5</sup>



Source: IFR, December 5, 2022.

## Additive Manufacturing Industry Drivers

Additive manufacturing, also known as 3D Printing, is another rapidly advancing technology that is changing the way we design and manufacture goods. With 3D printing, objects are created layer wise using digital designs, allowing for greater customization, faster production, and lower costs. This technology has the potential to revolutionize and disrupt a wide range of industrial sectors.

**Manufacturing and Prototyping:** 3D printing enables the production of complex and customized parts with fewer design constraints. Prototyping has become faster and more cost-effective, allowing companies to iterate designs quickly and bring products faster in the market.

**Supply Chain Disruption:** 3D printing has the potential to disrupt traditional supply chains. Instead of relying on centralized manufacturing, companies can distribute production to local facilities or even individual customers. This decentralized approach reduces shipping costs, lead times, and inventory requirements.

<sup>5</sup> IFR International Federation of Robotics, Dec 2022. China overtakes USA in robot density. IFR International Federation of Robotics. <https://ifr.org/ifr-press-releases/news/china-overtakes-usa-in-robot-density>.



**Healthcare Applications:** The healthcare sector has embraced 3D printing for a variety of applications. It has enabled the production of patient-specific implants, orthodontic devices, prosthetics, surgical instruments, and anatomical models for surgical planning. Bioprinting, the printing of living tissues and organs, shows promise for regenerative medicine and drug testing.

**Aerospace and Automotive:** The aerospace and automotive industries are utilizing 3D printing for lightweight and high-performance components. Complex geometries can be printed with optimized designs, reducing weight and fuel consumption. Spare parts can also be produced on-demand, reducing inventory costs and downtime.

**Consumer Products:** 3D printing has entered the realm of consumer products, with the availability of affordable desktop 3D printers. Hobbyists and enthusiasts can design and print their own creations, from toys and fashion accessories to home decor. Online platforms allow users to share and download designs, fostering a vibrant community.

**Sustainability and Waste Reduction:** 3D printing has the potential to reduce waste in manufacturing. By using the required amount of material for each print, it minimizes material waste compared to traditional subtractive manufacturing. Additionally, 3D printing enables the use of recycled or biodegradable materials, contributing to environmental sustainability.

One such breakthrough example was the creation of first ever bio-based 3D printed house<sup>6</sup> by University of Maine in November 2022. Such technological innovations have the potential to create a paradigm shift in multiple industries like real estate, materials, and logistics.

#### Exhibit 4: A 600-square-foot prototype of the first 3D printed bio house



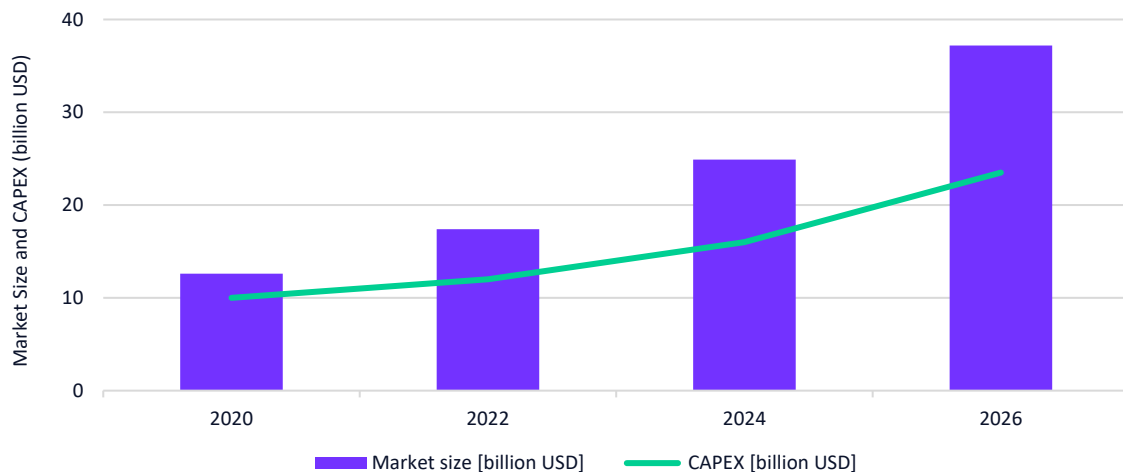
Source: UMaine news, November 21, 2022.

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<sup>6</sup> UMaine news, Nov 2022. <https://umaine.edu/news/blog/2022/11/21/first-100-bio-based-3d-printed-home-unveiled-at-the-university-of-maine/>.

The global market for additive manufacturing in 2020 was approximately USD 12.6 billion. Concurrently, capital expenditure (CAPEX) for 3D printing investments amounted to USD 10 billion during the same year. Looking ahead, the market is projected to experience substantial growth, with estimated market sizes of USD 17.4 billion and USD 24.9 billion in 2022 and 2024, respectively. Correspondingly, the CAPEX is expected to increase to USD 12 billion in 2022 and USD 16 billion in 2024. By 2026, the 3D printing market is forecasted to reach a size of USD 37.2 billion, accompanied by a CAPEX of USD 23.5 billion.

#### Exhibit 5: Global 3D printing products and services market size and CAPEX<sup>7</sup>



Source: Statista, October 8, 2021.

## Computer Aided Design (CAD) Industry Drivers

CAD is a technology that utilizes specialized software and computer systems to assist in the creation, modification, analysis, and optimization of designs. It involves the use of digital tools to produce accurate and detailed virtual representations of objects or systems. CAD software provides a range of features and functionalities that enable designers, engineers, and architects to create 2D drawings or 3D models with precision and efficiency.

The CAD industry has revolutionized the way we conceptualize, design, and create products across various fields. It has replaced traditional manual drafting methods, offering significant advantages such as increased speed, improved productivity, error reduction, and the ability to quickly iterate and experiment with designs. CAD models can be easily modified, updated, and shared digitally, facilitating effective collaboration among team members and enabling seamless integration with other computer-aided engineering (CAE) and computer-aided manufacturing (CAM) processes. It also enables the incorporation of additional information such as annotations, specifications, and documentation to enhance communication and collaboration between different stakeholders. As the CAD industry continues to evolve, it promises to reshape the future of design and manufacturing,

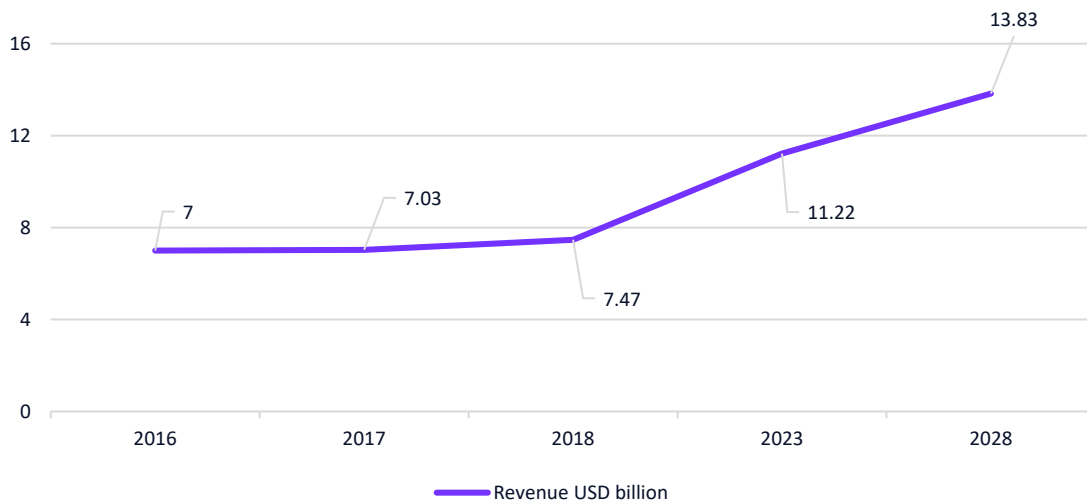
<sup>7</sup> Statista. "Global 3D Printing Industry Market Size." Statista, October 8, 2021. [www.statista.com/statistics/315386/global-market-for-3d-printers](https://www.statista.com/statistics/315386/global-market-for-3d-printers).



unlocking boundless possibilities for innovation and pushing the boundaries of what can be achieved.

This industry has recently hit somewhat of an inflection point in growth. Growth from 2016 through 2018 was gradual and consistent, rising from approximately USD 7 billion in 2016, to around USD 7.5 billion dollars in 2018. Projections indicate that the market will accelerate in the upcoming years, with annual revenues reaching nearly USD 14 billion in 2028.

#### Exhibit 6: CAD Revenue estimation<sup>8</sup>



Source: Statista, March 22, 2022.

## Company Examples

### ATS Corp [Advanced Technology Services] - Robotics

Global provider of managed services and solutions for industrial automation and information technology. With a focus on optimizing manufacturing processes and improving operational efficiency, ATS Corp integrates cutting-edge technologies like robotics, IoT, and data analytics into industrial environments. The company has shown a positive performance of 62% over the last year.

Source: [www.atsautomation.com](http://www.atsautomation.com), July 10, 2023.

<sup>8</sup> Vailshery, L. S. "Global Computer Aided Design (CAD) market 2028." Statista, March 22, 2022. <https://www.statista.com/statistics/789999/worldwide-computer-aided-design-market/>.

### Stratasys Ltd/Desktop Metal - 3D Printing<sup>9</sup>

Stratasys Ltd., a 3D printing original equipment manufacturer (OEM) based in the United States and Israel, and Desktop Metal, Inc., a global leader in additive manufacturing technologies for mass production, have officially agreed to merge their operations in a transaction valued at approximately USD 1.8 billion. This merger brings together the strengths of both companies, as Stratasys specializes in polymer-based 3D printing, while Desktop Metal excels in industrial-scale additive manufacturing. By joining forces, the newly formed entity aims to effectively cater to the evolving demands of customers in the manufacturing industry, leveraging the complementary strengths of Stratasys' polymer expertise and Desktop Metal's leadership in industrial mass production capabilities.

### Rockwell Automation - Robotics<sup>10</sup>

Rockwell Automation is a global leader in industrial automation and digital transformation solutions. The company offers a comprehensive portfolio of hardware, software, and services, including control systems, industrial networking, motor control devices, and analytical tools. By leveraging advanced technologies such as Industrial Internet of Things (IIoT) and AI, Rockwell enables organizations to enhance their manufacturing processes.

### Autodesk, Inc. – CAD<sup>11</sup>

American multinational corporation, Autodesk is a leading provider of software products and services for various industries including engineering, manufacturing, and media. It provides a portfolio of software tools that enable industries to digitally simulate on the projects. Along with its flagship products like AutoCAD, it also provides software tools like Fusion 360 and Robot Structural Analysis for designing and analyzing robotic systems.

## Holdings and Performance

The BlueStar® Global Robotics & 3D Printing Index (BRB3D) only includes companies that generate at least 50% of their revenue from industrial robotics, 3D printing solutions, or computer-aided design software. The index includes a minimum of 25 robotics companies, six 3D printing companies, and six CAD companies and stocks are weighted by float-adjusted market capitalization within tiers to achieve meaningful exposure to each of the three sub-themes.

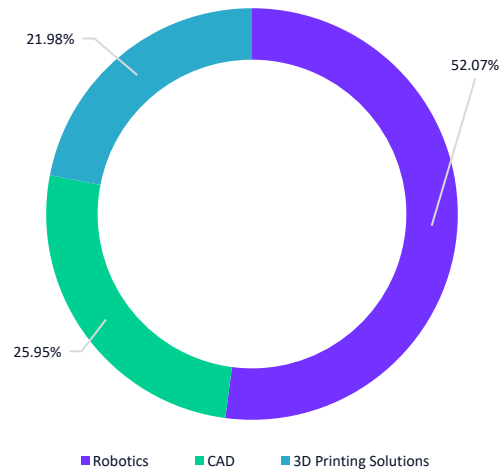
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<sup>9</sup> Source: Stratasys Press release, May 25, 2023. <https://investors.stratasys.com/news-events/press-releases/detail/820/stratasys-to-combine-with-desktop-metal-in-approximately>.

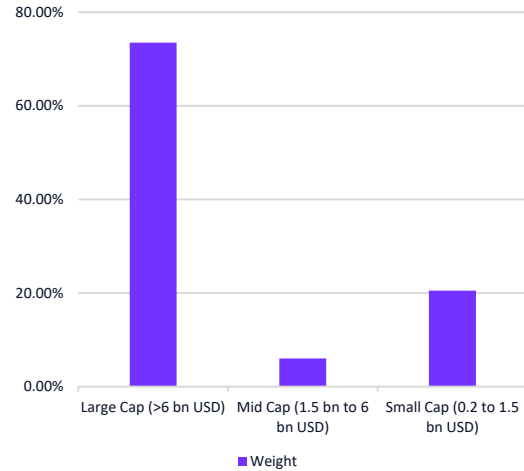
<sup>10</sup> Source: [www.rockwellautomation.com](http://www.rockwellautomation.com), July 10, 2023.

<sup>11</sup> Source: [www.autodesk.com](http://www.autodesk.com), July 10, 2023.

**Exhibit 7: Sub-Theme Representation by Weights Exposure**



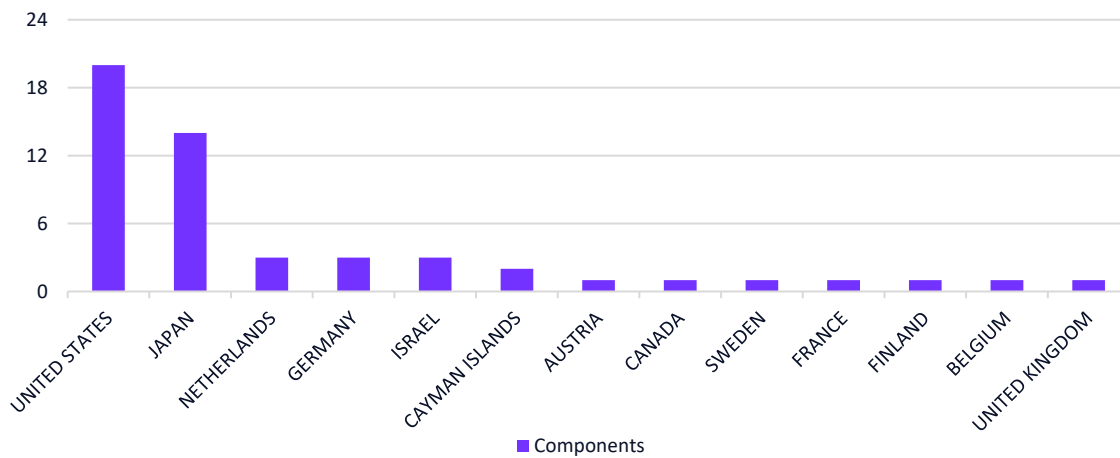
**Exhibit 8: Mkt. Cap Segment**



Source: [www.marketvector.com](http://www.marketvector.com), July 10, 2023.

The index has constituents from 13 different countries, keeping in line with the global robotics trend – countries like Japan and the US account for 65% of the total index exposure.

**Exhibit 9: Index Components by Country**



Source: [www.marketvector.com](http://www.marketvector.com), July 10, 2023.

Below are the top 10 holdings by Index weight which constitute around 56% of the index.

#### Exhibit 10: Top 10 holdings by Weight

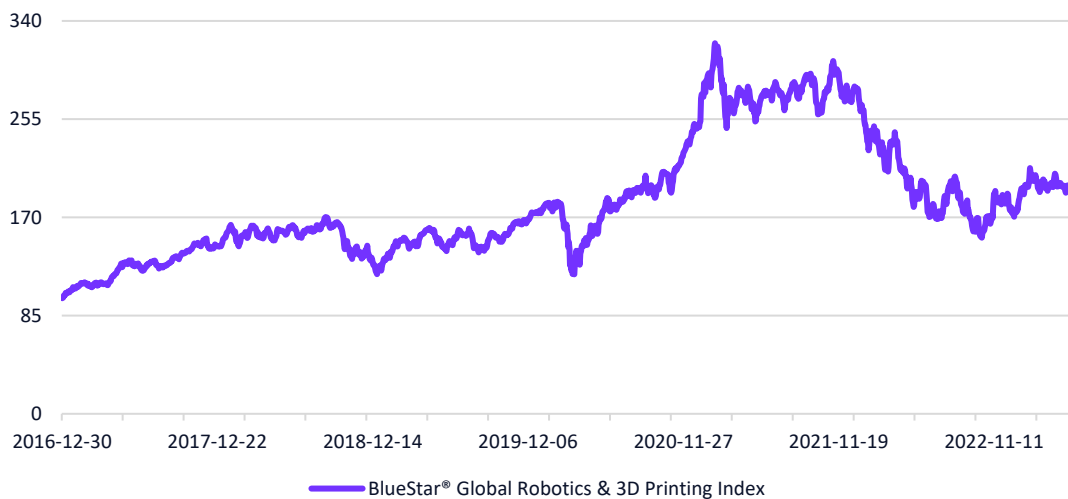
Security Name	Sub-Theme	Index Weighting	Security Name
ASML HOLDING	Manufacturing Automation Equipment	8.24%	ASML HOLDING
AUTODESK INC	CAD	7.59%	AUTODESK INC
SIEMENS AG	Robotics	7.38%	SIEMENS AG
DASSAULT SYSTEMES SA	CAD	6.32%	DASSAULT SYSTEMES SA
KEYENCE CORP ORD	Manufacturing Automation Equipment	5.54%	KEYENCE CORP ORD
APPLIED MATERIALS INC	Robotics	4.99%	APPLIED MATERIALS INC
ANSYS INC	CAD	4.35%	ANSYS INC
STRATASYS LTD	3D Printing Solutions	4.03%	STRATASYS LTD
LAM RESEARCH CORP	Robotics	3.93%	LAM RESEARCH CORP
3D SYSTEMS CORP	3D Printing Solutions	3.71%	3D SYSTEMS CORP

Source: [www.marketvector.com](http://www.marketvector.com), July 10, 2023.

## Index Performance

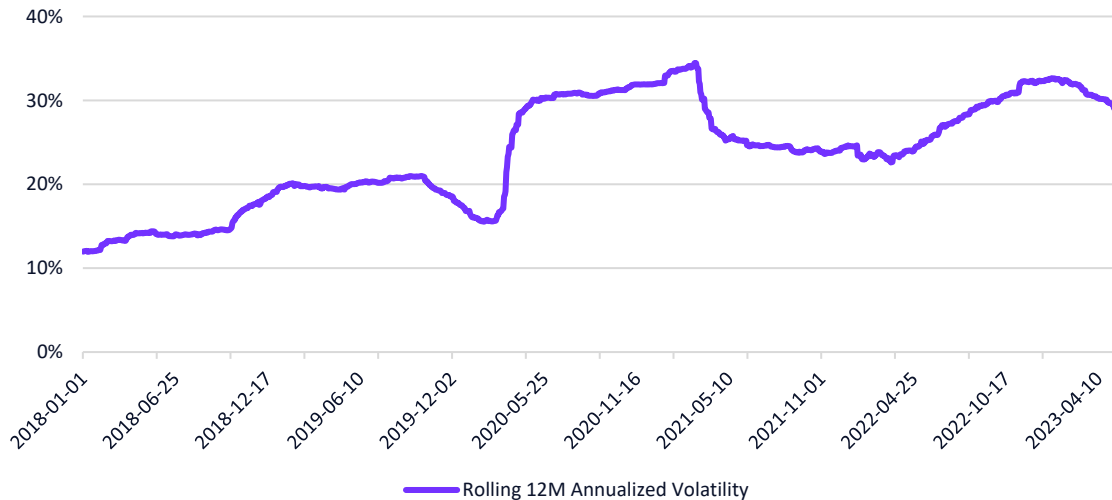
BlueStar® Global Robotics & 3D Printing Index (BRB3D) has performance history dated back to 2017. Since inception the index has been up by 88% attributed by the tech boom in the recent years. Exhibit 12 shows the rolling 12-month annualized volatility ranging from 10 to 35% over the past 6 years.

#### Exhibit 11: Total Return Historical Performance of BlueStar® Global Robotics & 3D Printing Index



Source: [www.marketvector.com](http://www.marketvector.com), July 10, 2023.

## Exhibit 12: Rolling 12 Month Annualized Volatility of BlueStar® Global Robotics & 3D Printing Index



Source: [www.marketvector.com](http://www.marketvector.com), July 10, 2023.

## Conclusion

The BlueStar® Global Robotics & 3D Printing Index (BRB3D), represents a significant milestone in tracking and assessing the performance of companies within the robotics, 3D printing, and CAD industries. This index serves as a valuable tool for investors, researchers, and industry observers to gain insights into the growth and trends within these sectors. By capturing the performance of key players and measuring the overall health of the market, the BlueStar® Global Robotics & 3D Printing Index facilitates informed decision-making and provides a comprehensive view of the advancements and potential of these segments. As these industries continue to evolve, the BlueStar® Global Robotics & 3D Printing Index will remain an essential reference point for understanding their trajectory and impact on various sectors.

Find out more about the index [here](#).



## Important Definitions and Disclosures

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