ROBOTICS BUSINESS REVIEW

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RBR50 2018 Names the Leading Robotics Companies of the Year

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RBR50 2018 NAMES THE LEADING ROBOTICS COMPANIES OF THE YEAR

By Eugene Demaitre, Senior Editor, *Robotics Business Review*

What does it take to be a robotics industry leader? Common ingredients include a novel technology, a strong understanding of customer needs, and an ecosystem of developers and integrators.

Other factors for success include investor support, components that are improving in capability and price, and a growing market that has room for competition.

End users expect systems that can perceive their surroundings; maneuver in dynamic environments; and interact with objects, one another, and humans for greater efficiency and productivity. From factories and warehouses to highways, hospitals, and the skies above, robots are becoming everyday tools to extend human capabilities.

For seven years, the RBR50 list has been one of the most prestigious collections of industry leaders in robotics, artificial intelligence, and unmanned systems. We've researched multiple companies and their applications, reviewed numerous submissions, and identified this year's top 50 companies worth following.

THE PATH TO THE 2018 RBR50

This year, we created five categories: artificial intelligence, autonomous vehicles, components, manufacturing, and supply chain. They reflect the most active markets for automation.

RBR also covers robotics and AI in agriculture, healthcare, security, and other verticals. However, it's difficult to compare companies by revenue, headcount, or number of robots sold across categories.

With so many sectors being served by automation, we tightened our list to mirror our editorial coverage and events, including this month's Robotics & AI Summit @ LiveWorx '18 in Boston and our flagship RoboBusiness conference in Silicon Valley in September.

The call for nominations ran from April through the end of May, and we received numerous submissions.

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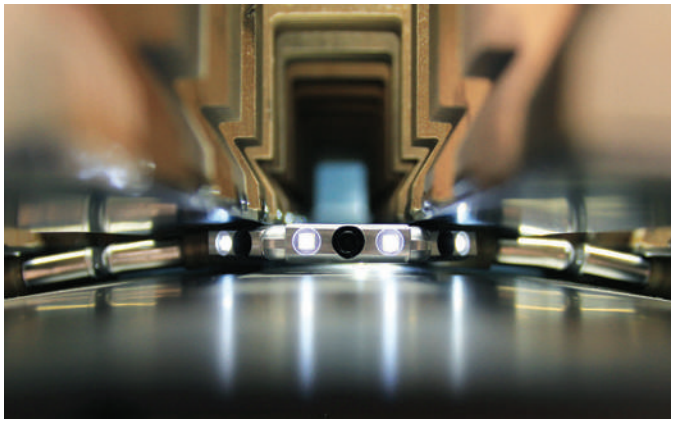


EVALUATION CRITERIA

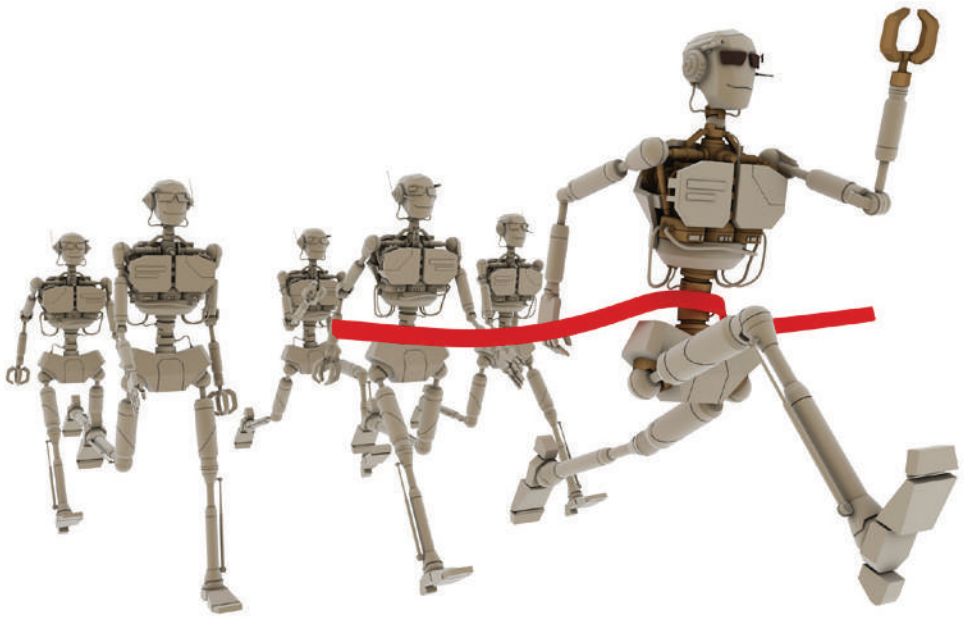
Our panel of judges, including the *Robotics Business Review* editorial team and industry experts, evaluated this year's submissions. We looked for the most innovative, successful, and influential companies in their respective areas.

For example, in innovative manipulation, IAM Robotics has been awarded the first patent for a mobile piece-picking robot. Soft Robotics has developed grippers that can handle varied objects without damaging them or relying on multiple expensive sensors.

In terms of commercial success, FANUC reportedly produces 6,000 robots per month and has more than 400,000 robots installed worldwide, making it the top industrial manufacturer. Universal Robots has grown 72% from 2016 to 2017 and is the clear leader in collaborative robot arms.

As for influence, there's no doubt that Alphabet and SoftBank Group, which have invested hundreds of millions of dollars in acquisitions and partnerships over the past year, are serious about being industry leaders. Alphabet owns Google, whose big data is helping to develop AI, as well as self-driving car company Waymo.

SoftBank Robotics' Pepper is a humanoid robot on the front lines of human-machine interaction. The company also bought media darling Boston Dynamics, whose SpotMini quadruped robots will be available for sale next year. Could these robots combine AI and mobility for the long-awaited service robots that can understand your request and fetch a drink from the refrigerator?



IN THE WINNER'S CIRCLE

In addition to bragging rights, this year's RBR50 companies can look forward to several benefits. *Robotics Business Review* will watch for developments around these industry leaders throughout the coming year.

We're also updating the pages in our company database for each RBR50 selection, which will be able to share contact information, product news, and videos with our readers.

Our audience includes engineers, robotics developers, investors, integrators, and end users. In addition to our daily articles and regular downloads and webcasts, RBR Insiders have access to subscriber-only reports, case studies, and transactions listings on *Robotics Business Review*.

Attendees at the Robotics & AI Summit and RoboBusiness can meet with speakers and exhibitors identified as RBR50 members. Our events include content devoted to chief robotics officers (CROs) and other business leaders charged with evaluating, implementing, and managing automation.

As newly minted advisers, the RBR50 companies are invited to participate in the quarterly Robot Activity Index. The RAI is an exclusive and confidential indicator of the industry's economic direction that *Robotics Business Review* is conducting with The Futurist Institute.

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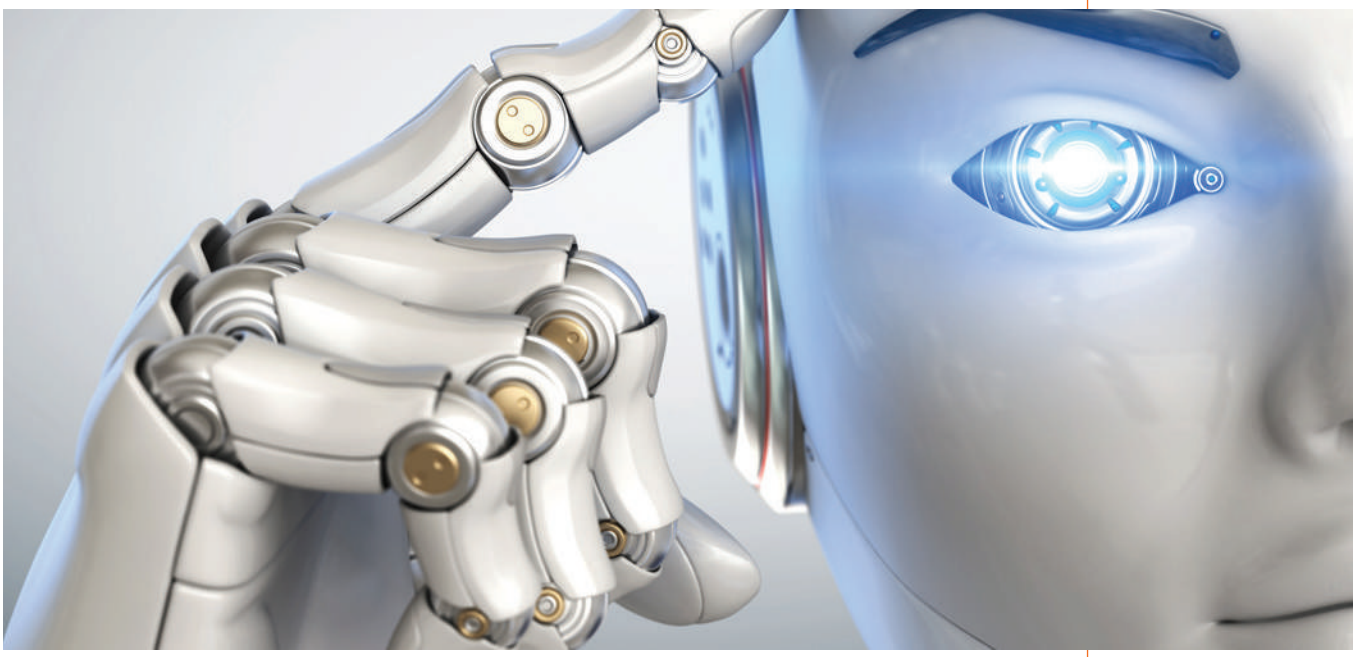
2018 ROBOTICS BUSINESS REVIEW RBR 50 COMPANY



AI + ROBOTS = GREATER UTILITY

Sure, there have been many investments in artificial intelligence in the past year, but commercial use is just starting beyond customer service, healthcare, and finance.

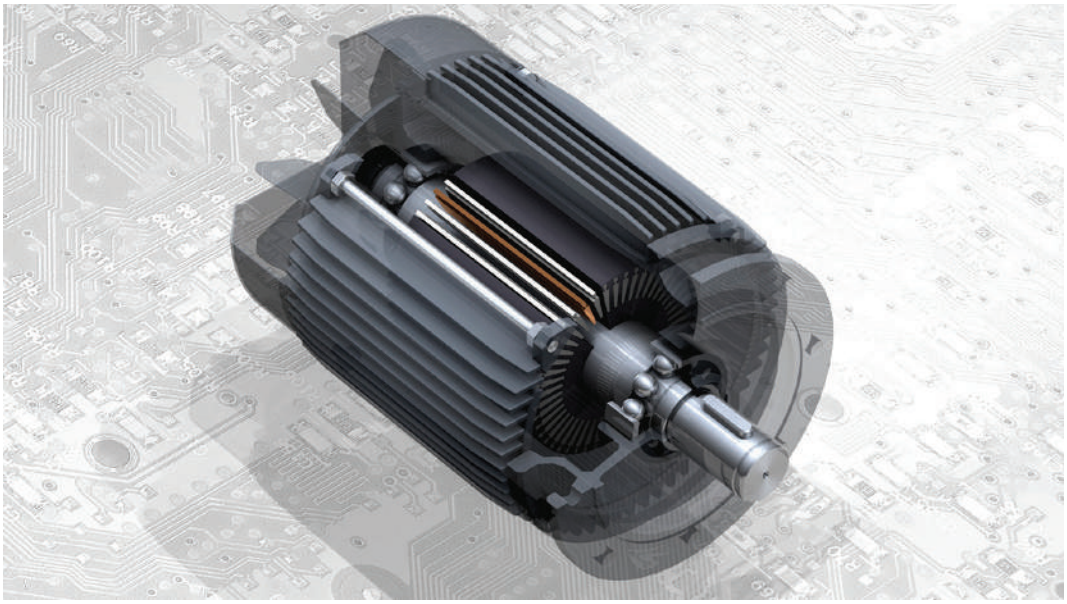
The "smart robot market" is expected to experience a compound annual growth rate (CAGR) of 23.7% from $4.94 billion in 2018 to $14.29 billion in 2023, according to Markets and Markets. The wider AI industry has already grown by 70% in 2018 so far, said *Forbes*, and it's already worth $1.2 trillion this year, claimed Gartner.

Market leader Nvidia makes the processors that power machine learning and deep learning. Deepu Talla, vice president and general manager of autonomous machines at Nvidia, described the state of the art for AI at our conference at the 2018 Consumer Electronics Show. The company's technology is also a building block for smart cities.

Similarly, Intel is working to build an ecosystem around its 3D cameras and drones. Improving navigation, object recognition, and swarm control are all examples of how AI and related technologies are making robots more useful.

One application of AI is to make existing equipment autonomous. For instance, Brain Corp. is working with Tennant Co. to make commercial floor cleaners self-driving.

In addition, the big data gathered by mobile sensors aboard drones and robots is only as good as the cloud-based controls, predictive analytics, and Industrial Internet of Things (IIoT) systems they're tied to. C2RO provides cloud-based services to both Qihan Sanbot's Elf service robots and to MIT's Senseable City Lab for smart city research.



COMPONENTS DIFFERENTIATE ROBOTS FOR DEVELOPERS, USERS

In contrast to most of this year's RBR50 categories, the components market is important behind the scenes. Developers and integrators need to know the best-in-class components to build robots that are agile, dexterous, and durable. If robots are meant to do tasks that are too dirty, dull, and dangerous for humans, they need to operate with a minimum of human intervention for maintenance.

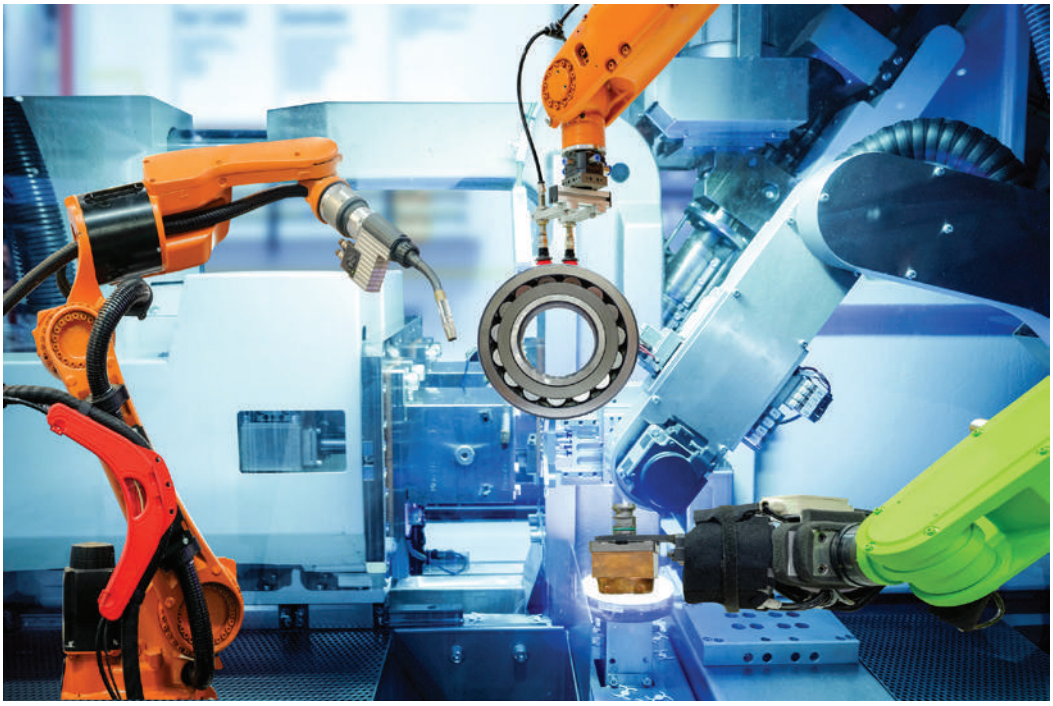
According to the Association for Advancing Automation (A3), the fortunes of machine-vision and motion-control firms have risen with robotics, setting new records last year. Vision and imaging sales reached $2.6 billion, and motion control and motors hit $3.5 billion, said A3.

Motors and controllers from maxon precision motor, drives from Harmonic Drive, and automation platforms from Kollmorgen are all designed for specific use cases, from collaborative robots and exoskeletons to robots in operating rooms, out in space, or deep underwater.

End users may not be aware of the strict requirements for size, power, and torque, but engineers must have absolute trust in the components they use.

Companies in this category do overlap with those serving manufacturing and supply chains, since Robotiq's grippers, Intel's cameras, UR's cobot arms, and Fetch's mobile platforms work across segments.

In addition, the software and AI inside service and industrial robots are becoming at least as much of a differentiator as the hardware. We'll see how they evolve in the coming year.



MANUFACTURING BUILDS ON ROBOT STRENGTHS

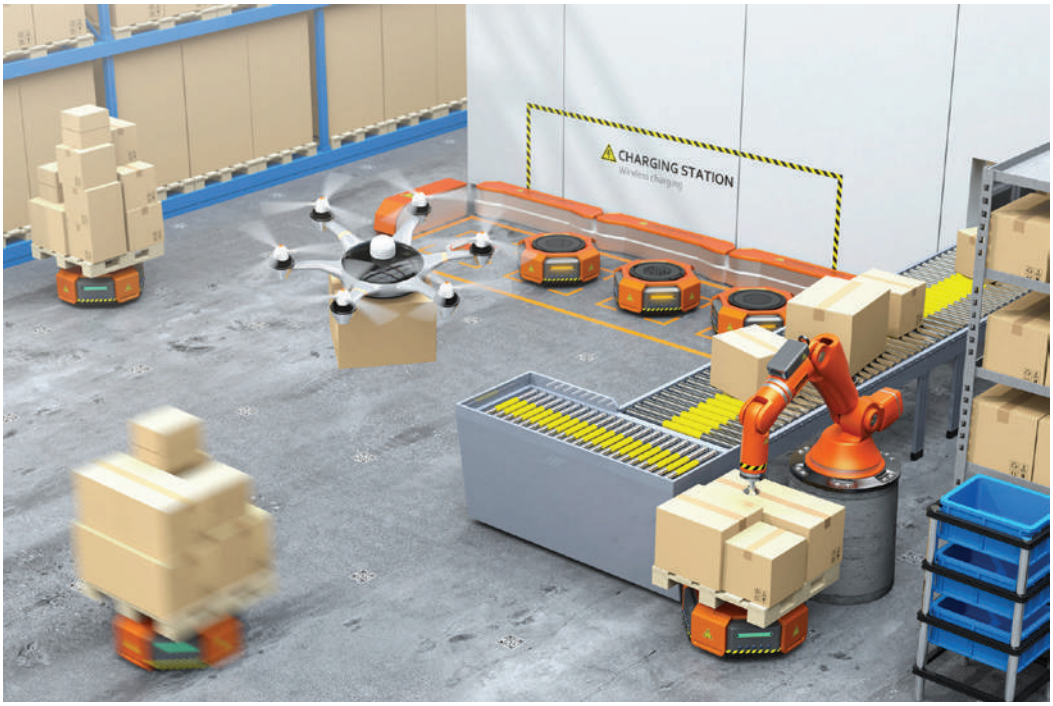
The global factory automation market totals $78.8 billion this year, found Statista. By 2020, the number of robots in factories around the world will double to more than 3 million robots, said the International Federation of Robotics.

This rapid growth will change the nature of production, as companies look to reshoring, retraining, and automation to stay competitive.

Not surprisingly, the “big four” of industrial automation — ABB, FANUC, KUKA, and Yaskawa Motoman — are among the RBR50. Even automotive manufacturing and electronics assembly, which are mature areas for automation, continue to adopt robotics at a brisk pace.

Improvements in sensors, processors, and software are making robots more flexible and affordable. Speaking of flexibility, collaborative robots, or cobots, are a major area of growth. Cobots are designed to be safer to operate alongside human workers.

Universal Robots’ cobot arms are helping to make factory line workers more efficient, as are Baxter and Sawyer from Rethink Robotics. The big four have added cobots to their own product lines, such as ABB’s YuMi or Yaskawa’s HC10.



SUPPLY CHAIN KEEPS ON TRUCKIN'

Lean manufacturing, international trade tensions, aging workforces, and the demand for rapid e-commerce order fulfillment have all contributed to growth in supply chain automation. Even more than in manufacturing, the need for supply chains to rapidly scale up while avoiding costly infrastructure revamps is encouraging robotics adoption.

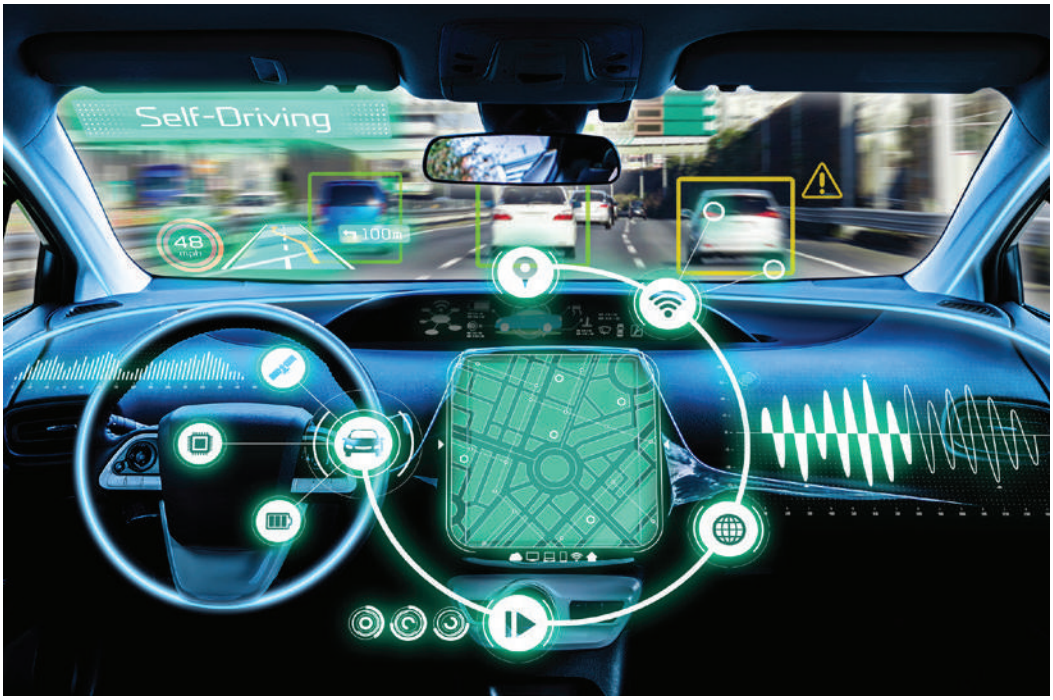
The global mobile robot market will grow from $1.1 billion in 2017 to $7 billion in 2022, predicts research firm Interact Analysis. Note that many materials-handling robots could also be useful in factories, retail stores, or hospitals. It should come as no surprise, then, that supply chain robotics companies are the biggest category in this year's RBR50.

Not only is Amazon a major user of robots in its warehouse, but it also helped create this category by buying Kiva Systems back in 2012 and taking its mobile robots off the market. Amazon Robotics is working on robots for packaging, piece picking, and solving the so-called last-mile problem for delivery.

Speaking of delivering value, Vecna Robotics won the DHL and Dell Robotics Mobile Picking Challenge late last year, and FedEx is testing its robots.

IAM Robotics, which combines mobile robots with piece picking, is only one of the companies chasing the "holy grail" of warehouse automation.

There are several approaches in warehouses, from Locus Robotics' collaborative mobile robots and OPEX's goods-to-person systems to fast-growing GreyOrange's Kiva replacements.



AUTONOMOUS VEHICLES GET READY TO HIT THE ROAD

Along with AI, the area getting the most investor and media attention in the past year includes self-driving cars, drones, and mobile robots outside of factories and warehouses. All the major automakers worldwide, as well as top tech companies such as Alphabet's Waymo, are betting on next-generation transportation of goods and people.

The market for autonomous vehicles will grow to $173.15 billion by 2030, according to Frost & Sullivan. The analyst firm expects Level 3 autonomy, conditional automation in which human drivers are used as a fallfack feature, in the coming year.

Toyota has supported R&D in driver-assist technologies, service robots, and AI. The research in driverless cars and AI is likely to benefit all forms of robotics.

Despite setbacks from recent automobile accidents, Tesla and Uber are determined to bring Level 5 cars to the roads soon. The challenges facing this category are as much social and legal as technological.

Among the recent large transactions around self-driving cars, SoftBank has invested billions of dollars in ride-sharing startups. Beyond mobile robots and passenger vehicles, Uber's OTTO Motors unit could soon be running trucks in Arizona.

In addition to ground robots, unmanned aerial vehicles (UAVs) and marine systems are increasingly used by energy providers, security forces, builders, and farmers worldwide.

The global UAV market will grow from $20.71 billion in 2018 to $52.3 billion by 2025 at a CAGR of 15%, predicts Research and Markets. SZ DJI Technology Co., or DJI, is the clear leader in this space, as drone makers tried to pivot from consumer drones to more lucrative commercial UAVs.

As with other forms of automation, software advancements and the emergence of clear use-case examples are helping adoption. For instance, in addition to its robots for inspecting and repairing live gas mains, ULC Robotics has developed a fixed-wing drone for infrastructure inspection as an alternative to expensive helicopter rentals.

RETURNING FAVORITES AND NEWCOMERS

The 2018 RBR50 includes 15 companies that have made the list more than three times in the past seven years. Some are big vendors, such as ABB, Bosch, KUKA, and Schunk. This reflects the relative maturity of robotics in manufacturing.

In supply chain, Aethon, Fetch, Omron Adept, and Seegrid continue to be market leaders, each with its own approach to materials-handling challenges.

COMPANIES TO WATCH

There are so many robotics startups and applications, we want to recognize several nominees that may not neatly fit into the 2018 RBR50 categories. These rising stars are still innovating and could shape their markets in the coming year.

- 6 River Systems Inc., Waltham, Mass. (mobile platform, supply chain)
- Calvary Robotics, Webster N.Y. (design, supply chain)
- Geek+ Inc., Beijing (supply chain, AI)
- Intuition Robotics Ltd., Ramat Gan, Israel (service, healthcare)
- Marble, San Francisco (mobile platform, supply chain)
- NearEarth Autonomy Inc., Pittsburgh (autonomous vehicles, aerospace)
- OhmniLabs Inc., Santa Clara, Calif. (telepresence, AI)
- RightHand Robotics LLC, Cambridge, Mass. (gripper, supply chain)
- Robby Technologies Inc., Palo Alto, Calif. (mobile platform, supply chain)
- Unit Dose One, Lodz, Poland (automated pharmacy, healthcare)
- Veo Robotics Inc., Waltham, Mass. (machine vision, manufacturing)

If you nominated your company but it didn't make this year's RBR50 list, note that we're always looking for news around new companies and robotics products.

About 20 more companies have been RBR50 members at least twice, including component supplier Micromo, AI leader IBM Watson, delivery robot maker Starship Technologies, and supply chain automation provider Swisslog.

The remaining third or so of this year's RBR50 are brand new. Some are involved in AI and robotic software, such as micropsi industries and Universal Logic. The number of AI startups continues to grow, but relatively few are offering products that advance industrial automation.

On the other hand, machine vision, natural language processing, and IIoT are likely to become part of robots serving every sector in the near future. The RBR50 categories could well change or grow in the coming year.

Other newcomers are in hardware components, like Elmo Motion Control, Harmonic Drive, and Kollmorgen. Given the rise of supply chain automation, it's interesting to see Canvas Technology, Fellow Robots, and Waypoint Robotics competing in a still-growing space. Which will rise to the top?

REGIONAL ANALYSIS

Although Japan and South Korea remain the world's most robot-friendly nations, both in terms of popular culture and industry adoption, they had relatively few representatives in this year's RBR50. FANUC, SoftBank, and Toyota have leveraged their size and experience into multiple international partnerships.

Also, DJI doesn't do justice to the financial and tech prowess of Alibaba, Baidu, or other Chinese conglomerates. China is interested in becoming the leading producer and user of robots and AI, but other countries, such as Canada, Germany, and Switzerland, picked up slots in this year's list.

Denmark, Estonia, and India have held onto their spots in the RBR50, but the big winner this year is the U.S., with 36 companies on the list.

American companies were represented in every category, with California home to AI firms Brain Corp., NVIDIA, and Alphabet. Mobile robot makers Fellow Robots, Fetch Robotics, and IAM Robotics are also on the West Coast.

Massachusetts had several list members, including Rethink Robotics for cobots, nuTonomy for self-driving vehicles, and Harmonic Drive for components.

The Pittsburgh area followed, with Aethon, Seegrid, and Uber reflecting the connections among Midwestern manufacturers, mobile robots, and Carnegie Mellon University alumni.

At RoboBusiness, we've examined how different regions are developing as robotics hubs, and *Robotic Business Review* will keep watching to see how efforts across the U.S., the U.K., Europe, and Asia play out.

BIG DEALS FOR RBR50 COMPANIES

As RBR Insiders can see in the *Robotics Business Review* Transactions Database, the RBR50 companies have been very successful at raising funding.

We've already mentioned the billions in investments made by the likes of Alphabet, SoftBank, and Toyota. Uber has reportedly tried to offset a $1 billion shortfall with a $1.25 billion loan.

DJI is looking for $500 million before its initial public offering. Other venture capital recipients include Locus Robotics ($25 million in November 2017), Fetch Robotics ($25 million in December), and Soft Robotics ($25 million in May 2018).

As the industry continues to grow, the RBR50 could just as easily become the RBR 100 or RBR 1,000, but by focusing on quality over quantity, we hope to share with our readers the automation companies worth following in the coming year.

NOTABLE TRANSACTIONS AMONG THE RBR 50

COMPANY	INVESTMENT AMOUNT	DATE
C2RO Cloud Robotics	$1.1 million	May 2018
Toyota	$2.2 billion	March 2018
Uber, Softbank	$7.7 billion	December 2017
Soft Robotics	$20 million	May 2018
Fetch Robotics	$25 million	December 2017
IAM Robotics	$500,000	October 2017
Locus Robotics	$25 million	November 2017
Starship Technologies	$17.2 million	January 2017
Canvas Technology	$15 million	December 2017
Rethink Robotics	$18 million	August 2017
Brain Corp.	$114 million	July 2017

THE 2018 RBR50 COMPANIES

The companies are listed here by category, then alphabetical order. Notes refer to their technologies and other markets served, but for more complete descriptions, as well as our coverage, check out RBR's company database.

ARTIFICIAL INTELLIGENCE

Alphabet Inc. (Google)
Location: Mountain View, Calif.
Notes: And Waymo for self-driving cars

Brain Corp.
Location: San Diego
Notes: OS for robots

C2RO Cloud Robotics
Location: Montreal
Notes: Cloud, supply chain

IBM Watson
Location: New York
Notes: Cognitive computing

Intel Corp.
Location: Santa Clara, Calif.
Notes: Processors, machine vision, drones

micropsi industries GmbH
Location: Berlin
Notes: And manufacturing

NVIDIA Corp.
Location: Santa Clara, Calif.
Notes: Hardware and software

SoftBank Robotics Corp.
Location: Tokyo
Notes: Service robots

AUTONOMOUS VEHICLES

DJI (Shenzhen Dajiang Innovations Co.)
Location: Shenzhen, China
Notes: Aerial drones

nuTonomy
Location: Cambridge, Mass.
Notes: Owned by Delphi

OTTO Motors
Location: Kitchener, Ontario
Notes: Supply chain

Tesla Inc.
Location: Palo Alto, Calif.
Notes: Self-driving cars

Toyota Motor Corp.
Location: Toyota, Japan
Notes: And AI, service robots

Uber Technologies Inc.
Location: Pittsburgh, Pa.
Notes: Self-driving cars

ULC Robotics Inc.
Location: Hauppauge, N.Y.
Notes: Infrastructure inspection

COMPONENTS

Elmo Motion Control Inc.
Location: Nashua, N.H.
Notes: And manufacturing

Energid Technologies
Location: Cambridge, Mass.
Notes: Motion control, manufacturing

Harmonic Drive LLC
Location: Peabody, Mass.
Notes: Manufacturing, mobile robots

Kollmorgen
Location: Radford, Va.
Notes: And manufacturing

maxon precision motors Inc.
Location: Fall River, Mass.
Notes: Drives

Micromo Electronics Inc.
Location: Clearwater, Fla.
Notes: Drives; owned by Faulhaber Group

Robotiq
Location: Levis, Quebec
Notes: Grippers

Schunk GmbH
Location: Morrisville, N.C.
Notes: Grippers

Soft Robotics Inc.
Location: Cambridge, Mass.
Notes: Grippers

MANUFACTURING

ABB Robotics
Location: Auburn Hills, Mich.; Zurich
Notes: Industrial automation

Bosch Group (Robert Bosch GmbH)
Location: Stuttgart, Germany
Notes: Industrial automation

Epson Robots
Location: Carson, Calif.
Notes: Industrial automation

FANUC Corp.
Location: Oshino-mura, Japan
Notes: Industrial automation

KUKA Robotics
Location: Shelby Township, Mich.; Augsburg, Germany
Notes: Owned by Midea Group

Rethink Robotics Inc.
Location: Boston
Notes: Collaborative robots

Stäubli Corp.
Location: Duncan, S.C.
Notes: Robot arms, controllers, software

Universal Logic Inc.
Location: Nashville, Tenn.
Notes: Software, robotic cells

Universal Robots A/S
Location: Odense, Denmark
Notes: Collaborative arms; owned by Teradyne

Yaskawa Motoman
Location: Miamisburg, Ohio
Notes: Industrial automation

SUPPLY CHAIN

Aethon Inc.
Location: Pittsburgh
Notes: Mobile platform

Amazon Robotics
Location: North Reading, Mass.
Notes: Mobile platform; formerly Kiva Systems

Canvas Technology
Location: Boulder, Colo.
Notes: AI, mobile platform

Clearpath Robotics Inc.
Location: Kitchener, Ontario
Notes: Outdoor mobile robots

Fellow Robots Inc.
Location: San Jose, Calif.
Notes: Mobile platform, retail

Fetch Robotics Inc.
Location: San Jose, Calif.
Notes: Mobile manipulation

GreyOrange Pte. Ltd.
Location: Gurgaon, India
Notes: Mobile platform

IAM Robotics
Location: Sewickley, Pa.
Notes: Mobile manipulation

Locus Robotics
Location: Wilmington, Mass.
Notes: Mobile platform

Omron Adept Technologies Inc.
Location: San Ramon, Calif.
Notes: And manufacturing

OPEX Corp.
Location: Moorestown, N.J.
Notes: Automated sorting

Seegrid Corp.
Location: Pittsburgh
Notes: Mobile platform

Starship Technologies Inc.
Location: Tallinn, Estonia
Notes: Ground-based delivery

Swisslog
Location: Buchs, Switzerland
Notes: Warehouse, healthcare

Waypoint Robotics Inc.
Location: Merrimack, N.H.
Notes: Mobile platform

Vecna Robotics
Location: Cambridge, Mass.
Notes: Mobile robots, telepresence