2020 TRENDS IN ROBOTICS, AI, AND HEALTHCARE INNOVATION

INVESTMENT INSIGHTS, EXPERT PREDICTIONS, & RESEARCH
Our Indices Capture Key Secular Trends

In this annual report, we highlight the following trends across our three innovation indices as key areas of growth in 2020 and the decade ahead.
Companies around the globe are revising and rethinking their strategies to cement their futures in a world that is dictated by robotics, automation, and AI (RAAI).

The ROBO Global Robotics & Automation Index (ROBO) helps investors capture the growth across this dynamic landscape. Deep learning, 5G, and computer vision are among the trends to watch in 2020 and beyond.
The ROBO Global® Robotics & Automation Index (ticker: ROBO) provides investors with a comprehensive, transparent, and diversified benchmark that represents the global value chain of robotics, automation, and enabling technologies.

THE ROBO INDEX OUTPERFORMED THE GLOBAL EQUITIES INDEX IN 2019 AND OVER THE PAST 3 AND 5 YEARS.
SENSING
The first step towards automation: Converting analog signals from the physical world into data for the digital world

In 2020, the use of sensors will continue to proliferate as costs decline and performance improves. We view computer vision as the most exciting sensing technology to date.

What is computer vision? The ability to see. It is something most humans take for granted, and yet it is astonishingly difficult to replicate in machines. Computer vision is the technology that gives computers and machines the sense of sight and the ability to analyze and understand the content of digital images. For decades, computer vision has remained extremely limited and prohibitively expensive. The complexity of the visual world is extreme and requires enormous computing power to process.
A new $10B market has arrived

In the past decade, researchers and companies like Cognex, Keyence, and ISRA Vision have made tremendous progress in computer vision. The result is what we believe is now a more than $10B market.

Computer vision—or machine vision—has a long runway for growth given current penetration levels in manufacturing and logistics, recent technological developments in AI and machine learning, and the rapid rise in labor costs in China and other manufacturing hubs in emerging markets.
The market for computer vision continues to expand

We are at an inflection point. **Computer vision** is increasingly used throughout the manufacturing process to enhance product quality, reduce waste, and improve productivity in a variety of end-markets, including consumer electronics, automotive, pharmaceuticals, and many more.

Computer vision guides production equipment such as robots, improving the quality and speed of manufacturing. It inspects and detects errors early, saving thousands of items from potentially being scrapped. It gauges and provides precise, fast, and non-contact measurements. It can also identify products by reading codes, characters, colors, and shapes to enable tracking, traceability, and data collection. And all of this is achieved at an increasingly rapid speed.
Deep learning is adding to the possibilities

Using a deep-learning approach to computer vision could address many new applications, particularly for inspection problems where algorithmic rules cannot easily be applied, such as detecting random cosmetic imperfections. In fact, AI-powered computer vision could help automate and improve the accuracy of work being performed by more than 365 million factory workers around the world—including 35 million workers that are focused specifically on visual inspection tasks.
“With the introduction of increasingly high-performance and affordable depth (3-D) cameras, the opportunity for highly dependable machine vision is even greater.

At the moment, the programming for interpretation of 3-D images is still fairly primitive, but that is unlikely to remain the case for long, and the more advanced programming methods that are emerging today promise to bring even greater rewards in interpretation of 3-D data.

When that shift happens, deep networks will be able to be trained to interpret that 3-D data. It is an exciting shift that is likely to completely alter manufacturing as we know it.”

Prof. Wyatt Newman, PhD
ROBO Global Strategic Advisor
Here comes 3D Vision!

3D vision, a type of computer vision which has long been prohibitively expensive and complex, is set to accelerate with the help of Isra Vision in manufacturing, Koh Young in semiconductor and electronics inspection, and FARO and Hexagon in metrology and surveying.

Computer vision is also enabling collaborative robotics and advanced driver assistance. Ambarella, the video processing technology provider, is rapidly morphing into an AI computer vision company. The company has received design wins for its CV chip in the professional security camera market and is engaged in several use cases in the automotive market.
2020 is when we expect deep learning will shine

Algorithms are critical for performing the more advanced functions required by deep learning (DL) models that rely on high-quality data to improve performance. A subfield of machine learning, deep learning uses algorithms that strive to mimic the deep neural networks of the human brain.

Reinforcement learning (RL) will also reach beyond the gaming industry to go mainstream. RL refers to goal-oriented algorithms that are the key to enabling autonomous robots, improving personalization, and accelerating drug discovery.
Reinforcement learning: taking machine learning to new heights

- Using reinforcement learning (RL), robots from Boston Dynamics have learned to do back flips and jump onto shelves.

- Amazon is using RL to train robots in its fulfillment centers to sort packages.

- In life sciences, RL can reduce time-consuming and trial-and-error work in a chemical lab setting to support the work of research technicians.

Next steps: RL will be used to dramatically improve the personalization of news and other content—a shift that will transform the massive data sets available to the advertising industry into practical, usable information—and to revolutionize myriad processes that can be simulated, including fraud detection and credit loan processes in the banking industry.
Semiconductors are racing to the future

Chip processors—CPUs, GPUs, FPGAs, DSPs, and ASICs—are improving faster than ever and using that speed to improve the applications of AI software across the board:

• New 7nm architecture will bring faster, more efficient power to mobile devices.

• Inference chips will take center stage in 2020. It is a greenfield landscape with no dominant player yet.

• Demand for 5G and AI will continue to drive adoption of Extreme Ultraviolet Lithography technology, a field dominated by THNQ Index member ASML Holding NV.
Two key players: Nvidia & Ambarella

**Nvidia** has a virtual lock on machine learning training with its Volta GPU accelerators and has made great inroads in the new inference space with its Turing GPUs, which are aimed at data center servers. As a key enabler of AI, the company is still best in class with its breadth and the depth of its hardware and CUDA AI software stack that are unmatched.

**Ambarella** develops high-performance, low-power system-on-a-chip (SoC) semiconductors that integrate video, image, and audio processing, and is currently transitioning to providing AI processors. As a leader in video processing technology, Ambarella is well positioned to take advantage of a significantly larger TAM as computer vision (CV) is increasingly adopted in surveillance cameras and automobiles. We expect CV to arrive first in the security camera market, and then in automotive in the CY23/CY24 timeline.
5G has (almost!) arrived

The fifth generation of mobile wireless communications—5G—boasts features that have the potential to supercharge everything from business processes to how we engage with the Internet. Once it is fully deployed, 5G is expected to deliver up to 100x faster connection times than 4G and is expected to enable download speeds of 500-1500 Mbps in a matter of seconds. Major carriers are expected to roll out some type of 5G services in late 2020 and into 2021. Consumers will soon be able to choose 5G-compatible mobile devices from leaders like Apple, Samsung and Xiaomi, powered by Qualcomm’s latest 5G Mobile Platform Snapdragon. This best-in-class RF System provides peak speeds that promise to surpass most wired connections and transform the mobile experience.

The Internet of Things (IoT) currently includes about 30 billion devices. The power of 5G will be more crucial than ever as this figure accelerates thanks to investments in autonomous vehicles, smart cities, smart factories, big data, and AI.

“By 2030, autonomous vehicles could generate more data than the earth’s entire population does today.”

(source: Cisco)
Industrial robots are enabling new levels of efficient manufacturing

Despite the downturn in global automotive and electronics capital spending, the industrial robotics market continued to expand in 2019 and looks set to accelerate into 2020 as manufacturing activity bottoms out.

By the end of 2020, we expect the installed base of industrial robots to exceed 3.1 million units—a 1 million increase compared to 2017. Double-digit growth is expected to continue over the next five years, supporting more than 360 million manufacturing facilities around the world.

The world’s top industrial robotics providers, including Fanuc, Yaskawa, ABB, and Kuka (which was acquired by Midea in 2017), continue to dominate the global market with a combined share of nearly 75%.
“Industrial robots are no longer a plan for the future—they are here and now. Orders by automotive OEMs rose 83% in the first half of 2019 alone, and sales in the semiconductor, life sciences, and food and consumer goods are rising too. Despite the trade war with China, the sector is seeing a full-blown reboot of growth.”

Henrik Christensen, PhD
Qualcomm Chancellor’s Chair in Robot Systems,
Director Contextual Robotics, UC San Diego
ROBO Global Strategic Advisor
Meet your new co-worker: the cobot

At the highest level, the most important development in industrial robotics is the advent of collaborative robots—or cobots. Recent innovations promise to dramatically expand the already wide range of applications in the manufacturing space.

While cobots are typically slower than traditional factory robots, because they are embedded with the sensing and intelligence required to work side by side with humans, they don't require the highly-skilled engineers and costly safety equipment that are required to operate the older, faster manufacturing robots.

While cobot sales still represent a small fraction of the overall robotics market, we expect the market to multiply over the next few years—growing from a current annual run-rate of just 20,000 units and ~$1B at a CAGR of 40% through 2022. Market leader Universal Robots, which was acquired by Teradyne in 2015, stands to benefit, as well as suppliers of key components, such as Japan-based Harmonic Drive.
China is now the largest industrial robotics market in the world

To date, China has annual installations of more than 150,000 units—more than the US (54,000) and Europe (74,000) combined.

We expect China to continue to drive global market growth in the sector as manufacturers strive to upgrade manufacturing quality and productivity. According to the International Federation of Robotics, China has deployed approximately 1.4 robots per 100 manufacturing workers, less than half the density in manufacturing powerhouses Germany (3.4) and Japan (3.3), and less than a fifth that in Singapore (8.3) and South Korea (7.8).

To gain exposure to this growth, the ROBO index added numerous Chinese players in 2019, including Shenzhen-listed equities of Siasun Robotics, Han’s Laser, Shenzhen Inovance, HikVision Technologies, and iFlyTek.
3D printing is fueling the digital factory market

In the year ahead, we expect to see continued double-digit growth in the digital factory market. Increased demand is likely to benefit ROBO index members Dassault Systemes, PTC, Rockwell, Siemens, and Autocad. While the benefits are many, including reduced waste materials, lower costs for small batch production, shorter time to market, and flexibility in design, the main hurdle that remains is speed.

We estimate the 3D printing market currently stands around $10B annually—up from $7B in 2017—and it has potential to expand multiple times over the next five years. While the technology has already penetrated the prototyping market to a large extent, it is only barely scratching the surface when it comes to the manufacturing of end-use parts, a nearly half a trillion-dollar market.
Medical and aerospace applications offer a tremendous upside in the next few years

In the medical market, we are seeing accelerating adoption in dental, implants, prosthetics, hearing aids, and more.

In aerospace, we are seeing additive manufacturing adoption for aircraft engines and other parts, with companies like Stratasys and former ROBO index member Arcam (which was acquired by GE in 2016).

In other areas, Adidas has plans to be the world's largest producer of 3D-printed products and is aggressively scaling its operations to reach its goal. We are also seeing adoption in eyewear, and we are particularly optimistic about the software side of the industry, with companies like Belgium-based Materialise set to benefit.
As this $50B market continues to accelerate, new applications abound

As we leap into the new decade, logistics remains one of the most promising applications within robotics and automation from an investor’s perspective. We estimate the warehouse and logistics automation market to be worth over $50B, with growth potential in the high-single digits to low teens.

The boom in ecommerce is dramatically raising the bar for supply chain efficiency across the economy, and innovation and M&A point to further transformation across the industry. In 2020, we expect to see more deals like Shopify’s acquisition of 6 River Systems for nearly half a billion dollars.
Autonomous Mobile Robots (AMR) are the sweet spot

- **Amazon** revealed its next-generation Kiva, the Xanthus, and has now deployed over 200,000 robots around the world, including 100,000 in 25 fulfillment centers in the US.

- **Teradyne** is pushing hard into AMRs, with the recent acquisition of AutoGuide for $165M, which complements that of MiR last year.
Logistics Automation was the best performing subsector of 2019

Of the 12 sectors that comprise the ROBO index, Logistics Automation came out on top once again, returning 49% in the first 11 months compared with ROBO's 27% overall gain.

The index provides significant exposure to trends across the sector. Best-of-breed players in logistics automation equipment, software and services, and supply chain automation technology in the US, Europe, and Asia now account for 11% of the index.

Since inception of the ROBO index in 2013, Logistics Automation has returned a total 269%—nearly 3x the 91% returned by the overall index—driven by companies such as Zebra (US), Daifuku (Japan), Kardex (Switzerland), and Manhattan Associates (US).
Logistics Automation was the best-performing subsector of 2019

Ocado, the UK-based online-only grocery chain, has earned its place on the list of growth leaders thanks to its ability to quickly morph into a key technology provider.

In 2019, Ocado sold half of its UK grocery business into a joint venture with Marks & Spencer. The company has also struck deals with some of the largest supermarkets around the world, including Kroger in the US, Casino in France, and Aeon in Japan. Its goal: to deploy its technology into 38 global robotic distribution centers by 2025.

“By 2025, over 4 million commercial robots will be installed in over 50,000 warehouses.”

— ABI Research
“Autonomous vehicles—or AVs—will transform the way we live, the way we get around, and the way we do business. I see the biggest near-term potential to be in logistics. Robots will deliver everything from pizza to containers in warehouses.”

Daniela Rus, PhD
Director of MIT’s Computer Science and Artificial Intelligence Laboratory (CSAIL)
ROBO Global Strategic Advisor
New scientific and technological breakthroughs are driving disruption in healthcare at an unprecedented pace and creating a multitude of compelling investment opportunities.

Our newest thematic investment strategy, The ROBO Global Healthcare Technology & Innovation Index (ticker: HTEC), aims to simplify this complex landscape for investors while capturing value throughout the fastest growing areas in healthcare.
Launched in 2019, the ROBO Global Healthcare Technology & Innovation Index (ticker: HTEC) provides unique, global exposure to best-in-class companies leading the healthcare technology revolution. Notable sectors include diagnostics, robotics, genomics, precision and regenerative medicine, lab automation, instruments, data analytics, and telehealth.

**THE HTEC INDEX OUTPERFORMED THE GLOBAL EQUITIES INDEX OVER THE PAST 3 AND 5 YEARS.**

<table>
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<th>ROBO GLOBAL® HEALTHCARE TECHNOLOGY AND INNOVATION INDEX</th>
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<th>WORLD EQUITY INDEX</th>
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*Periods greater than one year have been annualized. Periods prior to inception in 2019 represent a backtest.*
The genome contains an individual's genes and is made up of over three billion genetic letters. Genome sequencing is the process in which a high-powered machine analyzes a sample of a person's blood or saliva to determine the order of these letters. The sequence serves as a shortcut to help scientists locate and understand specific genes. From a clinical standpoint, this data can be used to screen for numerous things, including inherited conditions or mutated genes that cause cancer.
Technology and scale have bent the cost curve for genomic discovery

It cost almost $3B to sequence the first genome in 2003. Since then, technological advancements such as Next Generation Sequencing (NGS) and scale have driven the cost down to less than $1000 today. Further advancements will likely reduce the cost to under $100 in the next few years.

In terms of scale, the number of samples analyzed increased by more than tenfold over a four year period to reach 12 million in 2018, and 97 million samples are expected by 2025.
Natera’s early cancer screening technology has life-saving implications

Natera, a member of the HTEC index, is the global leader in cell-free DNA testing. This type of test analyzes DNA that is free-floating in a blood sample, rather than going into a cell for analysis.

Currently the market leader in prenatal testing, Natera is now using its cell-free testing to explore new areas, including oncology, kidney, and transplant. One of Natera’s new products, Signatera, can use a patient’s blood sample to detect colorectal cancer recurrence nearly nine months sooner than current standard of screening tests. Because 85% of relapses are discovered too late, Natera’s earlier detection abilities have life-saving implications. The company estimates an addressable market of $15B for this test, and it expects Signatera to begin generating revenue in mid-2020.
Genomic testing is enabling precision medicine

Genomic testing is enabling a transition from a one-size-fits-all approach to precision medicine—a more precise treatment tailored to each individual. The implications for new drug development opportunities are infinite.

Within the HTEC index, two companies that are making strides in precision medicine are:

- **Vertex**'s recent launch of its cystic fibrosis therapy, Trikafta, should provide the company’s next leg of growth.

- **Editas**'s EDIT-101 trial for the treatment of retinal disease is expecting its first-ever patient to have surgery with its CRISPR gene-edited ophthalmology treatment in 2020.

6,000 diseases and only 5% approved therapies

(Source: Editas.com)
The surgical robotics market is set to grow from $5.5B to over $24B by 2025, as reported in the latest study by Global Market Insights.

Robotic-assisted surgery offers advantages over conventional laparoscopic techniques to doctors and patients alike. Doctors benefit from enhanced precision, better ergonomics, and increased maneuverability. Patients benefit from smaller incisions, faster recovery, and less blood loss.

These and other advantages have driven global adoption of robotic surgery across at least seven surgical subspecialties, with doctors increasingly recommending robotic surgeries to their patients.
The da Vinci Surgical System is used to perform a procedure every 30 seconds

Intuitive Surgical is the gold standard in robotic surgery, with its da Vinci platform now used in an estimated 1.25M procedures worldwide in 2019. Each da Vinci robot ranges in price from $1.5-$2.3M, depending on bells and whistles added.

The company’s newest addition, the da Vinci SP, enables narrower and deeper surgical access through a single port. Although early in its launch, customers are already seeing strong clinical results. As new indications get approved over time (such as colorectal surgeries), the SP should help drive Intuitive’s next level of growth.
Growing demand for robotic-assisted procedures is driving more entrants to the market

Intuitive has paved the way, and there are now more than 40 companies working globally on surgical robotics including Globus, Novanta, and Stryker—all members of the HTEC index.

Because this sector is still in the early stages of adoption, there remains a massive runway for growth for these companies as new therapeutic areas will continue to expand the market. New entrants in this space will be focused on lowering per-procedure costs for providers, and potentially including new transluminal access points.
HTEC’s Medical Instruments subsector spans dozens of therapeutic indications, from arrhythmia to zonular cataracts. We view diabetes management as a particularly important theme heading into 2020, given its market size and the new technological breakthroughs that are meeting vast unmet needs.
New tech eases the burden of diabetes management

In the last 40 years, the world diabetes instance has increased fourfold to over 400 million people today, and bears a global economic burden of over $800B. According to the NIH, these costs are expected to exceed $1T by 2030.

The status quo of managing diabetes today involves 4 to 10 finger sticks per day to check one’s glucose levels, often followed by insulin injections. This routine is challenging, and failure to comply can lead to more serious complications over time, such as loss of sight, amputation of limbs, or kidney failure. As seen by the rapid growth of new devices in 2019, new technology is disrupting the day-to-day management of this disease, largely led by HTEC members Abbott Laboratories, DexCom, and Insulet.
Finally, a CGM for everyone

Continuous glucose monitoring devices (CGM), which replace manual finger sticks, are getting smarter and more advanced. Better accessibility is driving adoption beyond the traditional Type 1 market and is expanding into the Type 2 market.

Abbott Laboratories unlocked the Type 2 market with the launch of its FreeStyle Libre CGM, which offers a significantly lower cost and better accessibility than any other CGM on the market. Libre sales were up 70% in 2019. The company expects to launch its next generation device, Libre 2, some time in 2020.

Dexcom’s current generation CGM device (G6) is the most accurate one on the market today. It drove growth of 40% in 2019. In 2020, the company plans to further disrupt with the launch of its G7. Roughly the size of a nickel, G7 will be even more convenient and cost effective than its predecessor.
Insulet is changing how insulin is delivered

On the insulin delivery side of the diabetes equation, 75% of people with Type 1 are currently administering their own insulin, using an average of five needles per day. Insulet is set to change that with its Omnipod product, a disposable wireless pump that is worn for three days and administers 14 injections. Its simple, wearable design provides non-stop insulin delivery, without the need to see or handle a needle.

Over the last five years, Insulet’s sales have grown from $200M to $700M, and with its new pay-as-you-go model, it expects to exceed $1B in 2021.
Telehealth

Telemedicine, the service that connects a patient to a physician remotely, is the most rapidly growing theme in telehealth, and yet remains in an early stage of its lifecycle.

As markets and use cases continue to expand, we believe telemedicine will continue to grow sustainably for years to come and exceed $100B by 2024. Global government adoption, such as Medicare Advantage in the US, as well as increased use of behavioral health services, should provide tailwinds in 2020 and beyond.
Two companies provide HTEC with exposure to the rapid growth in telemedicine

Teladoc Health, an HTEC index member, is the US market leader in telemedicine. Over 50 million people have access to Teladoc in the 130 countries it serves. Through the cross-sales of new services, global expansion of partnerships, and penetration into new markets (e.g. CVS and Medicare Advantage), the company expects growth of 20-30% for the foreseeable future.

A Frost & Sullivan study indicates that online healthcare in China is poised to grow by 20 times to 198 billion yuan by 2026 from 11 billion in 2016. China-based Ping An Healthcare and Technology, another HTEC member, is positioned well for this growth, with 285 million registered users. The company expects to add another 10 million families over the next five years.
For investors, AI is still in the early stages of adoption. Historically, the stock market tends to under-appreciate the scale of opportunity enjoyed by leading providers of new technologies at this phase of development. As we watch AI companies paving the path, it is growingly evident that those involved in the space are on course to grow faster than many existing public companies.

The ROBO Global Artificial Intelligence Index (ticker: THNQ) was created to help investors profit from growth of companies who are putting artificial intelligence to work in industries such as cloud security, financial services, business process, and ecommerce.
Launched in 2019, the ROBO Global Artificial Intelligence Index (ticker: THNQ) offers exposure to the global AI ecosystem. The index includes companies that are demonstrating early growth and earnings potential across the AI landscape.

THE THNQ INDEX OUTPERFORMED THE GLOBAL EQUITIES INDEX IN 2019 AND OVER THE PAST 3 AND 5 YEARS.
Cybercrime is growing in volume and complexity. According to Risk Based Security, over 800 data breaches were disclosed in 2018, and more than 3800 data breaches hit organizations in 2019.

Luckily, AI is coming to the rescue.

The ability of machine learning and deep learning models to analyze massive quantities of data and provide proactive alerts and rapid response times will help the under-resourced security operations at enterprises around the world.

From network and data security, to IT governance, to risk measurement and policy compliance, cybersecurity is a growing industry that is estimated to be worth over $300B by 2025.
The cybersecurity investment opportunity has shifted

Many people still associate cybersecurity with perimeter defense or firewalls, but the days of building higher walls to keep threats out are gone. Today, the industry has become more specialized, putting AI to work to fuel a wide array of new technologies that focus on containing threats inside firewalls and limiting damage.

“The average cybersecurity vendor has seen annualized sales growth of 15% for the past three years.”

(Morgan Stanley and Scott Helfstein)

The cybersecurity market today is estimated at $123B in annual spending. The forecasting firm International Data Corporation (IDC) expects the market to grow by 12% annually through 2022 as companies and governments spend to defend themselves from evolving threats. This represents a good opportunity for investors to look beyond the firewall or traditional cybersecurity and focus on areas that are set to grow the fastest.
Connectivity creates vulnerability

There are more connected devices than ever before, creating greater potential for cyberattacks and more points of vulnerability. In 2000, Cisco Systems estimated that there were 200 million internet-connected devices. Today that number is 7 billion, and forecasts point to a reach of 21.5 billion in 2025—a 21% annual growth rate.

The average cost of a data breach for a company in the US is over $8M. And as businesses continue to move their operations to the cloud and the number of mobile devices billows, the number of threats—and the resulting costs—will surely rise.

Companies like Palo Alto Networks, Rapid7, ServiceNow, and Varonis are pushing innovation, using machine learning and deep learning to mitigate malicious cyberattacks within their clients’ networking infrastructure.
AI-driven solutions are transforming cloud security

Palo Alto Networks’ next generation cloud security platform is expected to drive a +20% topline growth over the coming years. Its AI-based continuous security platform, Cortex, has become the industry’s go-to solution, allowing security operations teams to speed the analysis of massive data sets and quickly orchestrate responses.

Rapid7 is an emerging security data vendor, with a core competency in vulnerability management. Rapid7 recently took their industry-leading user behavior analytics capabilities and automated workflows another step further by incorporating them into the new InsightIDR solution. This advanced security solution integrates machine learning algorithms into an organization’s existing network and security stack to detect malicious behaviors, as well as supports cloud reporting and compliance.
Business Process Automation: Driving Digital Transformation

Companies that are embracing digital transformation are creating a competitive edge for themselves, using AI to develop new, interactive, and immersive client experiences and radically inventing new business models.

At the pinnacle of the business process technology hierarchy is cognitive computing, which builds on a variety of technological advancements and existing software to tackle previously manual tasks. It also identifies tasks that software can’t yet perform and applies AI technologies to empower employees with recommendations and assistance to make better decisions.

Worldwide spending on the technologies and services that enable the digital transformation is likely to reach $1.97T by 2022

(source: IDC)

Gartner’s CIO Survey found that in the last 4 years, AI implementation grew by a massive 270% in business process operations. Machine learning can be extremely valuable and complementary for an organization seeking to bring about a digital transformation. Recent reports from Infosys indicate that enterprises using ML were able to drastically reduce the average time spent executing day-to-day activities and enabled more informed decisions with higher levels of accuracy. Because ML can help analyze complex data and make accurate decisions based on that data, it is critical in the process of achieving complete digital transformation.
The digital revolution has set the stage for a dramatic progression in technology

The move to digital, which we define as SMAC (social, mobile, analytics, and cloud), plus other emerging technologies such as the IoT (Internet of Things), wearables, AI, and automation, are serving as the foundation for a dramatic push forward on the technology front. In some areas, digital transformation is being coupled with AI to transform business models.

Robotic process automation (RPA) is an emerging form of business process automation technology that uses software robots to perform tasks in computer systems using fully automated rules-based business processes for everything from data entry and email management; to reporting, invoicing, and payroll processing; to IT services and employee onboarding.

Index member Blue Prism is one of the leading RPA providers pushing the envelope. Blue Prism’s RPA tools help organizations build their road to intelligent automation by organizing unstructured data and generating data lakes that will lay the ground for future AI and ML implementations. Blue Prism’s valuation is relatively attractive at just little over 5x NTM enterprise value/sales versus private company peer group’s 10-13x. Other players in the RPA space include Automation Anywhere and UiPath—both private companies that are projected to grow +75% as adoption of RPA implementation continues at a rapid pace.
AI is changing the financial services industry

Financial companies around the world are heavily investing in machine learning models to help balance risk mitigation with the customer experience.

**Fair Isaac’s FICO® Falcon® X** solution delivers groundbreaking AI and machine learning technology aimed at preventing new forms of fraud and financial crime that are enabled by the rapid adoption of real-time payments. The solution streamlines both fraud detection and anti-money laundering processes to empower banks to respond rapidly to evolving fraud attacks. The original Falcon solution changed the industry when it introduced AI to fraud detection 25 years ago. It now protects more than 2.6 billion payment accounts worldwide.
“AI could double annual economic growth rates in 2035 by changing the nature of work and creating a new relationship between man and machine.”

(source: Accenture)

Robotics and AI are no longer theoretical ideas that create the potential for change. They ARE the change that is taking place now—everywhere. This reality presents investors with a unique opportunity to invest in historical change as it is taking place.

ROBO Global’s Robotics & Automation Index (ROBO) and Healthcare Technology & Innovation Index (HTEC) provide exposure to this fast-changing landscape of best-in-class companies across the entire value-chain of robotics, automation & AI that are the force behind our changing world. Index members are carefully selected from the vast universe of established and emerging organizations that derive a meaningful percentage of their revenue from robotics, automation, and AI technologies and applications. With the assistance of deep research, the insights of leading experts in the fields of robotics and AI, and a focus on market-cap diversification, we believe the ROBO Global indices may well be the ideal option for investors hoping to make robotics and AI a valuable part of their own future.

In 2018, Tractica forecast that revenue generated from the direct and indirect application of AI software alone would grow to $105.8B by 2025.

In November 2019, Tractica revised that forecast to $118.6B by 2025.
"As technology continues to shift and morph by the minute, change and our ability to adapt to change are the only constants. We should not fear the technological innovations that will alter our world over the next year, the next decade, and the next century, but instead shape these forces to open the door to a new way of living."

Raffaello D’Andrea, PhD  
Professor of Dynamic Systems and Control at ETH Zurich  
Co-founder of Kiva Systems (now Amazon Robotics)  
Founder of Verity Studios  
Co-founder and Strategic Advisor, ROBO Global
After seven consecutive quarters of deceleration driven by a global industrial recession, earnings growth for the ROBO index marked a trough in 2Q 2019 and started accelerating again in 3Q 2019. This leaves the ROBO index trading on a median forward P/E of 25x, slightly above its long-term average valuation of 22x.

In 2020, we expect median EPS growth to return to the double digits as factory automation companies benefit from the imminent upturn in demand for industrial robotics. This will be supported by continued structural growth across a variety of other robotics, automation, and AI technologies and applications, including sensing, computing, healthcare, logistics, and consumer.
INVESTMENT TEAM

TRAVIS BRIGGS
CEO ROBO GLOBAL USA

WILLIAM STUDEBAKER
PRESIDENT & CIO

CHRIS BUCK
HEAD OF CAPITAL MARKETS & SALES

LISA CHAI
SENIOR RESEARCH ANALYST

RICHARD LIGHTBOUND
CEO ROBO GLOBAL EMEA

JEREMIE CAPRON, CFA
DIRECTOR OF RESEARCH

BRAD BAKER, CFA
CTO & DIRECTOR OF OPERATIONS

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