Intelligent automation: A new era of innovation

INTELLIGENT automation—the combination of artificial intelligence and automation—is starting to change the way business is done in nearly every sector of the economy. Intelligent automation systems sense and synthesize vast amounts of information and can automate entire processes or workflows, learning and adapting as they go. Applications range from the routine to the revolutionary: from collecting, analyzing, and making decisions about textual information to guiding autonomous vehicles and advanced robots. It is already helping companies transcend conventional performance tradeoffs to achieve unprecedented levels of efficiency and quality.

Signals

- References to artificial intelligence on wsj.com have quadrupled since 2010.[1]

- Since 2011, venture capital investment in ventures related to robotics and artificial intelligence has grown more than 70 percent per year, exceeding $600 million.[2]

- An exchange-traded fund that tracks the global robotics and automation sector was listed on NASDAQ.[3]

- Google acquired eight robotics start-ups in six months.[4]

- Littler Mendelson, a major employment and labor law firm, has formed a practice group focused on robotics and personal enhancement technologies.[5]

- Facebook acquired a speech recognition and machine translation company and is creating an artificial intelligence laboratory.[6]

- Audi, BMW, Mercedes-Benz, Nissan, and Volvo plan to introduce autonomous vehicles.

- IBM announced a $1 billion investment to commercialize its Watson cognitive computing technology.[7]

Automation powered by artificial intelligence is heralding a new era

Intelligent automation marries artificial intelligence—including natural language processing, machine learning, and machine vision—with automation. Artificial intelligence and automation are hardly new, but the technologies have progressed substantially in recent years. Advances in machine learning techniques, improvements in sensors, and ever-greater computing power have helped create a new generation of hardware and software robots with practical applications in nearly every industry sector. This progress has, in turn, excited the interest of venture investors, technology firms, and a growing number of clients that are implementing intelligent automation in both physical and information systems.

Some intelligent automation technologies, such as those powering a new generation of collaborative robots and Google's self-driving cars, analyze and respond to a stream of situational data from sensors. Others, like IBM's Watson, ingest and analyze massive amounts of textual information to respond quickly to complex inquiries, such as a request for a medical treatment plan.[8] Intelligent automation is sometimes used to streamline business processes and make complex decisions faster. Commercial examples include a marketing system that presents offers to customers based on their profile and market basket analysis, a credit card processing system that identifies and blocks fraudulent transactions, and an e-discovery system that classifies documents according to their meaning and relevance to ongoing litigation.

The range of business problems to which intelligent automation can be applied is expanding as technologies for voice recognition, natural language processing, and machine learning improve and become usable by non-specialists. These technologies are increasingly available as open source or low-cost products or cloud-based services.

Investors clearly see potential in intelligent automation. Venture capital investment in ventures related to robotics and artificial intelligence has grown more than 70 percent in each of the last two years, exceeding $600 million since 2011.

The rapid development of intelligent automation is ushering in a new era of productivity and innovation. As intelligent automation applications set new standards of quality, efficiency, speed, and functionality, companies that successfully employ it may surpass competitors that do not. If companies take full advantage of intelligent automation, the overall impact on business could rival that of the enterprise resource planning wave of the 1990s.

Intelligent automation addresses societal and business challenges

A range of societal and business challenges are creating demand for intelligent automation.

Changing talent demographics create an opening for automated alternatives. Some sectors, such as manufacturing and agriculture, are facing a shortage of workers. In an aging

workforce, fewer workers are able to perform physically demanding tasks.[9] In some markets, the cost and scarcity of labor have risen to the point where investments in automation now make economic sense. This is the case even in parts of China, which built its manufacturing industry on the strength of its large, low-cost workforce.[10]

Increasing complexity necessitates cognitive "power tools." Data and information are being created at an accelerating rate, outstripping the ability of humans to keep up. For instance, one study found that the amount of medical information is doubling every five years.[11] Just as power tools enable workers to keep up with increased production volumes, intelligent automation enables knowledge workers—from physicians to investment analysts to plant supervisors—to process, understand, and effectively use ballooning volumes of information.

Companies are seeking efficiency, growth, and differentiation. In an economy where growth has slowed and competition can be fierce, companies are applying intelligent automation to cut costs by improving efficiency, differentiate products and services with new features and experiences, and enter new markets to grow.

Companies in nearly every sector are investing in intelligent automation

Intelligent automation, though still rapidly developing, has matured to the point where it has penetrated nearly every sector of the economy. Some companies are using it to disrupt mature industries, such as household appliances (for instance, the Roomba robotic vacuum cleaner or the Nest thermostat). Incumbents are investing in intelligent automation to breathe new life into mature product categories, such as tractors and automobiles. And businesses of all kinds are employing intelligent automation to increase efficiency, improve quality, reduce labor costs,

and reassign workers from low- to higher-value tasks.

There are three primary forms of intelligent automation applications: *deciders, doers,* and *movers.*

Deciders are information systems that automate decision making

Intelligent automation systems that streamline decision making typically use tools for aggregating, extracting, and analyzing information—often, complex information such as human speech or unstructured text. The automated analysis and decision process can be embedded in a workflow that includes humans reviewing and approving machine decisions. Examples of decider applications can be found in multiple sectors:

Financial services: A large hedge fund automated its process of reviewing research notes for compliance and quality. While the sentiment expressed in the research note has to be consistent with the rating assigned to the stock, spot checks at the hedge fund revealed this was not always the case. Manually reviewing all 100,000 published research notes would have been prohibitively time consuming and impossible to do consistently. The hedge fund implemented a business process automation engine from Rage Frameworks to aggregate and extract the content from all of its research notes, applying computational linguistics technology to read and interpret it. The automated process discovered that in nearly half of the notes, the sentiment diverged from the analyst ratings, leading the company to review and redesign its processes and incentive structures. The intelligent automation system now provides an automated and efficient means of monitoring the quality of future research notes.[12]

Similarly, Credit Suisse uses a technology from Narrative Science to analyze millions of data points on thousands of companies and automatically write English research reports

that assess company expectations, upside, and risk. The reports help analysts, bankers, and investors make long-term investment decisions. Credit Suisse says the technology is helping to triple the volume of reports it produces while improving their quality and consistency compared with analyst-written reports.[13]

Health care: WellPoint, which provides health insurance coverage to nearly 40 million Americans, has implemented a utilization management system powered by IBM's Watson cognitive computing technology. After nearly 15,000 hours of training by nurse clinicians, the system can understand physicians' unstructured English treatment recommendations and match them to WellPoint's medical policies and clinical guidelines to present consistent, evidence-based responses for clinical staff to review. The goal is to provide faster, better-informed decisions about patients' care and save significant clinician time and costs.[14]

Public sector: To accelerate detection of potential threats, a major city has deployed a network of cameras, sensors, and data feeds linked to an artificial-intelligence-powered system that can automatically flag images for a human analyst watching for threats. London deployed a citywide network of video cameras and employs intelligent technologies to automate the process of identifying crime suspects.

Technology: A high-tech manufacturer has automated the process of monitoring suppliers and customers for risks and opportunities, and for making decisions on customer credit. Its software extracts key metrics from counterparty financial statements and automatically generates credit models. Between quarterly financial filings, when credit-risk information can become outdated, the system ingests thousands of news sources and data feeds, applying sematic analysis to highlight potential risks associated with each supplier or customer. This provides the manufacturer with forward-looking credit-risk information. Human analysts monitor the credit ratings calculated by the system, approving them 95 percent of the time without change. The technology has made the credit function more efficient and

responsive, enabling the business to use credit as a revenue-generating function by making it easier to identify clients who deserve attractive credit terms.[15]

Doers, such as collaborative robots, automate physical tasks

Traditional robots, such as those used in automotive manufacturing for over 30 years, perform one task repeatedly. A new generation of intelligent robots is able to perform a wider range of more sophisticated tasks and can collaborate with and even learn from human coworkers.

Retail and distribution: Kiva Systems developed a "mobile-robotic fulfillment system" to automate retail distribution centers for companies such as Crate & Barrel and Walgreens. Its robots travel around a distribution center, avoiding humans and each other, automatically transporting shelving units loaded with products to workers who are preparing customer orders for shipment. Crate & Barrel says the system has improved worker productivity by a factor of two, compared with its next-most automated facility.[16] Amazon acquired Kiva Systems last year for nearly $800 million.

Automotive: Volkswagen has implemented "collaborative robots" in an engine production plant in Germany. They work alongside people, taking over a physically demanding step in the engine assembly process. Volkswagen's motivation for implementing the robot was to prevent "long-term burdens" on its employees by having machines take over tasks that are "ergonomically unfavorable."[17]

Movers use sensors and artificial intelligence to automate transportation

The capabilities of autonomous vehicles are progressing rapidly, with applications in multiple sectors that include defense, automotive, and mining.

Aerospace and defense: The US military is funding the development of numerous applications of intelligent automation to improve decision making as well as the safety and effectiveness of troops. For instance, Boston Dynamics—funded by the Defense Advanced Research Projects Agency and recently acquired by Google—has developed a variety of autonomous, quadruped robots that can climb, navigate rough terrain, run nearly 30 miles per hour, carry heavy loads, and follow humans on command.[18]

Automotive: To position themselves for future growth, many automakers, including Audi, BMW, Mercedes-Benz, Nissan, and Volvo,[19] are developing self-driving cars. BMW aims to have partly automated vehicles on the road by 2016.[20] Google's autonomous driving technology has already powered driverless cars over hundreds of thousands of miles on public roads in California and Nevada.[21]

Energy and resources: International mining company Rio Tinto is using a fleet of autonomous hauling trucks developed with Komatsu to improve efficiency and worker safety in its Australian iron mines. Earlier this year, its fleet, which can move and navigate with limited human intervention, reached the milestone of moving 100 million tons of material.[22] BHP Billiton, another major mining company, has also announced investments in mine automation.[23]

Adopters will face many questions

As the cost of intelligent automation declines and its capabilities grow, applications of the technology will proliferate. Savvy use of intelligent automation starts as a competitive advantage and will become, over time, table stakes. Companies will need to consider a range of issues in order to take full advantage of the possibilities of intelligent automation:

- Strategy: discovering how to use intelligent automation to improve operations, innovate, or grow

- Technology selection and integration: choosing and integrating appropriate artificial intelligence technologies

- Information management: acquiring and readying information assets for machine learning applications

- Human capital: developing talent strategies and staffing and training plans as intelligent automation changes the skills, job descriptions, and organizational models that companies need

- Risk management: assessing and mitigating a host of risks, from cyber threats and privacy breaches to product liability and even claims of discrimination, which could be leveled at poorly trained robotic recruiting agents.[24]

Some companies, like WellPoint in the example above, may need outside expertise in artificial intelligence and data science to extract greater value from the rich data assets they already control. For others, benefiting from intelligent automation may require identifying and securing rights to third-party data sources that could power a machine learning system. Such data might be available from commercial aggregators or from participants in a company's own value chain.

Conclusion

Advances in artificial intelligence, robotics, and automation, supported by substantial capital investments, are fueling a new era of intelligent automation, which is likely to become an important driver of organizational performance in the years to come. It is important for companies in all sectors to understand and adopt intelligent automation, or risk falling behind.

Endnotes

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