

# How Will Artificial Intelligence Transform Business?

In the more than two decades since a supercomputer beat a chess grandmaster at his own game, the ability of machines to compete with humans has progressed from curiosity to game-changer. These days artificial intelligence is everywhere, and it's hard to find an industry that isn't at least considering what AI could do for it, says J. Mark Munoz, Andreas Professor of Business at the Tabor School of Business at Millikin University in Illinois.

Amid spending that is expanding exponentially, AI is bringing smart technology to everything from farm and utility management to inventory control and customer service. As we enter a world of robots picking delicate fruit and caring for the elderly, drones and self-driving vehicles making deliveries, ferrying passengers and transporting goods across the country, and computers reading x-rays, recognizing faces, and detecting manufacturing flaws in real time, some fundamental questions emerge.

Will the AI revolution create new jobs as it destroys others? What industries will be most affected? And how will it affect productivity and economic growth? OUTLOOK turned to Munoz, an advisor to the AI Initiative at Harvard University, for answers to these and other questions about a technology that could contribute trillions of dollars to the global economy over the next decade.

### ***OUTLOOK: What is your working definition of artificial intelligence?***

**Munoz:** Artificial intelligence is simply defined as intelligence demonstrated by machines. For decades, we've had computers able to process and organize data at high speeds. They've made it much easier for humans to interpret information and learn from it. With artificial intelligence, the machine itself is able to interpret and learn. That means robots in factories that don't just assemble items but anticipate equipment breakdowns before they happen and recommend maintenance. It means 'computer vision,' in which computers can look at pictures or video, recognize patterns and react to them. It means natural language processing, where computers analyze and understand the human voice and language to the extent that they can hold actual conversations.

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## This Month's Expert



J. Mark Munoz is the Andreas Professor of Business at the Tabor School of Business at Millikin University in Illinois. A former visiting fellow at the Kennedy School of Government at Harvard, he is presently an advisor to Harvard's AI Initiative (the Future Society). He is the author, co-author or editor of more than 20 business books, including "Global Business Intelligence, Managerial Forensics, Business Strategy in an Artificial Intelligence Economy" and "The Beaver Bot of Yellowstone," a short book on AI leadership for managers and entrepreneurs. A native of the Philippines, Munoz serves on several corporate boards in the United States and overseas. He earned an MBA and Ph.D. in management, both from the University of San Jose-Recoletos in the Philippines.

### ***OUTLOOK: What affect is AI having on business and industry?***

**Munoz:** By 2022, the global market for AI is expected to reach \$22 billion, a 5,400 percent increase from about \$400 million just five years ago, and much of that is going toward new applications for businesses. A recent study by PricewaterhouseCoopers estimates that AI could contribute nearly \$16 trillion to the global economy by 2030. The most important qualities AI brings to industry are speed, efficiency and personalization – the ability to customize services to the needs of individual consumers. Right now, we're in the early stages. As more companies, industries and countries see the value, the demand to keep pace with competitors will accelerate the pace of new innovations.

### ***OUTLOOK: What's behind the recent surge in AI?***

**Munoz:** The idea of artificial intelligence, and the underlying mathematics that support it, have been around for more than 60 years. But for decades most developments were confined to research labs. The technology wasn't there to develop mainstream applications. The rapid acceleration in AI development in recent years has been driven by three main factors. First is the data revolution – our ability in the Internet Age to gather unprecedented amounts of information. Second is that computers have become much more powerful, lowering operational costs and improving efficiencies. Third is advances in creating algorithms – the mathematical models that enable computers to think through and solve problems.

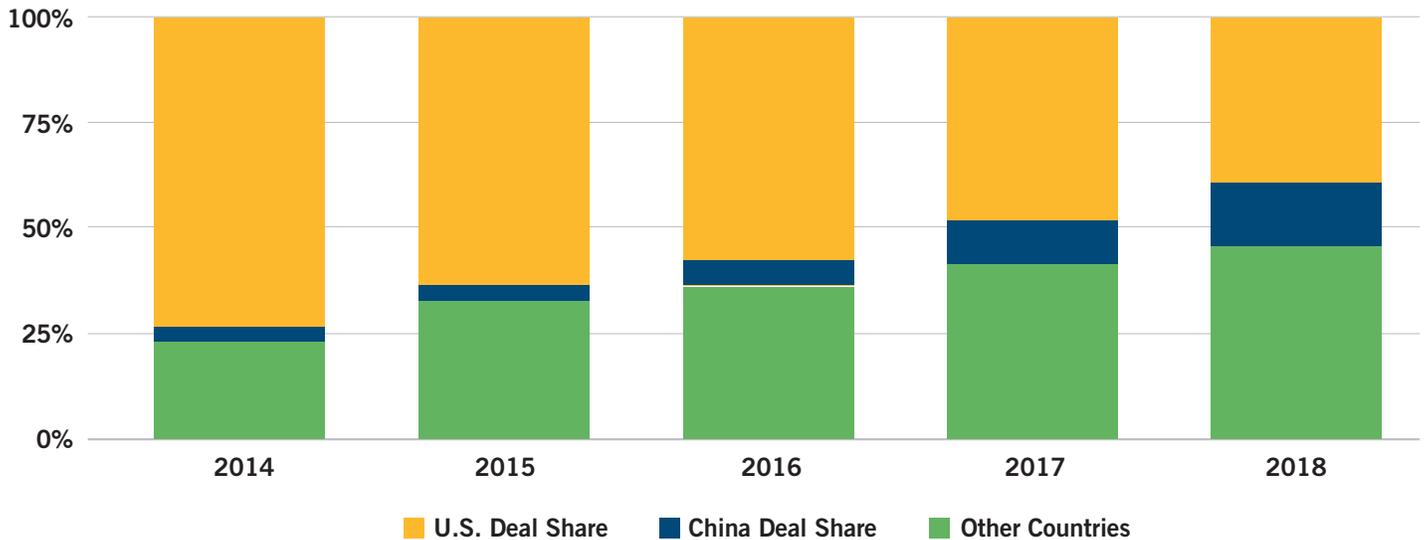
### ***OUTLOOK: What industries are likely to be most affected?***

**Munoz:** It's hard to think of industries that won't be changed by artificial intelligence. Retailers will get better and better at using AI to understand purchasing behaviors and preferences of individual consumers. Based on how frequently you buy certain items, they'll predict when you're running out of supplies and remind you to buy more, or even send them your way automatically. Natural language systems, meanwhile, will improve to the point that, instead of just recognizing and responding to certain words, they'll hold real-time conversations with consumers, helping them with questions or problems and gathering information on their preferences.

In health care, AI will increasingly be used not just to gather information on individuals and populations, but to diagnose illnesses and recommend treatments. Scientists are developing AI systems that could save thousands of lives by analyzing the number of hospital visits and other data very quickly, recognizing trends or patterns that indicate incipient pandemics. In financial services, AI will be essential in everything from automating operations to detecting fraud and helping clients and customers with financial planning. In transportation and logistics, self-driving vehicles and smart warehouses will help manage congestion and enhance safety.

### CHINA IS RISING IN PERFORMANCE IN AI

Equity deal share, 2014-2018



Source: CB Insights

**OUTLOOK: Which countries are leading the way with AI development?**

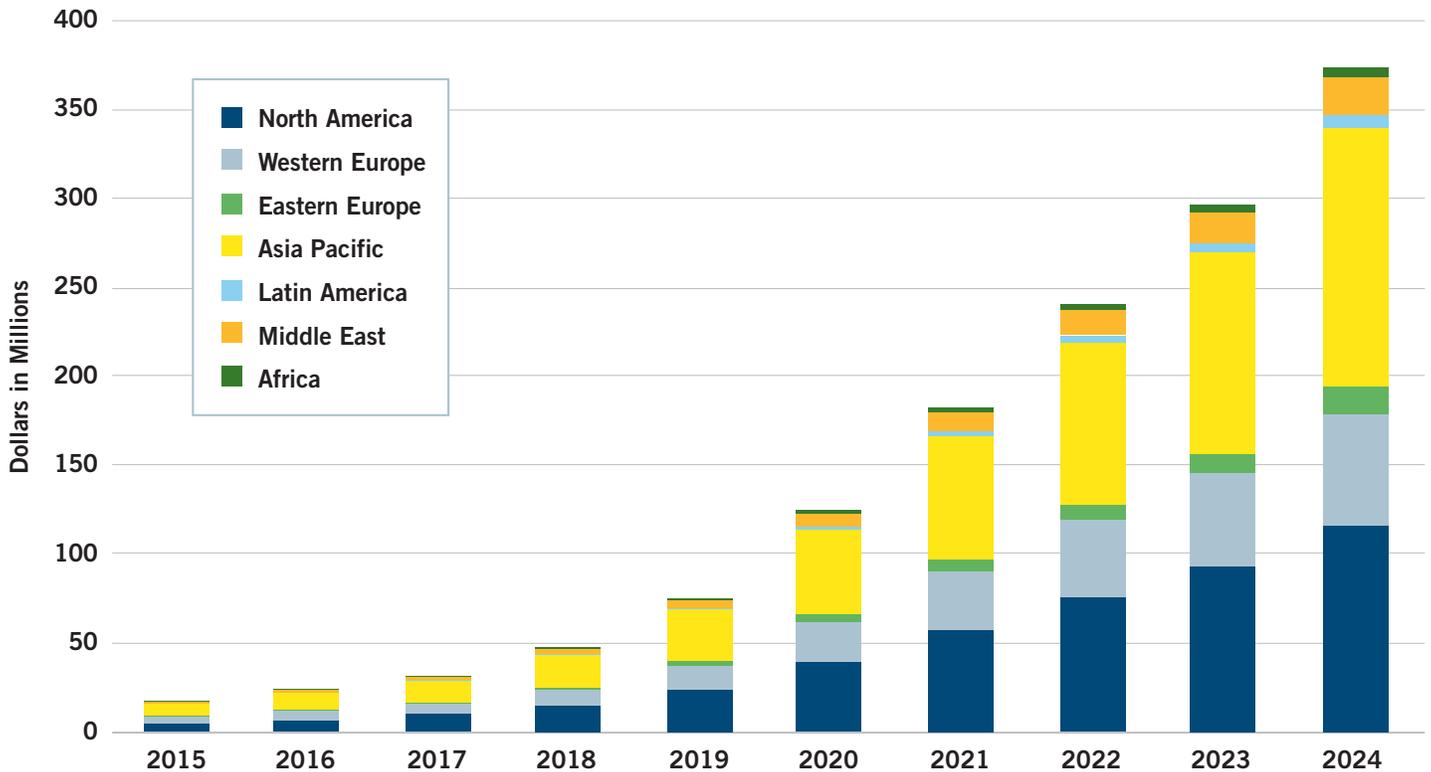
**Munoz:** The United States has been and remains the leader in AI development, but other countries are racing to catch up. According to the technology data firm CB Insights, the U.S. share of AI private equity deals globally dropped from about 75 percent in 2014 to less than half in 2018. China, in particular, has been investing billions of dollars in AI, particularly in areas such as facial recognition and AI chip technology. CB Insights reports that in 2017, Chinese AI startup companies surpassed U.S. counterparts in total funding for the first time, though the U.S. recaptured the lead in 2018. Germany, Japan, and the U.K. are among the other global leaders, and Australia, Canada, France, India and Poland are active as well.

**OUTLOOK: What is the impact AI has had on GDP of countries implementing the technology and what is the potential to impact GDP moving forward?**

**Munoz:** According to a PwC report, global GDP of \$114 trillion by 2030 will increase by a projected 14 percent or \$15.7 trillion because of AI. This is due to corporate productivity gains resulting from automation as well as increases in consumer purchases due to personalization and product enhancement from AI. North America’s GDP is projected to increase by 14.5 percent while China’s will be about 26 percent. Impact on countries will eventually vary depending on efforts companies and governments place in preparing for the Ai revolution.

### AI REVENUE IN THE AGRICULTURE INDUSTRY BY REGION

World Markets: 2015-2024



Source: Tractica

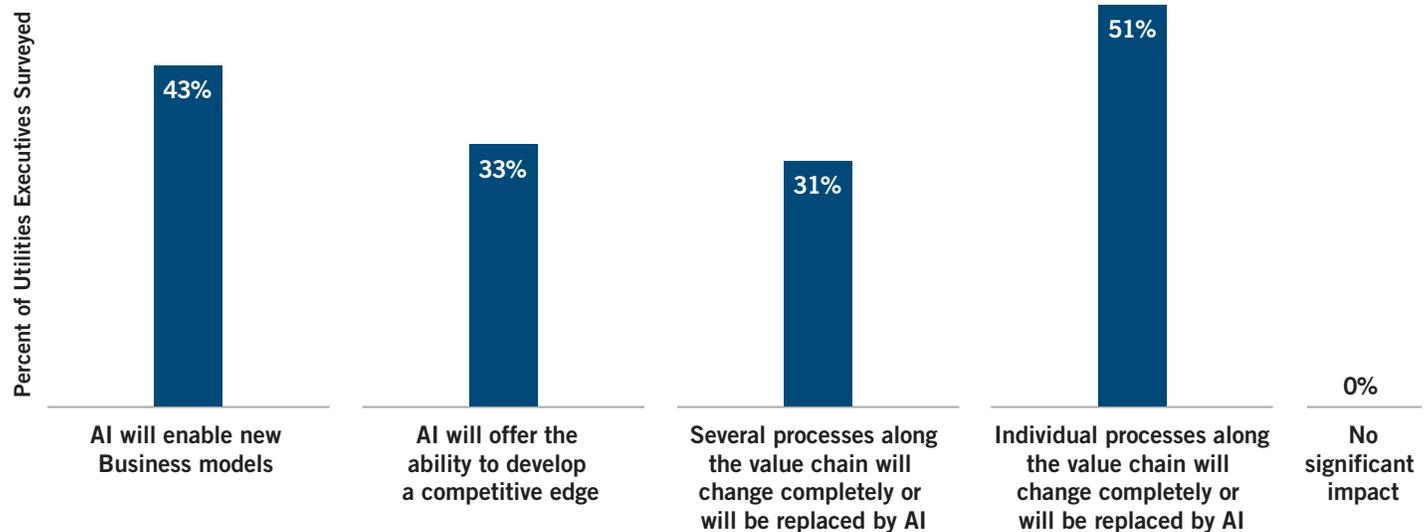
**OUTLOOK: How is AI affecting agriculture, and how will that evolve in the next decade?**

**Munoz:** AI is already starting to transform agriculture through everything from having robots harvest and pack crops to using drones to scan fields to determine crop condition, and installing ‘precision farming’ systems that assess soil quality and timing of farm activities.

AI can identify crop areas or even individual plants that are wilting from disease or poor soil, enabling farmers to pinpoint solutions by fertilizing the plant or uprooting it before it contaminates others. NatureSweet, the tomato company, is using AI in this way to control pests and study diseases. The Climate Corporations Climate Basic uses AI to identify where to plant corn based on temperature, erosion, precipitation and soil quality. Blue River Technology focuses on weed control and reducing the use of chemicals, while Harvest CROO Robotics focuses on harvesting and packaging strawberries and SkySquirrel Technologies uses aerial technology to monitor crop health. That’s just to name a few.

## IMPACT ON VALUE CREATION

Current and mid-term potential of AI in utilities n=51<sup>1</sup>



Source: Roland Berger report

As the technology improves, we'll see benefits to the environment as farmers get improved results from fewer pesticides, and farming practices overall become more sustainable with less waste. Crop yields and profit optimization will improve. And we're going to see a rise in food safety as AI gets better at detecting contaminations.

### **OUTLOOK: How can utilities use AI?**

**Munoz:** Some of the most promising areas are in load forecasting – predicting supply and demand of energy consumption – which leads to greater operating efficiencies, yield optimization and predictive maintenance that uses drones and other tools to inspect assets and predict potential problems. In the coming years, we'll see greater use of AI in these ways, as well as in tracking energy theft, optimizing prices and using virtual agents to provide real-time responses to customer inquiries.

### **OUTLOOK: What infrastructure will be required for AI to reach its potential in the United States?**

**Munoz:** Federal, state and local governments need to invest in creating a suitable environment for AI to flourish. This will require significant upgrades in broadband internet infrastructure, particularly in rural America. Individual communities may have to get creative. I would suggest that communities have the opportunity to benefit by establishing themselves as artificial intelligence zones – possibly working with a local university to train or retrain workers, or supporting AI startups in their areas. In 2018, artificial intelligence start-ups received more than \$9 billion in venture capital funding, so there's capital available for the right initiatives.



Artificial intelligence is only as good as the developers who create it. If there are flaws in the algorithm, there are going to be problems with the results”

***OUTLOOK: What new jobs are or will be created by AI and how will the workforce and education have to adapt?***

**Munoz:** As the field grows, we’re seeing rising demand for new AI specialists such as technology engineers, automation managers and “solutions architects,” responsible for applying artificial intelligence to solve specific business problems. Major companies such as Amazon, Nvidia, Microsoft, IBM, Accenture and Facebook are actively hiring AI specialists, and their needs are growing. People in many existing careers will need to be retrained as AI operational models increasingly become the norm.

To meet the demand, MIT, Carnegie Mellon, the University of California, Berkeley, Georgia Tech and others are offering programs or degrees in artificial intelligence, with courses focusing on areas such as human computational intelligence, intelligent systems design and human-robot interaction. These programs are sure to grow in numbers.

***OUTLOOK: What kinds of unintended consequences, such as bias or privacy issues, does AI potentially represent?***

**Munoz:** Artificial intelligence is only as good as the developers who create it. If there are flaws in the algorithm, there are going to be problems with the results. That’s especially true when it comes to issues of bias. As humans, we all have our own cultures, our own flaws and personal biases and our own ways of thinking. If conscious or unconscious biases on race, gender and other factors are integrated into the computer programs, they are going to exist in the AI. Developers are going to have to be aware and vigilant about preventing biases from leading AI systems to make incorrect or insensitive assumptions about people.

There are other ways that AI could have unintended consequences.

For example, a system that analyzes shopping patterns could notice that a consumer is spending thousands of dollars on each of multiple items. The system learns the consumer’s preferences and, assuming that person must be wealthy, entices him or her with suggestions for other high-end products and services. But the person, instead of being wealthy, might actually have a huge spending problem, and will be going further into debt with each purchase.

Of course, the more information the system is able to gather about people, the better it might be able to draw those distinctions. But that brings us to the other great issue, privacy, and where do you draw the line on information gathering? To create the perfect algorithm, you need to know everything about the customer, but you can’t. You have to operate within certain parameters. I’m an advisor to Harvard’s AI Initiative, and these are some of the most pressing issues being discussed.



In my view, it's not always about purchasing the best technology, or the newest or the most expensive equipment. It is equally important to weigh the suitability of the technology to your current infrastructure, type of operation, corporate culture and employee talent”

***OUTLOOK: Will AI ultimately create as many jobs as it eliminates, or are there worries that this technology could increase unemployment over the long haul?***

**Munoz:** There's significant debate on that point. Estimates vary widely and there are compelling arguments for both views. McKinsey Global Institute projects that about 400-800 million workers globally could be displaced by 2030 as a result of automation and artificial intelligence. In addition to jobs such as machine operator and food worker, white collar professions such as mortgage broker, paralegal and accountant are at risk as AI becomes better and better at analyzing data. Professionals such as teachers, doctors and lawyers – particularly those whose specialties involve face-to-face interactions with students, patients or clients – will be harder to replace with machines.

A Gartner Report in late 2017 estimated that by 2020, AI would displace 1.8 million jobs, but create 2.3 million. It's hard to accurately predict and measure AI's overall impact since it touches so many industries and there are a lot of variables. Employment adjustments may take years to materialize, and some industries will take a larger hit than others.

***OUTLOOK: To what extent should individual companies be investing in AI systems right now?***

**Munoz:** As exciting as artificial intelligence is, it's important to note that many AI firms are still in the early stages of development, and the process of technological innovation and integration can take years. In some cases, it will be difficult to precisely quantify the benefits that AI applications will have on an organization and investments in AI may never see a positive return.

AI requirements will vary from company to company. Establishing an AI department, or even integrating an AI application into a company's operations, has cost implications. In my view, it's not always about purchasing the best technology, or the newest or the most expensive equipment. It is equally important to weigh the suitability of the technology to your current infrastructure, type of operation, corporate culture and employee talent. Companies should look first at their pain points. What problems do they most need to solve? It could be that while AI would be nice to have, there are other issues that are more critical right now. Companies should look closely at their competitors. Are they investing in AI, and how? It's also important to think carefully about the needs of your customers. Can artificial intelligence help you better serve them? ■

# Interest Rates and Economic Indicators

The interest rate and economic data on this page were updated as of 3/31/19. They are intended to provide rate or cost indications only and are for notional amounts in excess of \$5 million except for forward fixed rates.

## KEY ECONOMIC INDICATORS

Gross Domestic Product (GDP) measures the change in total output of the U.S. economy. The Consumer Price Index (CPI) is a measure of consumer inflation. The federal funds rate is the rate charged by banks to one another on overnight funds. The target federal funds rate is set by the Federal Reserve as one of the tools of monetary policy. The interest rate on the 10-year U.S. Treasury Note is considered a reflection of the market's view of longer-term macroeconomic performance; the 2-year projection provides a view of more near-term economic performance.

## ECONOMIC AND INTEREST RATE PROJECTIONS

Forecasts courtesy of Bloomberg and Blue Chip Economic Indicators

U.S. Treasury Securities

	GDP	CPI	Funds	2-year	10-year
<b>2019</b>					
Q2	2.60%	2.40%	2.39%	2.61%	2.80%
Q3	2.30%	2.30%	2.32%	2.73%	2.90%
Q4	2.00%	2.20%	2.23%	2.80%	2.96%
<b>2020</b>					
Q1	1.70%	2.20%	2.16%	2.81%	2.98%
Q2	1.70%	2.10%	2.09%	2.83%	3.03%

## PROJECTIONS OF FUTURE INTEREST RATES

The table below reflects current market expectations about interest rates at given points in the future. Implied forward rates are the most commonly used measure of the outlook for interest rates. The forward rates listed are derived from the current interest rate curve using a mathematical formula to project future interest rate levels.

## IMPLIED FORWARD SWAP RATES

Years Forward	3-month LIBOR	1-year Swap	3-year Swap	5-year Swap	7-year Swap	10-year Swap
Today	2.63%	2.54%	2.31%	2.29%	2.32%	2.41%
0.25	2.53%	2.46%	2.24%	2.24%	2.29%	2.39%
0.50	2.45%	2.38%	2.24%	2.23%	2.28%	2.38%
0.75	2.43%	2.30%	2.21%	2.26%	2.32%	2.42%
1.00	2.28%	2.22%	2.17%	2.22%	2.30%	2.40%
1.50	2.19%	2.17%	2.19%	2.27%	2.34%	2.45%
2.00	2.07%	2.13%	2.20%	2.27%	2.36%	2.46%
2.50	2.11%	2.16%	2.23%	2.32%	2.40%	2.49%
3.00	2.14%	2.19%	2.27%	2.36%	2.43%	2.52%
4.00	2.22%	2.27%	2.36%	2.44%	2.52%	2.58%
5.00	2.31%	2.36%	2.45%	2.55%	2.58%	2.63%

## HEDGING THE COST OF FUTURE LOANS

A forward fixed rate is a fixed loan rate on a specified balance that can be drawn on or before a predetermined future date. The table below lists the additional cost incurred today to fix a loan at a future date.

## FORWARD FIXED RATES

### Cost of Forward Funds

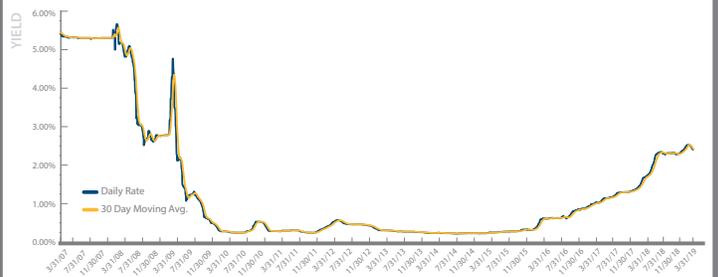
Forward Period (Days)	Average Life of Loan			
	2-yr	3-yr	5-yr	10-yr
30	5	5	5	5
90	5	5	5	5
180	5	5	5	6
365	5	5	11	10

Costs are stated in basis points per year.

## SHORT-TERM INTEREST RATES

This graph depicts the recent history of the cost to fund floating rate loans. Three-month LIBOR is the most commonly used index for short-term financing.

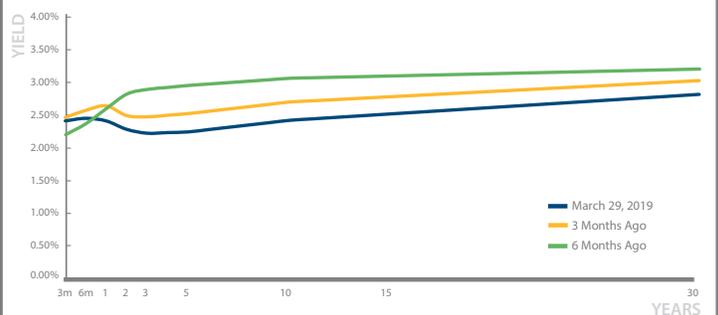
## 3-MONTH LIBOR



## RELATION OF INTEREST RATE TO MATURITY

The yield curve depicts the relation between the cost of borrowing and the time to maturity of debt for a given borrower in a given currency. Typically, interest rates on long-term securities are higher than rates on short-term securities. Long-term securities generally require a risk premium for inflation uncertainty, for liquidity and for potential default risk.

## TREASURY YIELD CURVE



## About CoBank

CoBank is a \$139 billion cooperative bank serving vital industries across rural America. The bank provides loans, leases, export financing and other financial services to agribusinesses and rural power, water and communications providers in all 50 states. The bank also provides wholesale loans and other financial services to affiliated Farm Credit associations serving more than 70,000 farmers, ranchers and other rural borrowers in 23 states around the country.

CoBank is a member of the Farm Credit System, a nationwide network of banks and retail lending associations chartered to support the borrowing needs of U.S. agriculture, rural infrastructure and rural communities. Headquartered outside Denver, Colorado, CoBank serves customers from regional banking centers across the U.S. and also maintains an international representative office in Singapore.

**For more information about CoBank, visit [www.cobank.com](http://www.cobank.com).**

## COBANK UPDATE

# CoBank Increases Sharing Success Charitable Giving Program to 4 Million Dollars Per Year

CoBank, a cooperative bank serving agribusinesses, rural infrastructure providers and Farm Credit associations throughout the United States, announced that the board of directors increased the size of the bank's annual Sharing Success charitable giving program from \$3 million to \$4 million per year.

Sharing Success provides matching funds for donations made by CoBank's customers to local nonprofit organizations in their communities. Since its inception in 2012 the program has generated more than \$36 million in total charitable donations, primarily in rural areas across the country.



*Thomas Halverson*

"We're extremely grateful for this generous decision by our board," said Thomas Halverson, CoBank's president and chief executive officer. "Over the past seven years, Sharing Success has enabled us to partner with our customers and elevate the amount of funding available for thousands of worthy causes across rural America. We're look forward to making an even larger positive impact in the years ahead."

In addition to increasing the annual Sharing Success allocation to \$4 million, CoBank is raising the maximum matching amount per customer from \$5,000 to \$7,500 each year. Contributions by eligible borrowers will continue to be matched on a dollar-for-dollar basis.

"We urge all eligible customers to take advantage of Sharing Success," said Sherry Johnson, senior manager of corporate social responsibility for CoBank. "Doing so is one of the best ways to leverage the power of an organization's local giving and to help people and communities in need."

Sharing Success launched April 1 and runs through October 31 or when the fund is exhausted, whichever comes first. Customers interested in participating in Sharing Success should contact their CoBank relationship manager or visit [cobank.com](http://cobank.com) for an application and detailed program requirements. ■