# How AI Will Transform Business

## What does AI mean for businesses big and small? What key opportunities and challenges does it present? Two experts on the topic weigh in: Rotman School Dean Tiff Macklem and Scotiabank CTO Michael Zerbs.

*Interview by Richard Piticco, CPA, CA*

**We hear so much about artificial intelligence (AI) these days, but many leaders are at different levels in terms of understanding what it means for business. What do they need to know?**

**MICHAEL ZERBS:** First of all, I want to be clear about something: AI is already here. You are using AI whenever you type a message on your iPhone and a word gets auto-completed; whenever you type a word into a search engine and it magically completes itself; and whenever you use **Google** Translate. These are all AI applications, and they share two key characteristics.

In each case, it's about a machine/agent perceiving its environment. If it were a real, natural intelligence such as you perceiving the environment, that would entail using your eyes and ears; but because it's a machine doing the perceiving, it uses sensors and algorithms. Once the environment is perceived, the agent takes an action that is orientated towards a distinct goal. That goal could be 'completing the word that you had in mind' when you started to type; or it could be 'autonomously driving a car from point A to point B' in a reasonable amount of time, without causing an accident. So, the key characteristics of AI are that a machine perceives the environment and then takes actions to optimize a particular goal.

Leaders should also be aware of machine learning — a branch of AI that 'creates' intelligence by learning from data. It's a way to take a lot of data and extract useful information to help us achieve a goal. Computers have become extremely powerful: Things that were once theoretically possible were only possible if you were willing to wait for a very long time; all of a sudden, you can do these things very quickly.

**Tiff, the University of Toronto – and the Rotman School in particular – have done some interesting research around the economic consequences of AI. Can you talk a bit about this?**

**TIFF MACKLEM:** What is so interesting about AI is that it's not an invention like, say, insulin. Insulin was a hugely important innovation that has massively improved the quality of life for diabetics — but it's not something that you can take and apply to all sorts of things. AI is more of a 'general purpose technology': It has wide-ranging applications, and we are only just starting to see what those are.

## Innovation improves our lives; but at the same time, it can destroy a lot of value.

The way economists think about AI is, we ask, 'What does it actually do?' Like any disruptive technology, it dramatically drops the cost of something — and in our view, that something is *prediction*. Take the analogy of computers. What they dramatically reduced the cost of was arithmetic — and as a result, things that involved a lot of arithmetic were quickly automated. Next, people began to realize that there were lots of problems that we didn't necessarily *think of* as arithmetic problems that could be made into arithmetic problems.

For example, we used to take photos on analog cameras using **Kodak** film, then take the film to **Blacks** to be developed via a chemical process. One day, someone said, 'You know what? Given that arithmetic is so cheap now, maybe we could produce photos digitally'. All of a sudden, we were taking more pictures than ever before — and Kodak and Blacks went bankrupt.

As in the case of computers, with AI, the initial applications we are seeing are very obvious things. So, based on your previous patterns, **Netflix** uses AI to predict which movies you might like to watch, and **Amazon** uses it to predict which books you might want to buy. These applications are handy — but hardly transformational.

However, we are starting to see more meaningful applications. For example, in healthcare, AI applications are dramatically dropping the cost of diagnosis. Say you notice a new mole on your arm: Is it just a sun spot, or is it a melanoma? You can now take a picture with your phone and an AI algorithm can tell you. That is going to lead to better health outcomes. The way to think about AI is, it's a very powerful prediction engine — and the uses we've seen to date are just the tip of the iceberg.

**Tiff, within five years, the Rotman School's Creative Destruction Lab (CDL) has far exceeded your expectations. Can you give us some background on it, and some idea of what is coming down the pipeline?**

**TM:** The name for the Creative Destruction Lab comes from economist **Joseph Schumpeter**, who was one of the first to think deeply about the process of innovation. He coined the term 'creative destruction' to capture the idea that innovation creates new inventions that improve our lives; but at the same time, it can destroy a lot of value and put people out of work. So, there are positives and negatives to innovation.

The fundamental insight that led us to launch the CDL was this: We have great science in Canada, but historically, we have done a *lousy* job of commercializing it and reaping the economic benefits. Too often, the pattern goes something like this: Canadian scientists invent something amazing, and an American entrepreneur develops it into a product and reaps all the economic benefits. Our insight was that there is a market failure in what we call 'the market for judgment'. The problem for a new entrepreneur is, we've got great scientists coming up with amazing inventions — but they don't know the first thing about whose problem it could solve, or how to start-up and scale a business. Most of what occurs between invention and revenue is *management*.

Rotman Professor **Ajay Agrawal**'s founding vision for CDL was to attract really promising deep science-based ventures, and connect them with some of Canada's most successful entrepreneurs to resolve the failure in the market for judgment. These mentors are people like **Tony Lacavera**, who founded **Globalive Holdings**; **Ted Livingston**, who started **Kik**; and **John Francis**, who started **Grounded**. They come in and volunteer their time, and we connect them to promising science-based ventures. Our MBA students also do *pro bono* work for these ventures, adding the required capacity and analytics to figure out who the customer is, how the initiative should be financed, and how it can be scaled. This gives Rotman students a unique entrepreneurial experience at the frontier of new technology.

This formula has been hugely successful: Five years ago, we set a goal of the ventures going through creating $50 million dollars of equity value. Today, we're closing in on $1.5 billion dollars of equity value created. Of course, this is notional — they haven't exited; that's based on the money they've raised.

We recently expanded beyond the University of Toronto: About a year ago we partnered with the University of British Columbia to create a CDL at the Sauder School of Business; last spring we announced partnerships with Dalhousie's Rowe School of Business, HEC in Montreal and the Haskayne School at the University of Calgary. And in October, we announced a partnership with NYU's Stern School of Business. The successful entrepreneurs — or Fellows, as we call them — who mentor CDL ventures come from Canada and beyond: People like **Barney**

**Pell**, who holds a PhD in Machine Learning and led the **NASA** team that flew the first AI into deep space; and **Shivon Zilis**, who founded **Bloomberg**'s AI investment arm, **Bloomberg Beta**.

About three years ago, when we decided to really focus on AI at Rotman, it was a case of coming back to where it all started. The University of Toronto is home to **Geoffrey Hinton** — a Computer Science professor who is one of the pioneers and global gurus of artificial intelligence. Around 2012, Prof. Hinton and his team of PhDs started winning lots of global prizes in AI — particularly around picture recognition, which is a classic AI problem. All of a sudden, Silicon Valley leaders were coming up to Toronto to hire many of his PhD students. These people are now running the AI labs at **Apple**, **Google**, **Uber** and **Facebook**. So, this is another sad Canadian story, because the Canadian government actually funded a lot of this research — through what is known as the 'AI winter', when progress was very slow. Suddenly, Prof. Hinton's team started hitting home runs, and Silicon Valley swooped in.

For the students and professors who want to stay in Toronto, we want to help them start and grow their businesses *right here*. We've now got 100 AI-oriented companies going through the Lab each year. As far as we can tell, it's the biggest concentration of AI ventures of any program in the world. And instead of Silicon Valley stealing our talent, its leaders now fly up to Toronto regularly for CDL meetings, because they want to invest in these ventures.

**Can you describe what these ventures look like?**

**TM:** Every year we are seeing an ever-broadening sweep of applications across sectors. In the beginning, many ventures used AI to predict some sort of fault or malfunction: Think of possible problems with cars, planes, trains, drones, pipelines or any kind of big machine. How many times have you gone to the airport gate and you hear, 'We have a mechanical problem; there's going to be a delay.' This costs the airlines billions of dollars every year, and it's a huge inconvenience for travelers. If they could do a better job of predicting these problems, air travel would be much more pleasant and safe, and the airlines would dramatically drop their costs.

At CDL recently, we've been seeing all sorts of applications in healthcare, including new types of diagnostics that are up to 100 times cheaper than what we use today, and applications for more personalized medicine. The reality is, people react differently to different drugs and treatments — and AI can predict how, say, a particular cancer patient will react to a certain treatment.

These are just some examples. There are many more I could talk about, but what I would underline is that the only limitation is our imagination.

**Michael, Scotiabank is one of the CDL's partners, but you are also involved with the Vector Institute and NextAI. Tell us about the strategy for these partnerships.**

**MZ:** A few years ago, we recognized that the world was moving so fast in terms of advancements in AI and related fields, that there was no way for us to 'know it all' internally. So, in Scotiabank-speak, we took an 'outside/in perspective'. Large enterprises often think that only people who grew up in the organization know best; but we knew that wasn't the case.

In terms of strategy, the main reason for our partnerships is simple: Gaining access to new ideas. Even though many AI ideas don't *directly* relate to finance, you can often look at, 'What are these entrepreneurs and scientists trying to achieve?' and figure out the 'finance equivalent' of that. It could be around finding anomalies, detecting patterns, or just reducing the cost of prediction at some level.

The second point is equally important to us: There is a massive talent shortage right now, in terms of people who understand AI and can apply it. At the scientific level, how do you practically apply deep learning algorithms? And at the business level, once you've got the tool, how can you use it in a transformational sense? We thought, we can sit here all day and complain about all the change taking place — or we can team up with great institutions like Rotman and initiatives like NextAI and *do something about it*. Canada has a great opportunity to be a leader in the AI realm, and we want to be part of that.

The third aspect is, while a lot of advances have been made, what academia often really needs are practical-use cases. It is very difficult to get access to real-world data. The good news is, banks collect a lot of data; the bad news is, it gets trapped in silos, because historically, banks have operated in silos.

To combat this, we have started several initiatives. For

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example, we anonymized and aggregated certain data sets, and gave our academic partners access to it, subject to appropriate security and confidentiality arrangements. This enables students to explore what kind of interesting insights and algorithms can be developed, leading to dialogues and all sorts of opportunities to develop solutions for our customers.

**Can you talk a bit about how you're leveraging third-party datasets as part of your AI strategy?**

**MZ:** If you work for a large organization, never underestimate the challenge of just *getting at the data* that you think you've already got. As indicated, it likely sits in different silos, which quickly raises organizational issues and data-governance issues. Even if you can get access to it, is it in the right format? The complexity of real-world data is a major issue. Getting our own data organized so it becomes 'AI friendly' is a critical exercise.

Also, Scotiabank is very active in various Latin American markets, and we see a tremendous need there to provide better service to our small business partners and customers. It's not easy for a small business to get along with any of the big banks, because their processes weren't designed for small businesses.

Of course, there are fintechs out there that have a very different approach. Currently, we're partnering with one called **Kabbage**, which works with small businesses. We realized that, if they provided us with access to what these merchants were selling and when they were getting paid, we could determine the credit-worthiness of individual merchants — and dramatically accelerate the loan-approval process. We can now say to small business leaders, 'Here is the traditional process for getting a loan; and here is an expedited process that we offer with our partner, Kabbage. If you agree to share some of your data with us, you can go down the latter path, which is much faster'. This is just one example of how we're using data in new ways.

**SMEs [small-to-medium-sized enterprises] are an important component of our economy. Given that they don't generate or have access to huge amounts of data, how can they embrace AI?**

**TM:** On the one hand, for companies that have large amounts of data, there are huge economies of scale and network benefits to be had. Just look at **Google** or **Alibaba**: These are unbelievably data-intensive companies that are thriving thanks to AI. On the other hand, different types of digital technology are benefiting SMEs. For example, Cloud computing. At one time, if you had a small business, you had to purchase your own servers, but today, you don't have to do that — and as a result, these companies can scale themselves much faster than in the past. Also, in a digital world, you often don't need to build a factory, and you can access global markets directly by selling online.

It's still early days for AI, but as it becomes more mainstream and gets packaged and sold to businesses, there will be ways for SMEs to leverage it. For example, one of the biggest prediction problems for a small business is, predicting your cash flow, and there is already a company out there building an AI engine to do that flow for small businesses. That is a well-defined prediction problem: A small business doesn't have massive amounts of data — but it does have all of its financial information for the life of the business. So, there will be applications for SMEs. Obviously there's an entry cost, and you need to look at whether you can partner with new ventures to accelerate your progress; you don't have to build it all yourself.

**We would be remiss if we didn't touch on human capital. Tiff, what are your thoughts on how AI is going to affect jobs and competencies?**

**TM:** If you believe, as we do, that AI is dramatically dropping the cost of prediction, this means that jobs involving a lot of prediction are going to see declining demand and lower wages. On the other hand, jobs that are *complementary* to prediction will do well. In the realm of healthcare, if you work as a radiologist, spending most of your time looking at x-rays, very soon, AI is going to be able to read x-rays faster and more reliably. But, if your job is to *care for* those people, or figure out what treatment they need next — those skills are only going to rise in demand.

I don't want to minimize the disruptive effects that AI will have on society. If we see really rapid progress, it *will* have serious implications. We are already seeing this play out in the world: Which two countries have the highest levels of inequality in wealth distribution? The U.S. and the UK; and the consequences of that are the election of President **Trump** and

Brexit. The consequences have nothing to do with the problem, really; but they are features of the anxiety lots of people are feeling. And, we shouldn't kid ourselves in Canada: We do have a more redistributed tax system, but we're seeing the same trends and the same anxiety. As a society, we need to manage this a lot better.

**Michael, how is AI impacting human capital at Scotiabank?**

**MZ:** Earlier, Tiff touched on the first-generation uses for AI in financial services, and *collections* and *fraud* are two great examples. It's actually a significant challenge to systematically optimize collections, because you need to determine several things: Out of all the customers who don't pay up initially, who will eventually pay? And for those that *will not* pay you otherwise, should you contact them when they're one day late or 10 days late? How should you ask for a promise to pay, and how insistent should you be? This actually requires a fairly complex resource-organization model, and we've already seen great results from using machine learning to optimize our collection process.

Fraud is more about 'anomaly detection', and we end up chasing a lot of false positives. That not only wastes untold resources, but can negatively impact our customers. Say you buy an expensive ring for your partner, and one of our alerts goes off. Suddenly, your credit card is declined, because this unusual purchase raised a red flag. These situations will be handled far better through AI.

Statistical tools have been around for hundreds of years. The way most tools traditionally work is, you say, 'I have a view that A depends on B. So, let me run some regression analysis and validate that view' and you complete it. Through this, good or bad outcomes are determined and you modify the model. Machine learning inverts that process, so the user says, 'I am not postulating anything up front: *The data will tell me*'.

That is a fundamentally different way of thinking, and it turns deployment into much more of a 'test-and-learn' approach, because the data will tell you different things, and you then need to test it on a larger scale. To foster this mindset shift, we have trained 'digital coaches' in place to help our teams adjust to the test-and-learn approach.

**How do you find a balance between innovation and risk management?**

**MZ:** I strongly believe that at the end of the day, automation will always reduce risk, because the majority of risk we see in practice relates to human error — and ultimately, automation reduces human error. The idea of testing and learning is extremely important. By trying out different things early, you will catch mistakes earlier. Traditionally, organizations — particularly large ones — have a mentality where they try to define everything up front, build it, and roll it out. We just expect that our customers will like it, and that everything will work properly; but usually, there are challenges. It's much better to get customers in within weeks of starting something to obtain early feedback, and run the first algorithm within weeks of developing the model. The big takeaway for me is that the potential of AI outweighs the risk. ***RM***

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