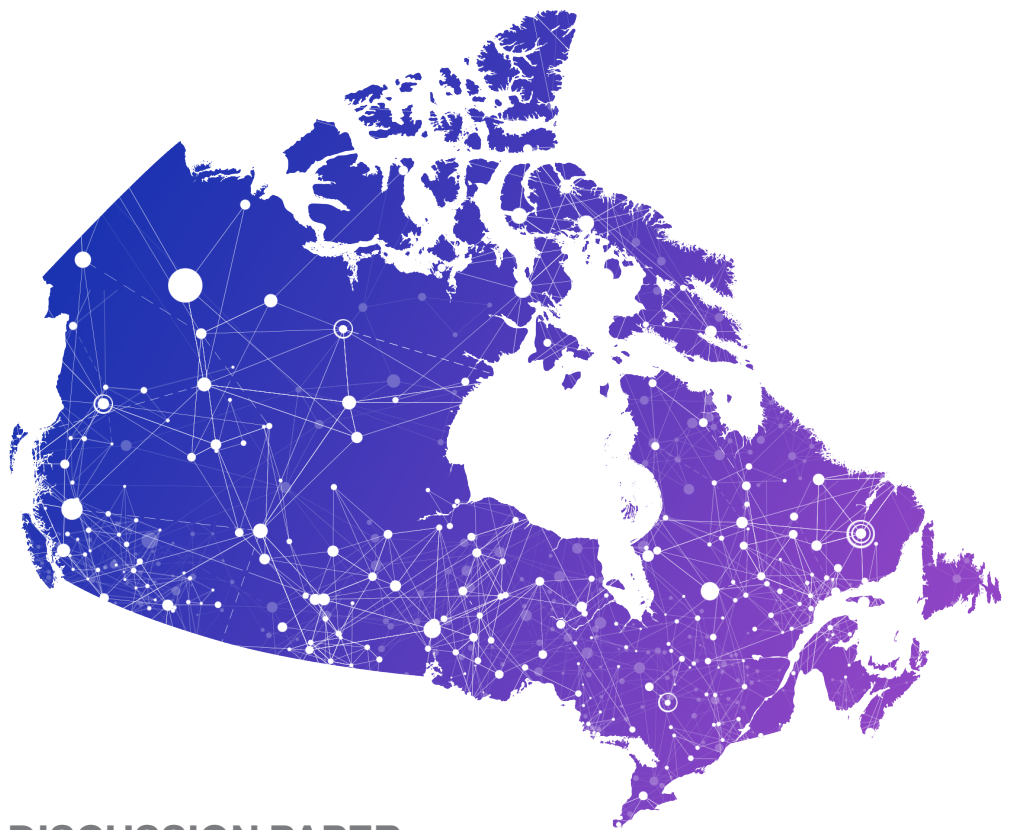


AI LOOKS NORTH: BRIDGING CANADA'S CORPORATE ARTIFICIAL INTELLIGENCE GAP



DISCUSSION PAPER
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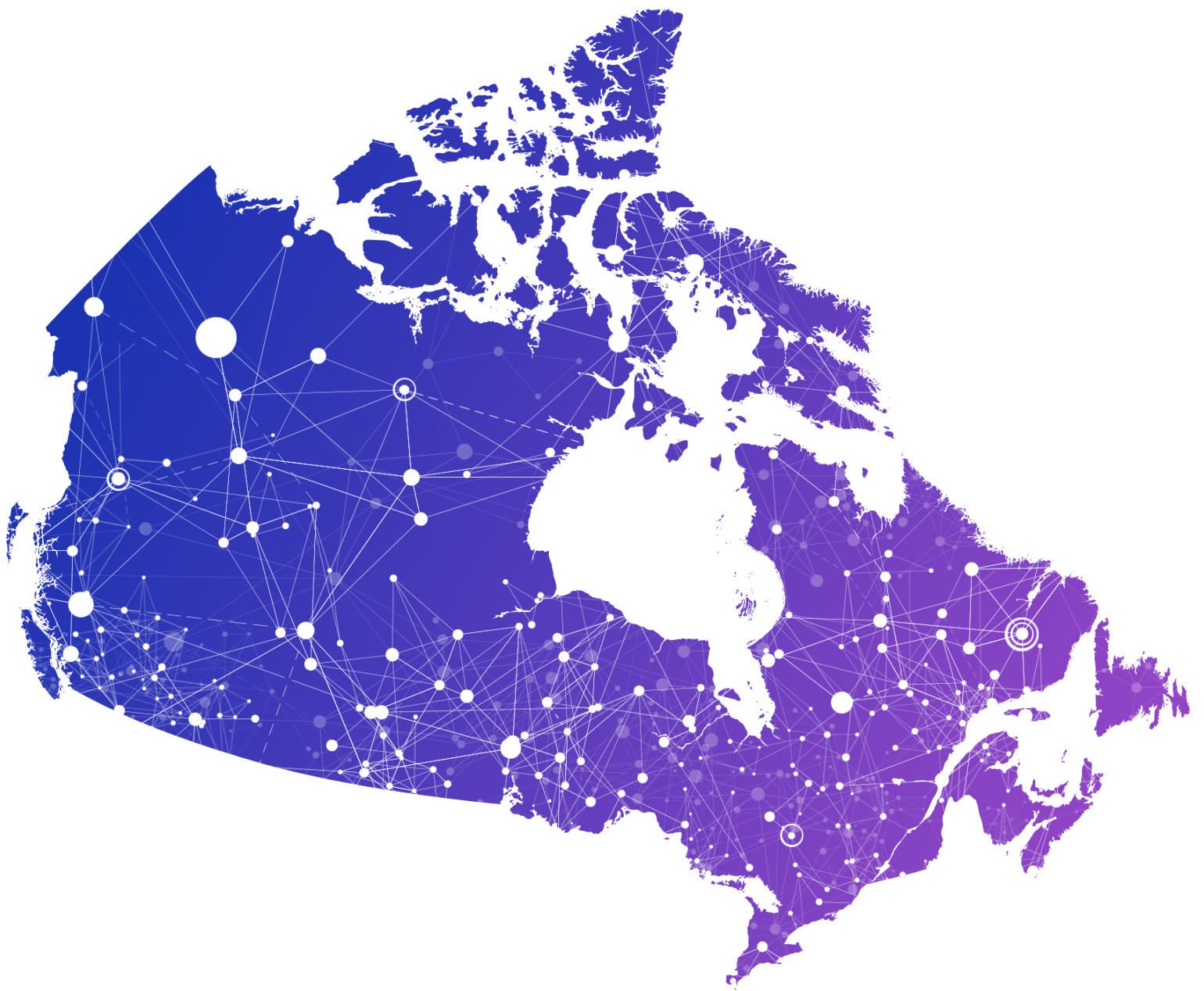
首席AI观旗下有3大类40余小类3000多AI社群，现进一步邀请行业人士加入。

AI技术群	云计算与大数据		机器学习		自然语言处理（NLP）		语音识别					
	计算机视觉（CV）		物联网技术		VR/AR		AI芯片					
AI应用	自动驾驶		安防		机器人		智能家居		智能音箱		物流	
	新零售		金融		教育		影视游戏		医疗健康		通信服务	
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SUMMARY

From high tech to retail, from mining to transportation, artificial intelligence (AI) is fast becoming one of the most promising forms of digital disruption. Early adopters are seeing real benefits that range from reducing operational costs by streamlining processes to building lucrative new AI-based businesses. And fast-followers are developing strategies to leverage AI opportunities while guarding against AI-driven competition from non-traditional sources.

Industry leaders are beginning to envision a future shaped by AI. The insurance sector is starting to think about how AI-guided autonomous vehicles will impact auto insurance as the number of accidents and private ownership declines.^{1 2} Forward-thinking retail companies are beginning to envision a time when AI's predictive capabilities — fed by a torrent of consumer data — will become so accurate that products can be shipped before customers order them.³ Tomorrow's leaders in the financial industry are preparing for an environment in which few products will be standardized, and offerings will be calibrated to individual needs, guided by AI-informed customer profiles.^{4 5}

These changes are coming, and all companies should be preparing themselves.

In Canada, which pioneered many foundational advances in deep learning research and possesses a rich AI talent base, the question confronting businesses is whether they can reap AI benefits commensurate with the nation's historic academic leadership.⁶ Right now, big players such as Google, Facebook, and Microsoft are coming to Canada to leverage its deep talent pool.^{7 8 9} But will Canada's pioneering AI history translate into accelerated technology advances in its own businesses?

To find out, McKinsey & Company surveyed 120 leading Canadian executives and interviewed 31 business leaders in depth. We found an encouraging amount of enthusiasm for AI — and a willingness to take even bolder actions to search for AI value. We uncovered valuable lessons from Canadian leaders that can be applied to other businesses that are struggling or have yet to embrace AI. However, we also found notable gaps in business leaders understanding of AI's potential, and its impact on the value chain, which has

1 Yuki Noguchi, "Self-Driving Cars Raise Questions About Who Carries Insurance", *NPR*, April 3, 2017.

2 John Cusano and Michael Costonis, "Driverless Cars Will Change Auto Insurance. Here's How Insurers Can Adapt", *Harvard Business Review*, December 5, 2017.

3 Robert C. Wolcott, "The King Customer Paradox: The More Empowered, The More We Lose Control", *Forbes*, April 10, 2017.

4 "Adobe Transforms Personalization With Artificial Intelligence", *BusinessWire*, January 27, 2017.

5 Melissa Burns, "How Banking Software Helps To Personalize Customer Experience", *Digitalist*, January 9, 2018.

6 "How Canada's unique research culture has aided artificial intelligence", *The Economist*, November 4, 2017.

7 Cade Metz, "For Google, the AI talent race leads straight to Canada", *Wired*, March 30, 2017.

8 Sam Sheard, "Facebook and Google Are Backing a \$150 Million Canadian AI Research Facility", *Inc.*, March 30, 2017.

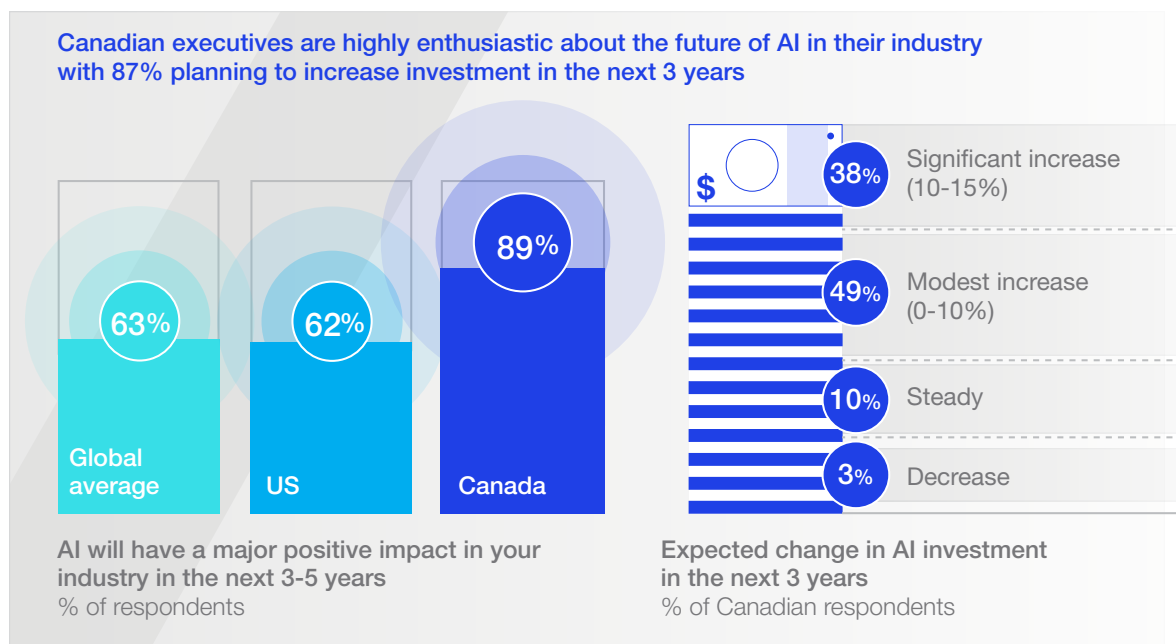
9 Ryan Bushey, "Why Canada is Becoming a Hub for A.I. Research", *R&D Magazine*, July 13, 2017.

manifested itself in a paucity of truly impactful initiatives. If Canada cannot mobilize aggressively to tap its wealth and talent, others will — and Canadian businesses will risk finding themselves at an enduring competitive disadvantage.

The report distills our findings and anecdotes into a series of targeted recommendations tailored to Canadian business leaders.

Exhibit 1

AI enthusiasm and investment



Source: MGI Survey, McKinsey Canada AI Survey

Our research uncovered three key gaps between Canada's AI aspirations and activities:

- STRATEGY DOES NOT MATCH EXPECTED IMPACT.**
 Although 89 percent of Canadian business leaders believe AI will create major, positive change within 3 to 5 years, only 34 percent have transformed their longer-term corporate strategies to position themselves appropriately to seize AI's potential benefits.
- THE BASICS OF AI ARE NOT WIDELY UNDERSTOOD.**
 Although 82 percent of survey respondents reported they currently use or invest in sophisticated AI applications — deep learning, reinforcement learning, neural networks — interviews revealed current use cases focus nearly entirely on traditional analytics — dashboards and statistics-based analysis.
- CURRENT AI APPLICATIONS ARE NOT TRANSFORMATIVE.**
 Most businesses that are currently exploring AI's benefits often focus on a small number of non-core use cases. However, transformative, value-chain targeting experiments are often underutilized.

While these responses align with early stage AI maturity, Canadian business leaders need to accelerate their efforts to fully participate in this next digital revolution. They can do this by implementing the following:

- **BECOME FLUENT IN AI** — driving alignment at the senior level on the potential of AI. A formal effort must be taken to ensure that all top-level executives are well-versed in the disruptive powers of an AI transformation.
- **REIMAGINE THE BUSINESS AS A TECH COMPANY** — determining where AI can support business objectives and reimagining processes by finding the relevant value drivers. The focus should be on changing the business, rather than only improving current assets. If new ideas are not disruptive, they are not bold enough.
- **BUILD A DIGITAL AND ANALYTICS BACKBONE** — building the foundational analytics and digital structures, capabilities, and policies. AI cannot exist in a vacuum. It can best succeed by building on existing capabilities.
- **EXPERIMENT AND SCALE AI APPLICATIONS** — developing proofs of value and quickly scaling the best. The current rate of experimentation needs to be accelerated by moving from 2 to 3 small scale experiments to 10 or more executed simultaneously across the organization.
- **EMBED ANALYTICS AND ANALYTICS-TO-BUSINESS “TRANSLATOR” TALENT** — ensuring the company has the right talent to execute its AI strategy. Businesses must re-train or recruit analytics-to-business “translators” and make strategic decisions about the degree of in-house versus vendor development talent. To maximize its impact, AI cannot be siloed. Businesses will need to consider and plan for new career paths and roles.
- **MANAGE HUMAN CHANGES DURING THE AI TRANSFORMATION** — communicating the upcoming changes broadly and clearly to ready the business and its people for the transformations to come. AI transformations are as much about people as they are about technology.

REPORT

BECOME FLUENT IN AI

In one-on-one interviews with senior executives, only a handful said they had a real understanding of AI and how it differed from what we used to call “Big Data” or other forms of analytics. Similarly, a small fraction of executives thought their board understood AI at a level that would make them comfortable sustaining significant investments.

Only when leaders fully understand AI’s disruptive power — its nature and potential — can they apply these technologies and techniques effectively and give them the attention they need. Two surveyed executives in oil and gas and forestry, for example, credited a large part of their companies’ AI strategies to off-sites they attended alongside CEOs and board members of Silicon Valley’s leading tech companies.

Senior leaders can also discover AI’s possibilities by engaging with the startup community. One survey respondent, a banking leader, says he consistently scans startups looking for new, cutting edge approaches to applying AI. Another respondent, a professional services CEO, says his leadership team reviews relevant startups each quarter to discuss their potential for disrupting his company as well as their suitability for potential acquisition or partnership.

We believe executive teams need to invest time to gain more granular knowledge of AI’s capabilities through retreats, events, and training to understand what is possible today and expected in the future. Once leaders become more knowledgeable about how AI can generate value for their businesses, they can begin looking for the use cases that point their organizations toward business value and shifting their focus from immediate cost saving to AI’s long-term strategic differentiating power.

RE-IMAGINE THE BUSINESS AS A TECH COMPANY

The revolution is wrongly seen as a technical one. To have long-term impact, AI efforts need to be transformative and go beyond adopting the new technology on an anecdotal basis. The same way that building a website was not a solution to the internet revolution, adopting cookie-cutter AI use cases won't be the hallmark of future winners of the AI revolution.

AI transformation must begin by determining where AI will best support strategic priorities, whether that is improving the customer experience, improving speed to market, developing innovative products and services, or some other objective. For example, one of AI's most powerful attributes is its ability to discern patterns in data flows and use them to generate predictive outputs.¹⁰ Amazon knows this well. Today, 35 percent of its sales have been attributed to its recommendation engine that predicts what a customer will be most likely to want to purchase in the future.¹¹

Taking a cue from Amazon, an organization could uncover AI opportunities by mapping its core business processes and asking, "Where would powerful and timely predictive abilities provide competitive differentiation and advantage? Where would it be a game changer?" (Of course, prediction is just one AI capability. AI-guided robots are transforming warehouses; utilities are using AI to make the power grid smarter; the list could go on.)^{12 13} Implementing disruptive AI capabilities demands that businesses take stock of their processes in detail and identify pockets of opportunity to reimagine how AI tools could improve that work. Exploring these opportunities can help companies determine which of their core processes should be rewritten to accelerate transformative change.

Focusing on core business processes and opportunities does not necessarily mean a narrow concentration on cost saving, which is often a driver of business change. Although cost saving, especially in support functions, can be low-hanging fruit AI can pluck, it is neither disruptive nor transformative — AI's two most salient characteristics.

As one survey respondent, a manufacturing CEO, said of his company's AI efforts: "We're redeploying savings to build other capabilities." In other words, this CEO knows the name of the game is transformation and growth, and the costs associated with improving processes need to be balanced with cost reductions, quality improvements, speed, and a richer, more valuable customer/user experience.

10 Bennat Berger, "The predictive powers of AI could make human forecasters obsolete", *VentureBeat*, February 28, 2018.

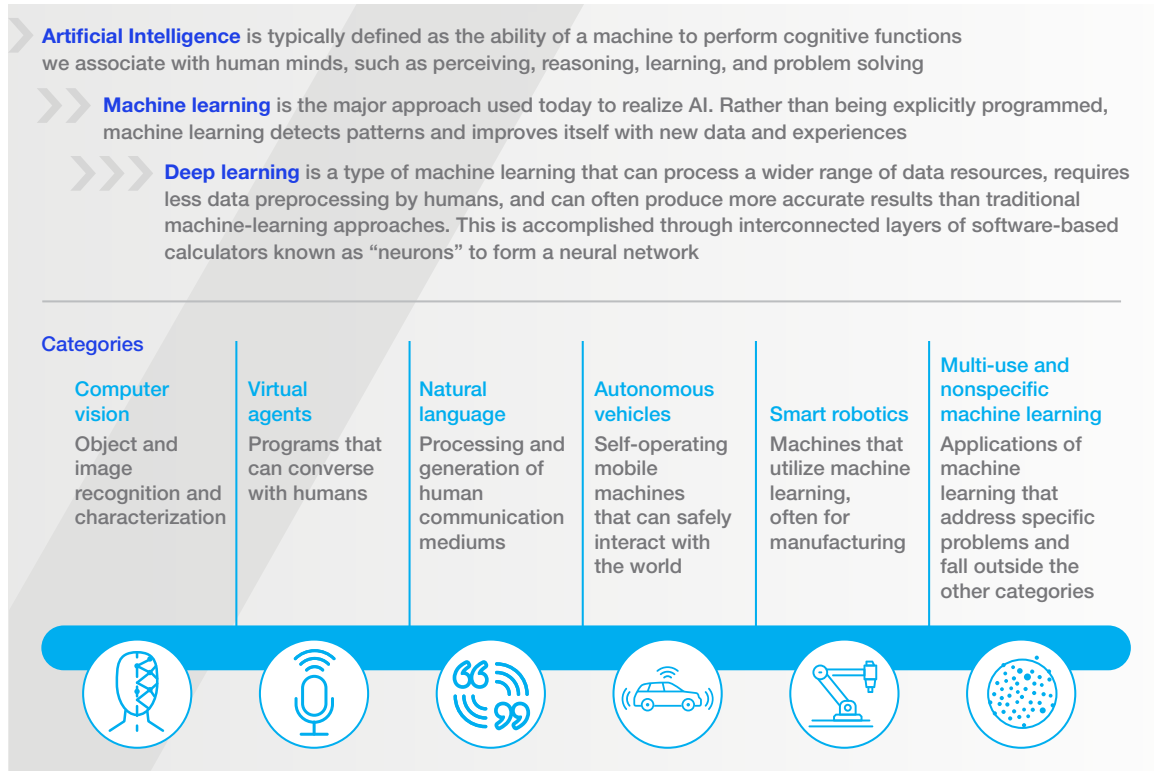
11 Elad Natanson, "Amazon Spark - A Social Network for Product Discovery", *Forbes*, September 5, 2017.

12 Jonathan Vanian, "Futuristic Robots Are Lending Their Hands in Gap's Warehouse", *Fortune*, October 24, 2017.

13 John Kosowatz, "Using AI to Manage the Grid", *The American Society of Mechanical Engineers*, January, 2018.

Exhibit 2

What is AI?



Source: Michael Chui, Vishnu Kamalnath, Brian McCarthy, *An executives guide to AI*, McKinsey Analytics, February 2018; Jacques Bughin, Eric Hazan, et al., *Artificial intelligence: The next digital frontier?*, McKinsey Global Institute, June 2017.

BUILD A DIGITAL AND ANALYTICS BACKBONE

Analytics and digital capabilities go hand in hand. For an organization to make the most of AI capabilities, certain foundational elements need to be in place:

1. Large quantity of data
2. Clean data
3. Infrastructure to easily work with and get value from data

By digitizing processes and building digital capabilities, an organization will start capturing an abundance of real-time data. However, just having the data is not enough. The data needs to be properly formatted to allow analytics to be performed. Although this may not sound valuable, 50 to 80 percent of data scientists' time

is spent “wrangling” data into a usable form rather than generating insights.¹⁴ A streamlined data operating model must be put in place to consolidate and manage the plentiful and clean data being generated across multiple business lines to enable value to be created. An industrial executive cited “ownership of data and interoperability” as the biggest bottleneck to expanding his machine learning capabilities.

A leader of a major insurance company discussed the importance of a wider data management strategy, given that his analytics experiments were limited to domains where the data is clean, plentiful, and easily accessible. To expand the scope of possible use cases, his company is undergoing a multi-year data consolidation effort.

CURRENT LIMITATIONS OF AI

Despite its great promise, AI still has some limitations. Being aware of these limitations will enable Canadian business leaders to better understand what is possible with today’s technology while planning for a future when these barriers are overcome.

The following limitations summarize the findings from the January 2018 *McKinsey Quarterly* article, “What AI can and can’t do (yet) for your business”.¹⁵

DATA LABELING: Many advanced AI models require data be characterized properly to realize benefits. For example, autonomous driving companies employ hundreds of people to manually annotate information from video feeds to allow its self-learning algorithms to properly train itself.

OBTAINING MASSIVE TRAINING DATA SETS: Depending on the training task, a machine learning algorithm may require thousands or millions of data records to function properly. Depending on the goal and data source, this may severely limit where AI can be used.

THE EXPLAINABILITY PROBLEM: It is difficult and often impossible to fully dissect how a deep learning algorithm arrived at its conclusions. This presents a problem when regulation, such as those described in the EU’s General Data Protection Regulation (GDPR), requires a degree of explainability in AI models.

GENERALIZABILITY OF LEARNING: Once an AI model is trained for a specific experience, it is difficult to apply that learning to other situations or contexts. Often, a new data set and training is required, even if the use case seems similar to humans.

BIAS IN DATA AND ALGORITHMS: AI is only as accurate as the data that it is being fed. If the training data contains misrepresentations, either intentionally or unintentionally, those biases will manifest in problematic outcomes.

¹⁴ Steve Lohr, “For Big-Data Scientists, ‘Janitor Work’ Is Key Hurdle to Insights”, *The New York Times*, August 17, 2014.

¹⁵ Michael Chui, James Manyika, and Mehdi Miremadi, “What AI can and can’t do (yet) for your business”, *McKinsey Quarterly*, January, 2018.

EXPERIMENT AND SCALE AI APPLICATIONS

Experimenting with AI requires identifying the greatest pools of potential value and then attacking them in an agile fashion with dedicated teams empowered to try new things and fail fast.

Early in AI experimentation and investment, it is often difficult to predict where value will be retrieved. One respondent, a banking leader, said he was shocked by how much value some of his proof of concept experiments returned — and how quickly. A manufacturing CEO said he's seen many multiples more value in his data capture and consolidation efforts than he expected. At the same time, an executive of a large transportation company stressed the importance of having multiple use case experiments running at once given that some will inevitably fail.

Understanding the difficulty of assessing early-stage AI ROI, a diversified portfolio approach to experimentation and investment with various timelines running in tandem is wisest.¹⁶ Although significant media attention is given to AI deals focused on startups with unproven technology, considerable value can already be realized with existing and proven technologies. Senior executives need to ensure that short-term benefits are being captured.

Short-term investment can focus on readily available, proven AI and advanced analytics tools that can be scaled easily to drive bottom-line value. Medium-term investments can be put to experiments with emerging solutions (like deep learning video recognition) and scaled only after they prove their business value. For longer-term investments, organizations can work with academic institutions or startups to explore cutting-edge, transformative capabilities (like augmented decision making) that could provide a first-mover advantage. It's vital to strike a balance between selecting ideas that redefine the business model and those that improve the existing business model. This diversified approach, with its built-in risk mitigation, also helps win buy-in across the more conservative areas of the business.

Once an experiment or initiative is underway, it is essential to go beyond traditional ROI measures and develop new KPIs. One banking executive said he found that a major reason his bank was not as digitally capable as others was due to overly conservative KPIs: "We underinvested for a significant period in our technology platform. Our problem was that we treated technology like other business units." In other words, technology KPIs were tied to the same sort of metrics as its banking products and it led the bank to underinvest in long-term strategic assets at the expense of short-term business returns.

¹⁶ Jacques Bughin, Brian McCarthy, and Michael Chui, "A Survey of 3,000 Executives Reveals How Businesses Succeed with AI", *Harvard Business Review*, August 28, 2017.

EMBED ANALYTICS AND ANALYTICS-TO-BUSINESS “TRANSLATOR” TALENT

The organizations we surveyed and interviewed tended to approach AI in one of two ways:

1. Pursuing AI primarily to tackle business problems, mostly leveraging external providers
2. Taking a more aggressive approach by using AI technologies to solve business problems and create new AI intellectual property (IP) that could fuel significant competitive differentiation or create an entirely new AI-based business line

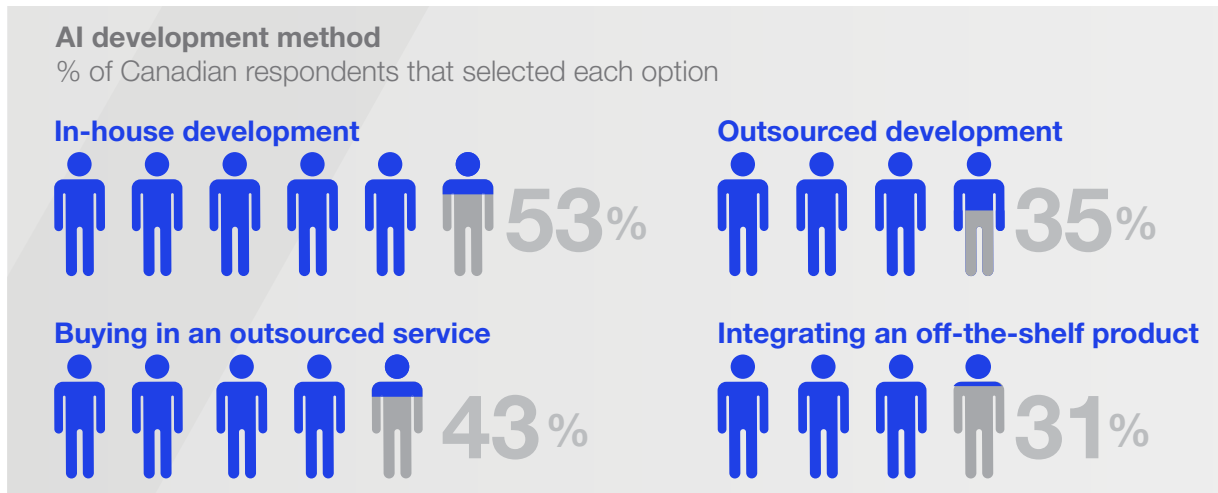
Companies taking the first, more conservative approach may not need to pursue IP development. Typically, they require less AI talent (and less of the top tier talent in such short supply) and more frequently engage external vendors to source AI solutions. Companies taking the second, more aggressive approach are more likely to need to focus on recruiting a larger cadre of more specialized AI talent.

However, both approaches present common challenges. One involves identifying talent for one of the most critical roles in AI initiatives: the translator. Translators should be able to articulate business challenges to the technical staff who build the solutions and then convey the solutions’ insights back to the business units. They must possess significant knowledge of the business and industry in addition to having enough technical expertise to know how to apply AI to solve business problems. As a board member of a large bank said, “We talk about investment in AI, but if it is not matched by skillsets in the business units, it doesn’t matter much.” This role is so critical that most large companies should have a clear plan to train 15 to 20 translators across their various business lines.

Developing a degree of in-house analytics fluency by hiring or educating existing talent is essential to both approaches as well. Even when companies primarily rely on external AI providers, they need internal talent with the technical expertise to evaluate how these resources are performing. A leading bank executive said that a major component of the bank’s experts’ work is vendor evaluation. Without that expertise, a company is more at risk of applying cookie-cutter solutions that often don’t deliver against the promises. As an executive told us: “I’d like to believe there are opportunities [in AI for us] but have yet to get past the buzzwords.”

Exhibit 3

Although AI development methods vary, over half of respondents prefer in-house development



Source: McKinsey Canada AI Survey

MANAGE HUMAN CHANGES DURING THE AI TRANSFORMATION

It should be obvious that the broader the adoption of AI across the enterprise, the greater the value a business will retrieve. There are, however, barriers that must be eliminated to achieve enterprise-wide adoption.

These barriers include concerns about job loss, the fear of the “black box” nature of AI (“How does it work?”), and, most important, the fundamental human resistance to change. A top executive at a prominent law firm said the difficulty of realizing value from AI in his firm came from a resistant base of lawyers who did not wish to change their familiar work behaviours, even while acknowledging the greater efficiency and accuracy new AI systems afforded their efforts.

To deal with that resistance, companies must invest time in understanding how machine prediction will interface with human judgement in making decisions. Spending time on change management and redefining business processes around AI will be more critical than the technology itself. In the end, AI will be a human problem, not a technical one.

At a large transportation company, an analytics-driven executive said, “It’s very scary. We have lifers, and it’s very difficult to get such a large organization to embrace this type of change. We need to communicate that it will be human plus machine, not human versus machine.” Organizations must work to help their people see the “plus” and continuously stress the importance of the human in the AI future.

LEADING FROM THE FRONT

Canadian businesses today have a great opportunity to align their aspirations for AI success with disruptive actions that will create heretofore unimagined value opportunities. This will require a granular understanding of AI, forward-looking, insightful business strategies, thoughtful experimentation, use cases that reveal where unfilled needs and new capabilities intersect, robust and revolutionary organizational models, talent, and change management activities that cultivate and tend to a new workforce of skilled analytics and AI professionals.

Canada has the will to succeed. There is no reason it shouldn't be at the forefront of this new age of AI.

METHODOLOGY

Between November 17 and December 14, 2017, McKinsey & Company conducted an online survey of 120 Canadian executives, including 33 CEOs. These executives represented organizations with global revenues of more than \$1 billion and either headquartered in Canada or with a substantial Canadian footprint.

Between November 2017 and March 2018, 31 in-depth interviews with Canadian business leaders were conducted across multiple sectors of the Canadian economy.

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