

# GLOBAL Insight



Wealth  
Management

## Special report

July 2024

### Generative AI: enablers and adopters

GenAI will likely have far-ranging repercussions on the economy, sectors, and business functions. We look at the potential impact and explore investment strategies we expect to benefit from the new era.

Frédérique Carrier

For important and required non-U.S. analyst disclosures, see [page 13](#).

All values in U.S. dollars and priced as of market close, July 12, 2024 unless otherwise stated.

Produced: July 16, 2024 16:59 ET; Disseminated: July 17, 2024 10:00 ET

**Investment and insurance products offered through RBC Wealth Management are not insured by the FDIC or any other federal government agency, are not deposits or other obligations of, or guaranteed by, a bank or any bank affiliate, and are subject to investment risks, including possible loss of the principal amount invested.**

---

## Special report

# Generative artificial intelligence: enablers and adopters



**Frédérique Carrier**  
London, United Kingdom  
frederique.carrier@rbc.com

Following up on the November 2023 Global Insight focus article, [“Are equity markets entering the AI era?”](#) this report delves into generative artificial intelligence (GenAI), a step change in the evolution of artificial intelligence. Over time, this new technology is likely to have far-ranging repercussions on the global economy, sectors, and business functions. We focus on the GenAI ecosystem, looking at both enablers and adopters, zeroing in on those which might be most impacted. We also explore investment strategies we expect to benefit from the GenAI era.

### Key points

- **GenAI has captured the world’s imagination thanks to both its broad potential use across text, audio, and video, and in coding modalities.**
- **This transformational technology is likely to have an impact on productivity and the economy, though estimates are wide-ranging.**
- **Most GenAI enablers operate in the tech industry and include hardware, cloud computing, and model makers. However, data centers, energy providers, and some industrial companies which produce power management and cooling systems have important roles to play.**
- **GenAI might deliver most value across four areas: software engineering, marketing and sales, customer operations, and, importantly, research and development.**
- **In today’s early stages of adoption, the largest impact of GenAI technology seems likely to be cost savings, which could result in margin improvements for some businesses.**

### A great leap forward

AI and machine learning have been around for a long time. They power smart phones, provide online shoppers with customized recommendations based on their preferences, and recognize cancer cells on an x-ray.

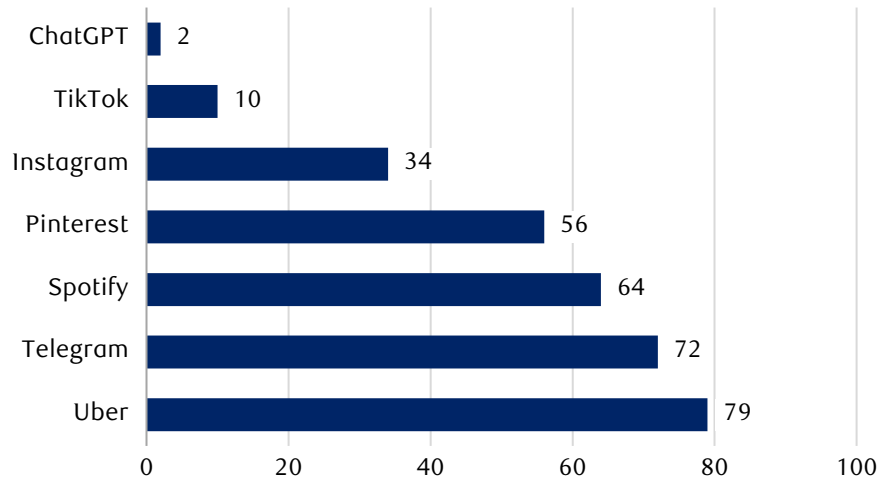
GenAI goes one step further. It is a type of machine learning, whereby users feed data into a computer which can not only solve many problems and learn as it goes along, but also provide output as if it were a human thanks to the use of “large language models.” Computers can now provide users an answer to any issue or problem, although the quality and veracity of those answers remain open questions.

Thanks to its broad potential usage, GenAI applications such as ChatGPT, launched in November 2022, have captured the world’s imagination, catapulting the technology into the mainstream.

**GENERATIVE AI:  
ENABLERS AND ADOPTERS**

**Generative AI adoption has been the fastest on record**

Months to reach 100 million monthly users worldwide



Source - RBC Capital Markets, IBM Global AI Adoption Index 2022, IDC Worldwide AI & Generative AI Spending Guide

Easy and free to use, ChatGPT set a record for how quickly a technology reached 100 million monthly users worldwide.

Among other things, GenAI applications can:

- Generate new content such as writing essays and composing emails;
- Classify data;
- Edit and summarize text;
- Quickly digest large amounts of data and draw conclusions from it;
- Answer complex queries; and
- Create digital art.

GenAI has the potential to radically change the way tasks are performed, much like the computer did in the late 1980s, or the advent of the internet in the 1990s.

**Impact on productivity and economic growth**

Inevitably this transformational technology has sparked a debate on the impact it may have on productivity and the economy. There are wide-ranging estimates that largely depend on several assumptions.

One optimistic estimate, but not the most optimistic, from the McKinsey Global Institute (2023) suggests that GenAI stands to add up to \$4.4 trillion to the global economy on an annual basis. To put this in perspective, the International Monetary Fund calculates that the world economy reached \$105 trillion in 2023.

Such optimistic high estimates are predicated on an analysis of the cost savings and the productivity enhancement that GenAI can bring, and the percentage of tasks that can be automated.

## GENERATIVE AI: ENABLERS AND ADOPTERS

### GenAI has many applications across different modalities

Examples of AI use cases

Modality	Application	Examples
<b>Text</b>	Writing	<b>Marketing:</b> Creating personalized written content <b>Recruitment:</b> Drafting job descriptions and interview questions
	Chatbots or assistants	<b>Customer service:</b> Using chatbots to boost conversion to sales on websites
	Analysis & synthesis	<b>Sales:</b> Analyzing customer interactions to extract insights <b>Risk and legal:</b> Summarizing regulatory documents
<b>Software</b>	Code generation	<b>Application development:</b> Accelerating code creation and improving quality
<b>Images</b>	Stock image generation	<b>Marketing and sales:</b> Generating unique media assets
	Image editing	<b>Marketing and sales:</b> Personalizing content quickly
<b>Audio</b>	Text-to-speech	<b>Training:</b> Creating educational voiceovers
	Sound design	<b>Entertainment:</b> Marketing custom sounds without copyright violations
	Audio editing	<b>Entertainment:</b> Editing podcasts without having to rerecord
<b>3D</b>	Object generation	<b>Video games:</b> Creating scenes and interactive characters <b>Digital representation:</b> Creating design mockups and virtual staging for architecture
	Product design & discovery	<b>Manufacturing:</b> Optimizing material design <b>Drug discovery:</b> Accelerating the R&D process
<b>Video</b>	Video creation	<b>Entertainment:</b> Creating short-form videos
	Video editing	<b>Entertainment:</b> Removing background images and noise
	Translation	<b>Video dubbing:</b> Translating into other languages using AI-generated or original speaker voices <b>Live translation:</b> Meetings and video conferencing

Source - McKinsey & Company, RBC Wealth Management

McKinsey calculates that:

- The cost savings, though they vary by activity, could be as high as 40 percent in the financial industry and 35 percent in software and media.
- The annual productivity boost could range from 0.1 percent to 0.6 percent from 2023 to 2040, depending on the rate of adoption.
- Thirty percent of tasks could be automated by 2030.

However, this extreme optimism is not universally shared. In a May 2024 paper, Daron Acemoglu, institute professor of economics at the Massachusetts Institute of Technology, and a leading authority on automation, disputes the extent of these numbers.

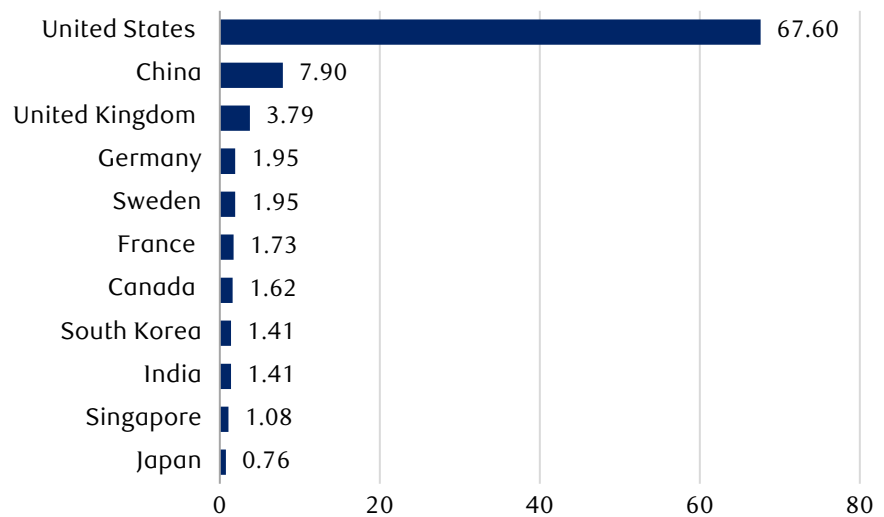
## GENERATIVE AI: ENABLERS AND ADOPTERS

He calculates that productivity would increase by a mere 0.66 percent over 10 years, or just 0.06 percent annually. His estimate is based on academic papers that suggest currently available GenAI tools yield average labour cost savings of 27 percent and overall cost savings of 14.4 percent, and put the share of tasks that will be affected by AI and related technologies at around 4.6 percent. These savings together with an AI-driven investment boom could boost annual GDP growth by one to 1.5 percent.

While consultants and economists debate the impact on the economy of this new technology, businesses, worried about being left behind, are investing in AI technology, with the U.S. significantly leading the pack.

### The U.S. far exceeds other countries in AI investment

Private investment in AI, 2023 (USD billions)



Source - Stanford University Artificial Intelligence Index Report 2024; European data based on average exchange rate of 1.08 EUR/USD

## GenAI ecosystem basics

### GenAI enablers

These can be found in a wide spectrum of industries. Most operate in the tech industry and include hardware, cloud computing platforms, and GenAI model makers. Outside of the tech industry, energy providers and some industrial companies are also key enablers.

#### Tech enablers

They include hardware, cloud computing, and model makers.

#### Hardware

High-powered advanced semiconductors facilitate GenAI as the technology needs to be fed huge amounts of data from which to train machine-learning models. According to its creators, OpenAI's GPT-3 was trained on some 45 terabytes of text data, the equivalent of 45 million e-books!

---

## GENERATIVE AI: ENABLERS AND ADOPTERS

Such workloads require significant amounts of computing power provided mainly by semiconductors called graphic processing units (GPUs), and by custom accelerator chips. Both can handle large amounts of data and perform an enormous number of calculations simultaneously. NVIDIA is the main developer of the advanced chips used to train and run AI models such as OpenAI's GPT-4, the brain power behind ChatGPT. Its dominant position currently results in handsome margins. Design companies such as NVIDIA outsource to Taiwan Semiconductor Manufacturing Company (TSMC) to produce the chips for them.

NVIDIA's dominance has not gone unnoticed. Established semiconductor firms such as Intel and Advanced Micro Devices are launching rival products, and the established cloud companies (Alphabet [Google's corporate parent], Amazon, and Microsoft) are now designing their own chips to reduce reliance on NVIDIA. Many smaller firms, including startups, are also in the race.

Other than AI semiconductor manufacturers, hardware also encompasses:

- [Semiconductor equipment manufacturers](#) (such as ASML), and
- Server and networking equipment makers (such as Dell and Amphenol).

### *Cloud computing platforms*

"Cloud computing" is the term coined to refer to the online availability of computer system resources such as data storage and computing capacity. It offers access to these resources without having to manage them directly and actively.

Most businesses find it more cost effective to build, tweak, and run large AI models in the cloud, rather than have this key hardware platform on premises given that infrastructure requirements and GPU chips are expensive, the latter costing up to tens of thousands of dollars each.

Cloud platforms, such as Amazon Web Services, Google Cloud, and Microsoft Azure, have developed the most comprehensive platforms for running GenAI workloads and they get preferential access to the chips and hardware.

### *Model makers*

AI models are pretrained to create content and can be adapted to support a wide array of tasks. Microsoft-backed OpenAI, which created GPT-4, the brain behind ChatGPT, had an early lead, but much competition has emerged.

Anthropic, a privately-held U.S.-based AI startup, recently unveiled Claude3, a rival to GPT-4. The company is backed by Alphabet and Amazon which are both reluctant to rely on Microsoft-backed OpenAI. French AI model maker Mistral, a private company backed by Microsoft, created a model similar to GPT-4 that requires much less computing power to train and run. Meta, Facebook's parent, also issued its own model, Llama, in 2023. Some AI models now also focus on specific tasks such as financial forecasting or medical advice.





---

## GENERATIVE AI: ENABLERS AND ADOPTERS

more power than traditional data centers, with a search on ChatGPT consuming 6x–10x the power of a traditional search on Google.”

Natural gas remains a key source of energy due to current grid constraints, though demand for renewables and nuclear in particular, a more reliable source, should grow over time, as Big Tech has committed to drastically reducing carbon usage over the next decade.

AI data centers also require power management and distribution systems to ensure the efficient use of power and industrial-strength cooling solutions to ensure the heat from servers remains controlled as they process data.

### GenAI adopters

---

While employees may be testing the capability of ChatGPT at home, few firms have adopted the technology, meaning the use of GenAI remains in its infancy.

According to a November 2023 U.S. Census Bureau survey, less than four percent of U.S. businesses reported using AI to produce goods and services, though usage was higher, at just under 14 percent, in industries such as information and technology.

A 2023 McKinsey report suggests three quarters of the value that GenAI use cases might deliver could fall across four areas: software engineering, marketing and sales, customer operations, and research and development.

#### Software engineering

RBC Capital Markets notes that the software industry is already heavily impacted with 46 percent of new code being generated by AI. The technology helps developers code 55 percent faster according to GitHub, a Microsoft-backed tool for developers.

Software engineering is a significant function in most companies, not just Big Tech. Companies embed software in many of their operations, as well as in goods and services. For instance, cruise control and parking assistance in automobiles, and Internet of Things (IoT) connectivity all depend on software. IoT refers to devices with sensors and their ability to connect and exchange data with other devices over the internet.

#### Customer services

Scores of companies already use AI chatbots for customer support as most queries tend to be simple and similar, so that chatbots are easy to train.

GenAI can bring customer experience to a new level. By rapidly processing customer data and browsing histories, GenAI can identify product suggestions tailored to customer preferences. McKinsey cites the case of a company with 5,000 customer service agents which increased issue resolution by 14 percent an hour thanks to GenAI. Moreover, the productivity and quality of service improved among less experienced agents. Such improved service may result in better customer retention.



## GENERATIVE AI: ENABLERS AND ADOPTERS

### Marketing and sales

GenAI can significantly improve the efficiency and efficacy of marketing material. It can reduce the time required for content drafting and ensure consistency for a uniform brand voice and writing style. It can enhance personalization of marketing messages so that mass email campaigns can be instantly translated in other languages, and imagery and messaging altered to target a specific audience.

GenAI is particularly useful to analyse unstructured qualitative and inconsistent data which traditionally required additional processing before insights could be drawn.

### Research and development (R&D)

AI and machine learning have been used for many years in R&D, but GenAI can be applied to the design and development of a broader range of products.

In manufacturing, GenAI can optimize designs, reducing costs in logistics as well as production and testing time.

In Biotech and Biopharma, GenAI can accelerate the selection of proteins and molecules best suited as potential candidates for new drugs. It can shorten trial phases by drafting scenarios and profile testing candidates, expediting drug development for complex disease.

### How various industries can use GenAI

<b>Engineering</b>	GenAI can help field engineers by accessing large amounts of technical information, manuals, and guides and assist them in tackling a described issue.
<b>Medicine</b>	GenAI can be used as a medical scribe, generating doctors' patient notes, creating summaries, and extracting key details, freeing up doctors and nurses to focus on patient care.
<b>E-commerce</b>	Shopify now offers Shopify Magic to help retailers generate product descriptions and other product-related content.
<b>Law</b>	Harvey is an AI startup backed by OpenAI to help lawyers with due diligence and contract analysis.

Source - RBC Capital Markets, RBC Wealth Management

### Monetisation

As GenAI technology is in the early stages of adoption, the largest impact of the technology seems to be cost savings, which could result in margin improvements for some businesses.

RBC Capital Markets cautions, however, that this margin improvement could take time to materialize. For instance, it estimates that within the software engineering industry, GenAI workloads cost around 5x more than traditional cloud workloads. This will be a significant drag on software gross margins from 75 percent to 60 percent initially. Although this cost may come down in time, it could remain elevated but may be offset by GenAI eventually boosting revenue, in its view.

---

## GENERATIVE AI: ENABLERS AND ADOPTERS

For now, RBC Capital Markets is somewhat surprised that more than 18 months after the launch of ChatGPT, relatively few companies have discovered uses for the technology that result in incremental revenues. Microsoft is an exception owing to its 2019 investment in OpenAI, long before ChatGPT had become a household name, which gave it a head start in integrating GenAI throughout its portfolio.

Some web designing firms that have incorporated GenAI into their product set are among the few businesses seeing increased incremental revenues today. Some companies can now make it very easy for a client who needs an e-commerce site, to type in their request and needs as if they were talking to a consultant. This enables web designing firms to build the site in an unstructured way. Website builders will charge extra for that special service, generating incremental revenue although that advantage will quickly get competed away. According to RBC Capital Markets, so far, such opportunities are few and far between within the marketing and online customer support domains.

### Adoption challenges

RBC Capital Markets notes there are challenges to GenAI adoption, including high costs, hallucinations, and data privacy. For instance, Dutch health care company Novo Nordisk, the maker of Ozempic, wouldn't want its clinical data to be used to train an AI model such as GPT-4 and then find out its competitor Eli Lilly was using ChatGPT, and benefitting from the application having its data as an input.

These challenges are perhaps the reason why a 2023 BlackBerry survey of 2,000 global IT decision makers found that 75 percent of organizations are considering bans on ChatGPT and other GenAI applications within the workplace—with close to two-thirds intending for these measures to be long term or permanent.

RBC Capital Markets believes that, in time, these challenges can be overcome. High costs should diminish as the current shortage of advanced chips dissipates with more participants starting to build their own chips and users becoming more selective of chip usage.

Hallucinations could eventually be greatly reduced, and perhaps avoided altogether, by training models on specific knowledge and including guardrails to prevent models from answering questions outside of it—for instance, a bank customer support bot should not be answering questions about politics.

Finally, companies could start to use local models, as opposed to central ones, and deploy them in a private cloud environment, to reduce data privacy concerns.

### Investing in the GenAI theme

GenAI adoption is still in its infancy. We think the technology seems very promising, but a full realization of its potential will take time and require intensive management as well as regulation to address the challenges its adoption will also present. As has almost always been the case in the past,

---

## GENERATIVE AI: ENABLERS AND ADOPTERS

investors may be overestimating what GenAI can deliver in the short term, but underestimating what it may become capable of in the long term given the technology's great promise.

Enablers selling AI equipment and software have been the clear beneficiaries of the new technology, their valuations having expanded markedly. We think portfolios would likely benefit from exposure to the infrastructure beneficiaries of GenAI where the eventual spending may take a decade or more to arrive.

As for the GenAI adopters, investors should assess how the new technology is being implemented—to increase sales, reduce costs, or improve productivity—and keep an eye on the competition. If competitors are also using GenAI effectively, any competitive advantage may erode quickly.

## Research resources

This document is produced by the Global Portfolio Advisory Committee within RBC Wealth Management's Portfolio Advisory Group. The RBC Wealth Management Portfolio Advisory Group provides support related to asset allocation and portfolio construction for the firm's investment advisors / financial advisors who are engaged in assembling portfolios incorporating individual marketable securities.

The Global Portfolio Advisory Committee leverages the broad market outlook as developed by the RBC Investment

Strategy Committee (RISC), providing additional tactical and thematic support utilizing research from the RISC, RBC Capital Markets, and third-party resources.

The RISC consists of senior investment professionals drawn from individual, client-focused business units within RBC, including the Portfolio Advisory Group. The RISC builds a broad global investment outlook and develops specific guidelines that can be used to manage portfolios. The RISC is chaired by Daniel Chornous, CFA, Chief Investment Officer of RBC Global Asset Management Inc.

---

### Global Portfolio Advisory Committee members

**Jim Allworth** – Co-chair  
Investment Strategist, RBC Dominion Securities Inc.

**Kelly Bogdanova** – Co-chair  
Portfolio Analyst, RBC Wealth Management Portfolio Advisory Group U.S., RBC Capital Markets, LLC

**Frédérique Carrier** – Co-chair  
Managing Director & Head of Investment Strategy,  
RBC Europe Limited

**Mark Bayko, CFA** – Head, Portfolio Management,  
RBC Dominion Securities Inc.

**Luis Castillo** – Fixed Income Portfolio Advisor, RBC Wealth Management Portfolio Advisory Group, RBC Dominion Securities Inc.

**Rufaro Chiriseri, CFA** – Head of Fixed Income, British Isles,  
RBC Europe Limited

**Janet Engels** – Head, RBC Wealth Management Portfolio Advisory Group U.S., RBC Capital Markets, LLC

**Thomas Garretson, CFA** – Fixed Income Senior Portfolio Strategist, RBC Wealth Management Portfolio Advisory Group, RBC Capital Markets, LLC

**Patrick McAllister, CFA** – Manager, Equity Advisory & Portfolio Management, RBC Wealth Management Portfolio Advisory Group, RBC Dominion Securities Inc.

**Josh Nye** – Fixed Income Portfolio Advisor, RBC Wealth Management Portfolio Advisory Group, RBC Dominion Securities Inc.

**Alan Robinson** – Senior Portfolio Advisor, RBC Wealth Management Portfolio Advisory Group – U.S. Equities, RBC Capital Markets, LLC

**Michael Schuette, CFA** – Multi-Asset Portfolio Strategist, RBC Wealth Management Portfolio Advisory Group U.S., RBC Capital Markets, LLC

**David Storm, CFA, CAIA** – Chief Investment Officer, British Isles & Asia, RBC Europe Limited

**Yuh Harn Tan** – Head of Discretionary Portfolio Management & UHNW Solutions, Royal Bank of Canada, Singapore Branch

**Joseph Wu, CFA** – Portfolio Manager, Multi-Asset Strategy, RBC Dominion Securities Inc.

# Required disclosures

## Analyst Certification

All of the views expressed in this report accurately reflect the personal views of the responsible analyst(s) about any and all of the subject securities or issuers. No part of the compensation of the responsible analyst(s) named herein is, or will be, directly or indirectly, related to the specific recommendations or views expressed by the responsible analyst(s) in this report.

## Important Disclosures

In the U.S., RBC Wealth Management operates as a division of RBC Capital Markets, LLC. In Canada, RBC Wealth Management includes, without limitation, RBC Dominion Securities Inc., which is a foreign affiliate of RBC Capital Markets. This report has been prepared by RBC Capital Markets which is an indirect wholly-owned subsidiary of the Royal Bank of Canada and, as such, is a related issuer of Royal Bank of Canada.

## Non-U.S. Analyst Disclosure

One or more research analysts involved in the preparation of this report (i) may not be registered/qualified as research analysts with the NYSE and/or FINRA and (ii) may not be associated persons of the RBC Wealth Management and therefore may not be subject to FINRA Rule 2241 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

In the event that this is a compendium report (covers six or more companies), RBC Wealth Management may choose to provide important disclosure information by reference. To access current disclosures, clients should refer to <https://www.rbccm.com/GLDisclosure/PublicWeb/DisclosureLookup.aspx?EntityID=2> to view disclosures regarding RBC Wealth Management and its affiliated firms. Such information is also available upon request to RBC Wealth Management Publishing, 250 Nicollet Mall, Suite 1800, Minneapolis, MN 55401-1931.

## RBC Capital Markets Distribution of Ratings

For the purpose of ratings distributions, regulatory rules require member firms to assign ratings to one of three rating categories – Buy, Hold/Neutral, or Sell – regardless of a firm's own rating categories. Although RBC Capital Markets' ratings of Outperform (O), Sector Perform (SP), and Underperform (U) most closely correspond to Buy, Hold/Neutral and Sell, respectively, the meanings are not the same because RBC Capital Markets' ratings are determined on a relative basis.

## Distribution of ratings – RBC Capital Markets Equity Research As of June 30, 2024

Rating	Count	Percent	Investment Banking Services Provided During Past 12 Months	
			Count	Percent
Buy [Outperform]	857	57.44	271	31.62
Hold [Sector Perform]	588	39.41	146	24.83
Sell [Underperform]	47	3.15	5	10.64

## Explanation of RBC Capital Markets Equity Rating System

An analyst's "sector" is the universe of companies for which the analyst provides research coverage. Accordingly, the rating assigned to a particular stock represents solely the analyst's view of how that stock will perform over the next 12 months relative to the analyst's sector average.

**Outperform (O):** Expected to materially outperform sector average over 12 months. **Sector Perform (SP):** Returns expected to be in line with sector average over 12 months.

**Underperform (U):** Returns expected to be materially below sector average over 12 months. **Restricted (R):** RBC policy precludes certain types of communications, including an investment recommendation, when RBC is acting as an advisor in certain merger or other strategic transactions and in certain other circumstances. **Not Rated (NR):** The rating, price targets and estimates have been removed due to applicable legal, regulatory or policy constraints which may include when RBC Capital Markets is acting in an advisory capacity involving the company.

**Risk Rating:** The Speculative risk rating reflects a security's lower level of financial or operating predictability, illiquid share trading volumes, high balance sheet leverage, or limited operating history that result in a higher expectation of financial and/or stock price volatility.

## Valuation and Risks to Rating and Price Target

When RBC Capital Markets assigns a value to a company in a research report, FINRA Rules and NYSE Rules (as incorporated into the FINRA Rulebook) require that the basis for the valuation and the impediments to obtaining that valuation be described. Where applicable, this information is included in the text of our research in the sections entitled "Valuation" and "Risks to Rating and Price Target", respectively.

The analyst(s) responsible for preparing this research report have received (or will receive) compensation that is based upon various factors, including total revenues of RBC Capital Markets, and its affiliates, a portion of which are or have been generated by investment banking activities of RBC Capital Markets and its affiliates.

## Other Disclosures

Prepared with the assistance of our national research sources. RBC Wealth Management prepared this report and takes sole responsibility for its content and distribution. The content may have been based, at least in part, on material provided by our third-party correspondent research services. Our third-party correspondent has given RBC Wealth Management general permission to use its research reports as source materials, but has not reviewed or approved this report, nor has it been informed of its publication. Our third-party correspondent may from time to time have long or short positions in, effect transactions in, and make markets in securities referred to herein. Our third-party correspondent may from time to time perform investment banking or other services for, or solicit investment banking or other business from, any company mentioned in this report.

RBC Wealth Management endeavors to make all reasonable efforts to provide research simultaneously to all eligible clients, having regard to local time zones in overseas jurisdictions. In certain investment advisory accounts, RBC Wealth Management or a designated third party will act as overlay manager for our clients and will initiate transactions in the securities referenced herein for those accounts upon receipt of this report. These transactions may occur before or after your receipt of this report and may have a short-term impact on the market price of the securities in which transactions occur. RBC Wealth Management research is posted to our proprietary Web sites to ensure eligible clients receive coverage initiations and changes in rating, targets, and opinions in a timely manner. Additional distribution may be done by sales personnel via e-mail, fax, or regular mail. Clients may also receive our research via third-party vendors. Please contact your RBC Wealth Management Financial Advisor for more information regarding RBC Wealth Management research.

**Conflicts Disclosure:** RBC Wealth Management is registered with the Securities and Exchange Commission as a broker/dealer and an investment adviser, offering both brokerage and investment advisory services. RBC Wealth Management's Policy for Managing Conflicts of Interest in Relation to Investment Research is available from us on our website at <https://www.rbccm.com/GLDisclosure/PublicWeb/DisclosureLookup.aspx?EntityID=2>. Conflicts of interests related to our investment advisory business can be found in Part 2A Appendix 1 of the Firm's Form ADV or the RBC Advisory Programs Disclosure Document. Copies of any of these documents are available upon request through your Financial Advisor. We reserve the right to amend or supplement this policy, Part 2A Appendix 1 of the Form ADV, or the RBC Advisory Programs Disclosure Document at any time.

The authors are employed by one of the following entities: RBC Wealth Management USA, a division of RBC Capital Markets, LLC, a securities broker-dealer with principal offices located in Minnesota and New York, USA; RBC

Dominion Securities Inc., a securities broker-dealer with principal offices located in Toronto, Canada; Royal Bank of Canada, Hong Kong Branch, which is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission ("SFC"); Royal Bank of Canada, Singapore Branch, a licensed wholesale bank with its principal office located in Singapore; and RBC Europe Limited, a licensed bank with principal offices located in London, United Kingdom.

## Third-party Disclaimers

The Global Industry Classification Standard ("GICS") was developed by and is the exclusive property and a service mark of MSCI Inc. ("MSCI") and Standard & Poor's Financial Services LLC ("S&P") and is licensed for use by RBC. Neither MSCI, S&P, nor any other party involved in making or compiling the GICS or any GICS classifications makes any express or implied warranties or representations with respect to such standard or classification (or the results to be obtained by the use thereof), and all such parties hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability and fitness for a particular purpose with respect to any of such standard or classification. Without limiting any of the foregoing, in no event shall MSCI, S&P, any of their affiliates or any third party involved in making or compiling the GICS or any GICS classifications have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages.

## Disclaimer

The information contained in this report has been compiled by RBC Wealth Management, a division of RBC Capital Markets, LLC, from sources believed to be reliable, but no representation or warranty, express or implied, is made by Royal Bank of Canada, RBC Wealth Management, its affiliates or any other person as to its accuracy, completeness or correctness. All opinions and estimates contained in this report constitute RBC Wealth Management's judgment as of the date of this report, are subject to change without notice and are provided in good faith but without legal responsibility. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Every province in Canada, state in the U.S., and most countries throughout the world have their own laws regulating the types of securities and other investment products which may be offered to their residents, as well as the process for doing so. As a result, the securities discussed in this report may not be eligible for sale in some jurisdictions. This report is not, and under no circumstances should be construed as, a solicitation to act as securities broker or dealer in any jurisdiction by any person or company that is not legally permitted to carry on the business of a securities broker or dealer in that jurisdiction. Nothing in this report constitutes legal, accounting or tax advice or individually tailored investment advice. This material is prepared for general circulation to clients, including clients who are affiliates of Royal Bank of Canada, and does not have regard to the particular circumstances or needs of any specific person who may read it. The investments or services contained in this report may not be suitable for you and it is recommended that you consult an independent investment advisor if you are in doubt about the suitability of such investments or services. To the full extent permitted by law neither Royal Bank of Canada nor any of its affiliates, nor any other person, accepts any liability whatsoever for any direct, indirect or consequential loss arising from, or in connection with, any use of this report or the information contained herein. No matter contained in this document may be reproduced or copied by any means without the prior written consent of Royal Bank of Canada in each instance. In the U.S., RBC Wealth Management operates as a division of RBC Capital Markets, LLC. In Canada, RBC Wealth Management includes, without limitation, RBC Dominion Securities Inc., which is a foreign affiliate of RBC Capital Markets,



LLC. This report has been prepared by RBC Capital Markets, LLC. Additional information is available upon request.

**To U.S. Residents:** This publication has been approved by RBC Capital Markets, LLC, Member NYSE/FINRA/SIPC, which is a U.S. registered broker-dealer and which accepts responsibility for this report and its dissemination in the United States. RBC Capital Markets, LLC, is an indirect wholly-owned subsidiary of the Royal Bank of Canada and, as such, is a related issuer of Royal Bank of Canada. Any U.S. recipient of this report that is not a registered broker-dealer or a bank acting in a broker or dealer capacity and that wishes further information regarding, or to effect any transaction in, any of the securities discussed in this report, should contact and place orders with RBC Capital Markets, LLC. International investing involves risks not typically associated with U.S. investing, including currency fluctuation, foreign taxation, political instability and different accounting standards.

**To Canadian Residents:** This publication has been approved by RBC Dominion Securities Inc. RBC Dominion Securities Inc.\* and Royal Bank of Canada are separate corporate entities which are affiliated. \* Member Canadian Investor Protection Fund. ® Registered trademark of Royal Bank of Canada. Used under license. RBC Wealth Management is a registered trademark of Royal Bank of Canada. Used under license.

**RBC Wealth Management (British Isles):** This publication is distributed by RBC Europe Limited and Royal Bank of Canada (Channel Islands) Limited. RBC Europe Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority (FCA registration number: 124543). Registered office: 100 Bishopsgate, London, EC2N 4AA, UK. Royal Bank of Canada (Channel Islands) Limited is regulated by the Jersey Financial Services Commission in the conduct of investment business in Jersey. Registered office: Gaspé House, 66-72 Esplanade, St Helier, Jersey JE2 3QT, Channel Islands.

**To persons receiving this from Royal Bank of Canada, Hong Kong Branch:** This document is distributed in Hong Kong by Royal Bank of Canada, Hong Kong Branch which is regulated by the Hong Kong Monetary Authority and the SFC. This document is not for distribution in Hong Kong, to investors who are not “professional investors”, as defined in the Securities and Futures Ordinance (Cap. 571 of Hong Kong) and any rules made under that Ordinance. This document has been prepared for general circulation and does not take into account the objectives, financial situation, or needs of any recipient. Past performance is not indicative of future performance. **WARNING:** The contents of this document have not been reviewed by any regulatory authority in Hong Kong. Investors are advised to exercise caution in relation to the investment. If you are in doubt about any of the contents of this document, you should obtain independent professional advice.

**To persons receiving this from Royal Bank of Canada, Singapore Branch:**

This publication is distributed in Singapore by the Royal Bank of Canada, Singapore Branch, a registered entity licensed by the Monetary Authority of Singapore. This publication is not for distribution in Singapore, to investors who are not “accredited investors” and “institutional investors”, as defined in the Securities and Futures Act 2001 of Singapore. This publication has been prepared for general circulation and does not take into account the objectives, financial situation, or needs of any recipient. You are advised to seek independent advice from a financial adviser before purchasing any product. If you do not obtain independent advice, you should consider whether the product is suitable for you. Past performance is not indicative of future performance. If you have any questions related to this publication, please contact the Royal Bank of Canada, Singapore Branch.

© 2024 RBC Capital Markets, LLC – Member NYSE/FINRA/SIPC  
© 2024 RBC Dominion Securities Inc. – Member Canadian Investor Protection Fund  
© 2024 RBC Europe Limited  
© 2024 Royal Bank of Canada  
All rights reserved  
RBC1524



Wealth  
Management