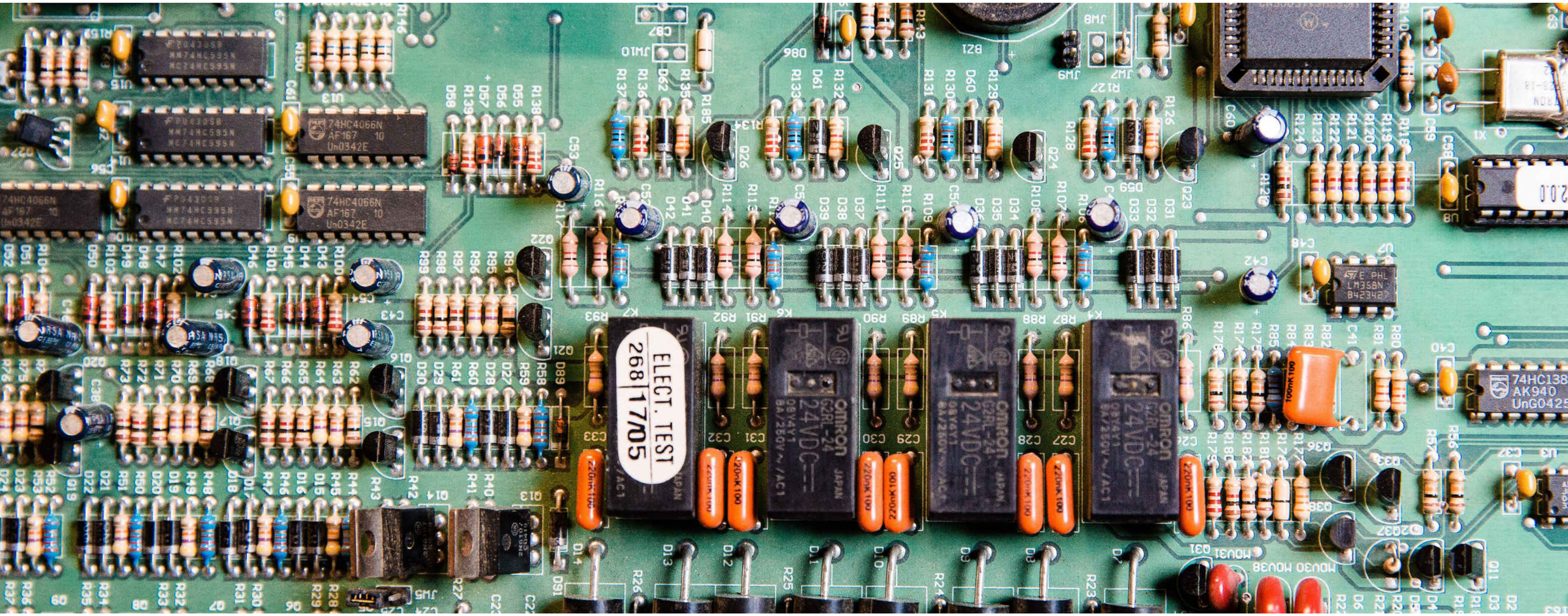
# Machine learning at a glance: highlights from our original research




Google Cloud

# Table of contents

“This is what is keeping business leaders awake at night: how to harvest and make sense of their data for competitive advantage. Machine learning is allowing companies to surface the untapped value in their data.”

**Fausto Ibarra,** director of global product management for Google Cloud Platform

“Machine Learning: The New Proving Ground for Competitive Advantage,” a study conducted by MIT Technology Review in partnership with Google Cloud, 2017. (link)

# Introduction

Computer scientists have been seriously exploring artificial intelligence — the idea that machines can mimic the cognitive functions of the human brain — for more than 60 years. No longer the stuff of science fiction, AI now has practical applications across industries and functions, and businesses are adopting it for everything from marketing personalization and image classification to supply-chain optimization and fraud detection. One technique in particular forms the backbone of many organizations' AI strategies: machine learning (ML), which uses large volumes of data to train sophisticated algorithms to self-improve. ML enables businesses to make sense of the unprecedented amounts of data now available to them, unlocking insights and efficiencies that can deliver competitive advantage.

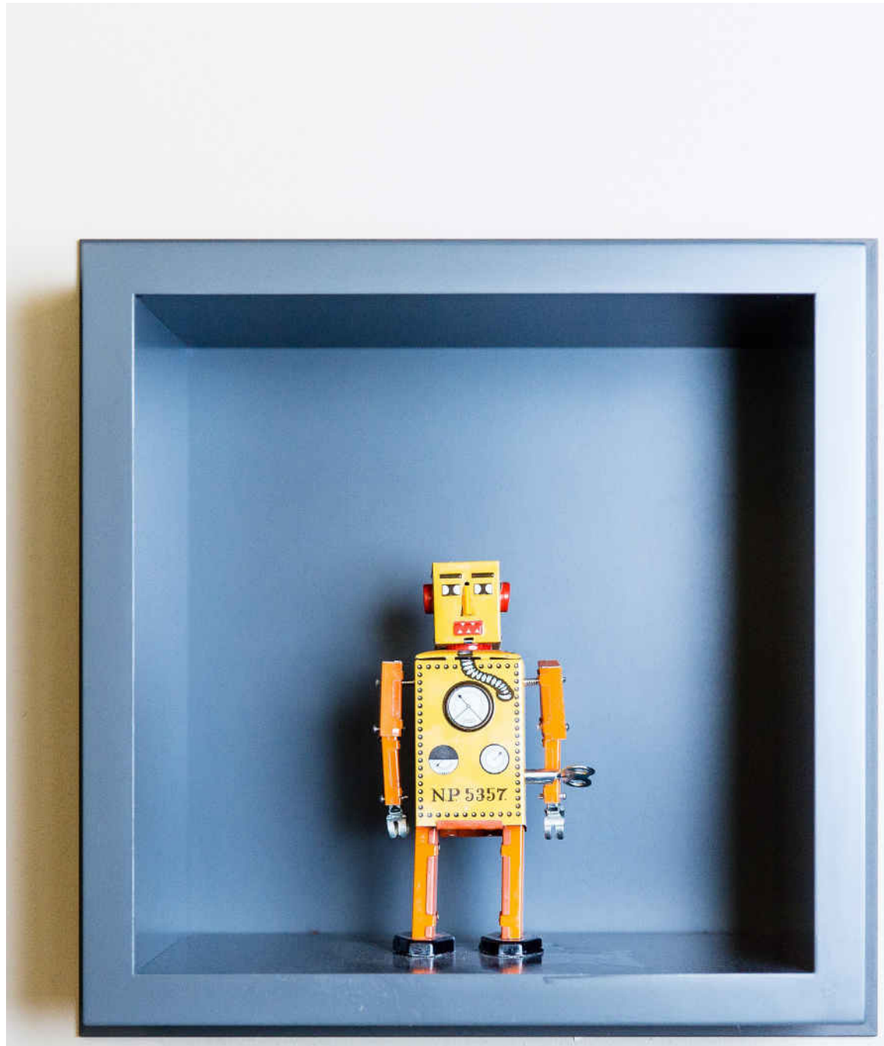
For more than a decade, Google has been working to make ML solutions more powerful, accessible, and secure, developing open-source tools and cloud-based services that can help businesses solve complex problems. In addition to publishing groundbreaking scientific research of our own, we regularly commission independent studies on vital aspects of the evolving ML landscape, including enterprise adoption rates, typical use cases, expected and achieved benefits, and success factors. Below, we've put together some of our most compelling recent findings to guide you on your journey, whether you're new to ML or want to get more value from your existing program.


"Machine Learning: The New Proving Ground for Competitive Advantage," a study conducted by MIT Technology Review in partnership with Google Cloud, 2017. (link)

# Adoption:
# The ML train is leaving the station, with most businesses on board.

The majority of today's businesses are investing in ML, according to our research. Use cases vary widely by industry, but several key applications — including process automation and customer behavior analysis — are common. ML adopters are seeing an especially high degree of impact from predictive analytics, a category of techniques that use data to assess the likelihood of future outcomes and help businesses solve complex problems.

# (Almost) everybody's doing it

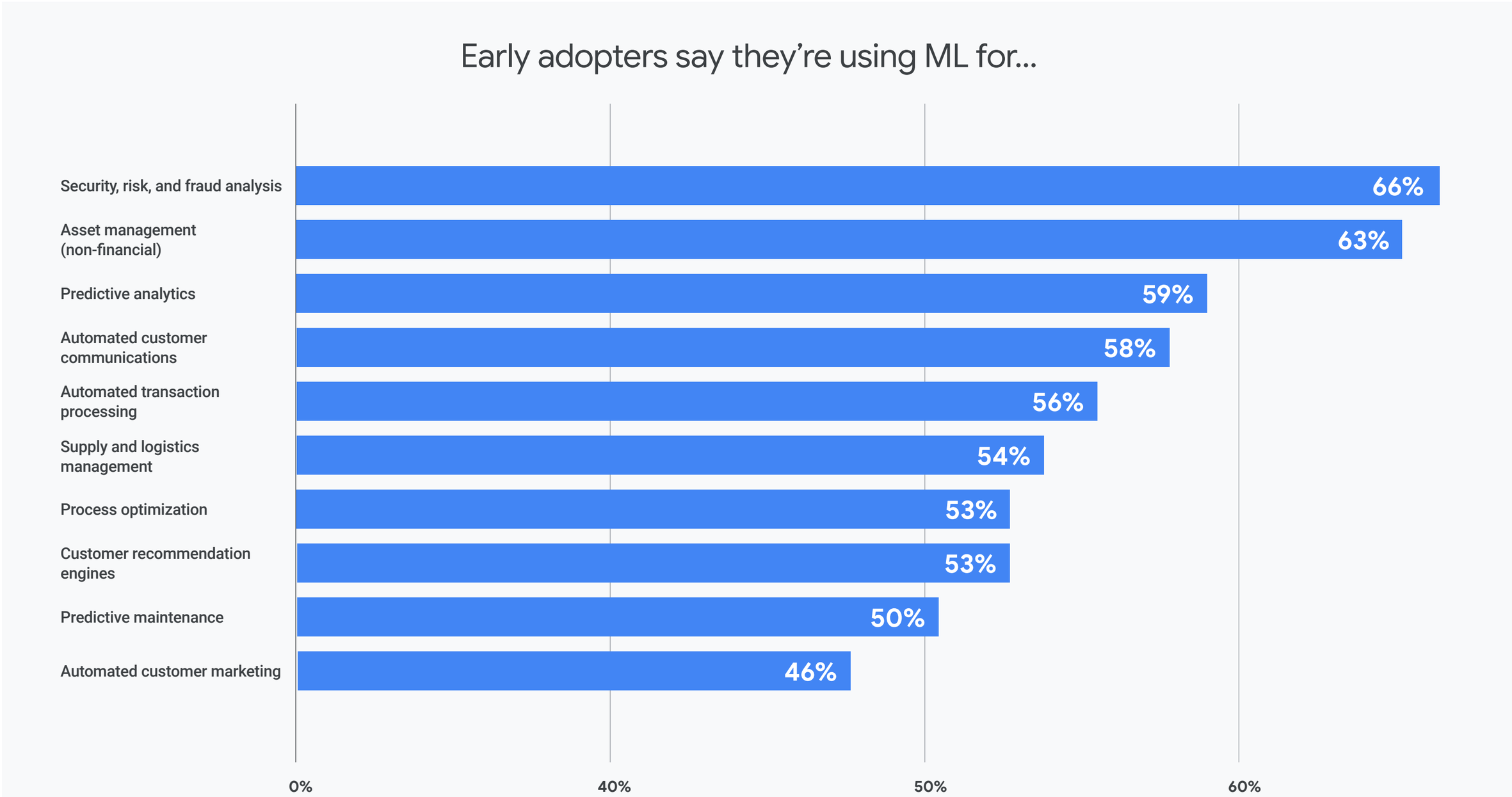



**60%**

of business and technology leaders have already implemented an ML strategy.

"Machine Learning: The New Proving Ground for Competitive Advantage," a study conducted by MIT Technology Review in partnership with Google Cloud, 2017. (link)

# Use cases, from analysis to automation




"Machine Learning is Delivering ROI for Early Adopters," a study conducted by IDG and commissioned by Google Cloud, 2017. (link)

# A considerable slice of the budget pie

26%

of early adopters report that more than 15% of their IT budget is devoted to ML.

"Machine Learning: The New Proving Ground for Competitive Advantage," a study conducted by MIT Technology Review in partnership with Google Cloud, 2017. (link)

# Top applications by industry

## Healthcare

- Predictive modeling
- Process automation
- Customer behavior analysis

## Financial services

- Predictive analytics
- Risk analysis
- Fraud detection

## Manufacturing

- Humidity and climate control
- Process automation
- Market trend analysis

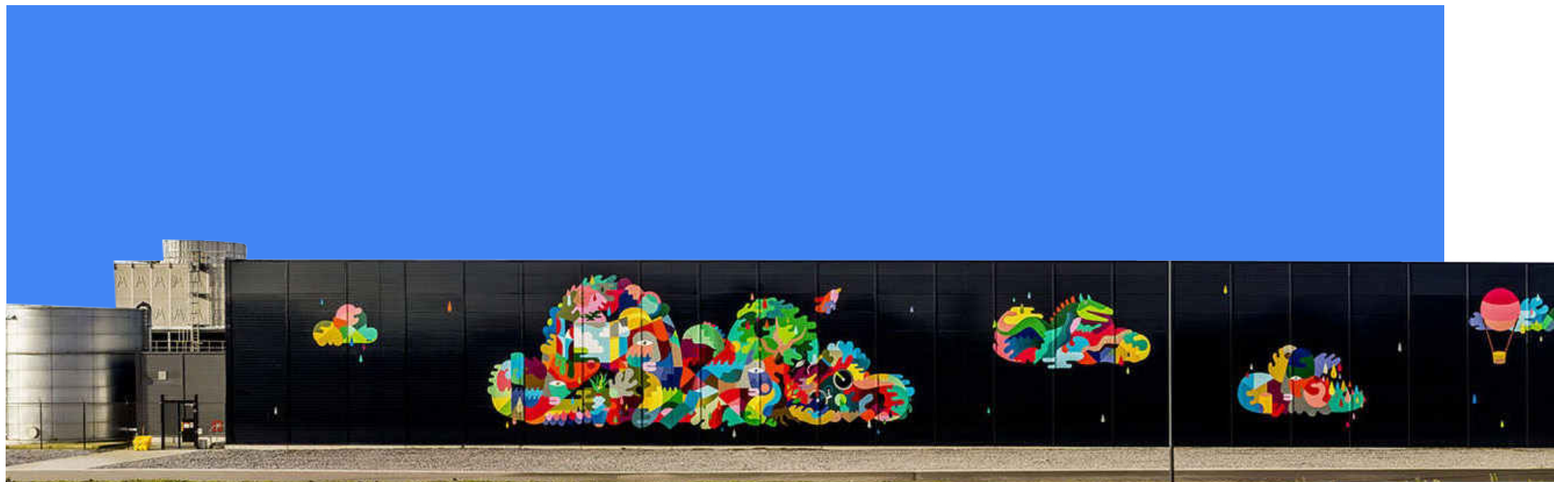
## Retail

- Credit risk assessment
- Supply chain management
- Customer behavior analysis

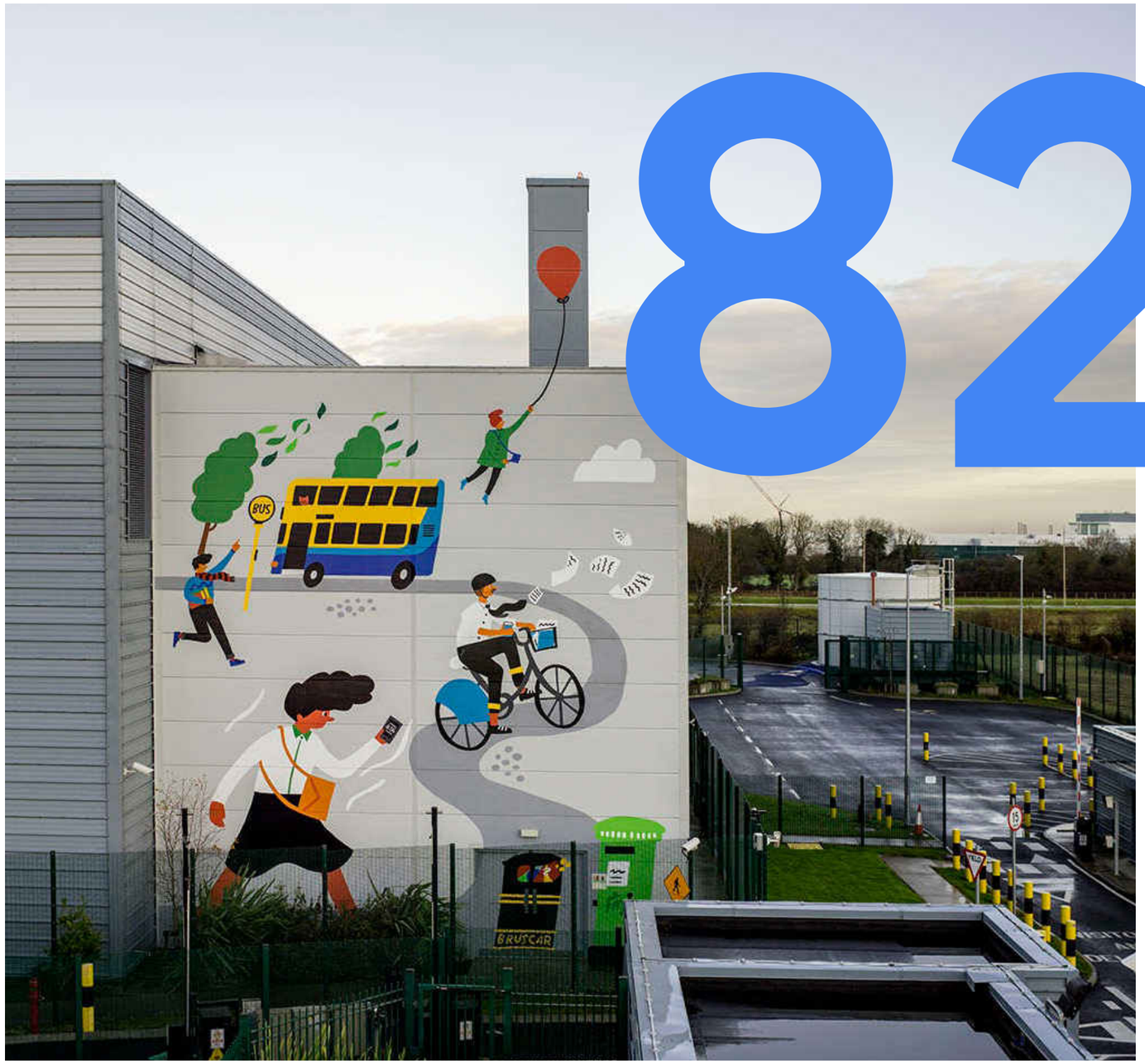
## Media & gaming

- Recommendation engines
- Process automation
- Customer behavior analysis

Qualitative interviews of ML adopters, conducted by M-Brain and commissioned by Google Cloud, 2017.



# Praise for predictive analytics




**82%**

of executives say predictive analytics is the ML branch most impacting their organizations today.

**Runners-up:**
text classification or mining, fraud detection, e-commerce, and behavior or sentiment analysis

"To the Cloud and Beyond: Big Data in the Age of Machine Learning," a study conducted by Harvard Business Review Analytic Services and sponsored by Google Cloud, 2017. (link)

“The sky’s the limit here. There is almost nothing we do that can’t benefit from intelligence and learning capabilities.”

**CIO** of a $1 billion real estate firm

“Machine Learning is Delivering ROI for Early Adopters,” a study conducted by IDG and commissioned by Google Cloud, 2017. (link)

“Machine learning is not just a new way of building software. It’s enabling new business capabilities at the most strategic levels, such as new services, processes, and business models.”

**George Gilbert,** big data and analytics analyst for Wikibon Research

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# Benefits:
# ML is making businesses more competitive, efficient, and secure.

Across industries and use cases, organizations that have implemented ML report demonstrable return on investment and substantial business benefits ranging from better, faster data analysis to improved efficiency and cost savings. The vast majority of early adopters — nearly 90 percent, according to one study — believe that ML provides a competitive advantage, and more than half of business leaders who participated in another survey expect that ML will determine their companies' future success. It's also worth noting that most early adopters say that ML enhances their cybersecurity efforts. We've experienced this effect firsthand here at Google Cloud, where we use AI-powered methods to identify vulnerabilities and thwart attacks.

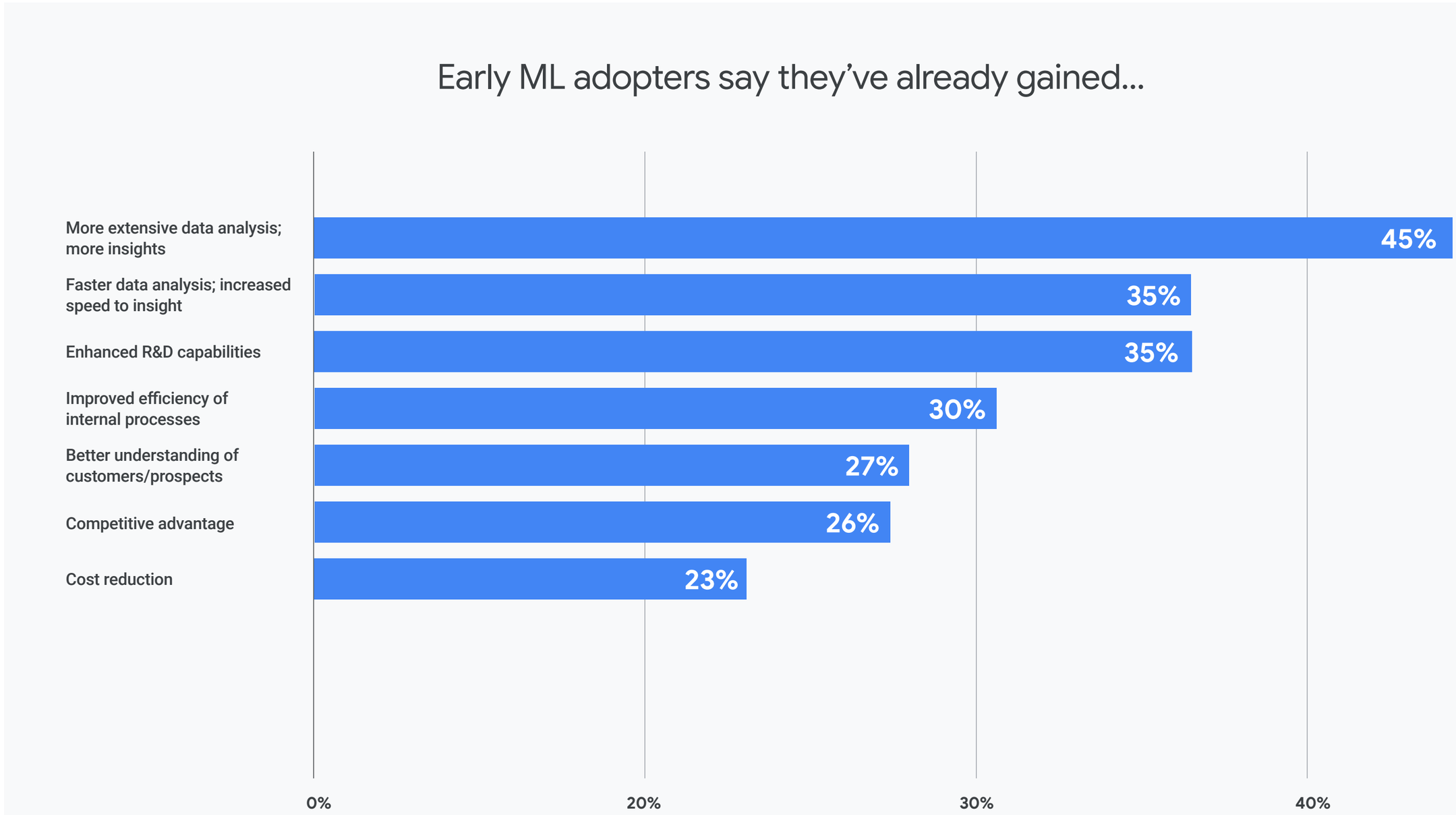
# A hefty payoff, fast

**2–5x**

ROI of most standard ML projects in the first year

"Business impacts of machine learning," a study conducted by Deloitte Access Economics and sponsored by Google Cloud, 2017. (link)

# The upshot of ML, from insights to efficiency

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# Getting ahead with ML

80%

of early adopters agree that ML can provide a competitive advantage.

"Pictured: Fei-Fei Li, chief scientist of ML and AI at Google Cloud"

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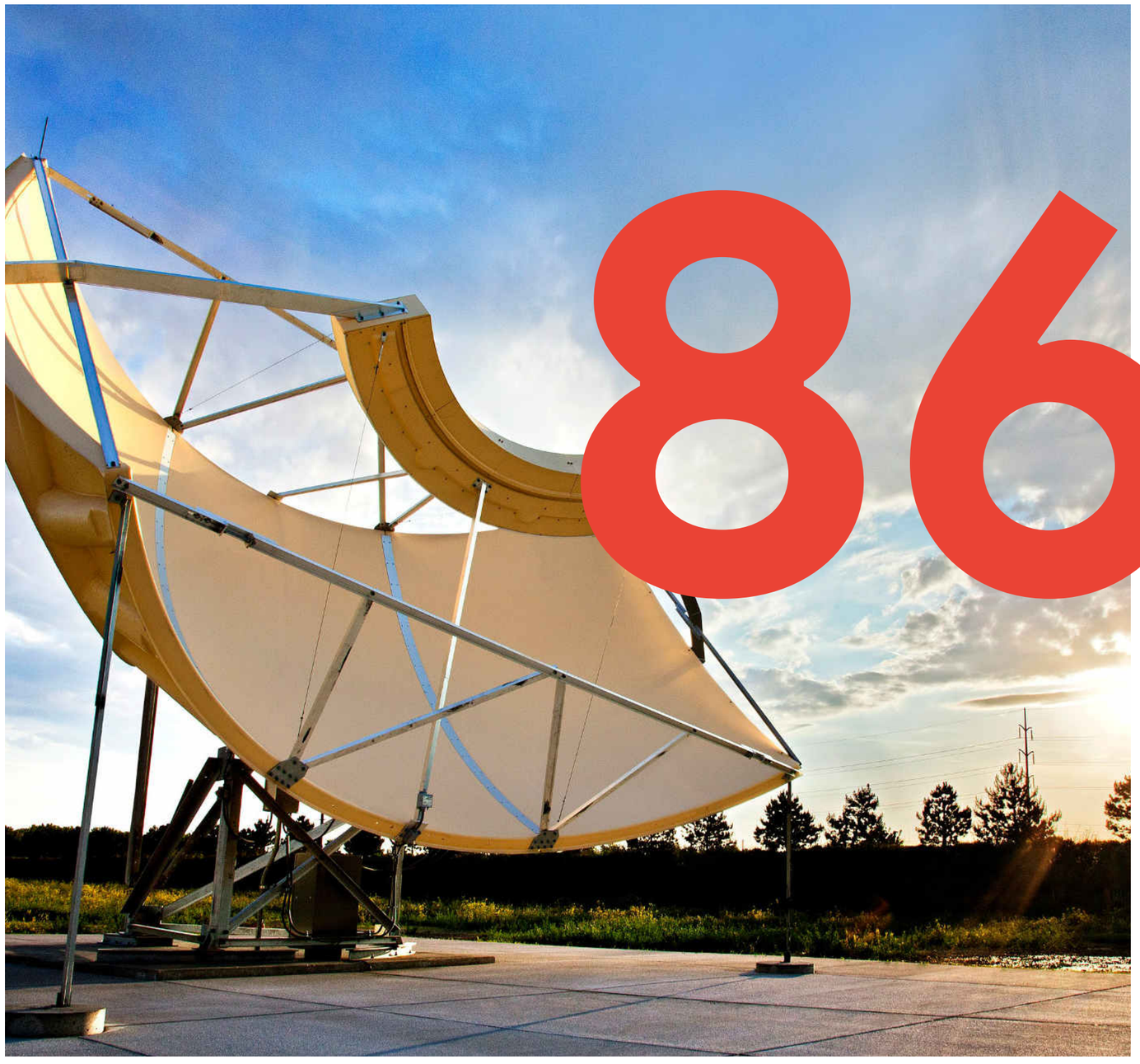
# Staying safer with ML



86%

of early adopters say that ML enhances their cybersecurity efforts.

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# Cutting costs with ML

81%

of early adopters agree that ML technology can drive down costs.

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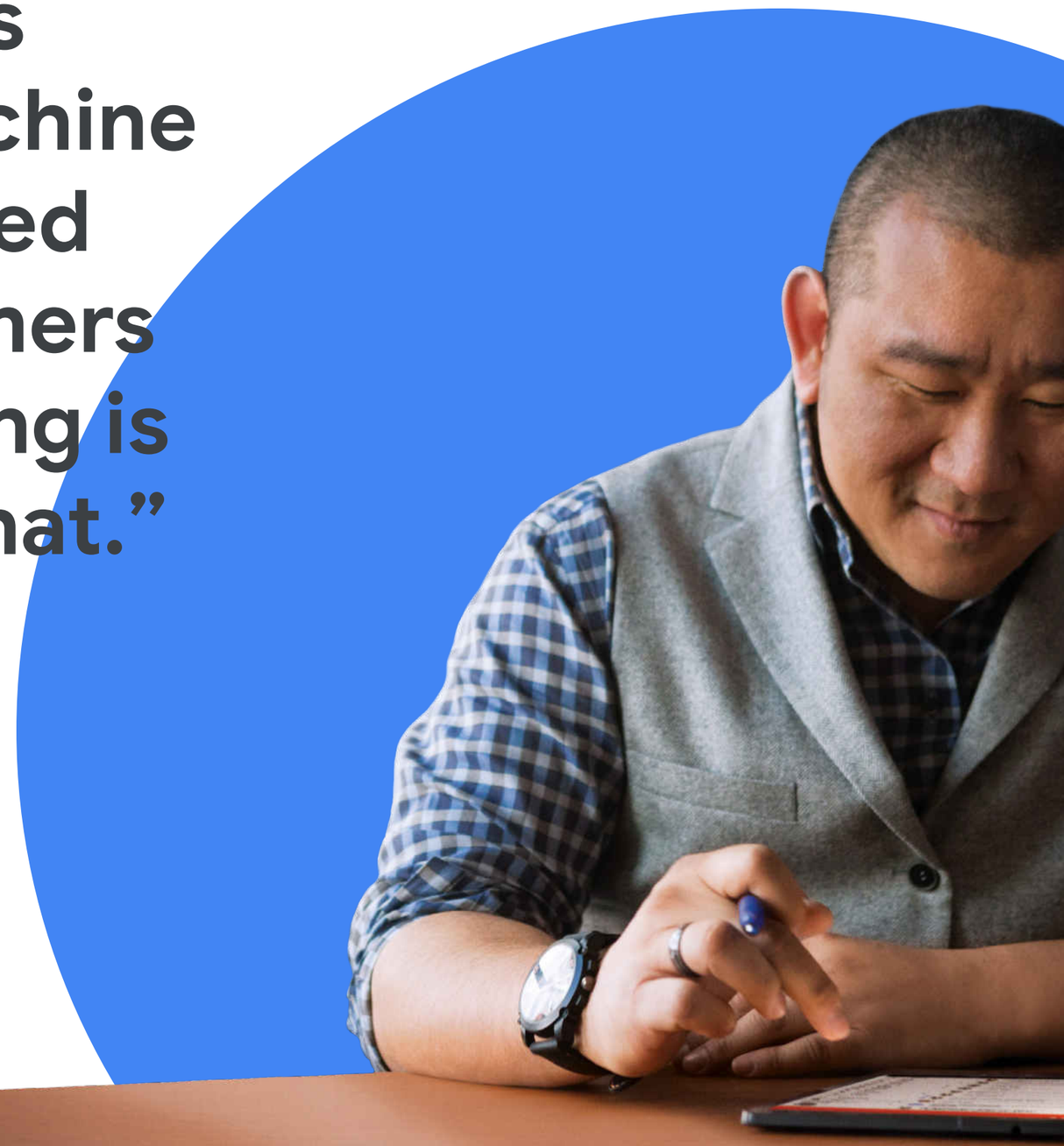
“One hundred percent of any company’s future success depends on adopting machine learning. [Companies] need to anticipate what customers want, and machine learning is **absolutely essential** for that.”

**Brandon Purcell,** senior analyst at Forrester Research



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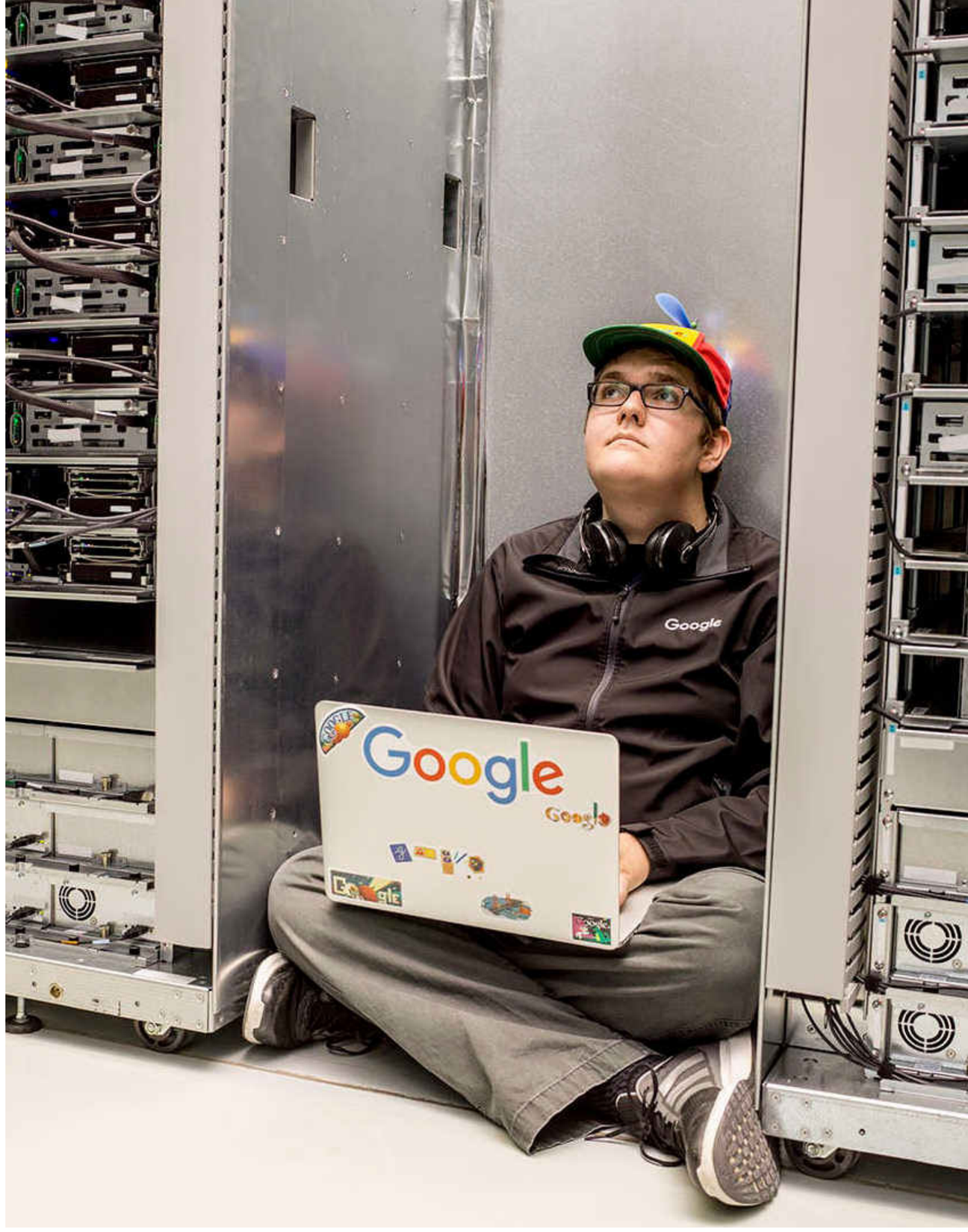
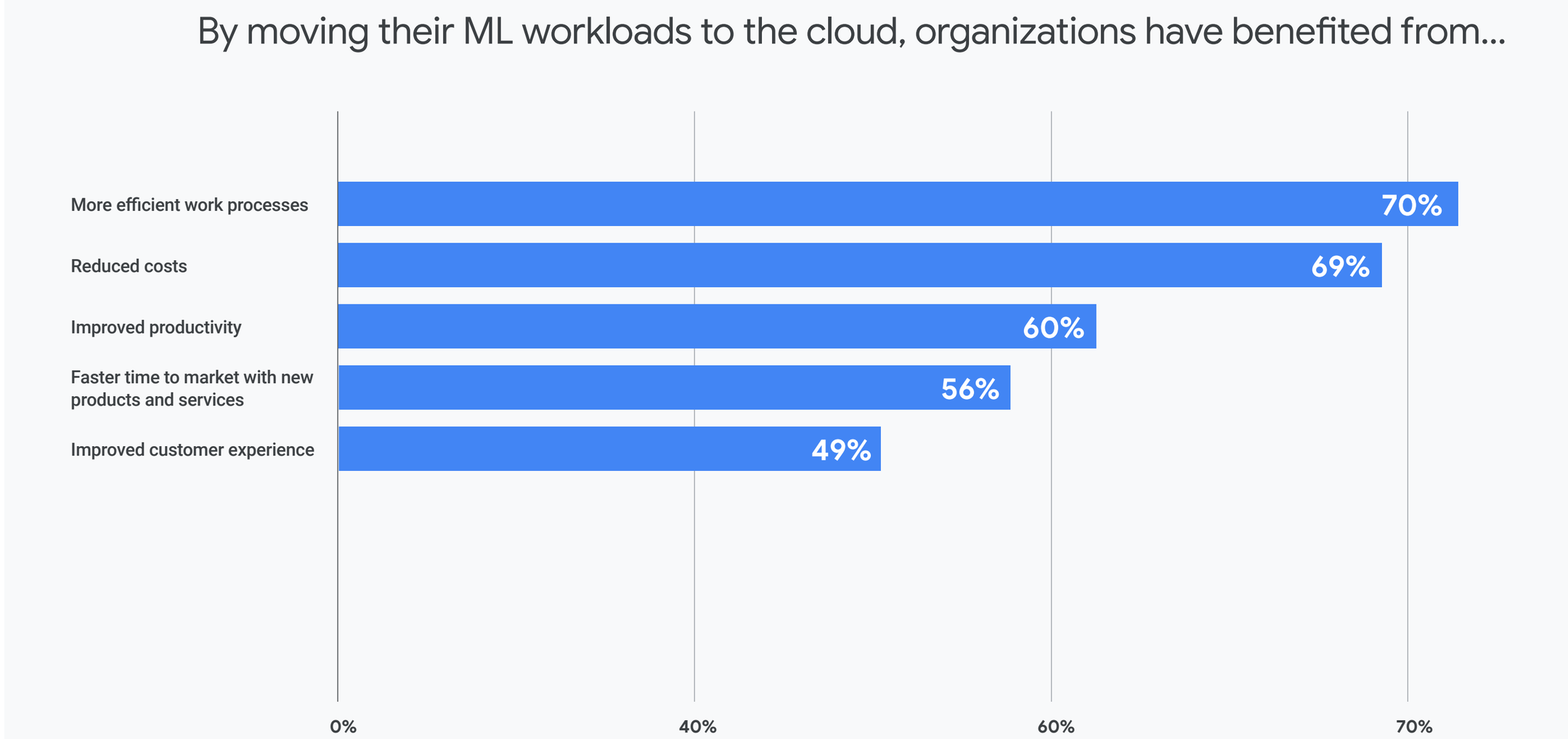
# Getting started: Businesses are looking to the cloud as a critical first step to succeeding with ML.

ML typically requires elastic computing resources, massive processing power, and deep expertise. As a result, companies are increasingly turning to cloud providers for not only scalable virtual machines and data storage, but also managed services and application programming interfaces (APIs) that help make ML accessible to all. Our research shows that migration of ML to the cloud yields a number of business benefits, including increased efficiency and reduced costs; it also suggests that the lion's share of ML workloads will soon be deployed in the cloud. This upward trend dovetails with a larger surge in cloud adoption, fueled by modern businesses' need for agility and openness as well as IT decision-makers' growing confidence in cloud security. At Google Cloud, we advise organizations hoping to harness the power of ML to take the first step by moving their data and workloads to the cloud.

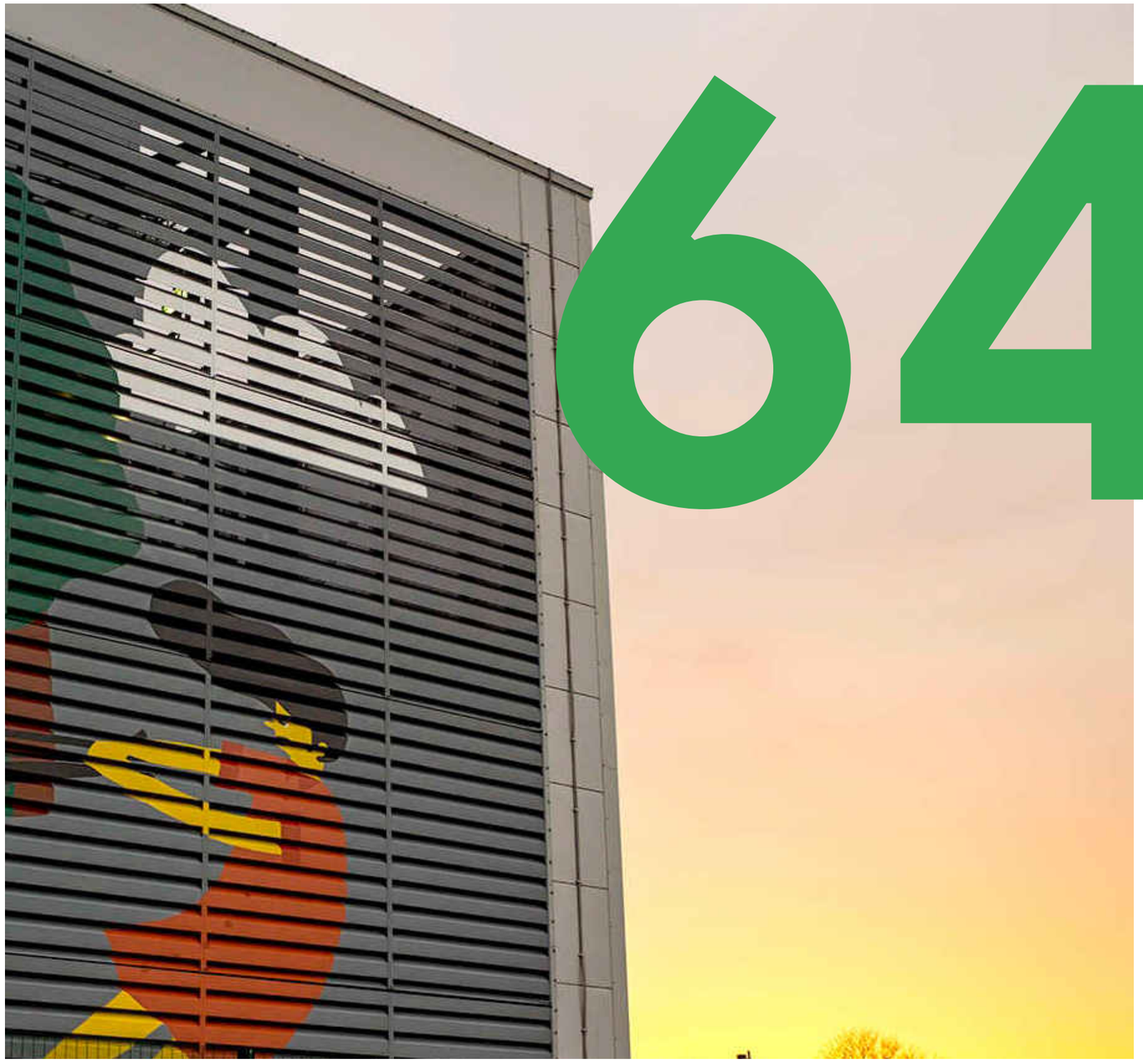


# The case for cloud ML




Survey data from “To the Cloud and Beyond: Big Data in the Age of Machine Learning,” a study conducted by Harvard Business Review Analytic Services and sponsored by Google Cloud, 2017. (link)

# More intelligence, for less



**64%**

of business leaders say reduced costs influence their decisions regarding cloud computing investments in machine learning.

"To the Cloud and Beyond: Big Data in the Age of Machine Learning," a study conducted by Harvard Business Review Analytic Services and sponsored by Google Cloud, 2017. (link)

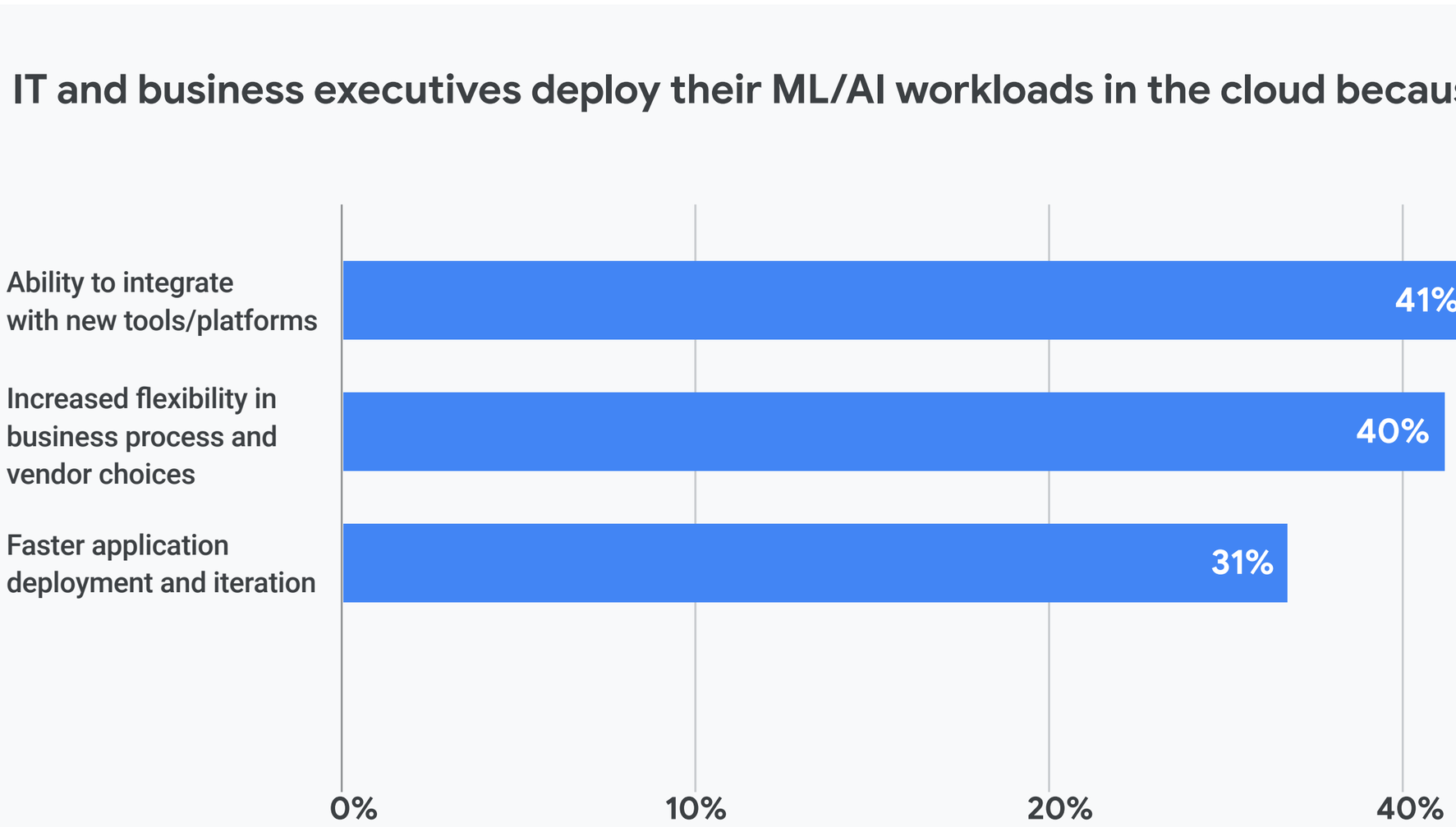
# Mass migration for ML

87%

of ML workloads will be deployed in the cloud by 2019.

"Behind the Growing Confidence in Cloud Security," a study conducted on behalf of Google Cloud in association with MIT SMR Custom Studio, September 2017. (link)

# More workloads, more benefits




Their growling reliance on the cloud to increased need for agility/speed to market (45%), increased confidence in cloud security (44%), and cost savings (34%).

"Behind the Growing Confidence in Cloud Security," a study conducted on behalf of Google Cloud in association with MIT SMR Custom Studio, September 2017. (link)

“AI remains a field with high barriers. It requires rare expertise and resources few companies can afford on their own. That’s why cloud is the ideal platform for AI. That’s also why we’re making huge investments in cloud AI and ML in the form of powerful, easy-to-use tools that will give every cloud customer an onramp into this field.”

**Fei-Fei Li,** chief scientist of ML and AI at Google Cloud

Day 1 keynote at Google Cloud Next ‘17. (link)

# Conclusion

In multiple studies, our research partners have demonstrated that ML offers significant business benefits to the substantial — and rapidly growing — number of organizations that are using it to turn data into insights. Indeed, ML has become essential to modern businesses' ability to compete and survive. We've held that belief for a long time at Google, and forward-thinking business and IT leaders clearly share it.

There's also evidence that companies can build more effective and affordable ML programs when they take advantage of cloud providers' scalable infrastructures, managed services, and APIs. In other words, when it comes to embracing ML techniques for the first time or extending your existing strategy into the cloud, your choice of technology partner matters — and you'll have a distinct advantage if you work with a seasoned pioneer like Google Cloud.

Find out more about Google Cloud's ML tools and services at cloud.google.com/products/machine-learning.

**Get started by exploring our key ML offerings, including:**

- Cloud Machine Learning Engine, a managed service that enables developers and data scientists to build and bring superior ML models to production
- Cloud AutoML, a suite of products that enable developers with limited ML expertise to train high-quality models

**Our ML APIs:**

- Cloud Video Intelligence, for making videos searchable and discoverable
- Cloud Vision API, for understanding the content of images
- Cloud Speech-to-Text, for converting audio to text
- Cloud Natural Language, for deriving insights from unstructured text
- Cloud Translation API, for dynamically translating between thousands of language pairs
- TensorFlow, an open-source software library for high performance numerical computation

# Appendix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