



AI-Powered Solutions for Flare Gas Reduction



رامت ستوده قره باغ

استاد و بیست و پنجمین رئیس دانشکده فنی دانشگاه تهران

SYNOPSIS

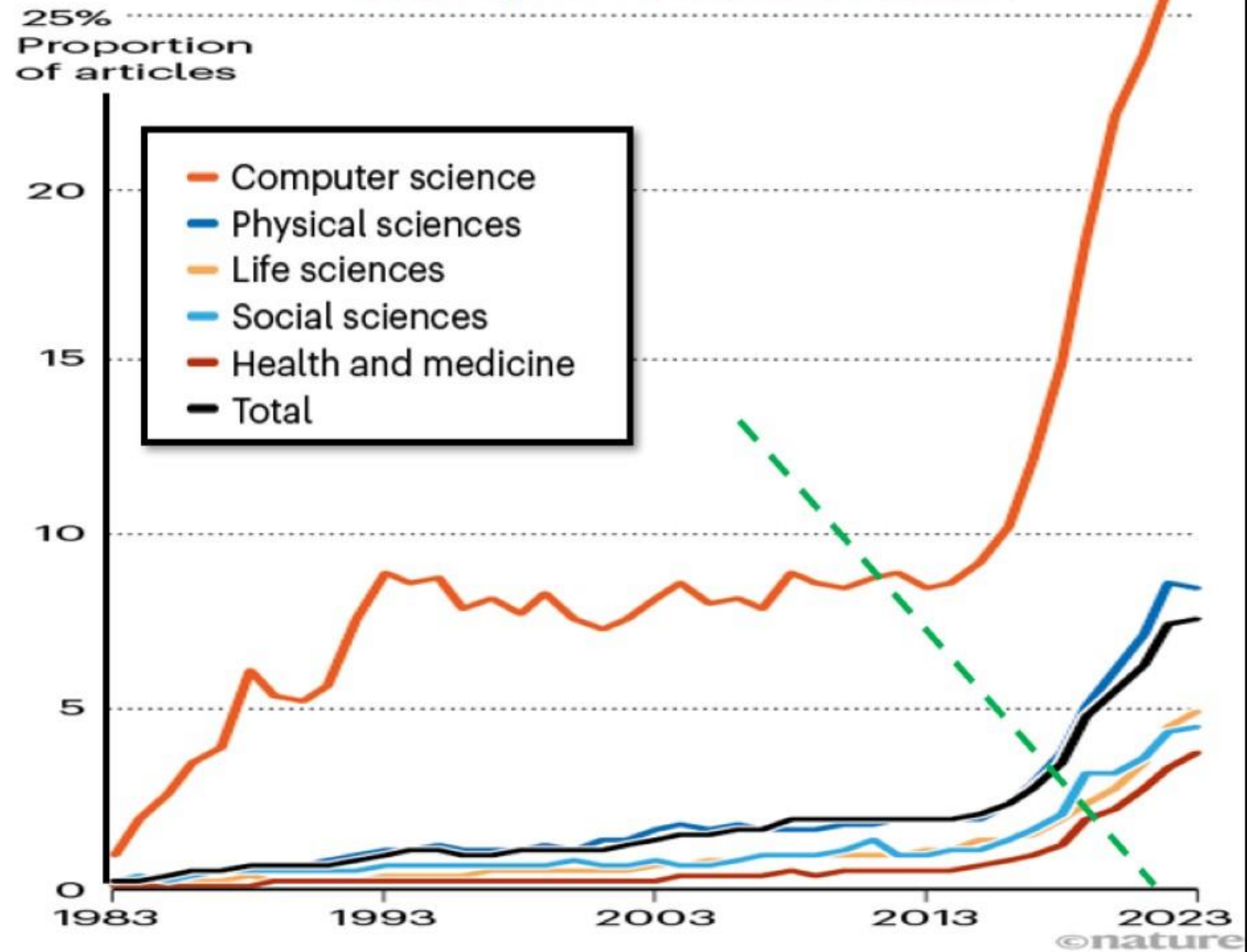
- 1. Introduction**
- 2. Global AI Index**
- 3. Iran AI Index**
- 4. AI Tools in Oil and Gas Industry**
- 5. Flare Reduction and Management**
- 6. Case Studies**
- 7. Conclusion**

Comparison of Popular Platforms

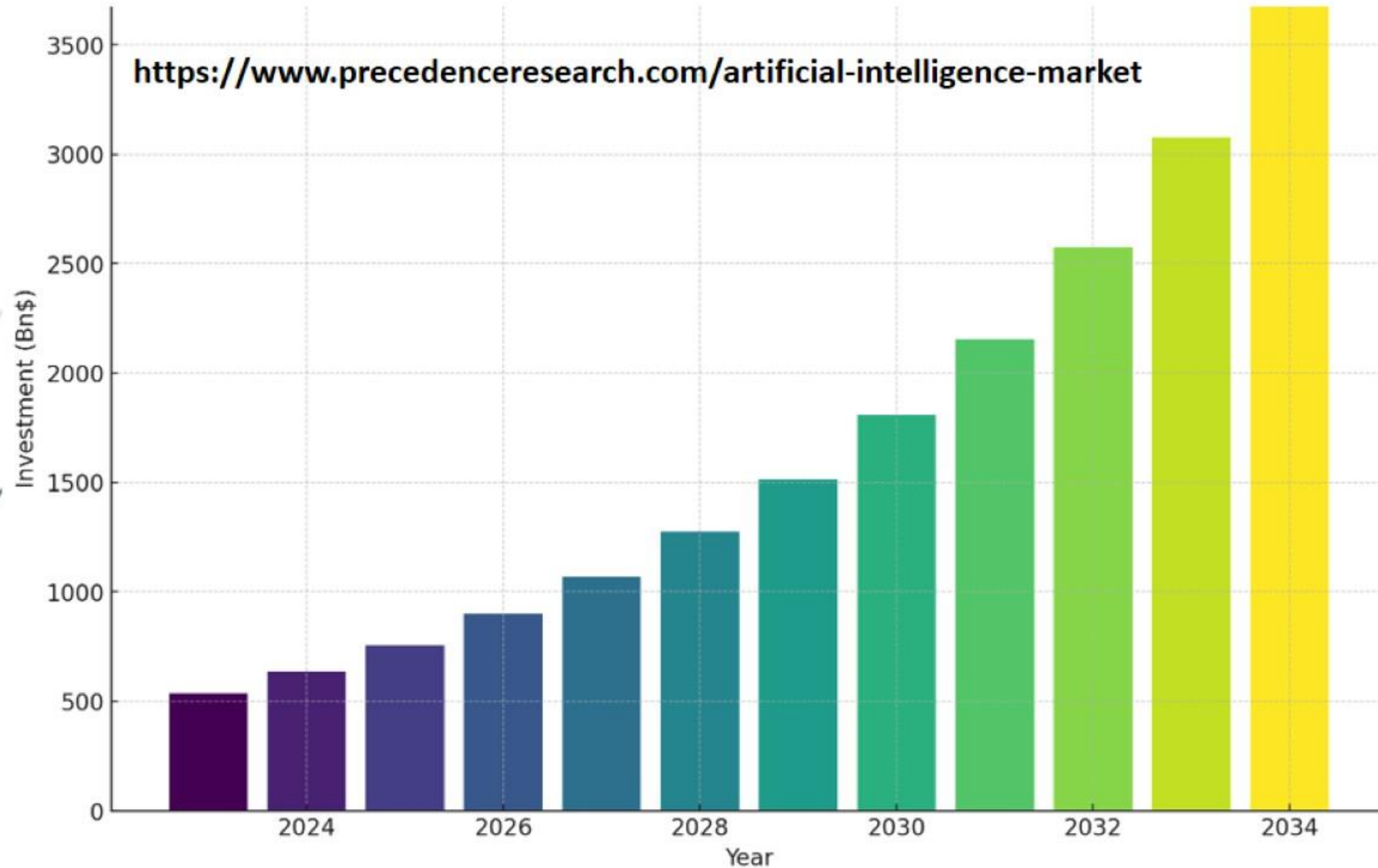
Time to 1 Million Users and Current Market Data

Platform	Year	Time to 1 Million	Current Users (Million)	Remarks
LinkedIn	2003	3 years	1,000	Leading professional networking platform.
Instagram	2010	2.5 months	2,500	Focused on photo sharing and social media.
ChatGPT	2022	5 days	300	Quickly adopted in AI and NLP applications.

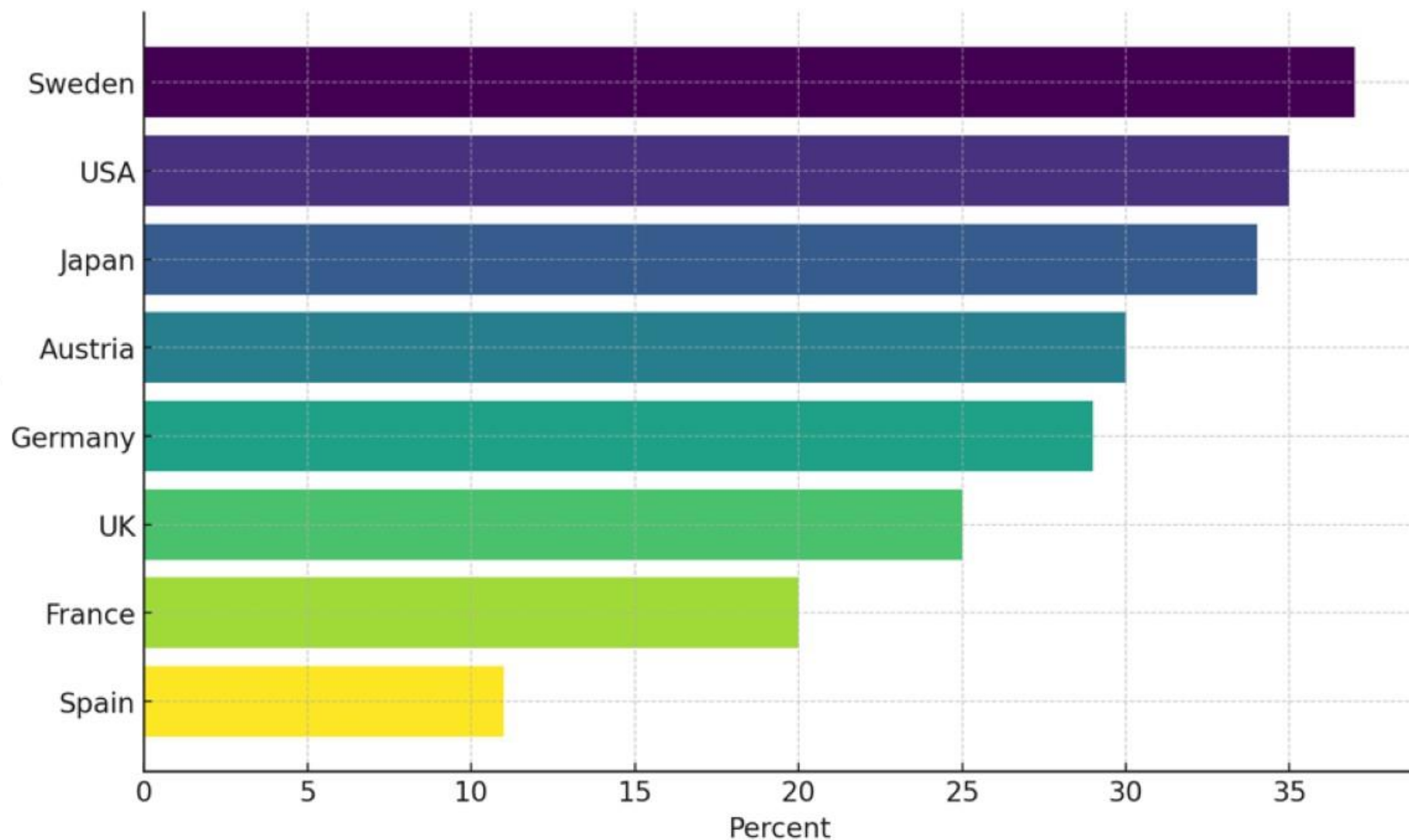
What 1,600 researchers think ?



Artificial Intelligence Market Size 2023 to 2034 (USD Billion)



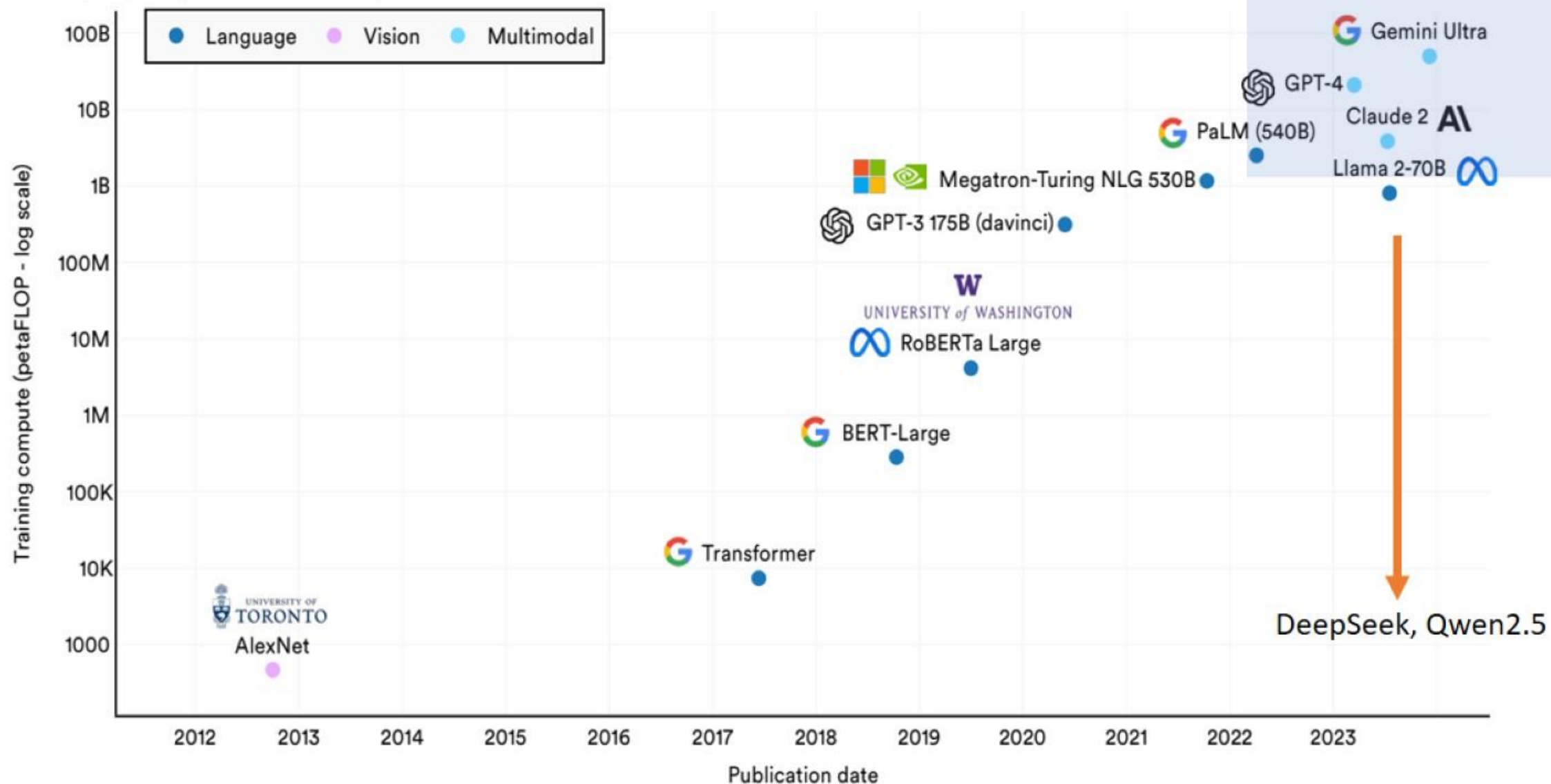
Productivity Increase by 2035 for Selected Countries



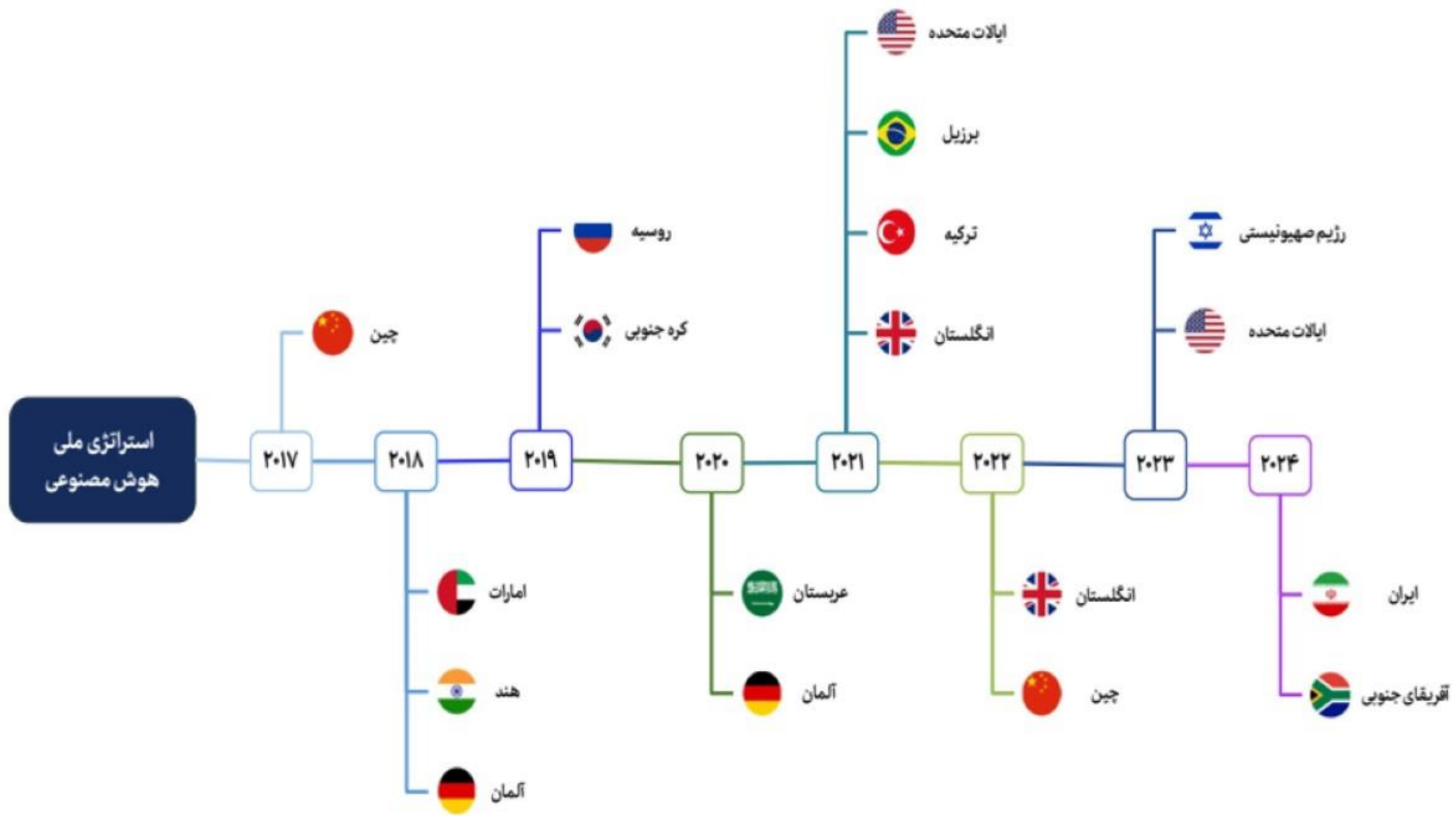
Data from <https://www.isna.ir/news/99100705312>

Training compute of notable machine learning models by domain, 2012–23

Source: Epoch, 2023 | Chart: 2024 AI Index report



در سال ۲۰۱۹، ۲۹ درصد از محققان برتر هوش مصنوعی از آمریکا بودند، در حالی که چین ۲۰ درصد را به خود اختصاص داده بود. با این حال، تا سال ۲۰۲۲، چین با ۴۷ درصد از استعدادهای برتر هوش مصنوعی، به رهبر جهانی را بر عهده گرفته و آمریکا با ۱۸ درصد از محققان برتر هوش مصنوعی، به طور قابل توجهی از آن عقب افتاد. این تغییر نشان‌دهنده سرمایه‌گذاری قابل توجه چین در تحقیقات و توسعه هوش مصنوعی و همچنین موفقیت این کشور در جذب و پرورش استعدادها برتر در این زمینه است. این موضوع همچنین چالشی برای رهبری آمریکا در هوش مصنوعی و پیامدهای بالقوه‌ای آن برای رقابت جهانی است.

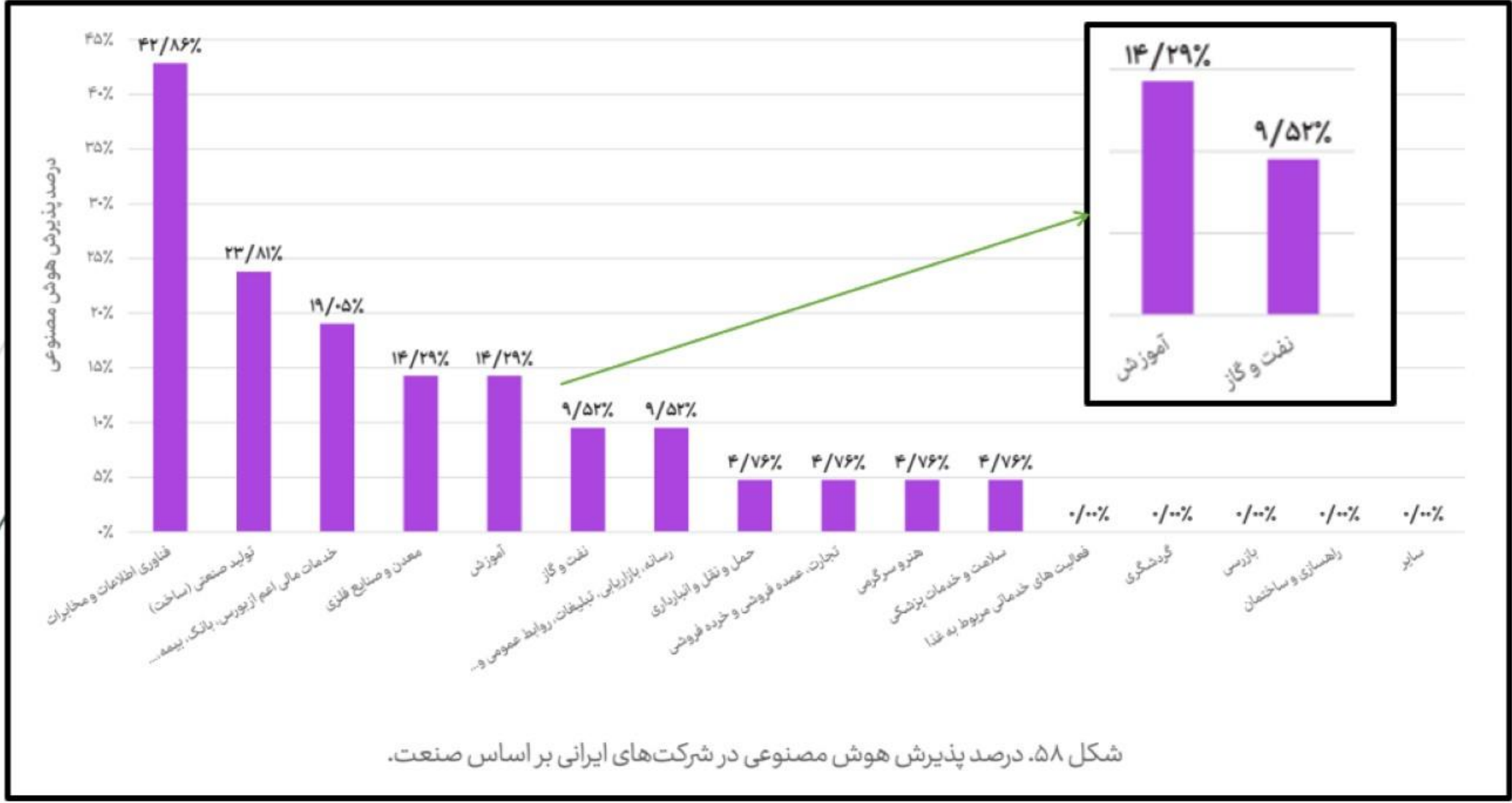


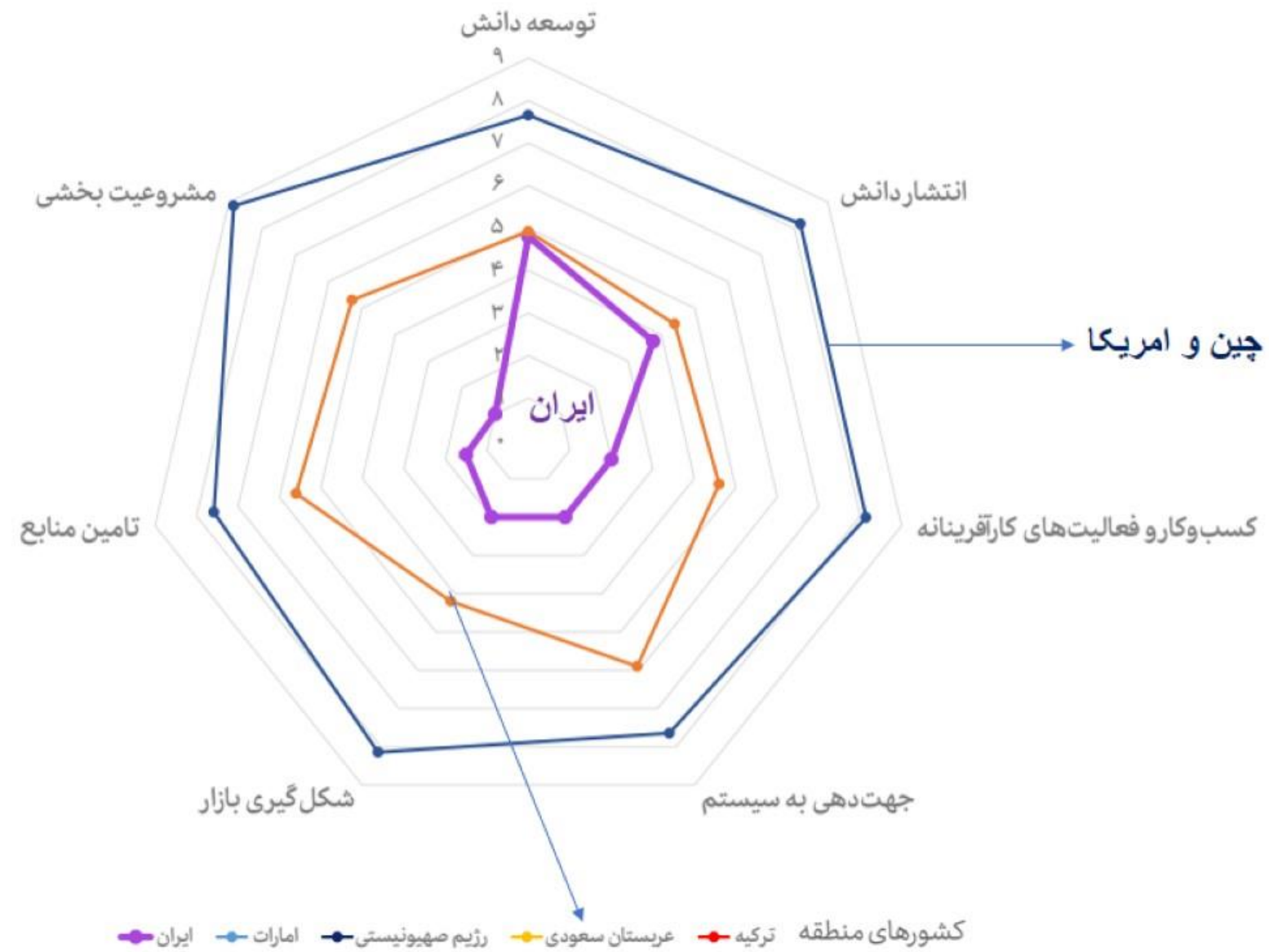
جدول ۷. اولویت‌های کلان هوش مصنوعی بر حسب پیش نویس سند ملی هوش مصنوعی

محور	اولویت الف	اولویت ب
صنایع و انرژی	سامانه هوشمند مدیریت و پشتیبانی تعمیر و نگهداری تجهیزات	توسعه دوقلوهای دیجیتال به منظور افزایش راندمان تولید، انتقال، توزیع و مصرف انرژی در کشور
	خانه هوشمند	هوشمندسازی یکپارچه همه خدمات شهری بر مبنای اولویت‌های مرتبط با هوا، محیط زیست، آب، غذا و امور مرتبط با سلامت عمومی
	سیستم‌های حمل و نقل هوشمند و وسایل نقلیه خودران و بدون سرنشین	

■ هوش مصنوعی در تقویت امور زیربنایی (شبکه‌های برق و انرژی الکتریکی، پیش‌بینی نیاز و مدیریت هوشمند تولید و مصرف و توزیع منابع، شبکه‌های توزیع شده برای تولید و ذخیره انرژی، پیش‌بینی خرابی تجهیزات و اجرای به موقع اقدامات لازم- نفت و گاز و معدن، سامانه‌های هوشمند کاوش و اکتشاف، حفاری).

پایگاه ملی اطلاع‌رسانی قوانین و مقررات کشور (۱۴۰۳). «سند ملی هوش مصنوعی جمهوری اسلامی ایران». قابل دسترس در:
<https://dotic.ir/news/16797>





شکل ۱۵۷. مقایسه ایران با میانگین منطقه و جهان در هفت کارکرد سیستم نوآوری هوش مصنوعی.

Overview of IBM-AI survey in the Oil and Gas Industry

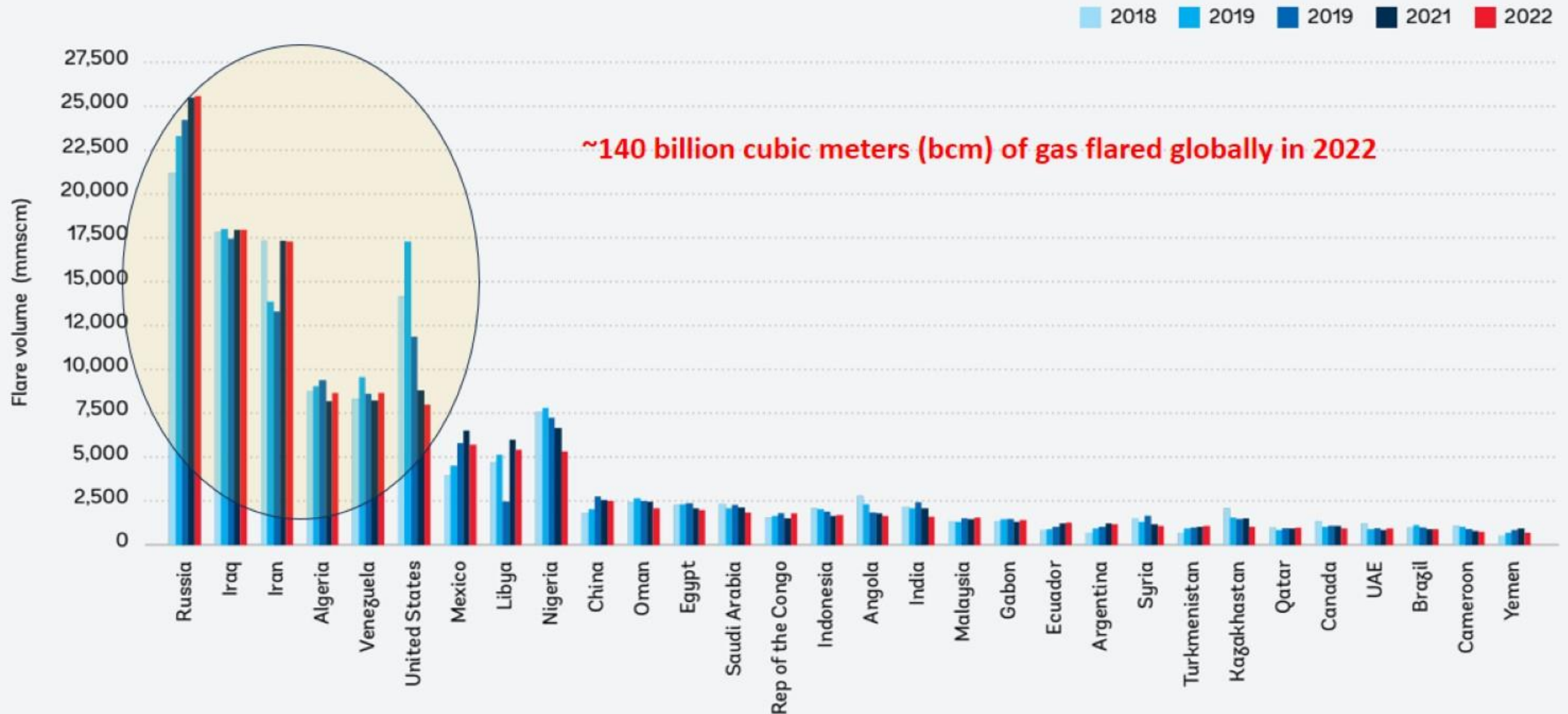
Section	Details
Study approach	Survey of 400 oil and gas executives across 18 countries in two phases (Jan-Mar & Jun-Jul 2020).
Respondents	Included CEOs, Heads of Strategy/Innovation, CDOs, CIOs, COOs, and Transformation Officers.
Locations	Asia Pacific, Europe, Middle East, North America, South America.
Organization types	Companies from various segments and sizes in the oil and gas industry.
Segment breakdown	33% Upstream, 33% Midstream, 33% Downstream.
Enterprise size	31% of enterprises had annual revenues between \$1-5 billion, 26% had revenues of \$10+ billion.

<https://www.ibm.com/downloads/documents/us-en/107a02e97e48fd89>

Major findings of the IBM study

Priority	Key Findings	Details	Companies
1	Leaders & Financial Performance	AI leaders achieve 43% ROI vs 29%, outperforming peers in revenue growth and profitability.	Shell, ExxonMobil, Gazprom Neft
2	AI's Importance	AI reduces costs and increases automation; <50% of companies have enterprise-wide AI strategy.	All surveyed companies
3	Impact on Financials	AI leaders gain over \$360M profit advantage per \$10B company.	AI Leaders (General)
4	Success Factors for AI Leaders	Leaders prioritize data governance, clear objectives, and skill investment.	Shell, ExxonMobil
5	AI's Role in Segments	AI enhances drilling, forecasting, and refining optimization.	Shell, Gazprom Neft

Global Flare Gas Challenge



Global Gas Flaring Trends

- **Global flaring decreased by 3% in 2022.**
- **Oil production increased by 5%, showing a decoupling of flaring and production.**
- **Flaring intensity decreased from 5.0 m³/bbl in 2021 to 4.7 m³/bbl in 2022.**

The Role of AI in Flare Gas Reduction

AI-Powered Predictive Maintenance

- **AI analyzes equipment data to predict failures and prevent unplanned flaring.**
- **ExxonMobil reduced flaring by 20% using AI-driven predictive maintenance.**
- Benefits: Reduced downtime, lower costs, and minimized emissions.

The Role of AI in Flare Gas Reduction

Real-Time Monitoring with AI

- AI-powered systems use **satellite data** and **IoT sensors** to monitor flaring in real time.
- Benefits: Improved operational efficiency and regulatory compliance
 - AI can help achieve **Zero Routine Flaring by 2030.**

The Role of AI in Flare Gas Reduction

Optimizing Flare Gas Recovery

- AI optimizes gas recovery processes by analyzing flow rates, pressure, and composition.
- Case study: **Angola LNG** reduced flaring by capturing and monetizing associated gas.
- Benefits: Increased revenue and reduced emissions.

Industrial Use Case

BP uses AI technology to reduce the time allocated to data collection, interpretation, and simulation by up to 90%. Using AI, data can be processed "in a matter of days, compared with months or years previously".

BP uses AI to monitor corrosion and cut manual inspections by 70%. They also use handheld devices or drones for inspections, reducing the need to send workers out in difficult conditions.

Petrobras: Developed an AI-based system to predict equipment failures and optimize maintenance schedules in its refineries.

Aramco Uses AI-powered drones and sensors to inspect facilities, improving safety and efficiency, predictive maintenance, optimizing production, and reducing downtime.

The Future of AI in Flare Gas Reduction

- AI will enable real-time decision-making and automated flare gas recovery.
- Emerging technologies: Digital twins, gas tracking, and advanced machine.
- **A flare-free future** with minimal emissions.
- Real-time monitoring, predictive maintenance, and gas recovery are key applications

Challenges of AI in Flare Gas Reduction

- Data quality and availability
- High upfront costs of AI infrastructure
- Integration into existing systems
- Regulatory and compliance barriers
- Resistance to technological change within organizations



Humans in the Loop

“

If you think about barriers, there are cultural barriers, there are technology barriers and then there are skills barriers. You can throw money at a problem and upskill your workforce. You can throw money at a problem and bring new technology in. Culture is a tougher nut to crack. The reality is, you can throw all of the money and resources you want at the other two but if you still have that cultural barrier blocking you, you're going to fail.

Digital finance executive, integrated oil company

https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/oil-and-gas/ey-oil-and-gas-digital-transformation-and-the-workforce-survey-2020.pdf

با تشکر از حسن توجه شما سروران گرامی



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