## Commercialization of Artificial Intelligence

The commercialization of artificial intelligence (AI) is occurring in four separate areas: Internet, business, perception, and autonomous (Lee 2018). Internet AI is largely about using AI algorithms as recommendation engines—AI systems that recommend content based on our personal preferences (Lee 2018:107). For example, Netflix recommends movies and TV shows to watch based on a viewer's history, and Facebook targets advertisements to users based on their activity, including their posts news and interaction with other users.

The second area, business AI, mines the databases of companies and organizations to develop algorithms to match or outperform humans (Lee 2018:110–11). For example, the financial industry has developed algorithms to approve mortgages based on the applicant's credit record, income, and other characteristics. Researchers in the United States have demonstrated algorithms to diagnose specific illnesses based on images that are on par with doctors (Lee 2018:113). These two areas have been widely implemented and are beginning to have substantial economic impact.

The third area, perception AI, is digitizing the physical environment through the proliferation of sensors and smart devices. These devices turn the physical world into digital data that can be analyzed and optimized by AI algorithms.
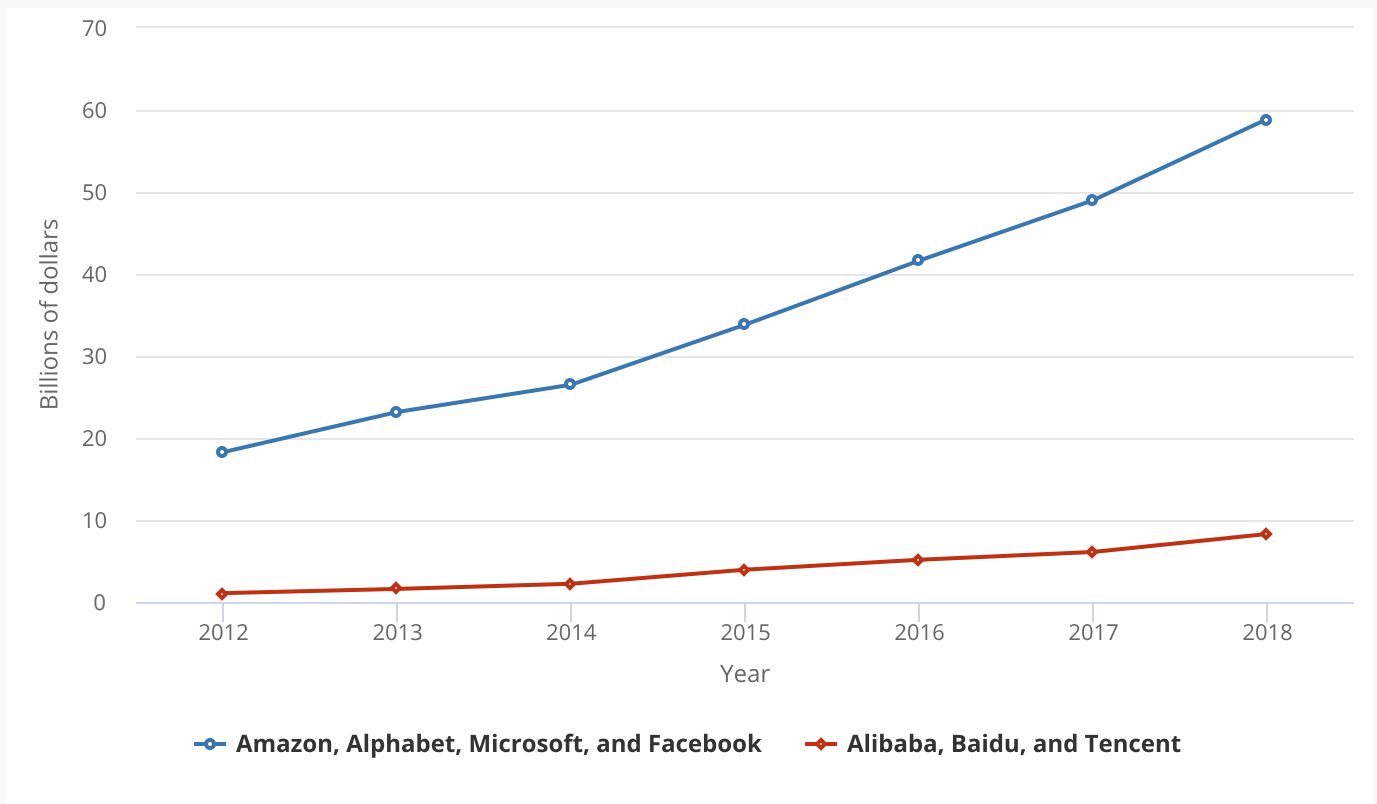
The fourth area, autonomous AI, includes autonomous vehicles and drones, intelligent robots, and other devices and hardware that will replace or supplement human labor, such as truck drivers. Technologies in this area generally remain under development or have not been widely commercialized compared to the other three areas (Lee 2018:106). For example, Google and other companies are testing autonomous cars to further refine and develop the technology.

The commercialization of AI technology in China and the United States has been occurring predominantly in large high-technology corporations and startups. According to Lee (2018:83), the "Seven Giants of the AI Age," four companies based in the United States—Alphabet (the parent company of Google), Facebook, Amazon, and Microsoft—and three companies in China—Baidu, Alibaba, and Tencent—have invested heavily in AI R&D and acquisition of talent. For context, data on total R&D of these seven corporations suggest that their R&D spending in AI has been increasing substantially. R&D spending by the four U.S. companies more than tripled from $18 billion in 2012 to $59 billion in 2018 (Figure 6-J). In 2018, Amazon and Alphabet were the first and second ranked companies in corporate R&D spending in the world (Jaruzelski, Chwalik, and Goehle 2018). R&D spending by the three Chinese corporations also grew rapidly, an eight-fold increase from a collective total of $1 billion to $8 billion. In 2018, Alibaba, Tencent, and Baidu were the first, second, and fourth largest spenders on R&D among Chinese corporations. The strategy of these large Chinese and U.S. corporations has been to construct privately controlled computing networks that distribute AI technology with wide applications across the economy, similar to utilities distributing energy across power grids (Lee 2018:83). For example, Amazon is selling AI services, including natural language processing, speech synthesis, image analysis, and video recognition, with the goal of serving large- and small-time developers that want AI without upfront costs (CB Insights 2018:27). Alibaba is working with the city of Hangzhou to optimize traffic flows and alert emergency services to traffic accidents using advanced object recognition and predictive transit algorithms (Lee 2018:94).

In contrast to the general AI grid approach of large corporations, the AI startups are building highly specific "battery-powered" AI products that are stand-alone applications. The battery-powered AI products are for specific tasks, including medical diagnosis, mortgage lending, and autonomous drones (Lee 2018:95).

**FIGURE 6-J**

R&D spending of seven AI-focused corporations: 2012−18



AI = artificial intelligence.

**Source(s):**
PwC, The 2018 Global Innovation 1000 study.

*Science and Engineering Indicators*