QUANTUM COMPUTING IN INDUSTRY

Assignment 1

Ranjima Mohan P

January 12, 2023

How these companies are using Quantum Computing in their business?

1. DAIMLER

2. JP MORGAN CHASE

3. EXXON MOBIL

4. GOLDMAN SACHS

5. BOEING

6. MITSUBISHI CHEMICALS

7. CLEVELAND CLINIC

Quantum computers hold great promise but aren't useful yet. Still, some companies are testing them for future applications in chemistry, banking and other fields.

IBM Quantum leads the world in quantum computing. This nascent technology is widely expected to solve valuable problems that today's most powerful classical supercomputers cannot solve and never will.


Figure 1: IBM Quantum Lab

1. DAIMLER

Daimler AG (DMLRY) is a multinational automotive corporation headquartered in Stuttgart, Baden-Württemberg, Germany. The company was formed in 1926 with the merger of Benz & Cie and Daimler Motoren Gesellschaft. Mercedes-Benz is owned by the Daimler Group, previously known as Daimler AG.Mercedes-Benz, in partnership with IBM Quantum, is exploring quantum computing to craft the future of electric vehicles.

Daimler AG transformed from vehicle manufacturer to mobility services provider through applications of quantum computing techniques. CASE stands for connectivity (Connected), autonomous driving (Autonomous), flexible use (Shared Services) and electric drive systems (Electric).

Daimler envisions a new generation of electric vehicles through quantum battery technology.
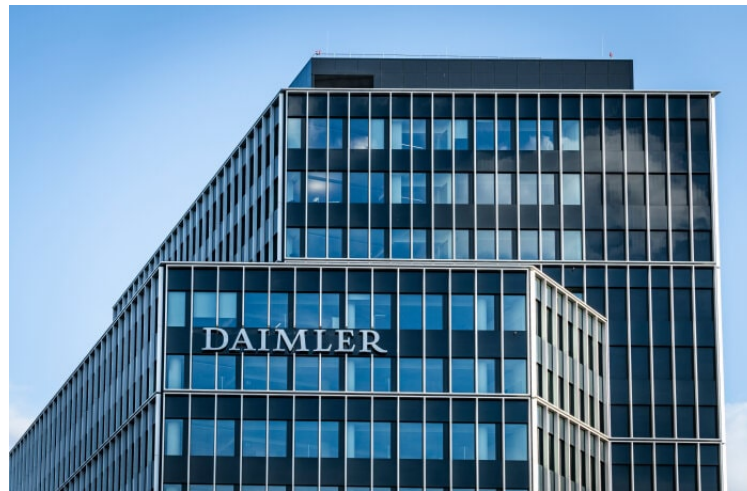

2. JP MORGAN CHASE

JP Morgan Chase & Co. is an American multinational investment bank and financial services holding company headquartered in New York City. As a "Bulge Bracket" bank, it is a major provider of various investment banking and financial services. As of 2021 it is the largest lender to the fossil fuel industry in the world. JP Morgan Chase is looking into how quantum computing would impact the financial services space. JP Morgan Chase is one of the first financial institutions worldwide to invest in quantum computing and to build an internal team of scientists to work on new quantum algorithms and applications to address business use cases in finance, AI, optimization and cryptography. They'll access supercooled quantum processors at IBM's Yorktown Heights, New York, labs over the internet—a kind of quantum cloud. The bank is among a small group of companies tapping IBM's prototypes, which if they can be scaled up should offer immense processing power.

Quantum processors built so far by IBM, Google, Intel, and some startups, are too small and unreliable to do useful work. But JP Morgan executives say they're interested in part as a hedge against a future slow down in improvements to conventional computers.

3. EXXON MOBIL

Exxon Mobil is one of the world's largest publicly traded international oil and gas companies. Moving the world's energy products across the globe is a complex puzzle that could benefit from a quantum solution. Exxon Mobil in partnership with IBM Quantum is exploring quantum algorithms to tackle the complexities of shipping the world's cleanest burning fuel. Exxon Mobil sought to understand the extent to which maritime routing problems could also be addressed using existing quantum variational algorithms, and to determine which strategies are needed to account for complex real-world constraints, including capacity limitations and time windows, which dictate the arrival and departure of shipments.
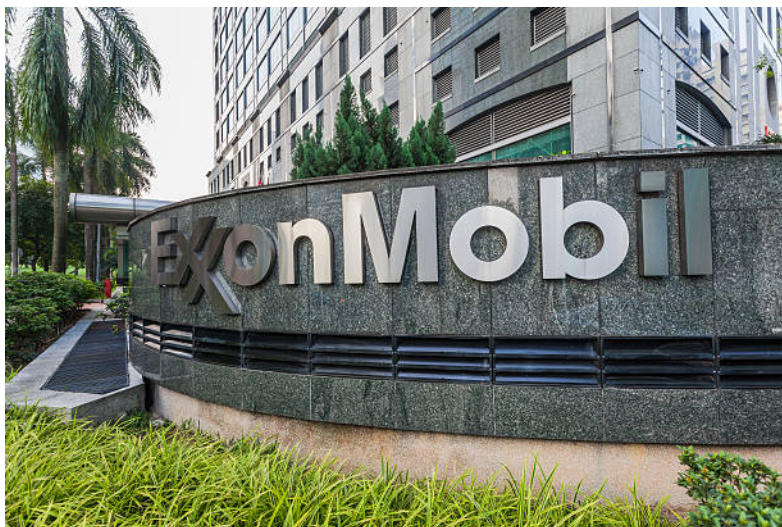
4. GOLDMAN SACHS

Finance was one of the first domains to embrace Big Data, and the drive to innovate continues. Much of the science behind the pricing of financial assets involves combinatorics calculations, the forte of quantum computing. Goldman Sachs has poured its resources into harnessing the power of quantum computing because in the financial markets, computing speed is a giant advantage. The calculations rely on so-called Monte Carlo simulations, which involves making a large number of projections about future random market movements to calculate the probability of a particular outcome.

5. BOEING

Boeing, the world's largest aerospace company and leading manufacturer of commercial jetliners, defense, space and security systems. Boeing Launched New Organization to Unleash the Power of Advanced Computing and Networks in Aerospace. By leveraging core technologies in quantum communications and computing, neuromorphic processing and advanced sensing, the new organization will enable Boeing to develop breakthrough solutions in secure communications, artificial intelligence and complex system optimization. Boeing's Disruptive Computing Networks organization works on quantum communications and computing, as well as neuromorphic processing and advanced sensing.

Boeing

6. MITSUBISHI CHEMICALS

One potential application is in the chemical industry, which hopes to create innovative materials using computer simulations. Mitsubishi Chemical envisions employing the computer to develop better light-emitting diodes and solar cells. Mitsubishi Chemical have simulated the initial steps of the reaction mechanism between lithium and oxygen in lithium-air (Li-air) batteries. Understanding the underlying mechanism of the Li-air battery chemistry could lead to significantly more efficient batteries for everything from mobile devices to cars. The goal of studying the battery from the electrochemical perspective is to reduce the formation of undesirable lithium peroxide.

7. CLEVELAND CLINIC

Cleveland Clinic and IBM aim to expand the speed and scope of healthcare and life science research and hope to uncover innovative approaches to public health emergencies such as COVID-19. The promises are astounding – the ability to simulate complicated physical and chemical processes and crunch numbers quicker than any supercomputer. Quantum computing has shown big potential for many years that's only just starting to be tapped. Its enormous processing power could enable new breakthroughs in drug design and the development of new therapeutics. Harnessing quantum computing, hybrid cloud technologies and artificial intelligence will enable faster gains from leading-edge innovations such as deep search, quantum-enriched simulation, generative models and cloud-based AI-driven autonomous labs.