

Observatoire des futurs
EM Strasbourg

Data: AI, Big Data and IoT

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Data

1. Definition and Relationships with Other Factors

General Definition

The macro-variable "data" encompasses AI, big data, and IoT.

- **AI:** a set of theories and techniques used to develop machines capable of simulating human intelligence. It aims to use machines to replicate mental activities—such as understanding, perception, or decision-making—as closely as possible. (ADEME)
- **Big data:** generally relies on the sheer scale of data sets and the need for significant computing power to extract value from this data within a reasonable timeframe. It differs from traditional data through the 3Vs (volume, velocity, variety)
- **IoT:** the extension of the Internet into the physical world. This framework enables advanced services by interconnecting virtual or physical objects through information and communication technologies. An industrial version exists, achieved by installing sensors on machines and objects during the manufacturing process (ADEME)

Connection to Uberization and Industry 2030/Key Questions for the Future

- The rapid increase in computing power, following Moore's Law (which states that the performance of electronic components doubles every 18 months), has enabled the maturation of numerous technologies, including hardware and algorithms (machine learning, big data, cloud computing, intelligent robots, the Internet of Things, etc.). **Every aspect of business operations is being impacted by the advent of digital technologies**, from R&D to management, including procurement, production, warehousing and logistics, marketing, and sales. (Industry of the Future, 4.0, Fourth Industrial Revolution)

- The emergence of these technologies creates **opportunities for platforms and other digital players to intervene in manufacturers' operations**, thereby increasing the potential for "Uberization." The digital transformation of industry through the application of these tools also makes it possible to view traditional players as potential "Uberizers."

2. Summary of the Retrospective Analysis

Retrospective

In General

- **Increase in data speeds:** 1990s: low speed (dial-up modem: 64 kilobits per second); ADSL (2000) increased these speeds by a factor of 100. In 2010, fiber optics once again increased access speeds by a factor of 10.
- **Explosion in Internet use:** Between 1990 and 2011, the percentage of Internet and mobile phone users worldwide rose from 0.05 percent (1990) to 32.7 percent (2011); today, it stands at 54 percent (4.12 billion internet users).
- **Decline in storage costs:** Cloud computing allows data to be stored at a lower cost. Globally, the price per gigabyte for a hard drive fell from approximately $16 (€12.30) on February 1, 2000 to $0.10 (€0.07) on August 1, 2010.
- **Emergence of new database management technologies** (Hadoop, MapReduce, NoSQL, etc.) capable of processing phenomenal volumes of information in real time and analyzing unstructured data.
- **Launch of the first connected device in 2003:** a DAL lamp by the company Violet
- **The shift from closed-system AI** (controlled parameters) to open-system AI (capable of processing large volumes of data)

Retrospective

Uberization and Industry 2030

- **The emergence of ERP in the 1990s**, followed by second-generation ERP (2000), which integrated the entire value chain with the network of suppliers and then consumers. Third-generation ERP (extended enterprise).
- **The development of connected factories** driven by individual changes (2012–2014)
- **The industry is focusing more on limited and structured data than on big data, which is still in the experimental stage.**

Current Trends

In General

- **The data explosion:** According to IBM (2016), we generate some 2.5 quintillion bytes (or 2.3 trillion gigabytes) of data every day. Ninety percent of the world's data has been created in the last two years alone.
- **The expansion of ultra-high-speed broadband access** is a major trend that will accompany the explosion of the Internet of Things and big data. (France Ultra-High-Speed Broadband Plan, 5G)
- **The emergence of Web 4.0 or the Internet of Robots:** a shift from communicating objects to connected machines—whether real or virtual—making networks of machines capable of understanding interactions increasingly autonomous. Development of low-bandwidth, low-cost, and low-energy-consumption networks.

Current Trends

In General

- **There will be no massive drop in unit costs unless there is an explosion in the volume of connected devices.** The cost of connected devices will trend downward, but the decline is not expected to be very significant due to integration costs and the addition of new sensors.
- **Improved energy efficiency of IoT network infrastructure and the prevalence of short-range wireless networks.** The development of radio technologies is increasingly focused on solutions offering low power consumption (LPWA networks, cellular solutions such as NB-IoT and 5G).



Current Trends

Uberization and Industry 2030

- **The use of big data is becoming more widespread but remains underdeveloped in the manufacturing industry**: big data adoption in businesses is reported to have risen from 17 percent in 2015 to 59 percent in 2018. Telecommunications (95 percent), insurance (83 percent), and advertising (77 percent) lead the way, while manufacturing lags behind.
- **This development has been facilitated by lower costs for data access and processing:** the cloud subscription model is accessible to businesses of all sizes.
- **Persistent cultural barriers to becoming data-driven.**
- **Greater technological mastery, with people at the center of AI initiatives:** We have recently been able to configure certain algorithms in production that were previously ineffective (deep learning, neural networks). It is people who make the decisions and steer the process, despite the proliferation of technology.

Current Trends

Uberization and Industry 2030

- **The IoT market is booming, particularly in the manufacturing sector:** this sector is expected to spend the most on IoT solutions in Europe in 2019 ($20 billion), ahead of public services ($19 billion) and retail ($16 billion). The global IoT market is projected to grow at an annual rate of 24.3 percent, reaching $1 trillion by 2026.

- **The development of the IoT will impact the entire value chain:** The Internet of Things will enable industries to further streamline their internal processes—both commercially (collecting data on purchasing motivations, consumer movements within stores, etc.) and in production (equipment management, inventory tracking, sending automatic orders to suppliers, and preventive maintenance).

3. Summary of Prospective Exploration

Major Trends / Constants

- **Moore's Law:** (doubling of electronic component capacity every 18 months). These trends have been consistent and remain significant. This suggests that the increase in data throughput—for both wireless and wired access—has no reason to plateau.
- **The volume of data continues to grow, and upgrading of analytical tools will continue.**

Uncertainties

- **A shift from big data to fast data:** the application of big data analytics to smaller data sets that need to be processed and analyzed in real time.
- **Evolution of data centers:** driven by the rise of disruptive technologies, the growing dominance of major cloud providers, and issues of national sovereignty.

Uncertainties

- **Data and device security technologies:** Without security, users might limit their use to basic solutions or devices that handle less sensitive data. This is complex due to multiple layers and stakeholders. Overall, the development of these technologies is hampered by the risks of cyberattacks.
- **Toward standardization and regulation that promote interoperability, system security, and consumer protection?**
- **Data protection risks hindering the development of the IoT market.**

Seed of Change

- **A giant leap forward for big data and AI via quantum computing:** the “qubit” is a linear combination. It can take the value 0 or 1, but also both at the same time. This enables parallel, simultaneous calculations, rather than sequential ones as with our current machines. Still in the experimental stage, but a major focus for the tech industry and research centers.

- **Traditional players are transforming themselves into key players in digital transformation**



Controversies

- **Network effects that can stifle competition and reduce consumer choice: Regulation?** User-driven virtuous cycles allow data-holding companies to accumulate market power and create a tendency toward the emergence of monopolies. This trend would thus work against consumers, who will become increasingly locked into the services they use. No specific regulations are currently in place, but discussions are underway, particularly at the European Union level.
- **Manufacturers vs. platforms in the race to impose a technological standard for the IoT.**
- **A struggle between traditional players and service providers with the development of the IoT**: in certain sectors, “restructuring through usage” is leading digital players to capture an increasingly significant portion of the added value of the product or service (the value of the service exceeds that of the product).
- **Data traffic between Europe and the United States controlled by GAFA.**

Disruptions

- **Capacity crunch:** Future networks will have to support much higher volumes of mobile traffic than they do today, even though the spectrum of frequencies available today is limited. Some scientists believe this lack of capacity will spell the end of the internet. They estimate it will happen as early as December 1, 2023.
- **The emergence of strong AI** (at least equivalent to humans), which some experts predict will occur by December 1, 2025, while others foresee it happening later.
- **Health risks** halt the development of 5G





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