I'm not a bot

History of digital

This chapter introduces a business-centric interpretation of what "digital" means, which will be employed throughout this publication. We also review the historical progression of digital technology from 1940 to 2020 to contextualize our current state's rapid development and hint at possible future directions. Furthermore, we highlight how digital technologies are becoming increasingly intertwined with the physical world, making it difficult to distinguish between the "physical world" and the "virtual world." Key terms include: 1. Digital literati: Organizations or individuals who possess a deep understanding of digital matters (technologies, business models, etc.). The rapid digitization of the business world has far-reaching implications for every aspect of enterprise operations. However, most efforts to transform enterprises into digital entities fail due to inadequate strategic planning. This publication distills key lessons from the rise of digital platform giants and offers practical advice on how established businesses can adapt these principles to remain competitive in a rapidly changing digital landscape. The book provides an integrated perspective on business and technology, analyzing megatrends, technological advancements, and shifting business models. By combining disjointed business transformation imperatives into a cohesive guide, it aims to help organizations achieve success in the digital arena. Drawing from extensive experience in promoting innovation and transformation, the authors outline a path for progressive change and value creation that balances revolutionary change with continuous optimization. Note: References, institutional subscriptions information, and access details have been omitted for brevity. David Daly is a senior leader in the tech industry, serving as an advisor to Atos' CEO and co-chairing its scientific community, comprising top scientists since 2009. He has held various roles in the Executive Committee, including Telecom, Finance, and Consulting & Systems Integration. Daly is also a bestselling author on Information System Design Methods. Daly has spent over two decades in the technology sector, with a background in software engineering and team leadership. As a fellow of the British Computer Society, Chartered IT Professional, and public speaker, he advocates for alternative approaches that can produce better results. José Esteban is an innovator and R&D expert with extensive experience driving transformation initiatives in both public and private sectors since 1997. He is heavily involved in emerging technologies such as Artificial Intelligence and Additive Manufacturing, focusing on Unpredictability and Machine Behavior. John Hall is a Chartered Engineer with over 30 years of experience in the IT and digital transformation sector. As a regular public speaker, he inspires others to think differently about digital disruption. His current areas of focus include Blockchain, Quantum Computing, and Ethical considerations for AI. George Miller is a seasoned product and services innovator with 20 years of experience in business technology innovation across various industries. His research interests include new business models, autonomics, and artificial intelligence, as well as mixed reality. The Digital Revolution has transformed society over the past few decades, from mechanical to digital technology, changing human communication and paving the way for the Information Age. The advent of computers marked a pivotal moment in history, as they soon found their way into households, revolutionizing the way people lived and worked. As video games became increasingly popular, digital technology continued to seep into every aspect of life, creating new job opportunities and transforming industries. The 1980s saw the emergence of computer production in film, robots in manufacturing, and ATMs in banking, with computers becoming a staple in many US households by the late 1980s. The widespread adoption of digital mobile phones and the internet in the 1990s further accelerated this trend, with cell phones becoming ubiquitous and high-definition television replacing analog broadcasting by the early 2000s. Today, the world is more interconnected than ever before, with nearly half of the global population having constant internet access. The ability to store information has grown exponentially, with terabyte storage now widely available. However, this shift has also led to the obsolescence of many traditional devices, including analog radio, fax machines, VHS tapes, and even landline phones. The Digital Revolution has had far-reaching social impacts, improving communication, access to information, and business productivity. Yet, it has also raised concerns about personal privacy, professional journalism, and the blurring of boundaries between work and personal life. Despite these challenges, experts argue that the Digital Revolution is far from over, with ongoing advancements in areas such as 3D printing, computer design, and online retail continuing to shape industries and transform manufacturing. As technology continues to evolve, it is likely that robots will increasingly work alongside humans, driving productivity growth and changing the nature of work. Meanwhile, on-line retail is becoming a dominant force, with consumers turning to digital channels for their purchases in growing numbers. As we move forward into an increasingly digital future, it is essential to navigate these changes carefully, acknowledging both the benefits and drawbacks of this revolution. The impact of the Digital Revolution is now being felt across various industries, including medicine, where it holds significant promise for genomic medicine and personalized treatment plans. The Digital Revolution has undoubtedly changed human lives, bringing about both positive and negative consequences. As technology continues to advance, its effects are only expected to grow in the future. A pivotal moment in the history of digitization was marked by Gottfried Wilhelm Leibniz's development of the modern binary number system in 1679, which laid the groundwork for the creation of computers. This innovation was later popularized by Samuel Johnson's publication of A Dictionary of the English Language in 1755. The digital transformation has far-reaching implications, affecting not only how we interact with information but also how we govern ourselves, manage our health, and enjoy life. The widespread adoption of digital technologies has enabled the efficient conversion of traditional forms of information storage into computer-readable formats, facilitating the exchange of data, analysis, and organization of information. As the Digital Revolution continues to shape our world, its impact on various aspects of society is becoming increasingly apparent. Boolean algebra paved the way for mathematical logic and universal computation. In 1854 George Boole wrote "An Investigation into the Laws of Thought," where he explained that 0 and 1 represented Nothing and Universe, respectively. Claude Shannon built upon this work in his 1937 master's thesis at MIT, showing how Boolean algebra could optimize digital circuit design. However, it wasn't until the 1950s with the advent of transistors that his ideas became commercially viable. The invention of pulse-code modulation (PCM) by Alec Reeves in 1938 led to the development of standard digital audio formats used today. Meanwhile, John V. Atanasoff and Clifford Berry developed the electronic digital calculating machine, which they described as superior for mechanized computation due to its base-two system. In 1943, SIGSALY's secure speech system performed the first digital voice transmission during World War II. The same year, John von Neumann distributed his report on the EDVAC design, which featured binary representation and reduced component count. Claude Shannon published "A Mathematical Theory of Communication" in 1948, introducing the concept of bits (binary digits) and their storage capacity. Shannon's estimates included a single-spaced typed page holding around 104 bits and the Library of Congress holding approximately 1014 bits of information. By 1954, General Electric had started using digital technology in their Louisville plant, marking a significant shift towards widespread digital adoption. The first computer used for business purposes in the United States was the UNIVAC I, which processed payroll and manufacturing control programs. The machine had speakers and played classical music in the evenings, according to designer Burton Grad. In 1955, John Hancock Mutual Life Insurance Co. digitized two million life-insurance policies, while IBM introduced the 350 Disk Storage Unit in 1956, a system that provided random access to stored data. This innovation was followed by the introduction of the 305 and 650 RAMAC systems, which allowed for instant processing of business transactions. The RAMAC technology became obsolete when vacuum tubes were replaced with transistors, but the concept of disk drives remained essential for storing digital information. In the early 1960s, American Airlines' Sabre flight-reservation system was developed, processing thousands of telephone calls per day and storing large amounts of data. The term "database" was first mentioned in print in 1962, while Charles Bachman developed one of the first database management systems, the Integrated Data Store (IDS), at GE's computer division. In 1965, Gordon Moore published his famous paper on integrated circuits, which became known as "Moore's Law." This observation of the constant doubling of transistors in integrated circuits has guided manufacturing innovations and reduced prices while increasing capabilities. The late 1960s saw significant developments in digital technology, including the creation of Machine Readable Cataloging (MARC) records by U.S. libraries in 1968. In 1969, Willard Boyle and George E. Smith invented the charge-coupled device (CCD), which played a major role in the development of digital imaging. The same year, Edgar F. ("Ted") Codd published "A relational model of data for large shared data banks," presenting the theoretical basis for relational databases that became dominant from the 1980s to around 2000. Arthur Miller wrote about privacy concerns related to information handling in his book "The Assault on Privacy" (1971). Meanwhile, Michael Hart launched Project Gutenberg in July 1971 with a mission to make copyright-free works electronically available. In 1972, Pulsar was launched as the world's first all-electronic digital watch. Key milestones continued through the decade: Charles Bachman received the Turing Award for his work on database systems in 1973. He noted the shift from computer-centered to database-centered perspectives, comparing it to Copernicus' shift in understanding celestial mechanics. The same year, Steven Sasson at Eastman Kodak invented the first digital camera. By December 1975, it took its first image after capturing multiple images over 23 seconds. The camera weighed 8 pounds and had a resolution of 0.01 megapixels. In 1977, Citibank installed its first ATM, eventually increasing to two machines per branch operating 24/7 by the end of the year. This led to an increase in ATM use during the 1978 New York blizzard. Federal Express launched COSMOS in 1979, digitizing package management and customer services. These developments reflect the rapid expansion of digital technology's scope and reach throughout the late 1960s and early 1970s. The history of data storage and digital innovation is marked by a series of pivotal events. In April 1980, I.A. Tjomsland presented at the Fourth IEEE Symposium on Mass Storage Systems, where he humorously noted that "Data expands to fill the space available," illustrating the growth of data in relation to storage capacity. The same year, computer storage capacities reached new heights with a capacity of 80 gigabytes. Notable figures in the industry made significant contributions during this period. In 1981, Edgar F. ("Ted") Codd was awarded the Turing Award for his work on database management systems. His invention enabled individuals to rely on secure transactions when using ATMs, purchasing airline tickets, or making credit card purchases. However, he also highlighted a challenge: handling heterogeneous data that includes images, text, and miscellaneous facts. The year 1982 saw two significant milestones in the realm of digital innovation. The movie "Tron," released July 9th, presented a futuristic vision of digital life, where characters could be digitized into mainframes. In August, the first commercial compact disc (CD) was produced, featuring Claudio Arrau performing Chopin waltzes. By 1984, personal computer ownership began to rise, with 8.2% of U.S. households reporting ownership. This number would significantly increase in the following decades. The WELL, a virtual community established in February 1985, provided a platform for individuals to connect and share ideas online. The late 1980s saw the rise of digital technology. In 1988, compact discs surpassed vinyl records in sales, demonstrating a shift towards digital music storage. General Instruments made headlines in June 1990 by successfully transmitting a digital HDTV signal through conventional broadcast channels, changing the landscape for television and broadcasting. In the early 1990s, cellular networks began to adopt digital technology, with the first 2G network launched in Finland in 1991. This introduced improved system capacity and data services such as text messaging. Tim Berners-Lee's posting of the first photo on the Web in July 1992 marked another significant milestone. The O'Reilly Digital Media group's launch of the Global Network Navigator (GNN) in May 1993 represented a major step towards commercialization of the internet, offering clickable advertisements and content. 1994 saw Teradata hold the largest commercial database at 10 terabytes, while Pizza Hut possibly made history with its online pizza order. The same year, HotWired started selling banner ads to major advertisers. In 1995, the National Digital Library program began digitizing archival materials from the Library of Congress, and NRK launched the world's first DAB channel. Toy Story became the first feature-film using CGI in theaters. The Internet Archives were established by Brewster Kahle in 1996 to preserve and provide access to nearly every site on the Web. The same year saw other web archiving projects launch, such as PANDORA from the National Library of Australia and Kulturarw Heritage Project from the Royal Library of Sweden. Digital storage became more cost-effective than paper. E-gold was launched in 1996, becoming the first successful digital currency system to gain widespread user adoption and merchant support. In 1998, Jim Gray received the Turing Award for his contributions to database and transaction processing research. Analog cameras peaked at almost 40 million units sold before being replaced by digital cameras. Digital television transmission began in the UK and US in 1998, marking the start of converting analog TV broadcasting to digital. Microsoft patented ones and zeroes in March 1998. The Last Broadcast was the first feature-length movie shot, edited, and distributed digitally via satellite download in October 1998. By December 1998, Nicholas Negroponte wrote that being digital would be like having air and drinking water - its absence would be noticed more than its presence. Walmart held the largest commercial database at 180 terabytes in 1999. Digital photos rapidly replaced traditional film photography by 2000. The MyAudio2Go.com service was launched in September 2000, enabling users to download news, sports, entertainment, weather, and music audio files. Audioblogging or podcasting gained popularity in early 2001 thanks to iPods, cheap audio software, and weblogs. January 1, 2001 saw the Electronic Product Code (EPC) defined at MIT as a replacement for UPC or bar code. Digital information storage surpassed non-digital for the first time in 2002. In the United States, electronic payments began to surpass cash and checks in usage for the first time in 2003. The same year saw the DVD format gaining popularity over VHS, while the Check 21 Act introduced digital check images, increasing paper check processing by over 50 billion. Google launched a book scanning project with several libraries in 2004, followed by the Internet Archives' million book project. By 2007, nearly all of the world's storage capacity was digital, reversing a trend that had begun in 1986. Estonia became the first country to use internet voting in 2007. Online shopping and music sales continued to rise, with iTunes outselling Wal-Mart for music sales. Bitcoin, introduced by Satoshi Nakamoto in 2008, gained traction as did online advertising, which surpassed newspaper ads for the first time in 2010. Digital camera production peaked that year, replaced by smartphones. In 2011, researchers analyzed millions of digitized books to study linguistic and cultural phenomena, coined "culturomics." Amazon sold more Kindle books than print books that same year. Online movie purchases overtook DVD sales for the first time in 2012, with Facebook's data warehouse growing exponentially. E-commerce sales surpassed $1 trillion annually by 2014, with streaming revenue from services like Spotify and Pandora overtaking CD sales. The Internet had a significant impact on relationships among young adults, and its user base reached 3 billion worldwide that summer. In 2015, Michael Stonebraker received the Turing Award for his contributions to modern database systems. That same year, millions of users made billions of digital connections through Skype, Twitter, YouTube, Pinterest, and Netflix. Snap enthusiasts shared a staggering number of posts on social media platforms, while Facebook users lavished praise on an impressive count of online content. A significant report titled '2015 Digital America: A Tale of the Haves and Have-Mores' shed light on the digitization of the US economy. This groundbreaking study introduced the MGI Industry Digitization Index to provide a comprehensive overview of companies' digital advancements. Surprisingly, it was found that only 18% of the country's potential was being utilized in terms of digital growth, which could potentially add up to $2.2 trillion to its annual GDP by 2025. The term 'digital' originates from numbers – specifically ones and zeros – used in binary code. The concept dates back to the mid-1950s when American engineers experimented with using these codes for data transmission over telephone lines. Later, digital technology gained prominence during the 1960s and 1970s due to its speed and clarity in long-distance communication. As a result, ASCII emerged as a benchmark for digital development. The private sector soon adopted this technology, leading to significant advancements in fibre optics and cell phone networks. Cable TV operators also recognized the potential of digital tech, which enabled fast data transmission between satellites across the globe. Today, billions of devices are installed worldwide, while space trash – left behind by old systems – continues to orbit the Earth. The rapid development of digital technology shows no signs of slowing down. With companies like Rhenus High Tech handling high-tech equipment, and initiatives like Elon Musk's 5G satellite launch, we're on the cusp of a new era – The Internet of Things – that promises unparalleled connectivity. A unified network of interconnected AIs will exert control over digital devices and itself, paving the way for numerous applications, including smart traffic management, seamless device control from afar, and enhanced collaborative projects. Nevertheless, if you're searching for a private investor to back your startup, consider these suggestions first. The AI phenomenon is undoubtedly revolutionary, as it has the potential to transcend human constraints and enable innovative solutions to global issues. As AI converges with digital technology, we can anticipate groundbreaking answers to pressing worldwide problems. However, some specialists are voicing concerns about AI's implications, cautioning that machine learning might be humanity's final innovation. To prevent misuse, strict regulations must be established to ensure AI is employed responsibly, ultimately elevating human capabilities to new heights.