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Value and risks of morphing technology into strategy and business model

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Abstract

Digital technologies became the primary source of innovation in the private and public sectors. The Internet profoundly changed the way businesses are run catapulting "most digital" industries and companies to the top of the S&P500. Two innovations that drive digital transformation changing the nature of competition are cloud computing and artificial intelligence (AI) technologies. Cloud-native business models and strategies proved successful in various industries, while AI is being tested in vivo by management mainstream. The publication provides an analysis of a multidimensional impact cloud computing makes on strategies and business models of companies. We show that what made cloud computing special in the management context was the way it morphed into strategies and business models best suited for the uncertain future. We also noted that as the focus of digital transformation shifts towards cloud-based AI powered decision-making solutions, managing the human aspect of "more digital" business models and related risks, recently referred to as an existential threat, becomes a priority of management research.

Keywords: cloud computing, digital transformation, cloud-native strategies, business models, decision-making, artificial intelligence

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Ценность и риски морфинга технологий в стратегии и бизнес-модели

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Аннотация

Цифровые технологии стали главным источником инноваций для частного и государственного секторов. Интернет оказал глубокое влияние на методы ведения бизнеса и способствовал тому, что «наиболее цифровые» отрасли и компании оказались на вершине списка S&P500. Облачные вычисления и технологии искусственного интеллекта – две инновации, ставшие главными драйверами цифровой трансформации, меняют ландшафт конкуренции. Бизнес-модели и стратегии, созданные с учетом использования облачных технологий, доказали свою успешность в различных отраслях, а искусственный интеллект тестируется in vivo управленческим мейнстримом. В статье анализируется многомерное влияние облачных вычислений на стратегии и бизнес-модели компаний. Мы показываем, что особенностью облачных вычислений в контексте менеджмента стала их интеграция в стратегии и бизнес-модели, наиболее подходящие для неопределенного будущего. Мы отмечаем, что по мере того, как фокус цифровой трансформации смещается в сторону применения облачных приложений для поддержки принятия решений на основе технологий искусственного интеллекта, управление человеческим аспектом «более цифровых» бизнес-моделей и соответствующими рисками, которые в последнее время даже называют экзистенциальной угрозой, становится приоритетом для исследований в области управления.

Ключевые слова: облачные вычисления, цифровая трансформация, облачно-нативные стратегии, бизнес-модели, методы принятия решений, искусственный интеллект, морфинг технологий, риски

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Introduction

According to Gartner Inc. worldwide end-user spending on public cloud services is forecast to grow 21.7% to total USD 597.3 billion in 2023, up from USD 491 billion in 2022.[1] All segments of the cloud market are expected to grow in 2023. Infrastructure-as-a-service (IaaS) is forecast to experience the highest end-user spending growth in 2023 at 30.9%, followed by platform-as-a-service (PaaS) at 24.1%. By 2025, enterprises will spend more on public cloud services than traditional IT solutions.

Cloud computing is driving management innovations, as business and organizations pursue disruption through emerging technologies. Like business model innovations of Henry Ford's assembly line in the early 1900s, and Malcolm McLean's patented container shipping in the 1950s, today open architectures, based on Kubernetes and containers, are driving the next wave of cloud-based business innovation.

Despite the conspicuous similarities cloud computing differs significantly from the innovations of Henry Ford and Malcolm McLean. When comparing with an assembly line, various authors note the following.

1. Level of automation: Both innovations use automation to simplify certain operations and increase efficiency. However, in the virtual world, where costs to move information are extremely low, and basic operations take micro and milliseconds, companies require digital technologies and decision-making procedures.

2. Complexity: Cloud systems are much more complex than any physical assembly line because of their distributed nature, and many interdepended elements.

3. Scalability: Both physical assembly lines and cloud systems can be reconfigured and scaled. However, the former will require significant upfront CAPEX (capital expenditure) and time to build premises and buy equipment, whereas cloud-based systems not only can be built and scaled up gradually, but they can quickly increase or decrease resources following the changing demand.

4. Standardization: Assembly lines use standardized elements and processes to achieve reliability and quality of products. Seamless operation of cloud-based solutions in heterogeneous computing environments is facilitated by containers and microservices.

5. Efficiency: Both assembly lines and cloud-based systems are designed to maximize efficiency and minimize operating losses. While the former focuses on time and effort per operation or product, efficiency of the latter is achieved by optimizing the computational and network resources with minimum system idle time.

When analyzing and comparing cloud-based strategies and business models with those from analogue era, we need to consider the following factors:

• managing in physical and digital environments: The differences of real and virtual processes require radically different approaches to management and optimizations.

• human participation: The use of digital automation significantly changes the nature of human involvement. Management of cloud-enabled processes is mainly done through software and infrastructure solutions.

Polls ran by Google show that 41.4% of global tech and business leaders plan to increase their investment in cloud-based services and products because of the current economic climate.[2] McKinsey foresees that companies in every industry can capture substantial value from cloud with more than USD 1 trillion in run-rate EBITDA across Fortune 500 companies up for grabs in 2030, based on a detailed review of cloud cost-optimization levers and value-oriented business use cases.[3]

Research materials

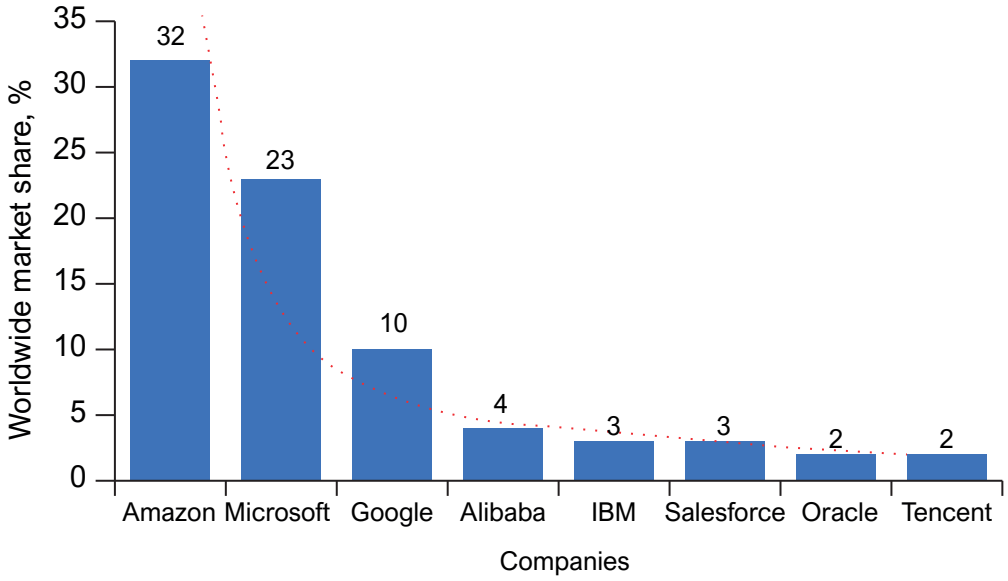
Various publications that analyze the ubiquity of applications and the speed at which cloud computing is being adopted by businesses and organizations look either at its technological aspects, the benefits of cloud-enabled business models, or the attributes of cloud-native strategies. To offer an answer to the question why cloud computing quickly became a solution of choice, we reviewed its multi-dimensional impact on competition and valuations of cloud providers and customers.

Figure 1 illustrates the worldwide market share of leading cloud infrastructure service providers in Q1 2023, including PaaS, IaaS and hosted private cloud services. The Big Tech, i.e. Amazon, Microsoft, and Google, account for more than 60% of the global cloud computing market.

[1] Gartner (Wednesday 19 Apr. 2023), *Gartner Forecasts Worldwide Public Cloud End-User Spending to Reach Nearly $600 Billion in 2023*, available at: https://www.gartner.com/en/newsroom/press-releases/2023-04-19-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-reach-nearly-600-billion-in-2023 (accessed 25.04.2023).

[2] Blair F. (Friday 3 Feb. 2023), "Survey says: Leaders are doubling down on cloud for stability and financial resilience", *Google Cloud*, available at: https://cloud.google.com/blog/transform/google-survey-build-financial-business-resilience-cost-optimization-cloud-finops (accessed 25.04.2023).

[3] McKinsey Digital (Friday 26 Feb. 2021), *Cloud's trillion-dollar prize is up for grabs*, available at: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/clouds-trillion-dollar-prize-is-up-for-grabs (accessed 25.04.2023).



Source[4]

Fig. 1. Worldwide market share of leading cloud infrastructure service providers in Q1 2023

The dominance of Amazon reflects the strategic transformation that it undertook by offering cloud services to its customers in the early 2000s. The distribution of market shares of leading cloud providers follows a power law typical, but relative shares of the Big3, i.e. Amazon, Microsoft, and Google, changed over time as Microsoft and Google have been gaining market shares over the last five years (Fig. 2).

Public cloud services are available to the general public and private cloud services are provided to the entities within an organization. Hybrid cloud can be viewed as a combined employment of public and private clouds, however public and private cloud services typically have different information management and disclosure policies because of privacy issues.

Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) are leading public cloud providers offering all three of SaaS (software-as-a-service), PaaS and IaaS. Many companies specialize in a single service model, i.e. Netflix specializes in video streaming services and Dropbox in storage services.

Results

The key elements of what is now known as cloud services are: 1) a service as utility, such as computing or storage; 2) sharing of the same computer resource, referred to as virtualization, and 3) access to services via networking (Fig. 3).[5]

For the first time, the idea that computing would someday be sold as a service was expressed in 1961 by John McCarthy, the inventor of LISP programming language and the one who coined the term "artificial intelligence".[6] In 1967, IBM virtualized operating systems allowing for multiple users to timeshare the same resource.[7] In 1969, ARPANET (Advanced Research Projects Agency Network), the first TCP/IP network was launched and became the forerunner of the Internet.

However, it took twenty years for the technologies underlying cloud computing to reach a certain level of maturity. The launch of the World Wide Web in 1991 connected a million computers to the Internet, and the adoption of the client-server model of distributed computing laid grounds for the dotcom revolution and ascent of e-commerce.

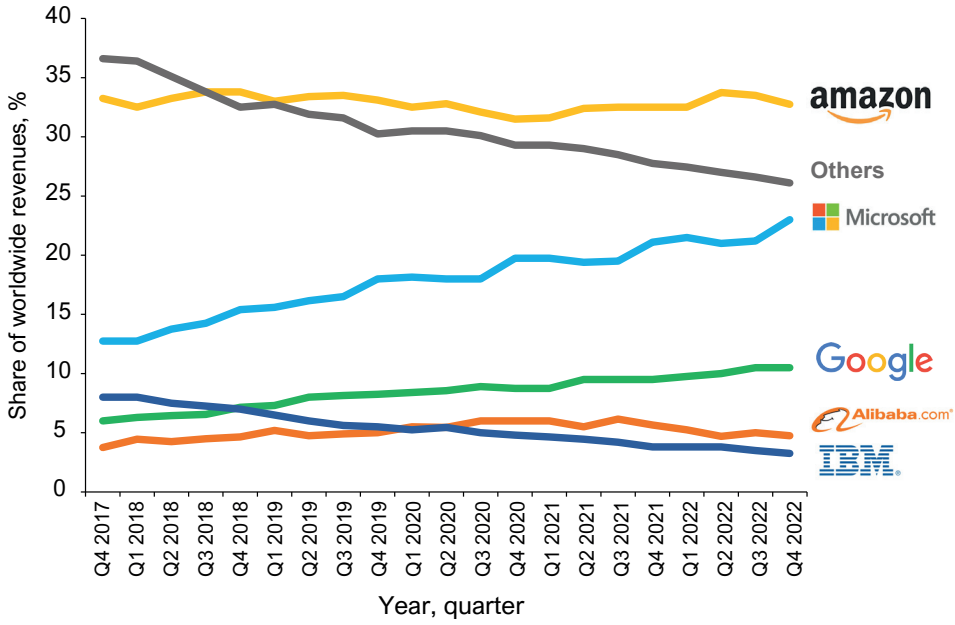
It took ten more years to transform the concept of cloud, from the "grid computing" introduced in the mid-1990s where grids networked resources of organizations across countries and continents but were not accessible to non-

[4] Synergy Research Group (Thursday 27 Apr. 2023), *Q1 Cloud Spending Grows by Over $10 Billion from 2022; the Big Three Account for 65% of the Total*, available at: https://www.srgresearch.com/articles/q1-cloud-spending-grows-by-over-10-billion-from-2022-the-big-three-account-for-65-of-the-total (accessed 02.05.2023).

[5] Blesson *V.* (Sunday 19 Mar. 2019), "History of the cloud", *BCS*, available at: https://www.bcs.org/articles-opinion-and-research/history-of-the-cloud/ (accessed 23.04.2023).

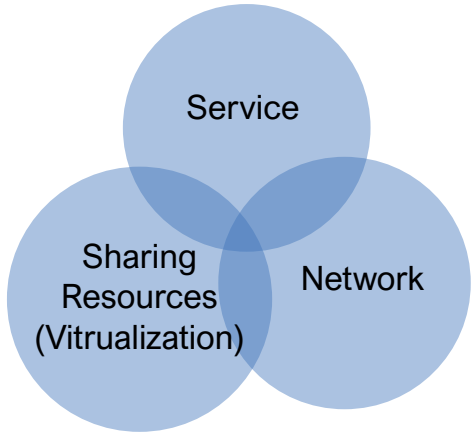
[6] John McCarthy's Original Website (2023), *Contributions and Impact,* available at: http://jmc.stanford.edu/contributions/index.html (accessed 23.04.2023).

[7] IBM (Friday 6 Jan. 2017), *A Brief History of Cloud Computing,* available at: https://www.ibm.com/cloud/blog/cloud-computing-history (accessed 23.04.2023).



Source[8]

Fig. 2. Quarterly cloud provider market share trend 2017–2022



Compiled by the authors on the research materials

Fig. 3. The key elements of a cloud service

specialist users or developers. An important additional factor that contributed to the development of the cloud technology market was the transition of traditionally "product" companies, including SAP, Oracle, IBM, Hewlett-Packard, to a wider use of the service business model [Suarez, Cusumano, Kahl, 2013].

The first use of the term "cloud computing" in its modern context is credited to then Google CEO Eric Schmidt who introduced it in 2006.[9,10] Importantly, Eric Schmidt was talking about cloud computing in the context of a business model, "What's interesting [now] is that there is an emergent new model... I don't think people have really understood how big this opportunity really is. It starts with the premise that the data services

[8] Synergy Research Group (Monday 6 Feb. 2023), *Cloud Spending Growth Rate Slows But Q4 Still Up By $10 Billion from 2021; Microsoft Gains Market Share*, available at: https://www.srgresearch.com/articles/cloud-spending-growth-rate-slows-but-q4-still-up-by-10-billion-from-2021-microsoft-gains-market-share (accessed 02.05.2023).

[9] Regalado A. (Monday 31 Oct. 2011), "Who Coined 'Cloud Computing'?", *MIT Technology Review*, available at: https://www.technologyreview.com/2011/10/31/257406/who-coined-cloud-computing/#:~:text=The%20notion%20of%20network-based%20computing%20dates%20to%20the,Schmidt%20introduced%20the%20term%20to%20an%20industry%20conference (accessed 23.04.2023).

[10] Google Press Center (Wednesday 9 Aug. 2006), *Conversation with Eric Schmidt hosted by Danny Sullivan*, available at: https://www.google.com/press/podium/ses2006.html (accessed 23.04.2023).

and architecture should be on servers. We call it cloud computing – they should be in a 'cloud' somewhere."

According to the National Institute of Standards and Technology (NIST) cloud computing is also defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [Mell, Grance, 2011].

The transformative potential of the new business model was first demonstrated by Amazon, a dot-com-era technology company best known for selling books.[11] In 2004 while working to streamline an internal process between programmers and hardware engineers an Amazon engineer decided to design an application that could facilitate renting Amazon's computing facilities to be managed by customers. The public beta of Amazon's IaaS was released in 2006, quickly gaining popularity and contributing to the exponential revenue grow of the segment now called Amazon Web Service[12] (Fig. 4).

The concept of renting servers to be managed by someone else, somewhere else, was exactly new. The innovation of the business model was flexible pricing that allowed customers to buy servers by the hour, particularly appealing to businesses with uncertain future demand and the need to increase computing capacity quickly.

Another example of strategic innovation in cloud computing is the adopted a new strategy of Microsoft's digital transformation in 2013.[13] The focus on cloud computing had a significant impact on the increase in the market capitalization of the company which now is of the Top3 providers of cloud services (Fig. 5).

According to the corporate statement published by Microsoft in 2013 the change of the strategic focus was required to address "...recent growth of broadband and the mobile Internet as well as the development of newer devices such as tablets and smartphones that fundamentally changed consumers' experiences and use of technology to begin an always-on, always-connected era that holds new promise for what technology can bring to people's lives and to businesses everywhere on the planet." [14]

The key guiding principles of the new strategy included:

- a business model based on partner and first-party devices with both consumer and enterprise services;
- optimization for activities people value most;
- a family of devices powered by a service-enabled shell;
- design for enterprise extensibility and enterprise needs.

The strategy was intended to fully realize the potential of the main intangible and infrastructure assets created by Microsoft, such as:

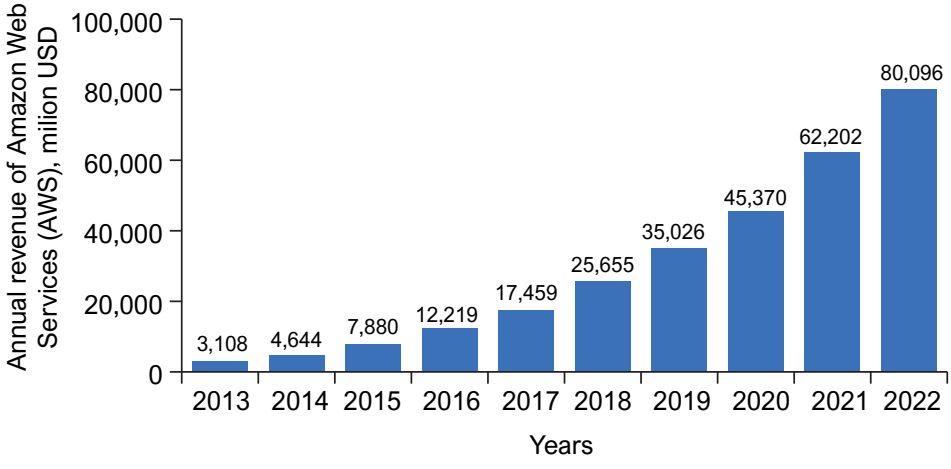
- a super-intelligent cloud that understands people and can solve problems for them;
- a platform that is adaptable to every screen – big, small, mobile, institutional, personal and even wearable –

[11] Gaun C. (Monday 12 Nov. 2012), "An Amazon engineer had a little idea that turned into a billion-dollar business", *The Anlantic*, available at: https://www.theatlantic.com/technology/archive/2012/11/an-amazon-engineer-had-a-little-idea-that-turned-into-a-billion-dollar-business/265124/ (accessed 23.04.2023).

[12] Ibid.

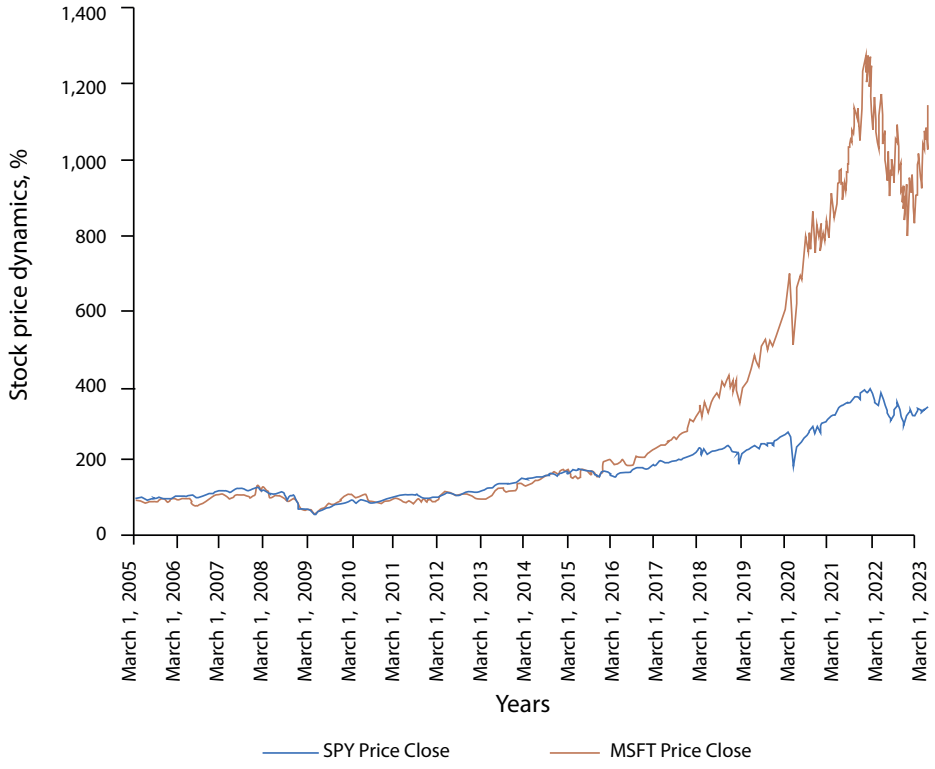
[13] Microsoft (Wednesday 10 May 2023), *Understanding Microsoft's digital transformation*, available at: https://www.microsoft.com/insidetrack/blog/inside-the-transformation-of-it-and-operations-at-microsoft/ (accessed 12.05.2023).

[14] Microsoft (Thursday 11 Jul. 2013), *Transforming Our Company*, available at: https://news.microsoft.com/2013/07/11/transforming-our-company/ (accessed 23.04.2023).



Compiled by the authors on the research materials

Fig. 4. Annual revenue of Amazon Web Services (AWS) from 2013 to 2022



Compiled by the authors based on data from NYMEX[15]

Fig. 5. Microsoft stock price dynamics VS S&P500 index

and is defined by a set of universal services that meet people's needs at home, work and school;

• gaming and home entertainment platform.

The bed rock of innovation of the new strategy was the digital ecosystem built by Microsoft: platform, services, and apps. The element of the strategy that in our opinion may prove transformative in the future was what Microsoft identified as "next-generation decision-making and task completion." Powered by Microsoft's machine learning infrastructure it was intended to "understand people's needs and what is available in the world and will provide information and assistance." At that time an artificial intelligence (AI) chatbot ChatGPT was only developing by OpenAI laboratory. In three years, Microsoft partnered with OpenAI and after another three years, it consolidated the partnership with a USD 1 bilion investment. OpenAI continues working closely with Microsoft's Azure cloud platform and facilitates AI functionality that promises to become the next big thing on the Internet.

Google cloud revenue primarily generated through the Google Cloud Platform has the same pattern as we saw above for Amazon and Microsoft albeit lagging in time. According to Statista, in 2022, Google Cloud revenue amounted to USD 26.28 billion, representing 9.3% of Google's total revenues[16]. To put it into context, Amazon's AWS accounts for 12.5% of the total revenue of the company but earns more than half of its operating income (Fig. 6).

Cloud computing is transforming the business world and its market is growing at an exponential rate. Industry distribution of AWS and Microsoft Azure users according to Enlyft is provided on the Figure 7.

Industry breakdown for Google Cloud Platform (GCP) besides Retail, Construction, Hospital & Health Care, and IT industries shows that the company has a significant number of users in industries where AWS or Microsoft are less active, i.e., Consumer services (21,175), Marketing and Advertising (20,454) and Restaurants (19,791).

[15] CME Group (2023), *NYMEX*, available at: https://www.cmegroup.com/company/nymex.html (accessed 23.04.2023).

[16] Statista (Thursday 30 Mar. 2023), *Global Google Cloud revenues from 2017 to 2022*, available at: https://www.statista.com/statistics/478176/google-public-cloud-revenue/ (accessed 23.04.2023).

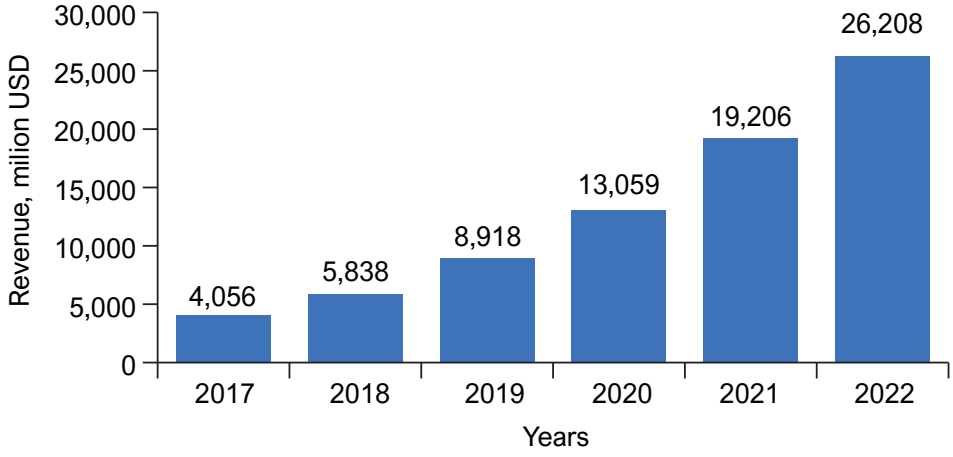


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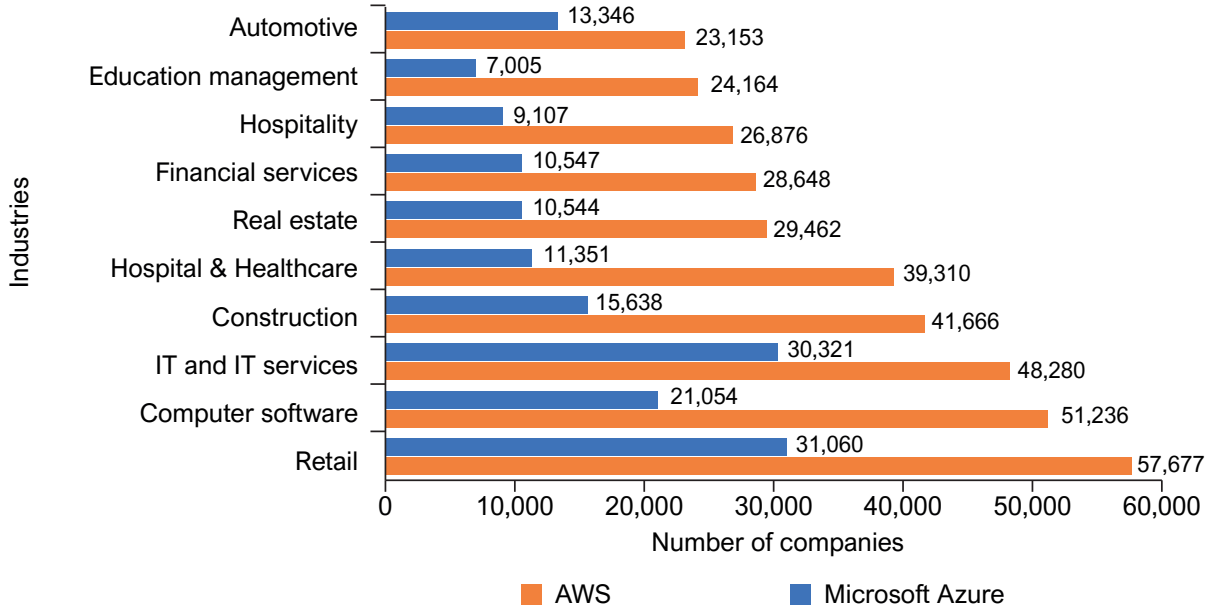
Fig. 6. Global Google Cloud revenues 2017–2022



Source[18]

Fig. 7. Distribution of companies using Amazon Web Services (AWS) and Microsoft Azure by industry

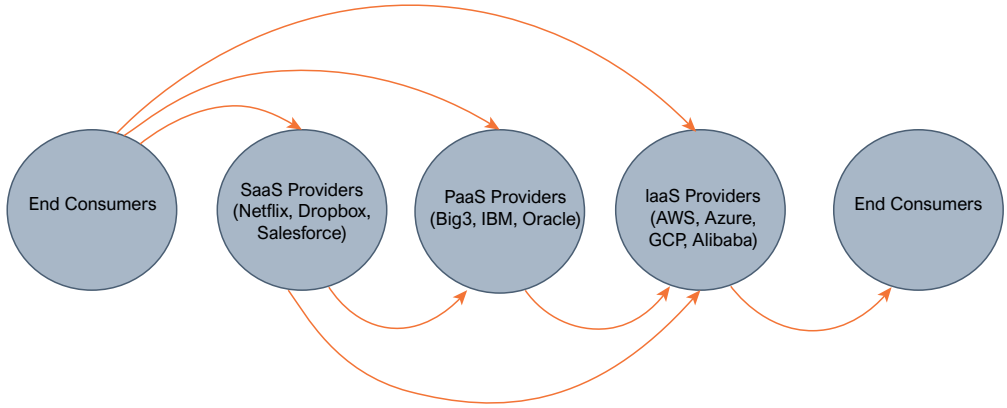
Discussion

The cloud computing industry is a complex ecosystem with many service providers and stakeholders, including clients, software and hardware vendors each with a unique set of decision problems [Iyoob et al., 2013]. An illustration of the cloud computing value chain shows the interrelations of cloud ecosystem constituents (Fig. 8). An arrow shows a customer-and-service-provider relation.

The composition of industries shows that competitive advantage of a cloud solution provider is related to its core competence and technology. It makes it almost inevitable for the competition between Google and Microsoft to only increase with time. Some examples of successful adoption of cloud technologies by major companies as part of their digital transformations and the logic of choice of the cloud provider are summarized in the Table 1.

[17] Ibid.

[18] Enlyft (2023), *Companies using Microsoft Azure*, available at: https://enlyft.com/tech/products/microsoft-azure (accessed 23.04.2023).



SaaS – software-as-a-service, PaaS – platform-as-a-service, IaaS – infrastructure-as-a-service

Compiled by the authors on the materials of the source [Chen et al., 2022].

Fig. 8. The value chain in the cloud computing market

Table 1

Examples of successful adoption of cloud technologies by major companies

Company	Cloud provider	Reasons for selecting a provider
General Electric (GE)	Amazon Web Services (AWS)	GE began its digital transformation in 2014 when then-General Electric CEO Jeff Immelt started pushing to transform GE from an industrial giant to a digital superpower. The proposal called for the company to build its own "industrial" cloud data centers to run software both for GE itself and for its large customers.[19] However, it later decided to focus on other aspects of its business while leaving the cloud infrastructure necessities to Amazon Web Services (AWS). In 2017, GE selected AWS as its preferred provider to host more than 2,000 cloud-based apps and services. Chris Drumgoole, General Electric's Chief Technology Officer and Corporate Vice President said: "Adopting a cloud-first strategy with AWS is helping our IT teams get out of the business of building and running data centers and refocus our resources on innovation as we undergo one of the largest and most important transformations in GE's history."
Kroger	Microsoft Azure	Kroger, a major grocery retailer, has thousands of projects for testing and development running as well as live applications. Like most big established enterprises, Kroger isn't moving everything to the public cloud. The company still has many of its core computing functions and storage in its own data centers. Kroger didn't specify how much the company is spending on the cloud, but said it's in the millions of US dollars and is split roughly equally between Microsoft and Google, but "over time that balance could shift depending on who creates more value."[20] Then, in 2019, Kroger partnered with Microsoft to combine the online and brick and mortar shopping experiences to modernize shopping. The Microsoft Azure cloud platform will help Kroger move forward with a data-driven approach to grocery shopping that keeps customer needs in mind, partially by using technologies including artificial intelligence
Uber	Google / Oracle	Uber decided to have Google Cloud and Oracle host its data-cloud infrastructure.[21] Uber's business model depends on data-driven decision-making and on-demand optimization. Its data platform tracks billions of daily events and organizes that data into a platform leveraged by users around the world. Therefore, the data infrastructure that hosts and powers these engines is fundamental to every aspect of Uber's business. Data signals are incorporated throughout their platform to inform dynamic pricing, predict wait times, and match supply and demand. Moving their data and services to Google Cloud also supports Uber's future growth strategy by increasing flexibility, scalability and providing immediate access to technology advances. Commenting on why Uber picked Google Cloud and Oracle and not Microsoft and/or AWS Umesh Vemuri, Google VP Global Strategic Customers, explained "For starters, we bring [to Uber] the innovation of Google… Customers choose us because we bring together innovations from across Google to deliver some of the industry's leading cloud technologies built on global infrastructure that delivers high levels of performance and availability." Asked how Google Cloud and Oracle will work together to ensure seamless integration of their services for Uber, Umesh Vemuri noted, "We work in environments with other cloud providers, as very few customers have a single cloud provider; this is nothing new."

Compiled by the authors on the research materials

[19] Darrow B. (Thursday 6 Aug. 2015), "GE is building its own cloud; outsiders wonder why", *Fortune*, available at: https://fortune.com/2015/08/06/ge-is-building-its-own-cloud-outsiders-wonder-why/ (accessed 23.04.2023).

[20] Levy A. (Wednesday 8 Nov. 2017), "Kroger using Google and Microsoft clouds to avoid paying Amazon", *CNBC*, available at: https://www.cnbc.com/2017/11/08/kroger-using-google-and-microsoft-clouds-to-avoid-paying-amazon.html (accessed 23.04.2023).

[21] Evans B. (Friday 17 Feb. 2023), "Why Uber Picked Google Cloud: The Inside Story (accelerationeconomy.com)Why Uber Picked Google Cloud: The Inside Story", *Acceleration Economy,* available at: https://accelerationeconomy.com/cloud-wars/why-uber-picked-google-cloud-the-inside-story/ (accessed 23.04.2023).

Moving to the cloud is no longer optional, especially when the economy is highly uncertain. The public cloud's elasticity and scalability reduce the financial risk of innovation while enabling business agility when companies need it most. With revenues of the public cloud market of about USD 600 billion in 2023 and assuming a revenue multiple of 3x which markets use to value companies like Microsoft, we can expect that the total value created by the public cloud services provider is close to USD 2 trillion. That does not account for the value created by the customers and users of cloud computing solutions.

The evolution of cloud computing industry gives rise to new service models, including Function-as-a-Service and Backend-as-a-Service[22]. The competition in the cloud market will increase, but there seems to be plenty of room for value creation as new technology applications and business models are emerging. Some of the top cloud computing trends expected by industry experts in 2023 include solutions for powering hybrid workers, cloud sustainability, adoption of cloud-native strategies, maturity of Everything-as-a-Service business models (XaaS).[23]

We need not forget the importance of the human factor in value creation by digital transformation powered by cloud computing and AI. The 1967 insight of John Culkin "We become what we behold. We shape our tools and then our tools shape us" [24] conveys the essence of digital transformation.

To become and remain successful companies need to prioritize the human resources element of their digital strategies. Traditional job roles, such as technical or financial, core operations or supportive activities may evolve towards domain knowledge, which is shared in collaborative teams, established and disassembled along product life cycle. Adaptive strategies and coopetition business models will require acquiring new management skills to fully benefit from partners' comparative advantages producing temporary alliances to meet emerging market needs.

The wide adoption of AI will only raise the skills bar and narrow focus on the quality of human resources across all industries. According to IDC FutureScape: Worldwide Artificial Intelligence and Automation 2022 Predictions, 85% of enterprises will combine human expertise with AI, machine learning (ML), natural language processing (NLP), and pattern recognition to help augment foresight, increasing worker productivity by 25% in 2026.[25]

Finally, the more powerful the tool, the higher the risks of unintended or harmful consequences of its use. The concern of AI developers is well grounded and AI-powered "Everything-as-a-Service concept", however appealing, needs to be well researched and analyzed before its wide adoption becomes a systemic economy-wide risk.

Conclusion

Technologies profoundly impact the way businesses are run. Significant potential benefits of cloud computing underpin the fast growth in the number of companies and organizations adopting cloud-native strategies and business models to create value for their stakeholders. To offer an answer to the question why cloud computing became a solution of choice in no time, we reviewed its multi-dimensional impact on competition and valuations of cloud providers and customers.

Historically, the way information technology changed management was through changes in how information is gathered.[26] Cloud-based solutions significantly increase the volume and speed at which information travels between companies, its partners, and clients. However, the transformation from cost savings to value creation will require firms and organizations to prioritize the development of cloud-native strategies and business models with a focus on decision-making as the key value-creating processes.

More digital companies have an edge, but to gain full benefit they, and those companies and industries that are currently lagging in digital transformation, will need to re-engineer processes and acquire skills necessary for adoption of cloud-native business models and strategies. The importance of human factor will keep increasing as the future becomes more uncertain and the risks of use and misuse of AI-powered cloud systems rise [Denisova, Lopatnikov, 2022].

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