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The expansionary strategies of intellectual monopolies: Google and the digitalization of healthcare

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Abstract

As big tech companies are entering new industrial sectors, an open question concerns the drivers of their expansionary strategies. This paper proposes that these companies are currently entering sectors based on their data-driven intellectual monopoly power, thereby complementing the preliminary answer provided by political economy research which has argued that expansion is driven by their infrastructural power. This approach is developed through a historical analysis of tech giants as companies that systematically turn knowledge and data into intangible assets, showing their expansionary strategies in the healthcare sector to be mainly driven by insights obtained from those intangible assets (a monopolized intangibles driver) and by a quest for conquering new knowledge and data to perpetuate their intellectual monopolies (an intangibles prospecting driver). The paper further illustrates its arguments through a case study of Google's expansionary strategy and its prioritized incursion into healthcare.

Keywords: platforms; big tech; intellectual monopolies; healthcare digitalization; Google.

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Introduction

In 2015, Tom Insel, the United States' top mental health researcher left the US National Institute of Mental Health to work for the private sector. He did not join a big pharmaceutical firm, but Alphabet, Google's parent company (for simplicity, in the rest of this paper we refer to the company as Google). Interviewed by the *MIT Technology Review*, Insel claimed 'In the future, when we think of the private sector and health research, we may be thinking of Apple and IBM more than Lilly and Pfizer'.[1] Insel was not an outlier; at least 23 tenured or tenure-track professors left US universities between 2014 and 2018 to work for Google (Benaich & Hogarth, 2020). Healthcare is one among the many sectors that are currently being disrupted by big tech companies, motivating this paper's main critical analytical question and contribution: what is driving these tech giants' current expansionary digitization strategies?

The existing political economy literature has argued that these companies expand based largely on their digital infrastructural advantage or power (Bratton, 2016; Dolata, 2017; Jacobides *et al.*, 2021; Kenney & Zysman, 2016; Khan, 2017; Van Dijck *et al.*, 2018). This paper provides a complementary conceptualization, building on the intellectual monopoly framework (Durand & Milberg, 2020; Pagano, 2014; Rikap, 2021). According to this emerging approach, today's leading corporations are intellectual monopolies because they base their power on the systematic appropriation of knowledge (and data in the case of tech giants) which is turned into rent-bearing intangible assets (Birch, 2019; Birch *et al.*, 2020; Rikap, 2020; Teixeira & Rotta, 2012). Further developing this approach, this paper proposes that big tech expansionary strategies are driven by intellectual monopoly power in two complementary ways: first, they enter new sectors by building on insights from their intangible assets (knowledge and data), what will be dubbed a monopolized intangibles driver; and, second, they expand not only to establish dominant market positions in new sectors, but also to acquire new knowledge and data sources to perpetuate their intellectual monopolies, what will be termed an intangibles prospecting driver.

To illustrate this line of analytical reasoning, the paper overviews tech giants' recent healthcare initiatives and then focuses on Google's overall expansionary strategy from three complementary dimensions. First, we will examine Google's recent innovation networks in terms of actors and research priorities. Besides its computer sciences' core, our network and clustering analysis will show that healthcare and biomedical sciences are a priority within Google's research efforts. Second, and complementing these findings, we will analyse the key industrial sectors of Google's acquisitions over time. Acquisitions can both be used to enter a new sector and to exclusively access knowledge and data to further expand Google's intellectual monopoly, and thus enable an intangibles prospecting driver. Here, again, healthcare appears as an emerging priority together with education, and we will show that healthcare and education acquisitions have provided Google with additional intangible assets. Third, we will show that, besides privileging healthcare, Google has developed or is developing solutions for every artificial intelligence (AI) application field as defined by WIPO (2019). Our empirical analysis will also point to different stages in Google's expansionary strategy. Its initial expansion beyond search engines relied both on Google's infrastructural and intellectual monopoly power. However, in Google's ongoing expansionary digitalization that embraces the healthcare sector in particular, its intellectual monopoly power is the primary and crucial driver.

The remainder of this paper is organized as follows. In the next section, we complement political economy analyses on big digital tech companies' infrastructural power with a historical and conceptual analysis that foregrounds their data-driven intellectual monopolies. Combining both explanations of tech giants' power, the third section elaborates on their expansionary strategies into the healthcare sector where intellectual monopoly drivers rather than infrastructural advantages are key. The fourth section of the paper briefly summarizes our case methodology for studying Google's overall expansionary strategy, and the main findings are presented and discussed in section five. We show that expansion into healthcare is a priority within Google's overall strategy, and argue that its intellectual monopoly power is crucial for explaining why and how Google is prioritizing healthcare. The final section concludes by reflecting on the paper's policy implications.

From platform infrastructures to data-driven intellectual monopolies

In the digital space economy, the term 'platform' has multiple meanings and roots (Gillespie, 2010; Langley & Leyshon, 2017). Within the current political economy literature, two conceptualizations stand out. First, platforms are understood to be a new type of business or company (Frenken & Fuenfschilling, 2020; Sadowski, 2020; Srnicek, 2017, 2021), thereby denoting that a majority of digital platforms eventually became or were directly born as for-profit businesses (see Van Dijck, 2013). Second, authors refer to platforms as a distinct relational arena or type of organization that is neither a state (or a direct hierarchy) nor a market, even if some agree that platforms retain features of both (Bratton, 2016; Caliskan, 2020; Peck & Phillips, 2020; Stark & Pais, 2020). In this respect, platforms can be thought as a new specimen whose logic, as Bratton (2016) puts it, cannot be reduced to that of states or markets or machines, not least because they would seem to combine all of these logics at the same time.

However, and leaving aside these differences, across these conceptualizations, political economy analyses often turn to the category of 'infrastructure' to attempt to integrate the technical features of digital platforms with their business and organizational structures. Unlike mainstream economics' perspectives, then, political economists tend not to regard platforms as neutral intermediaries or neutral digital infrastructures (see for instance Rochet & Tirole, 2003). For example, in Langley and Leyshon's (2017, p. 14) seminal paper on platform capitalism, platforms are 'understood as a distinct mode of socio-technical intermediary and business arrangement', as the infrastructures of a new form of digital economic circulation. Platforms are the digital infrastructures that connect users but are also businesses and organizations which curate those connections by using technical, discursive and formal protocols to set their own terms (Bratton, 2016; Dolata, 2019; Langley & Leyshon, 2017; Van Dijck, 2013). The common argument found within the political economy literature is, thus, that platforms engender inherently asymmetrical relations between platform operators and users and other actors precisely because they operate at the level of the infrastructure (Poell *et al.*, 2019). In the words of Srnicek's (2017) influential book, platforms have designed a core architecture that both provides for and governs the infrastructure of platform capitalism.

Indeed, infrastructural power has also been the main argument advanced by political economists to explain heterogeneities among platforms. As Montalban *et al.* (2019) emphasize, platforms are not an homogeneous group of businesses and organizations. Struggling platforms either do not make profits or do not create value, sometimes even destroying value. And, among successful platforms, the undisputed winners of the digital race are US, and to a lesser extent Chinese, big tech firms (Dolata, 2017; Rikap & Lundvall, 2021). Sadowski (2020) refers to big tech as companies that have monopolized essential services from which they extract absolute rents, which is close to Van Dijck and Poell's (2016) conception of these companies as realizing their power and profits by providing core infrastructural platforms which enable them to collect and combine data flows. Big tech companies, then, provide the infrastructure that all the other platforms such as Airbnb, Spotify and Uber – defined by Van Dijck and Poell (2016) as sectoral platforms – need to operate. Similar reasoning is put forward by Blanke and Pybus (2020) who concentrate on how the technical integration of Google and Meta has enabled them to be indispensable to the source code of the vast majority of apps. Furthermore, Jacobides *et al.* (2021) identify the infrastructural power of big tech platforms in AI, largely as a consequence of their role as cloud computing providers.

There nonetheless remains an undertheorized aspect of the undoubted and distinctive power of big tech companies: what is it that has enabled them to build such an infrastructural core or to monopolize essential (digital) services in the first place? In other words, even if tech giants' power emerges from their infrastructural advantage as platforms, this explanation already starts by accepting that tech giants are powerful business organizations that own such privileged infrastructures. Fundamentally, this overlooks what big tech companies share with other world leading corporations from the most diverse industries: they are concentrations of intangible assets. In 1976, 1 per cent of the assets of S&P 500 corporations were intangibles; this figure had escalated to

90 per cent by 2020. Assets are privately appropriated goods that are used to capture value from society in the form of long-lasting economic rents (see for instance Birch & Muniesa, 2020). In the case of intangible assets, Foley (2013, p. 265) explains that unlike land, knowledge and information 'can be rented or sold over and over again in very cheaply produced copies'. These rents have been dubbed intellectual, knowledge or technoscientific rents (Birch, 2019; Durand & Milberg, 2020; Pagano, 2014; Rikap, 2019; Teixeira & Rotta, 2012).

Explaining the concentration of intangible assets – and thus intellectual rents – from a historical and institutional perspective requires us to highlight the privatization and assetization of knowledge since the 1980s in the United States, processes which have been globalized since the mid-1990s triggered by the TRIPS agreement (Dreyfuss & Frankel, 2014; Orsi & Coriat, 2006). Unsurprisingly, after the establishment of a stringent international intellectual property rights (IPRs) regime, Dernis *et al.* (2019) found that just 2,000 corporations own 60 per cent of the patents simultaneously obtained at the world's five largest patent offices between 2014 and 2016. This transnational expansion of companies concentrating IPRs has been conceptualized as the emergence of a special type of legal monopoly called the intellectual monopoly (Boldrin & Levine, 2008; Pagano, 2014). As a preliminary definition, following Rikap and Lundvall (2021), the term intellectual monopoly refers to how organizations establish and sustain exclusive control and access to knowledge and information.

Beyond IPRs, it has also been shown that intellectual monopolies sprang from knowledge-specific features (Rikap, 2021). Firms that innovate have a greater absorptive capacity – understood as the capacity to absorb knowledge from the environment – to keep learning and innovating (Cohen & Levinthal, 1990). When certain firms innovate faster than other market participants, they engender intellectual monopolies based on their greater absorptive capacity with or without protecting knowledge with IPRs. As explained by Lemley and Feldman (2016, p. 188), 'in fast-moving industries, such as information technology, the technology described in the patent may be obsolete by the time anyone could read it'. In addition to this dynamic and the recent strengthening and expansion of IPRs previously mentioned, two historical transformations further contributed to intellectual monopolization. On the legal front, legislation that grants trade secrets was put in place over a century ago (Fisk, 2000), but has become all the more important as production has increasingly been more science and technology led since the Cold War (Weiss, 2014). And, given technological change, the acceleration effect of information and telecommunication technologies in the circulation of public knowledge has facilitated the appropriation and assetization of knowledge by those with the highest absorptive capacities.

Today's leading corporations also increasingly cement and expand their intellectual monopolies by capturing knowledge and data. Data are harvested from society (users, clients, etc.) and knowledge is not entirely produced in-house and is likely to be generated by other organizations or in (global) innovation networks or systems (Rikap, 2019, 2020, 2022; Rikap & Lundvall, 2020). The emergence of these global innovation networks, composed of modular blocks spread around the world where specialized research and development (R&D) tasks take place (Ernst, 2009; Liu *et al.*, 2013), relied on what Antonelli (1999, p. 243) called the 'deverticalization of knowledge production activities from the boundaries of the corporation'. Although the innovation process is geographically dispersed and takes place at multiple organizations, it can thus be seen that intellectual monopolies organize and control the overall processes, exercising knowledge predation and collecting most of the associated intellectual rents (Rikap, 2019, 2020).

The outsourcing of R&D by big pharma is, perhaps, the most extreme example of global innovation networks led by intellectual monopolies (Rikap, 2019), but big tech companies are also knowledge predators organizing global innovation networks that feature leading universities, public research organizations and start-up companies. Despite establishing hundreds of research collaborations, Google, Amazon and Microsoft only shared ownership of between 0.1 and 0.3 per cent of their patents with other organizations (Rikap, 2020; Rikap & Lundvall, 2020). Rikap and Lundvall (2020) argued that, by organizing multiple innovation networks over time and simultaneously, big tech companies extend their accumulation of intangible assets, thus further reinforcing their intellectual monopolies. Another way to strengthen an intellectual monopoly is to acquire companies as a way to get access to their talent and technology, which is also a strategy frequently used by big tech (Bourreau & de Streel, 2020; Lopez Giron & Vialle, 2017; WIPO, 2019). In line with Harvey (2002), a twofold process reinforces these companies' monopoly power: capital centralization (mergers & acquisitions) and the reinforcement of intangibles' assetization, thus the perpetuation of intellectual rentiership.

It should be stressed, however, that both the infrastructural and intellectual monopoly explanations of big tech power tend to identify them as capitalist rentiers. In this respect, the difference between both explanations concerns the nature or type of rents pointed out as those garnered by big tech and, therefore, the effects of their rentiership. For example, Srnicek (2021) states that platforms, in particular big tech firms, are rentiers that capture value through advertising rents, infrastructure rents and IPRs. Concerning the former, Srnicek (2021) explains that platforms' monopolized data have enabled the enclosure of the digital space, which is leased for a fee to companies that want to advertise their products. Meanwhile, Srnicek (2021) defines infrastructure rents as fees paid to get access to a platform, with the cloud as the clearest example because organizations rent what they used to own. In a similar vein, for Sadowski (2020), platform companies are the prevailing form of rentier in contemporary capitalism, collecting rents both in money and data. In line with Srnicek (2021), for Sadowski (2020) rentier platforms operate by extracting data, enclosing digital realms and converging with other rentiers, for instance, by expanding the real estate market. Concerning

IPRs, as the intellectual monopoly framework emphasizes, they are only one type of intellectual rent (Durand & Milberg, 2020; Rikap, 2020).

As noted above, even without IPRs, an organization can extend its intellectual monopoly over time if it systematically innovates anew before others adopt its previous innovation, which can be kept secret or tacit or even require a certain degree of absorptive capacity to be adopted that is only available to the intellectual monopoly. For instance, only 15 per cent of the papers dealing with AI disclose the code involved (Benaich & Hogarth, 2020). In this example, the most advanced forms of knowledge are kept secret, and rents will be extracted from their exclusive use. The intellectual monopoly will be the only one selling certain commodities based on that knowledge.

Moreover, big tech firms even sell the possibility to use that knowledge as a cloud service without providing access to it. In the cloud, they offer algorithms as black boxes that can be integrated into other organizations' codes. Likewise, as shown by Blanke and Pybus (2020), Google and Facebook concentrate the market for software development kits (SDKs) also sold as black boxes, in this case to app developers. The marginal cost of these products is close to zero because big tech companies sell again and again the same lines of secretly kept code. Hence, the price is mainly reflecting an intellectual rent. Moreover, the organizations that use those cloud services or SDKs are restricted from *learning by using* when adopting that technology because they only use black boxes (on how technology users used to learn see Lundvall, 1985). In this respect, part of what Srnicek (2021) defines as tech giants' infrastructure rent should be reconceptualized as intellectual rent. While storage in the cloud is a form of infrastructure rent paid for something that cloud clients used to own (servers), the fees to access software as a service in the cloud are paid for knowledge that was never owned – neither accessed – by cloud clients.

Finally, within digital intangible assets, exclusively accessed big data stand out as a main source of intellectual rents (Birch *et al.*, 2020; Durand & Milberg, 2020; Rikap, 2020). Platforms are a means to monopolize big data. In the case of big tech, extracted data are not only vast but also – as identified by Van Dijck and Poell (2016) – quite diverse, which triggers economies of scope; the chances to monetize data increase when different data sources are cross-referenced. Continuously gathered data are aggregated and processed with AI, in particular with machine learning algorithms, producing what UNCTAD (2019) has called digital intelligence, which is used for performing multiple analyses and predictions (Fourcade & Healy, 2016). Among machine learning techniques, deep learning (including deep neural networks) are algorithms that learn and improve by themselves as they process more data. In other words, these algorithms are self-improving means of production, which makes them unique since all the other means of production lose value when used. Deep learning algorithms significantly automate discoveries and expand the types of problems that can be addressed by analysing big data (Cockburn *et al.*, 2018). Companies mastering this AI technology and exclusively owning original data sources could eventually expand their intellectual monopoly without limits based on innovations derived from their continuous streams of digital intelligence. This is the case for Amazon, Microsoft and Google, leaders of the cloud computing business and the companies that, as shown by Jacobides *et al.* (2021), concentrate AI provision. The result is a sustained flow of a particular type of intellectual rent, that Durand and Milberg (2020) called data-driven innovation rents because innovations are based on processed data (digital intelligence).

In sum, we propose to complement political economy accounts that foreground the infrastructural power of platforms by considering big tech companies as data-driven intellectual monopolies. They are intellectual rentiers which base their power on different types of intellectual rents, ranging from IPRs and secretly kept algorithms sold as services to processed data harvested from their platforms. And, as we will show in the following sections, this has significant implications for the analysis of what is driving these tech giants' current expansionary digitization strategies.

Tech giants' expansionary strategies and the digitization of healthcare

As Kenney *et al.* (2021) show, 70 per cent of service industries (corresponding to 5.2 million establishments) in the United States are presently being affected by at least one platform. Similarly, according to Poell *et al.* (2019), we are in the midst of a platformization process, defined as the penetration of platforms in multiple economic sectors. Platformization entails both the emergence of new platform companies, and the entry of existing ones into new markets or sectors. In this respect, it remains an open question how and why certain sectors are prioritized over others for expansion by big tech platform companies, and more broadly, what are the drivers of big tech expansionary strategies and whether these drivers have evolved or changed over time. Following from accounts of the infrastructural power of platforms, the academic literature has largely answered this question by pointing to the digital architectures of big tech firms and emphasizing the constant amplification of their geopolitical role (Bratton, 2016; Kenney *et al.*, 2021; Van Dijck *et al.*, 2018). According to Kenney and Zysman (2020), for instance, big tech companies expand to adjacent markets based on their infrastructural power and the result is a geographical concentration of the digital economy. Among others, tech giants moved from e-commerce marketplaces to e-payments platforms or, in the case of Google, from general web searches to more targeted searches such as Google Shopping, Google Flights or even geolocalized searches (Google Maps). Expanding by relying on privilege access to key infrastructure is also suitable for explaining the different targeted solutions offered by big tech as cloud providers.

Nevertheless, an overlooked aspect is that all the expansionary strategies of big tech firms could also be driven by their intellectual monopoly power.

For instance, exclusive access to the most advanced search engine algorithm was used as the basis to develop specific algorithms for searching for flights or goods. Moreover, Google – as well as the other big tech companies – is currently entering not only adjacent markets, but also other more distant sectors. Driven by their intellectual monopoly power, big tech companies develop expansionary strategies that are based on intangible assets and aimed at expanding the further concentration of those assets. The former is a direct effect of already existing intellectual monopolies. Intangible assets (both knowledge and data) enable these companies to enter other sectors. In other words, entry is driven by monopolized intangibles.

The expansion and strengthening of IPRs since the 1980s (Dreyfuss & Frankel, 2014; Mowery, 2005; Orsi & Coriat, 2006) enabled, among others, to expand intellectual property over basic or more generic forms of knowledge, such as molecules and lines of code. Limiting access to these basic forms of knowledge favours those holding IPRs in the race for developing diverse applications for multiple industries. In the case of digital technologies, the literature has recently shown that basic or generic findings within AI are being monopolized by big tech (Ahmed & Wahed, 2020; Rikap & Lundvall, 2021; WIPO, 2019). Hence, these companies have an advantage in terms of developing applications for multiple industrial sectors building on generic AI intangible assets. Moreover, big tech companies enjoy exclusive access to digital intelligence. In the case of healthcare, emergent medical data (EMD) have been defined as data produced by people's everyday lives, including non-medical data, used to infer health data. EMD includes transactions by and about individuals, such as prescription orders, refills and broad e-commerce purchases that could be informative of people's physical and mental fitness (Marks, 2020). Big tech companies, therefore, enjoy a privilege access to multiple sources of EMD that once processed can provide digital healthcare intelligence. For instance, Google used search trends of symptoms to inform COVID-19 research.[2] EMD applied to find healthcare solutions, as in this case and in other examples mentioned below, are entries into the healthcare sector that are not based on infrastructural power but on privilege access to knowledge and information.

The second entry driver related to intellectual monopoly power is the quest for further expanding and perpetuating intellectual monopoly. By entering other sectors, intellectual monopolies will be cemented by accessing more data, by developing specific knowledge applied to those fields, and by using acquisitions to concentrate more intangible assets. To remain as an intellectual monopoly, a company must constantly innovate anew before the adoption (diffusion) of the previous innovation/s. Expanding to other knowledge or data-intensive sectors contributes to that end. In other words, privileged sectors are privileged because they provide new sources of big data and other intangibles that will not only be used for advancing positions in that sector, but that could also potentially inform already existing businesses. Slota *et al.* (2020) dubbed the process of discovering new data sources that can be disordered or even inaccessible as 'prospecting', and we adopt this term here to explicate this second entry driver for the expansionary strategies of big tech firms, an intangibles prospecting driver.

Big tech's decision-making process for choosing which sector to enter can thus be summarized as follows. Digital intelligence provides insights for defining a targeted sector and the firm evaluates to what extent, by entering, it could further expand its intellectual monopoly. If the assessment is positive, its infrastructural dominance as well as its data science skills and other intangibles can be mobilized to enter the sector. If it succeeds, the new business will become a new source of data (and possibly other intangibles), thus, renewing its data-driven intellectual monopoly. Even when big tech companies operate in apparently disconnected sectors, expansion and entry into sectors is underpinned by their already established data-driven intellectual monopoly positions, what we called the monopolized intangibles driver. Across sectors, expansion is also driven by a quest to further expand that monopoly, i.e. the intangibles prospecting driver.

Healthcare digitalization is a case in point. In relation to the monopolized intangibles driver, big tech companies are researching on healthcare-related applications using their exclusively accessed AI models, analysing their big data sources as EMD and acquiring AI technology applied to healthcare. As Microsoft's CEO, Satya Nadella, tweeted in 2021 just after the company announced its acquisition of Nuance, a speech recognition leader offering a cloud-based system for hospitals and doctors: 'AI is technology's most important priority, and healthcare is its most urgent application'. Google's healthcare ventures, meanwhile, are channelled through Google Health, Verily Life Sciences, Calico (which focuses on aging and age-related diseases) and DeepMind, a leader in generic AI that was acquired by Google in 2014. In 2019, DeepMind claimed to have reached its biggest healthcare breakthrough: an AI model for continuously predicting the future likelihood of a patient developing acute kidney injury (AKI) (Tomašev *et al.*, 2019). A year later, it achieved another breakthrough: another AI model that predicts protein structures.[3] Google is also applying AI to disease detection for diabetes, Parkinson's and heart diseases, and is working with different universities, such as Duke and Stanford, to define a healthy individual's biochemical fingerprint.[4]

Google is not the only big tech using its generic AI dominance to develop healthcare applications. Amazon works with universities and hospitals on applying AI to diagnosis, precision medicine, voice-enabled technologies and medical imaging.[5] When communicating its collaboration with Virtusa and the University of Texas, Amazon claimed that it aims to change the medical research process by applying AI.[6] According to one of Amazon's patents, its intelligent assistant Alexa can detect a cough or a cold and then suggests buying cough syrup.[7] These are all examples of healthcare initiatives that are not primarily based on tech giants' infrastructural power but on the R&D capabilities of these companies and of the organizations participating in their innovation networks. Nonetheless, there are other cases where infrastructure as well as monopolized intangibles play a role in these companies' expansionary strategies. The fact that Google, Amazon and Microsoft sell cloud services to hospitals and pharma companies is an example of a healthcare venture that is both based on their intangible assets and infrastructural platforms.

Also concerning monopolized intangibles as an expansionary driver in healthcare, big tech companies harvested big data provides industry insights. These companies exclusively access major big data sources that can indirectly inform on potential healthcare industry opportunities. According to Marks (2020), Google aims to be the world leader in harvesting and using EMD extracted from its search engine, other platforms and smart health devices, and use them for healthcare predictive analytics. Similarly, Meta uses AI to analyse users' content and predict suicide attempts. It also has a 'Preventive Health' tool that invites Facebook users to provide their health information and reminds them when to seek medical screening and professional advice.[8] Moreover, Alibaba's smart city cloud platform called 'ET City Brain' collects and analyses different data sources and, among others, provides healthcare predictions (CBInsights, 2018b).

Regarding the intangibles prospecting driver of big tech expansionary strategies in healthcare, according to Verily's top scientist and chief medical officer, every healthcare venture at Google is ultimately an engagement with healthcare data.[9] Healthcare is a source of colossal new databases that could be analysed with generic AI models and cross-referenced with big tech companies' already harvested data. Google has made different attempts in the United States and the United Kingdom to analyse Electronic Healthcare Records.[10] It also gave seed money and eventually acquired 23andMe, thus accessing the latter's huge source of genetic data. Amazon had a deal with the UK National Health Service to provide its Alexa devices to UK hospitals, potentially harvesting their healthcare data.[11] While all these examples are mainly driven by big tech's already monopolized and prospecting intangible assets, there are other examples where expansionary initiatives are also driven by big tech infrastructural power. Amazon acquired the online pharmacy PillPack in 2018 and Health Navigator in 2019,[12] and Alibaba and JD.com have their online healthcare units (Alibaba Health and JD Health, respectively). E-commerce behemoths can cross-reference big data, thus exploit the complementarities, between online health and selling over-the-counter drugs and prescriptions at their e-commerce marketplaces. Here, both expanding their data-driven intellectual monopolies (the intangibles prospecting driver) and using their infrastructure core to explain their expansionary strategy.

The search for new sources of healthcare data is also apparent in the wearables' market. Google acquired Fitbit, a leading fitness-tracking app, for US $2.1 billion[13] and Apple has multiple associated healthcare initiatives with universities to analyse Apple Watch harvested data (Rikap, 2018). Amazon has recently launched Halo, a wellness tracker that not only takes 3D scans and monitors people's sleep; it can even monitor (thus harvest data of) users' moods. Among big tech, probably the company that has gone the farthest in accessing and cross-referencing healthcare data is Tencent. Tencent's CEO detailed some of the company's healthcare initiatives in a recent WIPO report (Huateng, 2019), including an all-embracing healthcare platform (or a platform of platforms) seeking to control individuals' digital twins, accessing to several data sources simultaneously: from appointment booking and telehealth to personal health record management and SoYoung, which is an aesthetic medicine marketplace. Tencent also backs the health-tech start-up WeDoctor whose platform was accused of collecting data from rural patients in China without their consent.[14]

It is clear, then, that big tech companies are using their advantages in access to data and analytics skills to enter the healthcare sector (see Sharon, 2016, 2018). Firm-level case study analyses of 23andMe have also already made clear that Google is entering, and contributing to the platformization of, healthcare (Van Dijck *et al.*, 2018; Van Dijck & Poell, 2016). A more recent example, studied by Sharon (2020), is Apple and Google's API for contact tracing for COVID-19. Nonetheless, in all these firm-level case studies analytical investigations start by accepting tech giants' healthcare sector penetration without tackling a previous question: how relevant is healthcare incursion in these companies' expansionary strategy and, what is driving this expansionary strategy and what could be its effects? As we showed in this section, big tech companies' healthcare ventures not only spring from their core infrastructure platforms but are also explained by their intellectual monopoly power. The remainder of this paper will examine Google's expansionary strategy in greater depth to show how healthcare is among its priorities for expansion and further analyse intellectual monopoly power as the basis of its expansionary strategy.

Methodology

To anticipate business priorities for Google and, thus, analyse the reasons underlying its overall expansionary strategy, we studied its R&D priorities, acquisitions and AI applications. The former was addressed by applying network analysis and clustering techniques to Google's recent scientific publications to proxy its innovation networks in terms of participating organizations and its most relevant research fields. Google's scientific publications between 2014 and 2019 were retrieved from the Web of Science (WoS) database (4,492 publications). Our preliminary research on big tech healthcare ventures pointed to a potential focus on healthcare. Having this in mind, we chose 2014 as the starting year because until 2013 Google had only published 70 scientific articles in healthcare or biomedical sciences' journals, 12 of which were published in 2013 and 13 in 2012. Meanwhile, between 2014 and 2019, 539 scientific publications belonged to Google's healthcare and biomedical sciences' clusters. Also, Google's greatest healthcare breakthroughs were achieved by DeepMind after its acquisition in 2014. It was also in 2014 when Google first acquired a healthcare start-up, a medical hardware company called Lift Labs.

We employed network analysis techniques to build Google's network of the most frequent co-authoring organizations, providing a visual account of this complex set of social relations. We combined network analysis with clustering, a technique that groups the closest entities forming communities within networks (Fortunato & Hric, 2016). The Louvain community detection algorithm was applied as cluster detection method (Blondel *et al.*, 2008). In line with Rikap (2019), we interpreted each cluster as one of Google's innovation networks since clusters are formed with the organizations that most frequently co-author together within Google's scientific publications corpus. For each cluster, we also listed the three most frequent science categories as provided by WoS. As explained above, the intellectual monopoly is expected to innovate systematically (in-house and appropriating knowledge) and enter diverse industries or sectors relying on insights provided by its monopolized intangible assets; in particular, in the case of a data-driven intellectual monopoly based on its digital intelligence. Hence, conceiving Google as a data-driven intellectual monopoly, we expected to find different fields (proxied with WoS science categories) represented in each cluster besides computing science as Google's original R&D field.

The data were processed using CorText.[15] CorText allows the construction of network maps[16] based on specific algorithms that associate terms (here affiliations of Google's co-authors) according to their frequency of co-occurrence within a chosen corpus of texts (Barbier *et al.*, 2012). To construct these maps, we followed Tancoigne *et al.* (2014), including their proposed methodology for corpora cleaning. In the resulting maps, the nodes represent research organizations (universities, firms, etc.) and the nodes' size represents co-authorship frequency with Google. To focus on its most frequent partners, thus, those integrating its institutionalized innovation networks, we prioritized Google's top 100 co-authoring organizations.

Since we found a predominance of healthcare-related research, we also considered whether Google is patenting in this field as a way to evidence the expansion of its intellectual monopoly into healthcare. We retrieved its healthcare applied patents between 2014 and 2019 from Derwent Innovation, and compared the co-ownerships of this patent portfolio with Google's healthcare research co-authorships and found that Google is appropriating healthcare innovations based on research done with other organizations. Our sample excluded 2020 onwards to avoid an expected bias created by the global pandemic. To define Google's healthcare patent portfolio, we first retrieved every Google patent (considering the company's corporate tree) and filtered by patents related to healthcare using the OECD Patents Statistics manual, which defines healthcare patents as those within the following International Patent Classification (IPC) numbers: A61[B, C, D, F, G, H, J, L, M, N], H05G and A61K without A61K8 (Zuniga *et al.*, 2009). On top of them, since healthcare digitalization also comprises wellbeing, we included A63B patents (apparatus for physical training, gymnastics, swimming, climbing, or fencing, ball games, training equipment). We found 507 patent families corresponding to 1,138 individual records.

Next, Google's acquisitions over time were retrieved from Crunchbase, a database that provides business information about private and listed companies, including mergers and acquisitions and the technological fields or industries (not distinguished in Crunchbase) where each firm operates. Crunchbase does not follow any standard classification system; its industry classification is made by Crunchbase and firms themselves. Each company is typically associated with several industry groups or technologies. We listed the frequency of appearance of all the technological fields or industries in Google's acquired firms for two different periods: before and since 2014. This provided us with further information on Google's expanding technological and industrial priorities over time.

Finally, we also searched grey literature (annual reports, white papers, websites and mass and specialized media articles for examples of Google's different businesses according to each AI application field identified by WIPO (2019). This provided further evidence of the potential expansion of Google into diverse industries, and enabled us to elaborate on whether entering these sectors could have been driven by its infrastructural and/or intellectual monopoly power, distinguishing between economic sectors associated with the so-called first and second phase of digitalization. Margrethe Vestager, the Executive Vice President of the European Commission for a Europe Fit for the Digital Age, proposed a distinction between two phases of digitalization. The second includes health, energy, transportation, farming and public services, while the first one was mostly focused on consumer platforms (from ecommerce to social media and networks).[17]

Google's expansionary strategy: Findings and discussion

This paper argues that big tech companies enter new sectors not only based on their infrastructure power, but also on their intellectual monopoly power. Expansionary strategies are driven, in particular, by insights provided by their monopolized intangible assets and by a prospective search for yet further intangibles. If successful, the latter reinforces their data-driven intellectual monopoly, and thus their capacity to capture value in the form of intellectual rents. In this section, we provide evidence of this expansionary strategy for the firm-level case of Google, and identify healthcare as a priority within its expansionary strategy.

Google's innovation system

Figure 1 provides a network analysis of Google's co-authoring organizations between 2014 and 2019, including the main fields of research associated with each resulting cluster. Clusters are weakly connected with each other, plotting what we interpret as Google's different innovation networks working each on

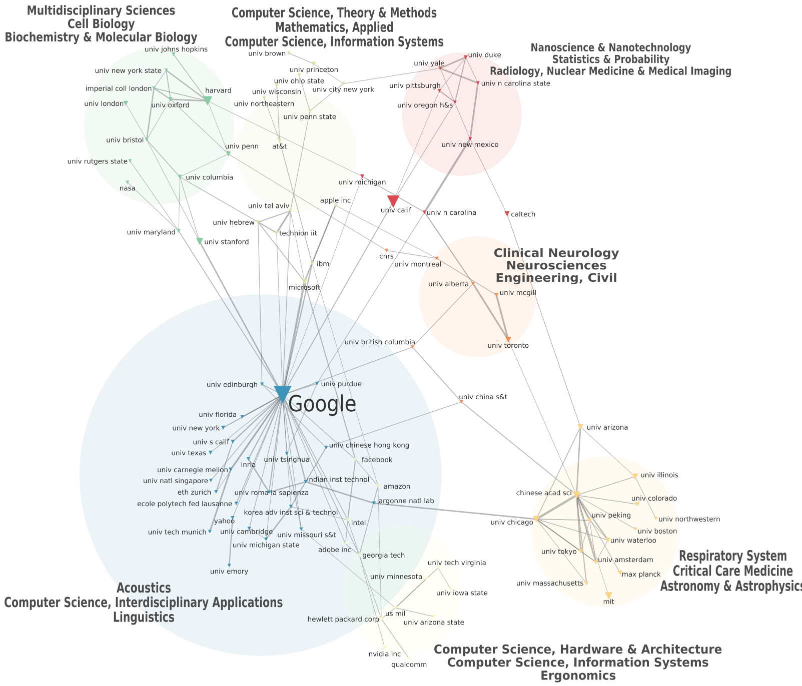

Figure 1. Google's co-publications network (2014–2019).
Source: Author's analysis based on data extracted from WoS.

relatively different topics. From the seven clusters that integrate this corporate innovation system, only three deal with computer sciences, including the biggest cluster which presents Google's node at its centre. In this cluster, computer science is related to acoustics and linguistics pointing to speech and voice recognition as its most probable applications. These technologies are essential to Google's most known businesses, from Google Search to its smartphone voice assistants and its smart speaker Google Home. Amazon leads the smart speakers' market with almost 30 per cent share globally, but Google arrives second with almost a quarter of the market.[18]

The remaining four clusters cover diverse healthcare and biomedical sciences topics. These clusters are a clear example of how Google is expanding into new sectors and moving beyond its core business. Google's R&D focus on healthcare – even before the pandemic – leads us to consider Google's different healthcare initiatives noted above as being a priority within this tech giant's expansion to other industries. Interestingly, Google's co-authors, shown in Figure 1, are also telling of the research priorities of each cluster. Clusters focused on computer sciences include all the other US big tech (Amazon, Facebook, Apple and Microsoft) and other ICT leaders (such as AT&T, IBM, HP, Qualcomm and Adobe). These clusters are also integrated by leading academic institutions in computer sciences, such as Techion (Israel Institute of

Technology), the French Institute for Research in Computer Science and Automation (Inria) and several technical universities. Likewise, clusters working on health and biomedical sciences include leading institutions in this field like John Hopkins University, Harvard and the University of Pennsylvania (which hosts the United States first Medical School).

Such prioritizing of healthcare and biomedical sciences implies that Google could be engaging in a technological competition and/or cooperation with big pharma as incumbents, a topic to be considered in future research. So far, we found that Novartis was the first company to licence Google's smart contact lens for people with diabetes. Moreover, Google's Verily Life Sciences partnered with GlaxoSmithKline for a project called Galvani Bioelectronics, and Onduo is a joint venture between Verily and Sanofi (CBInsights, 2018a). In the near future, we may thus expect to find big pharmaceutical companies among Google's top co-authors. In all these examples, partnerships are based on Google's exclusive access to AI knowledge, demonstrating how the firm's expansion into healthcare is underpinned by its monopoly power in intangible assets.

In the preceding sections, we proposed that intellectual monopolies such as the tech giants organize their expansion strategies in innovation networks integrated by other organizations and are successful at appropriating most of the associated intellectual rents. This argument holds for Google's expansion into healthcare. While Google's healthcare research takes place in collaboration with several other organizations (none of its 539 healthcare articles between 2014 and 2019 was authored exclusively by Google), Google profits almost by itself when it comes to patenting results. Of a total of 507 applied health patent families in this period, Google only shared ownership of 20 (3.9 per cent), all of them with other corporations, such as Abbvie and Johnson & Johnson. While this highlights the hypothesis of possible future technological cooperation with big pharma, it also points to the expansion of Google's data-driven intellectual monopoly into healthcare via exclusively appropriating knowledge results from its innovation networks and expanding Google's value appropriation in the form of intellectual rents.

The diversification of Google's acquisitions

Acquisitions are another way to analyse a firm's expansionary strategy. Until mid-2021, Google had acquired 248 companies. Table 1 lists the technology/industry groups of Google's acquisitions until 2013 included (141 companies) and between 2014 and 2019 (99 companies).

Table 1 outlines Google's continuous interest in software, internet services, apps, information and mobile technologies; all of which are the core of its business. Yet, Table 1 also shows that, from 2014 onwards, Google increased its focus on AI and big data analytics. According to WIPO (2019), Google ranks first in AI-related acquisitions. Since 2009 and until May 2018, it

Table 1. List of industries corresponding to Google's acquisitions.

Until 2013		Between 2014 and 2019	
Industry group	Frequency	Industry group	Frequency
Software	86	Software	73
Internet Services	52	Hardware	30
Media and Entertainment	40	Internet Services	29
Mobile	32	Data and Analytics	29
Hardware	28	Mobile	27
Information Technology	25	Information Technology	25
Sales and Marketing	19	Apps	20
Apps	18	Media and Entertainment	17
Data and Analytics	17	Science and Engineering	16
Commerce and Shopping	14	Artificial Intelligence	15
Consumer Electronics	14	Consumer Electronics	12
Content and Publishing	11	Platforms	9
Advertising	11	Other	8
Video	9	Content and Publishing	8
Messaging and Telecommunications	8	Education	8
Other	8	Sales and Marketing	7
Music and Audio	7	Advertising	7
Science and Engineering	7	Music and Audio	6
Platforms	7	Video	6
Financial Services	6	Design	6
Travel and Tourism	5	Messaging and Telecommunications	5
Design	5	Gaming	5
Privacy and Security	4	Privacy and Security	5
Artificial Intelligence	4	Transportation	4
Navigation and Mapping	3	Health Care	4
Transportation	3	Commerce and Shopping	4
Community and Lifestyle	3	Community and Lifestyle	3
Events	2	Professional Services	3
Manufacturing	2	Manufacturing	2
Professional Services	2	Financial Services	2
Payments	2	Travel and Tourism	2
Consumer Goods	1	Payments	2
Lending and Investments	1	Navigation and Mapping	1
Gaming	1	Sports	1
Clothing and Apparel	1	Sustainability	1
Administrative Services	1	Food and Beverage	1
		Government and Military	1
		Energy	1
		Administrative Services	1
		Real Estate	1

Source: Author's analysis based on Crunchbase.

acquired 18 AI companies. Apple and Microsoft followed with 11 and nine AI acquisitions, respectively. AI-related acquisitions contribute to reinforcing Google's data-driven intellectual monopoly since they expand the company's capacity to process data, thus enabling it to turn more digital intelligence into intangible assets.

Furthermore, until 2013, Google's acquisitions corresponded to 36 industries. Between 2014 and 2019, its acquired companies were related to 40 industries with eight new industries added and four dropouts. Among the new industries, two stand out in terms of the number of acquired companies: education and healthcare. Concerning healthcare, 53 patents applied between 2014 and 2019 were acquired by Google through company acquisitions, including those of Fitbit, Noth and Eyefluence, thus strengthening our argument regarding the expansion of Google's intellectual monopoly by entering healthcare. Another novelty, although with only two related acquisitions (one dealing with sustainability and the other with energy), is related to tackling environmental challenges. In its 2017 annual report, the company used the term 'sustainability' for the first time and, since 2019, there is a special section in Google's annual reports on its 'ongoing commitment to sustainability'. Further research is needed in relation to how big tech are using their intellectual monopoly and infrastructural power to expand into energy and other key sectors for tackling environmental challenges.

Overall, Google is diversifying the technological fields of its acquisitions. This expands its intellectual monopoly and also what Kamepalli *et al.* (2020) defined as Google's 'kill zone'. When Google acquires a start-up, venture capitalists reduce their investments (measured both in the number of deals and invested amounts) in competing companies or companies in close markets anticipating that the acquisition would lead to a winner take all market. This works as a form of self-fulfilling prophecy. Hence, while Google reinforces its intellectual monopoly by getting exclusive access to acquired companies' intangible assets, it further limits the emergence of potential competitors. Considering our findings, as Google enters new sectors by acquiring healthcare and education start-ups, this kill zone will probably expand into these two industries where curtailing innovation opportunities is directly at the expense of social and economic development.

Google's multi-product business

Further illustrating our argument that tech giants' expansionary strategies are driven by their intellectual monopoly power, we found that Google has entered several industries based on the data it harvests and by developing applications of its generic AI models. Google operates in every AI application field as defined by WIPO (2019) (see Table 2), and these operations provide the company exclusive access to new and diverse sources of big data, or what we have termed an intangibles prospecting driver. WIPO's (2019) report also found that Google is active in patenting in every AI application field.

Table 2 lists the AI application fields of the so-called first phase of digitalization and afterwards those corresponding to its second phase, as characterized by

Table 2. Google solutions for AI application fields.

AI field applications	Google solutions
Banking and finance	Google Pay
Cartography	Google Maps
Document management and publishing	Google Analytics (Google Cloud's BigQuery), Google Translate
Networks (social networks, IoT, smart cities)	Google Assistant, Google Nest, Sidewalk labs
Business (customer service, e-commerce, enterprise computing)	Google Cloud, Google Search (ads business), Contact Center AI solution, Google Analytics
Personal devices, computing and HCI	HCI contributes to Search, Gmail, Docs, Maps, Chrome, Android, YouTube
Entertainment	YouTube
Military	Project Maven: A Pentagon AI project with Google
Telecommunications	Google Meet, Contact Center AI solution, Subsea internet cables, Google Fiber
Computing in government	Google Cloud, Big data for statistics agencies
Industry and manufacturing	Digitization of their production facilities and supply chain. For instance, Renault
Energy management	DeepMind is used to reduce energy consumption in Google's DataCenters
Life and medical sciences	Verily, DeepMind, Google Health, Calico
Security	Chronicle, an AI-driven solution for the cybersecurity industry
Transportation	Waymo
Education	Google for Education, Google.scholar
Agriculture	Google's secretive 'moonshot' laboratory, X, has plans to modernize food production, and developing precision farming technology with the US government.
Arts and humanities (including AI for music)	Artsandculture.google.com, Magenta (tensorflow)
Law, social and behavioural sciences	Google patents, Google Analytics and Big Query
Physical sciences and engineering	Google's applied science team which combines computer science with physics and biology in four areas: Quantum Computing, Google Accelerated Science, Climate and Energy, and Scientific Computing Tools.

Source: Author's analysis based on Google websites, annual reports and media articles.

Margrethe Vestager, and defined in the Methodology section. The first phase coincides with the AI application fields where big tech already loom large, such as e-commerce, social networks and banking and finance. Google's attempts to operate – more or less successfully – in every sector of the first digitalization phase can be explained both by its infrastructure power leading the company to enter adjacent businesses as well as by the two drivers associated with its (data-driven) intellectual monopoly power. The examples provided in

Table 2 are all cases where privilege access to (and the possibility of further concentrating) intangible assets was used to identify and enter markets. For instance, its search engine provided the company exclusively accessed digital intelligence and trained AI models that were instrumental in the development of its Google Analytics and Google Cloud businesses.

Table 2 shows that Google has also entered all the sectors corresponding to the second and ongoing phase of digitalization. Among them, our findings suggest that healthcare, education and, to a lesser extent, energy are among Google's priorities in terms of non-tech related recent acquisitions, and Google has an independent business called Waymo dedicated to autonomous vehicles (see Table 2). Nevertheless, unlike healthcare, the other sectors do not have a prominent place in Google's scientific research priorities (see Figure 1). Furthermore, we consider the pattern of job openings at Google on 2 August 2021. On that date, Google had 114 open positions related to healthcare (considering all Fitbit and Verily positions as well as other positions that included the term 'healthcare'), 105 jobs with the term 'education' in their description, while Waymo only had one open position.[19]

All in all, our results complement those of authors focusing on big tech infrastructural power as driver for expansion (Bratton, 2016; Kenney *et al.*, 2021; Van Dijck *et al.*, 2018), since we showed that Google, as well as the other big tech, is entering multiple industries as supplier and not just as mediator or infrastructure reshaping the market architecture by creating a platform. Google's race for dominance over healthcare can be conceived as part of a broader long-term expansionary strategy into diverse industrial sectors based on and expanding not only its infrastructure core but also its data-driven intellectual monopoly.

Conclusions

With particular reference to Google, this paper has elaborated on big tech companies' expansionary strategies into new economic sectors, especially healthcare. While the political economy literature has argued that big tech firms expand into other sectors (especially adjacent markets) based on their infrastructural power, we provided a complementary account grounded in intellectual monopoly theory. This approach states that leading corporations continuously monopolize knowledge and turn it into intangible assets, thus profiting from capturing value produced elsewhere in the form of intellectual rents. For intellectual monopolies that are data-driven, like Google, their power rests on the continuous harvesting and analysis of big data with self-improving AI algorithms to produce digital intelligence. Therefore, we conceptualized big tech companies' expansionary strategies as framed by a monopolized intangibles driver and an intangibles' prospecting driver. Big tech companies define entry sectors based on insights provided by their intangible assets, including their generic AI models and the use of big data sources as emergent medical data. Moreover, by entering new sectors, we showed that they further expand their data-driven intellectual monopoly by accessing new datasets (such as electronic healthcare records or genetic data), appropriating more knowledge through intangibles-driven acquisitions and by organizing innovation networks to investigate in those fields.

Considering both our analysis of Google's overall expansionary strategy as well as selected examples of big tech healthcare initiatives, we conclude that intellectual monopoly power is a core driver of these companies' expansionary strategies. Building on this conclusion, our future research will revise and rework on the concepts of trust and corporation, which could contribute to better informing antitrust legislation. Tech giants operate in and are expanding into multiple sectors and markets based on (and further expanding) their intellectual monopolies. Frequently, new ventures also benefit one or more of a tech giant's ongoing businesses. Overall, our analysis of Google's expansionary strategy underlines that it operates its businesses in an interconnected way even when they correspond to distant markets because it uses intangible assets related to one business to reinforce other initiatives. Therefore, antitrust considerations at each separate market could be complemented with analyses of the evolution of capital and asset concentration and complementarities at the level of global capitalism, thus considering the intellectual monopoly power (as well as infrastructural power) of these companies and how it affects other firms and society. In other words, once we foreground the intellectual monopoly power of big tech companies, addressing big tech power abuses cannot be limited to single market analyses because these companies capture value in the form of potentially endless intellectual rents and thus enjoy sustained extraordinary profits even in markets where they do not have a clear market dominance. Therefore, dismantling the power of big tech would require a deep transformation of the current intellectual property regime into a system that fosters public or commons knowledge and learning. To that end, a first step could be limiting intellectual monopolies' assetization of both knowledge produced at the level of networks or systems of hundreds of organizations and of big data harvested from society.

In the specific case of healthcare, the COVID-19 pandemic has evidenced that current economic, (geo)political and social dynamics rely on digital and healthcare industries and technologies more than ever. The pandemic has also triggered an acceleration of the reach and use of digital technologies – among others in healthcare – while deepening and exposing wealth and income inequalities. Hence, the pandemic has incremented the urgency to address the implications of the expansion of tech giants' data-driven intellectual monopolies into this sector. Although healthcare data analysis with AI as well as digital healthcare solutions could be paramount for improving people's health, the priorities on which data should be gathered and analysed and by whom, the definition of a digital healthcare research agenda and the benefits of applying digital technologies for treatment and prevention cannot be left in the hands of a few corporate players that, more often than not, prioritizing their economic gains – including data harvesting for reinforcing and expanding their businesses – over healthcare.

Notes

1 Retrieved from https://www.technologyreview.com/2015/09/21/10487/why-americas-top-mental-health-researcher-joined-alphabet/ last accessed 20 January 2021.

2 https://blog.google/technology/health/using-symptoms-search-trends-inform-covid-19-research/.

3 https://deepmind.com/blog/article/AlphaFold-Using-AI-for-scientific-discovery.

4 https://www.ctsi.duke.edu/news/duke-and-stanford-assist-google-x-defining-health.

5 https://www.beckershospitalreview.com/healthcare-information-technology/pittsburgh-health-data-alliance-partners-with-amazon-web-services-5-things-to-know.html, https://www.beckershospitalreview.com/artificial-intelligence/amazon-to-beth-israel-deaconess-tell-us-how-ai-can-make-your-hospital-more-efficient.html.

6 https://www.virtusa.com/success-story/multinational-healthcare-services-synthetic-data-lake/.

7 https://thenextweb.com/artificial-intelligence/2018/10/15/amazons-new-patent-will-allow-alexa-to-detect-your-illness/.

8 https://www.theverge.com/2019/10/28/20936541/facebook-preventative-health-cancer-heart-disease-flu-tool.

9 https://www.businessinsider.com/verily-google-alphabet-ceo-shares-common-theme-behind-projects-2019-1?international=true&r=US&IR=T.

10 https://www.wsj.com/articles/google-s-secret-project-nightingale-gathers-personal-health-data-on-millions-of-americans-11573496790.

11 https://www.theguardian.com/society/2019/dec/08/nhs-gives-amazon-free-use-of-health-data-under-alexa-advice-deal.

12 https://www.cnbc.com/2019/10/23/amazon-acquires-digital-health-start-up-health-navigator.html.

13 https://www.ft.com/content/aba45bc9-ffc8-411e-ac29-dbb3171f4886.

14 https://www.wired.co.uk/article/china-ai-healthcare.

15 CorText is an open platform used to perform bibliometric and semantic analysis; it uses spatial algorithms that draw on classic graph visualisation methods to depict network maps (Fruchterman–Reingold). It can be accessed online at: https://www.cortext.net/.

16 All the network maps in this paper follow chi-square metrics, which is a direct local measure, meaning that it considers actual co-occurrences between entities. Indirect measures, such as the distributional, are not useful in our context because we are looking at actual links and not at the similarity of two nodes based on their entire co-occurrence profile and the other terms identified (Tancoigne *et al.*, 2014, p. 40).

17 Retrieved from https://www.project-syndicate.org/onpoint/eu-regulations-for-the-digital-economy-by-margrethe-vestager-and-anu-bradford-2021-05 last access 25 May 2021.

18 https://www.statista.com/statistics/792604/worldwide-smart-speaker-market-share/ and https://voicebot.ai/2020/04/28/amazon-smart-speaker-market-share-falls-to-53-in-2019-with-google-the-biggest-beneficiary-rising-to-31-sonos-also-moves-up/.
19 https://careers.google.com/jobs/results/.

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References

Ahmed, N. & Wahed, M. (2020). The de-democratization of AI: Deep learning and the compute divide in artificial intelligence research. ArXiv Preprint ArXiv:2010.15581. Retrieved from https://arxiv.org/abs/2010.15581

Antonelli, C. (1999). The evolution of the industrial organisation of the production of knowledge. *Cambridge Journal of Economics*, *23*(2), 243–260. doi:10.1093/cje/23.2.243

Barbier, M., Bompart, M., Garandel-Batifol, V. & Mogoutov, A. (2012). Textual analysis and scientometric mapping of the dynamic knowledge in and around the IFSA community. In I. Darnhofer, D. Gibbon & B. Dedieu (Eds.), *Farming systems research into the 21st century: The new dynamic* (pp. 73–94). Springer.

Benaich, N. & Hogarth, I. (2020). *State of AI report*. IIPP.

Birch, K. (2019). Technoscience rent: Toward a theory of rentiership for technoscientific capitalism. *Science, Technology, & Human Values*, *45*(1), 3–33. doi:10.1177/0162243919829567

Birch, K., Chiappetta, M. & Artyushina, A. (2020). The problem of innovation in technoscientific capitalism: Data rentiership and the policy implications of turning personal digital data into a private asset. *Policy Studies*, *41*(5), 468–487. doi:10.1080/01442872.2020.1748264

Birch, K. & Muniesa, F. (2020). Introduction: Assetization and technoscientific capitalism. In K. Birch & F. Muniesa (Eds.), *Assetization. Turning things into assets in technoscientific capitalism* (pp. 1–43). MIT Press.

Blanke, T. & Pybus, J. (2020). The material conditions of platforms: Monopolization through decentralization. *Social Media+ Society*, *6*(4), 1–13. doi:10.1177/205630512097163

Blondel, V. D., Guillaume, J.-L., Lambiotte, R. & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, *2008*(10), P10008. doi:10.1088/1742-5468/2008/10/P10008

Boldrin, M. & Levine, D. K. (2008). *Against intellectual monopoly*. Cambridge University Press.

Bourreau, M. & de Streel, A. (2020). *Big tech acquisitions*. Centre on Regulation in Europe.

Bratton, B. H. (2016). *The stack: On software and sovereignty*. MIT Press.

Caliskan, K. (2020). Data money: The socio-technical infrastructure of cryptocurrency blockchains. *Economy and Society*, *49*(4), 540–561. doi:10.1080/03085147.2020.1774258

CBInsights. (2018a). *How Google plans to use AI to reinvent the $3 trillion US healthcare industry*. CBInsights.

CBInsights. (2018b). *Rise of China's big tech in AI: What Baidu, Alibaba, and Tencent are working on*. CBInsights.

Cockburn, I. M., Henderson, R. & Stern, S. (2018). *The impact of artificial intelligence on innovation*. National Bureau of Economic Research. doi:10.3386/w24449

Cohen, W. M. & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152. doi:10.2307/2393553

Dernis, H., Gkotsis, P., Grassano, N., Nakazato, S., Squicciarini, M., van Beuzekom, B. & Vezzani, A. (2019). *World corporate top R&D investors: Shaping the future of technologies and of AI (EUR 29831)*. Joint Research Centre and OECD Report.

Dolata, U. (2017). *Apple, Amazon, Google, Facebook, Microsoft: Market concentration-competition-innovation strategies* (SOI Discussion Paper). Stuttgarter Beiträge zur Organisations-und Innovationsforschung.

Dolata, U. (2019). Privatization, curation, commodification. *Österreichische Zeitschrift Für Soziologie*, *44*(1), 181–197. doi:10.1007/s11614-019-00353-4

Dreyfuss, R. & Frankel, S. (2014). From incentive to commodity to asset: How international law is reconceptualizing intellectual property. *Michigan Journal of International Law*, *36*(4), 557–602.

Durand, C. & Milberg, W. (2020). Intellectual monopoly in global value chains. *Review of International Political Economy*, *27*(2), 404–429. doi:10.1080/09692290.2019.1660703

Ernst, D. (2009). *A new geography of knowledge in the electronics industry? Asia's role in global innovation networks*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2742923

Fisk, C. L. (2000). Working knowledge: Trade secrets, restrictive covenants in employment, and the rise of corporate intellectual property, 1800–1920. *Hastings Law Journal*, *52*(2), 441–535.

Foley, D. K. (2013). Rethinking financial capitalism and the 'information' economy. *Review of Radical Political Economics*, *45*(3), 257–268. doi:10.1177/0486613413487154

Fortunato, S. & Hric, D. (2016). Community detection in networks: A user guide. *Physics Reports*, *659*, 1–44. doi:10.1016/j.physrep.2016.09.002

Fourcade, M. & Healy, K. (2016). Seeing like a market. *Socio-Economic Review*, *15*(1), 9–29.

Frenken, K. & Fuenfschilling, L. (2020). The rise of online platforms and the triumph of the corporation. *Sociologica*, *14*(3), 101–113.

Gillespie, T. (2010). The politics of 'platforms'. *New Media & Society*, *12*(3), 347–364. doi:10.1177/1461444809342738

Harvey, D. (2002). *Spaces of capital: Towards a critical geography*. Routledge.

Huateng, M. (2019). Application of artificial intelligence and big data in China's healthcare services. In S. Dutta, B. Lanvin & S. Wunsch-Vincent (Eds.), *Global innovation index 2019: Creating healthy lives – the future of medical innovation* (pp. 103–110). WIPO.

Jacobides, M. G., Brusoni, S. & Candelon, F. (2021). The evolutionary dynamics of the artificial intelligence ecosystem. *Strategy Science*, *6*(4), 412–435. doi:10.1287/stsc.2021.0148

Kamepalli, S. K., Rajan, R. & Zingales, L. (2020). *Kill zone*. National Bureau of Economic Research. doi:10.3386/w27146

Kenney, M., Bearson, D. & Zysman, J. (2021). The platform economy matures: Measuring pervasiveness and

exploring power. *Socio-Economic Review*, *19*(4), 1451–1483. doi:10.1093/ser/mwab014
Kenney, M. & Zysman, J. (2016). The rise of the platform economy. *Issues in Science and Technology*, *32*(3), 61–69.
Kenney, M. & Zysman, J. (2020). The platform economy: Restructuring the space of capitalist accumulation. *Cambridge Journal of Regions Economy and Society*, *13*(1), 55–76. doi:10.1093/cjres/rsaa001
Khan, L. (2017). Amazon's antitrust paradox. *The Yale Law Journal*, *126*(3), 710–805.
Langley, P. & Leyshon, A. (2017). Platform capitalism: The intermediation and capitalization of digital economic circulation. *Finance and Society*, *3*(1), 11–31. doi:10.2218/finsoc.v3i1.1936
Lemley, M. A. & Feldman, R. (2016). Patent licensing, technology transfer, and innovation. *American Economic Review*, *106*(5), 188–192. doi:10.1257/aer.p20161092
Liu, J., Chaminade, C. & Asheim, B. (2013). The geography and structure of global innovation networks: A knowledge base perspective. *European Planning Studies*, *21*(9), 1456–1473. doi:10.1080/09654313.2012.755842
Lopez Giron, A. J. & Vialle, P. (2017). A preliminary analysis of mergers and acquisitions by Microsoft from 1992 to 2016: A resource and competence perspective. 28th European Regional Conference of the International Telecommunications Society (ITS): 'Competition and Regulation in the Information Age'. Passau, Germany.
Lundvall, B.-Å. (1985). *Product innovation and user-producer interaction*. Aalborg University Press.
Marks, M. (2020). Emergent medical data: Health information inferred by artificial intelligence. *UC Irvine Law Review*, *11*, 995–1066.
Montalban, M., Frigant, V. & Jullien, B. (2019). Platform economy as a new form of capitalism: A Régulationist research programme. *Cambridge Journal of Economics*, *43*(4), 805–824. doi:10.1093/cje/bez017
Mowery, D. (2005). The Bayh-Dole Act and high-technology entrepreneurship in US universities: Chicken, egg, or something else? In G. Libecap (Ed.), *University entrepreneurship and technology transfer: Process, design, and intellectual property* (pp. 39–68). Elseiver.
Orsi, F. & Coriat, B. (2006). The new role and status of intellectual property rights in contemporary capitalism. *Competition & Change*, *10*(2), 162–179. doi:10.1179/102452906X104222
Pagano, U. (2014). The crisis of intellectual monopoly capitalism. *Cambridge Journal of Economics*, *38*(6), 1409–1429. doi:10.1093/cje/beu025
Peck, J. & Phillips, R. (2020). The platform conjuncture. *Sociologica*, *14*(3), 73–99.
Poell, T., Nieborg, D. & Van Dijck, J. (2019). Platformisation. *Internet Policy Review*, *8*(4), 1–13. doi:10.14763/2019.4.1425
Rikap, C. (2018). Innovation as economic power in global value chains. *Revue d'Économie Industrielle*, *163*, 35–75. doi:10.4000/rei.7226
Rikap, C. (2019). Asymmetric power of the core: Technological cooperation and technological competition in the transnational innovation networks of big pharma. *Review of International Political Economy*, *26*(5), 987–1021. doi:10.1080/09692290.2019.1620309
Rikap, C. (2020). Amazon: A story of accumulation through intellectual rentiership and predation. *Competition & Change*, *26*(3–4), 436–466. doi:10.1177/1024529420932418
Rikap, C. (2021). *Capitalism, power and innovation: Intellectual monopoly capitalism uncovered*. Routledge.
Rikap, C. (2022). Becoming an intellectual monopoly by relying on the national innovation system: The state grid corporation of China's experience. *Research Policy*, *51*(4). doi:10.1016/j.respol.2021.104472
Rikap, C. & Lundvall, B.-Å. (2020). Big tech, knowledge predation and the implications for development. *Innovation and Development*, 1–28. doi:10.1080/2157930X.2020.1855825

Rikap, C. & Lundvall, B.-Å. (2021). *The digital innovation race: Conceptualizing the emerging New World Order*. Palgrave Macmillan.

Rochet, J.-C. & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, *1*(4), 990–1029. doi:10.1162/154247603322493212

Sadowski, J. (2020). The internet of landlords: Digital platforms and new mechanisms of rentier capitalism. *Antipode*, *52*(2), 562–580. doi:10.1111/anti.12595

Sharon, T. (2016). The Googlization of health research: From disruptive innovation to disruptive ethics. *Personalized Medicine*, *13*(6), 563–574. doi:10.2217/pme-2016-0057

Sharon, T. (2018). When digital health meets digital capitalism, how many common goods are at stake? *Big Data & Society*, *5*(2). doi:10.1177/2053951718819032

Sharon, T. (2020). Blind-sided by privacy? Digital contact tracing, the Apple/Google API and big tech's newfound role as global health policy makers. *Ethics and Information Technology*, *23*, 1–13.

Slota, S. C., Hoffman, A. S., Ribes, D. & Bowker, G. C. (2020). Prospecting (in) the data sciences. *Big Data & Society*, *7*(1). doi:10.1177/2053951720906849

Srnicek, N. (2017). *Platform capitalism*. John Wiley & Sons.

Srnicek, N. (2021). Value, rent and platform capitalism. In J. Haidar & M. Keune (Eds.), *Work and labour relations in global platform capitalism* (pp. 29–45). Edward Elgar Publishing.

Stark, D. & Pais, I. (2020). Algorithmic management in the platform economy. *Sociologica*, *14*(3), 47–72.

Tancoigne, E., Barbier, M., Cointet, J.-P. & Richard, G. (2014). The place of agricultural sciences in the literature on ecosystem services. *Ecosystem Services*, *10*, 35–48. doi:10.1016/j.ecoser.2014.07.004

Teixeira, R. A. & Rotta, T. N. (2012). Valueless knowledge-commodities and financialization: Productive and financial dimensions of capital autonomization. *Review of Radical Political Economics*, *44*(4), 448–467. doi:10.1177/0486613411434387

Tomašev, N., Glorot, X., Rae, J. W., Zielinski, M., Askham, H., Saraiva, A., … Protsyuk, I. (2019). A clinically applicable approach to continuous prediction of future acute kidney injury. *Nature*, *572*(7767), 116–119. doi:10.1038/s41586-019-1390-1

UNCTAD. (2019). *Digital Economy Report 2019: Value creation and capture: Implications for developing countries*. United Nations.

Van Dijck, J. (2013). *The culture of connectivity: A critical history of social media*. Oxford University Press.

Van Dijck, J. & Poell, T. (2016). Understanding the promises and premises of online health platforms. *Big Data & Society*, *3*(1). doi:10.1177/2053951716654173

Van Dijck, J., Poell, T. & De Waal, M. (2018). *The platform society: Public values in a connective world*. Oxford University Press.

Weiss, L. (2014). *America Inc.? Innovation and enterprise in the national security state*. Cornell University Press.

World Intellectual Property Organization (WIPO). (2019). *WIPO technology trends 2019: Artificial intelligence*. World Intellectual Property Organization.

Zuniga, P., Guellec, D., Dernis, H., Khan, M., Okazaki, T. & Webb, C. (2009). *OECD patent statistics manual*. OECD Publications.

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