

# **‘Public clouds’, what they are, how they work and what they mean for the NHS.**

KONP Data Working Group

*‘Technologies such as ‘the cloud’ made its ubiquity, its disconnection from its physical environment, a key selling point. Invisibility is a central feature of large-scale infrastructural systems—they are not supposed to be seen.’ Maximilian Jung, 2023*

## **Foreword**

NHS England and successive governments have seen digitalisation and its technologies such as Artificial Intelligence (AI)<sup>1</sup> as a means to solving the problems of the NHS. This paper is one of two that, together, look at the implications of technologies engaged in the digitalisation of the NHS. This first paper focuses on Big Tech and its control of the ‘public clouds’<sup>2</sup> that the NHS now relies on. The second paper highlights the global implications of dependence on Big Tech and their ‘clouds’.

## **Introduction:**

NHS and social care records, and clinical and ‘lifestyle’ measurements such as blood pressure readings, biopsy and blood test results, x-rays and scans, are being transformed into masses of data as the first step towards the digitalisation of NHS services. This digital transformation is essential to meet the demands placed on our 42 Integrated Care Systems – for instance to cut costs by improving the ‘value’ of the care they deliver. The amount of data is already huge, especially when genetic information is included, and is required for diagnostic and treatment purposes; population health management; and for the development of innovations in care. Innovation is seen by government not just as a cornerstone of healthcare improvement, but also a requisite for economic growth.<sup>3,4</sup>

The scale of the digitalisation project is huge and so, in the absence of any investment to develop state funded services, data are currently being moved to the massive resource provided by Big Tech ‘public clouds’. Currently it’s these that have the infrastructure and compute power to manage big data, and the code/ algorithms, knowledge and financial resources<sup>5</sup> necessary for innovation development. But in reality, these ‘public clouds’ are ‘private marketplaces’ monopolised and controlled by the Big Tech providers Amazon, Microsoft, Google, Apple and Oracle which have moved into healthcare in England using similar business models. This means that the NHS and its users are increasingly subject to the power of Big Tech. How has this happened?

## **1. ‘Public cloud’ and the power of Big Tech**

Big Tech does not have a simple market monopoly where competitors get competed out. Instead, its form of monopoly depends on constantly capturing new knowledge and transforming this into what

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<sup>1</sup> [A simple guide to help you understand AI from the BBC](#)

<sup>2</sup> Just as the term ‘cloud’ does not refer to ‘a magical place in the sky’ but rather to servers that are located in huge data centres and accessed via the internet, together with the software and databases that run on those servers so that those using the cloud (eg companies or organisations like the NHS) do not have to manage actual servers or run software themselves ( <https://www.cloudflare.com/en-gb/learning/cloud/what-is-the-cloud/> )- the use of the term ‘public’ is another misnomer for what are in fact privately owned and controlled ‘markets’.

<sup>3</sup> NHS England: The Health Innovation Network <https://www.england.nhs.uk/ourwork/part-rel/healthinnovationnetwork/>  
<sup>4</sup> <https://www.gov.uk/government/news/secretary-of-state-makes-economic-growth-a-priority>

<sup>5</sup> capitalisation values greater than the Gross Domestic Products (GDPs) of most countries’, and Research Funds similar in amounts to those of the ‘super-powers’

are called 'intangible' assets that are used to create ever greater market control. Big Tech has no wish to keep rivals out of any market but instead wants to subordinate them and to organise what the economic and social sciences literature more generally have described as Global Value Chains (GVCs)<sup>6</sup>.

What happens in the organisation of a GVC is an 'intellectual monopoly' dynamic akin to something perhaps more familiar - a franchise. So, let's look at NIKE, a global shoe design company whose shoes are manufactured by companies around the world in places where labour is cheaper, and the rights and safeguards of workers provide scant protection. Nike concentrates on the 'intangibles', such as the design and the brand of the shoe, and trademark protections, but also, going beyond that, the identity that makes someone feel that the shoe is something special 'because it is Nike'. It is because of its control over these 'intangibles' that Nike can control a whole set of other companies which are part of the 'value chain' and the 'supply chain' and can tell them not only exactly what to do and how to do it, but also what price it expects to pay for the shoes. This power also allows them to take a major part of the total profit from the franchisees.

A similar dynamic exists in the context of Big Tech and healthcare, particularly with AI and digital technologies. Here, Big Tech companies produce some of the intangibles (knowledge) in house, but always use and codevelop this with many others (such as open-source development platforms, universities, and public research organisations), creating what have been called 'Corporate Innovation Systems' (CIS)<sup>7</sup>. Big Tech rent out bits of key knowledge to smaller 'partner' companies; rent out places on their 'clouds' which act like 'virtual factories' where smaller companies manufacture innovative products to sell; and Big Tech control the entire process and extract the most wealth of all involved.



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## 2. The structure of Big Tech 'public clouds'

Big Tech have been (and remain) 'ahead of the game' in investing in the infrastructure needed for 'public clouds' to manage the big data sets for analysis, to run and train algorithms; and to host their own and 'partner' companies' software. This infrastructure consists of a range of services,<sup>8</sup> which require huge compute power, hyperscale data storage, cybersecurity, and the ability to handle large datasets for the running or development of Big Tech's own ('native') algorithms, and those run or developed by the companies who pay rent for the use of the 'cloud' facilities.

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<sup>6</sup> <https://www.tutor2u.net/economics/topics/global-value-chain>

<sup>7</sup> Cecilia Rikap (24 Jun 2024): Varieties of corporate innovation systems and their interplay with global and national systems: Amazon, Facebook, Google and Microsoft's strategies to produce and appropriate artificial intelligence, Review of International Political Economy, <https://doi.org/10.1080/09692290.2024.2365757>

<sup>8</sup> i) *Infrastructure as a service (IaaS)*, providing on-demand access to computing resources such as servers, storage, networking, and virtualization i.e. virtual representations of servers, storage, and other physical machines; ii) *Data as a service (DaaS)*, which uses the 'cloud' to make valuable or service-critical data accessible in a secure manner; iii) *Software as a service (SaaS)*, providing on-demand access to ready-to-use 'cloud'-hosted applications.; and iv) *Platform as a service (PaaS)*, which provides a 'complete development and deployment environment for services in the 'cloud'.

This hardware, plus the data for analysis and training, the knowledge, and the code/algorithms (which are kept secret, even from users) comprise the total ‘package’ necessary to control the market in healthcare innovation. In addition, to get any customer, such as the NHS, onto the ‘cloud’, a different set of ‘partner’ companies ( e.g. the [AWS Cloud Consulting Partners Network](#) ) is used to market services and tailor the ‘cloud’ experience to the needs of customers. In this way the NHS does not deal directly with Big Tech but with a host of smaller companies taking on the responsibilities of tech provision - the Big Tech infrastructure and its associated costs for the service may remain almost invisible!

### Feasting on academic talent

As mentioned above, Big Tech needs to acquire intangible assets e.g. new knowledge. In the pursuit of these assets, Big Tech may carry out joint research with many public universities and institutions around the world and then take out patents -but only on their own behalf.<sup>9</sup>

**Tech giants' co-authorships and co-ownerships**  
Source: Web of Science & Derwent Innovation

Company	Publications (until 2019 included)	Co-authoring organizations	Applied and granted patents (until 2017 included)	Co-owned patents with other organizations
Amazon	824	766	10063	13 (0.1%)
Microsoft	17405	4025	76109	160 (0.2%)
Google	6447	3397	25538	65 (0.3%)
Tencent	643	366	5462	13 (0.2%)
Alibaba	685	427	3532	0 (0%)

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At the same time, Big Tech often drain talent from academia, with Google, Amazon and Microsoft hiring the largest number of ‘AI scholars’, followed by Meta, Uber and Nvidia.<sup>10</sup> While young prominent scientists may accept full-time jobs with Big Tech after their PhDs, several senior scholars have been given juicier deals: they remain affiliated to their academic institution (keeping the prestige and the students that work with them and bring fresh ideas), while they are offered a millionaire compensation package to work part-time for Big Tech as well.<sup>11</sup>

Defining and then controlling the research agenda is also a useful way to control the market. Since 2012 Big Tech, especially Google and Microsoft, has increased its participation in major AI conferences. They lead in the number of presentations and the number of other organisations co-authoring research with them. While one driver for this is to identify and recruit AI scientists, another is the ability to orchestrate what organisations from around the world perceive as the ‘frontier in AI’ and to encourage the whole field to work on Big Tech priorities.

US Big Tech companies are heavily represented on these conferences’ committees. At the main machine learning annual conference, called ‘Neural Information Processing Systems’ or ‘NeurIPS’,

<sup>9</sup> Rikap C. and Lundvall B-Å. Big Tech, Knowledge predation and the implications for development. Download [here](#)

<sup>10</sup> Michael Gofman and Zhao Jin, “Artificial Intelligence, Education, and Entrepreneurship”, Journal of Finance, August 2022. <https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/jofi.13302>

<sup>11</sup> Ibid: A recent sample of all the presentations made at the 14 most prestigious AI conferences found around 100 universities and public research organisations with scholars that had such double affiliations with Amazon, Meta, and especially Microsoft and Google. They were mostly in the US, but institutions from Europe, China, Canada, Hong Kong and Israel also have such scholars.

every Big Tech has at least one member in the organising committee.<sup>12</sup> By joining these committees, tech giants get to define what papers will be accepted or win prizes, and apparently in tech this is a key sign of power to shape the field.

### Help from weakened regulation

In all this, Big Tech has benefited from a transformation at the level of policies and regulations that have become less vigilant on issues related to antitrust,<sup>13</sup> or the concentration of monopoly power (unless they have a direct impact on consumers). Some of the companies involved do *not* sell directly to consumers - for instance Big Pharma sell to governments - and Big Tech companies often seem to be offering something for free or very cheaply, as on Amazon, or sell through 'partners' (see above). It is only through identifying the full business models that we realise that Big Tech are capturing value from many places and from many other companies, and all the while appropriating data (knowledge) from all of us while we use their platforms. At the same time the patents regime has been strengthened through an increase in the scope of what can be patented and protected.<sup>14,15</sup> All this has helped to develop a process where the winner keeps winning, again and again.

### Further downsides

As well as the control that Big Tech can exert over innovation development and the market, there is a further, distinct downside in using 'clouds'. Even huge, extremely 'business savvy' global private corporations (e.g. Procter & Gamble, Samsung, Walmart) that have moved to 'cloud' have:

- found that costs of 'cloud' services gradually rise and 'customer relations' deteriorate over time. They use the term '**frenemy**' to describe their changing relationship with 'cloud'.
- found it difficult to leave 'cloud' (what's called '**stickiness**')<sup>16</sup> because it was so expensive to do so, and the fact that Big Tech uses so-called '**black boxes**'<sup>17</sup> meant that the companies were never able to learn anything helpful about the use of any algorithms or how to develop new tech themselves.
- eventually had to leave 'cloud' when the decrease in the quality of services and the increase in costs became unacceptable due to Big Tech pushing the imbalance in the market to its limits of wealth extraction.<sup>18</sup> This process Cory Doctorow calls '**enshitification**' (American Dialect society word of the year 2023)<sup>19</sup> aka 'platform decay'.

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<sup>12</sup> In the NeurIPS 2022 meeting, Google, who had the largest number of papers accepted, provided nine of the 39 committee members.

<sup>13</sup> Antitrust rules prohibit i) agreements between market operators that would restrict competition, and ii) the abuse of dominance.

<sup>14</sup> Christian Bessy. The transformations of conventions for patent use and the role of legal intermediaries. 2019. <https://shs.hal.science/halshs-01872163>

<sup>15</sup> Rochelle Dreyfuss & Susy Frankel, From Incentive to Commodity to Asset: How International Law is Reconceptualizing Intellectual Property, 36 Mich. J. Int'l L. 557 (2015). <https://repository.law.umich.edu/mjil/vol36/iss4/1>

<sup>16</sup> <https://doctorsinunite.com/wp-content/uploads/2024/02/cecilia-rikap-intellectual-monopolies-big-tech-and-healthcare-transcript-to-end-of-talk-edit-mb.pdf> page 12 Black boxes; page 16 'Stickiness'.

<sup>17</sup> Rikap, C. (2022). The expansionary strategies of intellectual monopolies: Google and the digitalization of healthcare. *Economy and Society*, 52(1), pp. 110-136. . <https://doi.org/10.1080/03085147.2022.2131271> see page 116.

<sup>18</sup> [https://www.theregister.com/2022/06/08/oracle\\_closes\\_283bn\\_cerner\\_deal/](https://www.theregister.com/2022/06/08/oracle_closes_283bn_cerner_deal/)

<sup>19</sup> Cory Doctorow is a special adviser to the Electronic Frontier Foundation and a visiting professor of computer science at the Open University.

### 3. Power and Big Tech's entry into healthcare

Big Tech was already employed by central government<sup>20</sup> before it was welcomed into the English NHS, most notably during the COVID pandemic.<sup>21</sup> However, some of the negotiations between our national government, health academics and Big Tech about the type of infrastructure to be used in the public health actions during COVID highlight a very worrying 'power imbalance' in that Big Tech got its own way.<sup>22</sup>

In order to facilitate its move into the health sector Big Tech companies have identified and invested in (or even owned as subsidiaries) many smaller companies that they regard as the 'most promising' in the sense that they will assist Big Tech's own growth. Inviting smaller start-up companies to rent places on their 'cloud' so that they can make use of the available cutting-edge technology helps Big Tech with the process of identification, and also with the subsequent control of any 'development process'. It is the huge resource from venture capital that enables Big Tech to invest in hundreds of smaller companies, and in so doing to develop what is called a 'Kill Zone'- when 'start-ups' are acquired in a particular area, other venture capitalists reduce their investments in competing companies or those in close markets in the anticipation that such acquisitions by Big Tech will lead to a 'winner take all' market.<sup>23</sup>

#### Acquisitions as part of Google's entry into healthcare-a Big Tech example<sup>24</sup>

Google was founded in 1998 and up to mid-2021 had acquired an astonishing 248 companies to develop its Big Tech status; until 2014 these were mainly software, internet services, apps, IT and mobile data technologies. From then on it moved quickly and powerfully into Big Data and analytics buying out 18 AI companies and gathering the hardware necessary for 'cloud' services; it then chose the sectors it wished to move in on and focused on companies specifically related to Education and Healthcare. It gathered 'intangible assets' by applying for 53 patents in healthcare between 2014 and 2019 and acquired companies to act in the market using their own brand names but under Google's control. These included 'Fit-Bit', and the less well known 'North'-a pioneer in human computer interfaces and Smart Glasses, and 'Eyefluence' - an eye interaction technology which owned a further 18 utility patents/intangibles from eye-tracking to biometric security scanning. These actions reduce the visibility of Google's healthcare ventures, as does the way that Google channels various healthcare operations through subsidiaries: Google Health, Verily Life Sciences, Calico (which focuses on ageing and age-related diseases) and DeepMind, a leader in AI, machine learning and neuroscience that was acquired as a UCL spin-off in 2014. These enable Google to cover a broad range of medical specialities and interests including: predicting the likelihood of future acute kidney injury (AKI); the prediction of protein structures; early detection of: diabetes, Parkinson's disease, and heart diseases; and the definition of a healthy individual's 'biochemical fingerprint'; while Verily has just agreed to work with

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<sup>20</sup> <https://www.thestack.technology/uk-government-cloud-spend-digital-suppliers/> see link to Crown Commercial Services dashboard powered by Microsoft

<sup>21</sup> <https://www.instituteforgovernment.org.uk/sites/default/files/2023-02/nhs-covid-datastore.pdf>

<sup>22</sup> <https://www.chathamhouse.org/2021/02/covid-19-pandemic-and-trends-technology/02-covid-19-app-how-big-tech-outwitted-uk> 'The episode highlights the power imbalances between elected governments and private sector corporations. There are significant differences in levels of accountability and transparency between the public and private sectors. It underlines the realpolitik of corporate power over that of democratically elected governments, and the willingness to block access to essential technologies....'

<sup>23</sup> Kamepalli, S. K., Rajan, R. & Zingales, L. (2020). Kill zone. National Bureau of Economic Research. doi:10. 3386/w27146 [https://www.nber.org/system/files/working\\_papers/w27146/w27146.pdf](https://www.nber.org/system/files/working_papers/w27146/w27146.pdf)

<sup>24</sup> Rikap, C. (2022). The expansionary strategies of intellectual monopolies: Google and the digitalization of healthcare. *Economy and Society*, 52(1), pp. 110-136. <https://doi.org/10.1080/03085147.2022.2131271> This paper shows how by buying and operating through wholly owned or heavily invested in subsidiaries, and any associated patents, Big Tech can be almost invisible to the public as it moves into and 'contols' numerous areas of healthcare.

Otsuka Pharmaceuticals to advance the development of novel treatments in the management of psychiatric disorders.<sup>25</sup> Overall, Google has managed to diversify the technological fields of its acquisitions, expanding its ‘intellectual monopoly’ and also its opportunities to employ its ‘winner takes all’ power.

Big Tech has entered sectors in ways like Google and has now set up shop in the NHS; most people are unaware of their role. If things are left unchanged, then as well as supplying almost all of the digital infrastructure needed for the future NHS to function, ‘business as usual’ will mean that between them and their venture capital investors, they will also control the market for the development and deployment of most of the innovation the NHS purchases. It will not be us owning and selling any tech, we will merely be the supplier of raw materials, finance a test showcase and, for tech useful elsewhere in the world, be part of the important ‘intangible’ brand.

### **What can be done?<sup>26</sup> (A few outline suggestions to be expanded in a further paper).**

1. The choice is not between accepting the dominance of Big Tech within AI development or rejecting the use of AI. Instead, Big Tech and the institutions that promote the development of AI should be regulated so that the interests of people are put ahead of profits
2. More regulation is needed on i) what type of AI is coded, ii) by whom and iii) who profits from it.
3. Further regulations must ensure that with *foundation models*<sup>27</sup>, the training data used, and its management is all brought into the public domain.
4. All further regulations should be accompanied by reforms in current antitrust laws<sup>13</sup> to ensure that AI start-ups get fair opportunities to grow in the market without being ‘taken over’ by a few huge companies that have access to vast amounts of corporate venture capital.
5. Our healthcare requires a more holistic perspective than individual technological fixes; we need research that synthesises multiple data sources to assess and address the socio-environmental determinants of health, and factors influencing disease onset and progression- an approach that seems to be decidedly absent in the current neoliberal agenda.
6. Reciprocity should prevail. If tech companies want to access public data, they need to share ALL their datasets with the wider community for public research and the planning of services.
7. Public databases, such as healthcare datasets, should be built on the principle of data solidarity; decisions to share our data based on the key appreciation that it is only through ‘collective goods’ and ‘commons’ that we are able to realise our individual freedoms.
8. Data governance could be placed in the keeping of an independent organisation to ensure that data are shared only where they will contribute to increase the public good, and that results remain in the public sphere.
9. The kind of life we want to live is a *political* decision; technology can, at most, unlock possible better futures. Without democratic control of AI, those better futures will never come about.

These are things that can be done by others. But before we consider what KONP can do, we need to examine other serious harms of Big Tech and their ‘clouds’- see our second linked, paper on the global implications see **here**.

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<sup>25</sup> <https://www.otsuka-us.com/news/otsuka-works-verily-launch-longitudinal-mental-health-registry-advance-novel-research>

<sup>26</sup> Rikap C. Dynamics of corporate governance beyond owner ownership in AI. Briefing. Common Wealth, May 2024  
<https://www.common-wealth.org/publications/dynamics-of-corporate-governance-beyond-ownership-in-ai>

<sup>27</sup> Foundation models are AI systems that can be applied to different tasks with minimal fine-tuning