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Platform Capitalism

Capitalism, when a crisis hits, tends to be restructured. New technologies, new organisational forms, new modes of exploitation, new types of jobs, and new markets all emerge to create a new way of accumulating capital. As we saw with the crisis of overcapacity in the 1970s, manufacturing attempted to recover by attacking labour and by turning towards increasingly lean business models. In the wake of the 1990s bust, internet-based companies shifted to business models that monetised the free resources available to them. While the dot-com bust placed a pall over investor enthusiasm for internet-based firms, the subsequent decade saw technology firms significantly progressing in terms of the amount of power and capital at their disposal. Since the 2008 crisis, has there been a similar shift? The dominant narrative in the advanced capitalist countries *has* been one of change. In particular, there has been a renewed focus on the rise of technology: automation, the sharing economy, endless stories about the 'Uber for X', and, since around 2010, proclamations about the internet of things. These changes have received labels such as 'paradigm shift' from McKinsey[1] and 'fourth industrial revolution' from the executive chairman of the World Economic Forum and, in more ridiculous formulations, have been compared in importance to the Renaissance and the Enlightenment.[2] We have witnessed a massive proliferation of new terms: the gig economy, the sharing economy, the on-demand economy, the next industrial revolution, the surveillance economy, the app economy, the attention economy, and so on. The task of this chapter is to examine these changes.

Numerous theorists have argued that these changes mean we live in a cognitive, or informational, or immaterial, or knowledge economy. But what does this mean? Here we can find a number of interconnected but distinct claims. In

Italian autonomism, this would be a claim about the 'general intellect', where *collective cooperation and knowledge become a source of value*.[3] Such an argument also entails that the *labour process is increasingly immaterial*, oriented towards the use and manipulation of symbols and affects. Likewise, the traditional industrial working class is increasingly replaced by *knowledge workers* or the 'cognitariat'. Simultaneously, the generalised deindustrialisation of the high-income economies means that *the product of work becomes immaterial*: cultural content, knowledge, affects, and services. This includes media content like YouTube and blogs, as well as broader contributions in the form of creating websites, participating in online forums, and producing software.[4] A related claim is that *material commodities contain an increasing amount of knowledge*, which is embodied in them. The production process of even the most basic agricultural commodities, for instance, is reliant upon a vast array of scientific and technical knowledges. On the other side of the class relation, some argue that the economy today is dominated by a new class, which does not own the means of production but rather has *ownership over information*.[5] There is some truth in this, but the argument goes awry when it situates this class outside of capitalism. Given that the imperatives of capitalism hold for these companies as much as for any other, the companies remain capitalist. Yet there is something new here, and it is worth trying to discern exactly what it is.

A key argument of this chapter is that in the twenty-first century advanced capitalism came to be centred upon extracting and using a particular kind of raw material: data. But it is important to be clear about what data are. In the first place, we will distinguish *data* (information that something happened) from *knowledge* (information about why something happened). Data may involve knowledge, but this is not a necessary condition. Data also entail recording, and therefore a material medium of some kind. As a recorded entity, any datum requires sensors to capture it and massive storage systems to maintain it. Data are not immaterial, as any glance at the energy consumption of data centres will quickly prove (and the internet as a whole is responsible for about 9.2 per cent of the world's electricity consumption).[6] We should also be wary of thinking that data collection and analysis are frictionless or automated processes. Most data must be cleaned and organised into standardised formats in order to be usable. Likewise, generating the proper algorithms can involve the manual entry of learning sets into a system. Altogether, this means that the collection of data today is dependent on a vast infrastructure to sense, record, and analyse.[7] What is recorded? Simply put, we should consider *data* to be the raw material that must be extracted, and the *activities* of users to be the natural source of this raw material.[8] Just like oil, data are a material to be extracted, refined, and used in a variety of ways. The more data one has, the more uses one can make of them.

Data were a resource that had been available for some time and used to lesser degrees in previous business models (particularly in coordinating the global logistics of lean production). In the twenty-first century, however, the technology needed for turning simple activities into recorded data became increasingly cheap; and the move to digital-based communications made recording exceedingly simple. Massive new expanses of potential data were opened up, and new industries arose to extract these data and to use them so as to optimise production processes, give insight into consumer preferences, control workers, provide the foundation for new products and services (e.g. Google Maps, self-driving cars, Siri), and sell to advertisers. All of this had historical precedents in earlier periods of capitalism, but what was novel with the shift in technology was the sheer amount of data that could now be used. From representing a peripheral aspect of businesses, data increasingly became a central resource. In the early years of the century it was hardly clear, however, that data would become the raw material to jumpstart a major shift in capitalism.[9] The incipient efforts by Google simply used data to draw advertising revenues away from traditional media outlets like newspapers and television. Google was performing a valuable service in organising the internet, but this was hardly a revolutionary change at an economic level. However, as the internet expanded and firms became dependent on digital communications for all aspects of their business, data became increasingly relevant. As I will attempt to show in this chapter, data have come to serve a number of key capitalist functions: they educate and give competitive advantage to algorithms; they enable the coordination and outsourcing of workers; they allow for the optimisation and flexibility of productive processes; they make possible the transformation of low-margin goods into high-margin services; and data analysis is itself generative of data, in a virtuous cycle. Given the significant advantages of recording and using data and the competitive pressures of capitalism, it was perhaps inevitable that this raw material would come to represent a vast new resource to be extracted from.

The problem for capitalist firms that continues to the present day is that old business models were not particularly well designed to extract and use data. Their method of operating was to produce a good in a factory where most of the information was lost, then to sell it, and never to learn anything about the customer or how the product was being used. While the global logistics network of lean production was an improvement in this respect, with few exceptions it remained a lossy model as well. A different business model was necessary if capitalist firms were to take full advantage of dwindling recording costs. This chapter argues that the new business model that eventually emerged is a powerful new type of firm: the platform.[10] Often arising out of internal needs to handle data, platforms became an efficient way to monopolise, extract, analyse, and use the increasingly large amounts of data that were being recorded. Now this model has come to expand across the economy, as numerous companies incorporate platforms: powerful technology companies (Google, Facebook, and Amazon), dynamic start-ups (Uber, Airbnb), industrial leaders (GE, Siemens), and agricultural powerhouses (John Deere, Monsanto), to name just a few.

What are platforms?[11] At the most general level, platforms are digital infrastructures that enable two or more groups to interact.[12] They therefore position themselves as intermediaries that bring together different users: customers, advertisers, service providers, producers, suppliers, and even physical objects.[13] More often than not, these platforms also come with a series of tools that enable their users to build their own products, services, and marketplaces.[14] Microsoft's Windows operating system enables software developers to create applications for it and sell them to consumers; Apple's App Store and its associated ecosystem (XCode and the iOS SDK) enable developers to build and sell new apps to users; Google's search engine provides a platform for advertisers and content providers to target people searching for information; and Uber's taxi app enables drivers and passengers to exchange rides for cash. Rather than having to build a marketplace from the ground up, a platform provides the basic infrastructure to mediate between different groups. This is the key to its advantage over traditional business models when it comes to data, since a platform positions itself (1) between users, and (2) as the ground upon which their activities occur, which thus gives it privileged access to record them. Google, as the platform for searching, draws on vast amounts of search activity (which express the fluctuating desires of individuals). Uber, as the platform for taxis, draws on traffic data and the activities of drivers and riders. Facebook, as the platform for social networking, brings in a variety of intimate social interactions that can then be recorded. And, as more and more industries move their interactions online (e.g. Uber shifting the taxi industry into a digital form), more and more businesses will be subject to platform development. Platforms are, as a result, far more than internet companies or tech companies, since they can operate anywhere, wherever digital interaction takes place.

The second essential characteristic is that digital platforms produce and are reliant on 'network effects': the more numerous the users who use a platform, the more valuable that platform becomes for everyone else. Facebook, for example, has become the default social networking platform simply by virtue of the sheer number of people on it. If you want to join a platform for socialising, you join the platform where most of your friends and family already are. Likewise, the more numerous the users who search on Google, the better their search algorithms become, and the more useful Google becomes to users. But this generates a cycle whereby more users beget more users, which leads to platforms having a natural tendency towards monopolisation. It also lends platforms a dynamic of ever-increasing access to more activities, and therefore to more data. Moreover, the ability to rapidly scale many platform businesses by relying on pre-existing infrastructure and cheap marginal costs means that there are few natural limits to growth. One reason for Uber's rapid growth, for instance, is that it does not need to build new factories – it just needs to rent more servers. Combined with network effects, this means that platforms can grow very big very quickly.

The importance of network effects means that platforms must deploy a range of tactics to ensure that more and more users come on board. For example – and this is the third characteristic – platforms often use cross-subsidisation: one arm of the firm reduces the price of a service or good (even providing it for free), but another arm raises prices in order to make up for these losses. The price structure of the platform matters significantly for how many users become involved and how often they use the platform.[15] Google, for instance, provides service likes email for free in order to get users on board, but raises money through its advertising arm. Since platforms have to attract a number of different groups, part of their business is fine-tuning the balance between what is paid, what is not paid, what is subsidised, and what is not subsidised. This is a far cry from the lean model, which aimed to reduce a company down to its core competencies and sell off any unprofitable ventures.[16]

Finally, platforms are also designed in a way that makes them attractive to its varied users. While often presenting themselves as empty spaces for others to interact on, they in fact embody a politics. The rules of product and service development, as well as marketplace interactions, are set by the platform owner. Uber, despite presenting itself as an empty vessel for market forces, shapes the appearance of a market. It predicts where the demand for drivers will be and raises surge prices in advance of actual demand, while also creating phantom cabs to give an illusion of greater supply.[17] In their position as an intermediary, platforms gain not only access to more data but also control and governance over the rules of the game. The core architecture of fixed rules, however, is also generative, enabling others to build upon them in unexpected ways. The core architecture of Facebook, for instance, has allowed developers to produce apps, companies to create pages, and users to share information in a way that brings in even more users. The same holds for Apple's App Store, which enabled the production of numerous useful apps that tied users and software developers increasingly into its ecosystem. The challenge of maintaining platforms is, in part, to revise the cross-subsidisation links and the rules of the platform in order to sustain user interest. While network effects strongly support existing platform leaders, these positions are not unassailable. Platforms, in sum, are a new type of firm; they are characterised by providing the infrastructure to intermediate between different user groups, by displaying monopoly tendencies driven by network effects, by employing cross-subsidisation to draw in different user groups, and by having a designed core architecture that governs the interaction possibilities. Platform ownership, in turn, is essentially ownership of software (the 2 billion lines of code for Google, or the 20 million lines of code for Facebook)[18] and hardware (servers, data centres, smartphones, etc.), built upon open-source material (e.g. Hadoop's data management system is used by Facebook).[19] All these characteristics make platforms key business models for extracting and controlling data. By providing a digital space for others to interact in, platforms position themselves so as to extract data from natural processes (weather conditions, crop cycles, etc.), from production processes (assembly lines, continuous flow manufacturing, etc.), and from other businesses and users (web tracking, usage data, etc.). They are an extractive apparatus for data.

The remainder of this chapter will give an overview of the emerging platform landscape by way of presenting five different types of platforms. In each of these areas, the important element is that the capitalist class owns the platform, not necessarily that it produces a physical product. The first type is that of *advertising platforms* (e.g. Google, Facebook), which extract information on users, undertake a labour of analysis, and then use the products of that process to sell ad space. The second type is that of *cloud platforms* (e.g. AWS, Salesforce), which own the hardware and software of digital-dependent businesses and are renting them out as needed. The third type is that of *industrial platforms* (e.g. GE, Siemens), which build the hardware and software necessary to transform traditional manufacturing into internet-connected processes that lower the costs of production and transform goods into services. The fourth type is that of *product platforms* (e.g. Rolls Royce, Spotify), which generate revenue by using other platforms to transform a traditional good into a service and by collecting rent or subscription fees on them. Finally, the fifth type is that of *lean platforms* (e.g. Uber, Airbnb), which attempt to reduce their ownership of assets to a minimum and to profit by reducing costs as much as possible. These analytical divisions can, and often do, run together within any one firm. Amazon, for example, is often seen as an e-commerce company, yet it rapidly broadened out into a logistics company. Today it is spreading into the on-demand market with a Home Services program in partnership with TaskRabbit, while the infamous Mechanical Turk (AMT) was in many ways a pioneer for the gig economy and, perhaps most importantly, is developing Amazon Web Services as a cloud-based service. Amazon therefore spans nearly all of the above categories.

Advertising Platforms

The elders of this new enterprise form, advertising platforms are the initial attempts at building a model adequate to the digital age. As we will see, they have directly and indirectly fostered the emergence of the most recent technological trends – from the sharing economy to the industrial internet. They emerged out of the easy credit-fuelled dot-com bust, whose effect was twofold. One aspect of it was that many competitors collapsed, leaving the various areas of the tech industry increasingly under the control of the remaining enterprises. The sudden unwillingness of venture capital (VC) to finance new entries meant that entry into the competitive landscape remained closed as well. The monopoly tendencies of the early tech boom were solidified here, as a new range of dominant companies emerged from the ashes and have continued to dominate ever since. The other important consequence of the bust was that the drying up of VC and equity financing placed new pressure on internet-based companies to generate revenues. In the midst of the boom there was no clearly dominant way to raise a sustainable revenue stream – companies were relatively equally divided among different proposals.[20] However, the centrality of marketing to finance capital's 'growth before profits' strategy meant that dot-com firms had already built the basis for a business model oriented towards advertising and attracting users. As a percentage of revenues, these firms spent 3–4 times more than other sectors on advertising, and they were the pioneers in purchasing online advertising as well.[21] When the bubble burst, it was perhaps inevitable that these companies would turn towards advertising as their major revenue source. In this endeavour, Google and Facebook have come to represent the leading edges of this process.

Created in 1997, Google was an early recipient of venture funding in 1998 and received a major $25 million funding round in 1999. At this point Google had been collecting user data from searches and using these data to improve searches.[22] This was an example of the classic use of data within capitalism: it was meant to improve one's services for customers and users. But there was no value leftover from which Google could generate revenue. In the wake of the dot-com bust, Google increasingly needed a way to generate revenues, yet a fee-based service risked alienating the users who were the basis of its success. Eventually it began to use the search data, along with cookies and other bits of information, to sell targeted ad space to advertisers through an increasingly automated auction system.[23] When the National Association of Securities Dealers Automated Quotations (NASDAQ) market peaked in March 2000, Google unveiled AdWords in October 2000 and began its transformation into a revenue-generating company. The extracted data moved from being a way to improve services to becoming a way to collect advertising revenues.

Today Google and Facebook remain almost entirely dependent on them: in the first quarter of 2016, 89.0 per cent of Google's and 96.6 per cent of Facebook's revenues came from advertisers.

This was part and parcel of the broader shift, in the early years of the new millennium, to Web 2.0, which was premised more on user-generated content than on digital storefronts and on multimedia interfaces rather than on static text. In the press, this shift came packaged with a rhetoric of democratising communication in which anyone would be able to create and share content online. No longer would newspapers and other mass media outlets have a monopoly over what was voiced in society. For critical theorists of the web, this rhetoric obscured a shift to business models premised upon the exploitation of 'free labour'.[24] From this perspective, the story of how Google and Facebook generate profit has been a simple one: users are unwaged labourers who produce goods (data and content) that are then taken and sold by the companies to advertisers and other interested parties. There are a number of problems with this account, however. A first issue with the free labour argument is that it often slides into grand metaphysical claims. *All* social interaction becomes free labour for capitalism, and we begin to worry that there is no outside to capitalism. Work becomes inseparable from non-work and precise categories become blunt banalities. It is important, however, to draw distinctions between interactions done on platforms and interactions done elsewhere, as well as between interactions done on profit-oriented platforms and interactions done on other platforms.[25] Not all – and not even most – of our social interactions are co-opted into a system of profit generation. In fact one of the reasons why companies must compete to build platforms is that most of our social interactions do *not* enter into a valorisation process. If all of our actions were already captured within capitalist valorisation, it is hard to see why there would be a need to build the extractive apparatus of platforms. More broadly, 'free labour' is only a portion of the multitude of data sources that a company like Google relies upon: economic transactions, information collected by sensors in the internet of things, corporate and government data (such as credit records and financial records), and public and private surveillance (such as the cars used to build up Google Maps).[26]

Yet even limiting our attention to user-created data, it is right to call this activity *labour*? Within a Marxist framework, labour has a very particular meaning: it is an activity that generates a surplus value within a context of markets for labour and a production process oriented towards exchange. The debate over whether or not online social interaction is part of capitalist production is not just a tedious scholarly debate over definitions. The relevance of whether this interaction is free labour or not has to do with consequences. If it is capitalist, then it will be pressured by all the standard capitalist imperatives: to rationalise the production processes, to lower costs, to increase productivity, and so on. If it is not, then those demands will not be imposed. In examining the activities of users online, it is hard to make the case that what they do is labour, properly speaking. Beyond the intuitive hesitation to think that messaging friends is labour, any idea of socially necessary labour time – the implicit standard against which production processes are set – is lacking. This means there are no competitive pressures for getting users to *do* more, even if there are pressures to get them to do more online. More broadly, if our online interactions are free labour, then these companies must be a significant boon to capitalism overall – a whole new landscape of exploited labour has been opened up. On the other hand, if this is not free labour, then these firms are parasitical on other value-producing industries and global capitalism is in a more dire state. A quick glance at the stagnating global economy suggests that the latter is more likely.

Rather than exploiting free labour, the position taken here is that advertising platforms appropriate data as a raw material. The activities of users and institutions, if they are recorded and transformed into data, become a raw material that can be refined and used in a variety of ways by platforms. With advertising platforms in particular, revenue is generated through the extraction of data from users' activities online, from the analysis of those data, and from the auctioning of ad space to advertisers. This involves achieving two processes. First, advertising platforms need to monitor and record online activities. The more users interact with a site, the more information can be collected and used. Equally, as users wander around the internet, they are tracked via cookies and other means, and these data become ever more extensive and valuable to advertisers. There is a convergence of surveillance and profit making in the digital economy, which leads some to speak of 'surveillance capitalism'.[27] Key to revenues, however, is not just the collection of data, but also the analysis of data. Advertisers are interested less in unorganised data and more in data that give them insights or match them to likely consumers. These are data that have been *worked on*.[28] They have had some process applied to them, whether through the skilled labour of a data scientist or the automated labour of a machine-learning algorithm. What is sold to advertisers is therefore not the data themselves (advertisers do not receive personalised data), but rather the promise that Google's software will adeptly match an advertiser with the correct users when needed.

While the data extraction model has been prominent in the online world, it has also migrated into the offline world. Tesco, one of the world's largest retailers, owns Dunnhumby, a UK-based 'consumer insights' business valued at around $2 billion. (The US arm of the company was recently sold to Kroger, one of America's largest employers.) The company is premised upon tracking consumers both online and offline and using that information to sell to clients such as Coca-Cola, Macy's, and Office Depot. It has attempted to build a monopolistic platform for itself as well, through a loyalty card that channels customers into Tesco stores with the promise of rewards. Simultaneously, more and more diverse information about customers is being tracked (to the point where the company is even suggesting using wearables as a source of customer health data).[29] Non-tech firms are also developing user databases and using data to adapt to customer trends and effectively market goods to consumers. Data extraction is becoming a key method of building a monopolistic platform and of siphoning off revenue from advertisers.

These advertising platforms are currently the most successful of the new platform businesses, with high revenues, significant profits, and a vigorous dynamism. But what have they been doing with their revenues? Investment levels remain low in the United States, United Kingdom, and Germany, so there has been little growth in fixed capital. Instead these companies have tended to do three things with their cash. One was to save it, and high levels of corporate cash have been an odd phenomenon of the post-2008 era. As we saw in Chapter 1, tech companies have taken up a disproportionately large amount of this cash glut. The leaders of tax evasion have also been tech companies: Google, Apple, Facebook, Amazon, and Uber. The second use of this cash was in high levels of mergers and acquisitions – a process that centralises existing capacity rather than building new capacity. Among the big tech companies, Google has made the most acquisitions over the past five years (on average, it purchases a new company every week),[30] while Facebook has some of the biggest acquisitions (e.g. it bought WhatsApp for $22 billion).[31] Google's creation of the Alphabet Holding Company in 2015 is part and parcel of this process; this was an effort designed to enable Google to purchase firms in other industries while giving them a clear delineation from its core business. Thirdly, these companies have funnelled their money into tech start-ups, many of the advertising platforms being large investors in this area. As we will see, they have set the conditions for the latest tech boom. Most importantly, however, they have provided a business model – the platform – that is now being replicated across a variety of industries.

Cloud Platforms

If advertising platforms like Google and Facebook laid the groundwork for extracting and using massive amounts of data, then the emerging cloud platforms are the step that has consolidated the platform as a unique and powerful business model. The story of corporate cloud rental begins with e-commerce in the 1990s. During the late 1990s, e-commerce companies thought they could outsource the material aspects of exchange to others. But this proved to be insufficient, and companies ended up taking on the tasks of building warehouses and logistical networks and hiring large numbers of workers.[32] By 2016 Amazon has invested in vast data centres, robotic warehouse movers, and massive computer systems, had pioneered the use of drones for deliveries, and recently began leasing airplanes for its shipping section.[33] It is also by far the largest employer in the digital economy, employing over 230,000 workers and tens of thousands of seasonal workers, most of whom do low-wage and highly stressful jobs in warehouses. To grow as an e-commerce platform, Amazon has sought to gain as many users as possible through cross-subsidisation. By all accounts, the Amazon Prime delivery service loses money on every order, and the Kindle e-book reader is sold at cost.[34] On traditional metrics for lean businesses, this is unintelligible: unprofitable ventures should be cut off. Yet rapid and cheap delivery is one of the main ways in which Amazon entices users onto its platform in order to make revenues elsewhere.

In the process of building a massive logistical network, Amazon Web Services (AWS) was developed as an internal platform, to handle the increasingly complex logistics of the company. Indeed, a common theme in the genesis of platforms is that they often emerge out of internal company needs. Amazon required ways to get new services up and running quickly, and the answer was to build up the basic infrastructure in a way that enabled new services to use it easily.[35] It was quickly recognised that this could also be rented to other firms. In effect AWS rents out cloud computing services, which include on-demand services for servers, storage and computing power, software development tools and operating systems, and ready-made applications.[36] The utility of this practice for other businesses is that they do not need to spend the time and money to build up their own hardware system, their own software development kit, or their own applications. They can simply rent these on an 'as needed' basis. Software, for instance, is increasingly deployed on a subscription basis; Adobe, Google, and Microsoft have all started to incorporate this practice. Likewise, the sophisticated analytical tools that Google has developed are now beginning to be rented out as part of its AWS competitor.[37] Other businesses can now rent the ability to use pattern recognition algorithms and audio transcription services. In other words, Google is selling its machine-learning processes (and this is precisely where Google sees its advantage over its competitors in the cloud computing field). Microsoft, meanwhile, has built an artificial intelligence platform that gives businesses the software development tools to build their own bots ('intelligence as a service', in the contemporary lingo). And International Business Machines (IBM) is moving to make quantum cloud computing a reality.[38] Cloud platforms ultimately enable the outsourcing of much of a company's information technology (IT) department. This process pushes knowledge workers out and often enables the automation of their work as well. Data analysis, storage of customer information, maintenance of a company's servers – all of this can be pushed to the cloud and provides the capitalist rationale for using these platforms.

The logic behind them is akin to how utilities function. Jeff Bezos, Amazon's chief executive officer, compares it to electricity provision: whereas early factories had each its own power generator, eventually electricity generation became centralised and rented out on an 'as needed' basis. Today every area of the economy is increasingly integrated with a digital layer; therefore owning the infrastructure that is necessary to every other industry is an immensely powerful and profitable position to be in. Moreover, the significance of the cloud platform for data extraction is that its rental model enables it to constantly collect data, whereas the older purchasing model involved selling these as goods that were then separated from the company. By moving businesses' activities onto cloud platforms, companies like Amazon gain direct access to whole new datasets (even if some remain occluded to the platform). It is unsurprising, then, that AWS is now estimated to be worth around $70 billion,[39] and major competitors like Microsoft and Google are moving into the field, as well as Chinese competitors like Alibaba. AWS is now the most rapidly growing part of Amazon – and also the most profitable, with about 30 per cent margins and nearly $8 billion in revenue in 2015. In the first quarter of 2016, AWS generated more profit for Amazon than its core retail service.[40] If Google and Facebook built the first data extraction platforms, Amazon built the first major cloud platform in order to rent out an increasingly basic means of production for contemporary businesses. Rather than relying on advertisers' buying data, these cloud platforms are building up the basic infrastructure of the digital economy in a way that can be rented out profitably to others, while they collect data for their own uses.

Industrial Platforms

As data collection, storage, and analysis have become increasingly cheaper, more and more companies have attempted to bring platforms into the field of traditional manufacturing. The most significant of these attempts goes under the rubric of 'the industrial internet of things', or simply 'the industrial internet'. At the most basic level, the industrial internet involves the embedding of sensors and computer chips into the production process and of trackers (e.g. RFID) into the logistics process, all linked together through connections over the internet. In Germany, this process is being heralded as 'Industry 4.0'. The idea is that each component in the production process becomes able to communicate with assembly machines and other components, without the guidance of workers or managers. Data about the position and state of these components are constantly shared with other elements in the production process. In this vision, material goods become inseparable from their informational representations. For its proponents, the industrial internet will optimise the production process: they argue that it is capable of reducing labour costs by 25 per cent, of reducing energy costs by 20 per cent (e.g. data centres would distribute energy where it is needed and when), of reducing maintenance costs by 40 per cent by issuing warnings of wear and tear, of reducing downtime by scheduling it for appropriate times, and of reducing errors and increasing quality.[41] The industrial internet promises, in effect, to make the production process more efficient, primarily by doing what competitive manufacturing has been doing for some time now: reducing costs and downtime. But it also aims to link the production process more closely to the realisation process. Rather than relying on focus groups or surveys, manufacturers are hoping to develop new products and design new features on the basis of usage data drawn from existing products (even by using online methodologies like A/B testing to do so).[42] The industrial internet also enables mass customisation. In one test factory from BASF SE, the largest chemicals producer in the world, the assembly line is capable of individually customising every unit that comes down the line: individual soap bottles can have different fragrances, colours, labels, and soaps, all being automatically produced once a customer places an order.[43] Product lifecycles can be significantly reduced as a result.

As factories begin to implement the components for the industrial internet, one major challenge is establishing a common standard for communication; interoperability between components needs to be ensured, particularly in the case of older machinery. This is where industrial platforms come in, functioning as the basic core framework for linking together sensors and actuators, factories and suppliers, producers and consumers, software and hardware. These are the developing powerhouses of industry, which are building the hardware and software to run the industrial internet across turbines, oil wells, motors, factory floors, trucking fleets, and many more applications. As one report puts it, with the industrial internet 'the big winners will be platform owners'.[44] It is therefore no surprise to see traditional manufacturing powerhouses like General Electric (GE) and Siemens, as well as traditional tech titans like Intel and Microsoft, make a major push to develop industrial internet platforms. Siemens has spent over €4 billion to acquire smart manufacturing capabilities and to build its industrial platform MindSphere,[45] while GE has been working rapidly to develop its own platform, Predix. The field has so far been dominated by these established companies rather than being subject to an influx of new start-ups. And even the industrial internet start-ups are primarily funded by the old guard (four of the top five investors), keeping funding for the sector strong in 2016 despite a general slowdown in other start-up areas.[46] The shift to industrial platforms is also an expression of national economic competition, as Germany (a traditional manufacturing powerhouse represented by Siemens) and the United States (a technology powerhouse represented by GE) are the primary supporters of this shift. Germany has enthusiastically bought into this idea and developed its own consortium to support the project, as has the United States, where companies like GE, Intel, Cisco, and IBM have partnered with the government in a similar non-profit consortium to push for smart manufacturing. At the moment the German consortium aims simply to raise awareness and support for the industrial Internet, while the American consortium is actively expanding trials with the technology.

The competition here is ultimately over the ability to build the monopolistic platform for manufacturing: 'It's winner takes all,' says GE's chief digital officer.[47] Predix and MindSphere both already offer infrastructural services (cloud-based computing), development tools, and applications for managing the industrial internet (i.e. an app store for factories). Rather than companies developing their own software to manage the internal internet, these platforms license out the tools needed. Expertise is necessary, for instance, in order to cope with the massive amounts of data that will be produced and to develop new analytical tools for things like time series data and geographical data. GE's liquid natural gas business alone is already collecting as many data as Facebook and requires a series of specialised tools to manage the influx of data.[48] The same holds for software designed to collect and analyse big data, for the modelling of physical-based systems, or for software that makes changes in factories and power plants. These platforms also provide the hardware (servers, storage, etc.) needed to operate an industrial internet. In competition with more generic platforms like AWS, industrial platforms promote themselves as having insider knowledge of manufacturing and the security necessary to run such a system. Like other platforms, these industrial firms rely on extracting data as a competitive tool against their rivals, a tool that ensures quicker, cheaper, more flexible services. By positioning themselves as the intermediary between factories, consumers, and app developers, these platforms are ideally placed to monitor much of how global manufacturing operates, from the smallest actuator to the largest factory, and they draw upon these data to further solidify their monopoly position. Deploying a standard platform strategy, both Siemens and GE also maintain openness in terms of who can connect to the platform, where data are stored (on site or in the cloud), and who can build apps for it. Network effects are, as always, essential to gaining a monopoly position, and this openness enables them to incorporate more and more users. These platforms already are strong revenue sources for the companies: Predix currently brings GE $5 billion and is expected to triple this revenue by 2020.[49] Predictions are that the sector will be worth $225 billion by 2020 – more than both the consumer internet of things and enterprise cloud computing.[50] Nevertheless, demonstrating the power of monopolies, GE continues to use AWS for its internal needs.[51]

Product Platforms

Importantly, the preceding developments – particularly the internet of things and cloud computing – have enabled a new type of on-demand platform. They are two closely related but distinct business models: the product platform and the lean platform. Take, for example, Uber and Zipcar – both platforms designed for consumers who wish to rent some asset for a time. While they are similar in this respect, their business models are significantly different. Zipcar owns the assets it rents out – the vehicles; Uber does not. The former is a product platform, while the latter is a lean platform that attempts to outsource nearly every possible cost. (Uber aims, however, eventually to command a fleet of self-driving cars, which would transform it into a product platform.) Zipcar, by contrast, might be considered a 'goods as a service' type of platform.

Product platforms are perhaps one of the biggest means by which companies attempt to recuperate the tendency to zero marginal costs in some goods. Music is the best example, as in the late 1990s downloading music for free became as simple as installing a small program. Record labels' revenues took a major dip, as consumers stopped purchasing compact discs (CDs) and other physical copies of music. Yet, in spite of its numerous obituaries, the music industry has been revived in recent years by platforms (Spotify, Pandora) that siphon off fees from music listeners, record labels, and advertisers alike. Between 2010 and 2014 subscription services have seen user numbers rise up from 8 million to 41 million, and subscription revenues are set to overtake download revenues as the highest source of digital music.[52] After years of decline, the music industry is poised to see its revenue grow once again in 2016. While subscription models have been around for centuries, for example in newspapers, what is novel today is their expansion to new realms: housing, cars, toothbrushes, razors, even private jets. Part of what has enabled these product platforms to flourish in recent years is the stagnation in wages and the decline in savings that we noted in Chapter 1. As less money is saved up, big-ticket purchases like cars and houses become nearly impossible and seemingly cheaper upfront fees appear more enticing. In the United Kingdom, for instance, household ownership has declined since 2008, while private rentals have skyrocketed.[53]

On-demand platforms are not affecting just software and consumer goods, though. One of the earliest stabs at an on-demand economy centred on manufactured goods, particularly durable goods. The most influential of these efforts was the transformation of the jet engine business from one that sold engines into one that rented thrust. The three big manufacturers – Rolls Royce, GE, and Pratt & Whitney – have all moved to this business model, with Rolls Royce leading the way in the late 1990s. The classic model of building an engine and then selling it to an airline was a relatively low margin business with high levels of competition. The competitive dynamics outlined in Chapter 1 are on full display here. Over the past 40 years the jet engine industry has been characterised by very few new companies, and no companies leaving the industry.[54] Instead the three major firms have competed intensely among themselves by introducing incremental technological improvements, in an effort to gain an edge. This technological competition continues today, when the jet engine industry pioneers the use of additive manufacturing. (For instance, GE's most popular jet engine has a number of parts that are now 3D printed rather than welded together out of different components.[55]) But margins on the engines themselves remain small, and competition tight. By contrast, the maintenance of these engines involves much higher profit margins – seven times higher, according to estimates.[56] The challenge with maintenance is that it is quite easy for outside competitors to come in to the market and take the profits away. This prompted Rolls Royce to introduce the 'goods as a service' model, whereby airlines do not purchase the jet engine but pay a fee for every hour one is used. In turn, Rolls Royce provides maintenance and replacement parts.

The raw material of data remains as central to this platform as to any other. Sensors are placed on all the engines and massive amounts of data are extracted from every flight, combined with weather data and information on air traffic control, and sent to a command centre in the United Kingdom. Information on the wear and tear on engines, possible problems, and times for scheduling maintenance are all derived. These data are immensely useful in blocking out competitors and in securing a competitive advantage against any outside maintenance firm that may hope to break into the market. Data on how the engines perform have also been crucial for developing new models: they enabled Rolls Royce to improve fuel efficiency and to increase the life of the engines, and generated another competitive advantage over other jet engine manufacturers. Once again, platforms appear as an optimal form for extracting data and using them to gain an edge over competitors. Data and the network effects of extracting them have enabled the company to establish dominance.

Lean Platforms

In the context of everything that has just been described, it is hard not to regard the new lean platforms as a retrogression to the earliest stages of the internet-enabled economy. Whereas the previous platforms have all developed business models that generate profits in some way, today's lean platforms have returned to the 'growth before profit' model of the 1990s. Companies like Uber and Airbnb have rapidly become household names and have come to epitomise this revived business model. These platforms range from specialised firms for a variety of services (cleaning, house calls from physicians, grocery shopping, plumbing, and so on) to more general marketplaces like TaskRabbit and Mechanical Turk, which provide a variety of services. All of them, however, attempt to establish themselves as the platform upon which users, customers, and workers can meet. Why are they 'lean' platforms? The answer lies in an oft-quoted observation: 'Uber, the world's largest taxi company, owns no vehicles […] and Airbnb, the largest accommodation provider, owns no property.'[57] It would seem that these are asset-less companies; we might call them virtual platforms.[58] Yet the key is that they do own the most important asset: the platform of software and data analytics. Lean platforms operate through a hyper-outsourced model, whereby workers are outsourced, fixed capital is outsourced, maintenance costs are outsourced, and training is outsourced. All that remains is a bare extractive minimum – control over the platform that enables a monopoly rent to be gained.

The most notorious part of these firms is their outsourcing of workers. In America, these platforms legally understand their workers as 'independent contractors' rather than 'employees'. This enables the companies to save around 30 per cent on labour costs by cutting out benefits, overtime, sick days, and other costs.[59] It also means outsourcing training costs, since training is only permitted for employees; and this process has led to alternatives forms of control via reputation systems, which often transmit the gendered and racist biases of society. Contractors are then paid by the task: a cut of every ride from Uber, of every rental from Airbnb, of every task fulfilled on Mechanical Turk. Given the reduction in labour costs provided by such an approach, it is no wonder that Marx wrote that the 'piece-wage is the form of wages most in harmony with the capitalist mode of production'.[60] Yet, as we have seen, this outsourcing of labour is part of a broader and longer outsourcing trend, which took hold in the 1970s. Jobs involving tradable goods were the first to be outsourced, while impersonal services were the next to go. In the 1990s Nike became a corporate ideal for contracting out, in that it contracted much of its labour to others. Rather than adopting vertical integration, Nike was premised upon the existence of a small core of designers and branders, who then outsourced the manufacturing of their goods to other companies. As a result, by 1996 people were already voicing concerns that we were transitioning to 'a "just-in-time" age of "disposable" workers'.[61] But the issue involves more than lean platforms. Apple, for instance, directly employs less than 10 per cent of the workers who contribute to the production of its products.[62] Likewise, a quick glance at the US Department of Labor can find a vast number of non-Uber cases involving the mislabelling of workers as independent contractors: cases related to construction workers, security guards, baristas, plumbers, and restaurant workers – to name just a few.[63] In fact the traditional labour market that most closely approximates the lean platform model is an old and low-tech one: the market of day labourers – agricultural workers, dock workers, or other low-wage workers – who would show up at a site in the morning in the hope of finding a job for the day. Likewise, a major reason why mobile phones have become essential in developing countries is that they are now indispensable in the process of finding work on informal labour markets.[64] The gig economy simply moves these sites online and adds a layer of pervasive surveillance. A tool of survival is being marketed by Silicon Valley as a tool of liberation.

We can also find this broader shift to non-traditional jobs in economic statistics. In 2005[65] the Bureau of Labour Statistics (BLS) found that nearly 15 million US workers (10.1 per cent of the labour force) were in alternative employment.[66] This category includes employees hired under alternative contract arrangements (on-call work, independent contractors) and employees hired through intermediaries (temp agencies, contract companies). By 2015 this category had grown to 15.8 per cent of the labour force.[67] Nearly half of this rise (2.5 per cent) was due to an increase in contracting out, as education, healthcare, and administration jobs were often at risk. Most strikingly, between 2005 and 2015, the US labour market added 9.1 million jobs – including 9.4 million alternative arrangement jobs. This means that the net increase in US jobs since 2005 has been solely from these sorts of (often precarious) positions.[68] Similar trends can be seen in self-employment. While the number of people who identify as self-employed has decreased, the number of people who filed the 1099 tax form for self-employment in the United States has increased.[69] What we see here is effectively an acceleration of the long-term tendency towards more precarious employment, particularly after 2008. The same trends are observable in the United Kingdom, where self-employment has created 66.5 per cent of net employment after

2008 and is the only thing that has staved off much higher levels of unemployment.[70]

Where do lean platforms fit into this? The most obvious point is the category of independent contractors and freelancers. This category has registered an increase of 1.7 per cent (2.9 million) between 2005 and 2015,[71] but most of these increases have been for offline work. Given that no direct measures of the sharing economy are currently available, surveys and other indirect measures have been used instead. Nearly all of the estimates suggest that around 1 per cent of the US labour force is involved in the online sharing economy formed by lean platforms.[72] Even here, the results have to take into account that Uber drivers probably form the majority of these workers.[73] The sharing economy outside of Uber is tiny. In the United Kingdom less evidence is presently available, but the most thorough survey done so far suggests that a slightly higher number of people routinely sell their labour through lean platforms. It is estimated that approximately 1.3 million UK workers (3.9 per cent of the labour force) work through them at least once a week, while other estimates range from 3 to 6 per cent of the labour force.[74] Other surveys suggest slightly higher numbers, but those problematically include a much larger range of activities.[75] What we can therefore conclude is that the sharing economy is but a small tip of a much larger trend. Moreover, it is a small sector, which is premised upon the vast growth in the levels of unemployment after the 2008 crisis. Building on the trends towards more precarious work that were outlined earlier, the crisis caused unemployment in the United States to double, while long-term unemployment nearly tripled. Moreover, the aftermath of the crisis was a jobless recovery – a phenomenon where economic growth returns, but job growth does not. As a result, numerous workers were forced to find whatever desperate means they could to survive. In this context, self-employment is not a freely chosen path, but rather a forced imposition. A look at the demographics of lean platform workers seems to support this. Of the workers on TaskRabbit, 70 per cent have Bachelor's degrees, while 5 per cent have PhDs.[76] An International Labour Organization (ILO) survey found that workers on Amazon's Mechanical Turk (AMT) also tend to be highly educated, 37 per cent using crowd work as their main job.[77] And Uber admits that around a third of its drivers in London come from neighbourhoods with unemployment rates of more than 10 per cent.[78] In a healthy economy these people would have no need to be micro-tasking, as they would have proper jobs.

While the other platform types have all developed novel elements, is there anything new about lean platforms? Given the broader context just outlined, we can see that they are simply extending earlier trends into new areas. Whereas outsourcing once primarily took place in manufacturing, administration, and hospitality, today it is extending to a range of new jobs: cabs, haircuts, stylists, cleaning, plumbing, painting, moving, content moderation, and so on. It is even pushing into white-collar jobs – copy-editing, programming and management, for instance. And, in terms of the labour market, lean platforms have turned what was once non-tradable services into tradable services, effectively expanding the labour supply to a near-global level. A multitude of novel tasks can now be carried out online through Mechanical Turk and similar platforms. This enables business, again, to cut costs by exploiting cheap labour in developing countries and places more downward pressure on wages by placing these jobs into global labour markets. The extent to which lean platform firms have outsourced other costs is also notable (though not novel); these are perhaps the purest attempts at a virtual platform to date. In doing so, these companies have been dependent upon the capacities offered by cloud platforms. Whereas firms once had to spend large amounts to invest in the computing equipment and expertise needed for their businesses, today's start-ups have flourished because they can simply rent hardware and software from the cloud. As a result, Airbnb, Slack, Uber, and many other start-ups use AWS.[79] Uber further relies on Google for mapping, Twilio for texting, SendGrid for emailing, and Braintree for payments: it is a lean platform built on other platforms. These companies have also offloaded costs from their balance sheets and shifted them to their workers: things like investment costs (accommodations for Airbnb, vehicles for Uber and Lyft), maintenance costs, insurance costs, and depreciation costs. Firms such as Instacart (which delivers groceries) have also outsourced delivery costs to food suppliers (e.g. Pepsi) and to retailers (e.g. Whole Foods) in return for advertising space.[80] However, even with this support, Instacart remains unprofitable on 60 per cent of its business, and that is before the rather large costs of office space or the salaries of its core team are taken into account.[81] The lack of profitability has led to the predictable measure of cutting back on wages – a notably widespread phenomenon among lean platforms.

This has also prompted companies to compete on data extraction – again, a process optimised by the access afforded by platforms. Uber is perhaps the best example of this development, as it collects data on all of its rides, as well as data on drivers, even when they are not receiving a fare.[82] Data about what drivers are doing and how they are driving are used in a variety of ways in order to beat out competitors. For instance, Uber uses the data to ensure that its drivers are not working for other taxi platforms; and its routing algorithms use the data on traffic patterns to plot out the most efficient path for a trip. Data are fed into other algorithms to match passengers with nearby drivers, as well as to make predictions about where demand is likely to arise. In China, Uber monitors even whether drivers go to protests. All of this enables Uber to have a service that is quick and efficient from the passenger's point of view, thereby drawing users away from competitors. Data are one of the primary means of competition for lean platforms.

Nevertheless, these firms are still struggling to be profitable and the money to support them has to come from the outside. As we saw earlier, one of the important consequences of the 2008 crisis has been the intensification of an easy monetary policy and the growing corporate cash glut. The lean platform boom is, fundamentally, a post-2008 phenomenon. The growth of this sector is reflected most clearly in the number of deals made for start-up companies: VC deals have tripled since 2009.[83] Even after excluding Uber (which has an outsized position in the market), on-demand mobile services raised $1.7 billion over the course of 2014 – a 316 per cent increase from 2013.[84] And 2015 continued this trend towards more deals and higher volumes. But it is worth taking a moment to put the funding of lean platforms in context. When we look at the lean platforms for on-demand mobile services, we are primarily discussing Uber. In terms of funding, in 2014 Uber outpaced all the other service companies, taken together, by 39 per cent.[85] In 2015 Uber, Airbnb, and Uber's Chinese competitor, Didi Chuxing, combined to take 59 per cent of all the funding for on-demand start-ups.[86] And, while the enthusiasm for new tech start-ups has reached a fever pitch, funding in 2015 ($59 billion) still paled in comparison to the highs of 2000 (nearly $100 billion).[87] Where is the money coming from? Broadly speaking, it is surplus capital seeking higher rates of return in a low interest rate environment. The low interest rates have depressed the returns on traditional financial investments, forcing investors to seek out new avenues for yield. Rather than a finance boom or a housing boom, surplus capital today appears to be building a technology boom. Such is the level of compulsion that even non-traditional funding from hedge funds, mutual funds, and investment banks is playing a major role in the tech boom. In fact, in the technology start-up sector, most investment financing comes from hedge funds and mutual funds.[88] Larger companies are also involved, Google being a major investor in the ill-fated Homejoy, while the logistics company DHL has created its own on-demand service MyWays, and firms like Intel and Google are also purchasing equity in a variety of new start-ups. Companies like Uber, deploying more than 135 subsidiary companies across the world, are also helped by tax evasion techniques.[89] Yet the profitability of these lean platforms remains largely unproven. Just like the earlier dot-com boom, growth in the lean platform sector is premised on expectations of future profits rather than on actual profits. The hope is that the low margin business of taxis will eventually pay off once Uber has gained a monopoly position. Until these firms reach monopoly status (and possibly even then), their profitability appears to be generated solely by the removal of costs and the lowering of wages and not by anything substantial.

In summary, lean platforms appear as the product of a few tendencies and moments: the tendencies towards outsourcing, surplus populations, and the digitisation of life, along with the post-2008 surge in unemployment and rise of an accommodative monetary policy, surplus capital, and cloud platforms that enable rapid scaling. While the lean model has garnered a large amount of hype and, in the case of Uber, a large amount of VC, there are few signs that it will inaugurate a major shift in advanced capitalist countries. In terms of outsourcing, the lean model remains a minor player in a long-term trend. The profit-making capacity of most lean models likewise appears to be minimal and limited to a few specialised tasks. And, even there, the most successful of the lean models has been supported by VC welfare rather than by any meaningful revenue generation. Far from representing the future of work or that of the economy, these models seem likely to fall apart in the coming years.

Conclusion

We began this chapter by arguing that twenty-first-century capitalism has found a massive new raw material to appropriate: data. Through a series of developments, the platform has become an increasingly dominant way of organising businesses so as to monopolise these data, then extract, analyse, use, and sell them. The old business models of the Fordist era had only a rudimentary capacity to extract data from the production process or from customer usage. The era of lean production modified this slightly, as global 'just in time' supply chains demanded data about the status of inventories and the location of supplies. Yet data outside the firm remained nearly impossible to attain; and, even inside the firm, most of the activities went unrecorded. The platform, on the other hand, has data extraction built into its DNA, as a model that enables other services and goods and technologies to be built on top of it, as a model that demands more users in order to gain network effects, and as a digitally based medium that makes recording and storage simple. All of these characteristics make platforms a central model for extracting data as raw material to be used in various ways. As we have seen in this brief overview of some different platform types, data can be used in a variety of ways to generate revenues. For companies like Google and Facebook, data are, primarily, a resource that can be used to lure in advertisers and other interested parties. For firms like Rolls Royce and Uber, data are at the heart of beating the competition: they enable such firms to offer better products and services, control workers, and optimise their algorithms for a more competitive business. Likewise, platforms like AWS and Predix are oriented towards building (and owning) the basic infrastructures necessary to collect, analyse, and deploy data for other companies to use, and a rent is extracted for these platform services. In every case, collecting massive amounts of data is central to the business model and the platform provides the ideal extractive apparatus.

This new business form has intertwined with a series of long-term trends and short-term cyclical movements. The shift towards lean production and 'just in time' supply chains has been an ongoing process since the 1970s, and digital platforms continue it in heightened form today. The same goes for the trend towards outsourcing. Even companies that are not normally associated with outsourcing are still involved. For instance, content moderation for Google and Facebook is typically done in the Philippines, where an estimated 100,000 workers search through the content on social media and in cloud storage.[90] And Amazon has a notoriously low-paid workforce of warehouse workers who are subject to incredibly comprehensive systems of surveillance and control. These firms simply continue the secular trend of outsourcing low-skill workers while retaining a core of well-paid high-skill labourers. On a broader scale, all of the post-2008 net employment gains in America have come from workers in non-traditional employment, such as contractors and on-call workers. This process of outsourcing and building lean business models gets taken to an extreme in firms like Uber, which rely on a virtually asset-less form to generate profits. As we have seen, though, much of their profitability after the crisis has stemmed from holding wages down. Even the *Economist* is forced to admit that, since 2008, 'if the share of domestic gross earnings paid in wages were to rise back to the average level of the 1990s, the profits of American firms would drop by a fifth'.[91] An increasingly desperate surplus population has therefore provided a considerable supply of workers in low-wage, low-skill work. This group of exploitable workers has intersected with a vast amount of surplus capital set in a low interest rate world. Tax evasion, high corporate savings, and easy monetary policies have all combined, so that a large amount of capital seeks out returns in various ways. It is no surprise, then, that funding for tech start-ups has massively surged since 2010. Set in context, the lean platform economy ultimately appears as an outlet for surplus capital in an era of ultra-low interest rates and dire investment opportunities rather than the vanguard destined to revive capitalism.

While lean platforms seem to be a short-lived phenomenon, the other examples set out in this chapter seem to point to an important shift in how capitalist firms operate. Enabled by digital technology, platforms emerge as the means to lead and control industries. At their pinnacle, they have prominence over manufacturing, logistics, and design, by providing the basic landscape upon which the rest of the industry operates. They have enabled a shift from products to services in a variety of new industries, leading some to declare that the age of ownership is over. Let us be clear, though: this is not the end of ownership, but rather the concentration of ownership. Pieties about an 'age of access' are just empty rhetoric that obscures the realities of the situation. Likewise, while lean platforms have aimed to be virtually asset-less, the most significant platforms are all building large infrastructures and spending significant amounts of money to purchase other companies and to invest in their own capacities. Far from being mere owners of information, these companies are becoming owners of the infrastructures of society. Hence the monopolistic tendencies of these platforms must be taken into account in any analysis of their effects on the broader economy.