From Automobile Capitalism to Platform Capitalism: Toyotism as a prehistory of digital platforms

Marc Steinberg
Concordia University, Canada

Abstract
This article explores the automotive lineage and manufacturing origins of platforms. Challenging prevailing assumptions that the platform is a digital artefact, and platform capitalism a new era, this article traces crucial elements of platform capitalism to Toyotist automobile manufacture in order to rethink the relationship between technology and organization. Arguing that the very terminology and industry applications of the ‘platform’ emerge from the automobile industry over the course of the 20th century, this article cautions against the uncritical adoption of epochal paradigms, or assumptions that new technologies require new organizational forms. By parsing the platform into two types, the stack and the intermediary, this article demonstrates how the platform concept and data-driven production practice both develop out of the Toyota Production System in particular, and American and Japanese analyses of it. Toyotism, we show, is the unseen industrial and epistemological background against which the platform economy plays out. In making this case, this article highlights the crucial continuities between the data-intensive production of companies like Uber and Amazon – emblematic of digital platform capitalism – and the organizational paradigms of the automobile industry. At a moment when the automobile returns to prominence amid platforms such as Uber, Didi Chuxing, or Waymo, and as we find tech companies turning to automobile manufacturing, this automotive lineage of the platform offers a crucial reminder of the automotive origins of what we now call platform capitalism.

Keywords
automobile industry, Japan, management theory, media theory, platform capitalism, platform history, Toyotism

Introduction
Imagine a familiar scene: a ride-seeker takes out their smartphone, opens the Uber app, and orders a ride. A few minutes later, an Uber driver picks up a passenger in a Toyota Prius, driving them to their destination. Guided by a data-driven app and set of algorithms that map the optimal route,
manage the driver’s performance, and extract data about the destination, Uber is the iconic image of the disruptive, asset-light tech firm driven by digital intermediary technologies and multiple rounds of venture capital financing that is the model of platform capitalism today (Srnicek, 2016). Uber and companies like it have become the face of ‘platforms’ today and their controversial social impacts. Yet what we neglect in this scenario is not the driver – increasingly acknowledged as an employee deserving of benefits with the company described as a ‘platform labour intermediary’ (van Doorn, 2017) – but rather the manufactured object of the automobile itself; the Toyota Prius. Built using lean manufacturing methods, just-in-time production, consumer data collection that feeds back into production, and variation combined with standardization, this car is the overlooked base of this platform economy and its organizational logics, literally and historically speaking.

The car is, and remains, the star of the platform economy. It is the oft-forgotten predecessor of the digital platform in its industrial and theoretical manifestations. As smartphone makers seek to get into electric vehicle production – including Apple supplier Foxconn – the automobile lineage of platform capitalism demands our attention. Focusing on this automobile lineage of the platform economy allows us to address two often unspoken claims made in recent literature on the platform: (1) that the platform is essentially a new technological and organizational form; and (2) that the platform is essentially digital in nature (e.g. Andreessen, 2007; Bogost & Montfort, 2009; Davis, 2016; Kenney & Zysman, 2016; Srnicek, 2016). To rephrase these claims as research questions, we should ask: (a) is the platform essentially new, and therefore productive of new organizational forms?; (b) is the platform essentially digital?; and (c) if the answer to both is ‘no’ then what do organization studies, technology studies and media studies miss by treating platforms as both new and essentially digital? In response to this special issue on the intimate relationship between organization and technology, this article traces the automobile lineage of the platform with a primary aim of forestalling assumptions of immediate organizational change corresponding to the rise of purportedly new technological forms like the platform; and with a secondary aim of prompting a deeper consideration of the non-deterministic relation of discursive and industrial practices to technologies and organizational forms.

Media studies scholars have noted the danger of taking platforms at face value. As Hoof and Boell caution, “‘platform’ has to be seen as an already value-laden description fostering certain managerial and economic interests” (2019, p. 246). If scepticism about YouTube’s claims to be a platform, for example, means we should regulate it like a media company or television broadcaster (Napoli & Caplan, 2017), what are the consequences of arguing that platform capitalism is much more like automobile capitalism than we care to recognize? Following an exposition of the literature on platforms (including attention to platform capitalism and platform organization), and an explanation of research results that show the automobile industry and theories around it are the basis for current digital platform theories, the discussion section will consider the consequences of taking this automobile lineage of platform capitalism seriously.

**From Platforms to Platform Capitalism**

*Platform* has become one of the dominant media concepts, organizational paradigms and corporate bywords of our era. The imperialistic advance of the term in claiming increasingly large swaths of industry, culture and life around the world points to the terminological porosity of platform as term. In digital cultures analysis, *network* as a keyword was pushed aside by *platform* around 2016, according to media theorist Geert Lovink (Lovink, 2017, p. xiv), the very same year *Organization Studies* had a special issue examining ‘the transformational power of network dynamics’ and ‘the network form of organization’. As the editors of the special issue argue, the network as concept and analytic has had a profound impact on organization studies since the 1980s. Given current trends,
platform will likely occupy a similar role to network in years to come. A thorough consideration of the term is hence in order.

Thus far the field of organization studies has treated the polyvalent term platform as self-evident – notwithstanding important exceptions (Alaimo & Kallinikos, 2021; Gawer & Phillips, 2013) – and has not accounted for its longer history within organization studies itself. As Alaimo and Kallinikos (2021, p. 1403) point out, ‘platforms remain badly understood as organizations’, and the field could benefit from some of the scepticism the term receives in media and technology studies. Media studies (notwithstanding Nakamura, 2014; Qiu, Gregg, & Crawford, 2014), on the other hand, tends to treat platforms as uniquely digital and could equally benefit from an organization studies approach that accounts for the analogue history of platforms and the continuities in organizational forms and managerial practices which this article highlights.

While sympathetic to claims that media technologies impact organizational forms – such that ‘[c]ontemporary forms of organizing, such as virtual teams, just-in-time, or crowd sourcing are virtually impossible without ICT, underlining that media technology forms the very epistemology of communication’ (Hoof & Boell, 2019, p. 637) or Alaimo and Kallinikos’s provocative (and, as they acknowledge, hyperbolic) claim the ‘the technology is the organization’ (2021, p. 1402) – this article urges caution in assuming one-to-one correspondences between technology and organization. For instance: just-in-time production and the teams model arose from Toyota’s managerial innovations rather than media-technological ones (Liu, 2004). True, these innovations spawned media forms, such as the simple paper kanban card that supported just-in-time production (Andrijasevic, Chen, Gregg, & Steinberg, 2021). But rather than ICTs and digital platforms we should refocus our gaze on the automobile and its assembly line. Doing so makes evident that organizational practices bleed across technological shifts, and technological shifts don’t necessarily prompt change in organizational practices. The analogue, automobile lineage of the digital platform brings these continuities to light.

Two models of the platform concept

Tracing this longer lineage of the platform requires a robust understanding of the term. The platform concept can be broadly parsed into two main variants: the layered stack model and the horizontal intermediary model.

The stack refers to the layered model of the platform, often associated with computing (Bratton, 2016). Gillespie (2010) and others have traced this to the architectural definition of the platform as something upon which one stands. The usage is as present in media studies as it is in organization studies; the term refers to hardware such as the IBM 360 or the Intel chip as platform (Bresnahan & Greenstein, 1999; Gawer & Cusumano, 2002), to software like Java, to websites like Wikipedia (Aaltonen & Lanzara, 2015), social media sites like YouTube, Facebook or Twitter (Beverungen, Böhm, & Land, 2015; Gillespie, 2010), or music services like Last.fm (Alaimo & Kallinikos, 2021). In computing one layer is built upon another; in social media one posts something on the platforms in question.

One finds this stack model within many definitions of the platform. Michael Cusumano, a crucial figure in this automobile lineage of platforms, refers to this as the ‘product platform’:

The term ‘platform’ first came into wide usage in the management field as a word meaning foundation of components around which an organization creates a related but different set of products (or services). Toyota’s Corolla sedan, Celica sports car, Matrix hatchback, and Rav-4 sports utility vehicle are different products built in separate projects. But they share the same underbody as well as other essential components such as the engine. (Cusumano, 2010, p. 23)
In their overview of platform literature in business studies, Negoro and Ajiro refer to this model as a ‘core technology that is common to many digital products, such as display technology, the chassis in cars, printed circuits in AV equipment, etc’ (Negoro & Ajiro, 2012, p. 5). This definition aligns with a similar one by Gawer and Phillips, wherein the platform is ‘a core technological building block upon which organizations build complementary technologies, products or technologies’ (2013, p. 1063). Bratton (2016, p. xviii), for his part, describes the stack as a ‘modular and interoperable vertical order’ and ‘a kind of platform that also happens to be structured through vertical interoperable layers’ (Bratton, 2016, p. 52). In what follows I take the stack as one of the earliest industrial models of the platform, particularly in its automotive form.

As Cusumano suggests above, one of the crucial referents of the stack model of the platform is in fact the automobile chassis, known as the platform. The use of a base platform for multiple car models is a practice that conjoins base-level standardization with maximal second-level variation (De Vaujany, Leclercq-Vandelannoitte, & Holt, 2019). Baldwin and Clark’s (2003, pp. 151–152) important work on modularity in the computer industry similarly traces these principles to automobile manufacture. Hence while the term stack may be most associated with computing, I resituate this usage in relationship to the automobile.

The second variant on the platform concept is the intermediary model. Unlike the layered model, this is a horizontal model of the platform as mediatory device enabling third party transactions to take place. The credit card is one of its models (Rochet & Tirole, 2003), and AirBnB and Uber are extensions of this model, operating as intermediaries between room hosts and renters, or drivers and riders, creating multisided markets (Parker & Van Alstyne, 2005). Most economics literature on platforms stresses their function in bringing together two or more market ‘sides’ to allow for transactions to take place – via a credit card or the Uber app. The second usage overlaps with what Cusumano (2010, pp. 23–24) calls an ‘industry platform’, which depends on complementors and network effects to give the service its value – a computer being of relatively little value without the applications that run on it and the users relying on such applications.

### Platform capitalism

These two senses of the platform are the basis for theorizations of the platform economy and platform capitalism. In Nick Srnicek’s formulation, platform capitalism emerges after the multiple crises of capitalism, from secular stagnation to the financial crisis of 2008. The prominence of digital platform companies on the stock market comes as capital seeks high-growth investments; their prominence as an industry comes as their shift to data collection ‘jumpstart[s] a major shift in capitalism’ (Srnicek, 2016, p. 41). Platforms are intermediaries that facilitate multisided markets: ‘Essentially, [platforms] are a newly predominant type of business model premised upon bringing different groups together’ (Srnicek 2017, p. 254). Proposed as a replacement for the competing terms ‘gig economy’ or ‘fourth industrial revolution’, platform capitalism is a manner of describing ‘the effects of digital technology on capitalism’ (Srnicek 2016, p. 3).

Used in parallel to platform capitalism, the term platform economy denotes an era where American or Chinese platform-owning technology companies dominate the stock market in valuation; where data-gathering intermediaries are dominant the world round; where digitally mediated transactions transform economy, society and culture (Chen, 2020; Kenney & Zysman, 2016; Pasquale, 2016; Steinberg, 2019; Van Dijck, Poell, & De Waal, 2018). The platform relies on a ‘new business model, capable of extracting and controlling immense amounts of data’ (Srnicek 2016, p. 6), resulting in a tendency towards monopolistic or oligopolistic firms, and leading some to term this ‘surveillance capitalism’ (Zuboff, 2019).
The now-pervasive keyword ‘platform’ has hence been accompanied since the mid-2010s by a periodizing claim: we live under a new regime alternatively called platform capitalism or the platform economy. Like Fordism or post-Fordism (Aglietta, 2000; Gramsci, 1971), platform capitalism is presented as an epochal shift: a transformative moment in modes of production, cultural forms, and organizational logics that have a corresponding form of labour: precarious work and the gig economy (Fleming, 2017; Scholtz, 2017). Scholars of India and China have pushed back on these epochal claims, rightly pointing out that platform capitalism is far from uniform; that ‘petty capitalism’ and ‘small-scale and family-based flexible regimes of production’ are the norm in China with Alibaba (Zhang, 2020); and the bazaar and the emporium are the real models of the platform marketplaces at work today in India (Athique, 2019), recalling earlier discussions of ‘bazaar governance’ (Demil & Lecocq, 2006). Nonetheless, the epochal and geographically totalizing iterations of the platform capitalism concept remain dominant.

These epochal claims have also impacted organization studies. Some have claimed that the platform represents ‘a new organisational form based on a relationship between the platform and the ecosystem of firms dependent on the platform and users who interact and transact through it’ (Kenney & Zysman, 2020, p. 55): an alternative to the corporation which is perhaps ‘less inevitable than we thought’ (Davis, 2016, p. 134). Davis has been a particularly vocal advocate for thinking of the platform as a replacement for the corporation, following upon ‘a regime shift in the costs of organizing’ (Davis, 2016, p. 129). Others likewise suggest that a shift from ‘pipelines to platforms’ requires a new corporate strategy (Van Alstyne, Parker, & Choudary, 2016, p. 57). Epochal claims about the platform economy subtend calls for radical shifts in organizational strategy – out with the old, in with the new.

Theoretical framework

This article takes a different approach, elucidating the automotive lineage of platforms, with an emphasis on continuities rather than discontinuities, betting on the usefulness of established tools of analysis and the value of historical consciousness. In this regard, platform capitalism may best be described as automobile platform capitalism: as a set of production practices, labour-management techniques, and data accumulation strategies optimized for the ‘production and self-expansion of capital’ (Wood, 2002, p. 3) that grew out of the auto industry, particularly in its Toyotist form. Indeed, in Toyota’s post-1950s management innovations we find many of the elements central to definitions of platform capitalism, including:

- data gathering and mobilization
- the modelling of firms as intermediaries or hubs between production sites
- the reliance on temp workers
- the crucial role of logistics
- just-in-time models of production and delivery
- platform models of standardization plus variation
- the outsourcing of risks and warehousing costs to subsidiary or supplier firms

The auto industry and Toyota’s contributions to it are hence the missing pieces of the history of the platform economy (as industry) and the platform concept (as theory) that informs it. Cusumano’s work points to this connection between the auto industry and digital platforms. Yet Cusumano limits this connection to the stack model of the platform, whereas this article demonstrates that both stack and intermediary models of the platform have their roots in Toyotist automobile
production. Toyotism is the unseen industrial and epistemological background against which the platform economy plays out.  

Pointing to this longer lineage allows us to temper some of the grander claims about novelty over continuity at play today in both critical and celebratory discussions of platform capitalism, and thus the consequences for organization being drawn from them. In doing so I draw on contributions to a literature of caution in organizational studies that mitigate against the frequent adoption of new, epochal paradigms (Du Gay, 2003) and argue for the need to attend to the historical dimension of organization research (Booth & Rowlinson, 2006). As Du Gay writes:

What is striking about much contemporary organizational theorizing—whether critical or more commercially purposeful—is the epochalist terms in which it is framed. By ‘epochalist’ I refer to the use of a periodizing schema in which a logic of dichotomization establishes the available terms of debate in advance, either for or against. (Du Gay, 2003, p. 664)

Du Gay’s words of caution are as helpful amid current platform epochalism as they were in 2003. There are crucial continuities between automobile manufacture and digital intermediaries such as Uber (Fleming, 2017; Rosenblat & Stark, 2016; Scholz, 2017), or the logistics-dependent Amazon for that matter. Here I use Uber as a shorthand both for the platform economy and its automobile centrism (including Didi Chuxing, Waymo, Tesla, and other auto-centric platforms; but equally so other non-auto platform giants like Google or Amazon). Under the hood, most platform companies (with the possible exception of social media) are ultimately data-dependent logistics firms, in the mould of Toyota.

In stressing the continuities between the automobile industry and the platform economy, this article also builds on John Urry’s visionary work on ‘automobility’, reaffirming his emphasis that the car is ‘the quintessential manufactured object’ that integrated different sectors of 20th-century capitalism (Urry, 2004, pp. 25–26) – and extending it into the 21st century. Urry foregrounds the determining role of the ‘system’ of automobility to the design of roads, to steel production, to the oil economy, and suburban life. Dennis and Urry also predict the increasing interdependence of the automobile and information technologies (Dennis & Urry, 2009; Urry, 2004). Building on this insight I detail not the extension of digital platforms into the car as entertainment systems (i.e. platforms in cars), but how the principles of Toyotist auto production inhabit the platform industry in its entirety (platforms as cars).  

Along with tracing the longer trajectory of industry practices, the lineage from the car to the platform traced here further aims to denaturalize assumed equivalences between platforms and the digital, finding something else at the platform’s beginnings: a car not a computer. In the context of this special issue, the aim is to show that a crucial lineage of the platform has been overlooked. Following Beyes, Conrad and Martin’s prompt to think ‘media through organization and organization through media’ (2019, p. viii), this article demonstrates that automobile manufacture and its organization are the basis for the digital media artefacts we call platforms. Before the car’s traces are fully erased in its subsumption by the digital, we must recover the automobile roots of the platform – much as Cornelia Vismann narrates the history of material files on the cusp of their replacement by icons of folders on desktop computers. Vismann argues that a ‘history of files therefore also contains a prehistory of the computer’ (2008, p. 164). So too, the history of Toyotism contains the forgotten prehistory of platform capitalism.  

To substantiate this lineage, below I trace the two models of the platform – stack and intermediary – to Toyotist transformations of the auto industry, illustrating the industrial continuities between
the automobile industry and the information technology sector. Subsequently, I show how academic discussions of platforms have taken their start in writing on the auto industry. Platforms are doubly determined by the auto sector, then: by their data-centric industry manufacturing practices, and by automobile theory’s formative influence on digital platform theory.

**Toyotism in Practice: Industry**

*The stack model*

The automobile industry is one of the first sites where we see an overt deployment of the stack as an industrial model of platform development: building multiple models of cars from a single base or standard; a ‘number of different body styles spun off a base model (or “platform”, in car talk)’ (Womack, Jones, & Roos, 1990, p. 112). The look of a given car is determined by the body stacked on top of the platform. This underbody includes the chassis, the steering mechanism, and sometimes the engine, common to different car models, sometimes belonging to entirely distinct brands. For instance, since the early 2000s, the Volkswagen Golf hatchback and Jetta sedan, the Audi A3 sedan and Q3 SUV, and the Skoda Octavia sedan are a few of the cars that all share the same underbody or platform—different models, price points and brands all housed on top of the same platform (Mike, Mats, & Javier, 2007, p. 12).

This system of platform standardization with model-level variation was pioneered by Ford in the 1920s, and further developed by General Motors (GM), which aimed for a full product and model range from inexpensive to expensive, a practice optimized by Toyota from the 1960s onward (Mike et al., 2007; Ohno, 1988, p. 113; Womack et al., 1990, p. 34). Toyota develops a flexible production system, responsive to market demands and offering the greatest product variety combined with base-level standardization—all the while avoiding the over-accumulation of parts and overproduction of vehicles that plagued both Ford and GM (Womack et al., p. 64). Today, the automobile industry as a whole operates according to a model of platform thinking (Mike et al., 2007, p. 4)—including almost all mass production car manufacturers, from Toyota to VW, Nissan, Fiat and GM (Whitford & Zirpoli, 2016).

The term *platform* was first used in the automobile sector in the early 1970s to describe this manufacturing practice. Prior to this, the base-level standard was referred to as ‘chassis’, ‘model’, ‘base model’, ‘base-shell’ or ‘body shell’. The popularization of the term platform in the automotive sector seems to date to the late 1970s, with its usage increasing by around 1978–79, becoming the go-to term by the 1980s (e.g. Flint & Tomarkin, 1979, p. 51). A 1980 report to the United States government describes the ‘now almost universal acceptance of the platform strategy (one basic car design that can be stretched or shortened without complete retooling of all phases of the production process) to cut production costs’ (United States Congress, *World Auto Trade*, 1980, p. 234). By this point the term is established in public discourse—notably prior to its widespread use in computing.

A thorough examination of the Factiva global news and magazine database, parsed semantically, supports this point, showing that the use of the term *platform* in relation to computing only begins in the mid-1980s, slightly after its usage in the auto industry. Some track the computer industry use of the term platform to the mid-1990s, led first by Microsoft and then Netscape (Plantin, Lagoze, Edwards, & Sandvig, 2018, p. 296). Others suggest that it was in the ‘late 1980s and 1990s’ that the ‘computer industry underwent a dramatic shift from a traditional supply chain logic dominated by computer assemblers to a new platform logic’ (Gawer & Phillips, 2013, p. 1036). Yet the computer usage of platform only overtakes the automobile industry over the course of the 1990s as the industries trade places in economic prominence and analytic focus.
assumptions of a computer-industry origin of the concept, often back-projecting it to decades earlier (for instance, calling the IBM 360 a platform; Bresnahan & Greenstein, 1999), we find it in the auto sector first, expanding from there to the information technology sector. The stack platform concept hence emerges from the automobile industry and its analysis, only later migrating to computing.

The intermediary model

If the stack model for the platform is traceable to developments first undertaken at Ford and GM, Toyota is where we see the development of data-intensive production and the platform as intermediary. Toyotist automobile assembly and manufacture, known as the Toyota Production System (TPS), was based on ‘just-in-time’ (JIT) principles developed in 1948 and expanded in the mid-1950s (Cusumano, 1985, pp. 278–279), a model of ‘lean manufacture’, and communicational porosity during the production process (Womack et al., 1990). Abandoning the Fordist ‘just-in-case’ logic of overproduction (Sayer, 1986, p. 43), Toyotist just-in-time production began building the automobile upon receiving the consumer’s order, with data gathered at multiple points in the production process. As noted above, Toyotism includes the following elements:

- just-in-time production processes supported by ‘kanban’ cards and other feedback mechanisms throughout the production process
- worker initiatives to suggest adaptations to the production line
- continuous improvement to the production process (known as ‘kaizen’)
- rigorous forms of quality control
- tight informational loops between automobile dealers, salespeople and the factories and component producers themselves, making for a highly adaptive, data-reliant production process (Cusumano, 1985; Dohse, Jürgens, & Nialsch, 1985; Hines, Holweg, & Rich, 2004; Kenney & Florida, 1993; Tsutsui, 2001).

During its managerial heyday in the 1980s and 1990s, the TPS was variously described in manuals, management literature and the popular press as TPS, JIT, lean manufacturing, or zero inventory (Andrijasevic et al., 2021).

Ohno Taiichi (1988, p. 15), the architect of the TPS, describes just-in-time as a system based around ‘the absolute elimination of waste’. According to Ohno, ‘Just-in-time means that, in a flow process, the right parts needed in assembly reach the assembly line at the time they are needed and only in the amount needed. A company establishing this flow throughout can approach zero inventory’ (Ohno, 1988, p. 15). Only the minimum necessary number of cars are produced, using parts arriving just-in-time for their use on the production line, thereby eliminating the need for ‘wasteful’ storage space on the premises. The main tool used in the elimination of waste and the operationalization of just-in-time was the kanban system. The kanban is a paper sheet encased in a translucent vinyl plastic cover that allowed workers to order additional parts as they run low. As the assembly line moves in one direction, kanban move in the opposite direction, informing internal and external suppliers what parts are needed and when, building a real-time data set about supply levels (Monden, 1994, p. 9). The kanban system also allowed Toyota to position itself as an intermediary between multiple parts suppliers and the final consumer during the sequence of production.

The essential element of the Toyota Production System was hence the once low-tech informational system supported by this mobile piece of paper, recalling what Bruno Latour in a different context referred to as an ‘immutable mobile’ (Latour, 1986, p. 7); a small, paper-based object that allows control to be exercised at a distance, in this case over the company’s suppliers. As veteran
TPS analyst Yasuhiro Monden puts it, ‘The kanban system is an information system that harmoniously controls the production of the necessary products in the necessary quantities at the necessary time in every process of a factory and also among companies’ (Monden, 1994, p. 15). While Toyota experimented from the 1950s on with computers to coordinate production, into the 1980s Ohno and his managers found it ‘unnecessary to buy costly software and computer systems when the paper kanban provided accurate information, almost instantaneously, on changes in production capacity, operating rates, and manpower’ (Cusumano, 1985, p. 298). The simple kanban represents an organizational system and technology of data collection and control that coordinated the massive, geographically sprawling Toyota enterprise, including its multi-tier layers of supplier firms. The system positioned Toyota as an intermediary between stages within production and, ultimately, consumption in a manner that anticipates contemporary platforms. In this regard we can say that Toyota anticipates the intermediary model of the platform. Like Uber today, Toyota operated as a coordinating intermediary: it gathered and mobilized data in car production, it delegated the production of parts to multiple suppliers, and it functioned as an intermediary between end consumers and suppliers.

This reliance on a large number of suppliers is another key element of the TPS. Toyota subsidiaries and subcontractors produced up to 70% of the final material of the automobile – compared to 30 to 50% within US suppliers (Kenney & Florida, 1993, p. 46). Toyota plants operate as central hubs around which a series of subsidiary companies and subcontractors are arrayed (Kaneko & Nojiri, 2008). These are figured in a core–periphery model, featuring some ten tiers of suppliers around a central production hub. Whereas core companies ensure guaranteed employment, the contractors – contrary to earlier depictions of Japanese lifelong employment (Ouchi, 1980, p. 132) – depend on expendable, precarious labourers, often women or temporary foreign workers (Yamada, 2010), anticipating the gig economy of today (a longer history of which Fleming (2017) delineates via human capital theory in another context). These massive, just-in-time, distributed production complexes function as the ‘ultrastructure’ of the Japanese economy (Kenney & Florida, 1993, p. 46). (Fiat has a similar reliance on outsourcing, as noted by Whitford and Zirpoli (2016, p. 1231), though space does not allow for more extensive comparisons between the two companies.)

In the words of a popular trade book, Toyota CEO ‘Ohno’s idea was simply to convert a vast group of suppliers and parts plants into one large machine’ (Womack et al., 1990, p. 61). At first this information system operated only in the sphere of production; later it tied moments of purchase back to the sphere of production. In so doing Toyota elaborated ‘a sales network very similar to the Toyota supplier group’ (Womack et al., 1990, p. 66). A network of vendors, who travelled around to their customers’ homes to canvass their needs, reported back their preferences and auto orders to Toyota’s head office. Consumers’ orders for new cars mirrored kanban cards, this time moving forward to the production facilities. In Toyota’s built-to-order system the vendor became the ‘first step in the kanban system, sending orders for presold cars to the factory for delivery to specific customers in two to three weeks’ (Womack et al., 1990, p. 66). Even when not selling a car, vendors making the rounds to customer homes in Japan helped accumulate data about each customer’s family status, car purchase history and preferences, ensuring that ‘distribution [became] a fully integrated part of the entire production system’ (Womack et al. 1990, p. 194). The TPS was hence one giant informational network, first conceived via the movement of the paper kanban, and later executed by networked computer systems like those used by airline reservation systems to regulate orders to the head company and then upstream to suppliers (Kaneko & Nojiri, 2008, p. 163; Aoki, 1990, p. 5).

Within this system, Toyota occupied the place of a data-gathering intermediary shuttling information about demand throughout the entire production network, from vendors and dealerships to secondary
Organization Studies 43(7)

and tertiary suppliers. Again, this hub-like function of the Toyota factory is structurally akin to the intermediary function of platforms within a multisided market. Toyota as production hub and coordinator hence anticipates the data-intensive, intermediary-style operations of the platform enterprise as a horizontally organized firm that sees the proliferation of data points: salespeople, consumers, firms, subcontractors, and workers. Toyota’s role in managing production anticipates the model of digital intermediaries like Facebook (Beverungen et al., 2015) or Amazon in their coordination of buyers and sellers. Like the digital platforms that would come later, the boundaries between inside and outside, and direct employees and indirect labourers, blurred within Toyota’s production system as it connected multiple agents whom it mediated. In its hub-like coordination of multisided markets, Toyotism is a crucial organizational antecedent of platform intermediaries today. Table 1 maps these correspondences.

**From Toyotism to Digital Platforms: Theory**

The above section charts the platform stack and intermediary models as they develop in the manufacturing practices of the automobile industry. In this section I focus attention on the history of popular and academic management writing about platforms, presuming the impact management writing has on industry practices (Gregg, 2018; Hoof, 2020; Liu, 2004). Here I trace the conceptual development of the stack and intermediary models of platforms from the automobile sector to information technology through the work of two figures: American management scholar Michael Cusumano, and Japanese management scholar Kokuryō Jirō. Their work represents two crucial moments of transition from automobile to digital platforms.

**American platform theory**

The development of platform theory within American and Japanese management literature in the 1990s is deeply indebted to its initial location inside automobile industry analysis. One of several
figures connecting the two is Michael Cusumano, a US-based academic trained at Harvard as an economic historian of Japan’s automobile industry, who subsequently taught within MIT’s Sloan School of Management. In the 1980s and 1990s he was associated with MIT’s International Motor Vehicle Program (IMVP), formally joining MIT in 1986. The IMVP was an influential program driven by American and international corporate and governmental efforts to grapple with changes the automobile industry was undergoing, and the Japanese ‘lean manufacturing’ challenge in particular (Womack et al., 1990, p. 2). Indeed ‘lean’ was itself coined by an IMVP researcher and popularized by The Machine that Changed the World (Holweg, 2007; Womack et al., 1990). The IMVP was established with automobile manufacturers’ funding to study the Japanese production system at a moment when it posed an existential threat to European and American automobile companies. It also served as a bridge, helping Japanese manufacturers Toyota and Nissan establish branch plants in the US and Europe. The IMVP was where much of the English language empirical and theoretical work on Toyotism first developed in the 1980s (Hines et al., 2004), and is a crucial site from which platform research emerges – first around automobiles, later around the computer industry, and today around the platform economy.

Cusumano’s work is foremost among this research group that started with automobile platforms before pivoting to digital platforms (Cusumano, Gawer, & Yoffie, 2019). Cusumano’s earliest work was his 1985 book, The Japanese Automobile Industry: Technology and Management at Nissan and Toyota. Based on his PhD dissertation, this extensively researched tome ‘attempts to rectify a major oversight – the absence of a comprehensive history of Nissan, Toyota, and the industry they have dominated for five decades in Japan’ (Cusumano, 1985, p. xix). This book was released amid a flurry of studies on the Japanese automobile industry, including more popular overviews such as David Halberstam’s The Reckoning (1986), Richard Schonberger’s Japanese Manufacturing Techniques (1982) and Robert Hall’s Zero Inventories (1983). Substantial research in Japanese on Toyotism already existed, and was being translated into English by the 1980s (Holweg 2007, p. 431). Yet Cusumano’s book stands out for its close attention to manufacturing processes and their histories – an approach adopted by IMVP researchers around this time.

By the late-1980s Cusumano had turned his attention to the software industries, first in Japan, and later in the US as well, publishing Japan’s Software Factories in 1991 (Cusumano, 1991) before shifting to the study of Microsoft (Cusumano & Selby, 1995) and then Netscape (Yoffie & Cusumano, 1998). At the same time, he continued his work on the automobile industry, extending his earlier work with attention to platforms in his co-authored book with his student and former Mazda employee Nobeoka Kentaro, Thinking Beyond Lean (Cusumano & Kentaro, 1998). This dual attention to the automotive and the digital is significant, and the former arguably informs his analysis of digital platforms.

As Cusumano was transitioning to an analysis of digital platforms, another group of scholars was extending the stack model of the platform from within automobile analysis to other product families, forming the ‘product platform’ subgenre of analysis in the 1990s. Wheelwright and Clark (1992) are credited with the expansion of the term from the auto sector outward (Gawer, 2009, p. 46), and they draw on the automobile industry’s framing of the term as both a system of parts and a process of product design (Holweg, 2007, p. 424). Even as they expand the platform concept beyond the car, Wheelwright and Clark anchor their account of this expanded platform concept with reference to automobiles: ‘Honda’s 1990 Accord line is an example of a new platform in the auto industry: Honda introduced a number of manufacturing process and product changes but no fundamentally new technologies’ (Wheelwright & Clark, 1992, p. 73). They continue with a reference to computers before expanding to a wide range of products, including Tide detergent: ‘In the computer market, IBM’s PS/2 is a personal computer platform; in consumer products, Procter & Gamble’s Liquid Tide is the platform for a whole line of Tide brand products’ (Wheelwright &
Clark, 1992, p. 73). The sequence from automobile to computer to cleaning products is indicative of the centrality of cars to platform theory. Wheelwright and Clark’s early foray into a generalized platform theory was followed by works by Meyer and Lehnerd, including their popular book, *The Power of Product Platforms* (1997). Product platform literature hence emerges from the automobile platform concept and leads to research around ‘modular product architectures and component reuse’ (Cusumano, 2010, p. 32). As Suarez and Cusumano note, ‘The auto industry was probably one of the first to adopt a platform strategy’ (2009, pp. 77–78). Platform theory until this point was informed by the stack model.

Building on the platform family concept but breaking both with its automobile origins and the presumption of adherence to a single family or brand, Cusumano introduces a version of the intermediary model in his influential book, cowritten with Annabelle Gawer, *Platform Leadership* (2002). *Platform Leadership* is one of the earliest management books about hardware and software platforms in the early twenty-first century. The book builds on Cusumano’s mid-1990s work on Microsoft and Netscape, as well as on Gawer’s dissertation research; Gawer has since become one of the most important figures in platform management studies. *Platform Leadership* differentiates the stack model of the product platform from a newer model of the platform, what they variously call ‘technology platforms’ or ‘industry platforms’ (Gawer & Cusumano, 2002). In Cusumano’s later definition, technology platforms provide ‘a common foundation or core technology that a firm can reuse in different product variations, similar to an in-house product platform’ (Cusumano, 2010, p. 32). The twist is that these reuses are assumed to be outside the company; the company disaggregates the platform (base) from its ‘complements’ (external software components or products that give the platform its value). This in turn requires ‘a strategy to open their technology to complementors and create economic incentives (such as licensing fees or financial subsidies) for other firms to join the same “ecosystem” and adopt the platform technology as their own’ (Cusumano, 2010, p. 33). The distinction between Microsoft and Apple during the 1980s is an obvious one in this context: Microsoft more successfully supported other companies (‘complementors’) creating software for its Windows operating system, which became the dominant OS (Gawer & Cusumano, 2002, p. 7). In this view complementors become more important to the success of a product than the product itself.

This emphasis on external complementors is a crucial step towards the now-dominant intermediary model of the platform. Understanding the technology platform as existing in a state of codependency with a system of objects – objects that increase the value of the platform for both the user and owner – signals a shift from a vertical platform stack model to the horizontal platform intermediary model. As seen in this brief account of Cusumano’s work, the horizontal intermediary model emerges out of initial research on automobile platforms, extending into work on digital platforms. It also provides a conceptual articulation of the intermediary model we saw already in industry practice in the Toyota Production System.

**Japanese platform theory**

This intermediary concept of platform also develops several years earlier by way of a separate (and to Anglophone scholars relatively unknown) group of Japanese management thinkers in the early 1990s. Here the platform begins as a way to grapple with the digital shift and the potentials of Internet-mediated commerce. Yet here too the automobile industry plays an important role in the development of this theory. In this the figure of Kokuryō Jirō is central. Kokuryō is a Harvard business school-trained Japanese management studies scholar who along with established management thinker Imai Ken’ichi developed some of the first theorizations of the platform as a mediation device for third party transactions (Negoro & Ajiro, 2012) – what would later become...
the mainstream of platform theory in the 2000s in the English-speaking world, especially via the economics of multisided markets (Rochet & Tirole, 2003). Kokuryō’s work sparked the development of Japanese intermediary platform theory, which in turn reflects the emergence of Japanese mobile Internet systems such as ‘i-mode’ (as well as the iPhone and Android systems inspired by it), which are premised around the centrality of the mobile phone as interface and hub for the digital economy (Kodama, 2003; Natsuno, 2003; Steinberg, 2019). This precedes and yet has overlaps with French and American research on industry platforms and multisided platforms.

A crucial first intervention here was the special issue of the journal *InfoCom REVIEW* titled ‘platform business’, which Imai and Kokuryō co-edited in 1994, followed by monographs by Kokuryō (1995) and Negoro and Kimura (1999), among others. The *InfoCom* special issue, released amid increasingly widespread use of proprietary information networks by companies like Toyota and 7-Eleven (Marutschke, 2011) and on the cusp of the widespread commercialization of the Internet in Japan in the mid-1990s, promised to account for what Imai describes as the ‘massive changes the Japanese industrial system is undergoing’ (Imai, 1994, p. 3). The aim was to examine ‘how the advances and innovations in information and communications technologies led to changes in the mechanisms of transactions between companies, and how these in turn led to changes in company organization and industrial organization’ (Imai, 1994, p. 3). The framing here is familiar to us from Davis (2016), Alaimo and Kallinikos (2021), and others above: how new technologies lead to new organizational forms. For Imai, the focus on transactions opened up a new front in the study of business organizations, via the concept of the platform. Imai presents the special issue as a step towards mapping some of the transformations wrought by digital technologies on the structure of inter-company trading and the ‘keiretsu’ business model, with the aim of envisaging the ‘composition of the new industrial organization’ (Imai, 1994, p. 3), with corporations modelled as transactional intermediaries.

Kokuryō would define the platform business as ‘one where the existence of a foundation or base provided by a private business allows anyone to supply goods and services to another party under a specific set of conditions, thereby invigorating transactions between third parties and building new businesses’ (Kokuryō, 1994, p. 4). He offers the following examples of such platforms:

Credit cards and other intermediaries of trust allow various businesses to be established and enable transactions between third parties to take place. Express delivery services, for instance, enable the creation of new transactional forms built around direct-from-the-farm deliveries, allowing the farm owner to establish a profitable business. Or, yet another example of the meaning of platform business can be found in manner in which Microsoft, by providing what is a ‘de facto standard’ OS, in turn allows for the establishment of independent companies built around offering related products and services. (Kokuryō, 1994, p. 4)

Each example Kokuryō provides is one in which a basic service or technology provides the ground from which other companies and businesses can spring into existence and mediate between third parties. In this sense he offers a synthesis of the two models of platforms we saw above: the stack model and the intermediary model.

Kokuryō explicitly articulates this as a shift from a vertical model of industrial organization to a horizontal model of industrial organization (Kokuryō, 1994, p. 5). Proposed with an eye to the effects of networked technologies on industrial relations, the platform also promised a shift from vertical integration to horizontal intermediation as an industrial model; from conglomerate or keiretsu to intermediary firm. This conception of the platform as both layered material support and intermediary is a composite of product platforms and technology platforms – both stack and intermediary, giving a first theoretical articulation of the industrial developments by Toyota tracked in the previous section.
In this regard, Kokuryō and his collaborators’ attention to the automobile industry – industrial and automobile parts supplier Misumi was one of their case studies; the Aucnet used car auction another – as well as their more general concern with what Imai called ‘changes in company organization and industrial organization’ suggests further connections between the automobile industry and the reconceptualization of industrial forms they undertake in their special issue. I would further speculate that the conditions for this initial development of the intermediary platform model were the particular conjunction of the rise of information technologies alongside the 1980s and 1990s hype around the intermediary industrial organization pioneered in the automobile industry, and by Toyota in particular. If this ‘platform business’ theory could emerge at this time, it was likely due to the prominence of the auto industry’s hub-like production practices in the first place. The auto industry offers the epistemological ground for the development of what would become digital platform theory.

To sum up, Cusumano’s research trajectory demonstrates how work on automobile platforms lays the ground for work on computing and digital platforms. Kokuryō’s platform business theory, including its deft marriage of stack with intermediary models of the platform, demonstrates how digital-first platform theory of the 1990s was itself still preoccupied with changes to one of the largest sectors of the Japanese economy: the automobile industry. Both scholars continue to be leading voices in the articulation of the digital platform economy in the US and Japan, with two examples being Cusumano’s co-authored *The Business of Platforms* (Cusumano et al., 2019) on the one hand, and Kokuryō’s co-edited (Japanese) volume *Platforms for Emergent Management* (Kokuryō & Platform Design Lab, 2011) on the other. Table 2 summarizes these correspondences.

| Michael Cusumano/US platform theory | Kokuryō Jirō/Japanese platform theory |
|-------------------------------------|---------------------------------------|
| Starts with automobile analysis in 1980s/90s | Starts with concern over changes in company organization and industrial organization due to new communications technologies, mid-1990s |
| Automobile analysis informs ‘product platform’ analysis that offers computers as one example | Kokuryō combines a stack model of platform (one business builds base for another) and intermediary model (enabling transactions between third parties) |
| Cusumano shifts to software and then platform analysis during 1990s and 2000s, publishing *Platform Leadership* in 2002 | Automobile parts supplier Misumi is one case study; Aucnet used car auction another |
| Cusumano and Gawer (2002) introduce the complementors model of the intermediary, explaining dominance of Microsoft with its ‘ecosystem’ approach | Background of digital platform theory are Japanese automobile companies and the existing structure of the Japanese industrial system |
| Becomes a leading voice in articulating platform economy in US | Becomes leading voice in articulating platform economy in Japan |

Table 2. Summary of the distinct trajectories of platform theory in the United States and Japan.

In the above sections this article outlines the industrial dependencies and theoretical continuities between the automobile sector and platform businesses. In doing so this article tracks changes in both industry practices and theoretical analysis, noting how the platform theory of Gawer, Srnicek and others is deeply dependent on developments in the automobile sector. In what follows I will
highlight some crucial takeaways of this shift from a computing to an automobile lineage of platforms, particularly in light of this special issue’s interrogation of the relation between technology and organization.

First, the longer lineage of platform theory and practice this article traces back to the automobile industry, the crucial industry of the 20th century, paves the way for a revaluation of the history and periodization of the platform today. It rescues the automobile platform from its erasure by digital platforms and suggests we may have something to learn from an increased focus on manufacture as a site of analysis (Qiu et al., 2014). In particular, the crucial role of just-in-time in both Toyotism and platform capitalism (via ‘on demand’ services in the latter) suggests an occluded connection between the two that should be further investigated moving forward. This lineage allows us to be critical of the presentism of writing about platforms. It also reminds us of the need to be cautious of claims of novelty whether they be in relation to the newness of new media (Chun, 2016) or to epochal paradigms in the study of organizations (Du Gay, 2003).

Consequently, we should reappraise recent writings on platform capitalism such as Srnicek’s which, while valuable in mapping the financial conditions for the rise of platforms and in creating platform typologies, tend to present the data-centrism and mediatory emphasis of the platform era as novel and Silicon Valley-centric. Platform capitalism should be considered an extension of Toyotism and automobile logics, rather than a complete break from these. To return to Vismann’s argument that a ‘history of files therefore also contains a prehistory of the computer’ (Vismann, 2008, p. 164), we must assert that the history of Toyotism contains the (or one) forgotten prehistory of platform capitalism. This becomes all the more clear when we observe how everything from firm organization (e.g. the lean organization) to software programming (e.g. Agile) to start-up philosophies (e.g. the ‘lean start-up’; Ries, 2014) revolve around ‘lean’ as a mantra.

Second, following from this, we should treat with some caution recent writing in organization studies that assumes the demise of the corporation ensues from the rise of digital platforms (Davis, 2016; Van Alstyne et al., 2016). The platform is less a technological object that results in the decline of the corporation than a managerial one that allows corporations to offer and distribute products and services by other means. It is true that new kinds of asset-light companies have emerged, whether Uber or Airbnb – ‘intermediaries of trust’ as Kokuryō (1994, p. 4) would call them – in which the majority of their ‘employees’ are in fact contractors. On the other hand, platform companies like Google, Microsoft, or Amazon have built computing stacks, data warehouses and logistics systems to support their hub-like intermediary operations, even as they too outsource large parts of their activities to contracted employees (Moreno, 2019). As such these latter firms more closely resemble Toyota and their multiunit, multi-divisional enterprise form, and may require a return to a consideration of the multidivisional form (M-form) of corporation that Chandler (1977) first analysed in his treatment of, alongside DuPont, the automobile industry and GM in particular. In this regard Srnicek’s convergence thesis – ‘the tendency for different platform companies to become increasingly similar as they encroach upon the same market and data areas’ (Srnicek, 2016, p. 107) – deserves attention. As Google, Microsoft and Amazon (or Alibaba, Tencent and JD.com) increasingly operate in the same fields they require multiple product divisions to support their activities, suggesting a continuation of the M-form organization. As platform firms become massive, monopolistic enterprises operating in multiple fields – from video streaming to consumer electronics to robotics to logistics, in the case of Amazon – returning to an earlier moment of corporate history (Chandler, 1977) and the attending critique of monopoly capital (Baran & Sweezy, 1968) may offer some critical tools for analysis.

Third, the attention to management theory’s impact on platform models suggests the importance of reading management theory as itself a site of industry modelling. Nigel Thrift notes that management discourse ‘increasingly. . . forms a background to how business is practiced’ (2005, p. 107)
30). Management texts are productive of models used to grapple with the industrial changes at hand. They feed back into managers’ own activities within their firms. In particular, the managerial innovations initiated at Toyota and the ripple effect of lean principles spreading across industries suggests that, as Melissa Gregg has written, ‘Toyotism – not Fordism – is the crucial managerial revolution of our time’ (personal communication, June 1, 2021; see also Andrijasevic et al., 2021). More attention should be paid to the rhetorics, concepts and ideas produced in management theory, and Toyotism in particular, in its complex entanglements with organizational practice and media history (Hoof, 2020).

Doing so requires that we appreciate the complex, two-way relationship between platform theory and organizational practice. Attending to how one impacts the other allows us to see the more circuitous relationship between new technologies as they produce (or do not produce) new organizational forms. Equally important here is the gap between technologies and practices. Just-in-time production is achieved first by circulating pieces of low-tech paper before being integrated into the networked computers and manifesting in the cultural expectations of on-demand service that propel JIT today. This ultimately reaffirms Raymond Williams’ (2003) caution against presuming deterministic relations between technology and culture – pushing back on McLuhan’s (1994) media determinism of the ‘medium is the message’ and serving as a preemptive rejoinder to Kittler’s subsequent assertion that ‘media determine our situation’ (1999, p. xxxix). Technologies are bound up with organization (Hoof & Boell, 2019), but, as the findings here illustrate, not deterministically so. Media do not simply organize; media themselves are organized by social institutions (Conrad, 2019). In this case platforms as media and technologies are informed by existing managerial practices. To Alaimo and Kallinikos’s pithy provocation that ‘the technology is the organization’ (2021, p. 1402) we might suggest, then, that organizations are collections of practices that inform and resist the adoption of technologies. This crucial gap between technology and organization is worth attending to.

Fourth, in recentring the automobile sector and the transpacific legacies of its study, this article reminds us of the complex geographies of the production of the platform concept. Displacing its usual association with Silicon Valley firms and showing how the platform as concept and practice is produced at a nexus between Japanese and US automobile industries and their analyses, this article has shown how theory itself is produced via transnational exchange. That this involves an exchange between the world’s two largest economies at the time of this exchange in the 1980s and 1990s is not surprising. Yet even while Japan has maintained a certain economic hegemony, it has not always been accorded the relative discursive attention, particularly within platform studies. Here, then, this article proposes a certain reorientation of theoretical production (Salazkina, 2015; Steinberg & Zahlten, 2017) by situating platform theory itself as a coproduction between Japan and the US.

Finally, there is a political lesson to learn from refocusing on the car. The automobile industry was a site of intense worker contestation and mobilization in the 20th century (Parker & Slaughter, 1990). In the midst of labour organizing by Amazon and Uber workers, one pragmatic lesson to be drawn from this continuist lineage of automobile capitalism to platform capitalism is that while the solidarities created by co-working in an automobile plant might seem more difficult to recreate in a platform-mediated present, they are not insurmountable. Even amid the setbacks of these efforts and the challenges of organizing in the face of these massive platforms, scholars have documented the efforts and successes of this mobilization in China, Europe and North America; solidarities can and are being created among gig workers (Chen & Qiu, 2019; Chen & Sun, 2020; Scholz, 2017; van Doorn, 2020). Mobilization for worker rights may be successful, and platforms may be sites of political organization, not simply resignation (Lovink, 2021).
Conclusion

This article has traced a lineage of the platform that redirects attention from the computer to the car. Developing the heuristic models of stack and intermediary forms of the platform as a means of giving definition to this otherwise slippery term, this article demonstrates the automobile lineage of platform capitalism. It also traces the gig economy to longer histories of outsourcing and precarious labour in the automotive industry, and traces data-mining to practices developed to regulate production at Toyota factories. In doing so, this article has emphasized the need to think technology and organizational practices together – as this special issue asks we do – all the while suggesting that tales of continuity across technological change are as revealing as stories of epochal shift. Attending to such continuities – on the industrial level via Toyota’s manufacturing practices as well as on the discursive level by attention to the emergence of digital platform theory out of automobile theory in the US and Japan – offers the opportunity to see what practices continue from the automobile economy to the platform economy and also what gaps there are between technology and organizational practice. Of course, an over-emphasis on continuities can obscure real differences between Toyotism and platform capitalism. Digital technologies and platforms in particular do see accelerations in the data-gathering possibilities of companies that organization studies must engage with, and which I do not have the space to elaborate on here. However, amid a proliferation of new periodizing concepts some attention to longer histories is much needed. Before we hitch ourselves to new organizational models or paradigms we best heed their obscured lineages, lest revealing continuities be papered over in our race to the new.

This lineage is all the more significant today, as platforms themselves are now completing their loops from automobile factories to smartphones back to the automobile with Uber, Didi, Tesla, Waymo, Apple and their experiments with autonomous driving and city mapping (Chen & Qiu, 2019), not to mention persistent rumours of tech companies getting into automobile production. The recent announcement that Foxconn, Apple’s main subcontractor in the manufacture of smartphones, is entering the electric vehicle business is a case in point (Hille, Inagaki, & Campbell, 2021). As smartphone makers move into EV production, there is no better time to recall this automobile lineage of platform capitalism, including its ecological perils.

The platform’s automobile lineage is a reminder that even amid the celebration of platforms by some, or the critique of their hunger for our data by others, we were never as far away from the car as we thought. Automobile manufacturing was the crucial industry and system of the 20th century (Dennis & Urry, 2009). If the lineage of platform industry and theory traced here is any indication, automobile capitalism will remain that of the 21st century as well.

Acknowledgements

I would like to thank the Special Issue editors, Timon Beyes, Wendy Chun, and Robin Holt for their advice, guidance, and encouragement, as well as the three anonymous reviewers whose helpful suggestions and critiques allowed me to sharpen and refine this article. I also wish to thank the friends and colleagues who read and commented on drafts of this article, including Melissa Gregg, Joshua Neves, Rutvica Andrijasevic, Julie Chen, Stephanie Sherman, Yuriko Furuhata, Orit Halpern, and Colin Crawford.

Funding

The author received support from the Social Sciences and Humanities Research Council (SSHRC) of Canada for the research and writing of this article.

ORCID iD

Marc Steinberg https://orcid.org/0000-0002-6560-2980
Notes
1. While Cusumano made the connection at the discursive level – something I follow more closely below – he tends to treat automobile platform research as separate from digital platforms.
2. There may also be other such unseen lineages of the platform economy; this is a preliminary, Toyota-centric account of the emergence of the platform economy. Stephanie Sherman (2020, p. 406) offers a Fordist account of platforms, calling Henry Ford a ‘geopolitical platform logician who propelled automobile to planetary scale’.
3. Whereas Urry treats automobility as a ‘self-organizing, autopoietic, non-linear system’ (2004, p. 27) here I focus more narrowly on automobile production and discourses around it, as a prototype for platform capitalism.
4. A significant difference in files and platforms is that whereas files depend upon a media materiality, the fuzzier term platform designates two possible structures and orientations (vertical stack and horizontal intermediary) rather than a specific materiality. Still, insofar as some assumptions about media materiality are built into the platform concept (whether as computer hardware, as support for content, or as infrastructural intermediary between multiple parties), Vismann’s insightful treatment of files is germane to this article.
5. This analysis is based on exhaustive searches of the Factiva, ProQuest, Academic Search Complete and Lexis-Nexis databases, among many others more closely related to the car industry (or production and engineering).
6. Here I omit a deeper engagement with what Cusumano himself sees as a major divide in his work: that automobiles are product platforms (not industry platforms) insofar as they allow for modularity within a single firm but do not rely on network effects for their popularity or value, whereas (digital) industry platforms do (2010, p. 33). Contra Cusumano, I would argue that network effects were in fact in play, given Toyota’s dependence on data, given that value accrued to the company in proportion to the number of customers it had, and given its status as an intermediary.
7. These and subsequent translations from the Japanese are the author’s.

References
Aaltonen, Aleski, & Lanzara, Giovan F. (2015). Building governance capability in online social production: Insights from Wikipedia. Organization Studies, 36, 1649–1673.
Aglietta, Michel (2000). A theory of capitalist regulation: The US experience (Vol. 28). London: Verso.
Alaimo, Cristina, & Kallinikos, Jannis (2021). Managing by data: Algorithmic categories and organizing. Organization Studies, 42, 1385–1407.
Andressen, Mark (2007). The three kinds of platforms you meet on the Internet. Pmarca Blog. http://web.archive.org/web/20071018161644/http://blog.pmarca.com/2007/09/the-three-kinds.html.
Andrijasevic, Rutvica, Chen, Julie Yujie, Gregg, Melissa, & Steinberg, Marc (2021). Media and management. Minneapolis, MN: University of Minnesota Press.
Aoki, Masahiko (1990). Toward an economic model of the Japanese firm. Journal of Economic Literature, 28(1), 1–27.
Athique, Adrian (2019). Digital emporiums: Platform capitalism in India. Media Industries Journal, 6(2). https://doi.org/10.3998/mij.15031809.0006.205
Baldwin, Carliss Y., & Clark, Kim B. (2003). Managing in an age of modularity. In Raghu Garud, Arun Kumararawamy, & Richard N. Langlois (Eds.), Managing in the Modular Age: Architectures, Networks, and Organizations (pp. 149–160). Oxford: Blackwell Publishers Ltd.
Baran, Paul A., & Sweezy, Paul M. (1968). Monopoly capital: An essay on the American economic and social order. New York: Modern Reader Paperbacks.
Beverungen, Armin, Böhm, Steffen, & Land, Chris (2015). Free labour, social media, management: Challenging Marxist organization studies. Organization Studies, 36, 473–489.
Beyes, Timon, Conrad, Lisa, & Martin, Reinhold (2019). Organize. Minneapolis, MN: University of Minnesota Press.
Bogost, Ian, & Montfort, Nick (2009). Platform studies: Frequently questioned answers. https://escholarship.org/uc/item/01r0k9br
Gregg, Melissa (2018). *Counterproductive: A brief history of time management*. Durham, NC: Duke University Press.

Halberstam, David (1986). *The reckoning*. London: Bloomsbury.

Hall, Robert W. (1983). *Zero inventories*. Homewood, IL: Dow Jones-Irwin.

Hille, Kathrin, Inagaki, Kana, & Campbell, Peter (2021, May 17). Foxconn the carmaker? Disruption in the era of electric vehicles. *Financial Times*. https://www.ft.com/content/b229250d-5d9e-4bb1-bb91-e57888233a98.

Hines, Peter, Holweg, Matthias, & Rich, Nick (2004). Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations & Production Management*, 24, 994–1011.

Holweg, Matthias (2007). The genealogy of lean production. *Journal of Operations Management*, 25, 420–437.

Hoof, Florian (2020). *Angels of efficiency: A media history of consulting*. Oxford: Oxford University Press.

Hoof, Florian, & Boell, Sebastian K. (2019). Culture, technology, and process in ‘media theories’: Toward a shift in the understanding of media in organizational research. *Organization*, 26, 636–654.

Imai, Kenichi (1994). Hajime ni [Preface]. *InfoCom REVIEW, Winter*, 3.

Kaneko, Jun, & Nojiri, Wataru (2008). The logistics of Just-in-Time between parts suppliers and car assemblers in Japan. *Journal of Transport Geography*, 16(3), 155–173.

Kenney, Martin, & Florida, Richard L. (1993). *Beyond mass production*. Oxford: Oxford University Press.

Kenney, Martin, & Zysman, John (2016). The rise of the platform economy. *Issues in Science and Technology*, 32(3), 61–69.

Kenney, Martin, & Zysman, John (2020). The platform economy: Restructuring the space of capitalist accumulation. *Cambridge Journal of Regions, Economy and Society*, 13, 55–76.

Kittler, Friedrich A. (1999). *Gramophone, film, typewriter* (transl., with introduction, Geoffrey Winthrop-Young & Michael Wutz). Stanford, CA: Stanford University Press.

Kodama, Mitsuru (2003). Strategic innovation in traditional big business: Case studies of two Japanese companies. *Organization Studies*, 24, 235–268.

Kokuryo, Jirō (1995). Ōpun nettowāku keiei: Kigyō senryaku no shinchōryū [Open network management: New trends in business strategy]. Tokyo: Nihon keizai shibunsha.

Kokuryo, Jirō, & Platform Design Lab (Eds.) (2011). Sōhatsu keiei no purattofōmu: Kyōdō no jōhō kiban zukuri [Platforms for emergent management: Building the information basis for cooperative work]. Tokyo: Nihon keizai shibunsha.

Latour, Bruno (1986). Visualisation and cognition: Drawing things together. In Henrika Kuklick & Elizabeth Long (Eds.), *Knowledge and society: Studies in the sociology of culture past and present* (Vol. 6, pp. 1–40). Greenwich, CT: Jai Press.

Liu, Alan (2004). *The laws of cool: Knowledge work and the culture of information*. Chicago: Chicago University Press.

Lovink, Geert (2021). Notes on the platform condition. *Making and Breaking*, 2. https://makingandbreaking.org/article/notes-on-the-platform-condition/

Lovink, Geert (2017). Foreword. In Clemens Apprich, *Technotopia: A media genealogy of net cultures* (pp. xiii–xix). London: Rowman & Littlefield.

Marutschke, David (2011). *Continuous improvement strategies: Japanese convenience store systems*. Basingstoke, UK: Palgrave Macmillan.

McLuhan, Marshall (1994). *Understanding media: The extensions of man*. Cambridge, MA: MIT Press.

Meyer, Marc H., & Lehnerd, Alvin P. (1997). *The power of product platforms: Building value and cost leadership*. New York: Free Press.

Mike, Danilovic, Mats, Winroth, Javier, Ferrandiz, & Oriol, Josa (2007). Platform thinking in the automotive industry: Managing the dualism between standardization of components for large scale production and variation for market and customer. *POMS 18th Annual Conference-Product Innovation and Technology Management*.

Monden, Yasuhiro (1994). *Toyota production system: An integrated approach to just-in-time* (2nd edition). London: Chapman & Hall.
Moreno, Johan (2019). Google Follows A Growing Workplace Trend: Hiring More Contractors Than Employees. Forbes, 31 May.

Nakamura, Lisa (2014). Indigenous circuits: Navajo women and the racialization of early electronic manufacture. American Quarterly, 66, 919–941.

Napoli, Philip, & Caplan, Robyn (2017). Why media companies insist they’re not media companies, why they’re wrong, and why it matters. First Monday, 22(5). https://doi.org/10.5210/fm.v22i5.7051

Natsuno, Takeshi (2003). I-mode strategy. New York: John Wiley & Sons.

Negoro, Tatsuyuki, & Ajiro, Satoshi (2012). An outlook of platform theory research in business studies. Waseda Business and Economic Studies, 48, 1–29.

Negoro, Tatsuyuki, & Kimura, Makoto (1999). Netto bijinesu no keiei senryaku: Chishiki kōkan to baryūchēn [Management Strategies of Net Business: Knowledge Exchange and Value Chains]. Tokyo: Nikka giren.

Ohno, Taiichi (1988). Toyota production system: Beyond large-scale production. Portland, OR: Productivity Press.

Ouchi, William G. (1980). Markets, bureaucracies, and clans. Administrative Science Quarterly, 25, 129–141.

Parker, Geoffrey G., & Van Alstyne, Marshall W. (2005). Two-sided network effects: A theory of information product design. Management Science, 51, 1494–1504.

Plantin, Jean-Christophe, Lagoze, Carl, Edwards, Paul N., & Sandvig, Christian (2018). Infrastructure studies meet platform studies in the age of Google and Facebook. New Media & Society, 20, 293–310.

Pasquale, Frank (2016). Two narratives of platform capitalism. Yale Law & Policy Review, 35, 309–319.

Ries, Eric (2014). The lean startup: How today’s entrepreneurs use continuous innovation to create radically successful businesses. New York: Crown Business.

Rochet, Jean-Charles, & Tirole, Jean (2003). Platform competition in two-sided markets. Journal of the European Economic Association, 1(4), 990–1029.

Rosenblat, Alex, & Stark, Luke (2016). Algorithmic labor and information asymmetries: A case study of Uber’s drivers. International Journal of Communication, 10, 3758–3784.

Salazkina, Masha (2015). Introduction: Film theory in the age of neoliberal globalization. Framework: The Journal of Cinema and Media, 56, 325–349.

Sayer, Andrew (1986). New developments in manufacturing: The just-in-time system. Capital & Class, 10(3), 43–72.

Scholz, Trebor (2017). Uberworked and underpaid: How workers are disrupting the digital economy. Cambridge, UK: Polity Press.

Schonberger, Richard (1982). Japanese manufacturing techniques: Nine hidden lessons in simplicity. New York: Simon & Schuster.

Sherman, Stephanie (2020). Why Lenin was a fan of Ford. In Benjamin H. Bratton, Nicolay Boyadjiev, & Nick Axel (Eds.), The New Normal (pp. 406–410). Moscow: Strelka.

Smicke, Nick (2016). Platform capitalism. Cambridge, UK: Polity Press.

Smicke, Nick (2017). The challenges of platform capitalism: Understanding the logic of a new business model. Juncture, 23, 254–257.

Steinberg, Marc (2019). The platform economy: How Japan transformed the consumer Internet. Minneapolis, MN: University of Minnesota Press.

Steinberg, Marc, & Zahlten, Alexander (Eds.) (2017). Media theory in Japan. Durham, NC: Duke University Press.

Suarez, Fernando F., & Cusumano, Michael A. (2009). The role of services in platform markets. In Annabelle Gawer (Ed.), Platforms, markets and innovation (pp. 77–98). Cheltenham, UK: Edward Elgar.

Thrift, Nigel (2005). Knowing capitalism. London: SAGE Publications.

Tsutsui, William M. (2001). Manufacturing ideology: Scientific management in twentieth-century Japan. Princeton, NJ: Princeton University Press.
United States Congress (1980). *World Auto Trade. Current Trends and Structural Problems;* Hearings before the Subcommittee on Trade of the Committee on Ways and Means, House of Representatives, Ninety-Sixth Congress, Second Session. *March 7, 18.*

Urry, John (2004). The ‘system’ of automobility. *Theory, Culture & Society, 21*(4–5), 25–39.

Van Alstyn, Marshall W., Parker, Geoffrey G., & Choudary, Sangeet P. (2016). Pipelines, platforms, and the new rules of strategy. *Harvard Business Review, 94*(4), 54–62.

Van Dijck, José, Poell, Thomas, & De Waal, Martijn (2018). *The platform society: Public values in a connective world.* New York: Oxford University Press.

evandooorn, Niels (2017). Platform labor: On the gendered and racialized exploitation of low-income service work in the ‘on-demand’ economy. *Information, Communication & Society, 20,* 898–914.

van Dijck, Jose, Poell, Thomas, & De Waal, Martijn (2018). *The platform society: Public values in a connective world.* New York: Oxford University Press.

Williams, Raymond (2003). *Television: Technology and cultural form.* London: Psychology Press.

Womack, James P., Jones, Daniel T., & Roos, Daniel (1990). *The machine that changed the world.* New York: Free Press.

Wood, Ellen Meiksins (2002). *The origin of capitalism: A longer view.* London: Verso.

Yamada, Mashiko (2010). The current issues on foreign workers in Japan. *Japan Labour Review, 7*(3), 5–18.

Yoffie, David B., & Cusumano, Michael A. (1998). *Competing on Internet time: Lessons from Netscape and its battle with Microsoft.* New York: Free Press.

Zhang, Lin (2020). When platform capitalism meets petty capitalism in China: Alibaba and an integrated approach to platformization. *International Journal of Communication, 14,* 114–134.

Zuboff, Shoshana (2019). *The age of surveillance capitalism: The fight for a human future at the new frontier of power.* New York: PublicAffairs.

**Author biography**

Marc Steinberg is Associate Professor of Film Studies at Concordia University, Montreal, and director of The Platform Lab. He is the author of the monographs *Anime’s Media Mix: Franchising Toys and Characters in Japan* (University of Minnesota Press, 2012), *The Platform Economy: How Japan Transformed the Commercial Internet* (University of Minnesota Press, 2019), and, with Rutvica Andrijasevic, Julie Yujie Chen and Melissa Gregg, *Media and Management* (University of Minnesota Press, 2021). He is also the co-editor of *Media Theory in Japan* (Duke University Press, 2017). His work has appeared in the journals *Asiascape: Digital Asia; Social Media + Society; Journal of Visual Culture; Theory, Culture & Society,* among others.