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ARTICLE



Platforms and industrial change

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ABSTRACT

Digital platforms are reorganising markets, restructuring the labour force, and redefining the scope of competition. These new intermediaries are transforming economic value creation, industrial structures, and innovative activity, all of which are about to undergo their biggest changes in the post-war era. Platforms have power over their ecosystem members, as algorithms mould users' incentives to elicit particular responses. This raises the question of whether non-platform firms will be overpowered by the likes of Amazon and Google that have considerable advantages, such as massive data centres and the ability to cross-feed online traffic. The answer is conditional, but its existence puts pressure on the state to adopt an aggressive regulatory role. At this time, we do not have a framework for properly regulating platform businesses. This special issue examines how ecosystems created by platforms reorganise markets and how value creation and capture by incumbents and entrants is affected.

KEYWORDS

Digital platforms; ecosystems; technology adoption; industrial change; market power

1. Introduction

Digital platforms and the firms associated with them are organizing or intermediating ever larger portions of economic and social life (Kenney and Zysman 2016; Srnicek 2016). For example, in 2018, 33 percent of Chinese retail sales were online (Statista 2018). Digital platforms intermediate economic and social interactions (Parker, Van Alstyne, and Choudary 2016). The platform giants, such as Amazon, Facebook, Google, and Microsoft, are becoming increasingly central firms in Western economies. They are joined by three platform firms - Alibaba, Tencent, and Baidu (in order of importance) - that have become leaders in the Chinese market. These giants - along with other platform firms, such as Airbnb, Expedia, Priceline, Saleforce.com, Shopify, and Uber - have become intermediaries, organizing, reorganizing, or even transforming a host of industries.

The term 'platform' has been defined in a variety of ways (Parker, Van Alstyne, and Choudary 2016; Evans, Hagiu, and Schmalensee 2006). In this special issue, we adopt

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Gawer's (2014) definition: 'platforms are evolving organizations or meta-organisations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand side of the markets; and (3) entail a modular technological architecture composed of a core and a periphery.' We confine ourselves to networked software platforms because they have powerful generative potential - that is, they enable the creation of new output, structure, or behaviour, often without input from the originator of the system (Zittrain 2008). This is accomplished by providing platform users with various social and technical boundary resources (Gawer 2009; Ghazawneh and Henfridsson 2013) that attract various platform complementors to join and thereby constitute its ecosystem (Jacobides, Cennamo, and Gawer 2018). Furthermore, boundary resources lower the market entry barriers of complementors regardless of their size.

In the past decade, platforms have initiated a reorganisation of many important markets, begun to restructure the labour force, and redefined the scope of competition, thus touching the very core of capitalist societies. Platforms have become new - and threatened old - intermediaries in the markets that they touch by altering barriers to entry and changing the dynamics of economic value creation, delivery, and capture.

It is important to recall the drivers of this platform-organised phase of the digital revolution (Kenney and Zysman 2018). Platforms have benefited from faster, cheaper, more scalable, and more diffused computing and connectivity available on demand via commercial cloud computing services (Kushida, Murray, and Zysman 2015). Software has been modularised and become more readily available, as programming and contracting tools have evolved rapidly. Firms attempting to establish platforms have complemented these developments by providing boundary resources, such as software development kits (SDK), application programming interfaces (APIs), and application contracting interfaces (ACIs) to be used by potential ecosystem complementors (Lauslahti et al. 2018; Ghazawneh and Henfridsson 2013).

This special issue has two goals. First, it examines the ways in which digital platforms have inserted themselves into value chains and labour markets and thereby transformed the supply chains and the locations where value is captured. Second, it examines the ecosystems created by digital platforms that organise markets, frequently integrating incumbents and providing opportunities for new entrants.

2. Characteristics of digital platforms

Through their structure and code, digital platforms create regulatory frameworks that set rules and parameters for economic and social interaction (van Dijck 2013). These rules are centralised control implemented in real time using algorithms and selfexecuting and self-enforcing software. The platform owner has nuanced power over the members of the ecosystem, as, properly programmed, the platform's algorithms and self-executing and self-enforcing software can provide 'individualised' incentives to users to elicit desired responses.

Platforms have economic benefits, as they reduce 'friction' hindering interactions, permitting many new forms of business/market arrangements and interactions to emerge (Parker and Van Alstyne 2005). The term 'friction' encompasses many phenomena, ranging from enabling the discovery of connections that would never have been possible otherwise to the circumvention of legal restrictions, such as zoning, in the case of Airbnb. A digital platform, in roughly the same way as any market but with far greater reach and scope, can connect diverse participants, allowing them to better match the fragmented desires and needs of the participants. By lowering the cost of intermediation and easing the regulatory restrictions on market entry, platforms - such as Airbnb, Didi Chuxing (a Chinese ride-hailing firm), Lyft, and Uber - can allow interactions that might have been impossible before (Cusumano 2015; Sundararajan 2016). In other cases, platforms can provide solutions to problems related to trustworthiness via a variety of mechanisms. For example, Alibaba enables online sales in a low-trust environment such as China by allowing the payment to be held in trust by a vendor until the buyer is satisfied with a purchase (Kwak, Zhang, and Jiang 2019), and Yelp, Booking.com, and Airbnb use a combination of ratings systems for user and provider vetting.

This has several implications. First, from an efficiency perspective, nearly all functions for hailing a driver or finding a place to stay can be performed digitally. This means that these functions can be accomplished at scale, as the software is in place and only the processing function needs to be scaled by renting more cloud capacity. Because the service is now on a digital platform, it can benefit from the feedback generated by both same-sided and cross-sided network effects (Parker and Van Alstyne 2005). Digital business and contract rules embedded in code often create more binding rights and obligations for their participants, as a practical matter, than government rules do (Lauslahti et al. 2018). To illustrate, in much of Europe, ranking on sites such as Booking.com may be more important for hotels than the government-inspected and -enforced star-ranking systems. Breaking the government rules may be violations that may or may not be followed with sanctions. Diverging from rules in code may not be possible, or may require, apart from possible penalties, 'hacking' the system.

To be successful, platforms must create ecosystems that attract participants. To attract the maximum number of users, platforms, at least initially, may have to under-price - that is, subsidise - resources on at least one side of their market (Caillaud and Jullien 2003; Parker and Van Alstyne 2005; Rochet and Tirole 2006). Deciding which side to subsidise is a critical aspect of platform business strategy. It is also possible for the platform firm to change its subsidisation patterns to address marketplace changes. What all the aforementioned papers suggest is that the optimal platform owner's business strategy changes over the platform's lifecycle (Teece 2017). This is typical in a situation in which new sides of the market, participants, are being introduced to the platform.

Information economics are different from traditional industrial economics, because many of the expenses are fixed costs of building the software and the platform. Initially subsidizing users may be expensive, but thereafter the marginal cost of adding participants is relatively low. Equally important, the belief and the fact that network industries exhibit winner-take-all characteristics mean that all entrants must endeavour to capture market share as rapidly as possible. This seems economically rational and necessary for each player. However, ceteris paribus, this encourages all competitors to subsidise all the sides that can affect outcomes. Therefore, in pursuit of market share, firms en masse may price their service below the cost of producing it, sometimes for long periods. To illustrate, Spotify, Uber (Horan 2017), Lyft (Norman 2018), and Airbnb (Carson 2018) continue to lose money or barely break even, even while they continue to expand rapidly. The conundrum with such business strategies is that – to other competitors that are not receiving infusions of capital from investors – such aggressive pricing appears to be, and might be considered, predatory (Vasconcelos 2015). And, in effect, they are predatory because the losses continue until one platform wins or a couple of remaining platforms essentially call a truce. After consolidation and lock in occur, it becomes difficult for platform participants to find alternatives. Therefore, the platform can raise prices for customers, lower payments to providers, overcharge other participants on other sides of the market, and restructure the terms of participation to complementors to capture an inordinate amount of the economic value generated by the ecosystem.

Many platforms try to attract complement providers to make the platform more valuable to other participants. Becoming a complementor may be attractive, as the platform offers the basic infrastructure, useful boundary resources, and access to its ecosystem. In addition to the immediate benefits, many diverse complementors introduce benefits via innovation, as complementors find new needs and discover new ways to satisfy them. McAfee and Brynjolfsson (2017) emphasise the role of combinatorial innovation enabled by platforms; significant value can be added through cheap and rapid combinations of existing basic elements. In fact, the word 'ecosystem' is apt in the context of platforms: when it comes to innovation, some platforms – for example, the Apple App Store and Google Play Store – nurture endless mutations, which then sort themselves out via intense competition. The relationship between the platform and its complementors is uneasy. First, the platform has direct real-time control over the distribution of the value generated by the platform ecosystem. Second, the platform has an incentive to bring in-house the businesses of successful complementors. Third, the platform makes every effort to deter competition and thus is wary of having complementors that are too big or too successful.

3. Are industrial platforms different?

Continuing discussions are taking place about whether digital platforms in the business-to-business (B-to-B) space will experience different adoption patterns from those in the business-to-consumer (B-to-C) or consumer-to-consumer sectors. The answer is likely to be conditional.

In their supply chain and proprietary business process data transactions, firms are likely to be far more cautious about joining a B-to-B platform, in particular, those owned by a private party that might compete with them in the future. The greater caution about B-to-B than B-to-C platforms is due to several factors. Firms frequently are not atomistic actors but, rather, have market power that a platform could weaken. By joining a platform as a complementor, the focal firm may be forced to surrender its market power or have unique types of market knowledge and proprietary business process data transformed into a commodity; hence, participation in a platform could reduce these assets' private economic value. This can be even more dangerous if the platform could potentially integrate particular ecosystem activities, as many firms feared might be the case by joining General Electric's industrial Internet of Things (IOT) platform, Predix, or similar enterprise software platforms (Kumar 2018).¹

In the B-to-B environment, firms adopt a strategic perspective. Many firms resist becoming undifferentiated members of a larger ecosystem, because their interests might be subordinated to those of the platform owner. Initially, the platform is powerless, but that changes when it gains market share and lock in occurs; then, the terms of engagement may change. For example, Apple - as a premium brand with a large retail network - had resisted selling directly through Amazon. However, by 2018, Amazon's increasing retail dominance had driven Apple and its resellers to begin selling on Amazon, and in return Amazon banned unofficial iPhone resellers (Leswing 2018). Apple runs the risk, despite its enormous size and power brand recognition, of becoming locked into Amazon's ecosystem as a complementor and losing some of its market power. Overall, firms may be reluctant to join B-to-B platforms unless they are pressured by customers or powerful suppliers. Being locked into a platform owned by another firm increases the risk of being subordinated, commoditised, or replaced by competitors.

Finally, although consumers never read a platform's entire terms-of-use contract, firms considering joining a platform must understand the implications of being dependent upon it. Despite the potential efficiency benefits, the acceptance of platforms in B-to-B value chains is likely to be slower. It is possible that innovative collective actions that address the fear of exploitation by the platform owner could be developed to facilitate and share the efficiencies of platformization.

4. Contributions in this special issue

In this special issue of Industry & Innovation, Koski, Pajarinen, and Rouvinen study the corporate adoption of the largest platforms - Facebook, YouTube, and five other social media applications. Their sample of firms in Finland suggests that business use of social media is common and has room to grow. Even though Finland is already advanced in terms of ICT adoption, in 2015 the diffusion of social media to firms had only reached 'early maturity.' Approximately, half the companies with a web site were on at least one platform. Because a little under half of the companies had a web site, an estimated twothirds of all companies - including tiny one person firms - were still not engaged with social media platforms. Koski et al. find that that a firm's digital orientation outside social media, innovativeness, external collaboration in marketing and sales, and orientation toward consumer markets increase its probability of adopting social media platforms; furthermore, larger and younger companies are more likely to adopt them. They suggest that discrepancies in social media adoption might further increase the digital divide between firms; despite exceptionally low adoption costs, firms that already use other forms of ICT and have superior financial performance are more likely to adopt social media, which - over time - is likely to boost their performance even further over that of those that do not. The still incomplete adoption of social media platforms suggests that they may induce further significant changes in years to come.

Two contributions to this special issue discuss Airbnb – a peer-to-peer temporary accommodations platform that has global reach but delivers its services locally. This means that Airbnb is embedded in local communities and that it must both adapt and attempt to mould local regulations and perceptions. In other words, as Boon, Spruit, and Frenken put it, a platform such as Airbnb must be both legal and legitimate in order to succeed. Their contribution explores the collective 'institutional work' that is necessary to define the platform's local operating environment. In another article, Uzunca and Borlenghi study the implications of regulatory strictness for two different temporary peer-to-peer accommodations platforms: the money-based Airbnb and the service-exchange-based Couchsurfing.

Legality and legitimacy are two distinct but interrelated dimensions. Boon et al. find that the 2008-2017 institutional evolution due to Airbnb in Amsterdam, London, and New York did not follow archetypical legality or legitimacy pathways; rather, it zigzagged with a constant back-and-forth interplay between the two. Contrary to popular belief, the platform concentrated on establishing new institutions, rather than on disrupting existing ones. Furthermore, users and non-users were more active than the platform in the public debates: the platform's users were mostly evangelists for peer-to-peer accommodations, while non-users attacked Airbnb by highlighting its risks and detrimental social impacts. Despite similarities across locations, in each city the outcome was the product of a different evolutionary path. Overall, the collective institutional work concerning Airbnb was dispersed, erratic, and uncoordinated. And even though Airbnb became a mainstay of shortterm stays in all three cities by the end of the observation window, the institutional work of establishing its legitimacy has shown no signs of decreasing. Thus, even though the platform was identical in the three cities, the local context resulted in different outcomes.

Extending the results of Boon et al., Uzunca and Borlenghi explore the association between the regulatory strictness and the supply of Airbnb and Couchsurfing accommodations in 59 US cities. What they find is that the stricter the regulations are, the greater the supply, especially when the suppliers have motivations other than financial ones. Although this study concerns only two platforms, it appears to be consistent with Vogel's (2018) contention that governments systemically craft markets and related institutions, thereby legitimating particular market initiatives. Based on their results, Uzunca and Borlenghi conclude that platforms such as Airbnb and Couchsurfing need – and should want – regulation.

The dynamics between the firm controlling a platform and complementors is invariably uneasy. In this special issue, Lan, Liu, and Dong examine the results of the power dynamics between an open source software (OSS) platform provider and complementors. They find that when the platform owner has larger market share in complementary segments, fewer complementors join an OSS development platform. This disincentive is stronger when the platform owner's sales growth is greater. In other words, potential complementors seem to anticipate the platform owner's superior ex-post value appropriation ability, based on these observable metrics, and are less likely to join such ecosystems. The authors suggest that platform owners wishing to attract more complementors could create mechanisms to alleviate ex-ante concerns about such value appropriation. Of course, for the platform owner, such forbearance can decrease total returns.

5. Concluding remarks

We believe that we are in the midst of a transformation in the global economy that can be likened to the advent of mass production in the 1940s. Based on the adoption of platforms and intelligent systems of the same magnitude, this is evident and will affect both industry and innovation. Our study of this transition raises several fruitful areas for future inquiry.

- (1) Is the industrial structure changing? How do platform firms leverage their existing strengths to enter new markets? Can non-platform incumbents resist new entrants, such as Amazon or Google, which have valuable, rare, inimitable, or non-substitutable advantages, such as massive data centres, payment systems, or the ability to cross-feed online traffic?
- (2) What are the contours of industrial change? For example, the automobile industry is disrupted by autonomous vehicles, which will be dependent upon data capture and analysis; a firm with better software, more data, and superior analytics capability could displace or, as likely, relegate the automaker to a subordinate actor in the industry.
- (3) Can the impact of increased software functionality in capital goods be measured or studied qualitatively? For example, how will that affect work processes and employment in manufacturing? Will this affect the geography of employment and value added? For example, will consumer goods manufacturing relocate to be in closer proximity to the end market?
- (4) Is the ecosystem metaphor in fact an ideological construct that hides power dynamics that more closely resemble those for serfs on a feudal manor - always at the mercy of the lord who can expropriate their business without any compensation? Research exploring the nature of these platform ecosystems could provide insight into the dynamics of the power relationships.
- (5) To date, little research has been conducted on the changing relationship between the platform owner and complementors from the platform's introduction through its maturity. This could also be extended to the dynamics of platform decline. Does it differ by type of platform, whether social media, search, or e-commerce?

The impacts of digital platforms seem to have only begun. We can expect further developments that may be as, or even more, transformative as the ones we have already seen. Intelligent systems are likely to continue to affect how work is done and how value is created. The difficulty of predicting how platforms and intelligent systems will affect industries is due in part to their remarkably pervasive impacts. As mentioned earlier, in the example of the auto industry, as these technologies are applied, they become insidious, pervasive, and ubiquitous. The initial applications are often generative of further innovation (Zittrain 2008), which makes prediction of the future difficult.

The decisions regarding platform adoption and operation will necessarily be shaped by the power of the government. The two papers on Airbnb suggest that the state could have a positive regulatory role. One critical issue over the next decade will be the formulation of regulatory frameworks including decisions on how to properly regulate these platforms. In some cases, this may include protecting ecosystem players, even though they have voluntarily made binding private contracts with the platform upon joining it. Those protections will vary in terms of the context and services. Therefore, evolution in the role of the state could also provide extremely valuable insights.

We believe that digital platforms and intelligent machines are likely to remain powerful organizing principles for economic and social activity over the next decade. Scholars interested in contemporary industry or innovation must consider how digital platforms and intelligent systems facilitate and channel social or economic activity. We anticipate a rising tide of further studies related to this topic.

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