



From creative destruction to creative appropriation: A comprehensive framework

Jack Linzhou Xing^a, Naubahar Sharif^{b,*}

^a Hong Kong Institute for the Humanities and Social Sciences, The University of Hong Kong, May Hall, Pokfulam, Hong Kong SAR, China

^b Division of Public Policy and Division of Social Science, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong SAR, China

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ABSTRACT

This paper introduces a conceptual modification of Schumpeter's concept of creative destruction. Identifying a Kuhnian anomaly in a case of creative destruction in the 'new economy', we analyze a case study of the Chinese e-hailing firm DiDi Chuxing to show that this firm used a strategy we term 'creative appropriation', whereby a new firm utilizes incumbent firms' complementary assets but without cooperating with the incumbent, to disrupt a market. This exploitation of complementary assets is based on recombining prevailing technological infrastructure(s) as well as flexible business models that facilitate open innovation. Employing documentary analysis, participant-observation, face-to-face interviews with informants, and a quantitative survey, the study finds that DiDi deployed its e-hailing app to disrupt the taxi market in Xi'an, China (as it did elsewhere in China) as a means of creative destruction, appropriating human-resource-based complementary assets (social and personal reputations, tacit knowledge, and connections) of taxi companies in Xi'an, first to dominate e-hailing in the taxi industry and then to destroy that industry by shifting its focus to private cars.

1. Introduction

Over the last half century, and especially over the two most recent decades, 'creative destruction' has been a key buzzword in business circles (cf. McKnight and Katz, 2002; Abernathy and Clark, 1985), not least among so-called 'new-economy' firms. We are presently witnessing the emergence of such new-economy firms, which are widely defined by innovation studies scholars (cf. Black and Lynch, 2004; Cooke, 2001) as firms competing in, and heavily reliant on, advanced artificial intelligence (AI), knowledge, and huge capital investments. Against the backdrop of the emergence of advanced technologies new-economy firms are also defined by economists (cf. Bertani et al., 2020, Shapiro et al., 1998, and Arthur, 1994) as competing in a business environment featuring increasing (positive) marginal returns, the emergence of standards, and winner-take-all markets.¹

In this paper we take, as our point of departure, Schumpeter's classical concept of creative destruction. Our approach, however,

involves modifying the concept through an in-depth case study that supports a thorough analytical investigation of its relevance in the new economy. We adopt Thomas Kuhn's seminal study, *The Structure of Scientific Revolutions* (Kuhn, 1966), to broadly frame our investigation. Specifically, we identify an 'anomaly' in the Kuhnian sense, a case to which the concept of creative destruction does not neatly apply. Towards that end, we introduce a closely associated concept—one that better reflects how new-economy firms in particular operate—which we label 'creative appropriation'. This concept describes a situation where a new firm takes advantage of incumbent firms' complementary assets to establish a solid market position, leading ultimately to the destruction of incumbents. We explain the concept's utility and show how creative appropriation can be used strategically by newly established new-economy firms to 'appropriate' complementary assets held by incumbent firms without actually cooperating with the incumbents. As this process of appropriation continues, we expect to see, ultimately, the effective destruction of many incumbent firms.

* Corresponding author.

E-mail addresses: xinglz@connect.hku.hk (J.L. Xing), sosn@ust.hk (N. Sharif).

¹ We thank an anonymous referee for this description of the new economy. To be sure, the idea of drawing a stark binary distinction between the new economy and the old economy has been heavily criticized (cf. Cooke, 2001) and many believe this distinction was proved inaccurate by the dot-com bubble. Moreover, many scholars (cf. Agrawal et al., 2018; Gordon, 2000) have also pointed out that the new economy is not necessarily new in terms of its applicability to existing economic fundamentals such as productivity and business cycles. Here, our intention is not to take sides in this debate regarding the newness of the new economy. We use the term 'new economy' simply to draw attention to the fact that emerging firms in the service sector rely heavily on technological innovation, knowledge, and flexible labor control.

Table 1
Profiting from Innovation: Invention and Commercialization Activities.

1. Invention	<ul style="list-style-type: none"> – Scanning the environment (Tidd and Bessant, 2013) – Generating ideas (Graves, 1989; Mowery and Rosenberg, 1979) – Conducting basic research (Godin, 2006) – Conducting applied research and development (Godin, 2006; Graves, 1989; Mowery and Rosenberg, 1979) – Recombining existing technologies, open innovation (Laursen and Salter, 2006; Chesbrough, 2003) <p>→ <i>Invention activities lead to discontinuities</i></p>
2. Commercialization	<ul style="list-style-type: none"> – Producing products or services (Tidd and Bessant, 2013; Godin, 2006) – Diffusing products or services (Tidd and Bessant, 2013; Godin, 2006) – Marketing (Graves, 1989) – Learning to address the needs of markets and society (Tidd and Bessant, 2013; Graves, 1989; Mowery and Rosenberg, 1979) <p>→ <i>Commercialization activities lead to revolutions</i></p>

To establish the empirical foundations of our conceptual contribution, we utilize the ‘anomalous’ example of e-hailing as our case. E-hailing enables a real-time, mobile-internet-supported, and algorithmic-controlled rideshare business (Sharif and Xing, 2019). As a poster child example of the new economy, e-hailing has received widespread attention in the innovation literature (cf. Schneider, 2017; Cramer and Krueger, 2016; Amey et al., 2011). While the rise of e-hailing companies such as Uber and Lyft have been studied extensively (cf. Glöss et al., 2016), our narrower purpose is to use the developmental trajectory of a Chinese e-hailing company, DiDi Chuxing (hereinafter ‘DiDi’), as a case to inform our effort to modify the creative destruction concept—by introducing our concept of creative appropriation.

By identifying a Kuhnian anomaly that cannot be neatly integrated into the received Schumpeterian model, this paper makes two important contributions to innovation studies. First, in introducing the new concept of creative appropriation, we further enrich the conceptual spectrum associated with the classical concept of creative destruction. This is important because our concept of creative appropriation adds another dimension to the scholarly literature to better inform our understanding of the possible outcomes of competition between new and incumbent firms. Second, this study modifies our existing understanding to explain the innovation process as it is conducted by an increasing number of new-economy firms. New-economy firms can take advantage of certain complementary assets owned by incumbent firms without actually cooperating with the incumbents—a process through which they can spread their innovation and destroy those incumbent firms. This exploitation of complementary assets owned by incumbent firms is based on recombining prevailing technological infrastructure (s)—such as smartphones, mobile internet access, global positioning systems (GPSs), order-matching algorithms, and digital payment systems—as well as flexible business models that facilitate open innovation (Laursen and Salter, 2006; Chesbrough, 2003).

This paper is structured as follows: First, we investigate the concept of creative destruction by analyzing relevant studies in the extant literature and ideas associated with the concept. Second, we present the DiDi case to show how it calls for modifying the concept of creative destruction. Third, based on the DiDi case, we discuss empirical and theoretical applications of creative appropriation in the transition from theory to practice. Finally, we offer concluding remarks that reflect on our study's implications.

2. Analyzing the concept of creative destruction

2.1. Joseph A. Schumpeter and the original concept of creative destruction

The concept of creative destruction—long a centerpiece in innovation studies—was originally introduced by Joseph Alois Schumpeter (1883–1950), widely considered the father of the field of innovation studies. Schumpeter introduced the concept in his book, *Socialism, Capitalism and Democracy* (Schumpeter, 1994 [1942]), which was written against the backdrop of the severe turmoil of World War II, accompanied by the rise of socialism and Keynesianism. In this milieu,

the very foundations of the capitalist sociopolitical system were being seriously questioned.

Reflecting his concern over the capitalist sociopolitical system, Schumpeter introduced the concept of creative destruction to describe the economic process that encapsulates a capitalist economy: a process that he characterized as “perennial gale[s] of creative destruction” (1994 [1942]: 84). Schumpeter wrote: “The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation . . . that incessantly revolutionizes the economic structure *from within*, incessantly **destroying** the old one, incessantly **creating** a new one. This process of **creative destruction** is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has to live in” (Schumpeter, 1994 [1942]: 83; italics in original; bold emphasis added).

Although Schumpeter introduced the concept, he did not develop a fully fledged, formalized theory of the idea; rather, it remained descriptive. To be fair, Schumpeter's perspectives on creative destruction were never intended to guide micro- or firm-level competitive strategies. For this reason—particularly at the firm level—the concept of creative destruction remains open to multiple as well as flexible empirical interpretations (cf. Schneider, 2017).

2.2. Profiting from innovation: invention and commercialization

To simplify our discussion of the process of innovation, we follow Teece's (1986) and Gans and Stern's (2003) discussions of profiting from innovation, and divide the processes through which innovative activities are carried out into ‘invention’ and ‘commercialization’, as summarized in Table 1.²

‘Invention’ involves formulating an idea and designing and creating the corresponding product, process, business model, source of supply, or industrial organization (Tidd and Bessant, 2013; Godin, 2006; Rothwell, 1994; Graves, 1989; Mowery and Rosenberg, 1979). Such activities include, but are not limited to, idea generation, research and development (R&D), and recombination of existing technologies.³ As a simple illustration, consider that, in the development of smartphones,

² More recently, Tidd and Bessant (2013: 59) proposed a general processual model of innovation which moves beyond the simple ‘invention’/‘commercialization’ dichotomy. That model includes four steps—a. searching (which involves ‘scanning the environment’ and finding ‘threats and opportunities for change’), b. selecting (which involves identifying threats and opportunities that require a response), c. implementing (which involves ‘translating the trigger idea into something new and launching’ it in the market), and d. capturing value from the innovation (which involves spreading and sustaining the change innovation, realizing financial returns and social value).

³ It is important to note that technologies utilized in the invention process are not necessarily, nor always, created or ‘invented’ by the firm that conducts the invention process; any firm can recombine pre-existing technologies to create a discontinuity. That said, Cozzolino et al. (2018) argue that disruptive *business models* (which recombine discontinuous technologies) usually emerge after a passage of time following the emergence of the discontinuous technologies.

'invention' comprised activities related to identifying market demand for each new smartphone, investing in R&D to design and manufacture new smartphones, and ultimately completing prototypes. The outcomes of the 'invention' process are *discontinuities*. Discontinuities include, for example, new products, new processes, new sources of input, new markets, and new ways of organizing a firm (Schumpeter, 1949 [1911]: 66). In our simple illustration, an actual new smartphone is a discontinuity.

'Commercialization' involves sustaining and spreading a discontinuity, ultimately achieving a revolution in the market. Continuing with the smartphone example, 'commercialization' involves manufacturing a new device, marketing it, and selling it through various distribution channels to attain a significant share of the mobile phone market. Revolutions are characterized by, for example, new products that obtain significant market share, new processes that are successfully applied to regular production processes, new sources of input that are successfully maintained, new markets that become stable sources of revenue, and new ways of organizing a firm that are successfully put in operation. In the smartphone example, the revolution occurs when the new smartphone successfully wins an overwhelming share of the consumer market for conventional mobile phones.

The split between 'invention' and 'commercialization' is significant (even if such a split may not be entirely clean in practice) insofar as it makes the analytical application of the concept of creative destruction possible.⁴ To be sure, creative destruction is not only a means of creating something new, it is also a means of sustaining and spreading a discontinuity in the market so that it can radically alter the behavior of affected firms and enhance or degrade their market positions (Dodgson and Gann, 2018; Dodgson, 2011). For this reason, it is crucial to understand whether a firm that succeeds in the 'invention' phase can adopt effective strategies to succeed in 'commercialization', thereby demonstrating its ability to complete the process of creative destruction.

2.3. Creative destruction at the firm level

Based on the above discussion of innovative activities in firms, we can sharpen our analytical focus by discussing how innovation studies scholars have enhanced and enriched the original concept of creative destruction, especially when applied at the firm level.

To facilitate this discussion, we split the analysis according to whether an incumbent firm (see Fig. 1a) or a new firm (see Fig. 1b) introduces a discontinuity which initiates the process of creative destruction. To be sure, the introduction of a discontinuity does not necessarily (or typically) equate to the creation of the corresponding technologies. In many cases, the constituent components that comprise the underlying technological infrastructure of the discontinuity come from neither the new firm nor the incumbent firm. The new firm or the incumbent firm simply adopts or recombines existing technologies to introduce a discontinuity.

Kivimaa and Kern (2016), Anderson and Tushman (1990), and Tushman and Anderson (1986) conceptualize an event in which an incumbent firm introduces a discontinuity as a 'competence-enhancing discontinuity'.⁵ A competence-enhancing discontinuity is based on an

⁴ Similar conceptual splits are frequently employed by other scholars. For example, Pavitt (1998) and Tripsas (1997) have emphasized that it is important to distinguish between technological and non-technological value-chain activities in technological firms, without which it would be difficult and confusing to study their operations and strategies related to innovation.

⁵ Bergeck et al. (2013) pointed out that even if a discontinuity comes from an incumbent firm, the incumbent firm has not necessarily acquired a new competence; it still needs to struggle at the strategic and management level to respond to the discontinuity. Therefore, the term 'competence-enhancing discontinuity' here is primarily a label indicating that the source of this discontinuity is the incumbent firm.

incumbent firm's existing knowledge and competencies, and aims to enhance that firm's competence. To manage the potential effects of discontinuities that originate within the incumbent firm itself, it must balance its efforts in two commercialization areas. First, firms need to create and spread such discontinuities as they move "into areas unrelated, or marginally related, to the organization's current domain of competences" (Lassen and Nielsen, 2009: 185, quoting Stopford and Baden-Fuller, 1994). Bergeck et al. (2013: 1210) classify such an effort as "creative accumulation." Second, as argued by Trott (2005), Hitt et al. (2002), and Kirznerian (1982), firms need to further exploit and facilitate their existing competitive advantages in the marketplace, a process which they label "controlled adaptation" (Lassen and Nielsen, 2009: 185, quoting Stopford and Baden-Fuller, 1994).

Additional complexity arises when a new firm generates a discontinuity. Considering the perspective of an incumbent firm, Kivimaa and Kern (2016), Anderson and Tushman (1990), and Abernathy and Clark (1985) have termed such an event a 'competence-destroying discontinuity'.⁶

The result of a competence-destroying discontinuity (from the new firm's perspective) depends on the nature and type of commercialization activities (related to complementary assets) that are involved. Complementary assets comprise activities and resources that can sustain or successfully promote the commercialization of a discontinuity (Teece, 1986). If a new firm spreads a disruptive innovation across a market by leveraging complementary assets—examples of which include human resources or activities such as quality control, marketing and promotion, customer service, and after-sales follow-up and service—then destruction is achieved. On the other hand, if the new firm is unable to spread the disruptive innovation across the market independently, it can cooperate—or, to use Teece's term (1986: 290), form a "contractual relationship"—with incumbent firms that possess more such resources, effectively making the disruptive innovation a win-win situation for both incumbent firms and the new firm (Rothaermel and Hill, 2005; Rothaermel, 2001a, 2001b). Rothaermel termed such a result "creative cooperation."

According to Teece (1986), complementary assets can be either generic, specialized, or co-specialized. When complementary assets are generic, they are "general purpose assets which do not need to be tailored to the innovation in question" (Teece, 1986: 289) and can be easily obtained or accessed by a new firm. In such a situation, the new firm will be able to independently conduct commercialization activities and thereby defeat an incumbent firm. If, however, the complementary assets are specialized or co-specialized and are owned or controlled by the incumbent firm, those assets cannot be easily obtained or accessed by the new firm. In this case, the new firm will need to cooperate with the incumbent firm to conduct commercialization activities—making creative cooperation more likely to occur.⁷

⁶ To be sure, so-called 'competence-enhancing' and 'competence-destroying' discontinuities were proposed originally by Tushman and Anderson (1986) to address the effects of discontinuities on the business environment at the industry level. Nevertheless, as Tushman and Anderson (1986) have also pointed out, the effects of competence-enhancing and competence-destroying discontinuities are ultimately about *firms* in an industry. Therefore, for our purposes here, we use the two terms to address the competitive situation at the firm level (with the caveat that our case-study firm—DiDi—is far and away the dominant player in its industry).

⁷ In introducing the term "market for ideas", Gans and Stern (2003: 333) offered a more sophisticated discussion of the impact of complementary assets. They find that, if a new firm can unequivocally preclude an incumbent firm from imitating or developing a discontinuity, and if the complementary assets are generic, then the new firm can be better off by competing in the "product market", that is, independently conducting commercialization activities, thereby achieving creative destruction. If, however, the complementary assets are specialized or co-specialized and controlled by the incumbent firm, then it is more favorable for the new firm to compete in the "market for ideas." In that case, the new firm should cooperate with the incumbent firm.

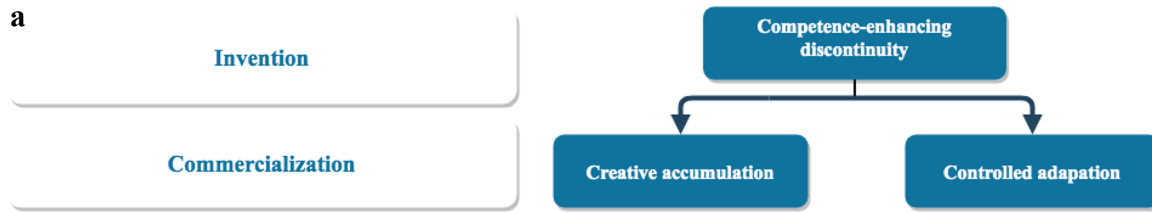


Fig. 1a. Mapping Creative Destruction When Initiated by the Incumbent Firm

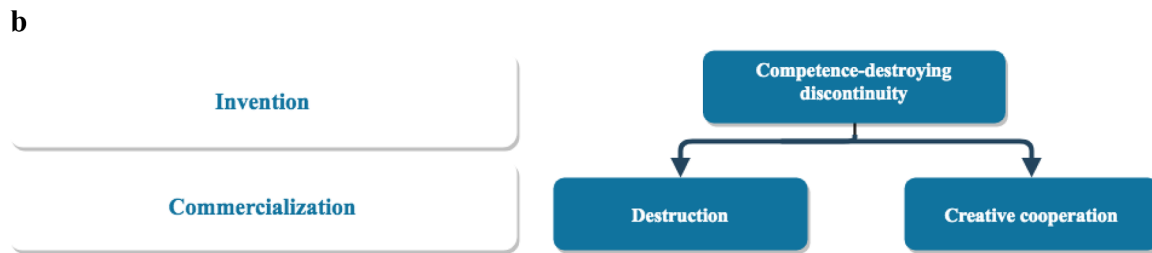


Fig. 1b. Mapping Creative Destruction When Initiated by a New Firm.

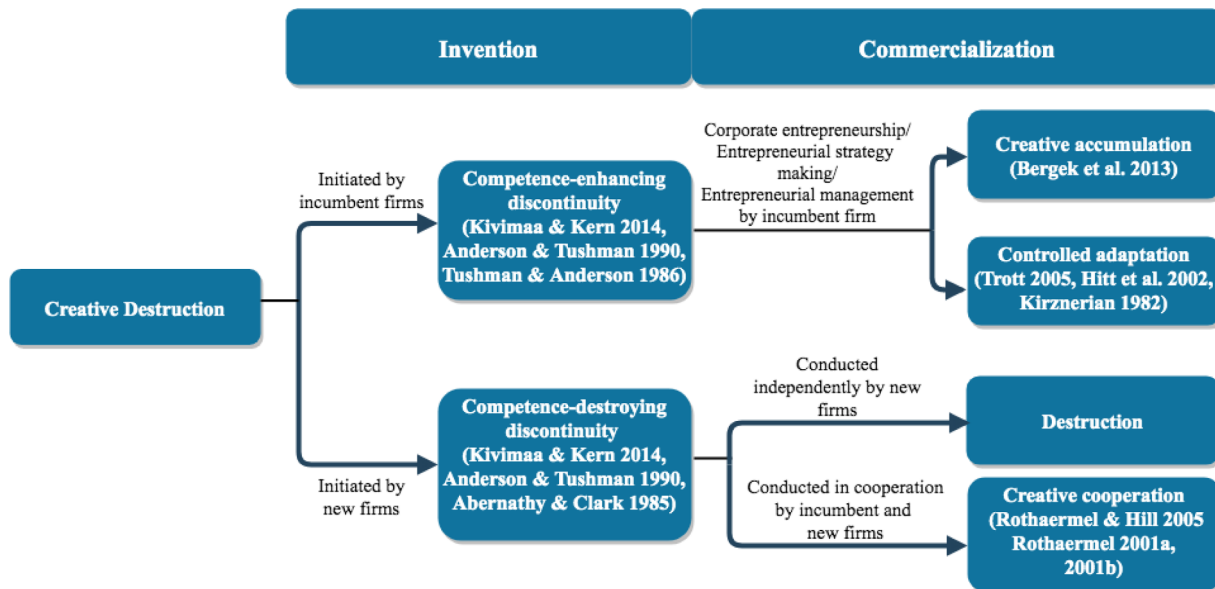


Fig. 2. Relationships Between Creative Destruction and Associated Concepts.

The concepts and categorizations discussed in this section are summarized diagrammatically in Fig. 2.

3. Didi case study

Using the case of DiDi—the largest e-hailing company in Xi'an (and China), which was founded in Beijing in 2012—we show how it appropriated complementary assets of taxi companies to achieve its influential market position and revolutionize the conventional taxi industry in China. In Kuhnian terms, DiDi's act of appropriation represents an anomaly that does not perfectly instantiate Schumpeter's original concept of creative destruction insofar as that and associated concepts are unable to adequately account for the nature of DiDi's ascent. As such, this case offers an opportunity to understand and resolve the anomaly (Carlile and Christensen, 2005: 9) as well as to enrich Schumpeter's original concept.

Even though concepts such as creative destruction, competence-

destroying discontinuities, and others we have mentioned focus largely on changes at the industry level, for the purposes of our firm-level case they remain applicable. Market data from multiple sources confirm the representativeness of DiDi's case for discussing industry-level changes in the taxi and e-hailing industry. From 2014 through 2015, DiDi's market share (plus that of DiDi's former competitor, Kuaidi, which DiDi acquired in 2015) was 97% (Bigdata Research, 2014). In 2017, DiDi's penetration rate (defined as the number of active users of DiDi's service divided by the number of active smartphone users) in China reached 58.6%, and the total number of users reached 450 million. Given DiDi's dominant position in the e-hailing industry, and its large user base as compared with the entire user base of the conventional taxi industry (inferred by China's total urban population in 2017 of 810 million (National Bureau of Statistics, 2018)), DiDi's operations can largely be considered reflective of the e-hailing industry in China.

Our case study of DiDi's rise focuses on one particular city in China—Xi'an—which in 2018 had a population of 9.5 million and is the

capital of Shaanxi Province.⁸ We chose to conduct an in-depth case study in a single city because the strategies undertaken by DiDi to enter and operate in the Xi'an market are almost identical to the strategies the firm applied to enter parallel markets in other large Chinese cities.⁹ This makes our single-city, in-depth case study representative of the industry as a whole, illustrating the issues we raise and highlight. In terms of our methodology, we adopted several methods to help us understand DiDi's rise. These included documentary analysis, participant-observation, face-to-face interviews, and a quantitative survey. Full details can be found in the Methodological Appendix.

3.1. Institutional setting and decline of the taxi industry in xi'an

The conventional government-controlled taxi industry in Xi'an is operated with the participation of the Taxi Administration Office (TAO), taxi companies, taxi owners, and employed drivers (in that hierarchical order). The TAO regulates fares while also controlling and delivering taxi licenses to the market. Since 1998, the number of taxis in Xi'an has been regulated by the government and all taxis are required to be registered with and managed by taxi companies. Currently, there are altogether 64 taxi companies in Xi'an registered under the TAO, operating 13,000 taxis.¹⁰ The larger companies manage hundreds of taxis, mid-sized operators manage dozens of taxis, and small companies manage only a few taxis.¹¹

Taxi owners drive 10-hour shifts by themselves and employ second drivers to drive additional 10-hour shifts. A day shift runs from 6:00 a.m. to 4:00 p.m., while a night shift lasts from 4:00 p.m. to 2:00 a.m. (on the following day). Per shift, taxi drivers typically drive between 40 and 60 passengers. Shift start and end times are rigid, and the associated inflexibility is usually experienced as a burden by taxi drivers as they juggle work with non-work commitments. Most taxi drivers are middle-aged males, and they complained about "being unable to carve out time to send or pick up my kid from school" or "accompany my wife" (Taxi-driver informant, interviewed on 20 June 2017, in Xi'an).

After a second driver drives a 10-hour shift, he or she must pay a fixed amount of money to the taxi owner (as rent), colloquially known as the '*fenzhiqian*' (literately translated as 'share money'). The remainder of the earnings (minus fuel costs) represents the full earnings for the shift. Note that the *fenzhiqian* is a pre-determined fixed sum that a driver needs to pay a taxi owner (in turn, taxi owners have to pay fixed monthly fees to taxi companies). Typically, the *fenzhiqian* is paid on a daily basis (at the end of a driver's shift), regardless of how much or how little business the driver has actually conducted, and indeed regardless of any other factor. It is an unwieldy and strict imposition to which all must adhere. Multiple informants characterized this

⁸ Located in northwestern China, Xi'an is a major provincial capital city. Insofar as Xi'an is a large city (with 2017 GDP of RMB 747 billion (Xi'an Statistics Bureau, 2018)), with limited national influence but strong regional influence, Xi'an is a suitable representative of the average large Chinese city.

⁹ To be sure, China's case is unique not least because of extraordinary countrywide receptivity to and diffusion of digital technologies. Consider one critical example of digital technologies—smartphones. The total numbers of smartphones shipped to Chinese domestic users were 520 million, 560 million, and 490 million, respectively, in 2015, 2016, and 2017 (CAICT, 2018). A second critical component of digital technologies is mobile internet access: as of 2018, China had close to 1.11 billion 4G users and a 4G penetration rate that ranked among the top five in the world (Internet Society of China, 2018). Digital payment systems—a third example of digital technology—shows similar levels of receptivity and diffusion in China: Wang (2018) shows that, in 2017, China-wide trade volume using digital payments totalled RMB 108 trillion (or USD 16 trillion).

¹⁰ This number has been capped since 2016.

¹¹ The three largest taxi companies in Xi'an are Xi'an No. 2 Taxi Company, Xi'an No. 3 Taxi Company, and Xunda Taxi Company. Combined, they own approximately 2,000 taxis, while the 61 other market players own the remaining 11,000 taxis (Qiyue Xinxi, 2018).

arrangement as, in effect, "subcontracting and exploitation." In 2018, the *fenzhiqian* in Xi'an was RMB 160 per shift.

Newcomers seeking to become taxi drivers must undergo two weeks of training, after which they are required to sit for a code-of-conduct examination. Afterwards, they need to find taxi owners. Because taxi owners typically choose taxi drivers with whom they are familiar, finding taxi owners can be very difficult for newcomers. One new taxi driver with just two years of experience reported:

Two years ago, it was hard to find a taxi owner who was willing to hire me because I had no history or reputation as a taxi driver. The only way I got the job was by first working as a stand-in driver for other established drivers when they had emergencies. It was only after a year that I got the position on a permanent basis.

(Taxi-driver informant, interviewed on 20 June 2017, in Xi'an)

That the taxi industry is government-controlled and characterized by an obdurate certification process means that taxi drivers possess a strong social reputation as professional urban transport service providers. Taxi drivers are known to be masterfully knowledgeable about the urban environment, so as to follow the flow of people, goods, work, business, and information in the city. On the one hand, as a taxi driver informant disclosed, drivers need to imagine the macro structure of the city and the positions of people, objects, landscapes, and themselves on the map:

You memorize the city's major streets: Xi'an's city structure is tidy. In the North Suburb, from south to north, it's Fengcheng No. 1, No. 2, No. 3, No. 4, all the way to No. 12; in South Suburb, from far out to the center to closer in, it's Erhuan, Youyi, Huancheng, East-West Avenue, Lianhu, Dongxin; from Eastern to Western Suburb, it's Taiyi, Yanta, Wenyi, Chang'an, Zhuque, Hanguang, Taibai . . ."

(Taxi-driver informant, interviewed on 18 June 2017, in Xi'an)

On the other hand, drivers need to know the everyday lived details of the city as well as the dynamic and opportunistic situations that arise or disappear in and around the cityscape daily. This includes, for example, places where passengers usually gather, detailed operation of traffic lights (timings), one-way roads, junction-turning cycles, the positions of temporary and permanent surveillance cameras (speed cameras as well as traffic light cameras), temporary road work, places that traffic police frequent, little shortcuts (through alleyways) in the city, and the constant changes in all of these factors over time.¹²

3.2. Initiating appropriation: DiDi's lure

When it was established, DiDi positioned itself as a service which utilized the technological discontinuity of e-hailing to help match orders between taxi drivers and passengers, enabling passengers to hail taxis in advance, or in real time. In the initial stages of its founding, DiDi did not charge passengers extra for its hailing service except when they voluntarily agreed to add tips as a top-up to the taxi fare.

DiDi sent promotional teams to all major Chinese cities, including Xi'an, targeting locations where taxi drivers traditionally gathered, including gas stations and restaurants. There, the DiDi employees preached (or 'sold') the advantages of the DiDi app, taught taxi drivers how to install and use the app, and demonstrated to them how to use digital payment tools such as WeChat Pay to collect fares. As an incentive, these promotional staff paid taxi drivers—also through WeChat Pay—RMB 10–20 for installing or using the app for the first time. The incentive payment for taxi drivers who shared the link with other drivers or passengers was RMB 20. One taxi-driver informant commented:

There used to be promotional people here in the Hongguang Road

¹² Combined, the certification process as well as the tacit knowledge possessed by taxi drivers make them more like the famous London Black Cab drivers who need to pass a test known as "The Knowledge" (Skok and Tissot, 2003).

gas station and other stations. When we refueled our cars, they would approach us and talk about their products, saying that this was free, and that it could help you get more passengers especially if your taxi was idle. Then they asked you if you had a smartphone and helped you download the DiDi app. Further, they told us that we could receive RMB 20 to install their app, and when we used it for the first time, we could get an additional RMB 10. For drivers like me who previously never used WeChat pay or Alipay, they even taught us how to use these digital payment methods, showing us that they are no different from bank accounts! Afterwards, I found out that if we asked other drivers or passengers to install the app and shared the link with them, we could get an additional RMB 20, so I started to share every day with colleagues!

(Taxi-driver informant, interviewed on 21 June 2017, in Xi'an)

These DiDi promotional staff even paid commissions to gas station and restaurant staff to facilitate their promotional activities. Our gas station and restaurant operator informants broadly echoed the above informant's view regarding the use of commissions as incentive payments. The owner of Sichuan Paradise Restaurant near Hongguang Road in Xi'an described how the wall inside his restaurant was, "filled with DiDi posters":

Some DiDi promotion teams visited me and asked me whether three to four of their people could promote their app to patrons of my restaurant. At first, I refused outright—I needed to serve my customers! But they said that the promotion team members would eat in my restaurant and would pay me RMB 500 for just allowing them to stay in my restaurant for a week. I agreed. The promotional team staff wandered in and out to talk with drivers and taught them how to use the app. Two weeks later, they left, and asked me to stick several posters on my wall for an additional RMB 200.

(Restaurant owner informant, interviewed on 27 June 2017, in Xi'an)

DiDi even approached local incumbent taxi companies, seeking their help in promoting their app. Its teams typically asked taxi company staff to promote the app during the regular monthly briefings the companies held with drivers and taxi owners. By offering money to individual taxi company staff, DiDi incentivized those individuals to help DiDi achieve its promotional goals. To attract smaller taxi companies, DiDi offered small sponsorship fees. These companies willfully acquiesced to DiDi's requests. As one staff member of Shaanxi No. 2 Taxi Company (a mid-sized operator) described it:

Not long ago, DiDi's promotional team approached me. They asked me to help promote their app during our monthly meetings with the drivers of the taxi fleet I am in charge of, for RMB 300. I agreed because I thought it could help my drivers get passengers. I did not think about the potential long-term threat of this to the taxi industry.

(Taxi company staff informant, interviewed on 20 January 2018, in Xi'an)

Sometimes, the promotional teams offered even more compelling rewards, such as smartphones (Chen, 2018). Through the combined effects of these aggressive promotional activities, DiDi achieved a high degree of popularity and penetration among taxi drivers. By early 2014, DiDi had spread its business to over 35 major Chinese cities and to over 10 million taxi drivers and passengers (Sanjjeke, 2016). The majority of our Xi'an-based taxi-driver informants reported that they made between RMB 50 and 60 above their usual daily income simply by using the DiDi app and promoting it to others. This income was not part of their *fenziqian*, it was not shared, and it was a welcome injection of revenue all of which went into the pockets of the taxi drivers.

3.3. Price competition to appropriate taxi drivers

In the first few years following its launch, DiDi had to contend with a

major challenger in the e-hailing industry in China. Another start-up, Kuaidi, was in the frame to challenge DiDi. By March 2014, DiDi and Kuaidi had a foothold on more than 97% of the Chinese e-hailing market (Bigdata Research, 2014). The competition between the two firms to win over taxi drivers and passengers was fierce. In the same year, a price war began between the two firms as they both poured vast sums of money into various schemes to lure taxi drivers to use their apps.

In early January 2014, Kuaidi kicked off the price war by offering RMB 15 per day to taxi drivers who used Kuaidi's app at least once during the day. DiDi immediately followed suit. By late January 2014, identical schemes from both companies had spread to more Chinese cities and the subsidy amount offered by both companies had risen to RMB 20. In early February 2014, Kuaidi began offering RMB 10 for each ride that a taxi driver arranged through its app, with a maximum daily reward of RMB 100 (for 10 rides in a day). Again, DiDi immediately followed suit. Just a few days later, this subsidy was ratcheted up by both companies to RMB 15 or RMB 20 per ride. Soon thereafter, the upper limit was raised from covering a maximum of 10 rides per day to a ceiling of 20 rides per day. By end-February, both companies offered RMB 20 to taxi drivers who could arrange more than 15 rides per day through their apps. This amount rose to RMB 30 a few days later, and a few weeks later yet further, to RMB 50.

During the five months that ran from January 2014 through May 2014, the subsidy war offered a huge boon to taxi drivers. In Xi'an, for example, our taxi-driver informants who regularly used either or both of the DiDi and Kuaidi apps reported making an extra RMB 100 per day. Based on their average monthly income of RMB 4000–5000, this helped these taxi drivers earn an additional 50% in income during those months. Times were good for taxi drivers in Xi'an (and likewise in other large Chinese cities).

Passengers were also complicit in the price war: first-time passenger users helped the introducing driver earn an extra RMB 20 for introducing the app to the passenger; moreover, passengers who shared the app with fellow passengers also received a monetary reward of RMB 15.

Correspondingly, the price war contributed significantly to the increase in market share claimed by, the reputation of, and user dependence on, taxi e-hailing—irrespective of the company concerned. By the second half of 2014, there were over 100 million users of both apps across China (Diyi Caijing, 2014). Moreover, the price war attracted the attention of millions of citizens as media coverage surrounding the war spread. This was the period during which having one or both of the apps on taxi drivers' smartphones was cemented. Among our 80 taxi-driver informants claiming that they had used the DiDi or Kuaidi app intensively during the price war, 50 said that more than three-quarters of the daily rides they completed at that time were received through one of the two apps.

3.4. Appropriation leading to revolution

The 2014 price war did not last long, not least because of the huge amounts of capital that DiDi and Kuaidi burned through during the process (Diyi Caijing, 2014). The war was brought to an end as Kuaidi and its investors decided to join DiDi in February 2015 to create a giant monopoly in the Chinese taxi e-hailing market. This merger did not, however, signal the end of the challenges DiDi faced. A few months prior, in August 2014, the international e-hailing pioneer, Uber, had entered the Chinese market.¹³ Unlike DiDi, however, Uber began its

¹³ One of the many reasons why—and this applies more to other industries—non-Chinese (technology) companies find it difficult to compete in China is that Chinese authorities, for strategic reasons, support local firms to enable them to dominate the Chinese market (cf. Huang and Sharif, 2016). In these instances, government regulations play a key role in providing domestic companies the space, time and favourable conditions needed to allow them to flourish.

business operations by trying to co-opt *private-car* drivers rather than taxi drivers to provide transport services to passengers—the latter group being the sole and exclusive focus of both DiDi and Kuaidi.

When Uber entered the Chinese market there was no local e-hailing provider based on mobilizing non-licensed private-car drivers. Inspired in part by Uber and in part in response to the competitive pressures Uber was exerting, DiDi launched its '*Kuaiche*' service (literally translated as 'fast car') in May 2015. This service enabled private-car drivers to engage in the e-hailing business and it was an attractive arrangement for those drivers because it allowed their cars to be better utilized while providing them with a side income.

The introduction of *Kuaiche* shifted DiDi's focus from taxis to private-car-based e-hailing. Beginning in mid-2015, DiDi gradually stopped subsidizing taxi drivers and taxi passengers and significantly reduced the frequency with which they improved the taxi function on their app. Instead, following the launch of *Kuaiche*, DiDi frequently improved the functionality of the *Kuaiche* portion of the app.

There was, however, one more price war to be fought. This time the price war played out against Uber (not Kuaidi) and it centered on private-car drivers (not taxi drivers). The schemes were largely similar to those initiated during the price war waged between DiDi and Kuaidi in 2014. During this new price war, private-car drivers who drove for eight hours a day saw their average daily incomes double or triple (as compared with what had been the case at the beginning of the price war). These levels of income attracted countless private-car drivers to join the business.

With the complete shift in focus to private-car drivers, taxi drivers were left in the lurch. The number of private-car e-hailing drivers increased dramatically and the number of passengers choosing to ride in private cars—over taxis—surged. DiDi's total number of rides in 2015 reached 1.43 billion, among which 70% came from its e-hailing private-car business (Sanjiek, 2016). This pivot led to two main outcomes—desertion (by taxi drivers) from the conventional taxi industry and also reduced incomes for those players who remained in that industry.

The first outcome saw thousands of taxi drivers in large Chinese cities including Xi'an quit their jobs when faced with competition from private-car-based e-hailing. According to figures from Sohu Auto (2016) and Jia (2016), around 40%, or 11,000 of the 28,000 contracted taxi drivers in Xi'an, left their businesses from July 2015 to June 2016, while two-thirds, or 7000, became e-hailing private-car drivers with the remaining 4000 leaving the taxi-driving industry altogether. This desertion was reflected in the difficulties faced by taxi owners seeking to hire drivers. All the taxi owners we interviewed intimated that it was so difficult to hire drivers that they had to resort to working longer shifts themselves (13 h a day as compared with 10 h a day) to mitigate the loss involved in being unable to find drivers to drive their taxis' second shifts.

Taxi companies also suffered from the dramatic reduction in available taxi drivers. Staff at Xi'an No. 2 Taxi Company and Xunda Taxi Company (two of the three biggest taxi operators in Xi'an) described how, despite reducing the monthly charges imposed on taxi owners, approximately 15% of taxi owners still terminated their operating contracts with each of the two companies all the same. Mid-sized and small taxi companies faced an approximately 30% shortfall in drivers.

The taxi companies' business volume also dropped. The number of trips completed China-wide, on a daily basis, via DiDi's *Kuaiche* app (i.e. the private-car e-hailing app) reached 20 million by the end of 2016 (Mai, 2017). Given the similarity of private-car e-hailing to conventional taxis as a means of transportation, it is not far-fetched to assume that the majority of these 20 million trips would previously have been completed by taxis.

The second outcome was verified by taxi drivers, taxi owners, and taxi companies that remained in the taxi business, all of whom bore witness to experiencing reduced income. Responding to our quantitative survey, taxi drivers in Xi'an reported their daily gross income

(before deducting *fenziqian*) in late 2015 as approximately RMB 200. This compared with the 2013 figure that was reported as approximately RMB 300 and the 2014 figure that was reported as approximately RMB 340. One particularly hard-hit taxi-driver informant even revealed that his "gross profit per day during April and May 2015 was only RMB 170–190" (Taxi-driver informant, interviewed on 10 Jan 2018, in Xi'an).

Correspondingly, the taxi owners' incomes shrank as they were compelled to reduce the *fenziqian* they charged taxi drivers just to keep drivers on board. In late 2015, the *fenziqian* was reduced to RMB 120–140, compared with the 2013 figure of RMB 170 and the 2014 figure of RMB 180. Higher up the chain, taxi companies too suffered from decreasing incomes. Staff at Xi'an No. 2 Taxi Company (one of the three biggest taxi companies) and Shaanxi No. 2 Taxi Company (a mid-sized operator) described how, in an attempt to retain taxi owners and taxi drivers—and to avoid renegeing on their operating contracts—the companies reduced their fixed monthly charges by between 20% and 30%.

4. Discussion: explicating the process of creative appropriation empirically and theoretically

We now expand on our idea of creative appropriation both empirically and theoretically. Empirically, we show how DiDi engaged in creative appropriation to make its innovation successful. Theoretically, we carefully analyze Schumpeter's original concept of creative destruction and show how our case—and the concept of creative appropriation—enriches and supplements Schumpeter's original concept.

If we recall our earlier discussion of the process of innovation from Section 2.2, we see that DiDi's business model is an example of a competence-destroying discontinuity insofar as it is a major departure from the previous way of conducting the same business anywhere in the industry. DiDi in effect created an invention as one of the earliest new-economy firms to use the pre-existing technological infrastructure, recombine it, and introduce the e-hailing business model and business in China. That is, while DiDi did not invent any of the constituent components of the technological infrastructure that enables e-hailing, such as smartphones, mobile internet access, GPS, order-matching algorithms, or digital payment systems, it invented a new way to deploy them.

In terms of commercialization, however, DiDi neither conducted its non-technological value-chain activities independently (which would have constituted creative destruction) nor cooperated with the incumbent taxi companies (which would have constituted creative cooperation). By encouraging taxi drivers to use its app but then later shifting its business focus away from taxi drivers to private-car drivers, DiDi appropriated the taxi companies' human resources (their drivers) in commercialization activities without actually cooperating with the incumbent taxi companies.

4.1. Mapping creative appropriation empirically

There were two important preconditions for DiDi's success with creative appropriation. First, the complementary assets they appropriated were/are mobile; second, the underlying technological infrastructure that DiDi exploited pre-existed and was widespread, and therefore familiar to most urban residents in China. In terms of the first precondition, the mobile nature of the complementary assets with which commercialization is carried out was decisive insofar as it determined whether or not the incumbent firm would be destroyed by, or would benefit from, creative appropriation.

We conceptualize taxi drivers, who comprise most of a taxi company's human resources, as complementary assets of incumbent taxi companies. We treat them as a complementary asset because we follow Teece's definition of complementary assets wherein "successful commercialization of an innovation requires that the know-how in question

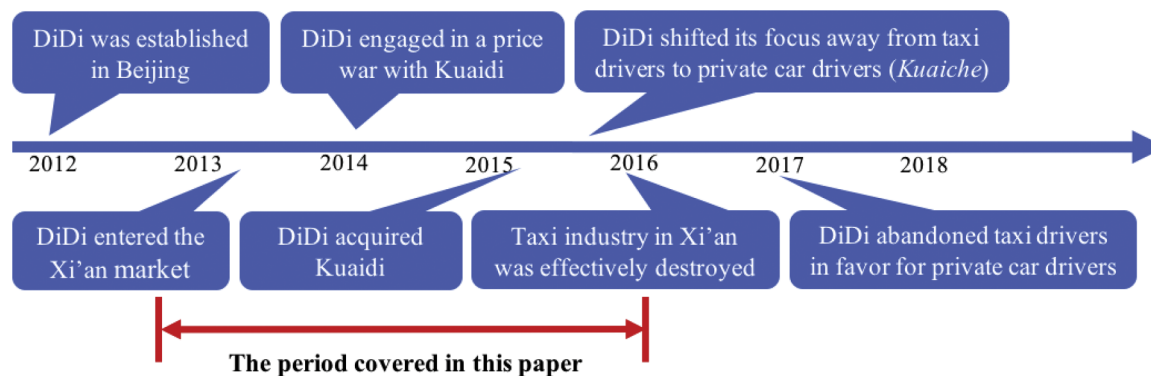


Fig. 3. Period and Events Within the Scope of this Research.

be utilized in conjunction with *other capabilities or assets*” (Teece, 1986: 288; our italics). In our case, the Teecean know-how is DiDi’s act of utilizing and recombining prevailing technologies to create the e-hailing app and corresponding (new) business model. In Cozzolino and Rothaermel’s terms (Cozzolino and Rothaermel, 2018: 3054), the discontinuity created by DiDi is a “core-knowledge” discontinuity. Furthermore, also in accordance with Teece, we classify the human resource-based complementary asset in functional terms: not only do taxi drivers function as workers, employees, and/or business operators, for DiDi they also served as “marketing channels” and “test beds” (Teece, 1986: 288) (i.e. sources of initial social reputation, tacit knowledge, and connections—see the related discussion later in this section), because they promoted the DiDi app to other drivers and passengers.

Although some may argue that taxi drivers as a human resource is *the* central asset in a service industry, or a tangible labor input into the production function, in the period covered by this paper (Fig. 3), taxi drivers’ significance as “market channels” and “test beds” was more important (than their significance as mere labor inputs). DiDi’s ideal goal, especially after shifting its strategic focus to *Kuaiche* (where anyone can drive his/her private car to join the business) is to substitute taxi drivers with lay drivers. Therefore, in the long run (for the period extending beyond that which is under consideration in this paper), DiDi has not considered taxi drivers as labor inputs. This longer-term abandonment of taxi drivers further reinforces our view that drivers were co-opted in the early stages not for their driving ability (which lay drivers also possess), but rather for their ability to act as marketing channels and test beds. In the later stages of DiDi’s business’s development—once taxi drivers had exhausted their function as marketing channels and test beds—DiDi abandoned taxi drivers in favor of lay private-car drivers. In this way, from DiDi’s perspective, taxi drivers are more like complementary assets than mere labor inputs.

Insofar as taxi companies have undertaken long-term operational efforts (such as managing taxi owners and drivers, holding monthly briefing meetings, giving guidance for passenger safety and security, etc.) to establish networks and institutions to assist taxi drivers and allow the drivers to accumulate social reputations, knowledge, and connectivity, taxi drivers constitute a specialized human-resources-based complementary asset. Nevertheless, taxi companies have limited control over the daily operating behavior of taxi owners and especially of taxi drivers. Taxi companies/owners have little control over when and where taxi drivers operate, how they find passengers, how they decide which routes to take in serving their passengers, how they interact with passengers (in manner, tone, or politeness), when and where they take breaks, and sometimes even the rates they charge. In other words, taxi drivers constitute a highly mobile complementary asset, and they can easily take up side vocations. These features make taxi drivers vulnerable to appropriation.

The second important precondition for DiDi’s success is the incorporation of the prevailing technological infrastructure—such as

smartphones, mobile internet access, GPSs, order-matching algorithms, and digital payment systems—into DiDi’s business model. By incorporating this infrastructure into its business model, DiDi was able to appropriate a key complementary asset through five mechanisms.

The most important mechanism was DiDi’s huge capital injections—cold cash as well as gifts-in-kind—to incentivize taxi drivers and others to use their app.¹⁴ The second mechanism was the revenue-sharing business model with immediate payments and highly fragmented rewards that DiDi offered to taxi drivers, enabled by smartphones, mobile internet access, and digital payment systems. This was particularly appealing because it bypassed the onerous, fixed *fenzhiqian* payments that had to be paid regardless of business volume, driving conditions, or profitability. Third, revenue-sharing led to a feeling of equality among taxi drivers whereby they felt part of a business they jointly owned and in which they were engaging, rather than working under the managerial pressures of an outside superordinate to whom they were compelled to pay the oppressive *fenzhiqian*. Fourth, the flexible work schedule facilitated by smartphones and mobile internet access enabled drivers to manage their times more independently and effectively. Fifth, the informal contract structure, whereby drivers were able to bypass taxi owners, including the associated logistical and administrative requirements, was also a facilitating mechanism. Without the associated technological infrastructure, DiDi’s business model would not have been as successful as it proved to be.

Each of these mechanisms—listed in order of their relative importance—is summarized in Table 2.¹⁵

By targeting weaknesses in the taxi industry’s extant business model, DiDi attracted taxi drivers to join its ranks by offering them convenience and a higher volume of business via its app. In this way, DiDi obtained key complementary assets of the incumbent taxi companies *without* cooperating with them. Given that the incumbent taxi companies did not have the technological capacity to imitate DiDi’s deeply information-and-communication-technology (ICT)-based business model, DiDi changed its competitive environment in relation to incumbent taxi companies,¹⁶ thereby facilitating the destruction of incumbent taxi companies and bringing about a revolution in the industry.

Yet, DiDi did not merely appropriate the complementary asset of

¹⁴ These capital injections—amounting to billions in RMB—originated from multiple global investors including Apple, Tencent, Ping An Insurance, Temasek Holdings, Alibaba, China Merchants Bank, Mubadala Development Company, and Softbank Group (to name but a few).

¹⁵ It is important to note that the mechanisms DiDi used to attract taxi drivers does not necessarily imply an effort on DiDi’s part to build an ecosystem to embed drivers and enhance their long-term loyalty. Rather, these measures served the purpose of incentivizing drivers to take the leap towards joining DiDi.

¹⁶ In Gans and Stern’s conceptualization (2003: 341), this change is classified as moving from “idea factories” to “greenfield competition.”

Table 2
Five Mechanisms through which DiDi Appropriated A Key Complementary Asset (Human Resources), Ranked from Highly Important to Minimally Important.

MECHANISM	DESCRIPTION
Cash Incentives	<ul style="list-style-type: none"> – Variety of cash or in-kind benefits to taxi drivers who install, use, or promote the DiDi app – Convenient payment to drivers via digital payment channels
Revenue -Sharing Business Model	<ul style="list-style-type: none"> – Direct and immediate cash stimulation for every trip taken – Drivers and DiDi share the revenue for every trip the driver takes – No fixed <i>fenziqian</i> payment required
Sense of Equality Among ‘Employer’ and ‘Employee’	<ul style="list-style-type: none"> – Eliminates the financial and emotional burdens of the oppressive <i>fenziqian</i> – Revenue-sharing makes drivers and DiDi more like partners than employer/employees – Drivers’ sense of fairness and equality is heightened
Flexible Work Schedules and Patterns	<ul style="list-style-type: none"> – Drivers do not feel subservient to an external body that has unilateral or a high degree of control over them – Autonomous and independently defined working hours (by drivers) – Drivers obtain flexibility in arranging their work and non-work activities
Informal Contracts	<ul style="list-style-type: none"> – Effective use of time is maximized and optimized for each individual driver – No requirement for taxi licenses, taxi drivers’ licenses, etc. – Unnecessary to undergo official procedures with taxi companies – Onerous registration procedures are bypassed

human resources in leveraging a significant advantage in terms of commercialization. By appropriating human resources, DiDi also obtained three subsidiary complementary assets embodied in taxi drivers (subsidiary to the human resources): social reputation, tacit knowledge, and taxi drivers’ connections with passengers.

Social reputation: In large cities such as Xi’an, taxi drivers (as a group) carry with them a certain social reputation. These drivers are known to be regulated by the government at several levels, as we have noted, through a hierarchy comprising taxi owners (at the bottom), taxi companies, and ultimately the TAO (at the top), and each of these layers lends legitimacy to the industry in large urban metropolises such as Xi’an. In appropriating human resources as a complementary asset, DiDi also appropriated their general social reputation as regulated urban transport service providers as well as their individual networks and personal reputations. By aligning itself so closely and so deeply with taxi drivers in the early stages of its business, DiDi was able to position itself—particularly in the minds of passengers—as a legitimate and professional alternative to government-authorized transportation services.

Tacit knowledge: By appropriating human resources as a complementary asset, DiDi also appropriated those drivers’ tacit knowledge, vast reservoir of shared experiences, and skills. This tacit knowledge is difficult to codify and formalize effectively, but is extremely valuable (Polanyi, 1966). In effect, during the process through which DiDi appropriated them, taxi drivers served as “test beds” (Teece, 1986: 288)—falling back on their knowledge to help DiDi improve the functionality of its app. In the early stages (particularly in 2014 and before), DiDi performed many updates of its taxi app, with the frequency of those updates bewildering even the app’s users (up to twice or thrice a week, instantaneously taking driver feedback on board). One taxi-driver informant reported that DiDi’s promotional team members “always asked us about our experiences of using their app, whether the electronic transactions worked smoothly, whether we received the correct amount of subsidies, etc.” (Taxi-driver informant, interviewed on 20 January 2018, in Xi’an). Another remarked that the DiDi app offered channels enabling “us to easily report problems with the app, such as the inability to refuse orders, tardiness in dealing with our passenger disputes, etc.” (Taxi-driver informant, interviewed on 25 January 2018, in Xi’an). By the time the private-car e-hailing function (*Kuaiche*) was launched in 2015, all of DiDi’s apps’ critical functions, including hailing, service star rating, coupons, and subsidies, had been tested by taxi drivers and teething problems had been resolved, bugs eliminated, and the overall quality of the app fine-tuned to perfection—all based on the embedded tacit knowledge of taxi drivers.

Connections: DiDi also appropriated the connectivity that taxi drivers enjoyed with urban citizens (Chen, 2018). Taxi drivers generally engage interactively with their passengers, some very extensively. Some

taxi drivers also interact more intensively with certain groups of passengers—for example, a taxi driver might focus on plying his or her trade in a certain concentrated part of the city or with a certain demographic (i.e. bankers, teachers, etc.). Combined, these connections were appropriated by DiDi, which used taxi drivers to exploit their connections and social capital to disseminate the DiDi app to passengers whom the drivers served. In this way, DiDi came to be portrayed as a soundly ‘referred’—rather than anonymous and untested—means of urban travel. The taxi drivers directly influenced the cultivation of passengers’ habits to adopt DiDi as their first-choice app for e-hailing. This effect was exaggerated further through the media attention that passengers received regarding e-hailing apps during the high-profile subsidy wars that played out between DiDi and Kuaidi and between DiDi and Uber.

These subsidiary assets, although specialized and immobile, are embodied in taxi drivers. Therefore, by appropriating the original human resource asset in taxi drivers, DiDi also folded in the appropriation of the drivers’ subsidiary assets. These subsidiary complementary assets that DiDi also appropriated are summarized in Fig. 4, which also combines the five mechanisms through which DiDi appropriated human resources as the original human-resource-based complementary asset.

After appropriating all of the abovementioned complementary assets—taxi drivers as well as their social and personal reputations, tacit knowledge, and connections (subsidiary complementary assets)—DiDi pivoted orthogonally to focus on *Kuaiche*. In this way, it became a fearsome competitor of taxi drivers, taxi owners, and taxi companies (in contrast to its previous role as a promoter of urban taxi trips). With this change, taxi drivers, taxi owners and taxi companies across the entire industry felt the rug pulled completely out from under their feet as they experienced reduced daily incomes, reduced *fenziqian*, and reduced market share and business volume, respectively. DiDi had thereby in effect achieved the destruction of incumbent taxi companies through its strategy of creative appropriation and, in the process, it revolutionized the taxi industry.

To be sure, conventional taxis are still running in Xi’an. Yet, given DiDi’s significant impact on the industry, as described in this case, DiDi massively shrunk the conventional taxi industry. The positions and behaviors of all firms in the marketplace have been altered, the old equilibria fundamentally displaced, and radically new conditions created. All these point to a ‘revolution’ in the Schumpeterian sense. Within the period covered by this paper (Fig. 3), incumbent taxi companies, unlike the firms addressed in by Cozzolino et al. (2018), have neither the ability to take advantage of the prevailing technological infrastructure nor the capacity to acquire or ally with DiDi so as to take advantage of its disruptive business model. These factors make it difficult for them to quickly adapt to the new competitive landscape.

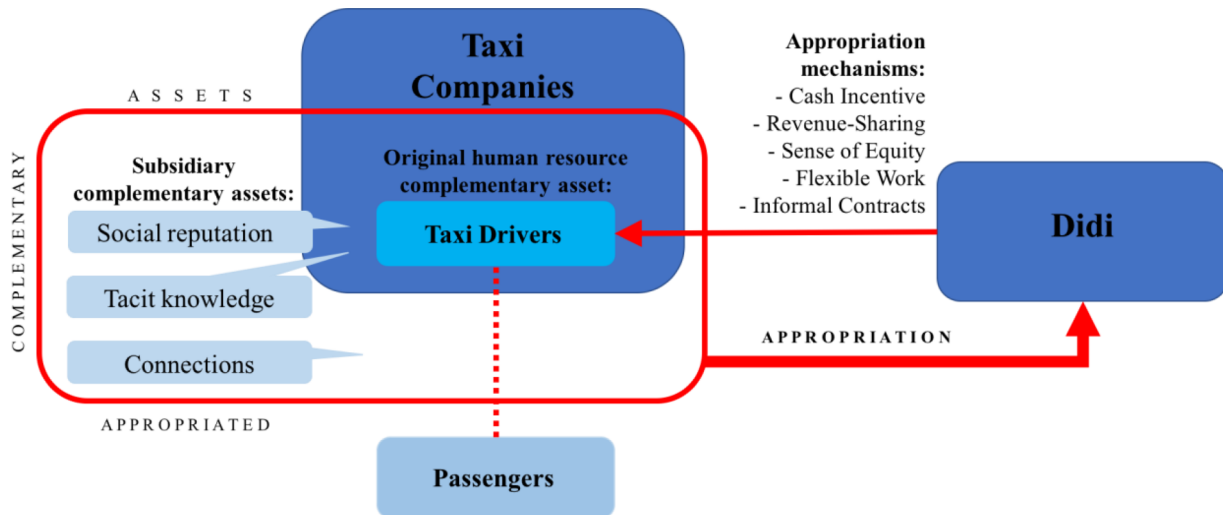


Fig. 4. DiDi's Appropriation of Human Resources and Subsidiary Complementary Asset(s).

4.2. Mapping creative appropriation theoretically

In Section 2.3 we described and mapped creative destruction whether it is initiated by an incumbent firm or by a new firm, and we examined other ideas closely related to the concept. What was missing from that discussion—that we are now able to examine more carefully—is another situation related to competence-destroying discontinuities. Specifically, we ask: how can a new firm engage with an incumbent firm in commercialization activities while a discontinuity it has caused nevertheless achieves destruction? Answering this question takes us along the path to enriching Schumpeter's original concept of creative destruction.

As the DiDi case illustrates, it is indeed possible for a new firm to engage with an incumbent firm in commercialization activities and simultaneously achieve destruction. As our case shows, this is possible even if the complementary assets are specialized or co-specialized and controlled by incumbent firms. So long as the complementary assets are mobile in nature, the new firm can, deploying certain strategies—for example, the five mechanisms we have identified—take advantage of (or appropriate) the complementary assets of incumbent firms without cooperating with them, thereby achieving market dominance and ultimately the effective destruction of the incumbent firm(s). That is, while DiDi engaged with the taxi companies to roll out and establish its app, we do not view this as cooperation because its motives were not transparent to those companies. This revolutionizes the positions and behaviors of all firms in the marketplace.

Such a situation differs fundamentally from all of the earlier processes and outcomes of creative destruction hitherto addressed in the literature (and described in Section 2.3). In the case at hand, invention activity is carried out by a new firm (DiDi) and therefore the discontinuity should be categorized as a competence-destroying discontinuity. Moreover, because the new firm (DiDi) cannot obtain or access the complementary assets (human resources/taxi drivers) by itself, it cannot independently conduct commercialization. Nevertheless, the new firm (DiDi) does not cooperate with the incumbent firms to obtain complementary assets to achieve the win-win result of creative cooperation. Instead, insofar as the complementary assets (taxi drivers) are mobile in nature, the new firm (DiDi) can, by using the existing technological infrastructure, adopt a strategy that involves taking advantage of, or 'appropriating,' the complementary assets of the incumbent firms in a way that eludes detection by those firms.

Finally, when the new firm (DiDi) has established a solid market position with its own discontinuities created through invention activities—but with the incumbent firms' complementary assets (taxi drivers)

in commercialization activities—it achieves destruction of the incumbents. It is because the new firm (DiDi) in essence 'appropriated' the complementary assets of the incumbent firms, that we label such a strategy *creative appropriation*.

In Table 3, we summarize in tabular format the characteristics of key concepts—including (in red) our newly introduced concept of creative appropriation—shown in Fig. 2, which we have also updated itself as Fig. 5, to demonstrate—with the addition of a red box in the bottom right of the figure—where and how in the literature our newly introduced concept of creative appropriation fits.

In his evaluation of the concept, Schneider (2017: 69) concluded that "Schumpeter does not develop an analytical account of what creative destruction is." Although Schumpeter openly pointed out that innovation is the empirical manifestation of creative destruction (Schumpeter, 1949 [1911]), he did not supplement his conceptual explanation with any specific cases. Through our associated concept of creative appropriation, we develop such a proper analytical account. We do so based on six specific dimensions, each of which represents a factor that enriches Schumpeter's concept of creative destruction.

First, who initiates the process of creative destruction (or, in other words, who is the agent)? Although Schumpeter introduces the general category of 'firms' as initiators, he draws no distinction between new and incumbent firms. That said, in *Socialism, Capitalism and Democracy* (Schumpeter, 1994 [1942]: 87), Schumpeter explicitly states that large firms are most likely to initiate the process given that they have the financial wherewithal to bear the (typically) high costs associated with R&D. In our empirical case study, we identify the initiator of the process as a new firm.

Second, what role do consumers (or users) play—if any—in the process of creative destruction? Does creative destruction impinge upon the consumer (and if so, how)? Here, there is scope to add further details regarding the agency or role of consumers in determining or shaping whether innovations can indeed lead to creative destruction. To be sure, Schumpeter mentioned "new consumers' goods" and "new products" as sources of creative destruction (Schumpeter, 1994 [1942]: 83), but left out the agency of consumers. From this absence we can infer that creative destruction as originally conceived was divorced from the consumer (or user) of the good or service that creatively destroys that which preceded it. Our in-depth case study shows that consumers were also appropriated in the process of creative destruction and were unwittingly complicit in helping DiDi achieve domination and revolutionize the industry. Consumers facilitated the process of destruction.

Third, under what pre-conditions—if any—does the process of

Table 3
From Creative Destruction to Creative Appropriation: A Summary of Key Concepts.

Invention	Commercialization
<p><u>Competence-enhancing discontinuity</u></p> <ul style="list-style-type: none"> – Discontinuity is introduced by incumbent firms – Based on existing knowledge and competencies of incumbent firms – Is used to enhance the competence of the incumbent firms <p><u>Competence-destroying discontinuity</u></p> <ul style="list-style-type: none"> – Discontinuity is introduced by new entrant/firm – Based on newly created knowledge and competencies – Destroys the competence of incumbent firms – Is used to enhance the competence of new firm 	<p><u>Creative accumulation</u></p> <ul style="list-style-type: none"> – Incumbent firms spread the competence-enhancing discontinuity – Creative destruction is spread outside the firms' current domain of competencies <p><u>Controlled adaptation</u></p> <ul style="list-style-type: none"> – Incumbent firms exploit and facilitate existing competitive advantages <p><u>Destruction</u></p> <ul style="list-style-type: none"> – Leads to a destruction of the market position of the incumbent firms <p><u>Creative cooperation</u></p> <ul style="list-style-type: none"> – New firm cooperates with the incumbent firms – Incumbent firms own complementary assets – Both the new firm and incumbent firms benefit from the cooperation <p>Creative appropriation</p> <ul style="list-style-type: none"> – New firm takes advantage of the complementary asset of incumbent firms – No cooperation between firms – Incumbent firms experience destruction

creative destruction take place? Schumpeter addresses this issue by saying in Chapter VII of *Socialism, Capitalism and Democracy* (Schumpeter, 1994 [1942], “Monopolistic Practices”) that the capital requirements of R&D are high, implying that larger, well-established firms would be better able than smaller firms to establish the pre-conditions required to engage in the process of creative destruction. But is it true that larger firms are better placed to engage in this process? Furthermore, why would some large firms and not others initiate the process of creative destruction? What internal pre-conditions have to be present in large firms, and what external (market) conditions do they have to be facing, for them to engage in creative destruction? What are the triggers for large firms—with the requisite capital slack—to engage in the process? Each of these questions represents a way in which the creative destruction concept can be further enriched.

Again, our empirical case study shows that there were two important preconditions for DiDi’s success in creative appropriation: First,

the human-resource-based complementary assets (taxi drivers) they appropriated were/are mobile; Second, DiDi artfully exploited the pre-existing technological infrastructure (smartphones, mobile internet access, a GPS, order-matching algorithms, digital payment systems) into their business model. This extant infrastructure, in turn, permitted the appropriation of the complementary asset through five mechanisms (cash incentives, a revenue-sharing business model, a sense of equality between ‘employer’ and ‘employee’, flexible work schedules and patterns, informal contracts).

Fourth, Schumpeter offered some limited insights into the sources of creative destruction (Dodgson, 2011). In *Socialism, Capitalism and Democracy* (Schumpeter, 1994 [1942]: 83), Schumpeter stated that the sources of creative destruction are “new consumers’ goods, new methods of production or transportation, . . . new markets, [and] new forms of industrial organization” (1994 [1942]: 83). In *The Theory of Economic Development* (1949 [1911]: 66), however, he listed five types

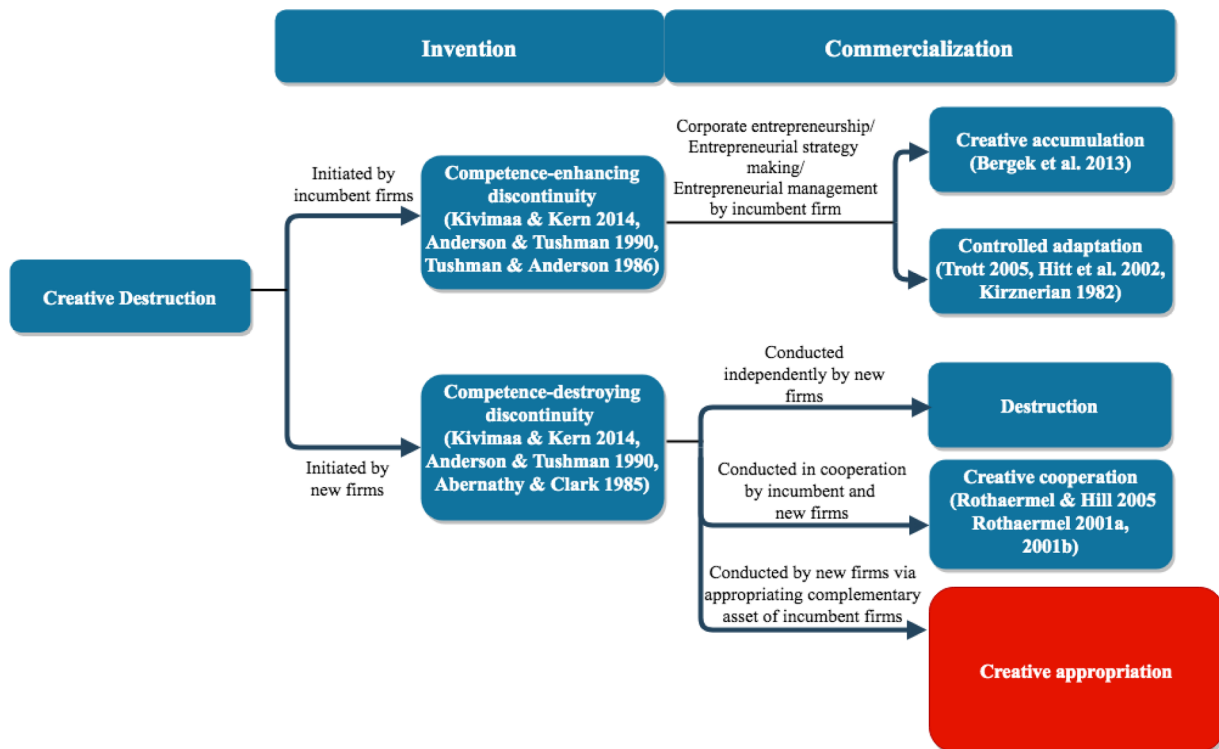


Fig. 5. Relationship Between Creative Destruction and Creative Appropriation.

of “new combinations,” namely new products, new processes, new business models, new sources of supply, and new industrial organizations, as sources of creative destruction. Our in-depth case study shows that the source of the creative destruction is the *Kuai* function in the DiDi smartphone app, which serves as a new consumer service.

Fifth, within what range of *time* does the process of creative destruction exert its effects? Relatedly, how frequently (and how repeatedly) do large firms engage in creative destruction? On these issues, Schumpeter employed the phrase “perennial gale” of creative destruction (Schumpeter, 1994 [1942]: 84). This suggests that the time frame for creative destruction is amorphous, its frequency persistent (regular or irregular), and the process occurs recurrently. In our case, we observed that the time frame in which creative appropriation took place was roughly two years, from start to finish. These two years were turbulent, however, insofar as they included two fiercely fought price wars (between DiDi and Kuaidi and between DiDi and Uber). This turbulence is akin to Kuhn's argument that revolutions—when paradigmatic shifts occur—are marked by periods of upheaval and uncertainty.

Sixth, what are the *outcomes* or results of the process of creative destruction? In this regard, Schumpeter highlighted what he saw as a revolution of “economic structures from within” (Schumpeter, 1994 [1942]: 83). Schumpeter explicitly mentioned the word “destroying” in introducing the concept of creative destruction (Schumpeter, 1994 [1942]:83), but his emphasis in using the term “destruction” suggested that he saw “revolution” occurring in the process (1994 [1942]: 83). A revolution, in the Schumpeterian sense, would alter the positions and behaviors of all firms in a marketplace and also likely (but not certainly) destroy the existing market positions of incumbent firms. Our empirical case study shows quite unequivocally that the outcome of the process of creative appropriation is indeed revolution—namely, a significant alternation of the positions and behaviors of all firms in the marketplace—in both the Schumpeterian sense and the Kuhnian sense.

We show that creative appropriation is associated with Schumpeter's original concept of creative destruction, but we believe that creative appropriation is a more precise descriptor of the process in reference to which we can best understand DiDi's rise in Mainland China. In this sense, we have followed Carlile and Christensen's lead in taking this anomalous case to discover “a new categorization scheme” (2004: 9). Fig. 6 diagrammatically displays the relationships between creative appropriation and related concepts in terms of activities performed and whether those activities are performed by a new firm or incumbent firms.

In a case of creative accumulation, it is the incumbent firm that creates a discontinuity, uses its own complementary assets in commercialization, and benefits from the commercialization of the discontinuity. In a case of creative destruction, a new firm creates a discontinuity, uses its complementary assets to implement and capture value from an innovation, and benefits from the discontinuity. In a case of creative cooperation, a new firm creates a discontinuity, but it is an incumbent firm that provides the complementary assets while both the new and incumbent firms benefit from the commercialization of the discontinuity.

In comparison, in a case of creative appropriation, a new firm (in our case, DiDi) creates a discontinuity, incumbent firms (existing taxi companies) provide the complementary assets, but it is the new firm rather than the incumbents that benefits from commercialization of the discontinuity. As such, creative appropriation highlights the complexity and diversity of possible patterns of interaction between new and incumbent firms and, (in some cases) even between a new firm and an existing industry, in a competitive context using a competence-destroying discontinuity.

5. Conclusions

In this paper we have introduced the concept of creative appropriation. Our motivation was to engage in the process of productive theory-building, a research process that is almost invariably prompted or instigated by an anomaly (Carlile and Christensen, 2005: 9, quoting Poole and Van de Ven, 1989). Creative appropriation is a process whereby a new firm creates a discontinuity but does not have the complementary assets—such as human resources—it needs to conduct commercialization to enable it to succeed in creative destruction. In this situation, the new firm takes advantage of the complementary assets of incumbent firms, but without cooperating with the incumbents, as it establishes its own strong market position. This strong market position in turn leads effectively to the destruction of the incumbent firms and indeed the industry (at least in its present form). It thus causes significant displacement of all firms in the marketplace by altering their positions and behaviors (i.e. a revolution).

DiDi's development as a company offers a neat illustration of the strategy and process of creative appropriation, and not simply because it represents the e-hailing industry. By taking advantage of taxi drivers as complementary assets which are controlled by incumbent taxi companies, DiDi appropriated much-needed human resources, capturing their social and personal reputations, tacit knowledge, and connections as well. Having established this advantage, DiDi thereafter dramatically shifted its strategic focus away from taxis to private cars, leading to a revolution that played out on the ground in the form of the effective destruction of incumbent taxi companies (measured in terms of income, market share, and business volume) and, for that matter, the taxi industry.

Looking to the future, we may well see the rise of autonomous vehicles (AVs) lead to yet another subtle alteration DiDi's business model (and those of other such ride-sharing firms). Although incumbent drivers are the key complementary assets for DiDi, these drivers may well be replaced by mechanized AI that is responsible for steering motor vehicles. Should such a change come to pass, it will likely reinforce DiDi's positive returns through the network effect: with increasing numbers of people using DiDi's e-hailing app, its service offerings are likely to be further refined and improved iteratively, to the point that it offers even greater value than incumbent services (provided by taxis) and greater value than other ride-sharing businesses. For this reason, it is even more important for DiDi to cement a position as early as possible, one that enables it to dominate competitors and service providers.

It is likely that the creative appropriation strategy will become increasingly popular among new-economy firms, for two reasons. First, the business model that many new-economy firms adopt involves recombining existing technologies. Given the widespread availability of the technological infrastructure that supports e-hailing and other industries that rely on AI, it is relatively easy for new-economy firms to introduce discontinuities. Second, the new-economy business model, especially in the service sector, is usually flexible and involves informal labor control, enabling firms to engage in open innovation by taking advantage of external resources to achieve and sustain innovations in diverse and innovative ways (Laursen and Salter, 2006; Chesbrough, 2003). Third, given that new-economy firms compete in a world of winner-takes-all competition and of increasing positive marginal returns, their priority is to improve their platforms so as to maximize their share of the market. Combined with the ease of substituting employees, appropriating complementary assets from incumbents becomes an inexpensive and straightforward means of achieving their objective (of maximizing market share).

As an e-hailing company, DiDi represents the archetypal business model of new firms in the new economy, which comprises sectors such as the sharing economy, the platform economy, the gig economy, crowdsourcing, and internet-based services (Huws, 2014;

FIRMS		CONCEPTS		
Incumbent firm		Creative accumulation		
New firm				
Incumbent firm		Creative destruction		
New firm				
Incumbent firm		Creative cooperation		
New firm				
Incumbent firm		Creative appropriation		
New firm				
		Who creates the discontinuity?	Whose complementary assets are used?	Who is the beneficiary of the discontinuity?

Fig. 6. Diagrammatic Representation of Interaction Patterns vis-à-vis Key Concepts.

Srnicek, 2017).¹⁷ The flexibility offered by such new firms attracts employees working in incumbent firms, laying the groundwork for creative appropriation to occur. The substitutability of employees in the new business model enables new firms to easily and quickly shift their employment strategies without troubling them to maintain a permanent labor force; this in turn facilitates the effective destruction of incumbent firms. Combined with other social trends, including the decline of conventional industries characterized by relatively fixed employment arrangements as well as cultural trends emphasizing individual entrepreneurship, self-motivation, flexibility in work and life, and so on (Huws, 2014), new firms in the new economy will likely be able increasingly to utilize creative appropriation to acquire human resources.

Regarding Schumpeter's original concept of creative destruction, which is open to multiple and flexible empirical interpretations, we have established conceptual underpinnings on the basis of which to enrich the rather ambiguous if seminal concept. In so doing we have introduced the empirically tethered concept of creative appropriation, taking an important step along the path of theory development. We do not claim to have reached our goal, however, because a single case does not a general theory produce.

When he introduced the concept of creative destruction, Schumpeter's key concern was the future of capitalism. Schumpeter viewed creative destruction as integral to capitalism. If we are right, though, it is creative appropriation that we are likely to see on an

¹⁷ Firms in these sectors typically build online platforms or infrastructure and rely heavily on ICTs, matching algorithms, etc. They recruit highly substitutable, informal, and flexible labor to participate in the work and coordinate with each other through a platform (Srnicek, 2017). Examples of such companies include DiDi and Uber (e-hailing companies), Meituan and Uber Eats (food delivery platforms), and Amazon Mechanical Turk (a crowdsourcing platform) (Irani and Silberman, 2013). These new-economy firms can, on the one hand, use automation technologies to lower employee requirements (in terms of work experience and skill level), and thus make employees highly substitutable. On the other hand, they provide highly flexible and informal employment structures and working practices by coordinating through ICTs and algorithms to attract employees from incumbent firms who feel restricted by fixed work requirements and the practices imposed upon them.

increasingly regular basis between new and incumbent firms in the new economy. Our highlighting the need to more deeply understand this strategy and process is therefore, we believe, timely—and also aligned with Schumpeter's original concern with the future of capitalistic society.

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Declaration of Competing Interest

There is no actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, our work.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.respol.2020.104060](https://doi.org/10.1016/j.respol.2020.104060).

Methodological Appendix

We adopted and deployed four methods in conducting our study: documentary analysis, participant observation, face-to-face interviews, and a quantitative survey. We elaborate on each of these below.

To conduct documentary analysis, we analyzed three categories of documents. First, we studied business reports published by third-party

business institutions—i.e. independent of DiDi (such as Diyi Caijing, 36Kr, Amap, Bigdata Research, 1991 IT, etc.). From these reports we gleaned information and data informing us about the urban traffic situation in Xi'an (such as city structure, automobile ownership and usage) as well as macro-level data and ground-level facts informing us about the taxi and e-hailing industries in Xi'an and China (such as market size, market share, and the financial operations of e-hailing companies). Second, we analyzed news reports from the period running from June 2013 through June 2018.¹⁸ We covered online and paper versions of public media reports and analyses from outlets including Xinhua News, sohu.com, Huashangwang, Sina Tech., NBD, Huashang Bao and China Daily, and business magazines such as *China Economic Weekly*. Third, we analyzed government policy documents released by the Xi'an city government and the Xi'an Transportation Bureau between 2014 and 2018 on the subjects of traffic administration, taxi industry regulations, and e-hailing regulations.¹⁹

For ethnographic participant-observation, we undertook two waves of field visits to Xi'an. The first ran from April to June 2017, lasting three months. This was when DiDi switched its strategic focus from the taxi model to the e-hailing private-car model (*Kuaiche*); it had beaten Uber in the subsidy war and had reached its peak penetration in Xi'an. The second wave lasted for two months, from December 2017 to January 2018. This was when the *Kuaiche* business started to stabilize. Over these two waves, we devoted much time to observing and interviewing, altogether, 80 taxi-driver informants. Of these 80 taxi drivers, 21 of whom were also taxi owners, we made sure that a portion (20) of the taxi drivers were relatively experienced users of the DiDi app (that is, had started using the app before 2017).²⁰ Among these 80 taxi-driver informants, we observed their daily work practices, conducted formal interviews and informal conversations with them about their experiences and attitudes related to DiDi, and followed up to seek answers to unanswered or outstanding questions.

Additionally, we interviewed six taxi company staff members who interacted with DiDi's promotional teams and whose companies suffered from driver shortages as a direct result of the impact caused by DiDi. We also interviewed operators of a restaurant and a gas station where taxi drivers habitually gather to capture their perspectives on DiDi's ascent. Each of these semi-structured interviews lasted between one and one-and-a-half hours. The themes of the semi-structured interviews included how DiDi promoted the app to taxi drivers, how taxi drivers were encouraged to use the DiDi app, how taxi companies dealt with the promotion of the DiDi app, how the subsidy wars unfolded, and how DiDi's switch in business focus influenced taxi drivers' and taxi companies' businesses. Altogether, we obtained 75 h of interview material from these informants.

Finally, we also conducted a small-scale quantitative survey (with respondents selected through snowball sampling) to obtain a snapshot of how taxi drivers in Xi'an generally experience DiDi and of their views—along certain dimensions—of DiDi. The survey was conducted in July and August 2018, offered through wjx.com, a well-known Chinese internet and mobile survey website, in Chinese, and spread through WeChat. We restricted access to the questionnaire by asking our taxi-driver informants to disseminate the survey only to drivers who

were currently driving taxis in Xi'an, and offered each respondent a modest sum of money as remuneration for their efforts in completing the survey. The survey contained 15 multiple-choice questions and took about three minutes to complete. The questions covered taxi drivers' attitudes towards their working practices, their incomes, the frequency with which they used the taxi function of the DiDi app, their encounters with DiDi's promotional activities, the changes in income they experienced as a result of DiDi's subsidy wars and shift in business focus, and the likelihood they would switch jobs to DiDi *Kuaiche*.²¹ The sample size was 149.²²

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¹⁸ We chose to analyze news and business reports from June 2013 through December 2018, because 2013 was when DiDi started having a strong impact on the taxi industry, and early-to-mid 2018 was when DiDi's *Kuaiche* business started to stabilize.

¹⁹ We chose to analyze government policy documents from 2014 through 2018 because it was not until mid-2014 that various local governments started paying attention to e-hailing and implementing policies to govern its development and growth.

²⁰ We were keen to interview taxi drivers who had been using the DiDi app before 2017 to capture the essence of DiDi's strategy before 2017 because many of DiDi's important actions vis-à-vis taxi drivers were implemented and completed before then (when the first wave of our participant-observations began).

²¹ We reviewed each of the survey responses manually and took care to delete obviously invalid or illogical responses.

²² Compared with approximately 26,000 taxi drivers in Xi'an, our sample was admittedly small (at 149), but nevertheless served as a reference point regarding DiDi's development trajectory in relation to taxi drivers.

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