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Sectoral evolution and shifting service delivery models in the sharing economy

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Abstract The rise of the sharing economy has had transformative impacts on extant service delivery models, with wide ranging implications for existing firms, regulators, and the workforce at large. This paper draws upon firm-level data to better understand how new forms of service delivery have accompanied the diffusion of the sharing economy. Unlike previous waves of technological innovation, sharing economy firms have emerged as digital intermediaries rather than direct service providers driven by shifting consumer practices and attitudes. We apply an innovation diffusion model to trace the development trajectory of the sharing economy across 1000 firms. Our model segments the evolution of the sharing economy into three distinct and overlapping phases, comprising an Embryonic Stage (1995–2008), an Early Growth Stage (2007–2015), and most recently a Late Growth Stage (2014–present). Analysis of the 1000 firms reveals that the sharing economy has rapidly gained momentum across all industry sectors, with its growth trajectory principally tied to the evolution of related financial and technological innovations paralleled by

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social adoption. We find that service delivery models differ considerably between sectors, with professional services favouring business-oriented models, and consumables oriented more towards peer sharing. Though peer-to-peer (P2P) has been the dominant model, this is changing as larger firms enter the market and existing firms become industry leaders. We argue that while the marginal cost of new transactions within a P2P structure is low, barriers to market entry become ever-higher as sharing economy service delivery models are increasingly embedded within the mainstream economy.

Keywords Service economies · Sharing economy · Collaborative consumption · Fourth industrial revolution · Platform capitalism

1 Introduction

The sharing economy (SE) has transitioned rapidly over the past decade from peripheral to the mainstream service economy to one of its most dynamic components (Belk 2014; Leaphart 2016; Stephany 2015). Geographically, firms across the Americas, Asia,¹ Australia,² and Europe³ have made significant economic impacts. The number of billion dollar firms has doubled annually since 2012 (Owyang and Cases 2016), with many providers becoming household names as industry leaders. Airbnb, for example, recently reported a total of 5 Mio. listings in 81,000 cities worldwide (Airbnb 2018), and French start-up BlaBlaCar coordinates 18 Mio. travellers per quarter globally (BlaBlaCar 2018), while Chinese ride-hailing start-up Didi Chuxing has more than 550 Mio. users (DMR Business Statistics 2018).

In contrast to previous modes of service provision that were reliant on large capital infrastructures and asset-heavy corporate portfolios, the extensive market penetration of sharing economy firms has been achieved with few tangible assets and often scant physical presence (Horowitz 2018). Instead, value is created through digital connectivities that rely on the interaction between individual consumers and producers. Sharing economy platforms rely upon proprietary software in which brand value is tied to algorithms and reputation more so than traditional factors of production (Horowitz 2018; Arvidsson 2018). This creates new models of service provision and opens up new possibilities, yet comes with great challenges in terms of regulation and taxation.

This paper aims to understand how new forms of service provision have accompanied the diffusion of the sharing economy. To this end, we trace the emergence of new service paradigms vis-à-vis the sectoral evolution of sharing economy firms and explain this through the lens of innovation diffusion theory and the S-shaped adoption curve. Though these platforms have become some of the world's most well-known companies, we contend that the transition has not been the

¹ USD 229 billion in value in 2015 (Pennington, 2017).

² USD 15.1 billion in value in 2017 ((Baldassarre 2017)).

³ USD 4.26 billion in revenue in five key sectors in 2015.

agenda of large corporations nor the financial architecture of venture capital alone (Owyang and Cases 2016; Schor 2015), but rather the simultaneous convergence of multiple technologies, social movements, and market conditions around a series of digital platforms (Schwab 2016). The transitioning of sharing economy platforms away from the incipient peer-to-peer (P2P) model toward business-to-business (B2B) and business-to-consumer (B2C) models indicates a new model for service provision, with disruptive albeit transformative capacities for existing social and economic systems. The sections that follow begin with a discussion of the forces behind the emergence of the sharing economy, followed by an overview of innovation diffusion and the S-curve adoption literature, before detailing our research methodology and reporting on resulting analyses.

2 The sharing economy as a novel service delivery model

The sharing economy is an outgrowth of a number of interrelated technical, socio-cultural and economic factors. At its core, it is a product of the Fourth Industrial Revolution—marked by the emergence of a set of technologies that increasingly integrate the physical and digital spheres through machine-to-machine (M2M) communication and Internet of Things (IoT) manifested through ubiquitous web and mobile internet; smaller and cheaper but powerful sensors including global positioning system (GPS); and artificial intelligence and machine learning along with big data and cloud computing (Bloem et al. 2014; Schwab 2016; García Ferrari 2017; Li et al. 2017). It is the fusion of these technologies, and their interaction across the physical and digital domains that creates a network in which virtual and real-life systems interact and cooperate with one another (Bloem et al. 2014; Li et al. 2017). This technological transformation has triggered a fundamental shift in established production, consumption, transportation and delivery systems across industries, leading to the emergence of new business models.

The transition of the sharing economy from a relatively unknown socio-technical phenomenon to a multi-billion dollar global industry has witnessed many of the same dynamics as other technological transitions. This follows the uptake of transportation technologies (e.g. aviation), telecommunications devices (e.g. mobile phones), and payment methods (e.g. credit cards) from low levels of adoption to one of that approaches universal acceptance. However, unlike many of their predecessors, sharing economy firms' emergence was not the result of industrial production, nor an outgrowth of state-owned industries, as was the case when many 'natural monopoly' sectors were deregulated from the 1970s onward. Instead, early-stage funding was deployed by private financial institutions quite apart from the bank-driven financial systems that led industrial capitalism to expansion (Kostakis and Bauwens 2014; Arcidiacono et al. 2018). Furthermore, these asset-light companies were valued based on their perceived brand value and/or forecasted market penetration level (PWC 2015; Stephany 2015), as sharing economy expansion was far less reliant on tangible assets than previous modes of production.

Though sharing economy firms' growth was catalysed by intensive capital injections and purposive expansionary strategies, the platforms themselves were

both enabled and popularised by a general shift towards digitally oriented capital accumulation, which in turn shifted consumer preferences, social norms and conventions, corporate strategy, and—ultimately—profit-oriented approaches. These shifts collectively have created some of the most dynamic firms of the post-global financial crisis (GFC) period—a decade marked by volatility and uncertainty.

Given the sharing economy's disruptive effects on existing systems, we apply a technological diffusion lens to better understand how firms catalyse techno-economic and social change over space and time. Diffusion of a technology is a multistage phenomenon in which different stages are influenced by their relationships to other technological diffusion processes (Arnulf 1991). As we explain vis-à-vis the sharing economy's three stages of growth, different sharing economy platforms focused on divergent niches markets at various points in their growth. Each stage is contextualised within its respective sectors, growth strategies, and socio-cultural influences, with a focus on relevant and complementary technologies shaping platform growth and expansion. Furthermore, different determinants of diffusion each stage, for example leverage the changing values of tech-savvy Generation-Y towards responsible consumption, or that the expansion of on-demand services delivery triggered experimentation with and acceptance of the sharing economy.

3 Diffusion of innovation and the S-curve

We adopt an innovation diffusion approach to examine how the shifting service delivery models of the sharing economy evolve from a sectoral perspective, which focusses on the transition toward the adoption of a product, technology, or set of practices over time. Diffusion of any perceivably new technology is a product of the social learning system that leads to deep-rooted behavioural changes (Marchetti 1980; Rogers 2010; Modelski and Perry 1991).

The S-curve, particularly in case of cumulative adoption of an innovation, has been a core component of diffusion research and is widely used to describe and interpret diffusion of innovation (Kamman and Nijkamp 1991; Hägerstrand 1991; Baek 2018; Steurer et al. 2012). Chapin (1928) refers to this as 'curve of cumulative growth'. The diffusion process plotted as cumulative adoption over time often takes the S-shape, with a comparatively slow take-off, faster growth at the intermediate stage and finally approaching a ceiling after declining growth (Rogers 2010; Brown and Cox 1971; Modis and Debecker 1991; Hägerstrand 1965). In product life cycle, these phases are termed the introductory phase, the growth phase and the maturity phase (Karlsson 1991; Wilson 2012; Baek 2018; Rogers 2010).

The logistic growth function that describes this learning process in general, and conforms to the S-curve, is an accepted method in research on technological adaptation (Rogers 2010; Modelski and Perry 1991; Reddy 2018). Gompertz functions and modified exponential functions and generalised extreme value functions (GEV) are also commonly used in innovation diffusion studies (Kamman and Nijkamp 1991; Steurer et al. 2012; Kim 2011). Kim (2011) studied the diffusion

process of the internet from 1994 to 2007 in the USA using the Current Population Survey (CPS) data and used the logistic function in the simple and multivariate trend analysis. Modelski and Perry (1991) studied democracy as an innovation and traced its global pattern of diffusion from 1800 until 1986 using the Fisher-Pry model of technological substitution (a special case of logistic growth), demonstrating that spread of democracy followed the social learning approach (S-shaped). Wilson (2012) employed logistic growth function to describe time series data to show diffusion of different energy technologies in OECD countries, summarising the sequence of the diffusion pattern into formative phase, up-scaling phase and growth phase.

To understand the evolution of the service firms in the SE paradigm, we first study the trend of diffusion of SE over time. Here our target is to fit the cumulative number of firms to a logistic S-curve. A good fit would confirm that the spread of SE is a diffusion phenomenon, and allow us to differentiate between the different stages of the diffusion process and the evolution of the service delivery industry. Although this characteristic S-curve is a macro-aggregate of an underlying complexity of the processes (Ausubel 1991), it is a good starting point when exploring the evolution of transformative technologies over time. Moreover, the diffusion process gradually transcends through various stages of its life cycle, characterised by different market niches and different relationships to other diffusion processes (Ausubel 1991). To conceptualise this trajectory of diffusion, we discuss and contextualise the stages of diffusion of the SE with preceding and often complementary technologies.

4 Data and methodology

The innovation diffusion study draws upon historical information concerning socio-technical change, primarily drawing on corporate records and databases such as CrunchBase, VentureDeal.com, dealroom.co, Pitchbook.com, Datafox.com and Angel.co for 1000 sharing economy firms. Given the infeasibility of capturing every sharing economy platform globally, this paper marks the first attempt at a comprehensive overview of the sharing economy by sector. For the initial list of SE firms, webpages such as Meshing.it and collaborativeconsumption.com were consulted and the snowballing method was adopted to complete the list. The 1000 firms were selected such that they represent all three systems of exchange discussed by Botsman and Rogers (2010), namely product-service systems, redistribution markets and collaborative lifestyles while focusing on platforms that facilitate exchange for some kind of monetary transaction. These firms cover all regions of the world, encompassing major industry sectors and a broad range of service provider–client relationships. The inclusion criteria for the 1000 firms attempted to incorporate firms of varying scale in terms of number of users (ranging from 50 to more than 1 billion users), in terms of geographical locus of operation (operating globally or in a single city).

Aligning with the work of Owyang (2016), Schor (2016) and (Rivera et al. 2017), we first develop a taxonomy of ten broad categories based on existing prominent

Table 1 List of industry sectors in the sharing economy realm including categories of service

Industry sectors	Service categories
Edtech and creative projects	Online education providing platforms such as Chegg and Coursera and creative projects, including design and video projects
Equipment, tools and toys	Construction equipment, other heavy equipment, everyday tools, arts, musical instruments and toys
Fashion wearables	Renting valuables including high-end fashion clothing, high-end jewellery, watches and handbags
Fintech	P2P lending platforms for businesses, individual and projects
Food start-ups	Home cooked food sharing at home, takeaway and delivery
Intangibles	Wi-Fi network, P2P mesh network, insurance, energy, and video streaming
Mobility services	Car sharing, RV rental, ridesharing, ride hailing, bike–motorbike sharing, vessels sharing, flight sharing; truck rental; shipping service, last mile logistics, moving and delivery services
On-demand labour	Software development, graphic design, professional services, repair service, sales services, lawn care, laundry service, house making, low skill labour; beauticians, fitness advisor, micro-lessons, trainers, delivery service, grocery service, pet care, care giving, health care, chef service tourist experience, fashion experience, tutors, entertainers, performers, photographers and DJs
Reselling and retail marketplace	Fashion clothing and other wearables, musical instruments, toys and children's ware
Space sharing	Short term accommodation rental, long-term accommodation rental, parking space rental, store front sharing, storage space rental, office/work/event space sharing, recreational space, garden sharing

industries through studying the 1000 firms in terms of industry composition, type of service and financing (see Table 1).

Next, following Baek (2018), Kim (2011) and Steurer et al. (2012) we examine the quantitative adoption curve to explore the diffusion pattern of the SE as whole. From the slope of the curves, we then identify three evolutionary phases of the service delivery industry. Scholars widely used different forms of the logistic model to fit cumulative number of adopters, firms, citations, etc., and often rate of adoption on scales of 0–1 or 0–100 (Debecker and Modis 1994; Meade and Islam 2010; Baek 2018; Wilson 2012). In fitting the curve, the nonlinear least square method is widely used in the diffusion literature (Peres et al. 2010; Steurer et al. 2012; Meade and Islam 2010). In this study, R library ‘nlstools’ is used to apply the nonlinear least square method to fit cumulative SE firms over 1995–2017 to a logistic function and check for the goodness of fit. We follow Wilson (2012), Debecker and Modis (1994) to apply the three-parameter logistic function of the following form (Eq. 1):

$$y = \frac{M}{1 + e^{-\alpha(t-t_0)}} \quad (1)$$

In Eq. 1, parameters M is the asymptote, α is the growth rate (in terms of cumulative number of SE firms) and t_0 is the point of inflection at approximately $M/2$. We used the R package ‘nslr’ to derive the slope of the curve at each point from the first derivative of Eq. 1, which gave us the basis for identifying the phases

of diffusion of the SE firms vis-à-vis evolution of the new service delivery industry. The particular points in time (year) when the phase changes took place are derived from the range of the slope and the plot of the slope against time (Fig. A-1 in Appendix A). The first transition from Stage I to Stage II is marked by a significant increase in the slope of the curve. The second transition from Stage II to Stage III is marked by a sign change in the slope i.e., from Fig. A-1 in Appendix A, we see that from 2014 onwards the direction of slope changes become negative implying that from that point number of SE firms grows but at a diminishing rate. A two-sample *t*-test is performed to compare the group means of cumulative number of firms of the consecutive three phases. We find that the mean of cumulative number of SE firms in Stage I is statistically different from that in Stage II (p value = 0.0007141) and there is true difference in the mean of cumulative number of SE firms in Stage II and Stage III (p value = 0.009524). The steps involved in the mathematical derivation of the phases are detailed in Appendix A.

To supplement the diffusion analysis, we then delve into different sectors of the SE and focus on how resources have been concentrated in the expansion of sharing economy sectors. Given that adopters have choice of technology in this case service delivery models, competing or complementing innovations are important in diffusion study (Dearing and Cox 2018), we also examine whether the nature of the relationships between service firms (Businesses, or B), consumers (C), institutional providers (Government, or G), and content producers (Peers, or P) has changed over time. This analysis follows the sectoral overview to identify the various permutations and directionalities that define the sharing economy. In terms of competing and complementing innovations, shifting relationships are indicated by new configurations of peer-to-peer (P2P), business-to-consumer (B2C), peer-to-business (P2B), business-to-business (B2B) and government-to-peer (G2P) models; we trace shifting relationships over time as they correspond to the three stages of innovation.

5 Simple trend analysis and stages of diffusion of the sharing economy

The adoption curve (in terms of cumulative number of SE firms) derived from Eq. 1 (see Fig. 1) gives a useful window to explore the diffusion pattern of the SE and its phases. The dots in Fig. 1 (left) are the observed cumulative number of SE firms. The fitted adoption curve (blue line) follows a typical S-shape. In a simple log-linear OLS exercise, the fitted curve appears as a straight line in the semi-logarithmic plane (Fig. 1(right)) with an adjusted R-squared of 98.66.

Summary of the nonlinear least square estimation of the logistic function with $N = 23$ is given in Table 2. Table 2 shows that all three parameters are highly statistically significant. Thus, following Modelski and Perry (1991) and Wilson (2012) we argue that diffusion of the new service model, i.e. the SE is a social learning process of diffusion. For the sample of 1,000 SE firms, a point between 2013 and 2014 is the point of inflection (maximum growth).

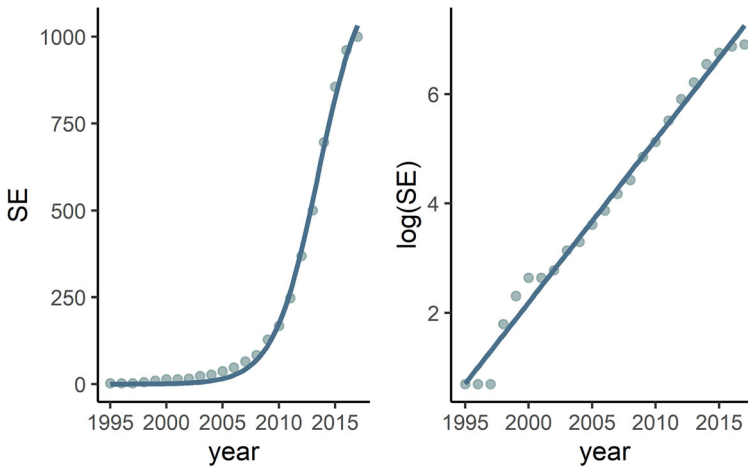


Fig. 1 Observed and fitted cumulative SE firms during 1995–2017 in (left) linear scale and (right) in semi-logarithmic plane

Table 2 Summary of nonlinear least square estimation of the logistic curve with $N = 23$

Parameters	Estimate	Std. Error	<i>t</i> value	Pr(> <i>t</i>)
<i>M</i>	1.203e + 03	4.497e + 01	26.75	< 2e-16***
α	5.105e-01	2.624e-02	19.46	1.82e-14***
<i>t</i> 0	2.013e + 03	1.951e-01	10,319.08	< 2e-16***

*Coefficients significant at 10% ($p < 0.10$), significance level

**Coefficients significant at 5% ($p < 0.05$), significance level

*** Coefficients significant at 1% ($p < 0.01$), significance level

Residual standard error: 18.81 on 20 degrees of freedom

Number of iterations to convergence: 9

Achieved convergence tolerance: 1.591e-06

6 The three stages of innovation diffusion: service firm evolution in sharing economy

The innovation diffusion literature suggests the existence of several stages that collectively form the diffusion process. Classical innovation diffusion models incorporate between three and five stages, consisting alternatively of (1) origin, followed by a slow take-off stage; (2) an intermediate or diffusion stage exhibiting rapid growth; and, (3) a stage of retardation or saturation, one of (4) diminishing growth, and finally one of (5) decline as new technologies supplant old ones (Fischer 1989; Hägerstrand 1965; Brown and Cox 1971; Peres et al. 2010). The stages are observed when the number of adopters (e.g. individuals, firms), are measured over time and with segmentation between them at various inflection

points. In this case, taking the birth of Amazon.com in 1995 as our starting point for the sharing economy (Quinn 2015; Hartmans 2017) we segment the sharing economy into three distinct stages: (I) embryonic; (II) early growth; and, (III) late growth stage. Based on our reading of the data, and the evidence provided by previous adoption curves, we would hypothesise a fourth stage—maturity—that has arguably yet to form (though early signs are emerging).

During the embryonic stage (Stage I), a relatively small number of start-ups operate (Sundararajan 2016), and traditional financial institutions such as banks are reluctant to invest (McNeill 2016; Langley and Leyshon 2017), and novel technologies are at direct odds with existing and established industries such as the taxi and hotel industries and regulatory systems. In this stage, early adopters embrace new technologies, and push-back from firms and industry groups representing older technologies is often the case (e.g. lobbying, litigation). During Stage II, firms experience more rapid growth than in the previous stage. Adoption expands beyond the relatively small number of users in Stage I. Expansion is now guided by more robust rounds of investment from both conventional and unconventional sources (Kressel and Lento 2010; Owyang 2014b). Established industries begin to understand the challenges that lie ahead, and adapt business models accordingly (Vaughan 2017; Botsman 2014). This has been exemplified by large automotive conglomerates adopting hybrid technologies in the 1990s, or the pricing models adopted by ‘legacy’ airlines in reaction to the no-frills pricing of low cost competitors in the early 2000s (Henke et al. 2016; Banister and Stead 2004; Matzler et al. 2015). During Stage III: late growth stage in the diffusion of innovation, products and technology are now widely established and adoption has advanced beyond the limited circle of Stage II (Beutin 2018). Stage III involves larger rounds of funding and often an inversion of power in which investors’ appetite for industry expansion often outstrips reality (Adepoju 2017; Allen 2017). Growth continues but growth rate slows slightly, and major industry leaders are joined by start-ups benefitting from access to capital. Industry giants either adapt to new conditions or experience difficulties maintaining a competitive advantage (Mahammad et al. 2017; Lanctot 2016). The recent decline of the taxi industry is exemplary of this and taxi associations have turned to regulators to slow the haemorrhaging of customers to ride-sharing platforms (Jonas 2015; Posen 2015).

As Fig. 2 details, our findings show that these phases conform to the varying rates of expansion across the adoption curve. The S-shaped, or sigmoid, curve captures the temporal pattern of sharing economy adoption characterised by a slow take-off initially followed by a growth that approaches an exponential rate before plateauing representing the upper asymptote of the curve followed by a decline in growth (Fischer 1989; Rietmann 2017; Hägerstrand 1965; Rogers 2010).

6.1 Stage I

The embryonic stage (Stage I) of the sharing economy runs from 1995 to approximately 2008. This stage is characterised by a low number of bona fide sharing economy firms, expansion in Web 2.0 platforms, and the mainstreaming of online marketplaces such as eBay, Alibaba, Amazon (Gansky 2010; Sundararajan

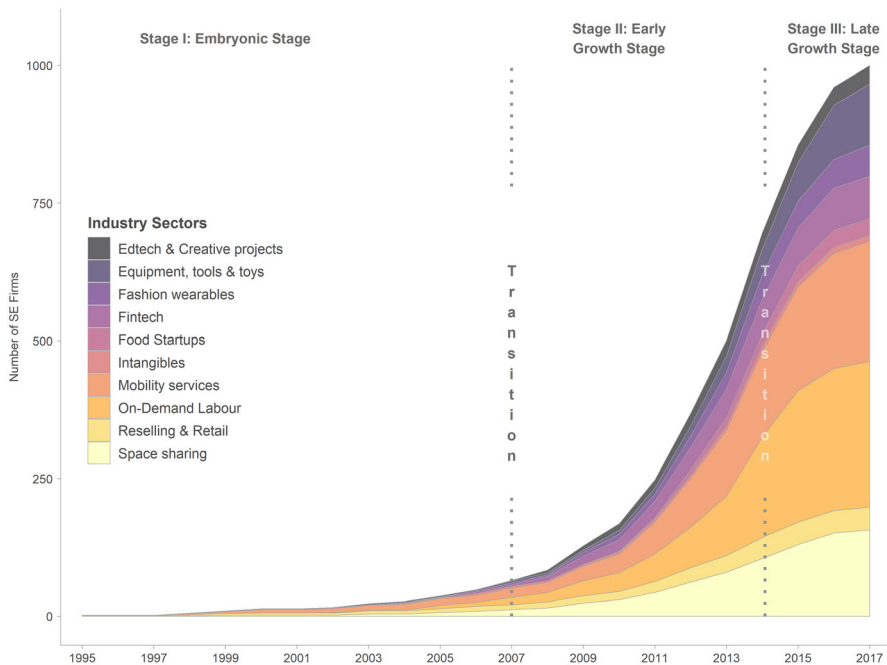


Fig. 2 The adoption curve of the sharing economy

2016). Expansion by these pioneering firms was rapid: by 1998 eBay had half a million users in the US and it went public in the same year (eBay; The Telegraph 2011). By 2002 Netflix had 0.6 Mio. subscribers in the U.S. (Wayner 2002), and by 2003 a British pioneer ridesharing platform Liftshare had 100,000 members (Liftshare 2017). In Asia, Alibaba's retailing platform ToaBao was founded in 2003 (Alibaba 2017). During 2005–2008, numerous big names in the sharing economy arena were founded, for example accommodation rental HomeAway and reselling platform Etsy were founded in 2005; P2P lending platform Lending Club, parking space sharing platform JustPark, ridesharing service BlaBlaCar and personal Wi-Fi network sharing service, Fon were founded in 2006; and Airbnb, Car2Go and on-demand home service platform Airbnb were born in 2008.

During Stage I there was a high proliferation of P2P providers leveraging heavy investment in internet and mobile infrastructure, which lowered entry barriers for the sharing economy firms (Gansky 2010)—both in terms of time and money. The embryonic stage is also marked by the advent of crowdsourced verification and ratings. eBay pioneered post-transaction 'star rating' systems in 1997 and unified web marketplace and online payment system in 2002 through incorporation of PayPal and introduced mobile app in 2008 (eBay; Zervas et al. 2014). Consequently, the user base for digital platforms such as eBay and Netflix increased, leading to formation of new firms in the later part of the embryonic stage. By the end of this period overall more than 8% of the start-ups became operational.

Among these, mobility services and on-demand labour platforms reached a take-off stage with each comprising more than one fifth of the firms followed by the space-sharing sector (around 18%). Although a whole range of different combinations of service provider–consumer relationship prevails in the sharing economy regime, this stage witnessed a remarkable growth of P2P platforms, about 70% of the firms formulated during this period were P2P and around 24% were B2C in nature.

6.2 Stage II

The Early Growth Stage (Stage II) of the sharing economy covers the period 2007 until 2015, which marks the emergence and spread of firms across all industry sectors. This stage witnessed the birth of a number of the largest sharing economy companies including Uber (2009), Kickstarter (2009) Mosaic (2010), Gett (2010) and Grab.com (2012). In terms of the number of firms, the Early Growth Stage experienced exponential growth in all sectors. More than 80% of the sampled start-ups came into being during the second stage. During this period, both businesses and customers began to accept and experimented the sharing economy business models and as a consequence, new firms emerged across all world regions (Vaughan and Daverio 2016; Owyang and Cases 2016; PwC Hungary 2016). In this stage, firms expanded through exponential international growth (Taylor 2011), with Airbnb completing its 10 millionth booking in 2012 (Taylor 2012) and Uber completing its 1st billionth trip in 2015 (Kokalitcheva 2015).

Capital raising in the sharing economy was minimal during the Embryonic Stage, but rose considerably during the Early Growth Stage (Owyang 2014a; Jeune 2016) with venture capital investments toward platforms such as Uber, Airbnb and TaskRabbit (CrunchBase 2017). From then onward, venture capital (VC) fuelled the scaling up of the sharing economy firms at home and their expansion abroad. For example, in 2011 alone, Uber received USD 48 Mio. in VC (Startup Ranking 2018) and consequently it went for international expansion (Tsotsis 2011). Again, Airbnb captured USD 112 Mio. VC injection and opened its first international office in Germany in the same year (Airbnb 2018). This sector received more VC funding than any other category (Jeune 2016; Owyang 2014a; Cusumano 2018). On the basis of a survey of 200 sharing economy start-ups in 2013, Owyang (2014b) found 37% of these firms were VC-backed. VC funding exhibited a surge of 350% in 2014 attributable to heavy investments in Airbnb and mobility service giants including Uber, Lyft and BlaBlaCar (Owyang 2014b). To date Uber raised USD 24.2 billion, Lyft raised USD 4.9 billion, Airbnb raised USD 4.4 billion to name a few.

Business formation vehicles (i.e. start-up incubators and accelerators such as Y Combinator and 500 Startups) (McNeill 2016) with low cost office space, access to early-stage funding and entrepreneurial networks, training, and mentorship have played an important role in backing the sharing economy firms due to profit expectations (Frenken 2017). For example, Y Combinator nurtured Airbnb, RocketSpace backed Uber (Yamaguchi et al. 2015; Kumar et al. 2017). In this way during Stage II, the innovation and technology-based entrepreneurship ecosystem backed by heavy VC involvement and incubator/accelerator programs on the one hand created a few industry leaders (unicorns) (Kumar et al. 2017;

McNeill 2016; Jeune 2016) and on the other hand allowed new entrants to incubate in the space leading to exponential growth of number of firms in all sectors.

During the 2007–2014 period within the sampled firms, the on-demand labour sector exhibited unprecedented growth of 1300%, followed by mobility services sector (811%) and space sharing sector (775%). The dominance of the on-demand labour platforms is mainly attributable to the existence of a sizeable freelancer marketplace (supply side) and growing popularity of freelancer platforms offering services such as food delivery or DIY tasks (demand side) (Vaughan and Daverio 2016). However, growth in mobility services and space sharing sector in particular was fuelled by heavy investment due to high frequency of transaction with low operating cost, i.e. the scalability of the business models (Owyang 2014b).

Adoption was widespread by the end of Stage II. A study in 2014 revealed that 19% of the US adults have used a sharing economy platform, whereas another study in selected countries of Europe in 2017 found that 44% of the respondents have used such platforms (Beutin 2018; PWC 2015). Furthermore, the beginnings of a shift away from P2P began to manifest as larger and more sophisticated operators crowded smaller entrants out of the market. Though P2P was still the dominant service provision model (54%), P2B increased markedly to 11% as a large number of crowdfunding and on-demand platforms emerged.

6.3 Stage III

We have arguably transitioned into the Late Growth Stage (Stage III) post 2014. In this stage, the sample of 1000 firms exhibit a slowed rate of growth measured by the formation of new firms, but established firms continue to grow in terms of number of users, and listings. Though the expansion by sector is perhaps more reserved than in the previous stage, people both as service providers and consumers are participating in growing numbers in the sharing economy along with its general acceptance as common consumer practice. From the ashes of nominally post-industrial Taylorist production networks emerged complex, integrated and custom-made solutions compared to standardised/homogenous products and services (Williamson and Meyer 2012) and the data-driven sharing economy firms with focus on consumer centricity, deliver highly targeted and customised goods and services at the right time and place (Gansky 2010; Schwab 2016). Moreover, the 2008 GFC fuelled shifts in consumer value towards ‘access’ rather than ‘ownership’ and wide acceptance of the sharing economy (Kathan et al. 2016; Walsh 2011), which manifest in the emergence of firms years later. This is evident from the growing popularity of the mobility services, fashion wearables and equipment, tools and toys rental industry. Fashion wearables platforms grew from 3 firms in Stage I to 57 firms in Stage III, and equipment, tools & toys sector grew from 2 to 64 during the same period. This indicates that consumers prefer accessing the right equipment, tools and toys at right time and place rather than bearing the liabilities of owning it.

During the Late Growth Stage, 499 of the 1000 were launched, and on-demand labour sector continued to be the dominant industry with more than 31% of new firms, followed by mobility services (20%) and space sharing Service industry (15%). While these three sectors established themselves well and matured in the

Early and Late Growth Stage, sectors such as Edtech and creative projects, food start-ups, and the equipment tools and toys industry began to take-off. Strong and steady growth is also observed in the equipment, tools and toys rental, fashion wearables, and Fintech industry during later stages. Intangibles sharing such as Wi-Fi, energy and insurance sharing platforms remain in their infancy in this period. Thus, following the trajectory of individual service industry, differential growth pattern in different industry is observed (Fig. 2) (Beutin 2018).

In terms of service provision models, while the rise in P2P start-ups continues at a similar pace to the previous stage, B2C firms grow at an increasing rate and comprise one-third of new firms. Noticeably, B2B firms also maintained increasing growth from only 7% firms in the Embryonic Stage through around 9% during Early Growth Stage to 10% in the Late Growth Stage. The emergence of B2C and B2B service models in Stage II and III indicates that traditional corporations are increasingly adapting to shifting economic conditions. For example, Car2Go and DriveNow are B2C Mobility Service platforms that are subsidiaries of Daimler and BMW, respectively (Lancot 2016; Botsman 2014). Again, in relation to choice of technology in this case nature of the relationships between businesses and consumers, B2C and P2P platforms are often competing innovations and at the third stage of the evolution process, B2C firms slowly go forward to P2P platforms in terms of growth in number of firms. A matrix is given in Table 3 with the drivers and outcome of the diffusion process at each stage showing the growth of the cumulative number of SE firms and change in growth discussed in Sect. 6 and 7, as indicated by change in slope, average cumulative number of firms, and slope range.

7 Novel service delivery models in sharing economy firms

Across the study period (1995–present), the dominant business model is P2P (53.7%) followed by B2C model (26.8%). P2B and B2B models comprise 9.9% and 9%, respectively. The emergence of P2P reflects values of the Fourth Industrial Revolution, which trends towards a ‘crowd-based market’ away from the ‘hierarchies’—a shift from centralised control towards peer-based organisation of economic activities (Sundararajan 2016; Ferdinand et al. 2016; Einav et al. 2016). However, the strength and growth of the B2C model imply that a growing number of incumbent service firms are adopting sharing economy principles to leverage their market share (Botsman 2014; Matzler et al. 2015). Though P2P remains by far the most dominant service delivery model, this is shifting in relative terms. As Fig. 3 indicates, P2P declined from 61 to 51% between Stage I and Stage III. B2C increased from 27 to 29%. The most significant gains in relative terms were from P2B, which increased from 4 to 8% of market entrants (rising to 11% in Stage II), and B2B. G2P all but disappeared, indicating that—importantly—while state subsidies are perhaps important for supporting and catalysing firm activities, they were somewhat less important in sustaining them. Figure 3 summarises these shifting relationships.

Table 3 Three-stage model describing the evolution of sharing economy platforms

Stages	Drivers	Outcomes	Slope Range (average cumulative number of firms)	Δ Slope
Embryonic stage (I)	<ul style="list-style-type: none"> • Start-up ecosystem commences near San Francisco • Heavy investment in mobile and internet technologies • Consequent diffusion and uptake of complementary technologies e.g. online review and payment systems 	<ul style="list-style-type: none"> • Adoption and experiments by few innovators (i.e. pioneer SE firms such as eBay, Netflix, BlaBlaCar, Airbnb) were founded • Slow growth in the user base at home for platforms such as eBay, BlaBlaCar • Proliferation of P2P platforms • SE firms' regulatory arbitrage over incumbents 	0.05–20.93 (20.46)	0%–61.9%
Early growth stage (II)	<ul style="list-style-type: none"> • The GFC and consequent shift in consumer values from ownership towards access-based consumption • Scaling up of the SE firms through injection of VC funds and start-up accelerators • Diffusion of complementary innovations (e.g. IOT and GPS-enabled smart devices and application programming interface (API)) • Changes in consumer behaviour towards online reviews and product experience 	<ul style="list-style-type: none"> • International expansion of established firms • Changing nature of employment • Legal battle over employment status, public safety and widespread regulatory and media responses • A shift away from P2P towards P2B and B2C as traditional operators enter the market • Widespread adoption at the user end 	33.28–151.25 (249.67)	59%–13.2%

Table 3 continued

Stages	Drivers	Outcomes	Slope Range (average cumulative number of firms)	Δ Slope
Late growth stage (III)	<ul style="list-style-type: none"> • Number of firms increasing at lower rate • Fierce competition, acquisition and merger of smaller firms (e.g. competition between Uber and Lyft) • Compliance with the new regulatory framework (e.g. removal of licenses and consequently listings) 	<ul style="list-style-type: none"> • Expansion of larger firms due to network effect (e.g. Uber, Zip Car) • Government response to regulate the new service delivery economy in relation to taxation and public safety. (e.g. introduction of licensing for listings on Airbnb) • Adoption of this business model by increasing number of incumbents and growth of B2C and B2B firms as a competing technology of the SE P2P paradigm 	151.81–74.84 (878.25)	– 0.3%–28.1%

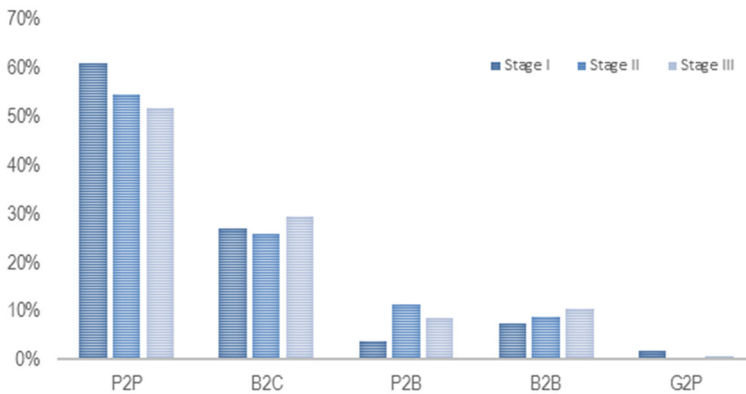


Fig. 3 Shifting service delivery models by growth stage [for graphical purposes, stages are segmented into three non-overlapping stages including from 1995–2007 (Stage I), 2008–2014 (Stage II), and 2015–2018 (Stage III).]

The transition from P2B to relationships involving companies as consumers (P2B, B2B) and as service providers (B2C) foreshadows a transition toward the ‘professionalization’ of the sharing economy.

Table 4 Service delivery model by sector (count)

	P2P	B2C	P2B	B2B	G2P
Edtech and creative projects	17	6	8	5	–
Fashion wearables	22	41	–	–	–
Fintech	38	1	46	5	–
Food startups	28	3	–	–	–
Intangibles	7	6	–	16	–
Equipment, tools and toys	62	34	1	18	–
Mobility services	143	74	9	26	6
On-demand labour	161	75	37	10	–
Reselling and retail marketplace	40	4	–	–	–
Space sharing	95	62	12	39	–
Grand total*	613	306	113	103	6

*Some firms identified under more than one model

The shifting service delivery models also vary to some degree between sharing economy sectors. In relative terms, the P2P model was most prominent in reselling and retail marketplace and food start-ups, reflecting the fact that individual entrepreneurs are most active in selling directly to the public through sharing economy platforms. In B2C, however, fashion wearables were by far the most significant in relative terms. P2B on the other hand reflected more of a sub-contracting model, with Fintech as by far the most significant in relative terms, followed by Edtech and creative projects, for which B2B was also significant. Table 4 summarises these relationships in absolute terms, noting that firms can be identified under more than one model (but only in one sector).

8 Discussion and conclusion

In this paper, we have modelled the multistage process of the growth of the sharing economy vis-à-vis the evolution of the service firms and theorised this process within the framework of diffusion of innovation theory. Each stage is a product of the interplay of its niche market, its socio-cultural determinants, its relationship with the diffusion of relevant competing and complementary technologies and incremental improvements in its underlying product and processes. We have attempted to understand the diffusion of a technology/product in the context of the Fourth Industrial Revolution unravelling some of its underlying complexities as a process to bring collective behavioural change.

The sharing economy enables a radical shift in the transaction costs facing firms and thus reduced marginal cost of production. The sharing economy ideal is for firms to own no assets and maintain only the requisite overhead for the operation and expansion of their platform(s). In this regard, Kaku (2003) envisaged perfect capitalism where power shifts to the consumers as they will know everything about

a product and its competitors and technology replaces the intermediary. The service provision model comprising businesses (B), consumers (C), governments (G), and individuals, or ‘peers’ (P) has been reconfigured, in some cases inverting the producer–customer relationships assumed under the dominant B2C modality.

The re-orientation from P2P towards B2C, P2B and B2B models has enabled sharing economy firms to overcome a number of geographical and regulatory obstacles that companies with greater physical presence would otherwise encounter. From a critical perspective, this is perhaps one of the greatest challenges associated with the rapid emergence of the sharing economy (van Doorn 2017; Stafford 2016; Murillo et al. 2017; Lemmon et al. 2016; Moore and Robinson 2016). Importantly, there is considerable ambiguity around property rights, as the technological drivers of sharing economy firms allow to transcend national boundaries quite easily (Sundararajan 2016; Guerrini 2017), and firms themselves are largely decoupled from assets, from a legal perspective.

Compared to ‘conventional’ service firms with fixed assets, including their number of employees, machines, and hard and soft infrastructures such as vehicles or other machinery, sharing economy firms are all but infinitely scalable—there are few practical limits to how much capacity (or demand) a platform can sustain. Thus, although the ‘instantly scalable’ firm encounters relatively few limits to growth across the sharing economy, the tapering of expansion in Stage III indicates that various sectors are increasingly saturated. Following antecedent diffusion of innovation models, this would suggest a restructuring in Stage IV in which firms with unprofitable models and/or those unsuccessful in winning new markets are ultimately overtaken by newer, more innovative firms. Furthermore, as regulation catches up to sharing economy service models, cost savings in terms of property tax, car registration, fitness and compliance with regulations are eroded as such.

Through our analysis of 1,000 firms we have shown that the emergence of the sharing economy was a consequence of the confluence of a series of socio-technical developments dating back several decades to the late twentieth century. It was the consumer-oriented focus of Web 2.0 that placed agency in the hands of billions of internet users and the funding tied to the subsequent expansion of internet giants such as Google and Amazon which lowered the barriers to entry to sharing economy firms. Consequently, the nexus of internet-based platforms developed the payment and verification technologies along with the hardware (smartphones with geo-spatial capabilities), allowing ‘peers’ to connect with one another. The GFC of 2008 was the major catalyst, as the discourse of austerity capitalism was deployed semantically along ‘actually existing’ austerity measures, framing ‘sharing’ as resource rationalisation.

The diffusion of innovation observed in the sharing economy is analogous to previous models of technology-led innovation. We used only year of foundation to predict the cumulative number of SE firms in our model. Although this modelling exercise ignored the complexity of the processes that drive the changes in collective behaviour, it provided a bird’s-eye view towards the phenomenon and served as a clue to establish the link with other concurrent technological change and explain the evolution of the new service models in that light. We find that the lead-up to the Embryonic Stage was linked with early-stage platforms allowing P2P interaction

with relatively little access to capital, and a business model that was almost instantly scalable. In Stages II and III, sharing economy platforms have gained wider acceptance by consumers, leading to a slowing in the formation of new firms while established firms expand exponentially. Mobility services have to date received the most funding, potentially because of the ‘wicked problems’ of transport associated with rapid urbanisation on a global scale (Cohen and Kietzmann 2014; Davidson and Infranca 2016). However, on-demand labour platforms remain the most common, indicating that sharing is—on a fundamental level—a form of labour appropriation within capitalist systems, whichever form it takes. The relationships formulated by the sharing economy emerge in various forms, with the enhanced role of corporations in B2B, P2B, and B2C service provision models increasingly reinforcing the commercial nature of sharing economy.

As municipalities contemplate the replacement of bus services with ridesharing-based public transit systems (Rayle et al. 2014, 2016), and city councillors intensely debate the flaws and merits of home-sharing, the future of the sharing economy will depend not only on firms themselves, but on consumer behaviour, governance, and social movements that will no doubt exert significant transformative powers. This paper has demonstrated that despite the notion that the sharing economy is merely a technology-led phenomenon, it represents a broad socio-technical transition driven by the diffusion of new service provision modalities across space and time.

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