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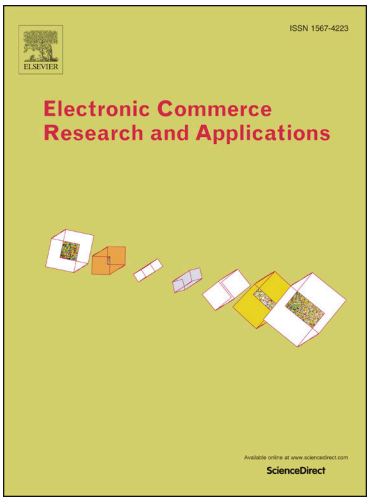

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RESEARCH DIRECTIONS FOR SHARING ECONOMY ISSUES

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ABSTRACT

The sharing economy proposes a new approach to designing and delivering products and services, that aims at avoiding waste, improving efficiency, and favouring a bottom-up change. In this research commentary, we survey the current state of things and propose some directions for research. We first describe the industries, products, and services currently embracing the sharing paradigm, the technology platforms enabling it, the business models driving it, and the regulatory issues. We envisage that promising areas of research should include: 1) devising more efficient algorithms; 2) considering ecological and pro-social objective functions; 3) dealing with regulatory issues; 4) expanding the span of research to cover more geographical areas and a wider set of services; 5) supporting services with more reliable reputation and recommendation systems.

Keywords: Business models, economic theory, regulation, research commentary, research directions, sharing economy, sustainability, technology platforms.

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1. INTRODUCTION

By any measure, the activities of the sharing economy represent a major business paradigm shift that has given rise for enormous new business and social value in many economies around the world. Statista (Mazareanu, 2019a) estimated the annual value of the worldwide sharing economy as having grown from USD 14 billion in 2014 to an estimated value of USD 335 billion by 2025 – nearly 24 times greater in just 12 years. Meanwhile, the global sharing economy platform revenues has been estimated to go from USD 18.6 billion in 2017 to USD 40.2 billion in 2022 (Mazareanu, 2019b), a more than doubling of the total as the industry builds global infrastructure. Currently, there are relatively few publicly-traded sharing economy firms, and the market has not been favorable of late for initial public offerings of their stock, though expectations of future market capitalizations are still fairly high among risk-loving investors (though possibly unfounded).[1] For example, February 2020 (just prior to the beginning of the coronavirus pandemic and its negative impacts on global financial markets), Uber had a market capitalization of USD 71 billion but fell it to USD 37 billion by late March, while GrubHub (a food delivery service) was worth USD 5.35 billion but dropped to USD 2.92 billion also by late March.

The sharing economy is widely viewed as a disruptive force on firms, business processes, industry sectors and their markets that is international in scope, and fast and ferocious in its transformational powers – but also one that is an enormous financial value-creation machine. Some of the most transformational market disruptions have included Airbnb for accommodations, Uber and Didi Chuxing for ride-hailing, which changed the choice sets for hospitality and taxi versus auto transportation for 100s of millions of travelers around the world. Even though Airbnb has not obtained equity funding or a true financial market capitalization, its private equity firm valuation in 2019 was USD 38 billion based on six million listings in 100,000 cities around the world (Lock, 2019).[2] Similar to Priceline's higher valuation in the past than its owner, Airline firm Delta (Schaal, 2020), Airbnb managed to achieve high market worth than the worlds' fourth largest hotel chain, Marriott, in February 2019 (Zvolska 2019).

The aspects of the sharing economy that create value are broadly recognized among experienced researchers, savvy venture capitalists and value-conscious business entrepreneurs, as well as senior managers and government regulators. They include: Acquier et al. (2019), who crafted a framework with four different forms of sharing economy firms. *Shared infrastructure providers* create value by providing monetized, temporary access to a centralized pool of proprietary resources that fee-paying people and business customers can access for a fee. In contrast to shared infrastructure providers,

[1] Among leading sharing economy firms, Airbnb, Grab Taxi and Didi Chuxing are all privately-held, and only WeWork among these leading firms attempted to have an IPO in 2019, but it failed due to disagreements on the company's market valuation (Aydin, 2019).

[2] In addition, in March 2019 Airbnb employees traded their common stock to HotelProvider, which it purchased in an equity-for-ownership stock purchase valued at USD 35 billion, which is similar to a similar move that Airbnb made to raise private capital in 2016 with an implied firm value of USD 26 billion (Schleifer, 2019).

commoners are non-profit organizations that create and encourage consumption of free public goods. *Mission-driven platforms* are operated as for-profit, not-for-profit and hybrid organizations, whose central focus is to create a social impact by making a centralized pool of resources available publicly and then organizing local decentralized P2P exchanges to encourage interactions among interested individuals. Finally, *match-makers*[3] – probably the most well-known organization type among the four – act as intermediaries to support decentralized P2P transactions, for goods or for services (Evans and Schmalensee, 2016). (Appendix A provides a table with key concepts and terminology to support readers who are less familiar with the vocabulary of the sharing economy that goes beyond the more familiar language of e-commerce and more traditional digital business.)

Somewhat less well recognized are the paradoxes related to the innovative new business models and market activities (Acquier et al., 2017). They span, for example, moral hazard and supplier / intermediary / consumer misbehavior involving market participants and community stakeholders. A second concern is problematic patterns of over-consumption of non-sustainable resources due price declines and market-wide information sharing via social media;[4] Next is the extraordinary market power of near-monopoly digital sharing economy platforms that have obtained large global market shares in a short time. Further, there is a more limited potential for community sharing sites to grow and succeed due to their lack of capital, technical capabilities, and technology access. And finally, there is also a widespread and growing awareness of contested *openness and access*, as well as problematic *distinction* effects, from potential participants' social connections, and their race and class, ethnicity and education. Problems with social bonding and perceived fairness seem to be occurring for various platforms, in spite of the related intermediary's promises to promote sharing economy values. This is happening due to ineffective internal oversight and the typical "tragedies of a commons" issues (Hardin, 1968).

It is also necessary to recognize that the sharing economy addresses different dimensions of the New Economy that go beyond the normal bounds of traditional e-commerce. So, this is not just selling and distribution, but also the co-creation of products and services (Somers and Baelus, 2018), new forms of distribution (like no hosts or renters to meet for Airbnb renters or bicycle sharing),

This Research Commentary will provide insights in five important issue areas related to the

[3] Belk (2014a) has noted that quite a few firms that operate "sharing platforms" for communities don't actually "sharing" in a strict sense. They include longer-term renting and leasing firms (for cars, vacation houses, etc.); short-term rentals and hires (again, for cars locally, but also paying a fee for baby-sitting help) as opposed to pure exchange without compensation; data sharing based on the acquisition of a user's private preference information, and websites that support P2P bartering.

[4] This phenomenon is referred to as the *Jevons effect*, which reflects how lower prices and increased consumer access to limited-supply resources can result in over-use and inappropriate exploitation. This can damage ecosystems, harm threatened species of wildlife, and diminish the value of unprotected spaces. One examples of this includes the Indonesian government's April 2019 decision to close Komodo Island from January to December 2020 due to excess tourism and declining habitat quality for its endangered species of large Komodo dragon lizards. Though this decision was later rolled back in October 2019, other countries closed and adjusted access to key tourism destinations due to their over-use and concerns about environmental impacts. Two examples are Denmark's Faroe Islands, which has instituted new fees and land use restrictions for hiking, as well as Thailand's uninhabited Phi Phi Leh Island, which closed a beach on Maya Bay that has been damaged by over-use.

sharing economy: the economics of sharing; the nature of sharing economy industries, products and services; the technology platforms used in the industry and some of their technical considerations related to them; the business models and regulatory issues faced by firms within the section; and the researcher topics and directions that we think are important make progress with respect to them. We also offer many citations and reference entries that reflect interdisciplinary research, sharing economy firm details, and industry and government agency perspectives.[5] The overall purpose of this work is to encourage readers of the journal to begin to develop unique, valuable and more well-informed research on things that truly need to be examined more carefully in technical, managerial, economic, organizational, behavioral and policy-making terms. This article is also intended to contribute to a special issue on "The Sharing Economy," to be published during *Electronic Commerce Research and Applications*' 20th anniversary since its founding during the Dotcom era.

2. THE ECONOMICS OF SHARING

Some of the characteristics of today's sharing economy include: temporary access to content; the transfer of economic value from the owner to the user, renter or beneficiary of sharing; multi-sided technology platform-based mediation; the expanded role of consumers; and crowdsourced supply (Eckhardt et al., 2019).[6] In this section, we will discuss some basic economic principles of the sharing economy that reflect how it operates and how a variety of stakeholder are able to obtain benefits from it that have never been available previously through such highly technological means to acquire them. We also will point out a number of research direction for this domain of study that address key issues that have been observed that can be dealt with based on past research.

2.1. Key Economic Principles for the Sharing Economy

There are a number of fundamental economic principles associated with the advent of the sharing economy that have been recognized over the years. In an early and influential published article in the *Journal of Industrial Economics*, Varian (2000) made an observation that presaged the pending arrival of the sharing economy around the world later in the 2000s:

> *Information goods, such as books, journals, computer software, and video tapes are often rented or shared, and there are several social institutions such as libraries, video stores, and used book stores that facilitate such sharing. It is sometimes thought that the existence of institutions that facilitate sharing is bad for the original producers of the goods. However, on reflection this is not so obvious. It is true that the presence of a library may reduce the demand for purchases of books, but because there are many readers who benefit from a library's purchase of a book, the price the library is willing to pay will generally exceed the price that individual users would be willing to pay.*

[5] For other valuable background, the reader should refer to Belk et al. (2016a), Codagnone et al. (2018); Goldfarb et al. (2015), Cramer and Kreuger (2016); Malhotra and van Alstyne (2014); Marchi and Parekh (2015), Manyika et al. (2016), Parker et al. (2016); PWC (2015); and Sundararajan, 2013, 2016).

[6] Another facet is *value co-creation*, involving consumers who help the sharing platform intermediary to enforce rules that maintain order with asset sharing (like for bicycles) via user trust and reciprocity (Lan et al., 2017), ethical participation of consumers (Nadeem et al., 2020), and intention to continue to use the same sharing service (Shao et al., 2020).

He noted three different circumstances in which a seller's profits are likely to increase in most markets (Varian 2000, p. 473):

> "(1) *when the transactions cost of sharing is less than the marginal cost of production*; (2) *when content is viewed only a few times and transactions costs of sharing are low; and* (3) *when a sharing market provides a way to segment high-value and low-value users*."

Filippas et al. (2020, p. 4) explored another important aspect of the sharing economy that provides a context for asserting fundamental theory on owning, using and renting durable goods. They offer the following theoretical interpretation for how ownership, rental and sharing seem to work:

> "*Although goods are durable, they are eventually used up and have to be replaced. In the presence of the P2P rental option, owners can make a different choice and become renters, and non-owners may decide to buy. … We find that if the short-run rental rate is below the purchase price, then ownership becomes less attractive and decreases in the long-run relative to the short-run, and vice versa. This result also offers an intuitive test for whether total ownership will decrease in the long-run. Ownership adjusts so that the long-run rental rate equals the purchase price. As a result, owners and renters receive the same utility at the margin, thereby decoupling individual preferences from ownership. … While ownership may increase or decrease in the long-run, the option of renting out an owned good makes ownership more valuable. As such, a P2P rental market can have a market-expanding effect, in the sense that it allows a previously infeasible product market to emerge. The reason is that the rental option can generate positive purchase demand at a price that exceeds all consumers' pre-'sharing' valuations.*"

Their theoretical perspective was affirmed by Benjaafar et al. (2019), who further indicated that consumers with higher ownership and usage levels are more likely to be observed when the cost of ownership is high, and that the difference in social welfare is not large when profit-maximizing and social welfare-maximizing platforms are compared. Earlier, Galbreth et al. (2012, p. 603) analyzed how social sharing of durable goods seems to work and pointed to the importance of social groups as opposed to individuals as the target for a sharing platform's pricing strategy. The authors state that when sharing becomes beneficial at the margin will depend on the sharing group size and social network structure, along with how group decisions are reached. They also indicate a limit to value of sharing in such a market as the unwilling nature of some consumers who decline to participate for ethical reasons.

The literature on firm strategy in the sharing economy has become rather well-developed over the course of the past decade. For example, Jiang and Tian (2018) recognized that the rental of a durable good for sharing by others via a sharing economy platform is largely founded on the rental fee net of the associated transaction costs is greater than the owner's value obtained through their own self-use. This especially pertains to shared accommodations, but also to other things like power tools and seldom-used kitchen appliances. Another effect occurs with respect to the firm that produces the durable good. It will benefit in terms of profitability by enhancing the quality of a durable good that it sells to make it more attractive for the sharing market, and to diminish its own costs of maintenance in sharing uses.

Weber (2016) used an overlapping generations model to analyze sharing economy product pricing and consumer choices with respect to durable goods purchase versus rental, involving owners who are

willing to share them. He focused on the demand for ownership, product price patterns, and the participants' payoffs in terms of consumer surplus, profits, and social welfare. He showed how retailers and manufacturers can potentially gain when a sharing platform creates a secondary market for goods. An important finding is that a sharing market can result in increased prices for new products, but this depends on a retailer's willingness to commit to after-market support for product sharing. In addition, higher-cost products tend to have proportionately lower prices, while lower-cost products are unattractive for the producer / manufacturer and intermediary to share. His modeling results show that a second market for product sharing beneficially increases consumer surplus and social welfare, which makes collaborative consumption worthwhile to promote in government policy terms.

Raghezian and Weber (2019a) studied sellers of durable goods in terms of their dynamic pricing strategies as demand and supply change. The sellers are assumed to use second-price discrimination, which focuses on the setting of different prices for different quantities with discounted bulk sales. In this kind of setting, sellers / intermediaries will construct consumption bundles with rental and purchase options. The authors reported that, as the marketplace moves from private ownership to collective consumption, sellers of durable goods will shift "*from unbundling (offering exclusively rentals), via mixed bundling (offering the options of rental and purchase side-by-side), to pure bundling (offering purchase*[*s*] *only).*" They further note that the propensity for peer-trading, the firm will prefer "*a cultural transition to an access-based economy. The underlying reason is that the asset base of a sharing economy ultimately depends on the firm's output, so that a portion of the anticipated rents from sharing can be captured*" by the seller / manufacturer (p. 1).

Another thread in this literature is related to "optimal durability" of goods involved in sharing. Raghezian and Weber (2019b) showed that consumer purchase decisions are strategic, in that they will take into account whether a second product market for sharing exists. In its absence, a manufacturer will prefer designs for greater product durability when production cost is relatively high. In contrast, a manufacturer will prefer to limit durability for low-cost products, so that a secondary product-sharing market will not emerge. And finally, when a sharing market is available, a manufacturer will never wish to limit product durability, which suggests that a sharing economy ought to be characterized by sustainable product designs to a greater extent than we may see in a traditional market.

There has also been research that has focused on sharing economy platform intermediaries that have become involved in transactions for many durables (e.g., real estate, autos, lawn-mower sharing, etc.), and who face the problem of sharing practices that involve unobservable actions by renters that may result in undesirable moral hazard. Weber (2014) developed theory that suggests such platform intermediaries can neutralize the financial value impacts of sharing practices on firms that finance the purchase of durable goods by offering insurance for a fee, when the durable goods are vertically differentiated in their quality levels, and renters are observed to take different levels of care with the

shared asset. In a model of that involves the consumer's choice between collaborative housing and staying at a nearby hotel, the intermediary is shown to be able to extract gains that the hosts would gain in comparison to direct host-to-renter transactions. The author further shows that sharing that is handled by an intermediary is economically sustainable, when the host sets its own fee and the sharing platform decides on the price for renter's insurance.

In addition, Weber (2017) examined the economic mechanism associated with sensing, monitoring and authorizing product transfers between consumers, to enable firms to strategically participate in after-market processes for their products when they are shared in the sharing economy marketplace. He refers to these shared durable goods as "smart products" and noted that the diminished demand for ownership may not yield higher profitability for the producer firm, even when it includes a "positive sharing tariff," though the creation of after-market product intelligence for the producers that creates greater firm informedness (Li et al., 2014).

2.2. Perspectives for Identifying Future Research Directions

We considered what future research directions in this Research Commentary will be worthwhile to discuss, as we developed this article. Usually, authors are silent in terms of how they arrive at the future research directions that they propose in an article. There are many ways to do this, of course, as we have seen in in our own work, and by observation of what others do, and what may make the most sense to do in a given context. With these things in mind, we propose: (1) What is the purpose of the research directions that are proposed? (2) Do they address real problems at, or beyond the current state of research and practice knowledge? (3) What is new and why will the proposed research matter? (4) Who will care? If the research agenda succeeds, how will the new knowledge that's generated make a difference? (5) Are some stakeholders more important than others? (6) Will the proposed direction of work result in new scientific, practical or policy knowledge for the context – or both? (7) And, can the work be done in a time-frame that is relevant for informing industry, government, and research organizations about issues?[7]

The purpose of the research questions that we will lay out is to create a future basis for understanding primary issues in the sharing economy through the interdisciplinary Technology, Social Science, Economics and Policy perspectives. Other topics are interdisciplinary in nature, so they cut across multiple disciplines (e.g., the psychological aspects of pricing mechanism design, the need for more emphasis on reputation and recommendation fundamentals to strengthen platform functionality, and so on.) Based on our backgrounds and interests, we place less emphasis on Behavioral and Computer Science research perspectives for defining the research directions (which can and should be subjects for separate study). We require that what we do should have powerful elements for "research

[7] The questions we have laid out were partly motivated by the 1970s, Defense Agency Advanced Research Projects Agency (DARPA) Director (1975-1977) George H. Heilmeier's (1992) vision of a useful guide for research evaluators vetting of million dollar-plus funding proposals related to new projects received by his agency. His "Heilmeier Catechism" (DARPA, 1977) has come to be a mainstay for those who are asked to review scientific proposals and justify their funding.

translation," so it is relevant for practice and the professional learning community, as well as for researchers. In our present work, we have sought to identify pressing problems, and leading issues in industry and subsector settings that our work with the literature, the business press, research and policy agency report indicate matter in a balanced way to the scientific, practice and policy contexts and their stakeholders. In contrast, it is likely to be the researchers who actually tackle the research problems to figure out what meaningful new knowledge that their work can deliver in the foreseeable future, while they strive to keep ahead of practice. Indeed, this is the benefit of undertaking forward-looking theory development and CS / design science research that yields new perspectives and novel artefacts that industry will need to catch up with in terms of finding applications in their business.

3. WHAT IS SHARED? AN OVERVIEW OF INDUSTRIES, PRODUCTS AND SERVICES

We next provide an overview of the industries where sharing platforms have been adopted and the range of products, services and other things that are currently being offered offered. We also discuss the motivation we had for our selection of key products, services, and industry sectors to showcase.

3.1. Digital Business Basics in the Sharing Economy

Before getting into the industry sectors, activities and companies that are involved in providing the kinds of things that one can observe in today's markets, we first will more broadly discuss the challenge of business strategy in the sharing economy marketplace today. Our observations are based to some extent on our prior analyses of the Dotcom boom in the late 1990s and early 2000s, when we identified the impetus for the emergence of a new generation of digital intermediaries and the rise of two-sided platforms (e.g., eBay and Amazon) and later multi-sided platforms (e.g., Apple iTunes and Hulu) (Chircu et al., 2000). We called this the "eBay of Blank," with the idea that digital commerce entrepreneurs ultimately "filled in the blank" with all sorts of things (e.g., electrical circuit boards, plumbing equipment, women's clothing and accessories, rock-climbing gear, used bicycles, new automobiles, and so on).[8] Our argument here is analogous for the sharing economy, though we think of the present context as being more like the "Airbnb of X."

It is important to recognize that identifying what "X" is for the sharing economy isn't the same as defining a business model, nor is it the equivalent of figuring out the details of a strategy that can deliver profitability. Magretta (2002), in an influential *Harvard Business Review* article on "Why Business Models Matter," reminded her readers that business models are supposed to tell a compelling story that investors and consumers can believe in to solve problems in the marketplace better than others heretofore were able to. She further cited Peter Drucker's questions as ones a good business model has to answer: "*Who is the customer? And what does the customer value? It also*

[8] The idea is that entrepreneurs have made an attempt to identify what kinds of assets and products, services, processes and social innovations can be brought to market in the ways that Varian (2000) and others wrote about. This is evocative of our earlier proposal for the "eBay of Blank" (Chircu et al., 2003), though we recognize that it is not a total fit due to the various sub-categories of sharing economy business models that have been noted.

answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?

She further argued that business models should be assessed in terms of two things: (1) a "narrative test" about whether the story of the business is convincing to investors and customers, and (2) a "numbers test" to see if the relationship between profit and loss makes any sense. Failures happen with many businesses that have great stories but fail to deliver sound financial performance, by not achieving sufficient market penetration and growth. Of key importance, Magretta (2002, p. further argued, is a competitive strategy which "*explains how you will do better than your rivals. And doing better, by definition, means being different. Organizations achieve superior performance when they are unique, when they do something no other business does in ways that no other business can duplicate.*"

The same things hold true for the business models and firm strategies in the sharing economy. Only there has been much greater awareness that creating a sharing platform is never enough for a business to succeed – in fact, author Michael Lewis (1999, p. 256-257), wrote that a business model is "*one of those terms of art that were central to the Internet boom: it glorifies all manner of half baked plans. All it really meant was how you planned to make money.*"

This is especially true in light of the "realities on the ground," such as customer acceptance of the psychology of renting and sharing but not owning, the inevitable problems along the way with identity building and competitors, getting the pricing model to work, and creating a social media following through which to target sales.

3.2. Industries Most Impacted by the Emergence of the Sharing Economy

The sharing economy has the potential to spread across all industries, wherever an individual has something to share, but appears to be more appropriate for some sectors than others, especially where it is appropriate to operate a technology-based platform. A possible explanation for that is due to Gansky (2010), who considered two dimensions that determine the chance of success of a peer-to-peer rental platform: the product cost as a proxy for its value and its frequency of use. High-value, low-use products are the most likely to be shared, since their owners do not need them all the time and require a large incentive to share them. On the opposite side are those products that have low value and are used extensively. We next examine the industries where sharing practices have emerged and see how they fit into this scheme.

According to the recent PWC report, "Share Economy 2017: The New Business Model" (Beutin, 2017), the sharing economy has become pervasive in several industries. (See Figure 1.) It suggests that a sharing economy usage share close to or larger than 20% occurs in four different industry sectorss: Media and Entertainment, Accommodation and Hospitality, Transportation, and Retail and Consumer Goods. (See Table 1 for the industry sectors and Table 2 for representative products and service, intermediaries and a sampler of the firms involved.)

Table 1. Sharing Economy Usage within the Different Industry Sectors

Industry Sector	Sharing Economy Usage Shares (2017)	Comments
Media and Entertainment	28%	The highest-adopting sector of sharing economy business models and operational methods includes such firms as Apple, Spotify, Vimeo, Soundcloud, Microsoft, Youtube, Netflix and many others. These industry players have achieved high capitalization and well-known capabilities for competitive in a variety of newly-vulnerable markets (Clemons et al., 2008).
Accommodation and Hospitality	20%	This sector has seen manage changes and the entry of new intermediaries, such as Hotels.com, Airbnb, Booking,.com, Priceline, Vrbo, HomeAway, Hostelz, Hostelworlds, and Hotwire. The incumbent firms in the sector were once again the targets of new technology-based and information-based strategies that rendered them vulnerable to new entrants with updates tech infrastructures, attractive-to-attack incumbents, and new customer profitability gradients that could be exploited with innovative ways to acquire once-inaccessible customer data and information (Granados et al., 2008).
Transportation	19%	The consumer side of this sector has been transformed due to ride-hailing, delivery-request, airline ticket booking, and car-sharing platform players, such as Didi Chixing, Uber, Lyft, Grab Taxi, RVShare, Orbitz, Expedia, Priceline, and Travelocity, among others. The markets in which these firm operate have also been subject to tremendous competitive pressures on the incumbent taxi, auto delivery and other transport services-sharing companies (Guo et al., 2019)
Retail and Consumer Goods	19%	The original player to have transformed this marketspace was eBay, which created a multi-sided market platform model that has been extensively adapted to implement "eBay of blank" opportunities for new entrants to participate in many market settings (Chircu et al., 2000). The difference today is that the main changes in the market have been to more focused sellers of second-hand clothing and fashion, books, and a variety of electronics and computer equipment, such as Etsy, Bag Borrow and Steal, and Gwinnie Bee, among others.
Services	14%	Just as we have seen Airbnb's business model take hold in the sharing economy for hospitality, so too is there an "Airbnb of X" phenomenon that has been at work in other service sectors, such as babysitting and childcare (Babierge, UrbanSitters), labor sourcing (Elance, Fiverr), space (Roomarama, WeWork), pet services (ShareYourPet) and food delivery (UberEats), etc. This sector offers many opportunities for entrepreneurs but is highly competitive due to the differentiated nature of the assets and specific services that are provided, unless ride-sharing and crowdsourcing of loans and capital.
Finance	11%	The Fintech Revolution has resulted in many new financial services entries that have built business models around sharing economy concepts, including crowdsourced capital, P2P loans, microfinance and other payments-related activities (Gomber et al., 2018). Some of the leading firms include Kiva, Klarna, TransferWise, Lending.com, Prosper, Funding Circle, Kickstarter, Patreon, GoFundMe, and others.
Machinery	10%	This is a somewhat less well-known section that involves B2B sharing as opposed to P2P or B2C sharing economy plays. The sharing economy functionality of firms in this sector is much less well-developed. Some leading players for machine and production mechanism sharing include: V-Industry, Fabrikado, KlickRent, and Yard Club (Eschberger, 2020).
Note: Partly adapted based on data from Beutin (2017).		

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Table 2. Sharing Economy Product and Service Examples and an Overview of Intermediaries

Sharing Sectors	Focal Products and Services	Intermediaries Involved	Representative Companies
Goods	Purchased goods, tools, sporting goods, electronics, computers, furniture, books, audio content	Booksellers and websites, stores, firms, Internet-based sellers, home furnishers, sporting goods exchanges	SidelineSwap, eBay, Spartoo, Fluugo, Inhabitr, Project Gutenberg, Internet Archive, Overdrive
Services	Pets, telecom, childcare, office set-ups, social media, food, human wellness, plumbing, fix-it, professional services, labor and hiring, space	Kennels, stores, websites, healthcare providers, space brokers, baby/pet-sitters, home services, other services provider groups	WeWork, ShareYourPet, UrbanSitters, Care.com, Elance, HourlyNerd, HomeAway, Roomarama, Uber Eats, LiquidSpace
Experiences	Innovations, e-games start-up investments, sightseeing, vacationing, organized athletics, work-outs, reading, learning and instruction	Idea exchange, travel groups, sports clubs, book clubs, language / math tutoring, online gaming competition	Goodreads, Our Shared-Shelf, Young Minds, Book Club, Books at Work, Toornament, World Gaming, Battefy
Money & Finance	Saving, investing, insuring, funds transfers, sending money overseas, contributing donations, P2P crowd-funding, collaborative finance	Banks, brokerage firms, angel investors, money intermediaries, fintech innovators, charity organizations	Prosper Marketplace, Lending Club, Upstart, Funding Circle, Kiva, Accion, GoFundMe, Kickstarter, Transfer-Wise, Azimo, World Remit, AngelList, SeedInvest
Transport	Bicycles, cars, motorcycles, RVs, 4WD vehicles, electric vehicles, delivery vans and trucks	Auto dealers, vehicle repair and services companies, driving instruction, ride-haling and car-exchange platforms	JustPark, Uber, Lyft, Grab Taxi, GoGoVan, RVShare, Blablacar, RidersShare, GoGet, ShareNow, Zipcar, Didi Chuxing, OFO
Communities and Agriculture	Energy production and sharing, support of sustainable technologies, creation of multi-sided energy platforms and agtech services	Electricity grid networks, solar energy trading, wind power trading, sustainable energy services intermediaries, traceability middlemen ,	PowerPeers, Power Ledger, Sun Contract Platform, Electrify, Orsted, EnergyPost, FoodLogiQ, Label Insight

Note: Content adapted and expanded from Kamilaris and Prenefeta-Boldú (2018).

In the Media sector, for example, the most well-known brands are Hulu (www.hulu. com), Spotify (www.spotify.com), and Netflix (www.netflix.com). Consumers pay for listening to music or watching a video but do not obtain property rights on what they wish to consume. Instead, they only are able to gain temporary access to the digital content. And this suggest why some have referred to the developments that we study in this article as the "access economy" instead of the sharing economy (Stepanek, 2018).

Similarly, in the Accommodation sector, the most widespread service is renting out a room. This can be seen as a massive diffusion of the classic Bed & Breakfast accommodation and hospitality model, but in some cases, there is a complete home exchange rather than simple cohabitation and sharing. In this sector, the most well-known brand is Airbnb (www.airbnb.com), with USD 2.6 billion in revenues in 2017 (Lima, 2019), and USD 4.3 billion for the year through August 2019 (AllTheRooms, 2020). In contrast, two other companies act as intermediaries for free hospitality services. They include: Couchsurfing (www.couchsurfing.com), which was launched in 2003 and reached 15 million users in early 2018, with about 4 million users per year (van Brugen, 2018); and

the volunteer organization, BeWelcome (www.bewelcome.org, 2020), which had 125,626 users at the end of 2019.

Other sharing economy platforms in the Accommodations sector are intended for more specific categories, such as WarmShowers (www.warmshowers.org), which is devoted to cyclists, Hostwriter (HostWriter.org, 2020), which focuses on supporting journalists so they can collaborate across national borders, and the Evergreen Club (www.evergreenclub.com), a bed-and-breakfast homestay service that serves adults over 50 years old (Zipkin, 2016). A variation of the paid scheme is the case of exchange of hospitality for work, as in the case of TrustedHouseSitters (www.trustedhousesitters.com), where guests are asked to take care of pets, or WWOOF (wwoof.net), where guests work on a farm. The most relevant example of an accommodations exchange platform is HomeExchange (www.homeexchange.com, 2019), which advertises 300,000 homes. Though the most visible impacts on the Accommodation sector is to undermine the business of hotels, Fang et al. (2016) have shown that the most-impacted ones are low-end hotels, but there is a side positive effect on tourism business, since the number of tourists, as well as their overall spending increase (Zervas et al., 2017).

The Transportation and Retail sectors are close, in third place. As to the Transport sector, the services that are supplied can be grouped under three categories: driving services, vehicle rental, and parking space rental (Tart et al., 2018). In the driving services category, the most well-known brand is Uber (www.uber.com), which provides a taxi-like transportation service and had market shares of between 74% (September 2017) and 69% share of the U.S. ride-hailing market (plus or minus) over the past four years (Statista, 2020a).[9] Meanwhile, Uber's competitor, Lyft (www.lyft.com), had a 30.3% share in 2019, according to a corroborating source (Zacks, 2019). Elsewhere, Didi Chuxing (www.didiglobal.com) started up in the Chinese market, where it took over Uber's nascent Chinese operations several years ago (Soo and Perez, 2016). More recently, it has moved toward establishing operations with greater international scope, including other large countries such as Brazil, Mexico, and Australia (Dai, 2020). A variant of the typical ride-hailing services is known as *carpooling*, which was proposed by BlaBlaCar (2020a, 2020b) (www.blablacar.com). Its services allow more persons to share a journey in a car that would otherwise have empty seats. BlaBlaCar claimed to have 70 million members in 22 countries and over 25 million in the U.S. ride-sharing market by the second quarter of 2019 (Vleugel, 2019).

A lesser-known but nevertheless active service niche is car rental, in which an individual can rent a car owned by another person. Examples of companies offering such services are Turo (https://turo.com) and RVShare (rvshare.com). The latter specializes in recreational vehicles (RVs) such as motorhomes and caravans. Individuals can also rent out their unused parking spaces through the JustPark platform (www.justpark.com), which had approximately 2.5 million registered users

[9] Ride-sharing market shares are typically denominated in terms of monthly or quarterly active platform consumers served (Vleugel, 2019; Zacks, 2019).

(The Mill, 2019). An unusual mixture of some of these business emphases was proposed by ForestCar (2020) (www.f6s.com/forestcar), which provides free parking services at airports in exchange for renting out one's own vehicle.

A number of empirical research studies have examined the impacts of the ride-sharing market in different regions of the world. For example, Snelling (2019) found that car-sharing social benefits, especially for improving the quality of life for older citizens. Shaheen et al. (2018) reviewed the North and South American transport-sharing markets, and provided numerous insightful descriptive statistics on the number of operators, their fleet sizes, vehicle and member growth to gauge how many customers are served per car available, the countries where they penetrated, and the substantial dominance of for-profit business models. In addition, Guo et al. (2018b, 2019) examined the case of Didi Chuxing and Uber's impacts on the new car market in 51 Chinese cities from 2013 to 2015. They found that cross-platform competition led to modest initial but non-sustainable longer-term growth in new car sales. This sector has now had a lot of research attention, including in this journal and others in various disciplines (e.g., Bielinski and Wazna, 2018).

In addition, Schmidt (2019) has noted that one additional car-sharing vehicle may reduce the number of new car sales by 2% to 4.5% per year. Similarly, participants in car-sharing schemes own fewer cars than non-participants (Becker et al., 2018), with 20% of people likely to give up a planned car purchase or shed a current car when a suitable car-sharing system becomes available (Liao et al., 2018). Other related works suggest that car-sharing has beneficial marginal effects on reducing *green-house gases* (GHGs) (Jung and Koo, 2018) and overall energy use in transport services, while the marginal effects on employment and regional growth are unclear (Chen and Kockelman, 2016).

In the Retail sector, the emphasis is not so much on sharing goods, but actually transferring the ownership. This is known as *collaborative consumption*, where individuals prolong the useful life of goods that they no longer use by selling them to other individuals (Belk, 2014b; Matzler et al., 2015). The peer-to-peer features of sharing systems are present in this approach (Botsman and Rogers, 2013). Such a scheme has always existed in the form of flea markets, garage sales, and car boot sales, but they recently gained a worldwide dimension through the use of technology platforms on the Internet. The most well-known case is eBay (ebay.com) (Chircu et al., 2000), with revenues over USD 10.8 billion in 2019 (Statista, 2020b). Also, Etsy (etsy.com), which specializes in handmade or vintage products and reached revenues slightly over USD 812 million in 2019 (Statista, 2020c). Examples of specialized platforms are Poshmark (poshmark.com), Gwinnie Bee (closet.gwinniebee.com), Rent the Runway (renttherunway.com), and Bag, Borrow or Steal (bagborroworsteal.com) which are devoted to used fashion and second-hand clothing and

accessories.[10,11]

A notable recent study is due to Hall and Kreuger (2018), who studied Uber's driver-partners, who are attracted by the flexibility offered by its business model, and reasonable levels of compensation (though not all agree about salaries). They noted that many of Uber's drivers previously had part-time jobs, so the platform's flexibility so drivers could set their own work schedules increased the value of their jobs.The authors also reported that Uber's driver-suppliers also had positive views about the relative stability of their income for the hours that they worked when they chose to drive.

Zha et al. (2016) also studied ride-sourcing and urban mobility services, and reported that sharing economy platform firms (e.g., Lyft and Uber, when they are not regulated by the government, will be able to maximize the joint profit they earn with their drivers. This will not occur, however, when the match function these use for potential passengers and available drivers exhibits increasing returns to scale, and the platform's cost function is subject to economies of scale. They also reported that under a variety of different market scenarios, the average waiting time for customers is an increasing functionthe of the average search time that drivers face to find riders. Their work also has implications for more competition among ride-sharing platforms: it doesn't always diminish the price levels that will be observed or improve social welfare – as is the case in other competitive markets. In addition, their study has shown that regulators may prefer merged platforms over competing platforms, and then to regulate the former as a monopolist in the market.

3.3. The Essence of Innovation in the Sharing Economy

The sharing economy seems to have brought about four different kinds of innovations: service, product, process and social innovations (Sanzo-Perez et al., 2015, Tidd and Bessant, 2013).[12]

3.3.1. Service Innovation

Incremental and disruptive innovations that have been pioneered by sharing economy firms are all founded to some extent on the dynamic capabilities of the firms' technical architectures, supporting their ability to move rapidly in one direction or another to be among the first in the market to seize new business opportunities (Gazolla, 2017). The result of such movement has resulted in historic

[10] For additional details on this sub-segment of the market, the interested reader should see Kamilaris and Prenefeta-Boldú (2018), and Albinsson and Perrera (2018) more generally.

[11] Hamari et al. (2015, p. 2048) have characterized collaborative consumption activities as having emerged "from a number of technological developments that have simplified sharing of both physical and nonphysical goods and services through the availability of various information systems on the Internet." They point to the following reasons for why people are willing to engage in this kind of behavior, especially to: (1) mitigatesocietal issues such as hyper-consumption, pollution, and poverty through allowing people to lower the economic coordination costs that they face within the communities in which they participate; (2) to benefit from the sustainability in a community of participating in a variety of kinds of social sharing that involve positive attitudes from the participants; (3) to enjoy the overall process of giving contributions and receiving benefits; and (4) to take advantage of the economic benefits, which may not be able to be obtained in any other way in a cost-effective manner.

[12] Several other typologies of innovation have also been popularly discussed, however, without such specific applicability to the sharing economy. They include, for example (among others): employee, customer, partner / supplier, competitor and public innovations (Morgan, 2017-2018), as well as sustaining, incremental, disruptive and radical innovation (Christensen and Raynor, 2003).

shifts in industry service innovations overall, with many new entrants, but also the invigoration of incumbent firms to also find path toward making their own new modes of services. (Ciulli and Kolk, (2019, p. 995) have argued that incumbents must respond to the new ultimatum of the marketplace: "share or die." And with that in mind, incumbents have sought to reposition themselves to achieve higher value creation for existing customers; refocus on the acquisition of new customers; pursue the reduction of costs of internal processes; and the explore the possibility for developing a reputation for being more sustainable organizations.

In addition, there have been many notable new entrants. Some examples of the innovative sharing economy companies to arise over the years include:

- a sustainable business model for the fashion industry through clothing and accessory rentals (LENA, the Fashion Library, Netherlands, lena-library.com);
- a multi-platform site that specializes in lending household appliances and items (Peerby, Netherlands, peerby.com);
- a food services waste-reduction platform that supports sharing restaurant and market left-overs with organizations and people in need (OLIO, U.S. and U.K., olioex.com);
- a P2P rental platform for luxury goods, such as high-end cameras, cruising sailboats, and other bundle-able products and services for the "good life" (Mutterfly, India, Mutterfly.in)
- a C2C sharing community platform, representing household assets, such as fondue sets to power tools to lawnmowers to golf carts, all available as community members connect with their neighbors (StreetBank, U.K, streetbank.com); and
- a digital exchange for matching empty and available car parking spaces at cut-rate prices for urban drivers in need of them (WesmartPark, Spain, wesmartpark.com).

These all go beyond the most well-known companies, such as Airbnb (accommodations), Uber (ride-sharing), and Elance (on-demand labor) – in the shift to sharing in the global marketplace.[13]

3.3.2. Product Innovation

As we pointed out in the previous discussion, the sharing economy is largely associated with service provisioning rather than creating or manufacturing new products. However, sharing an asset can have some indirect consequences for product innovation.

An instance is the sharing of working spaces. As investigated by Bouncken and Reuschl (2018a, 2018b), working closely with other people in a shared workspace may help a person to finding potential mates for teams and projects, though co-working settings may also allow for the leakage of ideas and lead to overall distrust. Such *opportunism*, often referred to as *knowledge leakages*, is more

[13] For a constantly-updated source of information on venture capital fund-raising for services-related sharing economy and on-demand economy start-ups that need capital and venture capital firms that can supply it, the interested reader should see Index by TNW (index.co, 2020). TNW also offers a free list of 50 large sharing economy, as well as a complete list, for each of the sharing market sub-sectors it tracks. Other listings are widely available as well, such as from VentureScanner (www.venturescanner.com), that cut across the multiple categories discussed at the outset of this section.

often observed in R&D alliances of different forms (Sampson, 2004; Frishammer et al., 2016). Yet in the sharing economy context, opportunistic knowledge leakages can lead to spoiled entrepreneurial efforts to create new products, damage support for unexpected innovations, and undermine trust and community building to enable a start-up organization to succeed.

Another secondary effect that has led to a lot of public debate is that car-sharing leads to having fewer products that are used more intensively. For example, car-sharing implies that fewer people will need to own a car, which ought to result in there being fewer cars that are purchased (Schiller, 2014). However, those cars that are shared are likely to be used more often, making it so they are subject to more rapid obsolescence and performance failures. Indeed, the expected negative effect is that such products not only will deteriorate faster but also will need to be replaced sooner, ultimately leading to slower but still positive growth in the industry's sales (Grosse-Ophoff et al., 2017). In the end, this may turn out to have a positive effect in the context of a circular economy, since such products can be replaced more often by newer, more economical, higher quality, and more environmentally-friendly ones, spurring product innovation in products (European Environment Agency, 2017).[14]

In light of the product innovations that have been linked to the sharing economyone must also consider the sharing of advanced technology products, which is a means of fostering innovation in products, such as the case of drones. For example, Ganapati and Reddick (2018) reported on the case of Fly4me (http://fly4me.be) and Sky-Watch (https://sky-watch.com), and the investments sharing companies themselves have been making into high technology, such as the case of Uber with self-driving cars (Tussyadiah et al., 2017).

3.3.3. Process Innovation

According to Tidd and Bessant (2013), *process innovation* is all about the way that goods and services are created and later delivered to customers in the marketplace. Gomber et al. (2018) have discussed the importance of process and technology innovation related to the "Fintech Revolution," for example. They indicated that the essential paradigm shift in the marketplace is that technological innovation often impacts processes, which results in disruptive forces that ultimately transform the nature of strategy, business, and society.[15] This idea applies with equal force and validity to the many transformations that characterize how digital commerce works in the sharing economy. Consider, Uber, Lyft and Grab Taxi, for example, though which ride-hailing has been made possible by mobile phones, software apps, and a multi-sided technology platform involving customers, ride-share transport drivers, and the institutional features that have made it possible for digital intermediaries to create new revenues and profits in an entirely transformed marketplace for consumer-level transportation services. The same goes for the impacts of technology for arranging private lodging

[14] To get a sense of the generality of this argument, the interested reader should see the example of washing machines reported in Potting et al. (2017).

[15] For a parallel interpretation of many different sectors that include the sharing economy and other aspects of digital comment, see Clemons et al. (2017), who discuss the information-driven transformations of strategy and society that have been observed in many different countries around the world.

and hospitality services typically for price-sensitive travelers.

Satopaa and Mehrotra (2018), in a position paper presented at the World Economic Forum several years ago, have suggested that the term "innovation" is most often used to mean product innovation, like an OLED television, wearable sensing technologies, or electric vehicles. In contrast, process innovations have typically been viewed as being most application within companies, especially with respect to improvements in their operations, sales, supply chain and accounting activities. In the past 30 years, however, process innovations have migrated beyond the boundary of the firm

They have taken the market by storm. Examples include business-to-consumer (B2C), business-to-business (B2B) and consumer-to-consumer (C2C) e-commerce, social networks and social media activities, digital telephony, and all kinds of audio (music) and video (movies) file-sharing and platform-based shared services (cloud computing). Uber, Lyft and Grab Taxi, in the ride-sharing space, have been especially interesting in this respect, since they have rejected what Satopaa and Mehrotra (2018) refer to as the "asset-heavy" business models of traditional hotel and taxi service providers. They further point to a number of reasons as to why such sharing economy firms (among others) have been able to penetrate traditional markets, generate high profitability, and dominate their marketspaces. They include the following: low barriers to market entry; disruptive growth potential; the power of the sharing economy platform business model; the changes in bargaining power of incumbent firms; and the perceived and actual new environmental sustainability of their operations.

We have earlier referred to this phenomenon as one involving *newly-vulnerable markets* in digital travel services and online travel agent changes (Granados et al., 2008), for which the theoretical perspectives were developed earlier by Baumol and Willig (1981) and Clemons et al. (2003). The related arguments, including newly-vulnerable incumbents due to last-generation technical infrastructures, markets that are newly-attractive to attack by sharing economy entrants, and customer profitability gradients that can be leveraged through the acquisition of much more informative data about their actual preferences – from financial services (Clemons and Thatcher, 2008) and social media (Clemons et al., 2017), newly-available big data and computational social science analytics (Kauffman et al., 2017), and extraordinary sensing and data capture approaches involving digital traces of human behavior (Liu et al., 2010, Chang et al., 2014).

3.3.4. Social Innovation

According to industry research and policy pronouncements from the European Commission (2020), *social innovations* are defined as "new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively." Although this is often the case with the many successful firms that have made social media, social network, and online review service innovations on the basis of new technology infrastructure, big data, PCs and mobile phones, and software apps, such innovation efforts are not always directed to traditional e-commerce purposes and firm-level profitability goals,

though there may nevertheless be significant changes in technology components, products and services, and infrastructures (Adomavicius et al. 2008a, 2008b).

In addition, relatively newer research directions have been opened up that focus on some of the most pressing issues of our time, and related to our topic in this article, how sharing technology-related social innovations can be married with grassroots efforts made to drive the transition of economies to sustainable societies (Martin 2016, Martin et al., 2015), especially related to energy sustainability (Ornetzeder and Rohracher, 2013.; Seyfang and Haxeltine, 2014; Seyfang et al., 2018). Another interesting aspect of the sharing economy was suggested in Frenken and Schor (2017, p. 6), who also commented on sharing platforms in the sustainability projects and community efforts in terms of their economic, social and environment impacts. They asserted:

> [*T*]*here* is *something new about the sharing economy, … called 'stranger sharing.' Historically, although there are some exceptions, people tended not to share with strangers or those outside their social networks. Sharing was confined to trusted individuals such as family, friends and neighbours. Today's sharing platforms facilitate sharing among people who do not know each other, and who lack friends or connections in common. Stranger sharing consequently entails a higher degree of risk, and for many of these platforms the situations are quite intimate—sharing one's home or car, or eating food prepared by unknown cooks. The digital platforms are able to make stranger sharing less risky and more appealing because they source information on users via the use of ratings and reputations.*

Sabitzer et al. (2018) pointed out that sharing involves a number of problems that involve people acting with self-interest as opposed to their approach being based on goodwill toward their community. It further must have participants who do not take advantage of others without contributing to the shared good. In short, people need to act in a cooperative, sustainable and community-conscious way on behalf of the social good.

We are reminded of ecologist, Garrett Hardin's (1968) over-population parable, entitled the "tragedy of the commons." Due to over-population of sheep or cows on the village commons, negative externalities often arise. As a result, when individual farmers put one more animal out to graze on the pasture, the carrying capacity of the land will no longer allow all of them to have enough grass to grow and achieve good weight. The negative externality that is created will be manifest in the lower average weights of the grazing sheep and cows.

Sabitzer et al.'s (2018) key perspective is that social participation in sharing communities works like Hardin's commons, So, to achieve effective resource allocation and use, it is necessary to create a basis for avoiding unnecessary group conflicts that may arise when social sharing occurs.

Although Sabitzer et al. (2018) considered the problems of cooperation and resource allocation, they did not advocate strict rules and controls on participant behavior, they nevertheless encourage other researchers – as we do – to consider the importance of conducting research on social regulation in sharing economy activities, if and when such regulation seems to be warranted .[16]

[16] For additional perspectives on social regulation, communities, the sharing economy and sustainability, the authors, Erickson and Sørensen (2016) and McKee et al. (2018) offer appropriate paths to pursue in the interdisciplinary literature.

4. TECHNOLOGY PLATFORMS

Technology has played a huge role in allowing sharing schemes to work. In particular, *information and communication technology* (ICT) has enabled sharing schemes through a combination of advances, including increased computational power, and the ubiquity of personal devices (Sen, 2012). In fact, in the sharing economy, matching supply and demand, and setting prices at the same time are very complex tasks, whose difficulty grows nonlinearly with the number of participants in the sharing scheme. This is relevant when the requirement of real-time processing is added. In all mobility-related sharing contexts (e.g., ride-sharing, delivery scheduling), the need to have a response in real time cannot be minimized. Sharing platforms are able to cope with the array of tasks involved in match-making and pricing if their computational power is sufficiently large and their algorithms sufficiently fast to cope with the large size of the problems, due especially to the number of participants in the sharing scheme (Marr et al., 2016). In addition, the use of mobile devices is a strong requirement in many instances of sharing. And that's the case, again, for mobility-related services. Widespread mobile communication services have served as the enabler of those schemes.

In general terms, the success of the sharing economy seems to have been linked to the wide use of digital platforms, accessible either through the web and specific apps.[17] The intermediary role of such platforms has been extensively analyzed by Sutherland and Jarrahi (2018), who have provided a classification of the various feature that those platform offer as an enabler of sharing schemes. Their exhaustive list includes the following activities:

(1) generating flexibility, and the capability of the platform user to access the service fast and on-demand;
(2) match-making between supply and demand;
(3) extending reach, by having the service available to as many users as possible regardless of their number, geographical location, and device;
(4) managing transactions, which includes taking care of logistics, cross-currency transactions, security, etc.;
(5) trust-building through the establishment of the platform and an appropriate reputation scoring mechanism; and finally

[17] To gain an awareness of a variety of interdisciplinary perspective son sharing economy platforms, see Gawer (2014). She notes that the Economics discipline characterizes platforms as markets, from a demand perspective and with a focus competition. It views value as being created through economies of scope in demand, and the platform serves as a mechanism for coordinating transactions among buyers, with the overall empirical setting framed in terms of *information and communications technology* (ICT), an industry-level view. In contrast, the Engineering Design perspective views a sharing platform as a technological architecture from a supply perspective. The focus is on innovation and value is created through economies of scope in supply and innovation, while platforms coordinates interactions among innovators, and the primary settings for research are manufacturing and ICT operations. Another more psychological perspective on sharing economy participants is offered by Hellwig et al. (2016), who distinguished among four psychological types of participants: idealists with high reciprocity and high motivation; opponents with lower motivation who do the least sharing; pragmatists with average sharing behavior, the lowest degree of generosity and reciprocity, and no sense of financial duty to share; and normatives with average sharing behavior but high generosity and reciprocity.

(6) facilitating collectivity, through the birth and growth of a socially-connected community of users.

All these activities may slant toward either side of the user-platform relationship. For example, the service can depend heavily on a centralized platform or delegate as much as appropriate to the direct P2P interaction between service providers and consumers. Some of them have been investigated more than others though. For example, in their survey of the Computer Science (CS) literature on the sharing economy, Dillahunt et al. (2017) highlighted the relative lack of coverage of *human-computer interaction* (HCI), which has a significant impact on the user experience.

Match-making issues play a dominant role, which calls for fast and scalable algorithms. As pointed out by Boysen et al. (2019). some problems in match-making run in polynomial time, but some others are NP-hard, so that effective heuristics must be employed. In addition to the speed of the algorithms other important factors are the frequency with which users are updated (and new matches are made) and the quality of matching (Jungleworks, 2020). The latter issue will grow in importance as users are allowed to enter more constraints (e.g., their preferences for service providers or the specific features of the sharing service they wish to consume).

As we hinted before, match-making is particularly hard for ride-sharing services and similar business models as described by Agatz et al. (2012). Several problem features enter the picture: multiple and possibly conflicting objectives (minimizing the number of miles run, minimizing the travel time, maximizing the number of participants), users' constraints (timing of service, preferences for service providers such as preferring male drivers to female ones or vice versa, and preferences for service environment, such as the possibility of smoking), the stochastic nature of supply and demand, through the arrival processes of riders and drivers, the desire to anticipate future requests, and the possibility to deviate from planned trips. However, matching based on more sophisticated methods has been shown by Agatz et al. (2011) to provide a significant improvement over simple greedy matching.

The heavy requirements imposed on computing systems to cope with sharing schemes have spurred proposals to make changes in computer architectures, fostering the move from a system-on-chip approach to an optical-network-on-chip approach, as suggested by Guo et al. (2018a).

5. BUSINESS MODELS AND REGULATORY ISSUES

The sharing economy can prosper if its business models are economically viable. This section provides insights into the business models that have been tried and how they differ from those currently employed in the sharing economy's sectors of interest. We also cover how the business models and industry success in different countries have resulted in a push for government regulation.

A classification of business models for transportation-sharing schemes has been provided in Cohen and Kietzmann (2014). They distinguished between car-sharing (where the shared object is a vehicle shared for a temporary period of time) and ride-sharing (where the vehicle is used just for a

single ride). They identified two classes of business models: one is the B2C, non-profit / cooperative, and P2P models, and the second includes ride-sharing models, where the customer is an individual, and car-pooling or van-pooling, where more people share a vehicle when it follows a common path.).

Other authors have proposed more complex taxonomies of business models, differing in the dimensions considered and based on the models actually deployed by car-sharing firms. For example, Münzel et al. (2018) analyzed 101 German companies, classifying them by the type of parties involved, distinguinshing between cooperative, B2C, and P2P models. Remane et al. (2016) went deeper by analyzing 80+ companies, employing 15 dimensions grouped around five classes: value proposition, interface, service platform, organizing model, and revenue model. Similarly, Muñoz and Cohen (2017) analyzed 36 companies employing 7 dimensions: collaborative governance, mission drivers, underutilized resources, alternative funding, peer-to-peer interaction, leverage on technology, and platform. A different approach was taken by Perboli et al. (2018), who adopted the customer's view and (though they only analyzed four companies), performed Monte Carlo simulation for what-if analysis related to profitability for changes in tariff plans.

In addition, Fraiberger and Sundararajan (2015) proposed a general model of the sharing economy for durable assets, where owners and renters act in a combination of resale and rental markets. They reported that ownership will be gradually replaced by rentals and, in addition, the prices of used goods will be lower, so there will be a contraction of sale revenues.

But what makes sharing business models different from traditional ones? Kathan et al. (2016) have tried to identify the features of sharing that have made it thrive and proposed these factors. (1) The ubiquity of the Internet is making sharing possible at scale now, though sharing trade models have always existed on a more limited scale (Frenken and Schor, 2017). (2) A shift in attitudes regarding the value of ownership has occurred, such that it is now viewed to be of diminishing importance by the younger generation (Chatterjee et al., 2018). (3) The increased emphasis on environmental sustainability also is playing more of a role, which has influenced people's preferences related to ownership versus renting versus sharing (Ciulli and Kolk, 2019; Nijland and van Meerkerk, 2017). And (4), recent industry business model changes have resulted in the movement of financial profit from manufacturers to individual asset owners to some a greater extent than ever before (Frenken and Schor, 2017).

The use of several business models should be evaluated in greater depth in the future. Though several of them presently co-exist (or may in the near future), the emergence of a dominant business model should be the result of several factors. For example, the price disruptions brought about by C2C / P2P transactions and economic exchange may emerge as a feature of the dominant business model. Another possible factor is that potential for the success of self-driving cars, which may replace taxis and ride-hailing as we generally know it today (Münzel et al., 2018). In addition, the ever-present impact of technology innovation represented by the development of new electric vehicles (Shaheen and Chan (2015) and self-navigating automobiles (Stocker and Shaheen (2017) may also

have major impacts. In both cases, no entirely new business models are likely to but some existing ones could have a competitive advantage due to features brought along by these kinds of tech innovations.

We next will explore some business model innovations in the sharing economy in greater depth.

5.1. Business Model Innovations in the Sharing Economy and Platform Pricing

One of the key aspects of business model innovation among sharing economy firms that use suppliers (e.g., drivers, delivery and task-specific gig-workers) is related to the price-setting mechanisms that are used. In traditional retail market settings in Western nations, prices were set by the seller, and the consumer would decide whether and when to buy. In many retail markets in Eastern countries, sellers and consumer haggle to reach an agreed-upon pricing. For stated retail prices to work, they typically need to be externally regulated to some extent (by the market, and also possibly more informally yet effectively, by a seller's emphasis on good reputation and fair prices). This helps to diminish the likelihood of price-gouging and charging uninformed consumers inappropriately high prices.

In contrast, the sharing economy has not been heavily regulated as traditional industries have been, and the firm in that section exhibit a lot of adaptability in terms of how to set prices. For example, in the ride-sharing niche, price-setting may be done by the platform intermediary / market-maker, and a consumer must submit her booking requests to the platform via a mobile phone. The platform is the one to accept the booking at a stated price, so it's a matter again of "whether and when" the consumer decides to make a purchase. In comparison, the price-setting mechanism may also permit the platform or driver to set prices to flexibility set prices based in awareness of local demand and supply. It is interesting to note that, in other cases such as mobility services, there is wide variation in prices in spite of the heavy government regulation in the telecom market. The price variety may reflect the actual demand for the services from a specific service-provider in a specific sub-niche of the market.

Things are more interesting when it comes to the institutional features of ride-hailing platforms. Naturally, consumers have an interest in paying the same amount for trips of equal distances, even though they may be made at different times of day under different conditions of congestion. Farajallah et al. (2019) have shown that, for BlaBlaCar's prices that are set by individual drivers, with consideration given to consumer's reputation, gender, and age – and likely, where they are being picked up or dropped off – in other words, the distinction effects noted earlier (Acquier et al., 2017) are likely to be at work. In addition, the authors note, that it is surprising that drivers with more positive feedback ratings and higher reputations tend to set lower prices, while female drivers and older drivers set higher prices.

5.2. Dynamic Pricing

Dynamic pricing, as we see with hotel room rate changes and day-by-day adjustments in airline seat prices, is most often associated with revenue yield management systems, Operations Research

(OR) (Zhao and Zheng, 2000) and Artificial Intelligence (AI) (Sauvage, 2019) and Machine Learning (ML) (An et al., 2016) approaches. Such approaches support continuous analysis of demand-and-supply curve price sensitivity in the marketplace, to support the practice of raising flexible fares dynamically to the marginal price level, so no higher fares will yield higher profitability.

What's interesting in the ride-hailing sector is that the "standard interpretation" of stated and flexible prices doesn't quite match what industry watchers may observe. The platform players suggest that signals for surge pricing encouraging drivers to supply their labor when it is most needed at a specific location or in an area (Chen and Sheldon, 2016; Pattnaik, 2019; Zha et al., 2017). Most of the platform players deny that they apply predatory surge pricing, by raising prices in the presence of sudden high market demand and limited ride-sharing vehicle supply in ways that drivers benefit at the expense of passengers. And yet, the popular press has printed quite a few articles that have prompted angry missives from consumers who cry out against "unfair fares" and inappropriate pricing practices. A brief example illustrates the seriousness of the concerns through a process now known as *surge price hacking*:

> "[*A*] *group of about 50 drivers for both Lyft and Uber sat at their waiting area at Reagan National* [*Washington, DC*] *waiting while two drivers watched online to see when planes were about to land. After a plane lands, a lot of passengers request rideshare rides, which pushes demand up to begin with. But the drivers further tipped the imbalance between demand and supply by simultaneously turning off their apps five minutes before landing. Then two drivers stood at opposite ends of the waiting area, looking at the Uber and Lyft pricing for fares from the airport. They kept checking fares and watching the surge price increase until the fares were $13 higher than normal. At that point, they told the other drivers to turn their apps back on so they could begin accepting rides. The whole operation took less than two minutes, but now arriving passengers would pay around $13 more to reach their destinations*" (Zetlin, 2019).

In response to this incident of driver / supplier tampering with its pricing mechanism, Lyft announced that "Ride-share drivers who tamper with surge pricing will face being deactivated" (Youn and Theodorou, 2018). The authors also quoted an Uber driver as saying "Uber doesn't pay us enough. What the company is doing is defrauding all these people by taking 35% to 40%," while another driver told them that "They are taking all this money because there's no system of accountability." The firms' counter is a willingness-to-pay argument based on the microeconomic principle that dynamic pricing benefits people who truly need to ensure that they can get ride-share transportation when they require it, while anyone who decides not to pay surge fares is making a rational decision based on their lower level of willingness-to-pay. Both Uber and Lyft argue that surge pricing does not benefit their drivers, who earn the same amount of money whether the distance is shorter or longer, since traffic congestion will diminish the value of the surge price bonus they obtain. And yet other observers disagree (Ridester, 2020), while academic researchers offer other interpretations of how the pricing mechanism works (Castillo, 2019).

Another surge-pricing incident occurred in Singapore in a manner that seemed nearly like an economic market mechanism experiment involving two competing firms in a behavioral lab. Here's why, according to a ChannelNewsAsia reporter (Low, 2018):

"*Uber fares surged islandwide on Tuesday evening (Apr 3), following the outage of rival Grab's ride-hailing app, with the price of rides spiking by as much as four times in some areas. A private hire car driver who did not wish to be identified told ChannelNewsAsia that Uber fares spiked to twice the usual fare amount in areas such as Singapore's central business district. The Pasir Panjang area also saw surges of 2.2 times the regular fare.*"

These examples offer motivation for researchers to examine real-world problems like this in a sharing economy service niche context, where it is possible to analysis how the technological platform, the pricing mechanism, and a firm's management approach affect the nature of the services and prices that consumers can expect in the marketplace. Although there are quite a few more institutional details that describe the incentive mechanisms that Uber, Lyft and Grab have used, there still have not been enough scientific studies involving big data analytics and tests of theory that explain the range of the issues that we have seen arising over time in this sector.

5.3. Regulatory Responses to Sharing Economy Success

Companies operating in the sharing economy have often taken advantage of gaps and holes in government regulation and ignored good judgment for prosocial corporate behavior. This is also one of the major accusations made by traditional companies, which has led to strong opposition by local governments in many cases (Cannon and Summers, 2014). This has also become a weapon that traditional companies adopt to stave off the competitive threats from rapidly-growing sharing economy start-ups. We next offer an overview of the regulatory issues that have been raised and how they are likely to impact the sharing economy.

Acevedo (2016) defined several different regulatory responses in the sharing economy related to renters, swappers and platforms, for which the time, place, manner and purpose of sharing economy consumption have changed compared to traditional e-commerce. She notes that the primary issues and regulatory concerns of platforms involve the nature of supplier participation and the extent to which the platform substitutes for the role of the government to ensure that suppliers are subject to "implied regulated" based on the intermediaries expectations of service quality and the relational and transactional processes. When "things go wrong" (e.g., ineffective vetting of suppliers' identities and service demeanor, and problems arise, the author suggested that the spate of court cases points to the need for the government to act with respect to the sharing platforms' lack of satisfactory remedies. The approaches to the sharing companies discussed and evaluated are:"don't regulate them at all," "wait and see," or "regulate them out of existence." The assessment led the author to further proposed that there should be a focus on service providers (e.g., drivers, homeowner / hosts, and babysitters, etc.), and new forms of employment regulation. Additional impetus for this is that suppliers are especially vulnerable and less well protected, since sharing platforms naturally tilt toward customers in their service concerns. After all, customers actually pay the bills, and so it makes sense that the platforms must act mainly on the nature of the employment they have established with the suppliers in order to establish a contract-based relationship.

Moreover, the need for a government (e.g., national or local) regulations is better understood in

terms of a number of different advantages or disadvantages associated with the sharing economy. Codagnone et al. (2016a) in their work for the European Commission on issues related to the future of work in the sharing economy, have suggested that there needs to be more careful consideration about the content of sharing economy work and the "unfair precarization" of employees – in other words, their endangerment and vulnerability to the effects of the platforms' drive to be market-efficient competitors.

These things should concern both customers and service providers in the "rhetoric versus the reality of the sharing economy (Codangnone et al., 2016b, 2018): (1) customers also may not be well-protected against poor service or service providers' abuses; (2) some service providers may be compelled to work several jobs to earn a living because their wages are low;[18] (3) in addition, their wages are likely to fluctuate in ways that the suppliers will not be able to control through their own effort and actions; (4) also, as gig-workers, they will not have access to retirement schemes or the kinds of employee healthcare benefits that traditional economy firms offer; and (5) the performance of the suppliers in their work-related tasks will be tightly monitored by app's algorithms.

Hong and Lee (2018) noted, through the analysis of the Airbnb case in Korea, that local governments may be less favorable in their attitudes toward the sharing economy than the central government, and therefore, the may put more restrictive regulations into force. This probably due to their need to cope with the unfavorable sentiment of traditional local businesses, which have a vested interest to obtain the governments help to protect them from forces of digitally-converging industry sectors and competitors (Duwadi et al., 2016; Yoffie, 1997) and newly-vulnerable markets (Clemons et al., 2008).

Consistent with newly-vulnerable markets theory, sharing platforms strongly reduce the barriers to entry for sharing economy start-ups. And this is often a typical downside of heavily-regulated environments, that are "opened up" to new competitors that weren't able to enter previously (Rossi, 2005). On the other hand, sharing platforms sometimes claim to be capable of self-regulation, which thus would act as a substitute for government regulation and serve to align the interests of the other parties (consumers and suppliers) involved in this market. Actually though, under this approach government regulations are replaced by the sharing platform's own vetting and reputation system. The platform's vetting systems are prone to abuses and discrimination (e.g., racial or sexual), since the sharing platform has its own interest and economic goals. Further, reputation systems have to improve their accuracy, since they are affected by phenomena such as "spite grading" and grade inflation.

A combination of external regulation and self-regulation, however, has been shown to be

[18] For example, as we are writing this Research Commentary, the extent of the exposure that gig-economy food and package delivery workers has risen to the point of widespread public awareness. This is due to the global COVID-19 pandemic, and the appropriateness of the "social distancing" and "sheltering in place" policies that governments have been promulgating to protect their citizens. Asking delivery workers and ride-sharing service drivers to continue to make their rounds among the concerns about the epidemic is just the sort of precarization that Codagnone et al. (2016a) and others (*New York Times*, 2020; Younger, 2020) have referred to, and why the current extent of regulation in the sharing economy seems to have a critical "blind spot" for employee safety.

successful. For example, Berkowitz and Souchaud (2019) report on the case of crowdfunding, where a meta-organization, Financement Participatif France (https://financeparticipative.org), has actually been successful in shaping its market. The authors found that self-regulation may be useful to fill a void in government regulation when a meta-organization made up of several stakeholders – and thus not a single sharing platform that regulates itself – has a coordination role and acts in a highly-fragmented market with strong player interdependencies.

And thus, this brings us back to Acevedo's (2016) comments about the wait-and-see approach to regulation. It relies on the assumption that more precise regulatory intervention is possible, but only once the market has become somewhat settled. The critical issues must have emerged and be widely agreed upon. Although there has been quite a bit of social and business sentiment that early regulation discourages innovation (e.g., Directorate-General for Research and Innovation, 2016), other authoritative sources on law and regulation suggest that government regulations can have both positive and negative effects on the innovation process" (e.g., Organisation for Economic Cooperation and Development, 1997)

6. RESEARCH DIRECTIONS

After reviewing in Sections 3 through 5 where research and practice have gone so far, in order to examine where research is headed in the future, we categorize the research topics into these major areas: sharing drivers; technology platforms; business models; and externalities. These are intended to be representation rather than exhaustive or final, but they are consistent with our goal of encouraging new thinking around what research ought to pursue to create value in their work.

6.1. Comments on the Categories for Future Topics in Sharing Economy Research

Sharing drivers. This refers to what drives both owners and customers to share some kind of asset. This is relevant to see if the motivation for sharing is significant and widespread enough for a related sharing service to take off, and what leverage must be employed by a sharing platform to attract users. This is already an extensive area of research interest, based on the related works that are available in the literature (e.g., Albinsson and Perera, 2012; Bardhi and Eckhard, 2012; Hawlitzchek et al., 2016; Lamberton and Rose, 2012).

Technology platforms. Technology platforms and the critical computational operations that they involve represent the enabling core of sharing economy firms. Most of the research conducted so been far outside the domain of now-traditional e-commerce research, as represented by the first 20 years of research published in *Electronic Commerce Research and Applications*. Instead, this includes research carried out within the Computer Science (CS) community, where there has been a considerable emphasis on ride-sharing bidding schemes, computation architectures, and algorithms for mission-critical computing processes for various sharing processes. It also includes others' work in the Operations Research (OR) and Artificial Intelligence (AI) scientific communities, where there

has been tremendous amount of output over the past 15 years or so.[19,20]

Business models. These have been studied by numerous researchers who specialize in Social Science investigation, but the evolution of the sharing economy will call for deepening commitment to innovative and evolving business models that are intended to some of the following thrusts. (2) One is the extension of sharing economy platform functionality to industries other than accommodation, mobility and transportation, and typical service settings, whose specific features will have to be addressed. (2) Another is the adaptation of sharing economy business models to different regulatory environments and legal structures (Light, 2017), different cultures (Qiu et al., 2013) and different regions of the world (e.g., Davidson et al., 2018), which are likely to impose additional constraints on the operations of sharing platforms and the use of platform participants' private information.

Externalities. The list of externalities related to sharing economy activities is quite long (Jing and Sun, 2018). The most visible of them are written into the stories from China on its "vast piles of impounded, abandoned and broken bicycles" in the country's cities due to the sudden over-supply and lack of user self-regulation of shared bicycles (Haas, 2017; Huang, 2018); This pointed to the ineffectively designed business models of the bike-sharing firms (e.g., OFO, Mobike, BlueGogo, and Kuqi Bikes), as their bicycles blocked streets and the ineffective of their business models led to unexpectedly quick bankruptcies (Taylor, 2018).

Nevertheless, sharing has a transformational impact on the related markets for the productw and services, such as shared cars have an impact on the car sales market (Guo et al., 2019). But this also impacts all of the issues that are affected by the usage of that product or service too, such as sharing-related traffic congestion levels (Gindrat, 2019) and environmental issues (Scarlett et al., 2018). The sharing economy will carry along both positive (e.g., reduced traffic, more livable cities, diminished greenhouse gas emissions) (Furuhata et al., 2013), and negative externalities (e.g., platform monopolies, more product delivery trucks, inappropriate information sharing privacy violations, and diminished healthcare benefits in the growing gig-temp labor force) (Ert et al., 2016; Ranzini et al., 2017; Tiku, 2013). We expect that with each major change of legislation, as well as each new field of application of sharing economy principles, there should be a call for new investigation into these kinds of externalities.

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[19] For a sampler of CS research that is illustrates the "tip of the iceberg" of these interests, see the following articles: for example, Dillahunt et al. (2017); Ghosh et al. (2017); Grbovic et al. (2017); Guo et al. (2018a); Sun et al. (2019; and von Hoffen, 2017). Similarly, representative research conducted in the OR and AI research communities includes: Chow and Yu (2015); Ghosh et al. (2016, 2017); Jia et al., 2017; He and Shen (2015); Nair and Miller-Hooks (2015); and Schuijbroek et al. (2017). The research output that we have seen among people who focus on Strategy, Information, Technology, Economics and Society (SITES), for example, at the Hawaii International Conference on Systems Science (HICSS), and at the Workshop on Information Systems and Economics (WISE), among other research conferences, workshops and symposium meetings around the world, has been much less.

[20] Research is currently ongoing in joint projects between university Computer Science and Operations Research groups in connection with their research centers and industry partners, for which the study of vehicle routing, bicycle sharing and algorithms for sharing economy operations. An example is Singapore Management University's Fujitsu-Singapore Management University Urban Computing and Engineering Corp Lab (UNICEN) (https://unicen.smu.edu.sg/). For a characterization of the kinds of activities involving Economics research at sharing economy firms, Griswold's (2018) article on Ubernomics is a good place to begin your exploration.

6.2. Some More Specific Potential Research Directions to Consider

We identified a number of overall directions for this research area through the process of preparing this Research Commentary. They include:

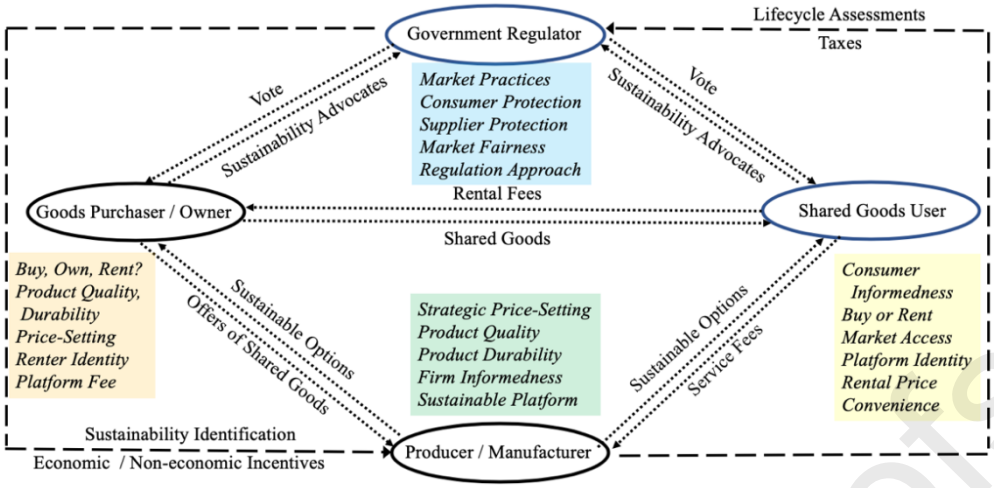
- **Research Direction 1 (Improve Algorithmic Efficiency to Support Sharing Platform Functionality and Performance).** *Improving the algorithmic efficiency of platform systems and architectures should be done to cope with increasing consumer requirements concerning the scale, service features, and constraints that such platforms must operate within.*

Although sharing economy platforms have created an innovative set of opportunities for entrepreneurs and consumers alike, it is critical to reflect on the extent to which sharing economy firms have actually succeeded in delivering the expected levels of greater transparency, more widespread participation, ubiquitous social connections and high consumer value to their key constituents (Frenken and Schor, 2017). In this context, the scale, service features and constraints that sharing platforms operate within have become mission-critical aspects that are founded on the algorithmic efficiency and performance characteristic of their technical components and software (Horton and Zeckhauser, 2016). This extends, for example, to queue-based congestion pricing (Banerjee et al., 2015) and spatial price discrimination (Bimpikis et al., 2019) in ride-sharing.

- **Research Direction 2 (Develop New Research Emphasis on Ecological and Pro-Social Objective Functions for the Sharing Economy and Sustainable Society).** *Allowing for objectives that include environmental and social components, rather than the sheer maximization of profits for the platform, is a matter of increasingly widespread interest that deserves more intensive research attention.*

Mi and Coffman (2019) and Lobel (2018) have observed that the sharing economy has the potential – through environmentally-friendly consumption and diminished negative externalities – to promote more sustainable societies. The typical interpretation of sharing economy outcome assessment has been through Coasian value maximization in which transaction costs are reduced nearly to zero while consumer free-riding is deterred. In this vein, Mi and Coffman (2019) have argued that balanced ecological and economic efficiency are both required if societies are to achieve the Sustainable Development Goals that the United Nations (2015) has laid out. Conflicts between the goals of profit maximization and other prosocial sustainability-focused objectives are bound to come into conflict, so research that examines how to "harmonize rather than optimize" the outcomes with the joint involvement of governments-regulators, users-consumers, enterprises-organizations, and owners-renters – are likely to be crucial. (See Figure 1.)

Figure 1. Extended Framework for Sustainable Sharing Economy Stakeholders and Activities



Source: Adapted from Mi and Coffman (2019)

The authors have further emphasized that it is necessary government authorities should offer both economic and non-economic incentives to make it possible for sharing economy enterprises to pass lifecycle assessments of their products and services in creating only negligible or acceptable (e.g., zero carbon) environmental impacts while enhancing the social well-being of people in the economy. An important corollary of Research Direction 2 is to engage in research that supports the goals of supporting more environmentally-conscious commodity allocation approaches and consumption mechanisms that truly deliver on the prosocial goals that ought to be targeted. Along these lines, the Canadian music artist, Sarah McLachlan (2004) has reminded us through the lyrics in her song, "World on Fire," of conscientious consumption and social participation at the community-level of the sharing economy: "*The more we take, the less we become … The fortune of one means less for some.*"

- **Research Direction 3 (Develop a Research Agenda to Build a More In-Depth Understanding of Regulatory Issues and the Impact of Related Actions).** *We advocate conducting research to define a legal framework within which sharing economy services can co-exist with traditional B2C schemes and outlining new approaches for the definition and application of regulatory actions that diffuses key conflicts between stakeholders while enhancing the quality of sharing economy markets on behalf of consumers and owners.*

Research Direction 3 implies that the time may be rapidly coming when a regulatory framework is promulgated in which both consumers' and service providers' rights are more protected than today. It further suggests that it may become appropriate for the near-monopoly platforms to no be exempt from all of the requirements imposed on traditional services that are similar. Edelman and Gerdin (2016, p. 293) opened up this line of research inquiry in a *Stanford Technology Law Review* article, by asking "How Should We Regulate Companies Like Airbnb and Uber?" They focused on a parallel set of issues:

(1) *"the various forms of inefficiencies that [sharing economy] software platforms provide, including reducing transaction costs, improving allocation of resources, and information and pricing* [*efficiencies;*]

(2) [*and the*] *need for adapting law and regulations to allow software platforms to operate legally so that both service providers and consumers can enjoy the efficiencies these*

platforms seek to offer."

The authors further pointed out that "*software platforms should not be above the law …* [*and*] *should comply with regulatory requirements that are needed to correct genuine market failures, and these requirements should remain in force*."

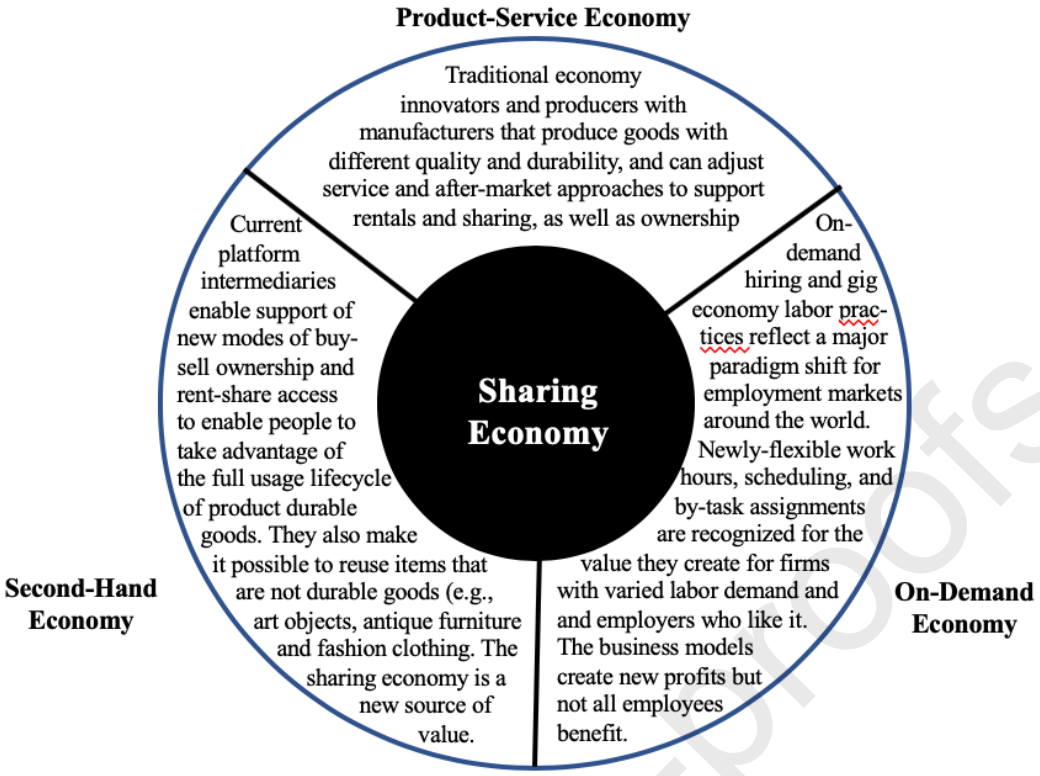
Edelman et al. (2017) also suggested that there is a need to more carefully assess the basis for and extent of racial discrimination in the sharing economy, which suggests the important of social justice issues that are also worthwhile to examine more closely in future research in this domain.

An alternate route for research is suggested by Cannon and Summer (2014, pp. 25-26), who wrote about strategy suggestions recommendations for sharing economy platform firms to mitigate the forces of government oversight and future regulation: (1) when their business models are viewed with suspicion for trying to avoid taxation and generating higher profits by challenging the relevance of regulations of traditional industries; (2) by trying to promote the reclassification of their platforms (e.g., from transport network firm to communications platform for Uber); and (3) actually acting as a digital intermediary while being viewed in the market as a producer and / or provider of goods or services. Thus, an equally valid direction for research – beyond the issue of prosocial objective functions and sustainability – is to delve more deeply into managing the corporate engines for economic success in a quickly changing consumer, social, economic and regulatory environment. It will be similarly useful to probe deeper to understand the fundamental issues with sharing economy suppliers' trust, such as in ride-sharing (Cheng et al., 2020) and accommodations (Wang and Filieri, 2019).

- **Research Direction 4 (Extend the Research Coverage of Sharing Services to New Societal Functions and Geospatially-Inclusive Regions).** *We recommend increasing the span of sharing services research, both in the spatial dimension, by studying the sharing economy in new geographical areas, and in the services dimension, by exporting the main sharing business models for a wider array of services contexts than only accommodation and transportations.*

In a *Guardian* (U.K. newspaper) article several years ago, Frenken et al. (2015) provided a useful characterization of the sharing economy as being composed of three distinct economic processes: an on-demand economy; a second-hand economy; and a product-service economy. (See Figure 2.)

Figure 2. The Activities Associated with the Sharing Economy



Source: Adapted from Frenken et al. (2015)

They noted that no economic activities in these processes involve the transfer of ownership from a producer to a consumer, but related to access to products and services temporarily when they are needed (including in the C2C mode between individual people), and for second-hand purchases of goods that don't involve their original producers. The sharing activities in the main product-service can occur with consumers and many kinds of consumers, but the main idea is that the consumer can gain access while the provider remains the owner (e.g., specialized power tools, high-end camera equipment, and robotics lawn-mowers – typically rarely-used or one-use items). They further depicted the true nature of the large economy's activities, which is likely to have other means besides sharing economy platforms for supporting other various on-demand, second-hand, and product-service rentals (with the black "Sharing Economy" circle in the middle partially covering the shaded areas of the three distinct sub-economies.

The range of economic exchange activities that we associate today with the three sub-economies is likely to change, so that different goods and services will be offered, in different ways that we see sharing economy platforms operating today. We also can expect some of the institutional features to change, as new entrepreneurs try out new ideas and business models. Our comments with respect to AI, OR and CS (as well as machine learning, ML) research is a case in point. There are going to be many new technical developments that will change the range of services that the sharing economy can encompass, as well as the scope of global geography that can be covered with more technology diffusion and economy / infrastructure changes in developing nations.

One thing that we have been keeping our eyes on is something that was proposed as long ago as

the 1990s, by Hagel and Singer (1999), who wrote a book on digital infomediation, published by McKinsey and Co. They recognized that:

> "*customers will increasingly need a trusted third-party or personal agent to act on [their] behalf to help us get more value from data about [them]. Among other services, the infomediary would act as custodian of [their] personal data and negotiate with various third-parties to provide limited access to the data in return for significant value received*" (Hagel, 2019).

Although few firms took on the role of infomediaries during the DotCom boom in the 1990s and 2000s, when infomediation only seemed possible via a "pay for customer information" or a "deliver value to compensate for personal information shared" business model.

In the current business environment of the sharing economy, most people are more circumspect about the quality of the information they receive (due to false product claims, fraud and fake news, and inflated value promises). Participation in a sharing economy community,(for customers of at least some providers, if not all) taps into consumers' willingness-to-trust, as a basis for enhancing their willingness-to-pay. This seems to be due to the social network and homophily aspects of the economic exchanges they pay to make (like booking an Airbnb room with an owner they never meet, or relying on "shared information" for an on-demand baby-sitter) (Dann et al., 2020). Infomediation has the potential to create new information gateways, and to enhance consumer willingness-to-trust and pay for services, enhancing the economic efficiency of the sharing economy.

- **Research Direction 5 (Develop New Reputation and Recommendation Systems Approaches for Sharing Economy Services).** *Since the sharing economy relies on customers' feedback to build and increase trust in its platforms, conducting research to create the "next-generation" of reputation and recommendation systems is essential for the diffusion of sharing services and the enhancement of the quality of their services.*

A key concern in this context is to engineer sharing platforms so they can implement highly robust and cost-effective reputation systems, to identify and screen out fake or biased reviews from platform participants and strengthen their information security. The latter is to ensure that their data are not hacked or compromised in ways that will affect consumers' willingness-to-pay and their estimation of the expected value of platform transactions and exchanges (Tadelis, 2016; Nadeem et al., 2020).

Based on the research directions that we have identified and provided background for, there should be many new and non-traditional research opportunities for researchers who wish to target *Electronic Commerce Research and Applications* as a publication outlet for their research manuscripts. In this article, we have emphasized economic perspectives and issues to a greater extent than sociological and societal, legal and political, psychological and decision-focused, anthropological and cross-cultural, behavioral and organizational and technical and computer science-based aspects of sharing economy activities and issues. Yet, we wish to make the journal's perspective clear in terms of its leadership's openness to new disciplines and interdisciplinary research. Extraordinary advances are possible based on responsible research and innovation (Boons and Bocken, 2018; Jirotka et al., 2017), new design science approaches for sharing economy settings

(Hevner et al., 2004; and research new algorithms for reputation and recommendations (Basili and Rossi, 2020; Sun et al., 2019). Of equally-high relevance are enhanced applications for causal inference, big data methods, and computational social science (Chang et al., 2014, Kauffman et al., 2017), and new machine and Internet-based experimental, machine learning and AI approaches.

REFERENCES

1. Acevedo, D.D., 2016. Regulating employment relationships in the sharing economy. Employee Rights and Employment Pol. J. 20, 1-35.
2. Acquier, A., Carbone, V., Massé, D., 2019. How to create model(s) in the sharing economy: Business models, scalability and sustainability. Tech. Innov. Manage. Rev. 9 (2), 5-25.
3. Acquier, A., Daudigeos, T., Pinkse, J., 2017. Promises and paradoxes of the sharing economy: An organizing framework. Tech. Forecast. Soc. Chang. 125, 1–10.
4. Adomavicius, G., Bockstedt, J.C., Gupta, A., Kauffman, R.J., 2008. Understanding evolution in technology ecosystems. Comm. ACM 51 (10), 117-122.
5. Adomavicius, G., Bockstedt, J.C., Gupta, A., Kauffman, R.J., 2008b. Making sense of technology trends in the information technology landscape. MIS Qtrly. 32, (4), 779-809.
6. Agatz, N., Erera, A.L., Savelsbergh, M.W., Wang, X., 2011. Dynamic ride-sharing: A simulation study in metro Atlanta. Procedia Soc. Behav. Sci. 17, 532–550.
7. Agatz, N., Erera, A., Savelsbergh, M., Wang, X., 2012. Optimization for dynamic ride-sharing: A review. Eur. J. Op. Res. 223, 295–303.
8. Albinsson, P.A.; Perera, B.Y., 2012. Alternative marketplaces in the 21st century: Building community through sharing events. J. Consum. Beh. 11 (4), 303–315.
9. AllTheRooms.com, 2020. An analyst's guide, Part 1: Going public, revenues, business model & statistics. New York, March. Available at: https://www.alltherooms.com/analytics/airbnb-ipo-going-public-revenues-business-model-statistics/.
10. An, B., Chen, H., Park, N., Subrahmanian, V.S., 2016. MAP: Frequency-based maximization of airline profits based on an ensemble forecasting approach. In Proc. 22nd ACM Intl. Conf. Knowl. Disc. and Data Mining, ACM Press, New York, August, pp. 421-430.
11. Aydin, R., 2019. The WeWork fiasco of 2019, explained in 30 seconds. Bus. Insider, October 22. Available at: https://www.businessinsider.com/wework-ipo-fiasco-adam-neumann-explained-events-timeline-2019-9?r=US&IR=T.
12. Banerjee, S.., Johari, R., Riquelme, C., 2015. Pricing in ride-sharing platforms: A queueing-theoretic approach. In Proc. Sixteenth ACM Conf. Econ. Comput., ACM Press. New York, 639–639.
13. Bardhi, F., Eckhardt, G.M. 2012. Access-based consumption: The case of car sharing. J. Consum. Res. 39 (4), 881-898.
14. Basili, M., Rossi, M.A., 2020. Platform-mediated reputation systems in the sharing economy and incentives to provide service quality: The case of ride-sharing services. Electron. Comm. Res. Appl. 39, 100835.
15. Baumol, W.J., Willig, R.D., 1981. Fixed costs, sunk costs, entry barriers, and sustainability of monopoly. Qtrly. J. Econ. 96 (3), 405-431.
16. Becker, H., Ciari, F., Axhausen, K.W., 2018. Measuring the car ownership impact of free-floating car-sharing: A case study in Basel, Switzerland. Transport. Res. Part D: Transport and Environ. 65, 51–62.
17. Belk, R.W., 2014a. Sharing versus pseudo-sharing in Web 2.0. The Anthropologist 18 (1), 7–23.
18. Belk, R.W., 2014b. You are what you can access: Sharing and collaborative consumption online. J. Bus. Res. 67 (8), 1595– 1600.
19. Belk, R.W., Eckhardt, G.M., Bardhi, F., 2019. Handbook of the Sharing Economy. Edward Elgar Publishing, Northampton, MA. URL: https://books.google.dk/books?id=mj2tDwAAQBAJ&pg=PA104&lpg=PA104&dq=white+papers+sharing+economy+mckinsey&source=bl&ots=QdSmeO_FnG&sig=ACfU3U0_jbn5BDX0wSn3lPvtil0ZFPd1dw&hl=en&sa=X&ved=2ahUKEwjm1OympKLoAhUJ3qQKHekLDgkQ6AEwBXoECAsQAQ#v=onepage&q=white%20papers%20sharing%20economy%20mckinsey&f=false.
20. Benjaafar, S., Kong, G.C., Li, X., Courcoubetis, C. 2019. Peer-to-peer product sharing: Implications for ownership, usage and social welfare in the sharing economy. Manage. Sci. 65 (2), 477-493.
21. Beutin, N., 2017. Share economy 2017: The new business model. White paper, PWC, New York. Available at: https://www.pwc.de/de/digitale-transformation/share-economy-report-2017.pdf.
22. BeWelcome.org, 2020. BeWelcome statistics. March 18. Available at: bewelcome.org/stats.
23. Bielinski, T.; Wazna, A. 2018. New generation of bike-sharing systems in China: Lessons for European cities. J. Manage. Fin. Sci. 11, 25–42.
24. Bimpikis, K., Candogan, O., Saban, D., 2019. Spatial pricing in ride-sharing networks. Op. Res. 67 (3), 744-769.
25. at: https://blog.blablacar.com/about-us.
26. BlaBlaCar, 2020b. Let's define the sharing economy. Available at: https://blog.blablacar.in/blablalife/reinventing-travel/let-s-define-sharing-economy.
27. Boons, F., Bocken, N., 2018. Towards a sharing economy: Innovating ecologies of business models. Tech.

Forecast. Soc. Change 137, 40-52.
28. Botsman, R., Rogers, R., 2010. What's Mine is Yours: The Rise of Collaborative Consumption. HarperBusiness, New York.
29. Bouncken, R.B., Aslam, M.M., Reuschl, A.J., 2018. The dark side of entrepreneurship in coworking-spaces. In T. Porcar and R. Soriano (eds): Inside the Mind of the Entrepreneur: Cognition, Personality Traits, Intention, and Gender Behavior, Springer, Cham, Switzerland, pp. 135–147.
30. Bouncken, R.B., Reuschl, A.J., 2018. Coworking-spaces: How a phenomenon of the sharing economy builds a novel trend for the workplace and for entrepreneurship. Rev. Manage. Sci. 12, 317–334.
31. Boysen, N., Briskorn, D., Schwerdfeger, S., 2019. Matching supply and demand in a sharing economy: Classification, computational complexity, and application. Eur. J. Op. Res. 278, 578–595.
32. Cannon, S., Summers, L.H., 2014. How Uber and the sharing economy can win over regulators. Harv. Bus. Rev. 13, 24–28.
33. CarClub.com.sg, 2020. Car-sharing vs. car rental. Available at: https://www.carclub.com.sg/car-sharing-rental-difference/.
34. Castillo, J.C., 2019. Who benefits from surge pricing? Working paper, Stanford Institute for Economic Policy Research, Stanford University, Stanford, CA, December 28. Available at: https://web.stanford.edu/~jccast/JMP_Castillo.pdf.
35. Chang, R.M., Kauffman, R.J., Kwon, Y.O. Understanding the paradigm shift to computational social science in the presence of big data. Dec. Supp. Sys. 63, 67-80.
36. Chatterjee, K., Goodwin, P., Schwanen, T., Clark, B., Jain, J., Melia, S., Middleton, J., Plyushteva, A., Ricci, M., Santos, G., Stokes, G., 2018. Young people's travel: What's changed and why? Review and analysis. Report to Department for Transport, UWE Bristol, UK, January 23. Available at: www.gov.uk/government/publications/young-peoples-travel-whats-changed-and-why.
37. Chen, T.D., Kockelman, K.M., 2016. Carsharing's life-cycle impacts on energy use and greenhouse gas emissions. Transport. Res. Part D Transport. Environ. 47, 276–284.
38. Chen, M., Sheldon, M., 2016. Dynamic pricing in a labor market: Surge pricing and flexible work on the Uber platform. Working paper, Anderson Graduate School of Management, University of California, LA. Available at: https://www.eurofound.europa.eu/data/platform-economy/records/ dynamic-pricing-in-a-labor-market-surge-pricing-and-flexible-work-on-the-uber-platform.
39. Cheng, X., Su, L., Yang, B., 2020. An investigation into sharing economy-enabled ride-sharing drivers' trust: A qualitative study. Electron. Comm. Res. Appl. 40, 100956.
40. Chircu, A.M., Kauffman, R.J., Wang, B., 2000. Beyond the 'eBay of blank': Next stage digital intermediation in electronic commerce. In S.J. Barnes (ed.), E-Commerce and V-Business, 1st Ed., Butterworth-Heinemann, London, England, pp. 43-78.
41. Christensen, C.M., Raynor, M.E., 2003. The Innovator's Solution: Creating and Sustaining Successful Growth. Harvard Business School Press, Boston, MA.
42. Chow, Y., Yu, J.Y., 2015. Real-time bidding-based vehicle sharing. In Proc. 2015 Intl. Conf. Autonom. Agents and Multiagent Sys., ACM Press, New York, pp. 1829–1830
43. Ciulli, F., Kolk, A., 2019. Incumbents and business model innovation for the sharing economy: Implications for sustainability. J. Clean Prod. 214, 995-1010.
44. Clemons, E.K., Dewan, .M., Kauffman, R.J., Weber, T.A., 2017. Understanding the information-based transformation of strategy and society. J. Manage. Info. Sys. 34 (2), 425-456.
45. Clemons, E.K., Gu, B., Lang, K.R., 2003. Newly vulnerable markets in an age of pure information products: An analysis of online music and online news. J. Manage. Info. Sys. 19 (3), 17-42.
46. Clemons, E.K., Thatcher, M.E., 2008. Capital One Financial and a decade of experience with newly vulnerable markets: Some propositions concerning the competitive advantage of new entrants. J. Strat. Info. Sys. 17 (3), 179-189.
47. Codagnone, C., Abadie, F., Biagi, F., 2016a. The future of work in the sharing economy: Market efficiency and equitable opportunities or unfair precarisation? Science policy report EUR 27913, Institute for Prospective Technology Studies, Joint Research Centre, European Commission, available at: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC101280/jrc101280.pdf.
48. Codagnone, C., Karatzogianini, A., Matthews, A., 2018. Platform Economics: Rhetoric and Reality in the Sharing Economy. Emerald Publishing, Bingley, UK.
49. Codagnone, C., Martens, B., 2016b. Scoping the sharing economy: Origins, definitions, impact and regulatory issues. Digital economy working paper 2016/01, JRC 100369, Institute for Prospective Technological Studies, Joint Research Centre of the European Commission, Seville, Spain.
50. Cohen, B., Kietzmann, J., 2014. Ride on! Mobility business models for the sharing economy. Org. Environ. 27, 279–296.
51. Constantiou, I., Marton, A., Tuunainen, V.K., 2017. Four models of the sharing economy. MIS Qtrly. Exec. 16 (4), 3.

52. Cramer, J., Krueger, A.B., 2016. Disruptive change in the taxi business: The case of Uber. Amer. Econ. Rev. 106 (5), 177-182.
53. Dai, S. 2020. Didi Chuxing expands in Sydney to step up growth overseas as coronavirus crisis slows down China business. South China Morning Post, February 17. Available at: https://www.scmp.com/tech/apps-social/article/3051013/didi-chuxing-expands-sydney-step-growth-overseas-coronavirus.
54. Dann, D., Teubner, T., Adam, M.T.P., Weinhardt, C., 2020. Where the host is part of the deal: Social and economic value in the platform economy. Electron. Comm. Res. Appl. 40, 100923.
55. Davidson, A., Habibi, M.R., Laroche, M., 2018. Materialism and the sharing economy: A cross-cultural study of American and Indian consumers. J. Bus. Res. 82, 364-372.
56. Defense Agency Advanced Research Projects Agency (DARPA). The Heilmeier catechism. Available at: https://www.darpa.mil/work-with-us/heilmeier-catechism
57. Dervojeda, K., Verzijl, D., Nagtegaal, F., Lengton, M., Rouwmatt, E., 2013. The sharing economy: Access-based business models for peer-to-peer markets. Case study 12, Enterprise and Industry, Business Innovation Observatory Contract No. 190/PP/ENT/CIP/12/C/N03C01, European Union, Brussels, Belgium, September. Available at: ec.europa.eu.
58. Dillahunt, T.R., Wang, X., Wheeler, E., Cheng, H.F., Hecht, B., Zhu, H., 2017. The sharing economy in computing: A systematic literature review. In Proc. ACM Hum.-Comp. Interact., 1, 38, ACM Press, New York.
59. Directorate-General for Research and Innovation, 2016. Better regulations for innovation-driven investment at the EU level. Commission staff working document, Publications Office of the European Union, Luxembourg. Available at: https://ec.europa.eu/research/innovation-union/pdf/innovrefit_staff_working_document.pdf.
60. Duwadi, K., Lee, N.C., Lupi, P., Levy, J., Marinello, M.L., 2016. Digital convergence and beyond: Innovation, investment and competition in communication policy and regulation for the 21st century. Background report, 2016 Ministerial Meeting on the Digital Economy, Committee on Digital Economic Policy, Organization for Economic Cooperation and Development, Paris, France.
61. Eckhardt, G.M., Bardi, F., 2015. The sharing economy isn't about sharing at all. Harv. Bus. Rev., January 28.
62. Eckhardt, G.M., Houston, M.B., Jiang, B., Lamberton, C., Rindfleisch, A., Zervas, G., 2019. Marketing in the sharing economy. J. Mktg. 83, 5–27.
63. Edelman, B., Geradin, D., 2016. Efficiencies and regulatory shortcuts: How should we regulate companies like Airbnb and Uber? Stanford Tech. Law Rev. 19, 293-328.
64. Edelman, B.G., Luca, M., Svirsky, D. 2017. Racial discrimination in the sharing economy: Evidence from a field experiment. Amer. Econ. J.: Appl. Econ. 9 (2), 1-22.
65. Erickson, K., Sørensen, I., 2016. Regulating the sharing economy. Internet Pol. Rev. 5 (2).
66. Eschberger, T. B2B sharing: The next step for the sharing economy? Lead Innovation Blog, March 3. Available at: https://www.lead-innovation.com/english-blog/b2b-sharing.
67. Ert, E., Fleischer, A., Magen, N. 2016. Trust and reputation in the sharing economy: The role of personal photos in Airbnb. Tourism Manage. 55, 62-73.
68. Ertz, M., Durif, F. Arcand, M., 2016. Collaborative consumption: Conceptual snapshot at a buzzword. J. Entrepr. Educ., December.
69. European Commission, 2020. Social innovation. Internal Market, Industry, Entrepreneurship and SMEs. Available at: https://ec.europa.eu/growth/industry/policy/innovation/social_en.
70. European Environment Agency, 2017. Circular by design: Products in the circular economy. EEA report no. 6/2017, Copenhagen, Denmark. Available at: https://circulareconomy.europa.eu/platform/sites/default/files/circular_by_design_-_products_in_the_circular_economy.pdf.
71. Evans, D.S., Schmalensee, R., 2016. Match-makers: The New Economics of Multi-sided Platforms. Harvard Business Review Press, Boston, MA.
72. Fang, B., Ye, Q., Law, R., 2016. Effect of sharing economy on tourism industry employment. Ann.Tourism Res. 57, 264–267.
73. Farajallah, M., Hammond, R.G., Pénard, T., 2019. What drives pricing behavior in peer-to-peer markets? Evidence from the carsharing platform BlaBlaCar. Info. Econ. Pol. 48, 15-31.
74. Filippas, A., Horton, J.J., Zeckhauser, R.J., 2016. Owning, using, renting: Some simple economics of the sharing economy. Manage. Sci.
75. ForestCar, 2020. About ForestCar. London, UK, March 18. Available at: www.f6s.com/forestcar/about.
76. Fraiberger, S.P., Sundararajan, A., 2015. Peer-to-peer rental markets in the sharing economy. Working paper, Stern School of Business, New York University, New York, March.
77. Frenken, K., Meelen, T., Arets, M., van de Glind, P., 2015. Smarter regulation for the sharing economy. The Guardian, May 20. Available at: https://www.theguardian.com/science/political-science/2015/may/20/smarter-regulation-for-the-sharing-economy.

78. Frenken, K., Schor, J., 2017. Putting the sharing economy into perspective. Environ. Innov. Soc. Transitions 23, 3-10.
79. Frishammer, J., K., Patel, P.C., 2015. The dark side of knowledge transfer: Exploring knowledge leakage in joint R&D projects. Technovation 41-42, 75-78.
80. Furuhata, M., Dessouky, M., Ordóñez, F., Brunet, M.E., Wang, W., Koenig, S., 2013. Ride-sharing: The state-of-the-art and future directions. Transport. Res. Part B: Meth. 57, 28-46.
81. Galbreth, M.R., Ghosh, B., Shor, M., 2012. Social sharing of information goods: Implications for pricing and profits. Mktg. Sci. 31 (4), 603–620.
82. Ganapati, S., Reddick, C.G., 2018. Prospects and challenges of sharing economy for the public sector. Gov. Info. Qtrly. 35, 77–87.
83. Gansky, L., 2010. The Mesh: Why the Future of Business Is Sharing. Penguin, New York.
84. Gawer, A., 2014. Bridging differing perspectives on technological platforms: Toward an integrative framework. Res. Pol. 43, 1239-1249.
85. Gazolla, P., 2017. Behind the sharing economy: Innovation and dynamic capability. In E.M. Vătămănescu and F. Pînzaru (eds.), Knowledge Management in the Sharing Economy, Knowledge Management and Organizational Learning, 6, Springer, Cham, Switzerland, pp. 75-94.
86. Gessner, K., 2020. Uber vs. Lyft: Who's tops in the battle of the U.S. rideshare companies? SecondMeasure.com, February. Available at: https://blog.secondmeasure.com/datapoints/ rideshare-industry-overview/.
87. Ghosh, S., Trick, M., Varakantham, P., 2016. Robust repositioning to counter unpredictable demand in bike sharing systems. In Proc. Intl. Joint Conf. Artif. Intell. AAAI, Menlo Park.
88. Ghosh, S., Varakantham, P., Adulyasak, Y., Jaillet, P., 2017. Dynamic repositioning to reduce lost demand in bike sharing systems. J. Artif. Intell. Res. 58, 387–430.
89. Gindrat, R., 2019. Can shared rides reduce traffic congestion? Forbes, July 11. Available at: https://www.forbes.com/sites/forbestechcouncil/2019/07/11/can-shared-rides-reduce-traffic-congestion/#5188d966f146.
90. Goldfarb, A., Greenstein, S.M., Tucker, C.E., 2015. Economic Analysis of the Digital Economy. University of Chicago Press, Chicago, IL.
91. Gomber, P., Kauffman, R.J., Parker, C., Weber, B.W. 2018. On the fintech revolution: Interpreting the forces of innovation, disruption and transformation in financial services. J. Manage. Info. Sys., 35 (1), 220-265.
92. Granados, N.F., Kauffman, R.J., King, B., 2008. How has electronic travel distribution been transformed? A test of the theory of newly vulnerable markets. J. Manage. Info. Sys. 25 (2), 73-95.
93. Grbovic, M., 2017. Search ranking and personalization at Airbnb. In Proc. 11th ACM Conf., AC M Press, New York, pp. 339-340.
94. Griswold, 2018. Uber's secret weapon is its team of economists. Quartz.com, October 14. Available at: https://qz.com/1367800/ubernomics-is-ubers-semi-secret-internal-economics-department/.
95. Grosse-Ophoff, A., Hasler, S., Heineke, K., Moller, T., 2017. How shared mobility will change the automotive industry. McKinsey Consulting, New York, April, Available at: https://www. mckinsey.com/industries/ automotive-and-assembly/our-insights/how-shared-mobility-will-change-the-automotive-industry.
96. Guo, Y., Li, X., Zeng, X., 2019. Platform competition in the sharing economy: Understanding how ride-hailing services influence new car purchases. J. Manage. Info. Sys. 36 (4), 1043-1070.
97. Guo, L., Ning, Z., Hou, W., Hu, B., Guo, P., 2018a. Quick answer for big data in sharing economy: Innovative computer architecture design facilitating optimal service-demand matching. IEEE Trans. Automat. Sci. Eng. 15, 1494–1506.
98. Guo, Y., Xin, F., Barnes, S., Li, X., 2018b. Opportunities or threats: The rise of online collaborative consumption (OCC) and its impact on car sales. Electron. Comm. Res. Appl. 29, 133-141.
99. Haas, B., 2017. Chinese bike graveyard a monument to industry's arrogance. The Guardian, November 25. Available at: https://www.theguardian.com/uk-news/2017/nov/25/chinas-bike-share-graveyard-a-monument-to-industrys-arrogance.
100. Hagel, J., III., 2019. The return of the infomediary. The Mktg. J. May 11. Available at: https://www.marketingjournal.org/the-return-of-the-infomediary-john-hagel/.
101. Hagel, J., III, Rayport, J.F., 1997. The coming battle for customer information. Harv. Bus. Rev. 75 (1), 53-61.
102. Hagel, J., III, Singer., M., 1999. Net Worth: Sharing Markets When Customers Make the Rules. McKinsey and Co., New York.
103. Hall, J.V., Kreuger, A.B., 2018. An analysis of the labor market for Uber's driver-partners in the United States. ILR Rev. 71 (3), 705-732.

104. Hamari, J., Sköjlint, Ukkonen, A., 2015. The sharing economy: Why people participate in collaborative consumption. J. Assoc. Info., Sci. Tech. 67 (9), 2047-2059.
105. Hardin, G.J., 1968. The tragedy of the commons. Science 162 (3859), 1243-1248.
106. Hawlitzchek, F., Teubner, T., Gimpel, H., 2016. Understanding the sharing economy: Drivers and impediments for participation in peer-to-peer rentals. In Proc. 2016 Hawaii Intl. Conf. Sys. Sci., IEEE Comp. Soc. Press, Washington, DC.
107. Heater, B., 2020. How Uber, Lyft, Seamless and more are addressing tax gig economy workers. Techcrunch, March 16. Available at: https://techcrunch.com/2020/03/16/how-uber-lyft-seamless-and-more-are-addressing-taxed-gig-economy-workers/.
108. Heilmeier, G., 1992. Some reflections on innovation and invention. Founders Award Lecture. National Academy of Engineering (NAE), Washington, DC, published in the Bridge, NAE, Winter.
109. Hellwig, K., Morhart, F., Girardin, F., Hauser, M. 2015. Exploring different types of sharing: A proposed segmentation of the market for sharing businesses. Psych. Mktg. 32(9), 891-906.
110. Hevner, A., March, S., Park, J., Ram, S., 2004./ Design science in information systems research, MIS Qtrly. 28 (1), 75–105.
111. HomeExchange, 2019. The advantages of HomeExchange. Paris, France, November 18. Available a https://homeexchangehelp.zendesk.com/hc/en-us/articles/360000611497-The-advantages-of-HomeExchange.
112. Hong, S., Lee, S., 2018. Adaptive governance and decentralization: Evidence from regulation of the sharing economy in multi-level governance. Gov. Info. Qtrly. 35, 299–305.
113. HostWriter.org, 2020. Stories across borders – and journalists should too. About, Berlin, Germany, March 18. Available at: https://hostwriter.org/about.
114. Huang, F., 2018. The rise and fall of China's cycling empires., ForeignPolicy.com, December 31. Available at: https://foreignpolicy.com/2018/12/31/a-billion-bicyclists-can-be-wrong-china-business-bikeshare/.
115. Index by TNW, 2020. For the "Sharing Economy" and the "On-Demand Economy: Available at: https://index.co/market/sharing-economy/investments, and also https://index.co/market/on-demand-economy.
116. Investopedia, 2020. Gig economy. Available at: https://www.investopedia.com/terms/g/gig-economy.asp.
117. Jia, Y., Xu, W., Liu, X., 2017. An optimization framework for online ride-sharing markets. In Proc. IEEE 37th Intl. Conf. Distrib. Comp. Sys., IEEE Comp. Soc. Press, Washington, DC, pp. 826-825.
118. Jiang, B., Tian, L., 2018. Collaborative consumption: Strategic and economic implications of product sharing. Manage. Sci. 64 (3), 1171–1188.
119. Jing, W., Sun, B., 2018. Negative externalities in the sharing economy: Sources, paths and recommendations. Intl. J. Crowd Sci. 2 (2), 149-163.
120. Jirotka, M., Grimpe, B., Stahl, B., Eden, G., Hartswood, M., 2017. Responsible research and innovation in the digital age. Comm. ACM 60 (5), 62-68.
121. Jung, J., Koo, Y., 2018. Analyzing the effects of car sharing services on the reduction of greenhouse gas (GHG) emissions. Sustainability 10 (2), 539-556.
122. Jungleworks, 2020. How the matching algorithm works in the on-demand economy? Part 3 of the User Journey Series. Available at: https://jungleworks.com/matching-algorithm-works-demand-economy-part-three-user-journey-series/.
123. Kamilaris, A., Prenefeta-Boldú, F.X., 2018. Mapping the collaborative economy landscape and its relationship with information and communication technologies. Chapter 6 in P.A. Albinsson and B.Y. Perrera (eds.), 2018. The Rise of the Sharing Economy: Exploring the Challenges and Opportunities of Collaborative Consumption. ABC-CLIO, Santa Barbara, CA, pp. 97-128.
124. Kathan, W., Matzler, K., Veider, V., 2016. The sharing economy: Your business model's friend or foe? Bus. Horiz. 59 (6), 663-672.
125. Kauffman, R.J., Kim, K., Lee, S.Y.T., Hoang, A.P., Ren, J. 2017. Combining machine-based and econometrics methods for policy analytics insights. Electron. Comm. Res. Appl. 25, 115-140.
126. Kobie, N., 2018. What is the gig economy and why is it so controversial? Wired, September 14. Available at: https://www.wired.co.uk/article/what-is-the-gig-economy-meaning-definition-why-is-it-called-gig-economy.
127. Lamberton, C.P., Rose, R.L., 2012. When is ours better than mine? A framework for understanding and altering participation in commercial sharing systems. J. Mktg. 76 (4), 109-125.
128. Lewis, M., 1999. The New New Thing: A Silicon Valley Story. Hodder and Stoughton, London, UK.
129. Lan, J., Ma, Y., Zhu, D., Mangalagiu, D., Thornton, T.F., 2017. Enabling value co-creation in the sharing economy: The case of Mobike. Sustainability 9. https://doi.org/10. 3390/su9091504.
130. Li, T., Kauffman, R.J., van Heck, E., Vervest, P., Dellaert, B.G.C., 2014. Consumer informedness and firm information strategy. Info. Sys. Res. 25 (2), 345-363.

131. Liao, F., Molin, E., Timmermans, H., van Wee, B., 2018. Carsharing: The impact of system characteristics on its potential to replace private car trips and reduce car ownership. Transport., October, 1–36.
132. Light, S.E., 2018. The role of the federal government in regulating the sharing economy. In N. Davidson, M. Finck and J. Infranca (eds.), Cambridge Handbook on the Law of the Sharing Economy Cambridge Univ. Press, Cambridge, UK.
133. Lima, V., 2019. Towards an understanding of the regional impact of Airbnb in Ireland, Reg. Stud., Reg. Sci. 6 (1), 78-91.
134. Liu, L., Andris, C., Cappi, C., 2010. Uncovering cabdrivers' behavior patterns from their digital traces. Comput. Environ. Urban Sys. 34 (6), 541-548.
135. Lobel, O., 2018. Coase and the platform economy. In N. Davidson, M. Finck and J. Infranca (eds.), Sharing Economy Handbook, Cambridge University Press, Cambridge, UK.
136. Lock, S., 2019. Company value of Airbnb from 2016 to 2018. Statista, September 23. Available at: https://www.statista.com/statistics/339845/company-value-and-equity-funding-of-airbnb/.
137. Low, Z., 2018. User fares surge island-wide following Grab outage. ChannelNewsAsia.com, April 3. Available at: https://www.channelnewsasia.com/news/singapore/uber-fares-surge-following-grab-app-outage-10100666.
138. Magretta, J., 2002. Why business models matter. Harv. Bus. Rev. 5, 86-93.
139. Malhotra, A., van Alstyne, M., 2014. The dark side of the sharing economy … and how to lighten it. Comm. ACM 57 (11), 24–27.
140. Manyika, J., Lund, S., Bughin, J., Robinson, K., Mischke, J., Mahajan, D., 2016. Independent work: Choice, necessity, and the gig economy. McKinsey Global Institute, New York. Available at: https://www.mckinsey.com/featured-insights/employment-and-growth/independent-work-choice-necessity-and-the-gig-economy.
141. Marchi, A., Parekh, E.J., 2015. How the sharing economy can make its case. McKinsey Qtrly., December. Available at: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/ Strategy%20 and%20Corporate%20Finance/Our%20Insights/How%20the%20sharing%20economy%20can%20 make%20its%20case/How%20the%20sharing%20economy%20can%20make%20its%20case.ashx.
142. Marr, B., 2016. The sharing economy: What it is, examples, and how big data, platforms and algorithms fuel it. Forbes Online, October 21. Available at: https://www.forbes.com/sites/ bernardmarr/2016/10/21/the-sharing-economy-what-it-isexamples-and-how-big-data-platforms-and-algorithms-fuel/.
143. Martin, C.J., 2016. The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism? Ecol. Econ. 121, 149–159. Available at: https://doi.org/10.1016/j. ecolecon.2015.11.027.
144. Martin, C.J., Upham, P., Budd, L., 2015. Commercial orientation in grassroots social innovation: Insights from the sharing economy. Ecol. Econ. 118, 240-251.
145. Matzler, K., Veider, V., Kathan, W., 2015. Adapting to the sharing economy. MIT Sloan Manage. Rev., Winter.
146. Mazareanu, E., 2019a. Value of the global sharing economy, 2014-2025. Statista, August 9. Available at: https://www.statista.com/statistics/830986/value-of-the-global-sharing-economy/.
147. Mazareanu, E., 2019b. Revenue of platform providers in the sharing economy worldwide in 2017 and 2022. Statista, October 21. Available at: https://www.statista.com/statistics/878844/global-sharing-economy-revenue-platform-providers/.
148. McKee, D., Makela, F., Scassa, T., Tremblay-Huet, S. (eds.), 2018. Law and the Sharing Economy: Regulating Online Platforms. University of Ottawa Press, Ottawa, Ontario, Canada.
149. McLachlan, S., 2004. World on fire. Arista Records, New York. Lyrics available at LyricFind.com.
150. Mi, M., Coffman, D., 2019. The sharing economy promotes sustainable societies. Nature Comm. 10, 1214.
151. Morgan, J., 2017-2018. The 5 types of innovation for the future of work, Pts. 1-5. Forbes, June 28, 2017 to August 10, 2018. Available at, for example: https://www.forbes.com/sites/jacobmorgan/ 2015/08/10/the-5-types-of-innovation-for-the-future-of-work-pt-5-public-innovation-2/#bc4a51a59945.
152. Muñoz, P., Cohen, B., 2017. Mapping out the sharing economy: A configurational approach to sharing business modeling. Tech. Forecast. Soc. Change 125, 21–37.
153. Münzel, K., Boon, W., Frenken, K., Vaskelainen, T., 2018. Carsharing business models in Germany: characteristics, success and future prospects. Info. Sys. E-Bus. Manage. 16, 271-291.
154. Nadeem, W., Juntunen, M., Shirazi, F., Hajli, N., 2020. The role of ethical perceptions in consumers' participation and value co-creation on sharing economy platforms. Tech. Forecast. Soc. Change 151, 119786.
155. Nair, R., Miller-Hooks, E. 2011. Fleet management for vehicle sharing operations. Transport. Sci. 45 (4), 524–540.
156. New York Times, 2020. Covid-19 pandemic erodes gig economy work. March 18. Available at: https://www.nytimes.com/2020/03/18/technology/gig-economy-pandemic.html.

157. Nijland, H., van Meerkerk, J., 2017. Mobility and environmental impacts of car sharing in the Netherlands. Environ. Innov. Soc. Trans. 1–8. https://doi.org/10.1016/j.eist. 2017.02.001
158. Organization of Economic Cooperation and Development (OECD), 1997. Regulatory reform and innovation. Report, Committee for Scientific and Technological Policy, Paris, France.
159. Ornetzeder, M., Rohracher, H., 2013. Of solar collectors, wind power, and car sharing: Comparing and understanding successful cases of grassroots innovations. Glob. Environ. Change 23 (5), 856-867.
160. Parker, G.G., Van Alstyne, M.W., Choudary, S.P., 2016. Platform Revolution: How Networked Markets Are Transforming the Economy – and How to Make Them Work for You. W.W. Norton, New York.
161. Pattnaik, A., 2019. How does Uber do surge pricing using location data? Medium.com, November 26. Available at: https://medium.com/locale-ai/how-does-uber-do-price-surge-using-location-data-cfee03415022.
162. Perboli, G., Ferrero, F., Musso, S., Vesco, A., 2018. Business models and tariff simulation in car-sharing services. Transport. Res. Part A: Pol. and Pract. 115, 32–48.
163. Potting, J., Hekkert, M., Worrell, E., Hanemaaijer, A., 2017. Circular economy: Measuring innovation in the product chain. No. 2455, PBL Netherlands Environment Assessment Agency.
164. PWC, 2015. The sharing economy. White paper, New York. Available at: https://www.pwc.fr/fr/assets/files/pdf/2015/05/pwc_etude_sharing_economy.pdf.
165. Qiu, L., Lin, H., Leung, A.K.Y., 2013. Cultural Differences and Switching of In-Group Sharing Behavior Between an American (Facebook) and a Chinese (Renren) Social Networking Site. J. Cross-Cultur. Psych. 44 (1), 106-121.
166. Raghezian, M., Weber, T., 2019a. The advent of the sharing culture and its effect on product pricing. Electron. Comm. Res. Appl. 33, 100801.
167. Raghezian, M., Weber, T., 2019b. Strategic durability with sharing markets. Sustain. Production and Consumption 19, 79-96.
168. Ranzini, G., Etter, M., Lutz, C., Vermeulen, I., 2017. Privacy in the sharing economy. Report, EU Horizon 2020 Project Ps2Share: Participation, Privacy, and Power in the Sharing Economy, April. Available at: https://www.researchgate.net/publication/316596483_Privacy_in_the_Sharing_ Economy.
169. Remane, G., Nickerson, R., Hanelt, A., Tesch, J.F., Kolbe, L.M., 2016. A taxonomy of carsharing business models. In Proc. 37th Conf. Info. Sys., Assoc. for Info. Sys., Atlanta, GA, December.
170. Retamal, M., Dominish, E., 2017. The sharing economy in developing countries. White paper for Tearfun UK, Institute for Sustainable Futures, University of Technology Sydney, Australia. Available at: https://www.uts.edu.au/sites/default/files/201712/ISF_The%20Sharing%20Economy%20in%20Developing%20Countries_2017.pdf.
171. Rietveld, J., Schilling, M.A., Bellavitis, C., 2019. Platform strategy: Managing ecosystem value through selective promotion of complements. Org. Sci, 30 (6), 1125-1139.
172. Ridester, 2020. How drivers can take advantage of Uber surge pricing. Blog, DATE. Available at: https:ridester/blog/.
173. Rinne, A., 2018. The dark side of the sharing economy. Geneva, Switzerland, January 16. Available at: https://www.weforum.org/agenda/2018/01/the-dark-side-of-the-sharing-economy/.
174. Rossi, J., 2005. Regulatory Bargaining and Public Law. Cambridge University Press, Cambridge, UK.
175. Sabitzer, T., Hartl, B., Marth, S., Hofmann, E., Penz, E., 2018. Preventing conflicts in sharing communities as a means of promoting sustainability. Sustainability 10, 2828.
176. Sampson, R.C., 2004. Organizational choice in R&D alliances: Knowledge-based and transaction cost perspectives. Manage. Dec. Econ. 25, 421-436.
177. Sanzo-Perez, M.J., Álvarez-González, L.I., Rey-García, M., 2015, How to encourage social innovations: A resource-based approach. Serv. Ind. J. 35 (7-8), 430-447.
178. Satopaa, V., Mehrotra, P., 2018. Disrupting business models is not enough: We need tech innovation too. World Economic Forum, Geneva, Switzerland, March 15. Available at: https://www.weforum.org/agenda/2018/03/sharing-economy-product-innovation-balance-disruption/.
179. Sauvage, J.M., 2019. How artificial intelligence is transforming revenue management for airlines. Amadeus, Madrid, Spain, December 16. Available at: https://amadeus.com/en/insights/blog/airline-ai-ml-revenue-management.
180. Scarlett, T.J., Kong, H., Wu, R., Sui, D.Z., 2018. Ride-sourcing, the sharing economy and the future of cities. Cities 76, 96-104.
181. Schaal, D., 2020. The definitive oral history of online travel. Skift.com. Available at: http://skift.com/histor-of-online-travel/.
182. Schiller, B., 2014. Car-sharing means there are already 500,000 fewer vehicles on the road. Fast Company, March 6. Available at: https://www.fastcompany.com/3027275/car-sharing-means-there-are-already-500000-fewer-vehicles-on-the-road.
183. Schleifer, 2019. Airbnb sold some common stock at a $35 billion valuation, but what is the company

really worth? Vox, March 19. Available at: https://www.vox.com/2019/3/19/18272274/airbnb-valuation-common-stock-hoteltonight.
184. Schmidt, P., 2018. The effect of car sharing on car sales. Working paper, Department of Economics, Bocconi University, Italy, June 26. Available at: https://ssrn.com/abstract=3198474.
185. Schuijbroek, J., Hampshire, R.; Van Hoeve, W.J., 2017. Inventory rebalancing and vehicle routing in bike sharing systems. Eur. J. Op. Res. 257 (3), 992-1004.
186. Sen, J., 2012. Ubiquitous computing: Applications, challenges and future trends. In Chapter 1, R.A. Aquino Santos and A.E. Block (eds.), Embedded Systems and Wireless Technology, CRC Press, Boca Raton, FL, pp.1-39.
187. Seyfang, G., Haxeltine, A., 2012. Growing grassroots innovations: Exploring the role of community-based initiatives in governing sustainable energy transitions**.** Environ. Plan. C: Gov. Pol. 30 (3), 381-400.
188. Seyfang, G., Hielsher, S., Hargreaves, T., Martiskaenen, M., Smith, A., 2014. A grassroots sustainable energy niche? Reflections on community energy in the U.K. Environ. Innov. And Soc. Transitions 13, 21-44.
189. Shaheen, S.A., Chan, N.D., 2015. Evolution of e-mobility in carsharing business models. In D. Beaton and D. Meyer (eds.), Electric Vehicles Business Models, Springer, Intl., Cham, Switzerland, pp. 169–178.
190. Shaheen, S., Cohen, A., Jaffee, M., 2018. Innovative mobility: Carsharing outlook. Tech. Report. Transport. Sustain. Res. Ctr., University of California, Berkeley, CA.
191. Shao, Z., Li., X., Guo, Y., Zhang, Y., 2020. Influence of service quality in sharing economy: Understanding customers' continuance intention of bicycle sharing. Electron. Comm. Res. Appl. 40, 100944.
192. Snelling, S., 2019. Study finds ride-sharing services like Lyft and Uber improve lives for older adults. Forbes, September 18. Available at: https://www.forbes.com/sites/nextavenue/2019/09/18/study-finds-ridesharing-services-like-lyft-and-uber-improve-lives-for-older-adults/#45211d402801.
193. Somers, L., Baelus, C., 2018. Understanding product-service systems in a sharing economy context: A literature review. In Sakao, T., Lindahl, M., Liu, Y., Dalhammar, C. (eds.), Proc. 10th CIRP Conf. on Indus. Product-Service Sys., May 29-31, Linköping, Sweden.
194. Soo, Z., Perez, B., 2016. Uber sells Chinese business to rival Didi Chuxing after bitter fight for supremacy. South China Morning Post, August 1. Available at: https://www.scmp.com/tech/ china-tech/article/1997821/uber-sells-chinese-business-didi-chuxing.
195. Statista, 2020a. Market share of the leading ride-hailing companies in the United States from September 2017 to January 2020. Available at: https://www.statista.com/statistics/910704/market-share-of-rideshare-companies-united-states/.
196. Statista, 2020b. Annual net revenue of eBay from 2013 to 2019. Available at: https://www.statista. com/statistics/507881/ebays-annual-net-revenue/.
197. Statista, 2020c. Annual revenue of Etsy Inc. from 2012 to 2019. Available at: https://www.statista.com/statistics/409371/etsy-annual-revenue/.
198. Stepanek, P., 2018. The access economy. Medium.com, November 12. Available at: https://medium.com/@patrickstepanek/the-access-economy-b4a277cc76b0
199. Stocker, A., Shaheen, S., 2017. Shared automated vehicles: Review of business models. Discussion paper 2017-09, International Transport Forum, Organization for Economic Cooperation and Development (OECD), Paris, France.
200. Sun, Z., Guo, Q., Yang, J., Fang, H., Guo, G., Zhang, Burke, R., 2019. Research commentary on recommendations with side information: A survey and research directions. Electron. Comm. Res. Appl. 37, 100879.
201. Sundararajan, A., 2013. From Zipcar to the sharing economy. Harv. Bus. Rev., January.
202. Sundararajan, A., 2016. The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism. MIT Press, Cambridge, MA.
203. Sutherland, W., Jarrahi, M.H., 2018. The sharing economy and digital platforms: A review and research agenda. Intl. J. Info. Manage. 43, 328–341.
204. Tadelis, S., 2016. Reputation and feedback systems in online platform markets. Ann Rev. of Econ. 8, 321-340.
205. Tart, S., Wells, P., Beccaria, S., 2018. Analysis of business models for car sharing. Deliverable D3.1, LGI Consulting, Brussels, Belgium, April 9. Available at: http://www.lgi-consulting.com/wp-content/uploads/2019/10/STARS-D3.1.pdf.
206. Taylor, A. The bike-share oversupply in China: Huge piles of abandoned and broken bicycles. The Atlantic, March 22. Available at: https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/#img09.
207. Teubner, T., Flath, C.M., 2019. Privacy in the sharing economy. J. Assoc. Info. Sys. 20 (3). 213-242.
208. The Economist, 2016. What is information asymmetry? September 5. Available at:

https://www.economist.com/the-economist-explains/2016/09/04/what-is-information-asymmetry.
209. The Mill, 2019. Dundee partners with a new cashless parking payment provider. April 2. Available at: https://themill.scot/latest/dundee-partners-with-a-new-cashless-parking-payment-provider/.
210. Tidd, J., Bessant, J.R., 2013. Managing Innovation: Integrating Technological, Market and Organizational Change, 5th Ed. John Wiley and Sons, New York.
211. Tiku, N., 2013. Digital privacy is making antitrust exciting again. Wired, June. Available at: https://www.wired.com/2017/06/ntitrust-watchdogs-eye-big-techs-monopoly-data/.
212. Tussyadiah, I.P., Zach, F.J., Wang, J., 2017. Attitudes toward autonomous on demand mobility system: The case of self-driving taxi. In R. Schegg and B. Stengl (eds.) Information and Communication Technologies in Tourism 2017, Springer, Intl., Cham, Switzerland, pp. 755–766.
213. United Nations, 2015. Transforming the world: The 2030 Agenda for Sustainable Development. New York. Available at: https://sustainabledevelopment.un.org/post2015/transformingourworld.
214. van Brugen, 2018. Deal watch: Budget travel. The Times (London), January 13. Available at: https://www.thetimes.co.uk/edition/money/deal-watch-budget-travel-bjvh3nhgq.
215. Varian, H.R., 2000. Buying, sharing and renting information goods. J. Indus. Econ. 48 (4), 473–488.
216. Vleugels, A., 2019. Why French unicorn BlaBlaCar still believes in 'done is better than perfect.' TheNextWeb.com, February 19. Available at: https://thenextweb.com/adobe-fundamentals/ 2019/02/19/why-french-unicorn-blablacar-still-believes-in-done-is-better-than-perfect/.
217. von Hoffen, M., 2017. The sharing economy meets the semantic web: An ontology for the matchmaking of peers. In Proc. 2017 IEEE 11th Intl. Conf. Seman. Comp., IEEE Comp. Soc. Press, Washington, DC, pp. 212-219.
218. Wang, Y., Asaad, Y., Filieri, R., 2019. What makes hosts trust Airbnb? Antecedents of hosts' trust toward Airbnb and its impact on continuance intention. J. Trav. Res. 59 (4), 686-703.
219. Weber, T.A., 2014. Intermediation in a sharing economy: Insurance, moral hazard, and rent extraction. J. Manage. Info. Sys. 31 (3), 35-71.
220. Weber, T.A., 2016. Product pricing in a peer-to-peer economy. J. Manage. Info. Sys. 33 (2), 573-596.
221. Weber, T.A., 2017. Smart products for sharing. J. Manage. Info. Sys. 34 (2), 341-368.
222. Yoffie, D., 1997. Competing in the Age of Digital Convergence. Harvard Business School Press, Boston, MA.
223. Youn, S., Theodorou, C., 2019. Lyft says drivers tampering with surge pricing could be booted. ABC News, May 18. Available at: https://abcnews.go.com/Business/lyft-drivers-tampering-surge-pricing-booted/story?id=63101962.
224. Younger, J., 2020. 21 gig economy leaders share how the coronavirus pandemic is impacting the freelance workforce. Forbes, March 20. Available at: https://www.forbes.com/sites/jonyounger/2020/03/ 20/update-how-coronavirus-is-impacting-freelancers-and-gigsters-now-today-march-20/#559c77b44a03.
225. Zacks, S.B., 2019. Uber versus Lyft: Road travelled since their IPOs. Yahoo! Finance, August 26. Available at: https://finance.yahoo.com/news/uber-versus-lyft-road-travelled-140702076.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAMbFEzjl5ntwCNPwYbZdurKz5XneEfdRkD9Xx3GesKjz_i0UNhOrGK-O1i3sfF-ZZat8aAymjobe8IlNB0GqTQ-hQvfJpVzfUDZVT5dKskMb1b-wktxLXmLEl7OYV-YH4qsCOZ7k-_0uGk7uUyOSb0ybDEOpTbQmCScxpGUwVV9i.
226. Zervas, J., Proserpio, D., Byers, J.W., 2017. The rise of the sharing economy: Estimating the impact of Airbnb on the hotel industry. J. Mktg. Res. 54 (5), 687-705.
227. Zetlin, May 23. Here's why Uber and Lyft drivers are artificially creating surge prices. Inc., May 23. Available at: https://www.inc.com/minda-zetlin/uber-lyft-drivers-artificial-surge-pricing-reagan-national-washington-arlington-drive-united.html.
228. Zha, L., Yin, Y., Yang, H., 2016. Economic analysis of ride-sourcing markets. Transport. Res. Part C: Emerg. Tech. 71, 249-266.
229. Zha, L., Yin, Y., Du, Y., 2017. Surge pricing and labor supply in the ride-sourcing market. Transport. Res. Proc. 23, 2-21.
230. Zhao, W., Zheng, Y.S., 2000. Optimal dynamic pricing for perishable assets with nonhomogeneous demand. Manage. Sci. 46 (3), 375–388.
231. Zipkin, A. Renting rooms to travelers can be a source of income later in life. New York Times, June 18. Available at: https://www.nytimes.com/2016/06/18/your-money/renting-rooms-to-travelers-can-be-a-source-of-income-later-in-life.html?_r=0.
232. Zvolska, L., 2019. The sharing economy as a disruptor. Urban Sharing, Amsterdam, Netherlands, February 19. Available at: http://www.urbansharing.org/new-blog/2019/2/19/the-sharing-economy-as-a-disruptor.

Appendix A. Sharing Economy Terms Used in This Article

Terms	Definitions and Descriptions	Sources
Access economy	Competition between companies doesn't hinge on which platform provides the most social interaction and community, contrary to current sharing economy rhetoric. Consumers think about access differently than about ownership. A successful business model consists of convenient and cost-effective access to valued resources, flexibility, and freedom from financial, social, and emotional obligations in ownership and sharing.	Eckhardt and Bardi (2015)
Asymmetric information	In economics, this term describes settings in which the parties to a potential transaction have access to different information, which creates an imbalance in their relative power such that they may be reluctant to transact with one another due to problems with trust. Less-than-best market transparency often leads to problems of adverse selection and moral hazard and diminishing information asymmetries will result in higher quality markets and more efficient economic exchange.	The Economist (2016)
Business models	What distinguishes sharing platforms from other digital intermediation in e-commerce is how organizational and market mechanisms are coordinate platform participation and generate value. There are four types: franchisers (tight control over participants / high rivalry among service suppliers), principals (tight control / low rivalry), gardeners (low control / low rivalry), and chaperones (low control / high rivalry).	Constantiou et al. (2017)
Car-sharing	In car-sharing, community members book cars by the hour or day, for short-distance trips, on a last-minute or advance self-serve basis, online via mobile apps anytime. In contrast, car-rental involves by making a booking transaction with a rental company by the day, week or month for any travel distance.	CarClub.com.sg (2020)
Carpooling	Carpooling refers to people who are strangers using mobile apps to connects to an intermediary's platform to engage in a trust relationship to get transportation services.	BlaBlaCar (2020b)
Collaborative consumption	In the sharing economy, the set of resource circulation systems, which enable consumers to both obtain and provide, temporarily or permanently, valuable resources or services through direct interaction with other consumers or through a mediator who uses a technology platform.	Ertz et al. (2016)
Customer profitability gradient	A customer profitability gradient occurs in industry sectors for which extreme differences in the cost to serve a customer or their willingness to pay results in discernably different degrees of capability for sellers to earn economic profit.	Clemons (2018)
Dynamic pricing	Dynamic pricing (also known as surge pricing), is a strategic pricing process used by firms which hope to take advantage of the changing relationship between supply and demand in a change marketplace.	Chen and Sheldon (2016)
Gig economy	In a gig economy, temporary, flexible jobs are commonplace and companies tend toward hiring independent contractors and freelancers instead of full-time employees. A gig economy undermines the traditional economy of full-time workers who rarely change positions and instead focus on a lifetime career. This term gets its name from each piece of work being akin to an individual "gig."	Investopedia (2020); Kobie (2018)
Idle capacity	Sharing of idle capacity is central to the sharing economy, because it distinguishes the practice of sharing goods from offering on-demand personal services.	Frenken and Schor (2017)
Knowledge leakage	Knowledge leakage is due to employee, co-worker and partner opportunism, from loss of tech knowledge intended to stay within a firm's boundariesl also may cause a weakened state in which the firm loses competitive advantage and industry position.	Frishammer et al. (2015)
Multi-sided platform	Multi-sided platforms are technologies, products or services that create value by enabling direct interactions between two or more customer or participant groups.	Hagiu (2014)
Newly-vulnerable market	Market becomes vulnerable if it is newly-easy to enter, as a result of regulatory, tech, or consumer preferences changes; as consumers become net-savvy, online shopping may threaten established mall operators and owners of large physical stores.	Clemons et al (2003)
Ownership	In traditional markets, consumers buy products to own them; in a sharing economy there is a greater emphasis on gaining access to their use by paying for temporary access-rights to a product, such as an audio book, online movie, or aggregator-based research journal articles. The key contrasts in today's digital marketplaces are among owning, buying and renting both digital and physical assets (e.g., bicycles and cars).	Dervojeda et al. (2013)
Platform ecosystem	A platform ecosystem has a stable core (e.g., a smartphone OS) that mediates the relationship between a wide range of complements (e.g., music titles) and prospective end-users. When a market is composed of a platform and complements this way, there is a complex interplay in how each element of the bundle contributes to system value, and there are important interdependencies between the actions of members comprising the ecosystem. Relationships are not as independent as arms-length market contracts, nor as dependent as in a hierarchy, so this is a a hybrid organizational form.	Rietveld et al. (2019)
Sharing economy	Sharing of idle assets via technology platforms, to produce economic, environmental, social and practical benefits for participants in transactions and sharing exchanges.	Rinne (2018)