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Review

Prospects and challenges of sharing economy for the public sector

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ABSTRACT

The sharing economy entails peer-to-peer exchanges for renting goods and services utilizing the Internet. In this paper, we critically examine the sharing economy's prospects and challenges for public sector, and explore the policy responses to the sharing economy. The sharing economy is innovative in capitalizing on underutilized assets using Internet platforms, but has adverse impacts as well (e.g. it could exacerbate inequality). As users, public agencies could adapt internal procurement processes focused on renting, and partner with sharing platforms to complement and supplement public services. As regulators, government agencies have a paradoxical role to maintain the sharing economy's innovation while addressing its downsides. Our study shows mixed policy reactions to sharing economy in three prominent sectors (mobility services, accommodation sharing, and gig labor). We suggest a research agenda that e-government scholars should focus on in order to critically examine the different facets of the emerging sharing economy.

1. Introduction

The sharing economy is broadly characterized by peer-to-peer exchanges for renting goods or services utilizing Internet platforms. The sharing economy platforms focus on peer-to-peer economic transactions by facilitating the sharing or renting of space, assets, and labor in real time. Airbnb and Uber are popular examples of the sharing economy, which facilitate the sharing of residence, car, and labor. Such platforms are distinctive from other social media and e-commerce platforms which are oriented toward peer to peer communications and commercial goods transactions respectively. The sharing economy is also largely mobile first, i.e., the platforms are explicitly oriented toward the smartphone users. With mobile apps, users can request the sharing economy services from any place at any time.

The sharing economy has grown exponentially over the last decade. PricewaterhouseCoopers (2015) pegged the sharing economy to grow from $15 billion dollars in 2014 to $335 billion dollars in 2025. The market value of some of the sharing economy platforms has surpassed long established firms in the sector. Uber (started in 2009) is valued at US $68 billion, which is more than each of the three big American automobile firms of Chrysler, Ford, and General Motors (Chen, 2015). Airbnb (launched in 2008) is valued at $30 billion, which is more than the Hilton hotel chain and nearly as much as the Marriott hotels (Schechner & Bensinger, 2016). Besides accommodation and car sharing, the sharing economy has spread across several sectors, including education, finance, goods, utilities, and workspace.

The rapid rise of the sharing economy is pertinent in the context of adaptive and agile governance where public agencies are expected to adapt quickly to the environmental changes (Gong & Janssen, 2012; Janssen & van der Voort, 2016; Mergel, 2016). In this paper, we explore the opportunities and challenges of the sharing economy for public sector in general and digital government in particular. On the upside, the rapid rise of sharing economy presents new opportunities for the public sector. The sharing economy is innovative in using underutilized assets and spare labor. It holds environmental benefits as it re-uses existing assets at capacity. Adaptive governance in the context of sharing economy would imply that public agencies should take advantage of the new opportunities for both internal management and external public service delivery. Internally, agencies do not need to own and manage assets; they can be rented flexibly based on demand. Digital government processes could facilitate the sharing to use assets at capacity. Externally, public agencies could partner with sharing platforms to enhance public services like transit.

On the downside, the rental emphasis of the sharing economy could exacerbate inequality by privileging those who own property already. The sharing economy is also re-shaping work, creating a class of independent workers who depend on piecemeal gigs without workplace benefits. Moreover, the sharing economy challenges the established businesses and labor unions. Regulating the sharing economy to address the downsides could be quite paradoxical since the innovative aspects of the sharing economy should be retained. Current policies aimed at the sharing economy range from benign acceptance to active resistance.

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As digital government researchers and policymakers begin to deal with consequences of the sharing economy, our paper is a useful step in taking stock of the major debates on the opportunities and challenges of the sharing economy. We suggest a research agenda on the nexus between sharing economy and the public sector. The paper is structured as follows. The next section reviews the major dimensions of the sharing economy and its growth. Then, we outline the prospects of sharing economy for the public sector, followed by the challenges of the sharing economy. After this, we outline the government's regulatory role in dealing with the sharing economy. We conclude with the principal features of sharing economy that require further research and attention from e-government scholars and practitioners.

2. Sharing economy's dimensions and its growth

The sharing economy is not entirely new. Traditionally, the sharing economy has implied an alternative to the capitalist profit-making economy, often characterized by collective ownership and collaborative consumption. Informal networks of sharing and collaboration have existed across societies. The newness of the present sharing economy lies in the use of information technology. In very broad terms, the present day sharing economy could be characterized as peer-to-peer sharing of goods and services utilizing the Internet platform. We must acknowledge that there are various debates surrounding the nomenclature of sharing economy. Parallel terms used include “collaborative economy” (Botsman & Rogers, 2010), “crowd-based capitalism” (Sundararajan, 2016), “elancing” (Aguinis & Lawal, 2013), “gig economy” (Mulcahy, 2016), “mesh economy” (Gansky, 2010), “on-demand economy” (“The Future of Work, 2015), and the “platform economy” (Parker, Van Alstyne, & Choudary, 2016). Each of these terms focus on a specific dimension of the broader scope of the emerging sharing economy. Despite definitional ambiguity, prominent scholars of the new digital economy have begun to rally around the term *sharing economy* to capture the core aspects of the emerging digital economy, while recognizing the other dimensions (Belk, 2014; Frenken & Schor, 2017; Sundararajan, 2016). For example, Sundararajan (2016, p. 27) argues: “Although I find “crowd-based capitalism” most precisely descriptive of the subject matter I cover, I continue to use “sharing economy” … because it maximizes the number of people who seem to get what I'm talking about.”

There are two key dimensions of the present sharing economy. First, the sharing economy centrally depends on Internet platforms to enable the peer exchange. Second, the emphasis of sharing is on creating exchange value through *sharing* assets, rather than *owning* assets. More accurately, the assets are often *rented* rather than shared, as the exchanges are usually commercial rather than being free (Rifkin, 2000; Sundararajan, 2016). The sharing economy has expanded across many sectors, including mobility (such as car and ride sharing), space (such as short-term residential and commercial work space rentals), and labor (part-time gigs).

2.1. Internet platforms enabling peer-to-peer connections

The advent of Internet in the mid-1990s spurred e-commerce, when peer-to-peer online marketplaces, such as Amazon, eBay, and Craigslist were born. In the 2000s, Web 2.0 mechanisms such as social media (Facebook, LinkedIn, and Twitter), blogs, and wikis enabled peer-to-peer communications within personal and professional collaborative networks (Tapscott & Williams, 2008). Platforms like Flickr, Pinterest, and Youtube enabled sharing multimedia. Crowdsourcing (e.g. Wikipedia) and crowdfunding platforms (e.g. Kickstarter, Kiva) catalyzed voluntary content and funding online respectively. The Internet is also central to the present sharing economy for enabling peer networks, bringing together service providers and consumers in a common online forum. The e-commerce, social media, crowd, and the sharing economy platforms have similar and distinctive characteristics. They are similar in using the Internet platforms for establishing peer networks, but the networks are used for different functions. E-commerce and sharing economy focus on transactional exchanges, but the former is oriented toward buying and selling goods, and the latter is for renting goods. Social media is oriented principally toward peer communication networks, not for transactional exchanges. Crowd platforms tap on knowledge and money from willing volunteers.

With the growth of mobile devices and the availability of wireless broadband over the last decade, Internet connected smartphones and sensors have spawned the mobile app economy and location based services (Ganapati, 2016). The smartphones have created new opportunities for peer-to-peer networking from anywhere at anytime, whereby citizens can obtain services at the location in real time. Location-based services capture the mobile user's real-time location information to give customized personal services in the immediate vicinity. Indeed, many of the sharing enterprises have taken a mobile first approach, i.e., they are designed from the beginning for the smartphone user. Lyft and Uber, for example, are essentially location-based services which connect a user with a driver in order to provide a ride on demand at the location (Ganapati, 2017).

Sharing economy enterprises use the Internet platform to establish connections between people and organizations across time and space. The platform provides the technological infrastructure for exchanging, interacting, communicating, and participating in the network. The platform is multisided since it brings together different groups of producers and consumers. The platform's overarching purpose is to be matchmakers so that there is exchange of goods and services between peer groups (Evans & Schmalensee, 2016). The sharing platform is a “business based on enabling value creating interactions between external producers and consumers” (Parker et al., 2016, p. 5). The U.S. Department of Commerce's Economics and Statistics Administration (ESA) (2016) classifies the sharing economy enterprises as “digital matching firms” which are “online platforms (or marketplaces) that enable the matching of service providers with customers” (2016, p. 2). The firms typically use an app or a website to facilitate peer-to-peer transactions.

A critical mass of peers—producers and consumers, service providers and service seekers, employers and workers—is required in the network for the functioning of the sharing economy platforms. The peers could be both producers as well as consumers, often referred to as *prosumers* where consumers are involved in co-production (Humphreys & Grayson, 2008; Ritzer & Jurgenson, 2010). Gansky (2010) describes the sharing networks as a mesh which “allows any node to link in any direction with any other node in the system.” Similarly, Sundararajan (2016) also conceptualized the sharing economy as crowd based capitalism. The crowd-based networks are horizontal with loose connections among individuals, rather than centralized vertical hierarchies of corporate entities. Individual peers, rather than corporations, supply the capital and labor. The crowd networks are loose as the individual peers are strangers, brought together by the platforms.

The platforms need to provide a digital mechanism for establishing peer-to-peer trust among strangers in the network. Information asymmetry and moral hazard problems loom among the peers in the online, virtual environment. The platforms use data driven systems to track goods and their usage, and to strengthen customer intelligence. Typically, the mutual trust is established in the sharing network through a feedback mechanism where clients as well as providers weigh each other. The feedback system is often bilateral, so that the providers also have an assurance about the integrity of the customer giving the review or ratings. Online customer reviews and ratings systems are open and publicly available; the trust system is thus horizontally distributed in the network, rather than being vertically enforced in a traditional firm. The digital platforms aggregate the reviews and rank the providers, which go toward building the reputation of the provider (Thierer, Koopman, Hobson, & Kuiper, 2015). The sharing economy is therefore also referred to as the “reputation economy” (Fertik &

Thompson, 2015; Gandini, 2016). Providers could be required to maintain minimum thresholds to continue to be in the platform's network.

2.2. Renting in sharing economy

The sharing economy is principally based on short-term renting, which could range from a continuum of non-commercial (genuine community sharing) to that of market exchange value generated through short-term commercial renting. Botsman & Rogers (2010, p. xv) describe the sharing economy as collaborative consumption, which includes "traditional sharing, bartering, lending, trading, renting, gifting, and swapping, redefined through technology and peer communities." Owyang & Samuel (2015, p. 4) argue that the collaborative economy is one where, "common technologies enable people to get the goods and services they need from each other, peer to peer, instead of buying from established corporations." Sundararajan (2016) considers the sharing to range from gift to market economy. Botsman and Rogers (2010) also include non-monetary exchanges, but Belk (2014) and the ESA (2016) limit sharing economy's scope to commercial exchanges. Frenken and Schor (2017), p. 4–5) argue that the sharing economy comprises of "consumers granting each other temporary access to under-utilized physical assets ("idle capacity"), possibly for money." Our emphasis in this paper is also on commercial renting (whereby sharing is a specific form, characterized by zero rent).

The emphasis of the sharing economy on *renting* shifts focus from long-term ownership exchange to short-term accessibility of property, product, or service. Hence, it is also called the access economy, where "markets give way to networks, sellers and buyers are replaced by suppliers and users, and virtually everything is accessed" (Rifkin, 2000, p. 6). The access could be given through lease, rent, or fees (e.g., admission, membership, subscription) (Bardhi & Eckhardt, 2012). There is no permanent exchange of asset ownership. Rifkin (2014) argues that sharing in the digital era upends the traditional market economy based on ownership, as the sharing significantly reduces the marginal costs of production to nearly zero. Benkler (2004) argued that the shareable goods are lumpy, whereby the owner cannot fully use the assets at capacity. The residual slack capacity can be shared among peers. Sharing platforms facilitate the sharing to use the asset at capacity.

The sharing economy platforms themselves do not own property or provide the service or provide the necessary tools for service to the providers. Service providers themselves provide the required assets or labor. The platforms facilitate the online peer network. Botsman and Rogers (2010) highlight three models of sharing through the platforms: product service system, redistribution market, and collaborative lifestyle. In the product service system, a good is available as a service for a limited time (e.g., Zipcar for car sharing). Redistribution market refers to reuse or reselling of used or preowned goods, so that products are not discarded as waste (e.g., Freecycle, Kashless, or Swaptree for finding used goods). Collaborative lifestyle refers to sharing or exchanging idle assets such as time, space, skills, and money. Such exchanges could range from hyper local (e.g., sharing working spaces through Citizen Space or Hub Culture) to the global (e.g., Couchsurfing and Airbnb for sharing accommodation).

The sharing economy has given rise to a new class of part-time gigs, where the workers are hired on hourly basis through the online platforms. Consequently, the sharing economy is also referred to as "elancing," "gig economy," or "on-demand" economy. Elancing is the means for "individuals interested in being hired and employers looking for individuals to perform some type of work to meet" (Aguinis & Lawal, 2013, p. 6). The workers and the employers are matched through the Internet platform, facilitating a worldwide work arrangement. Amazon Mechanical Turk, for example, advertises itself as online marketplace of work, connecting businesses and developers online. The gig work is inherently uncertain, wherein the gig workers' employment could range between working full-time and unemployment depending on the market demand. The gigs include "consulting and contractor arrangements, part-time jobs, temp assignments, freelancing, self-employment, side gigs, and on-demand works through platforms like Upwork and TaskRabbit" (Mulcahy, 2016, p. 1). The gigs are flexibly arranged in the on-demand economy wherein the systems "match jobs with independent contractors on the fly, and thus supply labor and services on demand" ("The Future of Work, 2015). The gigs do not have a stable employer-employee relationship that is characteristic of a typical full-time employment. Employers hire workers for specific task and time, and workers can choose to work flexibly on their own schedule.

2.3. Scope of sharing economy

The sharing economy grew significantly in the context of Great Recession (2007–2009), as the platforms provided new means of earnings by renting extant assets. Gig tasks provided flexible job opportunities in place of unemployment (Marshall, 2015). The sharing platforms have grown both in terms of service sectors and size worldwide. In terms of services, the U.S. Department of Commerce's Economics and Statistics Administration (2016) identified over 20 service areas where the sharing economy has a presence. Lisa Gansky's website (http://meshing.it) identified 25 service categories of over 9700 mesh companies distributed over more than 1630 cities in over 130 countries.

Owyang's (2016) Honeycomb is perhaps the most systematic in outlining the scope of the sharing economy. He conceptualized the sharing economy as a resilient honeycomb structure for, "access, sharing, and growth of resources among a common group." He identified nearly 280 startups, the large majority of which are young (about seven years or less). The Honeycomb categories expanded from six (version 1 in March 2014) to twelve (version 2 in December 2014) and then to sixteen (version 3 in March 2016). The sixteen categories are related to: Analytics and Reputation; services for Corporations & Organizations; Food; Goods; Health; Learning; Logistics; Mobility Services; Money lending; Municipal; Services (mainly Staffing); Space (accommodation or co-working); Utilities; Vehicle Sharing; Wellness & Beauty; and Worker Support. An exemplary list of platforms in these categories is given in Table 1.

In terms of size, the sharing platforms valued at over $1 billion dollars surged from two in 2010 to 24 in 2015 (Owyang & Cases, 2016). The platforms grew across a wide range of sectors internationally. Uber and Airbnb are the most prominent, whose valuations are comparable to the leading car firms and hotel chains respectively. Ride hailing services similar to Uber in the billion dollar club include BlaBlaCar, Didi Kuaidi, GrabTaxi, Lyft, Ola Cabs, and Yidao Yongche. Short term vacation rentals like Airbnb include Tujia and HomeAway. Besides these, gig platforms for connecting employers and workers include Freelancer, Thumbtack, WeWork. Large money lending platforms like FundingCircle, Jimubox, LendingClub, Prosper, and TransferWise bring together lenders willing to lend and borrowers needing the funds. Other large specialty sites include education (Chegg, Udacity), food (Blue Apron), and delivery (Instacart) services.

The sharing economy has taken a strong foothold over the last decade. PricewaterhouseCoopers (2015) survey report showed that 44% of Americans were familiar with the concept of sharing economy, with 18% participating as a consumer, and 7% participating as a provider. The report predicted the sharing economy will outpace the traditional rental sectors (like equipment rental, B&B and hostels, car rental, etc.) over the next decade. Aspen Institute's *Future of Work Initiative* study (Steinmetz, 2016) reported that 42% of respondents participated as a consumer and 22% participated as a provider. The participants were mainly in five sectors: ride-sharing, home-sharing, staffing services, car rental, and food or goods delivery. Pew Research Center's surveys highlight that 72% of Americans have used some type of shared or on-demand online service (Smith, 2016a) and 24% earned income through the sharing economy (Smith, 2016b). The most visible

Table 1
Sharing economy platforms.

Category	Sub-category	Platforms
Analytics and reputation	Driver services	Ridescout, what's the fare
	Identity and reputation	eRated, HireRight, Karma, Onfido, Traity, TrustCloud, Veridu, Vijilent
	Renter services	Beyond Pricing, Everbooked, Kigo (RateCoaster), Smart Host
Corporations & organizations	Employee services	Slice Rides, Twogo
	Platforms	Button, Cloud Commerce Factory, Crowdtap, eYeka, Innoverne, Juggernaut, Marketplacer, Mila, Nearme, Sharetribe, Tilt
	Supply chain	Cargomatic, LocalMotion, WoNoLo
Food	Food delivery	Farmigo, GrubMarket, Saucey, SpoonRocket, Sprig, UberEats
	Shared food	Bon Appetour, Eatwith, Feastly, Leftoverswap, Mealsharing, Vizeat
	Shared food prep	Barnraiser, Kitchen Surfing, Kitchit, Munchery, Rub & Stub, The Food Assembly
Goods	Loaner products	Bagborrowsteal, Hey, Neighbor!, Open Shed, Peerby, Pley, RentTheRunway, Rocksbox
	Maker movement	Brit + Co, CustomMade, Make, Maker's Row, Shapeways, Techshop, The Grommet
	Pre-owned goods	Kijiji, Moveloot, OfferUp, Poshmark, TradeMe, Wallapop, WarpIt, Yerdle
Health	Peer to peer	Bemyeyes, CoHealo, Crowdmed, Helparound
	Care services	Curbside Care, Dispatch Health, Doctor on Demand, Eaze, Heal, Medicast, Medneo, MedZed, Pager, RetraceHealth, Stat
Learning	Book sharing	Chegg, Sidewalk, Zookal
	Instructor-Led	Coursera, Khan Academy, SimpliLearn, Thinkful, Udacity, Udemy
	Peer-to-peer	Gibbon, Instructables, Maven, P2P University, Sharing Academy, Skillshare, uTest
Logistics	Local delivery	Deliv, Favor, Ghosttruck, Instacart, Kanga, Lugg, Postmates, Shadowfax, UberRUSH
	Shipping	BellHops, Nimber, PiggyBee, Roadie, Sheaply, Shipster, Shyp, Transfix
	Storage	MakeSpace, Roost, Stashbee
Mobility services	Ride hailing	BlaBlaCar, Bridj, Chariot, Didi Kuaidi, Easy Taxi, Flywheel, Gett, Grab (GrabTaxi), Hailo, Juno, Lazooz, Loup, Lyft, OlaCar, RallyBus, Shuddle, Surfair, TianTian, Uber, Wingz
	Bicycles	BCycle, BikeSharing, Splinlister
	Parking	CARMAnation, JustPark, Park On My Drive, Parqex, Roost, Rover, YourParkingSpace
	Support	Filld, YourMechanic, Purple
	Valet services	Caarbon, Luxe, Valetanywhere, ZIRX
Money	Crowdfunding	Circle Up, Crowdfunder, Experiment, FundingCircle, Gofundme, Indiegogo, Kickstarter, OurCrowd, Pave
	Cryptocurrencies	Bitcoin, Coinbase, Dash, Litecoin, Ripple
	Moneylending	Able, Faircent, Kiva, LendingClub, Prosper, RateSetter, Zopa
Municipal	City Sponsored Bikes	Bicing Barcelona, Hangzhou Public Bicycle, Santander Cycles London, Velib
	Platforms	Getable, MachineryLink, Munirent, SeeClickFix, YardClub
Services	Business	99Designs, Cloudpeeps, Crowdspring, FieldAgent, Gigwalk, HourlyNerd, Kaggle, Nabbesh, Payable, StaffJoy, Universal Avenue, UpCounsel, Upwork
	Personal	Airtasker, Ask for Task, Bannerman, Care.com, DogVacay, Fancy Hands, Fiverr, Musketeer, Taskrabbit, WeGoLook, Zaarly
Space	Personal space	9flats, Airbnb, CanadaStays, Couchsurfing, Flipkey, hipcamp, Homeaway, Homeexchange, HouseTrip, Love Home Swap, Nightswapping, Onefinestay, Tujia, We are Pop Up, Xiaozhu
	Work space	Breather, CoPass, HiRise, Liquidspace, PeerSpace, Pivotdesk, Sharedesk, Storefront, WeWork
Utilities	Energy	GridMates, Solar Mosaic, Vandebron, Yeloha
	Telecommunications	Fon, Open Garden, Serval Project
Vehicle sharing	Loaner boats	Boatbound, Boatsetter, Sailo
	Loaner vehicles	Atzuche, CambioCar, Car2Go, DriveNow, easyCar Club, Flightcar, Getaround, Scoot, Sharoo, Turo (RelayRides), YongChe, Zipcar
Wellness & beauty	Beauty	BeGlammed, Belita, GlamSquad, MyGlamm, Priv, Swipecast
	Wellness	ClassPass, Coachup, Entrenaya, Kindly, PopExpert, Vint, Zeel
Worker support	Insurance	Friendsurance, Guevara, MetroMile
	Renter services	GuestHop, Guesty, HostTonight, Pillow, TurnKey Vacation Rentals
	Resources	Breeze, Freelancers Union, Peers.org, SherpaShare, StrideHealth, Vugo

Source: Adapted from Owyang (2016).
http://www.web-strategist.com/blog/2016/03/10/honeycomb-3-0-the-collaborative-economy-market-expansion-sxsw/.

are ride-hailing (e.g., Uber, Lyft) and home-sharing services (e.g., Airbnb, VRBO), which are used by about 15% and 11% of Americans respectively.

Despite its growth in the last decade, the emerging sharing economy is in a flux and fraught with risks. While some platforms have seen remarkable rise in market valuations, a few platforms have closed down. Two noteworthy ride-sharing mobility platforms— Sidecar (for ride-sharing and business-to-business delivery, founded in 2011) and Shuddle (for transporting kids, founded in 2014)—closed in 2015 and 2016 respectively. Homejoy, a startup begun in 2010 for home cleaning services, closed in 2015. Several other pioneering neighborhood sharing platforms had short life-spans: Ecomodo (2007–2015), Crowd Rent (2009–2013), Share Some Sugar (2009–2011), Thingloop (2010 – 2011), OhSoWe (2010 – 2012), SnapGoods (2010–2014) and SpoonRocket (2013–2016). In the process of maturing, several firms have also been consolidated through mergers and acquisitions: Avis acquired Zipcar in 2013; Expedia acquired Homeaway, and LeTV (a Chinese conglomerate) acquired controlling stake over Yidao Yongche in 2015; AccorHotels acquired Onefinestay in 2016. The sharing economy has thus been quite volatile. At the same time, the rapid evolution of the sharing economy shows that it has fueled a new set of economic exchanges across several sectors. The new sharing economy raises both prospects and challenges for the public sector in general and digital government in particular.

3. Sharing economy's prospects

The sharing economy presents new opportunities for the public sector. Clearly, the digital platforms are innovative, though disruptive, business models. For public agencies, the benefit of sharing economy lies in reducing waste and increasing efficiency as it puts into use the otherwise idle assets or labor. The excess capacity of the assets can be leased out flexibly to willing peers using online platforms. The re-use potentially eases the pressure on natural resources. Smart cities leverage the digital technologies to create sustainable environments for better quality of life. The paradigm shift from individual ownership to

collaborative consumption has the potential to counter hedonistic consumerism and to provide sustainability framework based on community sharing (Albinsson & Perera, 2012; Heinrichs, 2013). As Belk (2014, 1599) argues, "Sharing makes a great deal of practical and economic sense for the consumer, the environment, and the community." The waste reduction resonates with the circular economy, whose aim is to use products and components at their highest utility through their life-cycle (Lacy & Rutqvist, 2015; Stephany, 2015). For instance, in its aim towards zero waste, San Francisco City's online platform called Virtual Warehouse enables used appliances, electronics, office furniture, and supplies to be recycled among city agencies, nonprofits, and schools.

Inclusion of sharing economy could arguably be seen as another phase in the evolution of digital government research. As Moon, Lee, and Roh (2014) argue, research on digital government until the mid-1990s was inward oriented, focusing mainly on back-office operations and functions. Such research aimed to examine how information technology (IT) applications (e.g., Enterprise Resource Applications) could enhance efficiency in organizational and financial management. The advent of Internet in the mid-1990s expanded the digital government's scope to e-government, focusing on external citizen services (government to government, business, and citizens). With Web 2.0 services, government is posited as a platform for co-production and to address collective action problems using IT (Linders, 2012; O'Reilly, 2010). Unlike IT/e-government, however, the sharing economy is not only a technological means of digital government, but also presents a distinctive digital economic model. Hence, consideration of the sharing economy is not only about its technological integration with digital government internally and externally, but also includes the public sector's adaptation to the economic model. Sharing economy pushes the boundaries of digital government further by creating new opportunities for renting assets.

Public sector adaptation to the rapidly evolving sharing economy is significant in the context of adaptive governance, wherein public agencies need to transform themselves quickly in response to the new, disruptive environment. Organizational flexibility requires innovation in internal business processes and digital infrastructure; the flexibility is important for agencies to quickly implement policies and adapt to the changing environment (Gong & Janssen, 2012). Adaptive governance emphasizes continuous adjustment to deal with the uncertain environment. At the same time, public organizations require stability for accountable decision making processes (Janssen & van der Voort, 2016). The focus is on realizing public benefits, rather than delivering a pre-defined end product or service.

Adaptive governance, in the sharing economy context, would imply that public agencies should adapt their policies and internal management to the sharing economy. Public agencies could be considered as *users* of the sharing economy, with an eye on obtaining the public benefits. Drawing on the sharing economy, digital government platforms can use assets at capacity for both realizing internal organizational efficiencies and enhancing external public services. The sharing platforms enable efficient sharing of the assets on-demand. Public agencies can reduce the large inventories of owned assets that are not fully used. From *internal* management perspective, the procurement norms would then have to change from buying to renting assets to capture cost efficiency and broader sustainability benefits. Using the sharing platforms or renting from peer government agencies reduces the upfront capital costs as well. Sharing economy can enhance *external* citizen services by providing access to the services on location. In this, the sharing economy bears synergies with the smart cities concept, leveraging the power of information technology to deliver public services on demand anywhere and anytime. The sharing economy facilitates the smart city by efficiently using resources through peer to peer renting. Public agencies can use the sharing economy to enhance traditional public services, while also playing a catalytic role to realize its public value.

Many public agencies have already begun to change procurement practices focusing on peer rental. Typically, the procurement change is with assets where the government agencies may have large inventory, but the agencies do not use the inventory at capacity. Such assets generally include equipment and vehicles, but there is also potential for sharing other assets like space. Of course, shared services between government agencies are not new (Grant, McKnight, Uruthirapathy, & Brown, 2007). Vertical integration for shared services like payroll, human resources, information technology is already being implemented. However, there are some differences between shared services and the sharing economy models. Shared services imply "the concentration of dispersed service provisioning activities in a single organizational entity" (Janssen, Joha, & Zuurmond, 2009, p. 16). Shared service models are organizational consolidations along a line of business. Sharing economy models, however, are platforms for sharing assets between organizations. Although the platform is common among the organizations, the assets could be distributed across the organizations. Unlike the shared service models which are joined at the hip with a consolidated organization for the line of business, there is no expectation that the organizations are joined for sharing the assets. The sharing is flexible, based on the demand. The platforms expand the scope for sharing underutilized assets within large government agencies and between government agencies.

Public agencies can develop the digital platforms in-house or partner with established platforms. Ohio state government's ShareOhio.gov portal is an exemplary in-house equipment sharing platform. It was launched in 2014 for local and state government agencies to use equipment at capacity. The portal was motivated by a study that showed local governments routinely underutilize heavy equipment: 42% of the equipment were used less than 5% of the time and sharing equipment could save over $5 million. Local government agencies upload information about the resources that they can share on the portal, and other government agencies can request the resources as required. Agencies can track the equipment use, both within and outside of the agency. Over 145 local governments had registered in the first year itself and more than 300 pieces of heavy equipment were shared across the state for city projects (Yost, 2015). MuniRent is a broader platform that facilitates sharing assets, mainly large equipment such as bulldozers, excavators, forklifts, etc. that are infrequently used by public agencies. They can be shared between government agencies in a region or within large city and state government agencies. About 25 state and local government agencies use the MuniRent platform to reserve and loan their surplus equipment. Renting equipment does not only save on inventory for local governments, but also allows the owners to recuperate the capital costs while using the equipment at capacity.

Public agencies generally have a large fleet of vehicles that are not used to full capacity. Reducing the vehicular inventory by establishing contractual partnerships with other sharing platforms brings down the need to buy and maintain the vehicles. Employees can use ride-hailing or car-sharing platforms to make trips on demand. In this vein, the U.S. General Services Administration (GSA) has deemed federal employees can use the ride-hailing services for official functions and the expenses are reimbursable. The GSA has also been experimenting with using car-sharing platforms like Zipcar and Enterprise CarShare for business trips of federal employees. Many large cities in the United States (Chicago, New York, Washington D.C.) have also implemented pilot programs for car sharing. The sharing programs are expected to reduce vehicle ownership in the agencies.

Co-working in large government agencies result in more efficient utilization of the government offices and reduces the real estate required for the agencies. Instead of dedicated office spaces to employees, agencies undertake flexible work arrangements like teleworking and desk sharing. Digital government platforms enable the work spaces to be reserved by employees flexibly. Cloud based tools, mobile apps, lightweight devices and wireless access in open offices allow employees to work from anywhere. The GSA's Total Workspace initiative is an

instance where the space sharing reduced real estate needs. Many federal agencies, including the Departments of Agriculture, Health and Human Services, Homeland security, have consolidated their offices as a result (Coleman, 2013). Several cities (e.g., Palo Alto, Santa Clara, Santa Cruz) have listed conference rooms and work spaces in public libraries and other government buildings for free or at nominal costs through space sharing platforms like LiquidSpace and NextSpace. The affordable workspaces support communication and networking opportunities and encourage entrepreneurship within the city. The co-working spaces help in neighborhood economic regeneration as these workers patronize ancillary services (e.g. coffee shops, restaurants) (Mariotti, Pachhi, & Vita, 2017).

In the context of smart cities, McLaren and Agyeman (2015) argue that the sharing paradigm provides a way for sustainability and social justice. The sharing could span from the communal to commercial. Smart city solutions tap on the sharing economy to provide in situ services over smartphones. A prominent example is that of mobility services. Ride-hailing and car sharing services are used to complement public transit, especially for the first or the last mile (e.g., home to a transit station and vice versa). Dallas Area Rapid Transit's GoPass app, for example, is integrated with Uber app, so that travelers can get the last mile ride on demand (Ganapati, 2016). Several other cities have integrated government sponsored transit apps and ride sharing apps to enhance public transit experience. Shared pooling also provides an alternative to costly community bus services and parking needs, while reducing the greenhouse gas emissions (Shaheen & Chan, 2016). The mobility services also have been beneficial to low income neighborhoods (Kim, 2015). A few city governments like Chicago, Portland, Sacramento, Washington D.C. have pioneered pilot programs of sharing energy efficient cars in public housing projects. Pew Research's survey (Smith, 2016a) show that the respondents considered the mobility services to be cheaper and more efficient than taxis or public transit. Nearly half thought the mobility services are better for people who have trouble getting taxis because of race or appearance; these mobility services also serve neighborhoods that taxis won't visit.

The sharing economy has provided just in time solutions for emergency needs in the aftermath of major disasters. Following Hurricane Sandy in 2012, Airbnb began the Disaster Response Program to assist in case of disasters. Airbnb activates the disaster tool to automatically contact hosts in the impacted and surrounding areas to inquire if they have extra space to share with their displaced neighbors. Willing hosts can then share their homes with disaster victims free of charge. In 2014, TaskRabbit launched the Needs for First Responders Program, connecting first responders with volunteers during emergency situations (Brown, 2014). Using the web tool, authorized first responders can post a need for help during an emergency. The TaskRabbit's community of skilled workers can then volunteer for the required tasks in real time.

4. Sharing economy's governance challenges

The rapid growth of the sharing economy does not only present new opportunities, but also new challenges for public agencies. The economy has rapidly expanded largely in the context of lax regulations. As the adverse impacts of the sharing economy on communities and labor markets unravel, government agencies are faced with how to cope with the negative consequences. In this context, IT/e-government researchers need to broaden their scope of inquiry from that of the internal or external use of the platforms. E-government researchers also need to be wary of the broader economic consequences of the digital platforms. There are four broad challenges aimed at the core premises of the sharing economy. First, renting could have severe disadvantages, creating new class divisions and more inequality. Second, Internet platforms are not necessarily egalitarian; they are themselves giant corporations which undercut gig workers' benefits. Third, the long term sustainability benefits of the sharing economy are unclear. Fourth, there are security and trust concerns with respect to the sharing economy.

The first set of critiques relate to the problems with renting. Standing (2016) dismisses the sharing economy as rentier capitalism, where rentiers derive their income from property and other assets. Slee (2016) also portrays the sharing economy as a harsher form of capitalism, characterized by deregulation, entitled consumerism for the wealthy, and precarious work arrangements. Although the access economy claims to de-emphasize ownership, rents are derived from the owned assets. Hence, wealth still accumulates to those who *own* property. For example, space sharing sites like Airbnb etc. may not own property, but the rents are due to those who own the property. Workers without property and other assets do not gain from the sharing economy. Property owners get better returns than wage workers, thus driving the inequality further (Frenken, 2017). Partnering of government agencies with the sharing economy platforms to provide public services could further deepen the endemic economic issues of inequality. For example, Airbnb's short-term renting could adversely affect the availability of long term affordable housing rental stock.

The second set of critiques relate to how the sharing economy platforms treat gig workers. Calling the sharing economy as platform capitalism, Srnicek (2017) portrays the platforms as no different from other Internet giants like Google and Facebook. Although the sharing platforms are intermediaries for renting assets, they have grown significantly in market size. They have capitalized not only on the intermediary fees, but also on the commercial gains from integration of related platform services sold to users and the platform data that can be packaged to other third party commercial vendors. The gig laborers are not considered as part of the platform's workforce; they are considered as independent contractors. The independent workers do not get the benefits (e.g., health, retirement, insurance, etc.) or security that are typically available to full-time workers. In this context, Reich (2015) dismisses sharing economy as, “share-the-scraps-economy” where, “human beings do the work that's unpredictable and patch together barely enough to live on.” The sharing economy has created a new precariat labor class that is flexible but without work security (Standing, 2011). Labor unions across many cities globally have protested ride-sharing platforms such as Uber on various grounds. These protests generally relate to unfair competition, facing discriminatory local regulations, and insurance coverage for drivers and customers. Government partnerships with Uber for providing transit services would then raise legitimate questions about how the drivers are treated.

The third set of critiques pertain to the sharing economy's purported benefits of long term sustainability. Frenken (2017) argues that the environmental benefits could be highly speculative as the data from the platforms are private and not available to independent researchers. Some studies do show that car-sharing has had environmental benefits in terms of lower greenhouse gas emissions and vehicle use, but critics maintain that these could be first round effects. With the lower prices of renting goods, the real income of consumer rise. Cheaper access could induce more consumption and more carbon footprint. Moreover, as the transactions are online, transportation of goods also have environmental costs. The net environmental benefits could therefore be small (Frenken & Schor, 2017).

The fourth set of critiques are related to the trust and security systems engendered by the sharing economy platforms. Trust is established through peer reviews and ratings. Dambrine, Jerome, and Ambrose's (2015) survey show the different mechanisms used by platforms to conduct these reviews and means to establish reputation. However, a few studies highlight problems with the ratings and feedback systems. The ratings have an upward bias and tend to be toward extreme experiences. For instance, 95% of the Airbnb offerings have close to the maximum ratings; only 1% of Uber drivers have ratings less than average (Stemler, 2017). Ratings could be manipulated through fake reviews posted by the provider or the customer (Mayzlin, Dover, & Chevalier, 2014). In two-way feedback systems, users abstain from posting negative comments for fear of retaliation (Cabral & Hortacsu,

2010; Dellarocas & Wood, 2008). New entrants face the "cold start" problem of not having any feedback history, and older entities intending to exit the market may not care about the reputation and milk it to maximum advantage. Reputational externalities could also exist across the platform if consumers make decisions about its quality based on single transactions, causing a reputational externality across sellers (Nosko & Tadelis, 2015). Stemler (2017) argues that the feedback loops could be flawed—instead of the crowd's wisdom, the ratings may exhibit crowd's collective bias. She calls for measured regulatory oversight to ensure that systems are fair, transparent, and accurate.

Early empirical studies do show some evidence of the inequality, as the sharing economy mainly benefits selected groups. Farrell and Greig (2016a) analyzed a random sample of the JPMorgan Chase bank's customers who have offered goods or services on any one of thirty sharing platforms between 2012 and 2015. They found that the participants were significantly younger (millennials) than the other customers. Overall, 78% participated in capital platforms like Airbnb, 21% participated in labor platforms like Uber, TaskRabbit etc., and 2% participated in both. The platforms were secondary sources of income for most participants. Whereas earnings from capital platforms were supplementary, labor platform earnings were complementary to other income. Labor platform participants tended to have lower income than those in capital platforms. Low- and moderate-income participants relied more heavily on labor platform earnings. Farrell and Greig's (2016b) subsequent study of 42 platforms between 2012 and 2016 showed that the platform economy could be peaking, as monthly earnings from labor platforms began to fall (6% since mid-2014) and experienced high turnover rate (almost half exit within a year). Possibly, gig workers returned to the traditional labor market when more full time jobs became available with improvement in economy. In her study of US providers on three platforms (Airbnb, RelayRides and TaskRabbit), Schor (2017) finds that providers are highly educated and with well-paying full-time jobs. They use the platforms to augment their incomes. The platforms exacerbate inequality, shifting income and opportunity to better-off households, crowding out lower educated workers who traditionally did such jobs like driving, cleaning and household tasks.

As the sharing economy matures, public agencies have had to deal with the attendant negative consequences. The negative consequences of the sharing economy (i.e. inequality, worker benefits, etc.) are still the responsibility of government and the costs of negative externalities are borne by the taxpayers as a whole. Public administration and digital government researchers and practitioners have to contend with these policy issues. Yet, on the policy front, sharing economy depicts the complexity of adapting to the rapidly evolving digital environment.

5. Paradox of regulating sharing economy

With the fast growth of the sharing economy, policies for regulating it are haphazard or have yet to take hold. National League of Cities' survey of city leaders shows the ambivalence of adapting to the sharing economy (DuPuis & Rainwater, 2015). Nearly 70% of the respondents indicated that their jurisdictions were generally supportive of the sharing economy. About 54% of respondents indicated that the municipality imposed no regulations, 40% indicated regulations similar to more traditional services, and the remaining 6% indicated light regulations. Over 60% indicated public safety and trust concerns about the sharing economy.

Public agencies have taken three main policy approaches toward the sharing economy: regulate, don't regulate, or wait and see (Acevedo, 2016). The *regulate* approach ranges from treating sharing economy like traditional services to taking a more strident approach that includes banning sharing economy activities altogether. The *don't regulate* approach privileges self-regulation, wherein platforms have to balance the interests of both providers and customers in order to attract and retain both (Bond, 2015). Consumer protection regulations are not required since the underlying trust systems are bilateral relationships and reputational incentives impel the platforms to satisfy consumer demands (Koopman, Mitchell, & Thierer, 2015; Möhlmann, 2015). The *wait and see* approach admits that some form of regulation is reasonable, but more information is required for surgical intervention.

The regulation of sharing economy is paradoxical. On one hand, the sharing economy is innovative in using the platforms to utilize the idle assets at capacity. On the other hand, the sharing economy has several negative consequences. Regulations need to preserve the innovation while addressing the negative consequences. Worldwide, governments and courts have intervened in the sharing economy with mixed approaches, ranging from adapting to the new environment to passive acceptance to bans. The European Union (2016) advised its member countries to undertake bans as the last resort, although various constraining measures have already taken place in France, Germany, and Spain. The relationship between public agencies and sharing platforms has also been often adversarial (Wiese, 2015).

The paradox of regulation is clearly evident in the three major areas where sharing activities are prominent: mobility and vehicle sharing services, accommodation sharing, and labor services. The aforementioned NLC survey shows how cities vary with respect to these sectors. While 66% indicated support for ridesharing services, only 44% indicated support for home-sharing (1% banned ride-sharing and 5% banned home-sharing platforms). Mobility and accommodation sharing services are hyper-local, but accommodation services have more significant consequences in terms of local zoning regulations on short-term rentals. Labor services could also be place-bound, depending on the nature of the task. The public benefits and regulatory challenges of these three areas of sharing economy are elucidated below.

5.1. Mobility and vehicle sharing services

Mobility and vehicle sharing services form the largest sector of the sharing economy and has attracted considerable attention. The Transportation Research Board (TRB, 2015) identified five types of services: carsharing (e.g., Zipcar, car2go), bikesharing (e.g., Citi Bike, Divvy, Capital Bikeshare), transportation network companies (TNCs, for ride-hailing, such as Lyft, Turo, Uber), microtransit (e.g., Bridj, Chariot), and taxi apps (e.g., Flywheel, Curb, myTaxi). Among these, Uber is the most prominent, with its presence in nearly 545 cities worldwide. Lyft operates in over 300 cities, Zipcar operates in over 50 cities across U.S. and Europe, and Turo operates in over 2500 cities. In addition to these, peer-to-peer ride-sharing platform cooperatives have also arisen: Juno (New York), Taxi Union (Denver), VTC Cab (Paris), Modo (Vancouver), Tapazz (Belgium).

Mobility and vehicle sharing services reduce the need for individual cars, reduce congestion, increase ride-sharing, and alleviate global warming (Cohen & Kietzmann, 2014). Early empirical evidence confirms such prediction of public benefits. Li, Hong, and Zhang (2016) found that Uber's entry into an urban area significantly decreases traffic congestion. Empirical studies show that car-sharing reduces the overall number of cars on the streets and greenhouse gas emissions (Martin & Shaheen, 2016; Nijland & van Meerkerk, 2017). Fraiberger and Sundararajan's (2015) study of Getaround (another peer-to-peer car rental service) showed that rental substituted ownership and lowered used-good prices, which mainly benefit below-median income users who provide a majority of the rental supply. The mobility platforms with microtransit option and carpooling services (e.g., UberPool, Lyft Line) could have a positive impact on carpooling, which has been on the decline since the 1980s. The sharing platforms offer flexibility in travel, which has been a major barrier for traditional carpools to succeed. Car sharing services give valuable transportation alternatives during times of disasters. Specialized services for the disabled and the elderly also benefit. The Massachusetts Bay Transportation Authority introduced a program to subsidize Uber and Lyft rides for customers with disabilities (Dungca, 2016). Home delivery platforms like Instacart

could supplement public transportation services for the elderly by helping with groceries (Woodward, 2016).

From digital government perspective, the mobility and car sharing services hold promise for efficient fleet management. Federal as well as local governments use Zipcar and its allied technologies (LocalMotion for motor pool management and FastFleet for vehicular fleet management). Moreover, the mobility services complement public transit systems—increase in shared transportation modes is accompanied with public transit and less spending in transportation expenditure. The sharing platforms have partnered with transit agencies in this regard: Uber has established partnerships in Atlanta, Los Angeles and Minneapolis and other cities; Lyft launched the "Friends with Transit" campaign to connect with transit.

Although the ride-sharing platforms hold benefits, they also raise broader challenges for digital government. While the ride-sharing platforms complement commuter train services, they supplement bus and light rail services (Clewlow & Mishra, 2017). Indeed, a few cities have begun to partner with the ride-sharing platforms, potentially cutting transit services. The benefits of replacing public transit with ride-sharing are not entirely clear. Ride-sharing has added more vehicle miles traveled in major cities and could exacerbate street congestion (Clewlow & Mishra, 2017; Schaller Consulting, 2017). Although early research shows environmental benefits, rebound effects are largely unknown. As private entities, the platforms are not subject to transparency requirements that apply to the public domain; hence data are largely not available about the services (Brustein, 2017). At the least, the platforms should be subject to data transparency when they receive public money through partnerships with government agencies. The data would allow monitoring the efficacy of supplementing transit services with ride-sharing services.

Lastly, the taxi unions across many cities of the world have rallied against ride-sharing platforms. The taxi unions argue that ride-sharing platforms have an unfair advantage because they are exempt from public safety regulations. Taxi operators are have typically subject to municipal licensing for public safety and other purposes. In most cities in the U.S., the licenses are given through a restricted medallion system, which are scarce and could be barriers to new taxi service operators (Rauch & Schleicher, 2015; Rogers, 2015). The ride-sharing services undercut the need for the medallions and drove the medallion prices down. Ride-sharing also introduces new competition that threatens the taxi industry—taxi cab use dropped by 65% from January 2012 to July 2013 in San Francisco alone (Bond, 2015). Taxi unions argue for either lifting the municipal regulations over the taxi operations or subject the ride-sharing services to similar regulations.

5.2. Accommodation sharing

Airbnb is the largest platform for short-term rental accommodation, with more rooms than established hotel chains. It has a presence in over 34,000 cities in 191 countries. Airbnb is popular among travelers for vacation rentals—it connects travelers with hosts who are willing to rent their home. The European startup, 9flats.com (which acquired Wimdu, its competitor, in 2016), explicitly advertises itself as an alternative to hotels. HomeAway.com operates in over 190 countries in partnership with other country or region specific platforms (e.g. VRBO in the US, OwnersDirect the UK, Abritel in France, travelmob.com in Pacific Asia, etc.). Unlike these commercial platforms, couchsurfing is a non-commercial site aimed to foster cultural exchange. It serves more than 200,000 cities.

The home-sharing platforms affect local governments in particular since the short-term rentals have local consequences on the community. Hence, local governments tend to be less favorable than higher tier state or national governments (Hong & Lee, 2017). The short term rentals could be disruptive for communities. Although property owners who put their accommodation on home-sharing platforms may benefit financially, the negative consequences of noise, traffic, and other disruptions are borne by the community. Moreover, short-term rentals could have the side-effect of impacting the affordable housing market negatively, as the rentals take out valuable inventory that could otherwise be available for long-term renting (Espinosa, 2016). Hence, affordable housing advocates criticize platforms like Airbnb for creating rental housing shortages in key housing markets where the housing prices are relatively high (Lee, 2016; Schäfer & Braun, 2016). Many local governments put zoning and other code restrictions on short-term rentals, but the sharing platforms routinely test the limits of these restrictions. New York, for example, found that 72% of the Airbnb rentals violated its Multiple Dwelling Law and the New York City Administrative Code (Schneiderman, 2014). The online homesharing platforms blur traditional boundaries between residential and tourist areas and could evade detection until neighbors complain (Gurran & Phibbs, 2017). Edelman, Luca, and Svirsky (2016) found evidence of racism wherein guests with African American names were 16% less likely to be accepted relative to identical guests with distinctively White names. Airbnb recognized the problem and issued new host guidelines that explicitly layout non-discriminatory practices.

The American Hotel and Lodging Association (AHLA), which represents the hotel industry, has been critical of Airbnb. An AHLA co-sponsored study contended that Airbnb hosts are increasingly full-time commercial operators (nearly 40%) and substantial share (26%) of Airbnb revenues come from full-time hosts (who rent year round) (O'Neill & Ouyang, 2016). The AHLA argued that Airbnb hosts should be subject to the taxes and health and safety standards that the hotels have to meet. Independent studies also reflect that Airbnb has a substitution effect on hotels (Lane & Woodworth, 2016; Zervas, Proserpio, & Byers, 2017).

Several cities across the world have imposed regulatory measures on home-sharing platforms, which have instigated legal battles (Hickey & Cookney, 2016). Jefferson-Jones (2015) identified five types of restrictions: full prohibitions, quantitative restrictions, proximity restrictions (e.g., near other vacation rentals), operational; and licensing requirements. He argues that the full prohibitions could be tantamount to regulatory taking without just compensation under U.S. constitution (Fifth Amendment). Following contentious cases, Airbnb entered into agreements with a few city governments to collect taxes similar to that of hotels. From digital government perspective, the local governments need to additionally monitor the impact of the short-term renting on the communities. However, the data for the short-term renting are not directly available to cities. As cities have begun to regulate short-term rentals, local governments could engage with the platforms for establishing home-sharing license when an owner registers with the platforms. The licensing data could then be monitored collaboratively online. Indeed, large cities (e.g. City of Chicago) increasingly require hosts to register with the city in order to list and rent their space on sites like Airbnb.

5.3. Labor and sharing services

Piecemeal labor cuts across different sectors of the sharing economy. The gigs are arranged through business and personal service platforms that explicitly recruit workers, or through other platforms that require such labor. Business service platforms arrange gigs directly for businesses, such as Freelancer (with over 22 million users) and Upwork (with over 5 million users) that connect businesses with professional freelancers (e.g., web developers, mobile developers, designers, writers, accountants, virtual assistants, sales experts) across the world. Personal service platforms arrange gigs for personal or home services. TaskRabbit connects workers for household chores such as cleaning, moving furniture, painting, and running other errands. Fiverr considers itself as a platform for entrepreneurs that utilize their skills and achieve financial independence. Zaarly connects householders with local service providers (e.g., plumbers, electricians, handymen, etc.). Niche platforms enable connections with specialty service providers,

such as care.com for caregivers, DogVacay for pet sitters, perdiemattorney.com for attorneys to handle a court appearances and deposition, etc. Health care services require specialized high quality professionals, such as doctors, nurses, caretakers, and other medical helpers. On-demand doctors are available through Heal and Doctor on demand. Helparound assists with finding helpers for those with diabetes. Besides the service platforms, the mobility services also use gigs (e.g. drivers).

The sharing economy holds benefits for workers in as much as they are additional avenues for piecemeal jobs. Labor is used on-demand, and is inherently unstable. Botsman (2015) opined that the gigs through these platforms attract four groups of workers: the flexers, who need flexible and autonomous work schedules (e.g., the stay-at-home parents, retirees, students, etc.); the unemployed who need the income; independent professionals who want to expand their businesses (microentrepreneurs); and full-time employees seeking some extra income. Dillahunt and Malone (2015) found that the sharing economy could be beneficial for individuals from disadvantaged communities to find jobs.

The principal point of contention is that the workers are not considered employees. They are contingent workers who do not have an implicit or explicit contract for long-term employment per se (Henten & Windekilde, 2016). They could also be independent contractors (such as freelancers), independent consultants, on-call workers, and temp workers. Regulations regarding benefits for the independent workers are yet to evolve. The rapid rise in gig workers has prompted calls for a third sector of workers as “dependent contractors” or “independent workers” that are in between “employees” and “self-employed” (Harris & Krueger, 2015; Sundararajan, 2016). As the gig workers do not get employee benefits, reformers have called for flexible benefits that could accrue to the workers. Peers, a nonprofit initiated by Airbnb, offers benefits package that could be flexibly availed by any independent worker. Progressive cities such as Seattle have also promoted worker rights by allowing them to unionize.

6. Conclusion and further research

Although it is based on Internet technology platforms, the sharing economy is a business model based on renting. As users, public agencies could tap on the public value of the sharing economy. The emphasis on renting could reduce waste and increase efficiency as it puts into use the otherwise dormant assets or labor, although the long-term environmental consequences are unknown due to rebound effect. Adaptive governance in the context of sharing economy would imply that the public agencies shift internal digital government processes (e.g. procurement) to share assets. Digital government could facilitate on demand sharing to use the assets at capacity. Sharing equipment, vehicles, and space hold promise on this front. Public agencies could also partner with sharing economy platforms to complement and supplement public services, such as transit and emergency accommodation after disasters.

Contending with the sharing economy is, however, not simply a technological artifact for public agencies. It also implies dealing with broader consequences of the sharing economy. Adaptive governance in this context implies being cognizant of the policy responses to address the downsides. Digital government researchers should not only focus on the digital aspect, but also have to be wary of unequal impact of the economy in terms of who is served and who is not. Just as digital divide has been a long-term concern for e-government researchers, inequality is a central concern with the sharing economy. The sharing economy could be viewed as a harsher form of capitalism that could exacerbate inequality. The sharing economy's benefits accrue to the already well-to-do class with property, and gigs result in precarious work arrangements without benefits. Government agencies have to deal with the burden of the negative externalities. Strident criticism of the sharing economy has come from incumbent, well-established groups like taxi unions and hotels, whose businesses are disrupted by the sharing economy. Labor issues loom large with the gigs wherein workers do not obtain benefits that typically accrue in a full time job.

As the sharing economy evolves rapidly, the public sector agencies would need to deal with the downsides. The three cases of mobility services, accommodation sharing, and gig labor show the paradox of regulating the sharing economy. Public agencies have exhibited mixed reactions to the rapid growth of sharing economy. The regulatory paradox lies how we can tap on the innovation's benefits while minimizing the challenges. The sharing economy platforms are at the forefront of innovation. The platforms have invested in new and emerging technologies. Startups like Fly4me and Skywatch are sharing platforms that connect firms requiring a drone with qualified pilots who own and operate drones. Uber is pioneering self-driving cars and vertical take off and landing aircrafts for on-demand urban transportation.

Future policies should support the sharing economy for its innovation, while developing strategies to address the challenges. Cities could subsidize sharing platforms to encourage expansion of public goods and generate consumer surplus. Facilitating the sharing economy could make the cities more attractive as being at the cutting edge of technology. Municipalities could tap on the digital platforms as tools for social equity and economic redistribution, whereby the platforms could serve poor residents as a pre-condition for regulatory approval (e.g., employing low-income and disadvantaged communities). Municipalities could contract with sharing platforms to supplement and complement public services (e.g., sharing parking spaces, encouraging carpooling, last mile for public transit services). At the same time, from a digital government perspective, public agencies should demand more data transparency from the sharing economy platforms. The sharing platforms should be subject to public information disclosure, especially for the activities that are in partnership with public agencies. Data on ride-hailing and home-sharing are not easily available to the government agencies. Barring data that impinge on privacy and safety concerns of the individuals, local governments could engage with the platforms to obtain public interest data. The data requirement would enhance inquiry into the problems as well as prospects for governance.

E-government researchers and practitioners need to pursue a robust research agenda that takes into account the sharing economy's significance for creating public value. We suggest there are at least six issues that require deeper examination:

- How can government agencies better adapt to the sharing economy for more efficient and effective public service delivery? In the digital era marked by remarkable growth of smartphones and e-government, the digital platform economy provides new exciting opportunities for expanding citizen services. There are new opportunities for sharing between government to government, government to business, and government to citizens. Agile methods of adapting to the new environment require public agencies to focus on enhancing public value with the sharing economy.
- What are the barriers for government agencies to adopt sharing economy? Despite the remarkable growth of sharing economy, public agencies have mixed reactions to the growth. The policies toward sharing economy require close attention toward understanding the adoption barriers.
- Can the sharing economy be made equitable socially and economically? E-government researchers have long been concerned about digital divide. The sharing economy could pose deeper digital divisions, not only in terms of access to digital technologies, but also in terms of better living. Participation in the sharing economy also does not benefit gig workers very well in the present arrangement. In addition, equity issues raise concerns about the cost to the society/taxpayer and the distributional effects of sharing economy.
- What are the regulatory measures that are unique to each sector? We have exemplified the paradoxical issues with mobility services, accommodation sharing, and labor. Work space sharing and financial platforms in terms of moneylending and crowdfunding are also growing. The sharing economy sectors have their own unique

issues that need to be dealt with separately.

- What are the privacy and security implications of the online feedback mechanism? Trust in the sharing economy is based on online feedback mechanism. As individuals increasingly participate in the feedback, there are also online challenges to their individual privacy and security. Public agencies need to be wary of online feedback that could be systematically biased.
- How can public agencies address the downsides of gig work? Although flexible, gig workers do not get employment security and benefits that are typically available to full-time workers. Public agencies that contract with digital platforms for services could also contribute to the problem. The work arrangements that provide flexible benefits to the gig workers are emerging and require further scrutiny.

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