



## **KNOWLEDGE** WHARTON

Special Report

# **The Sharing Economy:** Restacking Industry in the 21st Century



https://igel.wharton.upenn.edu • http://knowledge.wharton.upenn.edu

## INTRODUCTION

## The Sharing Economy: Restacking Industry in the 21st Century

People have been sharing things with each other for millennia, and yet for the first time, this ancient form of exchange is transforming commerce through technology. Call it the sharing economy or the light-asset economy, it is disrupting traditional business practices and provoking countermoves, particularly in the regulatory sphere. Whether all this sharing is as good for the environment as it would seem remains to be proven. But although some roadblocks may be thrown up, it's already clear that the sharing economy is here to stay.

## CONTENTS

## The Sharing Economy: A New Way of Doing Business

Two forces are fueling the sharing economy. First, today's marketplace is filled with goods (like the cars that sit idle more than 90% of the time) and services that offer buyers more capacity than they can use. At the same time, recent advances in technology have made this excess capacity simple and easy to share on a previously unimaginable scale. Companies can now become brokers for what once was wasted.

## The Sharing Economy Spills into New Markets

Investment capital is pouring into the new sharing economy and tiny startups are springing up everywhere. Those that are first and fastest to occupy a particular niche tend to prosper, quickly attracting and locking up business before competitors can interfere. Among those competitors are traditional heavy-asset companies that are turning to regulators for help.

## How Green is the Sharing Economy?

It's intuitive: Sharing resources must be good for the environment. And yet, a lack of hard data has made it difficult to quantify these benefits. But some advantages are already clear as sharing companies green the planet in unanticipated ways: a traffic app that uses crowdsourcing to reduce congestion reduces emissions from cars; open online collaboration streamlines invention of green technology; and at the end of the consumption cycle, data-rich, light-asset garbage collection is helping divert waste streams from landfills to new-product revenue streams.

# **SPONSORS**

The Initiative for Global Environmental Leadership (IGEL) and Rubicon Global have partnered to create this special report.







1

4



## The Sharing Economy: A New Way of Doing Business

**BEFORE IT HAD A NAME AND BECAME A CUTTING-EDGE CONCEPT**, the sharing economy had outposts in the American economy. Carpooling, for instance, has long been a way of sharing both the cost of commuting and leveraging an expensive asset — the private automobile (which sits idle more than 90% of the time).

Few observers in the last few decades recognized carpooling as a vanguard phenomenon, but that's what it was. The same basic concept, technologically assisted, has been applied to nearly every aspect of modern life. And it's enabled cost savings, convenience and environmental benefits on a large scale.

As a result, the peer-to-peer story is one of stellar growth. From modest roots, the international sharing economy reached about \$15 billion in 2014, reports PricewaterhouseCoopers (PwC), and it is on track to reach \$335 billion by 2025. Public opt-in to the collaborative economy almost doubled from 2013 to 2014. An AGC Partners report said that investors committed \$4.93 billion to 71 deals related to the sharing economy in 2014, up five times from 2013.

"The success of Uber, Airbnb and TaskRabbit isn't a fad — it's a new way of doing business," PwC said.

The two essentials are lumpiness and technology. In a groundbreaking paper, "Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production" (Yale Law Journal, 2004), Yochai Benkler, an entrepreneurial legal studies professor at Harvard, used carpooling as an example of large-scale sharing of private goods. Cars, he pointed out, are "lumpy" goods, that is, they have to be purchased in units that exceed the buyer's immediate needs. People invest in such goods when the lifetime value of the item is greater than its price (loans and leases, of course, help bend the cost curve to match the long period during which expensive items offer value).

At least until recently, car buyers haven't worried about the excess capacity they were purchasing, as long as the lifetime value of the vehicle was greater for them than its lifetime cost. But the reality is that all that time the private automobile sits idle, economic value is going unrealized. And cars are by no means alone in their lumpiness. Houses, apartments, offices, bikes, computers, clothes, books, toys — all represent goods that individuals buy for their own use, but which bring with them a good deal of excess capacity. And don't forget physical and intellectual labor: A handyman's ability to fix things goes unused much of the time, as does an engineer's ability to design solutions to specific problems.

"In the collaborative economy it's not the idea of sharing that's new... What's different now is the introduction of technology into the concept."

– H.O. Maycotte, Umbel

All this excess capacity is what makes the sharing economy possible. According to Oscar Salazar, the founding chief technology officer at Uber, now CTO at carpooling startup Ride and an executive advisor to Rubicon Global, one reason the transportation sector has been so successfully "shared" is, "a lot of people own cars; in some countries the number of vehicles surpasses the human population."

But excess capacity existed long before anyone began talking about an economy based on sharing (the term

"sharing economy" wasn't used to describe this kind of enterprise until the mid-2000s.) What empowered this new way of doing business was technology.

As it existed in the post-war years, carpooling was a widespread phenomenon. According to Benkler, it had become the second-largest commuter transportation system in the U.S. But it was not an activity that could be scaled up to the level of a commercial enterprise. Neither was offering a room to a guest, selling old clothes or toys at a garage sale or fixing a neighbor's sink.

What made Uber, Airbnb, eBay, TaskRabbit and all the other sharing-economy companies possible is the combination of Big Data analytics, low-cost cloud storage, prevalence of social media and widespread use of mobile devices.

Virtually all the sharing companies establish trust through crowdsourcing. Online reviews are at the heart of the sharing economy.

"In the collaborative economy it's not the idea of sharing that's new; people have been doing that for eons," notes H.O. Maycotte, founder and CEO of data rights management company Umbel in an article published on Dell.com. "What's different now is the introduction of technology into the concept — particularly easy-to-use digital technologies like location-based GPS that allow people to quickly make and respond to requests for goods and services."

### A SHARING OR ASSET-LIGHT ECONOMY?

Before there was a sharing economy, there was a rental industry, which created excess capacity at a scale that could be commercialized. Hotel companies built large structures and then rented out individual rooms to make a profit. Car rental companies purchased large fleets of cars, which they rented out by the day very profitably. But such rental-based business models demand not just capacity but also infrastructure. Hotels have to maintain properties, clean rooms, take reservations and provide a host of other services. Similarly, car rental companies have to maintain and store cars that are not in use, schedule pick-ups and drop-offs, build and staff rental offices and provide customer service.

Uber and Airbnb, on the other hand, don't have to worry much about infrastructure. Airbnb doesn't own any hotels

and yet it has more rooms for rent than Marriott and Hilton, according to *The New York Times*. And Uber said in a blog post that it provided 140 million car rides in 53 countries and more than 250 cities in 2013 without owning any cars or employing any full-time drivers.

Both companies do have full-time staff, of course, for customer service of various kinds and most importantly for technology. But neither private company is forthcoming about the number of people on its corporate staff. A check of open positions suggests that Airbnb and Uber incur significantly less labor costs than their brick and mortar competitors. On a recent day, Airbnb listed just 204 open positions worldwide, while Hilton had more than 10 times that number of jobs posted in just the U.S. and the U.K. That's a huge difference in salaries and benefits, generally a significant part of a company's cost structure.

Some have argued in fact, that the sharing economy is really nothing of the sort. "Sharing is a form of social exchange that takes place among people known to each other, without any profit, argues a recent article in the Harvard Business Review. "When 'sharing' is marketmediated — when a company is an intermediary between consumers who don't know each other — it is no longer sharing at all. Rather, consumers are paying to access someone else's goods or services for a particular period of time. It is an economic exchange."

Seen in this light, the distinctive feature of the sharing economy — its use of technology — is less about sharing and more about reducing costs by enabling vast numbers of customers and freelance workers to do business with each other, under the umbrella of the companies' brands. Robin Chase, co-founder of Zipcar, describes the process as "leveraging excess capacity, building platforms for participation that organize and simplify the work of these collaborating peers." Chase said that her book Peers Inc. is based on the thesis that tapping into all that extra value is only possible with platforms "that make the effort of sharing assets, ideas and networks very simple."

Many peer-to-peer companies begin with a simple idea of leveraging excess capacity, but it is the technologyenabled ease of use that makes them work. Marc Gorlin started Roadie when he realized that he could build an alternative to traditional shipping companies such as FedEx and UPS by leveraging existing passenger vehicles already on the road. "Someone is leaving somewhere and going somewhere else all the time," he said. "Suppose they could also earn money and other benefits by carrying packages to that destination?"

But the key to Roadie's future was making it incredibly simple for drivers and customers to connect and do

business. The company's mobile app enables an entire transaction to take place in moments (the Roadie keeps 80% of the contracted amount; the company 20%). One user reports standing in line to buy a rug at Ikea that was too big for his car, and a Roadie driver offering to deliver it for him before he'd reached the cash register. The Waffle House chain, with some 1,750 restaurants in 25 states, is now a Roadie partner (drivers get a free waffle as part of the bargain), and Roadie employs no full-time drivers or vehicles to meet the demand.

Another possible term for this approach is asset-light, and some of the largest hotel chains are embracing a far less technological approach to achieve the same corporate objective. A 2014 article in Medill Reports notes that Hyatt, Hilton, Marriott and Starwood (Marriott recently announced plans to acquire Starwood) have all "adopted what's known as an 'asset-light' model. Using this model, a hospitality company places more emphasis on franchising and managing hotels, rather than being the direct owner of hotel properties. The physical owner of a hotel property pays franchise royalties to the hospitality company for the right to operate under its name. This strategy requires less capital from the hotel chain."

### **VALUE PROPOSITION UNCHANGED**

However you define it, the sharing economy is a disruptive force in a slew of industries, particularly travel, consumer goods, services, taxis, bicycles and car rental, finance, music, employment and waste. And the disruption may be long-term if the new businesses permanently change consumers' attitudes towards ownership. In the PwC study, 81% of people familiar with the sharing economy agreed that "it is less expensive to share goods than to own them individually" and 57% agreed, "Access is the new ownership."

Shelby Clark, CEO of Peers described the disruption in the automotive sector. "I think the biggest change that we're seeing here is that people are choosing to buy mobility as opposed to just buying a car." Or as the saying goes, "I don't need a drill, I need a hole in the wall."

Whether attitudes towards ownership change for good remains to be seen. Another supposed aspect of disruption seems far less likely to endure. While 78% of the people surveyed by PwC said that the new sharing companies helped build a stronger community and 86% agreed that it was more fun doing business with these "upstarts" than with traditional companies, research published in the Journal of Consumer Research takes issue with this "romanticized view on access." According to the researchers, Giana M. Eckhardt (Royal Holloway University of London) and Fleura Bardhi (City University London), users of Zipcar "don't feel any of the reciprocal obligations that arise when sharing with one another. They experience Zipcar in the anonymous way one experiences a hotel; they know others have used the cars, but have no desire to interact with them. They don't view other Zipsters as co-sharers of the cars, but rather are mistrustful of them, and rely on the company to police the sharing system so it's equitable for everyone."

In fact, companies take the trust issue very seriously. Some go so far as to carefully vet those they do business with. DogVacay has a five-step screening process that certifies only 15% of applicants to offer dog sitting services. TaskRabbit runs identity and criminal record checks as well as in-person interviews. And many companies provide some level of insurance.

"Consumers simply want to make savvy purchases and access economy companies allow them to achieve this, by offering more convenience at a lower price."

- Giana M. Eckhardt and Fleura Bardhi, researchers

Virtually all the sharing companies establish trust through crowdsourcing. Online reviews are at the heart of the sharing economy. Before anyone agrees to use an Uber driver, rent an Airbnb room, sleep on a Couchsurfing couch or hire a TaskRabbit handyman, they check out what others who've used the particular service have to say. And companies facilitate this through easy-to-use technology and easy-to-understand rating systems.

If community and trust are not key variables in the value proposition for the sharing economy, what is important is what has always been of most value to consumers: convenience and cost. In the PwC survey, 86% and 83% respectively agreed that sharing companies make life more affordable and more convenient and efficient. According to Eckhardt and Bardhi, "Our research shows that consumers simply want to make savvy purchases, and access economy companies allow them to achieve this, by offering more convenience at a lower price."



## The Sharing Economy Spills into New Markets

AS OBVIOUS AS IT APPEARS NOW, the sharing economy didn't meet with instant acceptance. The rise of Airbnb is instructive. When founders Brian Chesky, Joe Gebbia and Nathan Blecharczyk approached investors in 2008, Chesky said they were told the market for shareable real estate was too small. To help pay for the venture initially, they raised money by selling collectible cereal.

Later that year, the partners were accepted at funding program Y Combinator (as were similarly strapped Reddit founders Alexis Ohanian and Steve Huffman). By 2009, Airbnb landed its first funding from Sequoia Capital and Greylock Partners and it took off quickly.

# "Over the past 15 years, nearly \$26 billion has flooded the sharing market."

- Jeremiah Owyang, Crowd Companies

Today, Airbnb is ranked behind only Uber among travel startups and (despite not yet being either public or profitable) is valued at \$25.5 billion. According to Mia de Villa of CollaborativeConsumption.com, Airbnb, which is now in 34,000 cities and 190 countries, recently hit a total of 50 million guests since it was founded in 2008 – 30 million in 2015 alone.

Of course, not every startup has hit the stratosphere; most sharing sites are far more modest in size. What is common to many is a willingness and ability to re-think direction. DogVacay, a site for dog walking and sitting services, shifted gears early on. "We quickly course-corrected into a national experience, and expanded to Canada just a few months after launch," said spokeswoman Katie Woods. In three years of operations, the service has booked millions of overnights, and approved 20,000 sitters in more than 3,000 cities. The company has raised \$47 million from investors such as Benchmark and Foundation — although it is not without competition: Rover has raised more than \$50 million.

For TaskRabbit, too, the path was rocky at first. Founded in 2008, the odd-job service went through a series of layoffs in 2013. As with some other services, TaskRabbit had trouble getting beyond an initial coterie of enthusiastic early adopters. "The realigned focus means getting leaner in some areas, and expanding in others," said founder Leah Busque (who thought up the company after running out of dog food, and wondering if the shopping could be outsourced). By the summer of 2015, a repurposed TaskRabbit had raised a total of \$38 million and now operates in 19 metropolitan areas in the U.S. and England.

As all these examples make clear, the sharing economy has attracted a great deal of capital. Jeremiah Owyang, founder of Crowd Companies, has calculated that, over the past 15 years, nearly \$26 billion has flooded the sharing market. The average total funding per startup has been \$94.8 million. Ignore the mammoth outliers, Uber and Airbnb, and total investment still tops \$21 billion, with average total funding of \$59.7 million per startup. That far exceeds the amount of investment in the social media boom at a similar stage in its development, said Owyang.

What's more, Owyang's research shows that more than 80% of this funding has come in the past two years, which suggests that it's still relatively early in the typical five-year funding cycle.

Mia de Villa of Collaborative Consumption believes that a growing share of future investment will move to potentially fertile new areas of the sharing economy. "What's happening is the ideas are moving beyond the early adopters and they are starting to extend into other segments," she noted. Predicting that funding will slow down in segments that have absorbed most of the investment over the past five years (such as space sharing, transportation and financial platforms), de Villa believes investment will "accelerate in emerging areas, including food, logistics and services."

Suna Said, founder and CEO at Nima Capital LLC, a venture fund that focuses on the sharing economy, also sees healthcare as a promising sector for peer-to-peer business growth, and possibly the environment, if future policies establish a price for carbon.

#### The sharing economy relies on a monopolistic business

**model.** While the sectors they serve grow increasingly varied, the business models of peer-to-peer companies remain generally quite similar. A company's technology platform is the key: By enabling individual providers to do business directly with customers (rent them a room, sell them used furniture or charge them for a car ride, for example), the platform allows the company to avoid altogether (or at least drastically reduce) some of the biggest expense items in many traditional companies: inventory, fixed assets and labor costs. (Uber doesn't own a fleet of cars or hire drivers while Airbnb doesn't own hotels or employ hospitality staff.) The company's revenue comes from the fee it charges people to use its platform (which usually includes such risk-reducing benefits as insurance, background checks and online reviews).

Fees are generally kept low or competitive to encourage rapid uptake among providers and consumers, and the user experience is almost always better than those of their traditional competitors, thus enabling companies to scale up quickly. That's critical in the sharing economy, because the more people who use a peer-to-peer service, the more valuable the service becomes, attracting still more users. It's a quintessential example of the network effect, often illustrated by the growth of the telephone (the more people used telephones, the more valuable the network that connected them became). Today, much Internet business relies on the network effect for its success everything from Internet search engines to social media.

The network effect also tends to lead to monopolies, as the companies that are first out of the gate often attract so many users and become so valuable that competitors are hard pressed to attract customers to their own fledgling networks. Once a network has reached critical mass, it becomes extremely difficult for anyone else to capture much market share, notwithstanding government intervention. Airbnb and Craigslist are good examples.

Peer-to-peer companies also tend to capture providers by virtue of their online review systems. The more positive reviews a homeowner has earned on Airbnb, for example, the less likely they are to move over to another home-rental service where they will have to start all over earning consumers' trust.

As Indy Johar, social venture specialist and founder of Project00, noted at the 2015 OuiShare Fest (a three-day industry event in Paris), sharing economy companies generally owe their success to "their intrinsic monopolistic nature and ability to 'lock-in' users." In fact, Johar believes that some sharing companies owe their stratospheric valuations to investors' expectations that they are or will become monopolies.

Today, much Internet business relies on the network effect for its success — everything from Internet search engines to social media.

Said in particular notes that her firm "specializes in firstmover, winner-take-all, monopolistic-type companies, anywhere in the world." There are markets, she adds, where "there can be a second or third, but generally once there's a groundswell of support from people, there tends to not be that much room for competition."

In some industries, established players are turning to regulation in their fight against peer-to-peer companies. "Sharing enterprises, such as Uber and Airbnb, are entering markets for taxis and hotels in which current participants stand to lose business, and they are not happy about it," said Gerald Faulhaber, professor emeritus of business economics and public policy at Wharton. According to Faulhaber, "If Uber is to be successful, it must learn to play in the real world of politics, regulation and lobbying, not just the e-world of Silicon Valley. It has to counter these lobbying efforts with well-organized efforts of its own. "

Uber seems to have learned this lesson quickly. The company has hired David Plouffe, Obama's presidential campaign manager (and also a new member of Rubicon Global's board of advisors), as its new chief adviser. The company replied to a recent *New York Times* op-ed by running a large masthead ad on both the *Times'* home page and on NYDailyNews.com. Both ads linked to an online petition in favor of Uber, which addressed regulation issues.

Ironically, it's the cabdrivers who now seem somewhat flummoxed. At a recent meeting of the New York Taxi Workers Alliance in Long Island City, members called for a takeover of city hall and a shutdown of traffic at airports and major intersections, akin to a similar action in Paris. "If we do not stop Uber, Uber is going to terrorize us forever," Seydou Bah, a 31-year-old aspiring cabbie from Mali, told *The New Yorker*. Another driver at the meeting urged more coordinated action, exhorting his peers to join together to hire lawyers and lobbyists. "This is a billion-dollar business," said Sergio Cabrera. "We can't keep running it the way we did back in the day, when we used to buy used police cars and paint them yellow."

Among the most prominent debates now raging is whether the sharing economy is creating vast numbers of flexible jobs ... or abusing workers who earn little, receive no benefits and go unprotected by labor law.

Airbnb, too, is facing stiff resistance from hotel owners and others. According to *The Washington Post*, "fights have continued in cities across the country, as community groups, lawmakers and hospitality interests seek to prevent property owners from using the service to set up what are functionally hotels without the regulation." (Airbnb has disarmed one grievance by agreeing to collect and pay certain hotel taxes on a city-by-city basis.)

Much remains to be resolved. Among the most prominent debates now raging is whether the sharing economy is creating vast numbers of flexible jobs that help the economy or abusing workers who earn little, receive no benefits and go unprotected by labor law. Both the National League of Cities, which created a task force, and the Federal Trade Commission, which held a public workshop, are wading into these murky regulatory waters in an effort to help urban regulators come to terms with the new economy.

The genie is not going back in the bottle. Despite all the resistance, virtually no one thinks the sharing economy is going anywhere but up. Gilles Duranton, a Wharton real-estate professor, said it is probably too late to stop the sharing economy with regulation. "Banning Uber or Airbnb after people have actually experienced them and decided they liked them a lot, will make many consumers unhappy. The elected officials that block these services will pay a heavy price." While many will lament the changes wrought by the new economy, "there are only very few cases of successful bans on real progress," he said. "The Tokugawa shoguns in Japan managed that but from what I've read this is a rare example."

Robin Chase, the co-founder of Zipcar, observed, "of course there are lots of roadblocks. But the economic upside of getting more value out of excess capacity (including labor that works on their own time in very flexible ways) is so compelling, I don't see any way to stop this. Rather, we should see to protect the public good, which includes safety, upholding workplace rules that matter, and making sure that social safety nets apply to all, regardless of whether they work full-time for one employer or not."

Oscar Salazar, the founding chief technology officer at Uber, now chief technologist at carpooling startup Ride and an executive advisor to Rubicon Global, admits that "there are some areas of the economy we can't actually optimize with sharing. It won't work without high frequency and excess capacity, so it won't permeate the whole culture."

Ethan Mollick, a management professor at Wharton, told Knowledge@Wharton that what's ahead is a period of compromise and bargaining between government and sharing services. The meteoric rise of these companies, he said, has forced the political sector to examine which regulations "really matter," and to live with a new market reality.



## How Green is the Sharing Economy?

#### ACCORDING TO A 2015 PRICEWATERHOUSE-

**COOPERS (PwC) STUDY**, 76% of U.S. adults familiar with the sharing economy believe it's better for the environment. That makes intuitive sense, considering that much of what is being shared — everything from cars and bikes to vacant rooms and abandoned toys — is otherwise sitting idle, stranded assets that occupy space and are seldom used. But identifying and quantifying just how environmentally friendly the new peer-to-peer economy is can be difficult.

According to Nicolas Voisin, founder of TheAssets.co, which trades in business-related goods, "80% of the things in our homes are used less than once a month, and self-storage has increased by 1,000% over the past three decades."

And underutilized goods don't make us happy. A 2014 survey by the Center for a New American Dream reported that a whopping 91% of Americans believe that "the way we live produces too much waste," and 70% agree that, "we [Americans] consume more resources and produce more waste compared to other countries." Sixty-four percent agree that, "sharing lowers environmental impacts."

Robin Chase, the co-founder of Zipcar, said that working with that company "really opened my eyes to the idea of excess capacity. I truly understood, and worked into the website and marketing materials, that people could only pay for what they used, and didn't need to buy more than they wanted."

Hard data is hard to come by. Many green claims are anecdotal. Airbnb cites several studies that highlight how much energy, water and greenhouse gas emissions people save by staying in its properties, but the company does not reveal how these studies reached their conclusions. According to a study conducted by the Cleantech Group, for example, Airbnb claims that, in a year, its guests avoided greenhouse gas emissions comparable to 33,000 cars on North American roads, and saved the equivalent of enough water to fill 270 Olympic-sized swimming pools.

One presumes that these savings are the result of traditional hotels operating less efficiently than individual homes. But Airbnb, which commissioned the study, has "refused to allow its full study to be published online," according to VentureBeat. And it "has yet to explain why it does not want the entire study published."

"Eighty percent of the things in our homes are used less than once a month, and self-storage has increased by 1,000% over the past three decades."

- Nicolas Voisin, TheAsset.co

There is some support for the argument that pay-for-use systems are more efficient and environmentally friendly than our current model, which maximizes individual purchases and the energy and resource use that is necessitated. In an Ecotrust paper titled "Online Platforms for Exchanging and Sharing Goods," Anders Fremstad, an economics professor at Colorado State University, reports: "There is significant environmental benefit to increasing the use of existing goods and reducing the demand for new goods. Although Americans discard about 40 million tons of durable goods each year, there is early evidence

that Craigslist significantly decreased waste disposal as it expanded to more cities."

Fremstad studied the Couchsurfing ("stay with locals instead of hotels") and NeighborGoods ("save money and resources by sharing stuff with your friends") sites, and concluded that their environmental impacts "are less clear, but increasing peer-to-peer sharing will probably reduce waste and environmental degradation." Couchsurfing stays are 12 to 18% reciprocated, he said.

When it comes to the auto industry, several different studies support the idea that Zipcar is good for the environment, but the actual numbers they arrive at vary a good deal. Zipcar has said that "every Zipcar takes at least 20 personally owned vehicles off the road." A Transportation Research Board study is somewhat more modest, however, reporting that, "at least five private vehicles are replaced by each shared car." Yet another report, from the University of California Transportation Center, puts the number higher, at nine to 13 cars taken off the road.

"There is significant environmental benefit to increasing the use of existing goods and reducing the demand for new goods."

- Anders Fremstad, Colorado State University

Numbers related to business-car use seem somewhat more reliable. The Transportation Sustainability Research Center (TSRC) estimated that 20% of users driving Zipcar vehicles for business (who joined through an employer) had sold a personal car after becoming a member, and another 20% avoided buying a car for the same reasons. The report said further that the business program as a whole had "eliminated the need for roughly 33,000 vehicles across North America."

At this relatively early stage in the growth of the sharing economy, it is difficult to say whether this kind of progress will continue. The TSRC report notes that of the Zipcar members who eliminated car ownership entirely, 41% use public transit more often, 41% walk more and 22% use their bikes more often. This suggests that these early adopters may be more environmentally conscious than other ZipCar users will be in the future, assuming the company continues to reach a larger segment of the population.

Judging the environmental impact of taxi replacements such as Uber and Lyft is difficult, because there isn't much data. The San Francisco Municipal Transportation Agency has reported a 50% drop in taxi use over several years, but the agency reported trouble getting data from Uber and Lyft to quantify whether those lost rides (with undoubted environmental benefits) were simply replaced with others from the services. Even if they were, there would likely be emission gains if the shared cars were newer than the cabs.

According to Marc Gunther in the environmental magazine Ensia, it is indeed challenging to measure the impact of ride-sharing services. "The point is," he wrote, "the economy is such a ridiculously complex system that calculating the impact of any specific intervention is difficult — economists still disagree on what ended the Great Depression. And people need to think about all the possible outcomes of these things."

One quantifiable way to benefit the environment is to reduce traffic congestion. A 2008 report by researchers at the University of California, "Traffic Congestion and Greenhouse Gases," studied a segment of Interstate 110 in Los Angeles during rush hour and calculated that "the congested traffic for this one-hour time period on this segment of freeway emits approximately 166 metric tons of CO2 [carbon dioxide]." If the traffic flow were improved so that cars were able to travel 20 miles per hour faster, said the report, CO2 emissions would drop 12%, "resulting in a reduction of 21 metric tons of CO2." Extrapolate that reduction to a full year, and easing congestion on just that one stretch of L.A. interstate would reduce CO2 emissions by 249,000 tons, the equivalent of taking 41,500 cars off the road.

One peer-to-peer company focuses in particular on relieving congestion. The Waze navigation app uses crowdsourcing to generate maps drivers can use to reduce travel time (and avoid speed traps, among other things). By reporting everything from a broken-down car to a mattress in the road, Waze users enable the app to reroute people around such bottlenecks. Waze already had 50 million users before Google acquired it in 2013 (Google does not give out statistics on the company).

Julie Mossler, head of global communications for Waze, reports that the service is particularly popular wherever there is heavy traffic congestion, including Brazil, Malaysia and Indonesia (where eight cities are reported to offer some of the world's worst driving experiences). Waze rapidly built up a user base in Los Angeles during the 2011 shutdown of the 405 highway known as "Carmaggedon." By March 2015, says Mossler, "users contributed three million alerts to the maps in LA." Those alerts not only reduced the time people spent stuck in traffic, they also significantly reduced CO2 emissions. Mossler notes: "When your car is not idling in traffic and when you're on the road for less time, then we are reducing harmful emissions all over the world."

Tapping the environmental potential of sharing

**technology.** One interesting speculation is that by monetizing the untapped potential of under-utilized goods, the sharing economy may prompt consumers to purchase more expensive products that are more durable and possibly eco-friendly as well. Padden Guy Murphy, head of public policy and business development at car-sharing service Getaround, cites electric cars as an example. Sharing can be "a massive needle mover for adoption of electric cars," he said, noting that a Tesla Model S, which might lease for \$900 a month, becomes affordable for many more people when it also produces \$2,000 to \$3,000 in that same period through Getaround rentals.

Making better use of under-utilized products is probably the most obvious, if vaguely quantified, environmental benefit of the sharing economy. But companies large and small are putting peer-to-peer technology to use in other surprising ways that may well prove far greener in the long run.

Quirky, which bills itself as an "invention machine" that turns crowdsourced ideas into actual products, first began partnering with GE in 2011. In 2014, the two companies launched Wink, which is producing connected products for the home, wireless devices that communicate with each other and homeowners via the Internet. Among Wink's products, some of which are customizable and built to order using 3-D printing, are a smart window and door sensor, a sensor to detect water leaks, a monitor and remote control for garage doors, a smart HVAC controller and thermostat to remotely monitor temperature in the home and a smart switch for one-touch control over smart bulbs.

The efficiency of Quirky's crowdsourcing inventiveness and the marketing and distribution power of GE offer "an exceptional opportunity to make the connected home a reality for everyone — accessible, affordable and focused on the foundational elements of how a home works," said Beth Comstock, GE's chief marketing officer. "This includes lighting, energy management and safety. We have seen tremendous success working with Quirky and its community of inventors to find new ideas and bring them to market at remarkable speed."

Crowdsourcing can also be the basis for innovative design. A startup company called Local Motors is building automobiles with open-source architecture, and has built a committed network of talented professionals to work on its cars. Local Motors, whose name is derived from its belief that auto manufacturing could be smaller, decentralized and modular, is also deeply committed to 3-D printing, and received a lot of attention for printing a car on stage at the Detroit Auto Show in 2015.

Greg Rucks, an expert in automotive lightweighting who contributed to the ahead-of-its-time Hypercar hybrid developed by the Rocky Mountain Institute in the 1990s, said he's intrigued by the possibilities of crowdsourcing. "It's an interesting idea to outsource the design," Rucks said. "The Hypercar was developed internally, but with today's ease of sharing data, something like that could really work. If everything is open-source, then protecting your intellectual property isn't a huge concern — as it is with many suppliers today."

Identifying and quantifying just how environmentally friendly the new peer-to-peer economy is can be difficult.

At the other end of the consumption cycle, Rubicon Global is tapping into the data it collects through its platform to divert waste streams from landfills and turn them into revenue streams. For instance, food scraps can go into anaerobic digesters, to be made into fuel or fertilizer. "A digester with just a small food waste stream isn't viable," Rubicon founder Nate Morris said. "But if we can aggregate 50,000 tons per month, we can match supply and demand."

Data can also be used to enable vast efficiencies in garbage pickup. Rubicon is launching a new model in which customers will use the company's app to schedule a truck when their dumpster is actually full, rather than regularly scheduled pickups that might not be needed. Cameras can monitor the dumpster level, and sensors can indicate when pickups happen. The potential savings through avoided truck trips — measured in local emissions and greenhouse gas — is clearly enormous. Special Report

# **The Sharing Economy:** Restacking Industry in the 21stCentury



### About IGEL

The Wharton-led, Penn-wide **Initiative for Global Environmental Leadership (IGEL)** promotes knowledge for business sustainability through world-class research, transformative teaching and constructive dialogue between top alumni, academic, corporate, government, and non-government organizations. IGEL is a hub for business and sustainability, connecting and leveraging academic capital at Penn to help business leaders of today and tomorrow to create more sustainable industries.

For more information, please visit https://igel.wharton.upenn.edu

## **KNOWLEDGE** WHARTON

#### About Knowledge@Wharton

Knowledge@Wharton is the online business analysis journal of the Wharton School of the University of Pennsylvania. The site, which is free, captures relevant knowledge generated at Wharton and beyond by offering articles and videos based on research, conferences, speakers, books and interviews with faculty and other experts on global business topics.

For more information, please visit knowledge.wharton.upenn.edu

#### **Eric Orts**

Faculty Director Initiative for Global Environmental Leadership (IGEL) The Wharton School, University of Pennsylvania ortse@wharton.upenn.edu

#### Joanne Spigonardo

Senior Associate Director of Business Development Initiative for Global Environmental Leadership (IGEL) The Wharton School, University of Pennsylvania spigonaj@wharton.upenn.edu