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SHARING CITIES AND SUSTAINABLE CONSUMPTION AND PRODUCTION: TOWARDS AN INTEGRATED FRAMEWORK

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Sharing Cities and Sustainable Consumption and Production: Towards an Integrated Framework

"Building a sharing infrastructure and culture is quite simply one of the most important things cities can do to contribute to a fair and sustainable world" (Agyemen, et al., 2013, p. 29).

Abstract
Calls for a transformation towards more sustainable consumption and production (SCP) have been intensifying. As urban populations swell across the planet, cities are faced with incresing pressure on infrastructure, economic and ecological systems. Yet, with their high population densities and ubiquity of information and communication technologies, cities are becoming breeding grounds for a new, circular economy driven by emerging and long-standing sharing activities. This research provides a comprehensive view of SCP systems in cities by integrating and examining sharing economy activities in the context of two continuums, i.e. SCP and private/public orientation. Based on these two analytical dimensions, the paper evaluates and plots five groups of 18 sharing activities to create a Sharing Cities-SCP Typology comprised by five ideal types. Each of these five types represents a unique form of SCP activity, with the potential to directly impact SCP systems in the context of urban environments. By enabling diversity and hybridity in the SCP analysis, we allow for a theoretical expansion of SCP models and a new way of understanding how they may play out in cities.

Highlights

- The paper examines the relationship between sharing economy activities and SCP in cities
- It analyzes several classification alternatives in light of substantive data
- It examines sharing activities in light of two continuums, i.e. SCP and private/public orientation
- It evaluates 18 activities to develop a Sharing Cities-SCP Typology comprised by five ideal types, each of them representing a unique form of SCP activity within the SCP system.
- In the context of sustainable business, we extend the notion of hybrid modeling by incorporating the consumption and production dimensions

Keywords: sharing cities, sharing economy, collaborative economy, circular economy, sustainable consumption and production, maker movement

1. Introduction

Much has been made of the historic milestone reached in 2008 when, for the first time in history, more people were living in cities than in rural areas (UNFPA, 2011). The number of urban residents, estimated at 3.5 billion today, is expected to approach 5 billion by 2030 (UNFPA, 2011) as more migrants seek improved employment opportunities, access to health services and better education in cities. In this process, cities can become major engines of economic growth that spill over to the region (Venkataraman, 2004) and to other cities (Jacobs, 1984).

Yet today, cities are also major contributors of environmental problems. While representing only one percent of the world´s total land mass and housing just over 50 percent of humanity, cities represent more than 70 percent of all energy consumption and greenhouse gas emissions worldwide. This despite the efficiency benefits gained by denser forms of living. To sustain life, the global economy will need to transition to more sustainable consumption and production systems (SCP), and it is expected that cities will form part of the solution.

In SCP literature, there is an underlying assumption that changes in business activity towards sustainable development has the potential to positively affect either consumption or production systems (Blok et al., 2015). This dichotomous understanding of the SCP space has reduced the possibility of identifying alternative economic forms that can simultaneously deal with both sides of the SCP spectrum. Overcoming this limitation requires a broader view that not only treats SCP as a continuum but also considers the actual – public / private - orientation of the economic activity under examination. When the system is viewed through this lens, an impressive array of sharing economic activities emerge in cities that, by articulating a hybrid

approach to value creation, have a potential combined effect on both sides of the SCP system.

The sharing economy is a fast-growing sector disrupting mainstream industries, yet to date, there is a dearth of research on the sharing economy. Emerging streams such as business models for sharing, incumbent responses to sharing economy startups, the role of information and communication technologies (ICTs) as an enabler of sharing, the importance of and mechanisms for the development of trust in sharing economy initiatives, and the potential social, economic and environmental benefits from sharing economy activity remain unexplored in management and sustainability literatures alike. Scholars from the University of Utrecht sought to address this gap by hosting the First International Workshop on the Sharing Economy in June of 2015 where many of these topics were explored. While not exclusive to cities, the sharing economy is gaining more traction in urban areas because they are where dense populations and ICTs such as smart phones and high speed Internet coexist (Agyeman, 2013). We suggest that cities are also faced with scarce resources and insufficient infrastructure capacity (McLaren and Agyeman, 2015) which require innovations in consumption and production systems to maintain or improve quality of life for all.

Therefore this research is primarily concerned with the development of an integrated framework for theorizing about the role the sharing economy can have in accelerating sustainable consumption and production patterns in cities around the globe. It is worth noting that while the majority of recent media attention about the sharing economy has been focused on commercial, scalable sharing economy stalwarts like Airbnb and Uber, the historical roots of sharing in communities, and even many emerging approaches to sharing that leverage ICT are not even commercial endeavors. This aspect of sharing in cities is under-researched so we actively sought to explore the

range of sharing from highly commercial to non-monetary, community-based in line with McLaren and Agyeman (2015) broader interpretation of the emerging space in the city context.

In order to understand the range of sharing activity in cities, we classified 18 sharing activities into five key categories, to subsequently examine, evaluate and plot them according to two analytical dimensions: orientation of value creation (i.e. public or private interest) and the location of the activity on the SCP spectrum, embracing particularly diversity and hybridity in the analysis of the SCP space. From the results we derived a Sharing Cities-SCP Typology comprised by five ideal type, each of them representing a unique, hybrid form of SCP activity, with the potential to directly impact SCP systems in the context of urban environments. Our results allow for a theoretical expansion of SCP models and a new way of understanding how they may play out in cities.

2. Background literature

2.1 Sustainable consumption and production

The formal introduction of the sustainable consumption and production (SCP) concept occurred during the 1992 World Summit on Sustainable Development; emerging as a response to the sustainability challenges facing communities around the globe. It has been defined as "the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations" (Norwegian Ministry of Environment, 1994). Twenty years later, at

Rio+20, the United Nations Conference on Sustainable Development reaffirmed the commitment towards SCP via the creation of a 10-year framework of SCP programs.

In extant SCP literature, sustainable consumption and sustainable production are generally treated as two discrete constructs within SCP systems. Sustainable consumption is concerned with "raising awareness and changing consumer behavior, values, and motivations" (Barber, 2007, p. 500). Sustainable production is mostly concerned with "not only the volume and types of goods and services produced, but the process of making them, the natural resources extracted to make them, and the waste and pollution resulting from the extraction, production, and affiliated process resulting in a particular 'good'" (Barber, 2007, p. 502). A rich stream of multidisciplinary research has developed since the SCP concept was introduced exploring how (e.g. Pusavec, et al., 2010) and why (e.g. Dyllick and Hockerts, 2002) some companies engage in SCP activity as well as measuring the impacts sustainable production processes achieve (e.g. Veleva et al., 2001).

As sustainable consumption requires consumers to adopt different approaches towards their purchasing and use patterns, it has often been associated with social movements (Barber, 2007). Yet, sustainable consumption has been increasingly associated with improved health and quality of life as well (Jackson, 2005). The Lifestyles of Health and Sustainability (LOHAS) marketplace has emerged as a way to frame and market the direct health and quality of life improvements obtained by consumers embracing sustainable consumption of goods and services.

Yet consumption and production systems are not necessarily discrete components. Although the notion of SCP has evolved through two different streams, we emphasize its integrity and the need for embracing the shades of grey between the C and the P. Scholars studying creative industries, for example, have implored researchers to

consider consumption and production on a continuum (Mbaye, 2011). The sharing economy is further blurring these lines by supporting user communities that conceive of, co-finance, and co-create products and services. Therefore, we suggest that sustainable consumption and production, at least in the context of the sharing economy, be treated as a continuum from sustainable consumption to sustainable production, allowing for hybrid models which include both consumption and production at their core. We argue that the blurred lines create challenges for an accurate placement of some sharing models, particularly with peer-to-peer (P2P) activity. We have decided to make a distinction pertaining to asset use and additional services offered. Specifically we consider the pure sharing of a resource, without service production, to be part of the sustainable consumption model. Whereas sharing an asset with additional service becomes both sustainable consumption and sustainable production.

2.2 SCP, sharing economy and cities

Management scholars have been reluctant to research the sharing economy (Belk, 2010). Belk suggests three primary reasons for the dearth of research on sharing in management research: 1) sharing has historically been considered part of either a gift exchange or commodity exchange in conflict with rationalist perspectives of competing interests; 2) historically sharing was more associated with in-home activity; and 3) sharing is so ubiquitous that it has been taken for granted.

Yet, sharing is arguably "the most universal form of human economic behavior" and has been so for "several hundred thousand years" (Price, 1975, p. 1,12). Of course historically, sharing involved intimate relationships within families (Price, 1975) or local communities (Voelker and Flap, 2007). New forms of the sharing economy no longer rely on previously formed relationships with sharers. The sharing economy,

driven by a convergence of numerous factors including the global economic recession, growing environmental consciousness and the growing ubiquity of information communication technologies (ICTs) is booming, with more than $2 billion in investment raised from venture capitalists (Owyang, et al., 2013) and $3.5 billion generated for users in P2P models in 2013 (Geron, 2013).

The collaborative economy is impacting life throughout the globe, but its impact has been highest in cities. Carsharing and bikesharing projects have emerged onto the global scene, with each having been implemented in more than 500 cities (Cohen and Kietzmann, 2014). Airbnb offers most of its 600,000 shared housing listings in 34,000 cities worldwide (airbnb.com). Crowdsourcing tools are being used to influence designs for 3D printing projects which may have significant implications for the development of localized manufacturing ecosystems in cities.

In the past few years, "sharing cities" is a term which has emerged to express the marriage of the sharing economy in urban areas (Agyeman et al., 2013; McLaren and Agyeman, 2015) . The Sharing Cities Network, for example, now counts more than 50 cities on six continents[1]. Sharing City Seoul, for example, is a vast, ambitious program focused on converting Seoul into the sharing capital of the world. Faced with growing resource constraints and environmental challenges, coupled with a dense population and impressive internet and smart phone penetration, city leaders recognized a unique opportunity to position the city for a future, sustainable and connected economy. The city´s strategy has three key components: change laws to support instead of inhibit the sharing economy, provide financial and advisory support to sharing startups, and facilitate citizen participation in the sharing economy. Furthermore the city is taking initiative to lead by example by opening up municipal buildings for public use outside

[1] shareable.net/sharing-cities

of work hours providing financial support in several sharing startups, opening up more than 1,000 data sets for public use and creating book and creating tool lending libraries in different neighborhoods throughout the city[2].

Economic activity occurring in cities may take many forms and the local government can exert a range of influence from being the primary developer and implementer, to serving as an active supporter to being a non-participant. Despite the attractiveness and evident relevance of the sharing economy in urban settings, cities are sometimes resistant to certain sharing activities, as has been observed by legal changes brought to Airbnb in New York City and to Uber in Brussels (Rauch and Schleicher, 2015).

2.3 Value creation in sharing cities: public and private interest

Sharing economy initiatives receive revenue streams from, and provide benefits to, customers as well as other entities such as public agencies and non-governmental organizations. They therefore act in pursuit of delivering both public and private goods. This creates hybridization (Pache and Santos, 2013), resulting in the presence of conflicting aims through practices that allow the venture to assimilate 'conflicting-yet-complementary' business logics (Smets et al., 2014). As a result, they must utilize two different sets of value creating logics: a private interest logic and a public interest logic. In different degrees sharing economy initiatives combine these logics to create a hybrid logic (Florin and Schmidt, 2011). Private interest logic focuses on customers paying for a product or service, while public interest logic focuses on organizations, communities, and/or individuals receiving the social and/or environmental benefit (Austin et al. 2006).

[2] http://www.shareable.net/blog/is-seoul-the-next-great-sharing-city

The hybrid logic borrows elements from both dimensions to create business solutions that use market forces to address social and/or environmental issues.

Similar to Lamberton and Rose (2012), we consider the extent to which a shared good or service is associated with public or private offerings to be of relevance for this research. In fact, because this study is particularly concerned with the role that the sharing economy plays in addressing SCP systems in cities, framing the sharing economy in light of the public and private interests of sharing initiatives (in the way the seek to create value) is more pertinent because local governments can play a significant policy and support role in local sharing activity (Cohen and Kietzmann, 2014).

3. Data and methods

In exploring sharing economy activities in cities and their impact on SCP systems, we set to explore and visualize the sharing space in the context of the SCP continuum. In order to do so, we needed to organize and categorize the spectrum according to a set of criteria. As any new field, there is a lack of consensus regarding definition, boundaries and central components. In addition, virtually anything in society can be shared including our time, possessions, services and even food. This poses a major research design challenge. In establishing classification criteria for our study, we reviewed extant literature aimed at delineating the field. Leveraging existing research on public goods, Lamberton and Rose (2012) introduced a shared goods typology which evaluated the sharing economy based on rivalry (low or high) and exclusivity (low or high). Agyeman, et al. (2013) developed a sharing spectrum containing five categories of sharing: material, product, service, wellbeing and capability. In embracing the complexity of the field, Owyang et al. (2013) created the "Collaborative Economy Honeycomb" which highlights six families of the sharing economy including: money,

goods, food, services, transportation and space. The Honeycomb is then broken down into 14 sub-classes. Despite the array of concepts covered by these classification models, they do not cover the full spectrum of cases and there is no organized data available, upon which to contrast our theorizing. Nevertheless, they offer relevant insights that support our typology building effort.

Following Barber (2007) we leverage an existing database of suppliers to help understand the SCP marketplace, in this case the sharing economy. Mesh has a growing directory of more than 9,400 sharing economy projects and companies in 130 countries, categorizing this directory into 25 areas ranging from accessories to upcycling[3]. This gives us a more comprehensive view of the phenomenon and access to organized data. Combining insights from the sharing economy types from prior research and from a review of the Mesh directory and categorization, we sought to develop a typology for understanding the sharing economy in the context of sustainable consumption and production in cities. This was conducted in two phases. Phase one focuses on the generation of the Sharing Cities-SCP classification which connects sharing economy and SCP concepts. Phase two focuses on the development of the Sharing Cities-SCP Plot and typology mapping. The criteria and methodology for classification and subsequent typology development is discussed below.

3.2 Sample selection: identifying sharing cities-SCP activities

Phase one entailed a review of the key sharing economy frameworks referenced above, and a thorough review of the Mesh database of 9,400 sharing initiatives around the globe. The goal of this phase was to generate a typology of sharing activities which occur in cities and have a direct relationship to SCP systems. In order for a sharing

[3] http://meshing.it/companies

activity to be incorporated into our Sharing Cities-SCP classification, it needed to meet the following criteria: 1) have some element of being embedded in place; and 2) a direct and clear relationship between the adoption of that sharing model and impact on SCP systems.

While we have addressed both of these concepts to some extent in the literature review it is necessary to expand on the place-based criteria. Management researchers have been increasingly concerned with understanding under what contexts are entrepreneurs embedded in place and how that might influence their venturing activity (Mckeever et al., in press). A key differentiator between more generic frameworks of the sharing economy discussed above, and our framework relates to the extent to which the sharing activity is tied to a place, in this case, cities. Crowdfunding for example is a powerful component of the sharing economy but most crowdfunding is not tied to place. That is to say, services like Indiego and Kickstarter have no clear tie into the location of the campaign[4]. A contributor to a crowdfunding campaign can easily live in another city or even another country from the campaign organizer.

There are of course, place-based angles to crowdfunding. Civic crowdfunding platforms like Neighbor.ly specifically seek to support local community projects usually with local contributions. However, civic crowdfunding also failed to make our screen due to the weak connection between civic crowdfunding and our second criteria, that is, a direct connection between the sharing activity and SCP systems. Certainly some projects funded via civic crowdfunding platforms do have a direct impact on SCP but many projects are unrelated altogether.

[4] Indiego and Kickstarter are arguably the largest and most recognized examples of peer to peer crowdfunding platforms. Both facilitate individual project developers´ access to consumers or individual investors in their fledgling projects in return for discounted prices on future goods, equity investment in the project, and/or other rewards.

After reviewing the Mesh database and the efforts by Owyang, et al., (2013), Lambert and Rose (2012) and Agyeman, et al. (2013), we also explored extant research on key areas of focus for SCP research and action. The Sustainable Consumption Research Exchange (SCORE!) identified food, mobility, energy and housing as key focal areas for SCP action (Tukker, et al., 2008). Leveraging the SCORE! work and our review of sharing economy models, we identified five sharing economy categories which met our two criteria of having a dependency on place and a meaningful relationship to SCP systems in cities: energy, food, goods, mobility and transport and space sharing. Table 1 summarizes a proposed Sharing Cities-SCP classification complete with 18 subcomponents, examples from cities around the globe and summary points about each example.

---Insert Table 1 about here---

3.2 Data analysis and typology mapping

The concept of typology in the context of typology development has been defined as the "conceptually derived interrelated sets of ideal types … each of which represents a unique combination of attributes that are believed to determine the relevant outcome(s)" (Doty et al. 1994: 232). Typology mapping is a strong form of theory development in that it tends to ensure greater parsimony (Fiss, 2011). The development of interrelated sets of ideal types permits the reconciliation of prior efforts aimed at characterizing SCP and private-public interest (while retaining the richness of individual subcomponents), and allows us to move forward research at the intersection of sharing economy and SCP in cities. Because the purpose of ideas types is to simplify the complexity of the real world, the process of typology development generally

involves the pragmatic reduction of an extensive set of features to a limited set relevant to the purpose at hand.

In uncovering ideal types, we used several analytical techniques in a stage-wise process. First, two independent researchers evaluated the private-public interest and SCP continuums based on 0-100 scale, with 0 representing full public interest and full consumption orientation and 100 full private interest and full production orientation. Our selection of data numbers does not reflect degrees of something, it simply allows us to estimate and compare where the SCP components fall in the plot. In evaluating each of the SCP subcomponents, we focus on exemplar cases (Table 1), which were purposively selected because they are revelatory (Eisenhardt and Graebner, 2007) and can richly describe the existence of a phenomenon (Siggelkow, 2007).

Once the researchers finalized the rating procedure, we conducted a simplified inter-rater reliability (IRR) test to demonstrate consistency among observational ratings provided by the two coders. Given that our analytical units are types of SCP activities, not reflective measures, the IRR calculation relies on average scores, not statistical techniques of variance of true scores and measurement errors. Discrepancies were detected when IRR was +0.2, which we scrutinized and discussed until reaching agreement. Following, we calculated thresholds for top quarter (max_score*.75), bottom quarter (min_score*1.25), and crossover point (median) to set anchors for the calibration procedure, used in configurational comparative analyses (Rihoux and Ragin, 2008). The objective of the calibration procedure is to transform variable raw scores into set measures based on the observed score distribution, rescaling the original measure into scores ranging from 0.0 to 1.0 (Ragin 2008). Table 2 depicts the scores resulting from the rating procedure, calibrated scores and results from the IRR test (0.89). Based on these new scores, cases were plotted in a matrix distributing the cases

into five ideal types: four clear corners and an area of complete hybridization in the middle. Each of these five types represents a unique form of SCP activity within the SCP system.

---Insert Table 2 about here---

The development of a Sharing Cities-SCP typology represents a useful way to categorize sharing activities, which frequently occur in cities and have the potential to advance SCP systems. Our analysis provides a rigorous way to understand the relationship between different sharing activities and SCP systems. Following, we develop a Sharing Cities-SCP Plot based on two different analytical dimensions: 1. the central aim of the sharing economy initiative regarding value creation, i.e. public interest or private interest, and 2. the location of the activity on the SCP spectrum; to subsequently elaborate on the emerging distinct ideal types.

4. Results: Towards a Sharing Cities-SCP Typology

In order to understand how the sharing economy interacts with SCP systems in cities, we considered different methods of mapping the results of our typology analysis above into a plot reflecting unique aspects of the sharing models and the SCP system. This resulted in the development of a plot with two dimensions: the extent to which the activity could be classified as of public, private or hybrid interest; and the extent to which the sharing activity has a primary impact on sustainable consumption, sustainable production or both. The discussion draws upon extant literature on organizational hybridization and from SCP systems literature in order to support the development of the Sharing Cities-SCP Plot (Figure 1).

---Insert Figure 1 about here---

It is clear from the plot that there is balance in the private-public interest domain and a slight tendency towards the sustainable consumption component of our SCP continuum. As can be observed, the 18 identified sharing activities are widely dispersed across both continuums. As discussed above, one contribution of this research has been to demonstrate that particularly in the context of the sharing economy, several SCP activities can be described as a hybrid of both consumption and production. Diversity is inherent to the social world, our goal is to simplify reality and provide parsimonious explanations of how the SCP system is structured, while retaining the richness of such dispersion.

4.1 Quadrant 1: Sustainable Consumption Platforms

Quadrant one (private interest, sustainable consumption) focuses on sharing activity which is primarily oriented towards private interest and primarily oriented towards sustainable consumption. We refer to this quadrant as Sustainable Consumption Platforms because all three sharing activities residing in this quadrant tend to serve as platforms for sustainable consumption. In many specific examples of these sharing activities, one can observe for profit enterprises leveraging either information and communication technologies (ICTs) or distributed physical resources (e.g. carsharing) to facilitate scalable access or reuse of goods. The three subcomponents residing in the Sustainable Consumption Platforms quadrant are: loaner products, pre-owned goods and carsharing. The justification for their placement on the plot follows.

Loaner products have been in existence in some form for centuries. In their original form, owners of rarely used products occasionally lent them to friends and family. Technology and social networks which can facilitate increased trust, have enabled the growth of the loaner products to a wider audience of potential users. One of the most popular intermediaries for loaner products is Rent the Runway. Founded in

2009 by two Harvard Business School students, Rent the Runway connects owners of expensive and rarely used fashion items to other users for about 10 percent of the retail cost for the item. While Rent the Runway started as a purely online venture, in 2013, they began investing in physical stores as well. As of February 2014, Rent the Runway had more than 4 million members. Loaner products are generally enabled by private intermediaries and are focused on sustainable consumption, placing this subcomponent in the upper left portion of the plot.

Pre-owned goods enable the redistribution of goods to places where they are needed (Botsman and Rogers, 2010). Like loaner products, pre-owned goods have long been an important part of the global economic system. Ebay has served as an intermediator between buyers and sellers of used, pre-owned, goods since 1995. Craigslist, also started in 1995, facilitates more than 80 million classified ads per month with more than 700 local sites in 70 countries around the globe[5]. The transfer of ownership of pre-owned goods within the sharing economy, as is the case for Ebay and Craigslist, are frequently facilitated by for-profit intermediaries and generally do not receive direct support from local governments. Pre-owned goods support more sustainable consumption as opposed to the purchase of new goods, thus placing them in the middle left side of the plot.

Carsharing facilitates the shared use of personal vehicles amongst friends or members of carsharing networks. There are several different business models within carsharing including business to consumer (B2C), peer-to-peer (P2P) and community owned cooperative models (Cohen and Kietzmann, 2014). The most recognized B2C model is Zipcar which was recently sold to Avis for $500 million. While P2P carsharing models have emerged around the globe, Relay Rides is one of the most

[5] http://www.craigslist.org/about/factsheet

successful to date. Founded in Boston before moving to San Francisco, Relay Rides facilitates the shared use of personal vehicles, frequently to and from airports.

While in some cases, cities have fought carsharing models which compete with taxi services or rental car agencies, many cities have provided support to carsharing service providers in the form of free or discounted parking spaces and road use fees. Carsharing facilitates sustainable consumption by minimizing the need for users to acquire their own vehicle. In fact research suggests that for every car in a carsharing fleet, up to 13 vehicles are removed from city streets as new carsharing members sell their personal vehicles or defer the purchase of a new one (Martin, et al., 2010). Thus carsharing has been placed closer to the center of the private-public interest category and lies on the sustainable consumption side of the SCP continuum.

4.2 Quadrant 2: Sustainable Production Platforms

Quadrant two (private interest, sustainable production) focuses on sharing activity which is primarily oriented towards private interest and primarily oriented towards sustainable production. We refer to this quadrant as Sustainable Production Platforms because all five sharing activities residing in this quadrant tend to serve as platforms for sustainable production. While most sharing found in this quadrant are similarly scalable as the ones in the Sustainable Consumption Platforms quadrant, the Shared Food Prep is more limited because it is restricted to a specific physical location (although of course, the option to franchise the model do exist). The five sharing activities in the Sustainable Production Platforms quadrant occurring in cities are: group purchasing of renewable energy, shared food prep, 3D printed goods & facilities, crowd-shipping and places to stay. The justification for their placement on the plot follows.

Group purchasing of renewable energy seeks to enable individual citizens to consolidate their purchasing power in hopes of obtaining localized renewable energy solutions at a discount over retail rates. One Block off the Grid (1BOG) launched in San Francisco in 2008 to accomplish this group buying approach by supporting homeowners in converting to solar roofing. In 2009 alone, 1BOG facilitated 600 home solar installations with an average savings of 15%, allowing 1BOG to secure a $5 million (USD) investment from New Enterprise Associates[6]. 1BOG was acquired by Pure Energies Group in 2012. Group purchasing does not rely on government subsidies or support and is primarily focused on individual consumption of renewables as opposed to producing energy for others to consume. Therefore we have plotted group purchasing in the upper middle space of the Sharing Cities-SCP Plot.

Shared food prep is associated with the creation of commercial kitchen space accessible to independent restaurateurs and food producers. This is of particular use for small catering businesses and independent food producers as it allows them have access to certified and maintained kitchen facilities without having to invest in their own individual kitchens. Union Kitchen, based in Washington D.C. offers a 7,300 square foot kitchen facility for use by small restaurateurs and producers. As of October 17th, 2014, Union Kitchen had 54 member companies. Members of shared food prep organizations are focused on the production of food and normally pay fees to the facility at market rates, leading to this category's placement in the middle right space of the plot.

3D printed goods & facilities have been discussed for years as disruptive innovations which will someday 'change the world' (Campbell, et al., 2013). 3D printing may have not yet achieved such an impact, but it appears to be on the verge of

[6] http://techcrunch.com/2010/02/10/one-block-off-the-grid-raises-5-million/

becoming an important and potentially transformative alternative to traditional production and distribution models. One project which has garnered substantial media attention, and even earned a visit by President Barack Obama, is the 3D Print Canal House in Amsterdam. Utilizing bio plastics and locally sourced materials architects designed and constructed a home on Amsterdam´s canal-front. "What we wanted to achieve with this project is to take production out of the factory and into the city and show the people that they can be part of production again." (3dprintcanalhouse.com).

While some 3D printing projects receive government subsidies due to the perceived research and development benefits for local industry, most 3D projects will eventually have to survive on their own economic merits. 3D printing facilities are shared facilities for utilizing 3D printing technology without requiring all potential users to acquire their own 3D printers. Burlington, Vermont-based Blu-Bin, the oldest 3D printing facility in the U.S., offers its printers to individuals and small businesses from the local community. Blu-Bin has a focus on the use of locally recycled plastic as input into the products it prints for its clients. 3D Hubs takes this concept to the platform level by connecting local communities to more than 8,000 3D printers in cities around the globe. Imprima3D in São Paulo Brazil marries both consumption and production by allowing designers to both print at their facilities and sell their customized products online. Therefore we have positioned 3D printed goods and printing facilities as a hybrid model on the Sharing Cities-SCP Plot. There is a strong tendency, however, for 3D printing facilities to move towards the private interest domain. While some 3D shops are being supported by local governments, the majority are independent, private operators charging market rates for their use.

Crowdshipping facilitates the shared use of excess capacity in vehicles to deliver goods locally (or even internationally). MeeMeep, a Melbourne-based crowdshipping

startup, "connects people who need stuff moved with people on the move." Similar to Uber, MeeMeep has a process for verifying aspiring movers in order to mitigate user safety and security concerns. While much of the deliveries occur within the same citify, the service is now available throughout Australia. MeePeep is not alone as there are dozens, if not hundreds, of similar crowd-shipping services in cities throughout the globe. Crowd-shipping enables more sustainable consumption over alternative forms of delivery as they facilitate consolidated delivery and geo-located delivery to optimize routes. However, unlike ridesharing which focuses on optimizing unused resources (i.e. unoccupied seats in a car) on the way from point A to B, crowd-shipping also optimizes unused space in a vehicle, but it is also service production because it entails recovery of a package from a user and delivery to another location. Therefore we consider crowd-shipping to be a hybrid offering on the SCP continuum.

Places to stay is associated with sharing short-term housing options. Airbnb, offering shared alternatives to more than 800,000 temporary housing options in more than 34,000 cities around the world, has become synonymous with the sharing economy movement. Airbnb, like many others summarized above, leverages technology to serve as an intermediary between potential renters and homeowners. In some cases, owners rent out rooms in their own house where they currently live, and in others they rent out the entire house or apartment (or one of 600 castles) for short stays. The success of Airbnb in cities around the globe has raised significant questions, and challenges to the traditional hotel industry. For example, a recent brand survey by NetBase found that Airbnb has a more positive brand image amongst travelers than leading hotel chains such as Four Seasons and Hyatt.[7] While we do not have tangible data to support this, we believe that the rapid growth of Airbnb and its competitors may result in deferred or

[7] http://www.web-strategist.com/blog/2013/07/29/collaborative-economy-airbnb-loved-over-traditional-hotel-brands/

abandoned plans for new hotel construction. Regardless, Airbnb offers a more sustainable consumption option to people seeking temporary housing as it allows increased sharing and optimization of unused housing space.

4.3 Quadrant 3: Localized Sustainable Consumption

Quadrant three (public interest, sustainable consumption) focuses on sharing activity which is primarily oriented towards public interest and primarily oriented towards sustainable consumption. We refer to this quadrant as Localized Sustainable Consumption because they are primarily local in nature and primarily focused on sustainable consumption. We identified four subcomponents of Localized Sustainable Consumption sharing occurring in cities: libraries, repair cafes, bike-sharing and co-work spaces. The justification for their placement on the plot follows.

Libraries are arguably the oldest form of sharing economy activity. Most cities and towns around the world have libraries containing collections of books, magazines and other reading materials to be shared by members of the community. In recent times, libraries have begun to transform into more modern versions with computer labs and Internet access to allow users access to digital information as well as physical reading materials. In Medellin, Colombia, a poor neighborhood on the hillside was the recipient of one of the best public libraries created in the country. Not all libraries are public and some require admission or membership. As an alternative to purchasing the reading materials, or even computers to gain Internet access, libraries support sustainable consumption.

Repair cafes first emerged in 2009 in Amsterdam. The concept behind repair cafes is to encourage people to salvage household goods which have been damaged and would likely be heading to the landfill. As the take-make-waste, consumerist society

gain prominence worldwide, the tendency for people to stop using and eventually dispose of items needing minimum repair to be born again eroded. It was the recognition of the wasteful nature of local communities that inspired Martin Postma to start the first Repair Café in Amsterdam, where tools are made freely available and a community of sustainability-minded community members are invited to repair their own toasters, bikes, clothes and toys, or get or offer help to others in a social environment. The Repair Café has helped established hundreds of other repair cafes around the globe. Repair Cafes do not intend to replace repair services and instead focus on helping individuals salvage something they would never consider paying to repair. As such we consider Repair Cafes to be primarily oriented towards sustainable consumption, while we have placed them close to hybrid models because there is an element of service production when others assist someone repair a personal item, albeit without a fee.

Bikesharing involves the shared use of bicycles, usually secured in designated bikesharing spaces throughout a city. At least three generations of bikesharing systems have evolved over the past few decades and several different business models have been employed to facilitate bikesharing in cities throughout the globe (Cohen and Kietzmann, 2014). Because of their potential to support more sustainable multi-modal transit and to address the first-mile/last-mile challenges for public transit (Cohen and Kietzmann, 2014), bikesharing programs typically obtain significant benefits from local governments. This ranges from free space for the bikesharing infrastructure to government subsidies and, in some cases, such as in Providencia, Chile, the local government pays for most of the service and only outsources the operation of the a private enterprise. Some cities, like Barcelona, restrict access to their bikesharing service to local residents, whereas others like Vienna offer rental services to visitors as

well. Bikesharing would generally be classified as an initiative driven by public interest and supports sustainable consumption by diverting motorized vehicle use. While many bike sharing systems are locally developed and operated, some, such as those developed by Trek´s B-Cycle, have moved towards a franchise model, offering them more scale.

Co-work spaces have emerged in cities and suburban areas around the globe. They frequently offer access to printers, Internet, couriers, meeting spaces and other facilities one normally expects to find in office settings, while also offering the opportunity to interact with others in a more informal environment. While the majority of co-working spaces emerging in cities throughout the globe are local and independent there are some franchise models as well. Urban Station, for example, emerged as a chain of co-work spaces, first in Argentina, and subsequently in Chile, Mexico, Colombia and Turkey. Members can pay a monthly, daily or hourly fee to use the facilities. While Urban Station, and other co-work facilities cater to independent consultants and entrepreneurs seeking shared facilities and social interaction, they also can serve to alleviate congestion in cities by facilitating tele-commuting from employees in large firms who live far from corporate offices. For this reason, and for co-working's potential to foster synergies and local economic development, many cities have invested in their own co-work offerings, or offer support to independent co-working facilities. As such we have placed co-work spaces between a public and private interest and on the sustainable consumption side of the SCP continuum.

4.4 Quadrant 4: Localized Sustainable Production

Quadrant four (public interest, sustainable production) focuses on sharing activity which is primarily oriented towards public interest and primarily oriented towards sustainable production. We refer to this quadrant as Localized Sustainable Production

because they are primarily local in nature and primarily focused on sustainable production. We identified four subcomponents of Localized Sustainable Production sharing occurring in cities: energy co-ops, community gardens, edible communities and freecycling. The justification for their placement on the plot follows.

Energy co-ops are organizations formed by individuals in a community to pool their funds for the generation and consumption of renewable energy resources (Maruyama, et al., 2007). This makes energy co-ops one of the sharing economy's innovative activities incorporating both sides of the SCP model. At the time of writing, Mesh had about a dozen energy co-ops listed in their database although there are hundreds if not thousands of energy co-ops around the globe. Brighton Energy Cooperative, owns more than 500kw of solar photovoltaic (PV) panels in Brighton, UK. While virtually all energy co-ops focus on production, as is the case with Brighton, co-ops do not always manage to deliver the renewable energy to members, instead feeding into the local grid. However, in some cases such as with local district energy plants, efforts are made to directly deliver the energy to local community owners (e.g. Vancouver´s Southeast False Creek district energy system). Brighton Energy Cooperative is able to take advantage of local policy incentives in the form of feed-in-tariffs (FITs) and tax breaks for investment in the initiative. Thus, energy coops have been place between hybrid and production on the SCP continuum and classified as a hybrid organization on the public-private interest dimension of the Sharing Cities SCP Plot.

Community gardens are community owned or donated lands devoted to small-scale, primarily organic, fruit and vegetable crop raising and consumption. Urbanfarming.org has its own map of thousands of community farms around the globe, while Sharedearth.com puts a spin on community gardening by connecting landowners

with gardeners seeking an area to create a garden. The landowner and the gardener then share in the crops produced. More traditional community gardens, such as Liz Christy Community Garden in New York City, the first community garden in the U.S., bring together local gardening enthusiasts together to share in the productive capacity of a small plot of land in an urban setting. Frequently, members are given, or pay a small contribution to obtain, a micro-plot to produce their own fruits and vegetables for personal consumption. While the land itself is often donated or highly subsidized we have plotted community gardens as public interest activity because their space is limited. Community gardens' utility in both production and consumption leads community gardens to be identified as a hybrid on the SCP continuum, focused primarily on public interest.

Edible communities emerged in 2008 in Todmordon, UK after a local woman, Pam Warhurst and her friends began experimenting with making public community gardens where anyone in the community, not just members of a community garden could plant, cultivate and/or consume fruits and vegetables in the community. The initiative spread to the point where much of the public green space in Todmordon is now edible. Since 2008, edible communities have emerged in towns and cities around the globe. Because the local government frequently offers free space to the gardeners and because the fruits of their labor are freely shared with the community, edible communities have been plotted as hybrid SCP models in the public interest domain.

Freecycling either virtual or physical, is another form of the redistribution market. This normally involves the donation of pre-owned goods for reuse by others. As opposed to donation to non-profits, an intermediary facilitates the redistribution of the goods to others for free. Freecycle.org is a virtual network with more than 8 million members which facilitates local freecycled redistribution. Island Re, in Port Alberni,

Canada has a physical storefront dedicated to redistributing free goods. Some freecycling organizations gain local municipal support. Some freecycle users seek to convert an unwanted good into something more useful by combining it with other materials, up-cycling the item and or incorporating artistic elements. Thus, in some cases freecycling can also be used for sustainable production. As such, we have placed freecycling towards the public domain and in-between sustainable consumption and hybrid on the SCP continuum.

4.5 Quadrant 5: Complete hybridization

One of the contributions of this research includes an articulation of a continuum for both SCP and public-private interest. As such, our model enables the identification of sharing activities at the intersection of both continuums in cities. Thus far, we were able to identify two fully hybrid sharing activities occurring in cities: shared foods and ridesharing. The justification for their placement on the plot follows.

Shared foods may not sound appealing to all, but certainly have the potential to support SCP in cities while also addressing the inequality gap. Leftover Swap, for example, allows possessors of excess meals to connect to locals in search of cheap cooked food. The idea for Leftover Swap emerged when its founder and his friends had ordered too much pizza and did not want to waste it. Several other companies and organizations have emerged in cities around the globe seeking to address the massive food waste in developed countries by redirecting this food to those in need, either for a fee or, in the case of non-profits, for free. Boulder Food Rescue, for example, recovers leftover foods from bakeries or small grocery stores and delivers the food by bike to local shelters. Therefore in some cases, shared foods are closer to the public interest while in others they are closer to private interest.

Ridesharing/Carpooling. Instead of sharing individual access to passenger vehicles, ridesharing and carpooling offer the option to be a passenger in the vehicle driven by someone else. Carpooling usually involves pre-arranged trips to shared destinations, whereas ridesharing, popularized by Uber and Lyft, facilitate the connection between drivers and prospective passengers seeking to travel similar routes. Carpooling services have frequently been encouraged by employers and cities to address congestion in cities, frequently on an ad-hoc basis. Ridesharing has become a disruptive innovation to the taxi industry. As such, intermediaries such as Uber and Lyft have experienced legal action from the taxi industry and from some select cities around the globe. We consider ridesharing/carpooling to be a private service with hybrid interest, contributing towards sustainable consumption. The more ridesharing becomes a substitute for taxi services, the less ridesharing actually belongs in the SCP conversation. However, ridesharing frequently optimizes single occupancy vehicle use, so we believe ridesharing and carpooling belong in the taxonomy and plot.

5. Contribution, limitations and Future Research

The Sharing Cities-SCP Plot seeks to provide a framework for understanding the emergence (and diversity) of sharing activity in cities and their contribution to a transformation of urban economies towards increased sustainable consumption and production. Next, we will discuss contributions and limitations of this study along with suggestions for future research.

The sharing economy, at least the 21st century version of it, is in its infancy. Extant research in management literature regarding the sharing economy is virtually non-existent. At such an early stage of the emergence of a new field, this type of conceptual and pre-theory development is necessary to support further theoretical and

empirical development of the field. We believe that the Sharing Cities-SCP Plot will be useful for other scholars in sustainability and management who wish to incorporate sharing economy in their future research activity as it provides a basis for framing this sector of the economy. Furthermore, we believe the Plot offers a significant contribution to the sustainable consumption and production research stream by demonstrating that some economic activity has the potential to be a hybrid of both sustainable consumption and production, which may open up new research opportunities in the SCP literature, within sharing and in other economic activity as well.

The sharing economy is a rapidly growing and diversifying segment of the urban marketplace. Despite our best efforts to review the Mesh database and other initiatives to classify the sharing economy, it is quite likely we have overlooked some emerging sharing activities worthy of placement in the typology and the plot. Furthermore, this space is likely to continue to evolve rapidly and there will be some new sharing activity which will disrupt other incumbent actors in the take-make-waste industrial economy of the 20th century (Hawken, et al., 1999). For example, Helsinki recently launched a personalized bus service, Kutsuplus, which is a hybrid between traditional public transit bus service and a ridesharing service, whereby users can notify the service of their need to go from their current location to a specific destination. Kutsuplus aggregates inquiries in real-time and customizes routes to optimize the use of their 15 minibuses. Since Kutsuplus was the only service of its kind we were able to identify we chose not to include it as a separate subcomponent of the model.

Also, the effort to locate the subcomponents on the plot is not an exact science. There are a range of business models and approaches to each of the subcomponents and some of them likely skew towards or away from the x and y-axes. As mentioned above,

carsharing comes in a variety of models from B2C, P2P and cooperative. Some involve direct city economic support while others operate independent of the city. Some, like Zipcar offer a range of vehicle types whereas others, like Velib in Paris, focus exclusively on electric vehicle (EV sharing), suggesting relatively different impacts on urban SCP systems.

A natural evolution of the typology and plot would be to quantify the social, economic and ecological impacts of the different sharing categories and subcomponents in cities. Each activity likely has differential implications on SCP systems, and even within subcategories, business models and approaches to implementation likely result in different SCP impacts. Knowledge about the impacts of sharing activities could be beneficial for local policy makers, scholars, executives and entrepreneurs alike. Cities are only getting started in understanding the sharing economy, what it means for their city, and what kind of policy can be used to support those services that lead to positive benefits while limiting negative externalities. It is clear that many sharing activities may have profound impacts on the quality of life in cities and may serve to complement or disrupt existing public and private offerings (Cohen and Kietzmann, 2014). SCP researchers have extensively explored public policy instruments to support advances in SCP systems, yet there is a dearth of research exploring public policy tools for supporting the local sharing economy.

As we mentioned earlier, typology mapping enables a strong form of theory development in that it tends to ensure greater parsimony. Far from viewing typology development as means for ordering and comparing groups of elements and clustering them into categories, they offer the possibility to elaborate complex theoretical statements that, unlike traditional linear or interaction models of causality, allows for accommodating multiple relationships between their constructs, thus considerable levels

of causal complexity (Fiss, 2011). We strongly believe that our typology mapping is a first step towards theorizing on the relationship between SCP and organizational hybridity in the context of the sharing economy in that it facilitates further understanding and theorizing on this topic. We therefore encourage future research in this area.

A second contribution of this research was to challenge the assumption in SCP research that sustainable consumption and production are separate constructs. Particularly in the context of the sharing economy, there are a growing number of activities which involve users collaborating for the purposes of sustainable consumption and production together. These maker communities, as Owyang (2013) and others refer to them, represent another potentially fruitful area for future research. Hybrid activities which bring user communities together to co-design, co-finance, co-produce, co-distribute and consume collectively or individually challenges many established institutions, could be very disruptive to incumbent industries, and may transform local economies in innovative and more sustainable ways. What can be learned from these hybrid models and how do they inform theory, policy and practice for the further development of SCP systems?

Finally, throughout this research, we highlighted sharing economy projects around the globe. Yet we still know very little about how local conditions affect adoption and implementation of shared economy concepts in different cities, regions and continents. Relatedly, what factors influence the diffusion of sustainable, sharing innovations across cities and which models can be successful at the platform level? For example, Airbnb, 1BOG and 3D Hubs are all platform level solutions allowing for users in any city to participate in local sharing. However some sharing activities appear to require more localized interaction and collaboration, such as those in the maker movement.

With this research we sought to begin to frame the unique interaction between the emergence of the sharing economy in cities and sustainable consumption and production aspirations. The Sharing Cities-SCP Typology and the Sharing Cities-SCP Plot are tools which can be used to frame this new space and support further research and policy development. Cities are arguably the most important battle ground for transforming to a more circular economy, and the sharing economy will be an integral component of the transformation.

6. Final Reflections on the Sharing Economy and Future Directions

As scholars we are in the nascent stage of developing conceptual, theoretical and empirical models for understanding the emergence of the sharing economy and its potential for sustainable development, as well as its impact on business models, the role of peer-based platforms, industry incumbents and of course sharing cities. One could interpret our analysis in this paper as an optimistic perception of the contribution of the sharing economy to sustainable cities and sustainable development over all. The potential for substantial and positive implications of the sharing economy in cities on SCP is clearly present. Yet, empirical evidence is lacking to ascertain the sharing economy's current impact, let alone future potential. Is the sharing economy a passing fad, just one of many new combinations being added to the global economy or something much bigger and more profound?

We do not know the answer to that question, and would argue no one does yet. However, it is possible to consider what lasting impact the sharing economy may have already had on economies and society. In order to do that, we briefly leverage the

sharing economy through the lens of the Social Construction of Technology (SCOT), (Pinch and Bijker, 1984). Rather than view the emergence and dominance of new technology artifacts as the result of a purely objective assessment of the superiority of one technology over the other, SCOT scholars suggest that the adoption of new technologies occurs as a result of a complex and iterative interaction amongst developers, users, regulatory agents and civil society. The introduction of new business models and economic approaches such as the sharing economy activities discussed herein, have already created new, and often conflicting narratives amongst numerous stakeholders with respect to the benefits and drawbacks of sharing activity, appropriate regulatory approaches and varying rates of resistance and adoption from industry incumbents and peer groups in territories around the globe. These narratives represent different interpretations about what the sharing economy is, what it can and can't do. The mere existence of sharing economy activities has opened up the field allowing for interpretative flexibility. From this perspective, the sharing economy has already had a lasting impact on society in the sense that it has helped generate meaningful discussion regarding the role of the economy in society, peer to peer business models and alternatives to traditional capitalism. Some voices in mainstream media have even argued that the post-capitalist era has already begun (e.g. Mason, 2015), and that the modern sharing models are a driving factor of this transformation. The prevailing take-make-waste society is being challenged by many sharing economy activities, which in their purest form ,could assist our global economy to reshape itself in a more sustainable manner by leveraging technology (artifacts) to connect underutilized resources with those in need of access to them, instead of ownership of them. Which dominant paradigms and business models will have staying power in the decades to come may be

anyone's guess, but what is certain is that the sharing economy has already contributed to changing narratives about economic activity at a local and global level.

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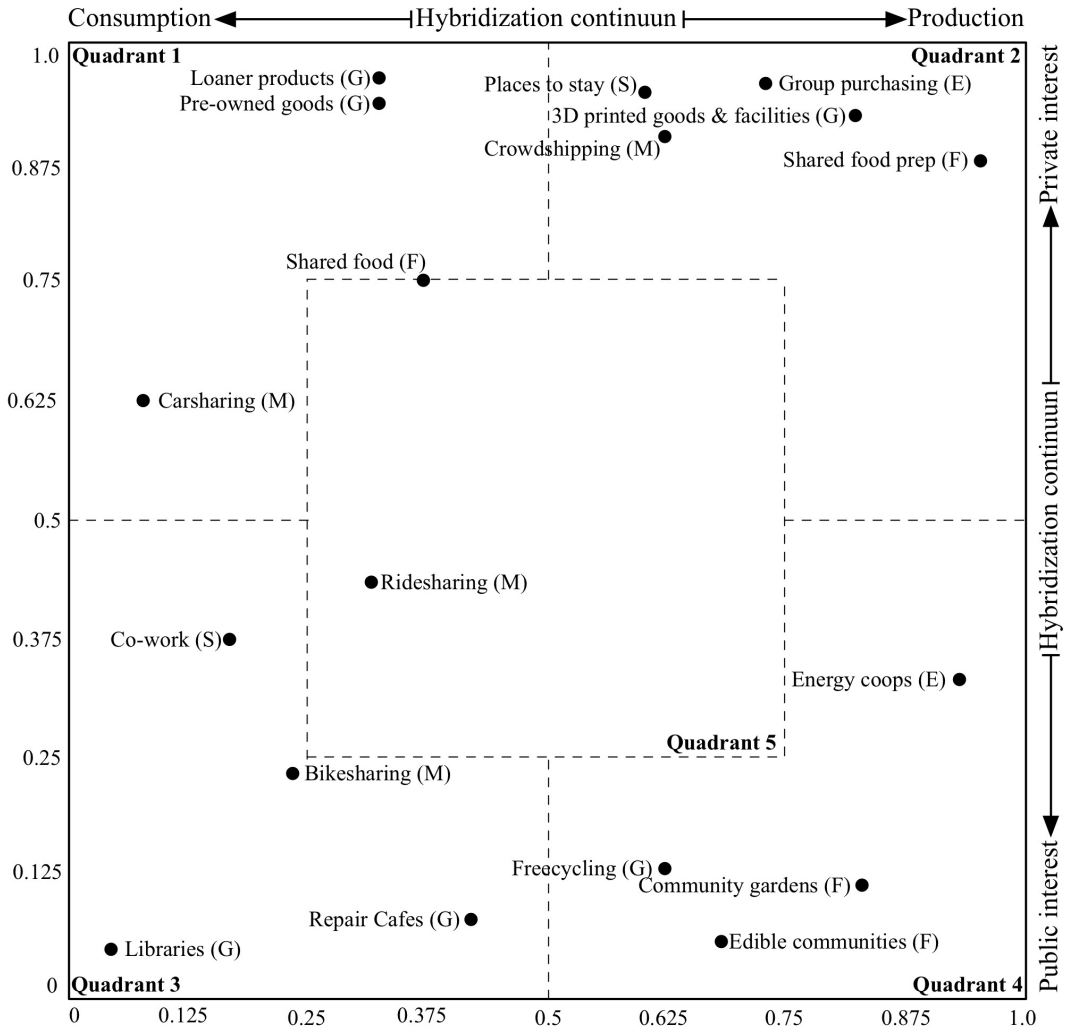
Table 1. Shared Cities-SCP classification

Sharing Category	Subcomponent	Cases	Comments
Energy	Energy co-ops	Brighton Energy Co-op (UK)	Community-funded solar power
	Group purchasing	1BOG (S.F., multi-city)	One Block off the Grid is a group purchasing portal to facilitate discounted solar purchasing for residents
Food	Community gardens	Liz Christy Community Garden (New York)	Liz Christy Community Garden, founded in New York City in 1973, is recognized as the first community garden in the U.S.
	Edible communities	Incredible Edible Todmordon (UK)	Open community gardening and consumption
	Shared foods	Leftover Swap (San Francisco, multi-city)	Mobile app to facilitate the sharing of leftovers
	Shared food prep	Union Kitchen (D.C.)	Possess 4,500 sq ft worth of kitchen facilities to support independent restaurants
Goods	3D printed goods & facilities	Blu-Bin (Burlingont, Vermont)	Oldest 3D printing house in US which uses locally recycled plastic
		3D Hubs (multi-city)	Intermediary connecting 3D printing facilities with local inventors
	Loaner products	Rent the Runway	Platform for short-term lending of luxury fashion
	Pre-owned goods	Craigslist (multi-city)	Ubiquitous, virtual marketplace for local used goods, services and job listings
	Freecycling	Island Re (Port Alberni, Canada)	Local store for redistributing items no longer needed to people who want them
	Libraries	Virtually every city in the world	Arguably the oldest form of the sharing economy
	Repair Cafés	Started in Amsterdam, now global	First Repair Café started in 2009 as a free place to come and fix broken household items
Mobility & Transport	Carsharing	Autolib' (Paris)	All EV project supported by the city and privately operated
	Bikesharing	Providencia (Santiago)	City owned and privately operated bikesharing
	Ridesharing	Uber (SF, multi-city)	Platform for connecting drivers and riders
	Crowdshipping	MeeMeep (Melbourne, Australia)	Connects approved drivers with users seeking to send something locally or within the country.
Space Sharing	Work space	Urban Station (Buenos Aires and selected cities)	Founded in Buenos Aires, Urban Station is a small chain of shared work spaces.
	Places to stay	Airbnb (S.F. and multi-city)	Airbnb, a sharing economy pioneer, is valued at $10 billion (USD) for its ubiquitous network of local/shared housing options.

Table 2. Scores, calibration and IRR

	Full score (average)		Calibrated scores		
	PP Interest	SCP	PP Interest	SCP	IRR
Energy co-ops	32	73	0.32	0.92	0.91
Group purchasing	79	50	0.95	0.73	0.87
Community gardens	16	60	0.11	0.84	0.94
Edible communities	9	45	0.06	0.67	0.92
Shared foods	55	30	0.75	0.37	0.75
Shared food prep	66	82	0.88	0.95	0.95
3D printed goods & facilities	70	58	0.91	0.82	0.93
Loaner products	78	28	0.95	0.31	0.95
Pre-owned goods	76	28	0.94	0.31	0.84
Freecycling	19	42	0.13	0.62	0.80
Libraries	6	12	0.05	0.05	0.97
Repair cafes	11	31	0.07	0.4	0.99
Carsharing	46	17	0.6	0.09	0.91
Bikesharing	25	24	0.2	0.2	0.91
Ridesharing	37	29	0.42	0.34	0.80
Crowdshipping	69	39	0.9	0.58	0.85
Work space	35	22	0.37	0.16	0.94
Places to stay	75	37	0.94	0.55	0.86
IRR	**0.90**	**0.88**			**0.89**



Key (E) Energy, (F) Food, (G) Goods, (M) Mobility/transport, (S) Space