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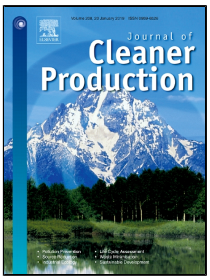
# Climate-Governance Entrepreneurship, Higher-Order Learning, and Sustainable Consumption: The Case of the State of Oregon, United States

Halina Szejnwald Brown
*Clark University*, hbrown@clarku.edu

Maurie J. Cohen
*New Jersey Institute of Technology*

# Accepted Manuscript




Advancing sustainable consumption and production in cities - A transdisciplinary research and stakeholder engagement framework to address consumption-based emissions and impacts

Patrick Schröder, Philip Vergragt, Brown Halina, Leonie Dendler, Neal Gorenflo, Kira Matus, Jaco Quist, Christoph Rupprecht, Arnold Tukker, Ronald Wennersten

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**Abstract for category: Consumer behaviour and lifestyles towards post carbon societies**

**Title:** Advancing sustainable consumption and production in cities - A transdisciplinary research and stakeholder engagement framework to address consumption-based emissions and impacts

**Abstract:**

Urban consumption patterns and lifestyles are increasingly important for the sustainability of cities today and in the future. However, considerations of consumption issues, social norms, behaviour and lifestyles within current urban sustainability research and practices are limited. Much untapped potential for the reduction of the environmental footprint of cities exists in combined production and consumption-based approaches, particularly in the “demand” areas of mobility, housing, food, and waste. To change unsustainable consumption and production patterns in cities, research needs to be transdisciplinary, actively involving stakeholders through co-creation processes. This paper builds on the premise that the perspectives and approaches of Sustainable Consumption and Production (SCP) for cities require the involvement of non-traditional stakeholders that are generally not included in urban planning processes such as social change initiatives, citizen groups and informal sector representatives. We present a transdisciplinary research and engagement framework to understand and advance the transition to sustainable SCP patterns and lifestyles in cities. This transdisciplinary approach to SCP transformations in cities combines co-creation, participatory visioning processes and back-casting methods, participatory urban governance and institutional change, and higher-order learning from small-scale community initiatives. We illustrate our conceptual framework through three empirical case studies in cities which take an integrative approach to lowering ecological footprints and carbon emissions.

**Title:** Advancing sustainable consumption and production in cities - A transdisciplinary research and stakeholder engagement framework to address consumption-based emissions and impacts

## 1. Introduction

Cities are consumption hubs which generate environmental impacts far beyond city boundaries. Combined production and consumption-based approaches are required to fully understand and address environmental impacts of cities. The importance of taking a systems approach for sustainable cities has been emphasised by Bai et al. (2016). This requires addressing production and consumption as a coupled system and taking into account upstream impacts in supply chains to cities (e.g. Tukker et al., 2010; Reisch et al., 2016) and embodied energy (Lenzen et al., 2008) to determine to complete environmental footprint. The issue has been emphasised by the publication of a report by the C40 Cities network, which for the first time has applied consumption-based emission inventories to measure the carbon footprint of consumers in big cities (C40 Cities, 2018). The report shows that per capita carbon footprints of cities are two to three times higher as compared to the traditional production-based sectoral inventory approaches.

Solely addressing geographically limited production-based emissions and impacts has limited effect on the overall carbon footprint of cities (Millward-Hopkins et al. 2017). To reduce the indirect consumption-based impacts, cities will need to address upstream and downstream scope 3 emissions (Greenhouse Gas Protocol, 2014). Low-carbon city experts acknowledge that more needs to be learned about how to change residents' lifestyles and consumption patterns to create low-carbon cities (Bai et al. 2018). However, most current initiatives and research on low-carbon cities and climate-resilient urbanisation (e.g. German Advisory Council on Global Change, 2016; UNEP, 2013; UN, 2017) do not explicitly focus on consumption issues such as lifestyles and consumer behaviour. Taking a combined consumption- and production-based approach to urban carbon emissions, rather than the mainstream sole production-based approaches, shows that substantial reorientation of policies and planning for low-carbon cities and climate change is required (Sudmant et al. 2018).

In this paper we add to the discussion about combined approaches to bring about sustainable, low-carbon and liveable cities. We introduce an analytical perspective and framework how both production and consumption issues can be included into the sustainable cities discourse. Practical multi-stakeholder engagement and inclusive governance processes to involve groups advocating for social change, citizens, neighbourhood initiatives and informal sector

representatives are important elements of this framework. The paper is based on a scoping document of the Working Group on “Sustainable Consumption and Production in Cities”, part of the Future Earth Knowledge Action Network (FE KAN) on Systems of Sustainable Production and Consumption (SSCP) (Future Earth 2018). It provides an overview of root causes and drivers of increasing resource use in cities in Section 2, followed by discussing major challenges and possible solutions for several consumption domains, with an emphasis on bottom-up developments involving citizens, and other non-traditional stakeholders in Section 3, the development of a transdisciplinary and future oriented framework in Section 4 before illustrating the framework for three cases in Section 5, followed by discussion and conclusions.

## 2. Drivers of increasing resource consumption of cities

From a systems perspective of sustainable consumption and production (SCP), consumption patterns and lifestyle choices of people are important aspects which determine carbon and material footprints of cities. Smart and low-carbon cities require smart and low-carbon people, not just smart infrastructures and connected devices. Sizes of houses and apartments, motor vehicle ownership and mobility choices are not only influenced by urban form, but also by cultural and socio-economic characteristics and social practices (Tukker et al., 2010; Moore, 2015). Similarly, urban food choices and diets are influenced by the physical availability of food offered in supermarkets, restaurants and other outlets, but also by culinary trends, social practices and cultural norms and regulations.

People are generally striving for a higher degree of well-being, one of the main motivations of moving to cities, but it appears that urban consumption and modern lifestyles are only partially fulfilling this desire. However, wellbeing is not only determined by levels of wealth and affluence, there is growing evidence that social relations, mental and physical health, belonging to a community and living a good life are also key to wellbeing (Layard, 2011; Skidelsky and Skidelsky, 2012).

Urban lifestyles are therefore increasingly important for the sustainability of current and future consumption and production systems. In the near and medium-term future, lifestyles in many cities are likely to be affected by ongoing changes towards the service economy, the expanding labour-market informalization, increasing social vulnerability and inequalities, and further societal disembedding. We are likely to see the deepening of tendencies toward centralization, cultural divides and power asymmetries, the intensifying of complexity and speed, the accelerating accumulation of risks, and the expanding scope of ecological and social threats (World Economic Forum, 2017).

There are important differences between cities in the global North and South. In the global North, especially in Japan and Europe, the population of several inner cities is shrinking because of gentrification, ageing of the population and changing demographics (Matanle, 2014). Another reason for shrinking cities is the decline of the traditional manufacturing base, especially in the USA. In contrast, nearly all cities in the global South are growing fast because of migration from rural to urban areas, industrialization and jobs creation, and rationalization and integration of agriculture with a steep decline of jobs outside cities. High population density, poor infrastructure conditions, lack of affordable housing, emergence of slums, traffic congestion and air pollution are serious urban problems. Cities in developing countries thus face multiple major challenges, including a rapid increase in urban populations with unequal access to social services, a growing divide between rich and poor, insufficient job opportunities, burgeoning municipal waste generation, inefficient infrastructures and air pollution (UN 2017).

Cities in developed countries also face huge challenges related to resource and energy requirements and climate change, as well as social challenges related to deprived groups, shrinking populations, decreasing labour conditions, and withdrawal of the welfare state. Whereas the majority of citizens in developing countries are more concerned about ensuring a livelihood, in the developed countries the emphasis should be more on moderation of lifestyles and reducing resource and energy intensity of lifestyles. Interestingly, there are some signs that new urban consumers in the Global South are “lifestyle leapfrogging”, bypassing the high-impact urban lifestyles of consumers in Europe and the US (Schroeder and Anantharaman, 2017), while alternative, more environmentally aware lifestyles, prosumer initiatives and local citizen initiatives are growing in size and numbers in cities in developed countries.

Against this context we consider it necessary to address the following main interlinked socio-economic aspects of unsustainable urbanization and associated consumption and production patterns to bring about transformations to sustainable cities:

1. **Consumer culture and lifestyles**: In cities, higher income levels, a combination of various institutional processes and the widespread promotion of a culture of consumerism leads to increasing material consumption and waste generation (Wiedenhofer et al. 2017; Hubacek et al., 2017; Ummel 2014). This also includes the “nutrition transition” toward higher caloric, protein rich, meat and dairy based diets and more processed (fast) food. These lifestyles are spreading worldwide, especially in urban centres and suburbs, and are major drivers for increasing material consumption levels and urban footprints.
2. **Linear systems of “take-make-throw away”** are the cause for increasing waste generation and air pollution which are pressing concerns of many cities, especially in

developing countries, where deteriorating quality of urban environments from poor waste management has negative effects on health and well-being (De and Debnath, 2016). Municipal waste problems in cities are often the result of inefficient management systems and lack of infrastructure and specialised processing facilities dealing with waste (Kumar et al., 2017), however, the increasing amounts of waste generated by cities can be linked back to societal behaviour shifts from minimal waste generation to a throw-away society and more consumerist-type lifestyles (Mukthar et al., 2016).

3. **Growing inequality and marginalisation within cities**, especially in relation to consumption and production patterns and unequal distribution of benefits and burdens through urban provisioning systems including unequal access to housing and services such as public transportation, healthcare and education is a growing concern. This includes quantitative relationships between income levels, education levels, and age distribution and the ecological footprints in cities; as well as qualitative relationships and case studies.

This situation calls for alternative models of provisioning with lower aggregate resource consumption and associated environmental impacts while enhancing local economic development, innovation and job creation. Furthermore, it requires bringing these models into frameworks and approaches to analyse and bring about sustainable consumption and production patterns as part of urban transitions to sustainability.

## 3. Sectoral approaches and systems of provisioning

We highlight the cross-cutting topics linked to one or more of the four provisioning systems (or demand areas) of housing, food, mobility, and use of household products including generation of municipal waste. These areas count for over 70% of the life cycle impacts related to e.g. water use, material use land use and energy use of final consumption - where it has to be noted that such impacts often take place at totally different locations as the urban area under study (see e.g. Tukker, 2006; Tukker et al, 2010; Stadler et al., 2018). Figure 1 provides an overview how production and consumption systems connect and relate in the context of urban provisioning systems.

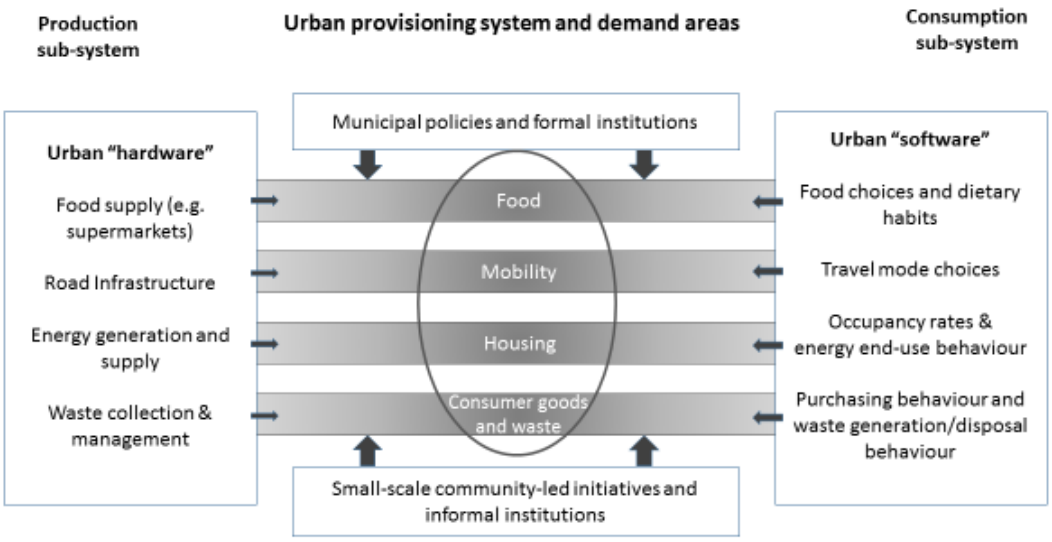


**Figure 1: Urban production-consumption system components and demand areas (direct energy and embodied energy are included is all four demand areas)**

**Housing** including heating and cooling and the use of electrical appliances accounts for a major share of urban energy consumption and material use[1]. Urban energy transitions will be to a large degree determined by their success in dramatically improving the end-use energy efficiency of the building stock, next to the use of low-energy appliances. High-performance buildings such as PassivHaus are socio-technical solutions to this problem. PassivHouse buildings allow for heating and cooling related energy savings of up to 90% compared with typical building stock and over 75% compared with average new builds (Passipedia, 2017). PassivHaus design and standards are an opportunity for fast growing cities in developing countries where new construction is happening, potentially leapfrogging conventional building technologies and building stock with lower efficiency. In terms of materials, housing is a growing factor in the accumulation of building material stock which needs to be taken into account in the design of urban circular systems (Ellen MacArthur Foundation, 2017). This issue is closely linked to strategies aimed at making sustainable lifestyles easier through appropriate infrastructures and urban forms that enable well-being (e.g., community and family friendly urban forms). Emerging developments for low-carbon housing includes local energy cooperatives (e.g. Seyfang and Haxeltine, 2012) and circular buildings (Pomponi and Moncaster, 2017; Leising et al, 2018)

[1] http://metabolismofcities.org ; http://www.urbanmetabolism.org/

A major issue is the housing space per capita and the occupancy of individual housing units. Sizes of houses and apartments have been increasing steadily in the last half-century, especially in the US, which more than offsets increases in efficiency (Darlin, 2016). This becomes especially evident when GHG emission calculations include the embodied energy of construction materials (Oregon DEQ, 2010). The solution lies in a combination of a cultural change toward reduced symbolism of a large house as an expression of wealth and success, the availability of more sustainable housing stock, and policy incentives (including taxation) that favour smaller dwellings and facilitate moving to smaller or shared spaces. Design of neighbourhoods that foster well-being and strong communities in smaller private spaces are equally important; community spaces should be included in the design. Design should also include possibilities for sharing spaces and functions, for instance laundry, child care, even cooking. At the same time, rapid gentrification and fast increases of house prices in cities and neighbourhoods which prosper economically require an integrated approach to balance the requirements of ecological and social sustainability.

**Sustainable urban mobility** includes walkable and bikeable cities, inclusive transport infrastructure, access to public transit, car-sharing systems, and autonomous (electric) vehicles. In recent years, a lot of progress has been made to address mobility in urban areas. The main issue is to reduce the use of private automobiles in cities and beyond, without compromising access to mobility. While in some cities in the US interest in car ownership among young people has declined (The Motor Report, 2017), overall car mobility is hardly decreasing mainly due to low fuel prices, lack of viable alternative transport modalities, and entrenched habits and the “automobile culture.” Urban planning, transit-oriented development, increasing density, more democratic access to public transit, and bike infrastructure are getting more attention from many city planners and municipalities and are crucial for a transition to low-impact mobility (e.g. Geerken et al., 2009).

There is scope for new business models based on sharing, which includes different types of both bike sharing and car sharing. Car sharing experiences in the Netherlands show that using a shared car can achieve an average reduction of between 175 and 265 kilograms in $CO_2$ per user per year, which equals a reduction of around 8% to 13% in emissions related to car ownership and car use (Nijland, van Meerkerk and Hoen, 2015).

Other measures and policies include internalisation of the costs of carbon emissions into fuel prices and changes towards less automobile use and reducing size of vehicles through congestion charges, low emission zones, limiting vehicle parking options and restrictions on access for private vehicles in city centres.

**(Urban) food systems** are faced with a number of sustainability challenges that reach from undernutrition and safety concerns, inequality issues, to overnutrition and related health threats, and increasing use and competition for natural resources (Bennetzen et a., 2016; FAO, 2017). Cities expose key conflicts in dealing with these challenges. Regimes of food production have been historically focused on achieving food security and food safety goals through means of globalisation, integration and standardisation. Emerging alternative approaches such as organic food production within and beyond the urban context, tend to question and conflict with these dominant regimes. Focussing on small-scale efforts to produce locally, distribute, share and consume food resources while addressing issues of inequality and other alternative sustainability goals (Forssell & Lankoski, 2015; Holloway et al., 2007). Urban organic agriculture can contribute to food security, counter trends to processed foods and reduce transportation of food by emphasizing localisation, health, soil conservation, biodiversity, recreation, local identification, and social cohesion. Environmental benefits include increased soil organic matter which is conserved better with organic than with conventional farming practices. In Europe research has shown that soil organic carbon is 6–34% higher under organic than under conventional agriculture (Erhart and Hartl, 2009).

There is also likely a role for urban gardening and other forms of intercultural and collective gardens, while vertical agriculture is also on the rise. However, those trends also raise serious questions around food safety and wider health impacts. An integrated research framework needs to look at how these conflicts play out in practice including their different sustainability implications and potential synergies between them. This may include the support of low-meat and hence more sustainable diets (e.g. Behrens et al., 2017).

Food losses and waste amounts to roughly USD 680 billion in industrialized countries, where they happen mostly in retail and consumption (FAO, 2011). Cutting food waste can significantly reduce a city's consumption-based carbon footprint. For example, in the case of Bristol, the city's consumption-based emissions are three times the production-based emissions, largely due to the impacts of imported food and drink. Reducing food waste by half would result in the same reductions as low-carbon investments of circa £3 billion production-based emissions by 25% in 2035 (Millward-Hopkins et al. 2017). Food waste can be reduced through urban food sharing mediated by ICT (Davies and Legg, 2018) to support transformation of urban food systems.

**Household consumer goods, packaging and waste:** The increasing acquisition of household consumer goods is closely related to the challenge of municipal waste. The circular economy requires a radical re-conceptualisation of waste as a resource that can provide incomes, improves local urban environments and reduces dependency on external inputs. Dealing effectively with the challenges of municipal solid waste and related emissions and

impacts upstream and downstream will require cities to reduce the acquisition of new products by citizens in order to reduce waste generation at the source as well as increasing recycling rates. The benefits of increasing municipal plastic recycling rates will help address indirect consumption-based emissions. An average net reduction of 1.45 tonnes of $CO_2$-e per tonne of recycled plastic arises from the substitution of virgin polymer production (Hopewell, Dvorak and Koisor, 2009). In developing country contexts where municipal waste is growing at fast rates, community-based waste management and recycling initiatives have proven successful in informal settlements where municipal government services are not available (Gower and Schroeder, 2018).

## 4. Conceptual research and engagement framework for transformations to SCP in cities

The previous sections have shown the complexities of the challenge for SCP in cities and pointed to promising directions and emerging developments. In response we have developed a framework to analyse, understand and transform unsustainable urbanisation towards sustainable consumption and production, which consists of a combination of different elements. They draw on theories of social learning and institutional change, contributing to a view of transformative change. occurring through non-linear interactions between dynamic technological and social systems and participatory co-production oriented methods. This paper builds on the idea that the perspective and approaches of SCP for cities permits and requires the active involvement of non-traditional stakeholders that are generally not included in urban planning processes, such as consumer organisations, retailers and supermarkets, sharing platforms for mobility and tools, community co-housing initiatives or (informal) recycling cooperatives. For instance, citizen-led groups and their initiatives have put their dissatisfaction with the slow pace of realising sustainability use their civic engagement to start more sustainable alternative like energy cooperatives and repair cafes (Pesch et al, 2018).

In order to investigate these propositions more systematically, this paper provides an analytical framework for how the transitions to sustainable SCP patterns, lifestyles and consumer behaviour in cities can be understood and advanced. It can be applied to answer questions about how urban transformations towards SCP systems and sustainable lifestyles be conceptualized and achieved through policies, citizens' initiatives, social enterprises and innovative business startups. The normative framework also offers an approach to answer how sustainable provisioning, greater equality and people's well-being in urban areas can be pursued simultaneously, while minimising the potential trade-offs between these desirable objectives. By paying attention to power dynamics and political economy, the framework can show how various self-reinforcing co-evolutionary dynamics often mean that some pathways

(e.g. promoting sustainable consumption and lifestyles changes) are 'crowded out' (Leach et al., 2010). In addition to these socio-political approaches, more traditional approaches like Material Flow Analysis could be fruitfully combined with transition analyses (Hodson et al 2012).

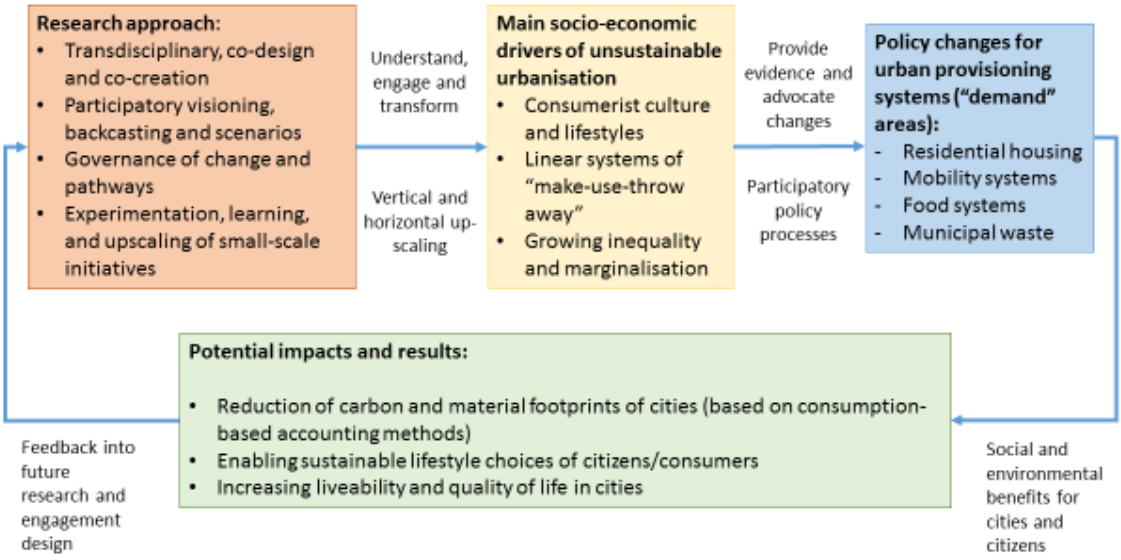


**Figure 2: Research and engagement framework for addressing consumption and production practices in cities**

### 4.1 Transdisciplinarity, co-design and co-creation

Transdisciplinarity has been identified as is a key component of sustainability science (Brandt et al., 2013; Lang et al., 2017) and science needs to engage with practitioners to achieve sustainable transitions. Transdisciplinary research is characterized by the involvement of non-academic actors in the research process, and it is an important feature of the Future Earth approach to global environmental change research (Mauser et al., 2013). This also holds true for our research framework on SCP in cities: to change unsustainable consumption and production patterns in cities, research needs to be not only interdisciplinary, but transdisciplinary (Polk, 2015) and actively involve stakeholders through co-design and knowledge co-creation processes (Davies and Andrew, 2017). The concept and approach of co-creation is also becoming relevant not only for researcher-practitioner collaboration, but also for transformative relationships between users and producers in the sharing economy. These new developments consist of social learning processes and have strong links with social innovations that support sustainability in cities. The evolving terms of

prosumer/prosumption are often used to describe the mesh of changing consumer-producer roles of value co-creation (Lan et al., 2017)

### 4.2 Scenarios, backcasting and participatory visioning

. Achieving SCP in urban settings requires profound systemic changes and transitions of current cities and SCP patterns in those cities, which are currently heavily locked-in into practices with high environmental impacts. Taking a long-term and systemic perspective on SCP in an urban context calls for adequate methods to develop long term perspectives. There is a range of scenario methods like visioning (Vergragt, 2013), backcasting (Quist, 2006), and transition management/governance (Loorbach, et al., 2017). Participatory approaches, and the involvement of stakeholders and citizens in visioning and scenario exercises, leads to processes of co-creation and co-production, facilitating learning and awareness raising among stakeholders and meeting rising calls for participatory openings of dominant decision making processes. Participatory backcasting (Vergragt and Quist, 2011) as well as transition management provide good methodological frameworks for such visioning exercises, which contribute to commitment and endorsement among stakeholders involved. Interestingly, both in participatory backcasting and transition management there is emerging interest in consumption, lifestyles, communities and the local level (Loorbach, et al., 2017; Quist and Leising, 2016).

One recent example is the EU-funded Glamurs project in which a backcasting methodology for sustainable lifestyles and a green economy was developed and applied in seven European countries. A distinction between a green growth context and a sufficiency or de-growth context was systematically used to develop visions of how sustainable consumption and sustainable lifestyles could look in the future (Quist and Leising, 2016). The distinction between green growth and degrowth is especially relevant for cities in the developed world, whereas for developing countries it needs to include equity and development while also paying attention to how local context may shape processes of participation. Other examples of citizen involvement in vision development and backcasting include sustainable urban planning (Carlsson-Kanyama et al., 2007), sustainable household consumption domains (Doyle and Davies 2013), and the use of transition management in urban districts (Wittmayer et al., 2014). Current good practices could be used as sources of inspiration for developing visions, and it is interesting to note that visions and scenarios can also give a better understanding of what the benefits, implications and conditions of upscaling good practices could be, which may have significant policy relevance.

### 4.3 Governance of change and pathways

Efforts to drive a transformation towards urban sustainability, especially in terms of lifestyles and low-carbon consumption behaviour, require more than development of appropriate infrastructures. It also necessitates innovation in governance and institutional change – namely a change of norms, rules (both formal and informal), laws, cognitive frames, policies and governance systems that shape actors' way of viewing and thinking about the world (Scott, 1995; Tukker et al, 2008; Mahoney and Kathleen, 2010 ; Reisch et al, 2016; Brown and Vergragt 2017). Institutions, and their processes of change, are shaped by a variety of different actors (Battilana, Leca and Boxenbaum, 2009) and the urban sustainability space gives rise to a number of new actors from civil society and community groups, businesses, academia, and governments at municipal and even national levels (Vergragt et al., 2016).

One key question is how these different actors, many of whom have very specific areas of interest or goals (i.e. gender equality, housing, sustainable transportation, biodiversity conservation) as well as different worldviews and narratives can collaborate to collectively drive institutional change processes (Greenwood et al., 2008; Smets et al 2012). This is a fundamental issue not only from a theoretical perspective but also because improvements in one domain may compete with those in other domains. For example, improvements in infrastructure and services, while fostering well-being and better provisioning, often lead to gentrification and growing inequality. These, in turn, bring about higher greenhouse gas emissions owing to the strong link between income and carbon footprint (Wiedenhofer et al. 2017; Hubacek et al., 2017). In another example, increasing density may reduce energy consumption but may negatively affect well-being. Therefore, narratives, local knowledge, and system thinking are as important as technical data (Bai et al., 2018) and must be assimilated to contribute to sustainable urban governance processes.

Furthermore, actors are embedded in multi-level systems, which can create both challenges and opportunities for institutional change. Many actors emerging at the city level are challenging the dominant incumbents, especially those who are more nationally or internationally connected. For example, there are cases of conflicts between city and national governments in terms of policies that would improve local sustainable consumption on the one hand, versus national priorities on the other.

Similarly, many city level activities involve local, often small-scale firms that challenge the practices of incumbent multinational corporations (MNCs). Examples include small firms engaged with local production, local farmers markets or food box schemes, from which multinational corporations are often absent and which can challenge dominant trends towards integrated, globally connected and standardized supply chains. There are also issues that arise between local civil society actors such as NGOs and neighbourhood groups, and NGOs that operate at the international, incumbent level.

Looking at these conflicts more closely we often find competing normative goals framed by different institutional logics and narratives. The complexity of institutional change is further amplified by the differences across geographical contexts. Specific actors and their embeddedness into different structures of power and competing institutional logics are all crucially shaped by local contexts. As such we need to understand institutional dynamics not only on an overall global but also on specific contextual levels.

### 4.4 Experimentation, learning, and upscaling small-scale initiatives

The urban environment provides many opportunities to undertake small-scale initiatives that experiment with more social organization and sustainable lifestyles. However, from the broader perspective of social change such small-scale initiatives are viewed as having a rather limited power because they are very hard to replicate in new contexts or to scale-up without losing innovative radical edge. A more optimistic perspective views small-scale initiative as incubators of innovations which will become engines of change when a 'window of opportunity' opens up. The opportunity may come in various forms, for example a large-scale political movement, major technological breakthroughs, environmental and population pressures, and others.

Sociologist Eric Olin Wright reflects this view of small scale initiatives from the perspectives of political power and socio-economic processes (Wright, 2010). Wright sees great value in novel modes of social organization in the fractures of the dominant system, in niches where they do not seem to pose any immediate threat to dominant classes and institutions. While leaders of these small-scale activities do not usually regard their interventions as being focused on undermining the larger system they deliberately work to build new organizational forms and social relations. Such "interstitial" processes have, according to Wright, historically played a central role in large scale social change, including the capitalist forms of economic activity developing within the feudal society.

Wright's theory of social change through small scale interstitial processes is in several respects closely related to the so-called multi-level perspective (MLP) on sociotechnical transitions (Geels and Schot, 2007). In that framework, small scale initiatives with new technologies and socio-technical systems incubate for long periods of time (years and decades) in niches; and when the opportunity presents itself through changes in the landscape *and* through growing tensions in the incumbent dominant socio-technical system the niche technology and system diffuses upward and eventually replaces – in an appropriately adapted form – the incumbent dominant system. The literature offers many retrospective case studies of such niche-to-regime transitions as well as principles on the factors conducive to such transitions (Geels, 2002). The MLP complements the Wright's formulation by stressing the importance of technology in producing social change and by pointing out how technical know-

how, culture and institutions co-evolve. On the other hand, it essentially implies that small scale initiatives must compete with each other in their effort to grow when a window of opportunity opens up, and disregards the potential synergistic relationships among niches and their actors. The interstitial and MLP frameworks are less helpful in explaining change in dominant culture – for example, a shift toward less consumerist lifestyles – than they are with regard to political, institutional and technological breakthroughs.

Small scale experiments can be assessed from a perspective of higher order learning helps to address these shortcomings (Brown and Vergragt 2008; Vergragt and Brown, 2017). Higher order learning among participants, and its diffusion beyond the boundaries of individual initiatives, may indeed be the essence of replication and upscaling and the critical vehicle for affecting wider social change. Higher order learning is a radical change in interpreting observations (interpretive frames) and in solving problems and advancing sustainability objectives. It carries strong resonance with institutionalists focus on underlying institutional logics. It entails changes in the assumptions, norms and interpretive frames which govern the decision-making process and actions of individuals, communities and organizations, or which underlie a policy discourse. Higher order learning (also known as double loop/generative/conceptual learning) contrasts with lower order (single loop/adaptive/ technical learning), in which problems are corrected or policies and procedures altered without changes in problem definition, interpretive frames or in norms and values.

We contend that when the individuals, collectives and institutions participating in a small scale initiative re-frame their problem definitions and interpretive frames they (or others in their network who come in contact with these ideas) are then enabled to initiate further initiatives in very different contexts, for which adaptation will mostly require the much easier technical learning. This kind of diffusion of interpretive frames and problem definitions is also more likely to diffuse vertically onto a larger scale. Finally, the small scale initiatives may find support from and commonality with other possibly very different small scale initiatives with, however, similar interpretive frames and/or problem definitions. It is through these mechanisms that small scale initiatives are most likely to contribute to replication and upscaling that are necessary for social change.

## 5. Case studies on SCP in cities

The framework developed in the previous section can be used for action research and co-designing solutions, and also for monitoring and evaluating existing cases and initiatives. We have selected three qualitative cases that show a transdisciplinary approach, a vision or visioning, governance of change, and replication, upscaling, and monitoring and that were available within the KAN's working group on SCP in cities. Several co-authors of the paper are actively involved as practitioners and researchers in the case studies and draw on the

learning outcomes, field research findings and experiences of the work. Transdisciplianry methods applied include participatory inquiry, multi-stakeholder workshops and interviews.

Because of the broad scope of this paper, the case studies cannot claim to be representative; we choose to present a diversity of cases in order to illustrate the applicability of our conceptual framework for a variety of provisioning systems. The cases include sharing networks with a focus on car sharing, localised food production, and municipal waste recycling. The case studies illustrate the factors relevant in the transformation process to new consumption and production patterns. This paper is not the place to do in-depth assessments that quantify the sustainability gains achieved in the case studies. Based on short reviews we do, however, make plausible that the cases reflect a transformation to consumption and production patterns that are more sustainable.

### 5.1 Shareable.net - San Francisco, Seoul and other cities worldwide

Shareable (www.shareable.net ) is a non-profit founded in 2009 to bring sharing forward as a strategic solution capable of addressing environmental and economic challenges simultaneously. Shareable pursues its mission to empower people to share through research, publishing, and activism. More recently, Shareable has turned its attention to cities where over half the human population lives on just 2% of our planet's land. Despite this small geographic footprint, cities account for more than 70% of global CO2 emissions and two thirds of energy consumption (C40 Cities, 2018). At the time of writing, on Shareable 73 cities are listed as Sharing Cities. Cities are the perfect breeding ground for sharing due to the close proximity of users and high population density. Public spaces and shared infrastructure are common in cities and offer a promising platform for even more sharing. Add on top of this, sophisticated new digital technologies and city's sharing potential could be greatly amplified.

Car sharing perfectly illustrates the potential of sharing for positive environmental and economic impacts. According to a UC Berkeley study of car sharing membership in North America, one shared car replaces up to 13 owned cars and 46% of people who join did not have access to a car beforehand (Shaheen, Hotte and Stocker, 2018). This obviously represents a significant reduction of physical materials use. Furthermore, it has been widely illustrated that individuals participating in car sharing schemes reduce their transport related carbon emissions significantly (e.g. Martin and Shaheen, 2011; Nijland and van Meerkerk, 2017). In addition, it's estimated that for every car a city takes off the road through policy and other measures, it can keep an estimated $7,000 a year in the local economy - a reduction of 140,000 cars equates to a $1 billion a year annuity (City Clock Magazine, 2014). There are few innovations that can so dramatically reduce consumption, increase access to resources,

and boost the local economy simultaneously. The main factor that could reduce all these positive sustainability impacts is the rebound effect. People using car sharing schemes tend to have less costs for road transport. If they spent the money saved on high-impact expenditure categories, no overall environmental gains may occur (e.g. Ornetzeder et al., 2008).

Through various communications channels, Shareable invites the public to imagine a whole economy based on sharing. This is mostly done through reporting on real-world case studies. To begin pursuing this opportunity for impact, Shareable hosted a conference called Share San Francisco in the city on May 7, 2011. This event brought together 130 leaders from city government departments, social enterprises and non-profits to explore the possibilities of sharing through one key question, “How can we amplify the city of San Francisco as a platform for sharing?” Shareable hoped to catalyze positive social change from a set of opportunities coalescing around cities through sharing of goods and services. What has transpired since this initial event has gone well beyond expectations of the initiators. It all started with a conversation around a few observations that have world-changing potential, if managed together for the common good. Through the conference and stakeholder engagement, a case was made that sharing and cities offered a unique, world-saving opportunity. This message became cornerstone of the global sharing cities movement that started to unfold shortly after Share San Francisco where city officials showed immediate interest.

In South Korea a similar initiative was started half a year later, by Mayor Park Won-soon of Seoul, who launched Sharing City Seoul, which was at least partly inspired by San Francisco’s SEWG. It started with a substantial package of municipal policies and programmes with the goal to mainstream sharing in Seoul. The motivation was not only to address environmental issues like air pollution, but to address Seoul’s pressing social problems including unemployment and social isolation. It had government funding, a multiyear implementation strategy, numerous citizen-stakeholders, and the city’s 60-person innovation department behind it. For these reasons, Sharing City Seoul became the single biggest catalyst of the global sharing cities movement and earned Mayor Park the prestigious Gothenburg Award for Sustainable Development in 2016. It has inspired dozens of cities around the world to start similar sharing programmes.

In Europe, the London-based SharingCities.eu consortium has started working with a number of major cities including London itself, but also Milan, Lisbon, Warsaw, Burgas, Bordeaux, and other sharing cities projects. The Netherlands-based ShareNL has long worked with the city of Amsterdam, the first official European sharing city. ShareNL is now reaching out to many more cities in Europe and beyond through a newly formed Sharing City Alliance which aims to build transformative alliances across cities boundaries. The P2P Foundation has recently completed an urban commons transition strategy for the city of Ghent. In 2017, the Paris-

based non-governmental organization OuiShare co-hosted a new initiative called “Sharing Lille” to foster more sharing in Lille, France. OuiShare organised a multifaceted festival attended by over 1,000 people to initiate this social sharing movement. The 2017 theme of the organization’s flagship Paris event – OuiShare Fest – was cities.

In addition, Shareable’s far-flung members are working with numerous city authorities on sharing projects through its network in Europe and South America. In Asia, the Sharing Economy Association of Japan (SEAJ) is currently developing sharing cities programs with 26 rural municipalities in Japan. Last year, five Japanese cities – Chiba, Yuzawa, Taku, Hamamatsu, and Shimabara – unveiled plans, developed with SEAJ, to foster more sharing. And, of course, the movement has taken off in South Korea. On Nov. 6, 2016, at Seoul Sharing Festival, seven additional Korean cities – Seoul, Jeonju, Suwon, Seongnam, Siheung, Gwangju, and Don-gu – signed a joint declaration announcing their plans to develop their sharing cities programs together.

Along the way, Shareable supported this movement through continual coverage of the sharing cities movement on the Shareable.net news site, specialty publications, advisory, and Shareable’s activist network. Shareable published “Sharing Cities: Activating the Urban Commons,” a 275 page guidebook of sharing case studies and model policies from around the world (Sharable, 2017). The Internet and social media played an integral role in spreading the idea of sharing cities, supporting research efforts, connecting participants, and catalyzing action. While many cities have started sharing cities programs, it is a new movement. Statistics around impact are still scant except in specific sectors with a long history such as carsharing. One trend Shareable has witnessed in these and other similar efforts is increased focus on the neighbourhood or street-level scale as a target for interventions. This is the first scale outside of the home where people meet non-family members and thus is a strategic starting place for sharing, sustainable lifestyles, and civic participation programs. Despite the successes, there are still challenges and obstacles to overcome. First, creating awareness remains one of the main obstacles in becoming a sharing city. Secondly, challenges for the sharing economy are laws and regulations that do not apply seamlessly to new organisational models, such as the peer-to-peer marketplaces (shareNL, 2015).

### 5.2 Sustainable food systems in Kyoto, Japan (FEAST project)

Shifting consumption patterns and increasing globalization of food markets have left Japan in a state of food insecurity, while farming households are rapidly decreasing (Hisano et al. 2018) and the ecological footprint of food is growing. Facing a predicted population decline by over

ten percent (National Institute of Population and Social Security Research, 2013), Kyoto residents prefer increasing urban agriculture and recreational space as a strategy for their shrinking city over growth at all costs (Rupprecht, 2017). This depopulation trend could be harnessed to relocalize the city's food system, but land use planning favours conversion of farmland to new housing developments over renovating the large stock of old, empty houses (Oda et al., 2018).

Against this background, a diverse group of civil society actors and members of the academic community are currently in the process of co-designing and co-producing Kyoto's future food system in a more sustainable way to achieve the goals of food security (stable access to food) and food sovereignty (the right to healthy and culturally appropriate food, and to define one's own food and agriculture systems). Members in the Kyoto food system have experimented with a wide variety of innovative methods to facilitate institutional change towards a better food future, including conceptual tools, building new (governance) mechanisms, and a crowd-sourced public debate about "good food". Conceptual tools developed in collaboration with futures-research experts from Utrecht University included group workshops as well as "serious games" with participants from local stakeholder groups (Mangnus, 2017) (e.g., farmers, mothers with children, students, food company employees, local government officers, NGO volunteers, restaurant chefs). In the group workshops, participants envisioned ideal local food futures together with the necessary social context, while in follow-up workshops backcasting was used to identify pathways towards implementing changes and realizing the envisioned futures. Serious games involved roleplaying to simulate how policy innovations such as a Kyoto Food Policy Council would function in bringing diverse stakeholders together to craft strategies and policies. These games followed a series of talks and meetings between various civil society actors and members of the academic community that introduced the concept of food policy councils (FPCs), showcasing how such governance mechanisms had helped cities such as Toronto to address food-related issues. In the context of Kyoto, one main aim for the FPC is to overcome the vertical hierarchies within the local government that have led to food issues remaining unaddressed, as they often do not fall clearly within the mandate of local government departments and as such are difficult to justify as budget expenditure. Additional efforts saw the establishment of a community-organized farmers' market to foster stronger ties between producers and consumers.

For Japanese consumers trust in food quality is often achieved through direct relationship building, for example, through a photo of the producer on the package (McGreevy and Akitsu 2016), which stands in contrast to large food retailers aiming to increase efficiency and profit through the streamlining of global, long-distance supply chains. Meanwhile, rising prices for vegetables despite stagnant wages (Reuters, 2018) are reinforcing a split in consumer

behaviour. A small group of affluent and safety-sensitive young parents drive the demand for organic produce, which is often purchased online or via subscriptions. Other alternative food initiatives, such as community supported agriculture or urban gardening, seems to be hindered by issues of time poverty. In a country famous for long working hours, many participants saw the lack of time to engage with social movements and to co-design a future food system as a crucial issue to be solved. Also, most consumers remain focused on price, relying mainly on supermarkets to supply cheap produce.

Kyoto City is home to the Research Institute for Humanity and Nature, a government institution that has dedicated itself to support transdisciplinary research. This mission has provided space for a five-year action research project called FEAST ("Lifeworlds of Sustainable Food Consumption and Production: Agrifood Systems in Transition", FEAST Project, 2018a), which targets a grassroots transformation of the food system to tackle related environmental and social problems in several study sites including Kyoto City. One lesson learned from small-scale community initiatives that grew into institutionalized Food Policy Councils was that change takes time. FEAST has therefore two target time frames for the change it seeks to build, the five years of the project for co-producing institutional change and kicking off the transformation, and an additional 30-year frame that allows to plan and achieve long-term social impact without the constraints of project evaluation, membership fluctuation and short-term political cycles.

The second lesson learned, in particular from the Transition Town movement (Transition Network 2018), is the importance of forging alliances and networks beyond the local context. Kyoto City's movement to transform its food system is connected nationally with similar initiatives in the neighbouring small town of Kameoka as well as with the regional cities Nagano and Noshiro, all of which face similar challenges. Joint learning workshops involving stakeholders from each of the sites are planned in the future to share insights and extend collaborations to new sites. Internationally, the movement draws on academic networks and collaborates with researchers at Wageningen University, UC Berkeley, Mahidol University, and the Global Footprint Network, in addition to loose links with the farmer's movement La Via Campesina (2018).

Communication has been central for bringing together stakeholders in the Kyoto food system. The FEAST project maintains a variety of social media outlets (homepage including blog (FEAST Project, 2018b), Facebook, Twitter), while for other community organizations such as the Kyoto Farmer's Market Facebook page is crucial to achieve visibility and grow a network of supporters. Recent experimental outreach activities include an initiative to collectively reflect on what "good food" means for Kyoto residents. This debate was launched via public

transport advertising that encouraged passengers to contribute via a shared hashtag on Twitter (2018), from where participants can then learn more about ongoing food system activities and become involved if interested. This initiative aims to broaden the membership of the movement beyond the social networks of current members and foster public debate.

The Kyoto food system transformation as well as associated projects and movements are ongoing, and a full evaluation of sustainability impacts has yet to be conducted. The FEAST project is entering its third year and the Farmers' Market has celebrated its first anniversary in November 2017. This anniversary was marked with a special event at the Research Institute of Humanity and Nature, attracting 300 to 400 visitors (FEAST Project, 2017). A completed survey of farmland in urban Kyoto crucial to relocalizing the food system (Oda et al., 2018), an ecological assessment of Kyoto's food footprint, and the translation of several key texts into Japanese, e.g. Milan Urban Food Policy Pact, to which Kyoto is signatory (Tachikawa and Ota, 2017) are now available as tools for the community to plan and educate with as well as placing them on the agenda of the local government and policy makers. Next steps include the formal establishment of the Food Policy Council, an essential step towards urban food policies currently lacking – policies co-produced by producers and consumers to transform the Kyoto food system and make it socially and environmentally sustainable in an age of economic and demographic decline.

### 5.3 Co-operative waste recycling and 3D printing in Pune, India

India generates nearly 62 million tons of municipal solid waste (MSW) annually, mainly in cities, creating huge problems for the natural and urban environment. The main reasons for waste crisis in Indian cities are unaware consumers in general and poor institutional initiatives (Ghosh, 2016), waste is therefore inextricably linked to the situation of changes in consumption and production patterns. To address the issue of MSW, India launched the Swachh Bharat 'Clean India' Mission in October 2014, the country's biggest-ever cleanliness drive. One of the stated objectives of the mission is to ensure door-to-door garbage collection and proper disposal of MSW. Swachh Bharat citizen communities were formed subsequently to generate awareness and citizen participation across more than 100 cities of India. The informal sector plays a very important role in Indian cities. It is characterised by small-scale, labour-intensive, largely unregulated and unregistered low-technology manufacturing or provision of materials and services (Wilson, Velis and Cheeseman, 2006), such as waste collection and recycling. The waste pickers essentially make a living by sorting and selecting waste items and pursuing their re-use, component re-use, repair or recycling – which rank higher in the waste hierarchy as incineration and landfill. While the waste hierarchy in some

cases can be disputed, in general waste options higher in the waste hierarchy have environmental benefits over those lower in this hierarchy (e.g. Defra, 2011).

In Pune city, a city of 3 million near Mumbai, the SWaCH Cooperative (Solid Waste Collection and Handling) is a waste management co-operative, providing door-to-door collection service to Pune's various property types including hotels, households, malls, and makes sure their services are regular and reliable, which arguably are inspiration for other initiatives of Swachh Bharat. Established over 10 years ago with the waste picker union KKPKP through advocacy for basic rights for the workers, it now organises more than 10,000 waste pickers in Pune (Linder, 2018). In 2016, over 50,000 tonnes of material was collected in the door-to-door collection system in Pune, one of the highest figures in India. Waste pickers in Pune also collect organic waste for composting and biogas generation (Kumar et al., 2017).

Replication of the Pune model in other cities and countries can be linked to the First Global Strategic Workshop of Waste Pickers which took place in Pune in 2012. This workshop was hosted by SWaCH and KKPKP, the trade union of waste pickers in Pune, on behalf of the Global Alliance of Waste Pickers and with the support of WIEGO/Inclusive Cities and RedLacre. Waste picker representatives from 22 countries participated and identified priorities, challenges and best practices for replication for the waste picker sector. Privatization of access to waste and the related move of final waste disposal systems toward incineration and waste-to-energy schemes are some of the biggest common threat to waste pickers' livelihoods (Global Alliance of Waste Pickers, 2012).

Rising community standards and citizens' lifestyle expectations regarding the management and need for clean urban environments have also played an important role. The impact of these new (informal) standards regarding the removal of household waste have served as a catalyst for marginalized female waste pickers from the Dalit caste, who responded to the changing 'rules of the game' through self-organizing and processes of professionalization (Kilby, 2013)

The role of higher order learning from Pune's examples and institutional changes regarding Pune's waste management can be linked to the trustful relationship SWaCH developed over the years with the Pune Municipality. It lead to a contractual agreement in which the Municipality pays SWaCH an administrative fee to coordinate waste collection throughout the city, and households are enabled to join the door-to-door collection scheme for a set fee (Linder, 2018). Also, Pune was among the first municipalities in the country to authorize waste pickers to collect recyclables by endorsing their photo-identity cards, giving waste pickers official status, respectability and a sense of identity. In recognition of their work, the Ministry

of Urban Development and the Ministry of Water and Sanitation honoured SWaCH with an official award in 2016 (World Environment Day, 2018)

Important socio-technical innovations are linked to the waste picker co-operative through co-creation. Protoprint is a Pune based “social enterprise”, founded by an alumnus of MIT (USA) working in cooperation with the SWaCH cooperative, which has developed a method to take waste plastic from the waste that is picked by the waste pickers in Pune and convert that into the raw material that is needed by 3D printers (Kabra, 2014). The initiative is linked internationally to the Ethical Filament Foundation, launched by the UK charity techfortrade in 2013, to check recycled filament is up to scratch and to ensure wastepickers are not exploited. The foundation works with Dutch 3D printer-maker Ultimaker and US design software house Autodesk to ensure standards are met (Marks, 2014). This example demonstrates how through re-conceptualising waste as resource, social inclusion and technological innovation can mutually reinforce each other, leading to positive outcomes for more sustainable urban provisioning systems.

### 5.4 Case study comparison

The three case studies from different parts of the world illustrate how this framework can be brought into practice. The first example is the stimulation of city-level sharing economies, which started in San Francisco but is now replicated in many other cities globally. The second example is the bottom-up development of sustainable food production and consumption in Kyoto. The third example is waste management cooperative in Pune, India, that provides collection services employing waste pickers that previously were part of the informal economy, and now upgrades this waste via 3D printing. The characteristics of the cases, describing how they use various elements of our conceptual framework, are summarized in Table 1.

**Table 1: Case study overview and comparison**

| | **San Francisco - Shareable.net** | **Kyoto - FEAST** | **Pune SWaCH cooperative** |
|---|---|---|---|
| Competing normativities and narratives | Status of car ownership vs convenience and cost savings through car sharing | Industrial food system vs local grassroots transformation of the food system | Municipal waste as problem vs waste recycling as livelihoods of women and marginalised groups |

| | | | |
|---|---|---|---|
| Main actors and drivers | Sharable and progressive municipal governments and mayors, together with non-profits and foundations established transnational alliances. | FEAST Project, Taskforce to establish Kyoto Food Policy Council, Peace Flag Project, Kyoto Organic Action, Tsukaisute Jidai wo Kangaeru Kai | Informal waste pickers, SWaCH Cooperative, waste picker union KKPKP; Global Alliance of Waste Pickers |
| Transdisciplinarity, co-design and co-creation | Cooperation with and support from urban policy think tanks like SPUR and non-profits like P2P Foundation and Sharing Economy Association of Japan (SEAJ) | Food Policy Council co-created through RIHN and several civil society organisations, co-organized farmer's market | Pune-based social enterprise Protoprint co-created through MIT researchers in cooperation with the SWaCH cooperative |
| Scenarios, backcasting and visioning elements | Catalyzing change by bringing together 130 leaders from city government, nonprofits, and social enterprises in San Francisco in 2011 | Visioning & backcasting workshops for ideal food future, Food Policy Council simulator role-play game workshops | First Global Strategic Workshop of Waste Pickers in Pune in 2012 with international and local participation |
| Governance of change and institutional innovation | Inspired dozens of cities to start similar programs, in Europe, the London-based SharingCities.eu | Ongoing efforts to establish civic food networks (ex. Kyoto Food Policy Council) | Introduction of fee based for door-to-door collection scheme; step to formalisation |

| | | | |
|---|---|---|---|
| | and Netherlands-based ShareNL, reaching out to many more cities in Europe and beyond through newly formed Sharing City Alliance. | | through photo ID for waste pickers |
| Higher order learning from small scale initiatives | San Francisco's Mayor Ed Lee organized a new city government task force called the Sharing Economy Working Group (SEWG), tasked with formulating sharing-related regulations. Mayor Park Won-soon of Seoul, South Korea, launched Sharing City Seoul. | Initiatives take pace of change into account (30-year time frame), networking with other local food initiatives within Kyoto (including old and new NGOs) and beyond (Nagano, Noshiro, Kameoka), | Contractual agreement with municipality paying administrative fee to waste pickers to coordinate waste collection; replication of Pune model to other Indian cities |
| Communication and social media strategies | Creation of movement through continual coverage of the sharing cities movement on the Shareable.net news site, specialty publications, and Shareable's online activist network. | Social media presence (Facebook, Twitter, blog), participatory public transport social media campaign, research reports for public consumption | Strong media engagement and official awards for public awareness raising |

## 6. Discussion and Conclusions

Cities now host most of the global population and consumption in cities drives most of the carbon, water, land and material footprint of humanity. This makes cities a paramount focus for implementing sustainable consumption and production patterns. In this paper we have argued that a transdisciplinary research and engagement framework is required to understand and advance the transition to sustainable SCP patterns and lifestyles in cities to address production-based and consumption-based emissions and impacts. The transdisciplinary approach to SCP transformations in cities combines co-creation, participatory visioning processes and back-casting methods, participatory urban governance and institutional change, and higher-order learning from small-scale community initiatives that enables active involvement of stakeholders in change processes. Engagement of policymakers needs to occur throughout research projects based on science-policy interfaces.

We see that in all cases transdisciplinarity, co-design and co-creation, next to participation and visioning, higher order learning from small scale initiatives, followed by institutional changes and governance innovation plays a crucial role. We therefore recommend to apply this framework to address complex challenges such as high environmental footprints stemming from embodied carbon in goods and services, which is mostly not addressed through purely technological efficiency improvements and infrastructure solutions. An obvious limitation of our work is that we only addressed three case studies in this paper[2], and that the cases have a too short history to see if the novel practices reflected by the cases can replace the current dominant regimes and make the switch from being niches to becoming mainstream. Another limitation is that we did not aim to embark an in-depth quantitative assessment of the sustainability performance of the cases, although a limited analyses of earlier assessments makes it plausible the cases have environmental benefits.

A major recurrent issue in sustainability research is the rebound effect (Herring et al, 2008), mentioned in passing in some sections of the paper. Rebound effects occur most prominently when environmental efficiency gains have been achieved together with cost savings, and these savings then are reinvested in activities which may be more environmental damaging. Efficiency measures thus needs to be complemented with sufficiency approaches (Princen, 2005). This framework and the case studies demonstrate how low-carbon urban initiatives in cities can contribute to opening up the social and political space for alternative SCP pathways that address cities production-based emissions and impacts within cities as well as

[2] More case studies can be found in the Special Journal Volume "Transitions to Sustainable Consumption and Production in Cities", summarized in Vergragt et al, 2016

consumption-based emissions with impacts upstream and downstream in the value chains of goods and services.

Key findings and lessons learned from the case studies show that bottom-up initiatives, supported and facilitated through co-creation processes, can achieve institutional changes towards SCP patterns in the areas of food, mobility, housing, and consumer products and waste. Our recommendations resulting from the framework and the case studies for sustainable cities include the need for additional efforts by cities to facilitate multi-stakeholder processes, provide institutional space to let bottom-up initiatives emerge and allow higher learning processes to take place for replication and scaling-up.

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