

The background image is a photograph of a modern urban park. In the foreground, a paved walkway runs alongside a small, man-made stream. The stream is decorated with numerous colorful, translucent lanterns in shades of green, yellow, orange, and red. Lush green plants and trees line the walkway. In the background, a dense city skyline with various high-rise buildings is visible under a clear sky. The magazine title 'igusQUARTERLY' is overlaid at the top, with 'igus' in blue and 'QUARTERLY' in grey. Below the title, the subtitle 'INNOVATIVE GOVERNANCE OF LARGE URBAN SYSTEMS' and the issue information 'Vol 3 | Issue 1 | July 2017' are printed in a smaller, dark font.

igusQUARTERLY

INNOVATIVE GOVERNANCE OF LARGE URBAN SYSTEMS

Vol 3 | Issue 1 | July 2017

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A multi-disciplinary concept

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The IGLUS platform promotes innovative governance practices that can contribute to improve the efficiency, resilience and sustainability in cities. The definition and quantification of each of these performance dimensions presents an important challenge, but it seems that in recent years, sustainable policy, sustainable development and plain-old sustainability have become especially important buzzwords in the urban context. The Brundtland Commission's original definition of sustainable development as "development that meets the needs of today without compromising the ability of future generations to meet their own needs" remains the most commonly cited definition. But in reality, the concept has been expanded far beyond this basic definition, and today, in the urban context it is essential that sustainable governance address not only the traditional environmental notion of the concept, but development programs must equally consider its economic and social dimensions.

In this edition of IGLUS Quarterly we pay homage to this expanding definition of sustainability and present you with five articles that broadly touch on the topic from five different perspectives.

In the first article, Jerry Kolo defines the concept of the Large Urban System and all of its associated challenges. By introducing urban governance practices employed in the Abu Dhabi-Dubai-Sharjah region, he outlines three important lessons that can be taken from the case to facilitate sustainable regional governance in other evolving regions. In the second article, author Hillary Brown explains how the city of Lille, in France, was able to implement an integrative approach to infrastructure governance and effectively create a virtuous cycle that promoted both the economic and environmental sustainability of the city's waste, transport and energy systems. Thirdly, Sandra Wapplehorst and colleagues from the Innovation Centre for Mobility and Societal Change in Berlin explain what the future of urban mobility will

look like as we transition out of the fossil fuel era and into one that is centered around human-powered transport, electric vehicles, intermodality and technological innovation. Next in Detroit, Dean Hay recounts the evolution of the relationships between the city residents and the urban forest over the last century, and emphasizes that sustainable policy can not exist without the support and engagement of the citizens. In the final contribution, David Kasdan touches on an entirely different dimension of sustainability; one that pertains to the ultimate sustainability of the Smart City. By outlining the evolution from Ubiquitous ICTs to dataveillance and the associated privacy concerns, he describes the policy requirements and governance approaches that will be essential for ensuring citizen safety and privacy in this age of the Smart City.

Each of these articles present but a glimpse of sustainable governance practices. Ultimately, the concept is very complex and nuanced, but a city's abilities to plan and develop in a sustainable manner are inherently linked with the future performance, which in turn relies on the city's ability to adopt holistic, well-rounded and integrated approaches to policy development, planning, utilization of technological innovation and citizen engagement.

We invite you to share your experience and join in on the discussion at www.iglus.org, and if feel you that there are innovative practices underway in your city-region and you would like to contribute to an upcoming edition of IGLUS Quarterly, we encourage you to contact us at iglus@epfl.ch.

Mohamad Razaghi and Rebecca Himsl

Lessons from Cities in the United Arab Emirates for the Development of Large Urban Systems

Jerry Kolo*

Abstract: Large urban systems are infrastructure systems that are needed to make cities sustainable. Around the world, cities are rapidly morphing into regions, and these regions must collaborate and develop cost-effective infrastructure systems. A review of the collaborative regional approach to infrastructure development in the Emirates' Abu Dhabi-Dubai-Sharjah region offers practical lessons for other emerging regions.

Introduction

In the context of the scholarly discourse around “large urban systems” (LUS), this paper describes how three of the largest cities in the United Arab Emirates (UAE), namely, Abu Dhabi, Dubai and Sharjah, address their infrastructure needs and obligations in the geographic metropolitan region which they constitute and anchor. Since the formation of the UAE federation in 1973, the Abu Dhabi-Dubai-Sharjah metropolitan region (ADS) has risen to become one of the most developed economic, technological, industrial and tourism regions in the world. This paper discusses specific lessons that other cities and regions can learn from the experiences of LUS development in this region.

Challenges of LUS Development in Cities, Megacities and Regions

The term LUS was coined and originated at Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland in the early 21st Century. LUS is the thrust behind EPFL's Innovative Governance of Large Urban Systems (IGLUS), which is a robust educational and scholarly research program focused on innovative ideas for the “management and the governance of the urban infrastructure systems, so as to make our increasingly global cities more efficient, more sustainable, more resilient and ultimately better prepared for their futures,” (IGLUS 2016). Essentially, LUS focuses on an aspect, precisely infrastructure or capital facilities systems, of an urban phenomenon known generally as ‘region.’

A region evolves when two or more independent geographic entities, cities or a city and its hinterlands, fuse into either, (1) a functionally larger and more convenient activity region; (2) a territorially larger or bigger corporate/legal entity; or, (3) a combination of one and two. As cities have grown in population, so have they grown in geographic size, amongst other impacts of population growth. The spatial expansion has resulted in, among other things, the morphing or flocculation of adjoining cities and/or hinterlands into larger spatial territories known as regions. First used by pioneering geographer Patrick Geddes, various alternative terms or neologisms have been coined for the term ‘region’ by urban scholars. For example, French Geographer Jean Gottman, in 1961, used the term megalopolis to describe an unbroken chain of cities stretching from Boston to Washington on the North East Coast of the US, and called it BosWash corridor. Hall (2002) and Sassen (2002) respectively used the terms global city and global city-regions for what this paper terms typologies of regions around the world. In its latest World Cities Report 2016, for example, the UN-Habitat (2016) used the term megacities to denote cities with more than 10 million people, and noted that the number of the world's megacities has more than doubled over the past two decades, rising from 14 in 1995 to 29 in 2016. Other terms that are in use in the urban literature include metropolises, conurbations, megaplexes and gigalopolises.

Since the inception of the study of regions, a broad area of multidisciplinary scholarship has evolved known as

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‘regionalism’ (Gillham, 2009). Scholars from different disciplines focus on different aspects of the region, with specialization in every aspect, from politics, power and governance, through economics, growth and development planning, to infrastructure, technology, the environment and cultures. Specialized as these areas of urban research are, they all study phenomena that are inextricably interwoven, implying pragmatically that, for regions to function effectively, efficiently and sustainably, urban scholars, practitioners and policy makers would do better adopting what this paper calls systems thinking and integrated strategies.

The evolution of a region, by design or by default, is a practical indication of noticeable growth, development and prosperity in the region. A natural consequence of this is more influx of people into the region, and specifically into cities in the region, in search of opportunities. The influx of people into cities all over the world remains unabated primarily because cities are considered, rather paradoxically, to be, on one hand, oases of opportunities, where people can and do realize their dreams for self-accomplishment, and, on the other hand, cesspools of despair, where failed dreams for a better life can and do lead to despair, misery and hopelessness. As Macionis and Parrillo (2004) aptly stated, “cities offer the promise—but not always the reality—of a better life,” stating also that “cities reveal the best and the worst about the human condition.”

One of the fundamental effects of the growth and expansion of territories and populations in a region is the burden placed on all resources, especially natural and physical resources, and mainly infrastructure and services, in the region. There are numerous complex and intertwined dimensions to the governance and management of cities in regions, city-regions or regional cities. Generally, regions and cities face numerous governance challenges, including addressing their infrastructure needs cost-effectively. Examples of regional governance challenges are shown in Table 1, disaggregated according to the five main goal clusters of any society. In spite of these challenges, cities have legal and political obligations to serve their citizens’ infrastructure needs, as infrastructure is a critical factor for economic growth, development and quality of life.

Societal Goal Clusters	Regional Challenges
Political	<ul style="list-style-type: none"> • Statutory limitations and constraints • Differences in governance and political philosophies • Differences in administrative and management styles and capacities • Differences in philosophies, stages and paces of development • Differences in foreign relations and alignments • Illegal immigration • Inadequate and inequitable health, educational and community facilities and services
Economic	<ul style="list-style-type: none"> • Labor mobility • Unemployment • Underground economy • Labor force abuses
Natural Environment	<ul style="list-style-type: none"> • Environmental pollution, mainly air, noise and light • Illegal waste dumping • Biodiversity destruction • Land degradation • Deforestation
Built Environment	<ul style="list-style-type: none"> • Traffic congestion • Affordable housing shortage • Infrastructure capacity overload and deficiencies • Urban sprawl • Spatial imbalance of development
Psychosocial	<ul style="list-style-type: none"> • Differences in culture, tradition, history • Illiteracy • Crime and delinquency • Social inequities and injustices

Table 1: Regional Challenges for Governance and Development

LUS Development in the United Arab Emirates

Worldwide, governments at all levels are always seeking innovative ways to provide LUS or infrastructure cost-effectively in their jurisdictions. Infrastructure is defined in this paper as a system or network of physical or built and natural facilities in a community by which all anthropogenic activities are performed (cost-effectively,

equitably and sustainably). Infrastructure development is one of the most prioritized policy and financing activities of governments worldwide (Elmer and Leighland, 2014). Infrastructure and infrastructure systems can be developed as independent or integrated systems. Besides policy and financing, other critical phases of infrastructure development are legislation, engineering and design, planning and implementation, management and administration, maintenance and replacement. In governing and managing regions, therefore, stakeholders in the public, corporate, non-profit and grassroots sectors - the four main stakeholder sectors in any society - are faced with the daunting, complex and multidimensional challenge of who provides, who pays, who uses and who maintains infrastructure and services, especially for and/or to the public.

In order to explore what this paper deems to be an exemplary case and practice of LUS development in a regional context, this paper reviews the case of the ADS region with the intent of deciphering lessons that can be learned from the case. ADS is a very unique region that has managed to develop and manage LUS to support a regional economy that is very competitive by world standards. Aspects of this uniqueness are exemplified below, and should be considered in an attempt to understand the context of, and approach to, LUS development in the region.

- Each city in the region is a city state, known as an 'emirate,' judged by and within the constitution of the country (UAE). Each emirate is an independent constitutional, political, economic and strategic entity.
- Based on their shared history, heritage and culture, the geographic territories and boundaries of the cit-

ies overlap in many cases. Sharjah, for example is the one emirate in the country that shares boundaries with the other six sister emirates in the country. Dubai shares boundaries with four emirates and Abu Dhabi with three. It is not uncommon to find territorial spots of one emirate located smack in the boundaries of another emirate.

- Growth and development in the emirates have occurred at different paces, and with different foci or visions. The approaches and key activities that have driven development in the emirates are depicted in Table 2.
- Mutual collaboration and partnership have been adopted as a de facto approach to governance and development among the emirates under the spirit of brotherhood and comradeship articulated in the national ethos and institutionalized through the UAE Supreme Council, which the Rulers of the seven emirates are members of.
- Unlike in western-type democratic systems of government around the world, citizens do not participate overtly in decisions about LUS development, neither are they involved in approving financing for LUS. However, they are all guaranteed full and equitable access to the benefits and services of LUS, and cost recovery from citizens for services is zero to minimum, through full or partial subsidization by the emirate governments.
- Financing, planning and construction of LUS are undertaken through public-private partnership arrangements, where the public role is basically administrative and management oversight at the backend of the LUS development process.

	Abu Dhabi (A)	Dubai (D)	Sharjah (S)
Development Approach	Gradualism	Entrepreneurialism	Conservatism
Key Functions	Administration (Regional, National) Oil and Gas Banking/Finance Institutions (Diplomatic and Heritage) Sustainability Innovations	Administration (Regional) Trade and Commerce Real Estate Tourism / Hospitality Manufacturing Aviation Technology	Administration (Regional) Education Culture / Heritage Manufacturing Trade
Population	2.7 million (2015)	2.4 million (2015)	1.4 million (2015)
Land Area	67,340 km ² (87% of UAE)	3,900 km ² (5% of UAE)	2,590 km ² (3.3% of UAE)

Table 2: Growth and Development Approaches and Activity Drivers in the ADS Region

Lessons from the ADS Region for LUS Development in Emerging Regions

This paper identifies three key lessons that can be learned from the impressive case of LUS development in the ADS region. These are lessons that can be instructive for LUS development in regions around the world, irrespective of the challenges, especially political challenges, listed in Table 1.

The first lesson is that, in light of the statutory and even strategic constraints and challenges that may prevent and/or inhibit overt collaboration between cities in a region, a de facto strategy that implies collaboration based on goodwill, cordial, courteous communication and consultation on LUS development issues can be adopted and even quasi-institutionalized for perpetual collaboration. This approach is in use in the ADS region for infrastructure development and some essential services, for example, inter-emirate highway development, inter-emirate bus transportation services, energy supply and pooling, and healthcare infrastructure. De facto collaboration can and does create opportunities and foster conditions for formal and statutory actions at the levels

of the collaborating cities. Institutions can be co-created to serve the collaborating cities, resulting in resource and capacity leveraging.

The second lesson is that, of all the factors that are pivotal and critical for growth and development in a region, the ADS region has identified LUS as the most feasible for regional collaboration, hence the remarkable achievements of the region in LUS development. LUS need not be over-politicized, as in many Western industrial societies, and, financing need not cripple government's obligation to provide sustainable LUS. The reasons for this summation include the following. LUS are:

1. Critical necessities for all citizens, businesses and agencies at all times and for all activities
2. Politically, ideologically and culturally neutral, thus, least controversial and contested
3. Objective indications of development and competitiveness of the society
4. Critical for self-preservation through economic productivity
5. Critical for an overall good standard of living and

Stakeholder Sectors and Roles	Ideal Scale of Stakeholder Roles in Societal Goal Clusters															
	Political				Economic				Natural Environment				Built Environment			
Public: Policies Legislation Finance Projects Programs																
Corporate: Finance Management Technology Entrepreneurship Innovation																
Non-Profit: Advocacy Capacity Building Technical Assistance Education and Training																
Citizens: Self-Preservation Engagement Citizenship																

Figure 1: Scale of Society's Stakeholder Involvement in the LUS Development Process

quality of life

6. Concrete indications of the responsiveness of government (supply side)
7. Equitable and fair to consumers (demand side) in terms of access and pricing
8. Fundable and implementable through non-public sources or mechanisms, and through public-private partnerships

The third lesson is that cities collaborating to develop LUS at the regional level would be more successful by assigning stakeholder sectors in the society to the most appropriate roles they can play in LUS development, based on the expertise, competencies and resources of each sector. This is in realization that one sector cannot play all the roles required for LUS development, and a partnership approach would be most cost-effective. The practice in the ADS region is to rely on private sector expertise and resources for LUS development, while reserving the backend roles of LUS administration and oversight for the public sector. The estimated scale of involvement of society's stakeholders in serving the main goals of a community is shown graphically in Figure 1. Each row shows the roles of each stakeholder sector, while each column shows the scale of involvement, in the various dimension of LUS development. Attention should be paid to the built environment goal, where LUS belong. This scale was constructed from observations by this author of the roles of key actors in the infrastructure planning processes at the federal and emirate levels in the UAE as well as in the South Florida Regional Planning District in the USA.

Conclusion

Worldwide, cities are 'exploding' in population and area, leading in most cases to inadvertent morphing of cities into megalopolises. Governments have the statutory and political obligations to provide infrastructure and services for economic productivity, quality of life and self-fulfillment for citizens. Yet, cities face various challenges in addressing their critical goals, among them statutory constraints. For LUS development, the financial, political, environmental and social costs, challenges and implications are increasingly prohibitive for cities. Cities must devise innovative ways to collaborate for LUS development by taking advantage of economies of scale, resource and institutional capacity leveraging and other regional assets and opportunities. The ADS region

in the Emirates has adopted a practical and relatively effective de facto approach to the regional development of LUS. Three basic lessons that this approach offers can be adapted by evolving regions around the world were identified in this paper.

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Lille, France's 'Virtuous Cycle' – Integrating Urban Services to Valorize Waste

Hillary Brown*

Abstract: Local governments can reduce ecological footprints and unlock new economic potential by pioneering “infrastructural ecology,” defined as integrative business models for public services. Lille, France improved the performance of the otherwise fragmented operations of its public transport and utilities by aligning policy objectives vertically and horizontally, gaining multiple co-benefits.

1. Introduction

The idea of “infrastructural ecology” derives from the field of industrial ecology (Pandit et al., 2015; Brown, 2014). Industrial ecology actualizes the synergistic potential between different enterprises’ production processes through exchange of residual by-products. These include the “cascading” (passing along) waste energy, water or other matter (Preston, 2012). Reclaiming internal resource flows for potential reuse minimizes the consumption of virgin materials and reduces the practice of sinking wastes into the environment (Jacobsen, 2006). Infrastructural ecology is the application of such closed-loop paradigms to the massive technological footprints of critical infrastructure—transport, energy, sanitation, and waste management services to garner savings, lower greenhouse gas emissions, eliminate harmful wastes while producing multiple co-benefits, creating in effect, a “virtuous cycle”, a chain of events favorably reinforcing themselves through a feedback loop.

To implement infrastructural ecology, governments must transcend the confining perspectives of “siloed” public policy-making. Lille France’s integrative governance captured the economic and environmental benefits of such closed-loop urban infrastructure planning (Walker and Lefevre, 2015). This case study suggests that integrated governance—horizontally coordinated, inter-sectoral development, and vertical alignments across government jurisdictions—should become a more entrenched form of practice, one that can improve multi-institutional performance and optimize service quality.

2. The Context for Lille’s Innovation

Located in France’s most productive industrial region, the Lille Métropole Communauté Urbaine (LMCU) was created in 1967 in the Nord-pas-de-Calais region bordering Belgium. It effected an “urban agglomeration” of its 85 constituent communes in the metropolitan area (population then 1.2 million) under France’s 1996 law on intra-community cooperation. While multiple polluting industries contributed to environmental degradation in the region, notably, half of its approximately 600 km² (150 sq. mile) area was still comprised of small villages and rural land that supported an agricultural economy (ICLEI-Europe /Northumbria University, 2006). LMCU’s mandate included town-planning, service provisioning, housing, and economic development. But it was its key responsibilities for door-to-door household waste collection, transport systems, and wastewater treatment that set the enabling conditions for its integrative activities.

As early as 1994, Lille had adopted its “Scheme for Urban Waste Collection and Treatment,” which receives and processes wastes from approximately 50 percent of the Nord-Pas-de-Calais region’s total population. Built upon a concerted campaign to eliminate landfilling, its local communications enlisted citizens in sorting packaging and kitchen wastes from households, as well as from gardens, markets, food processing, and catering. (Mulder et al., 26).

The second condition was LMCU’s development of stringent transit policies. France’s 1996 laws on transport and energy use required urban areas larger than 100,000 km² to create an urban mobility plan. In 1999, LMCU

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adopted its Plan de Déplacements Urbains, a set of integrated strategies to reduce private vehicular dependence, while lowering public transit emissions (NO_x , CO , SO_2 and PM). A 90 percent reduction in private vehicle use by 2015 was to be achieved by doubling public-transit utilization by offering intermodal transport and unified ticketing among its metro, buses, trams as well as regional and national rail. Buses were granted dedicated lanes (ICLEI-Europe 2006).

The last enabling condition included LMCU's responsibility for wastewater treatment. It owned the privately-operated Marquette-lez-Lille wastewater treatment plant, which was constructed in 1969 as a conventional activated sludge system, treating about a third of Lille's urban sewerage.

3. Implementing A "Virtuous Cycle"

Lille Métropole Communauté Urbaine began reducing its ecological footprint during the late-1990s by examining both its infrastructural context and under-exploited waste outputs as potential renewable energy resources. Its multiprong, integrated plan was to procure a low-emissions fuel for its buses - biogas (bio-methane) - by capitalizing on energy and nutrient exchanges from its own wastewater-treatment plant and a purpose-built organic-waste-treatment facility, establishing a unique "virtuous cycle".

Biogas, a biologically-produced high quality fuel derived from various types of waste, can be utilized in combined heat and power generation. It can also be cleaned and compressed for combustion as compressed natural gas (CNG) in vehicles, as well as for injection into the national grid. Readily sourced from municipal wastewater and industrial, forest, agricultural and food industry waste, biogas is considered a renewable energy source.

The first source of biogas was identified at Lille's Marquette wastewater treatment plant, which recovered biogas produced by the plant's anaerobic digesters. While most was used to generate heat for the plant, the rest was being flared (wasted). Lille's 1990 pilot—a biogas-scrubbing unit—recovered 3,000 m^3/day of the gas, cleaned, and upgraded (compressed) it to fuel four CNG-converted buses in its public fleet. These buses evidenced

notable improvements in acceleration and drivability as well as reductions in ozone, hydrocarbon, nitrogen oxide, and particulate emission reductions. Their noise levels also diminished by nearly 60 percent (Energie-Cités, 1999). By 1999, half of the city's bus fleet had been replaced with CNG-fueled vehicles. In 2009, a new biogas upgrading unit at Marquette would increase its output to .28 million m^3 annually (BIOGASMAX, 2010).

Given its initial success in biogas utilization, and with the goal of expanding the program to its entire fleet of 400 vehicles, LMCU cast about for other waste sources. Opened in 2007, Lille's newly constructed Organic Waste Recovery Facility (ORC)—annual capacity 108,000 tons—was built to manage the area's burgeoning contribution of organic waste. At the ORC, the household, garden, market and food processing organic wastes, arriving by barge (another low-carbon initiative) spend roughly a month in oxygen-free digesters that separate biogas from sludge, the semi-solid waste. The sludge is processed into compost, which is then returned to fertilize agricultural fields (BIOGASMAX, 2010). Forty new jobs were created at the ORC.

While some of the recovered biogas (4.11 million m^3/yr) is used directly for heating the ORC, the rest is purified, water-washed, concentrated, and added to buses (Kovács, 2016). This displaces the need for almost 5 million gallons of diesel bus fuel (Cousyn, 2014). (It is noteworthy that since all biogas is derived from decayed plant material that was originally photosynthesized, the fuel is considered carbon neutral.) LMCU's 2005 decision to locate its new bus depot facility *next to the ORC*, further eliminated carbon emissions from vehicles miles otherwise expended in travel for refueling. Significantly, in 2011, Lille's biogas output was approved for direct addition into Gaz de France's (GrDF) gas grid (Ibid). Today, Lille has three bus depots delivering gas to 400 buses and all its waste collection trucks, with the remainder used to generate electricity for 25,000 households. The by-product of 25,000 to 30,000 tons of compost returns to its agricultural hinterland, reducing the farmers' dependence on chemical fertilizers (Ibid).

The program owes its success to a number of factors, including the political and technical support of the Euro-

pean Union. Ultimately, however, the critical factor was LMCU's commitment to effect an ecologically integrated solution to its transportation, wastewater treatment, and solid waste processing.

4. Innovation Through Adroit Governance

Lille Métropole Communauté Urbaine was the key actor that mobilized and brokered this important sustainability initiative, with impact ultimately felt beyond its jurisdiction. LMCU typified three key modes in which local government can be progressive. These include: proactive exploration of alternative futures, fostering integrated governance, and accepting financial risk and responsibility.

Foregrounding Analysis and Experimentation

The first mode is the practice of “reflexivity”—reappraising current institutions and reconsidering existing practices—indicative of advanced administrative leadership (Meadowcroft, 1997). Lille's systemic, integrative approach to challenges relied on foresight and visioning. Examining the sanitation, wastewater and transport departments under its purview, LMCU appraised the limits of its institutional and facilities' practices, and saw opportunities to transcend them. Its administrative culture proactively embraced experimentation and risk-taking—not only at the most executive level but also by multiple administrators—implementing cross-linkages among the conventionally fragmented municipal operations.

Exercising Integrated Governance

It might be said that the capacity to foster integrated municipal governance is a normative tenet of sustainable development. Integrated governance has recently evolved from the understanding that most challenging urban problems are cross-cutting, and cannot be resolved through single-sector solutions (Stanley, 2015). As a management approach, it promotes engagement and policy coherence at both the horizontal level, across processes within government boundaries, as well as vertically, at the federal level above, and below in its outreach to citizenry.

First, LMCU coordinated and aligned policies horizontally by creating dialogue among the various departments—transit, sanitation and wastewater—their technical experts and economic partners (private operators). Intra-department maneuvers overcame many of

the structural issues from these previously siloed agencies and their private companies that held public service contracts: Transpole (public transport agency), Esterra (which operates waste collection) and Carbiolane (operator of the ORC, which is owned by LMCU). A bus manufacturer (Renault) and Gas de France also contributed expertise. Among these parties, information sharing and transparency helped resolve conflicting policies and create useful synergies.

Second, Lille's vertical integration involved the coordination between federal and regional government as well as gaining buy-in from the grassroots level. Lille demonstrated how by using its two-way bridge of knowledge and resources, successful experiments can become standard policy at scale and make lasting change.

Vertical coordination was necessary to develop gas standards, create enabling regulations and incentives, and coherent policies. In 2006, in order to move its already-proven biogas initiative forward, Lille assumed the coordinating position for the Biofuel Cities European program “Biogasmax.” One of the program's aims (and Lille's specific goal) was to validate the technical and cost feasibility and sustainability potential of biogas-powered vehicles.

One barrier was that biogas fuel utilization lacked regulatory approval, a barrier precluding LMCU's obtaining optimal environmental and economic benefits from biogas production and use. Lille advocated for national legislation enabling biogas to be grid injected and distributed. This went into effect in France in 2011. Another challenge was that for biogas to be economical, it would need tax credits or feed-in tariffs, like those already allocated for biogas co-generation (Mulder et al., 2009). In 2012, Lille was instrumental in promoting legislation for a subsidized feed-in tariff. For these initiatives, LMCU worked closely with ADEME (the French Environment and Energy Management Agency). Other partners in these endeavors included GrDF, together with AMORCE (a national association of companies and professionals for the management of waste, energy and heat networks) and Solagro (a consultancy in energy, agroecological and food transitions (Ibid).

LMCU's proactive outreach also extended to the public at large as well as the workforce. In the early 90s, it had targeted households as well as food markets and processing centers for the pre-sorting of biowastes for

direct collection (Cousyn, 2014). It worked to explain the added value of biogas-from-waste to vehicle manufacturers and fuel distributors. Working with the National Health Agency (whose assessment concluded that biomethane was no more hazardous than natural gas), it fostered communications with local communities to increase acceptance and overcome initial concerns for potential hazards of biogas storage facilities (Mulder et al., 2009). Finally, it obtained buy-in from the transport workers operating the converted buses.

Assuming Financial Risk/Responsibility

LMCU undertook targeted investments to affect more intensive use of its local resources, namely waste methanization from dual streams to serve its transport needs. Practically speaking, LMCU committed to underwrite the higher costs of using biogas in its local public transport system. The total project costs (approximately €90 million) were funded and financed in part thanks to LMCU's leadership role with the Biofuel Cities EU framework. For its initial pilot, it received research and demonstration funding at the EC level as well as national funds for purchasing natural gas vehicles. The largest investment (building the ORC) was financed with a reduced loan from the European Investment Bank for approximately €35 million. Other contributions totaled approximately €3.8 million from the Regional Fund for Energy Management, and the ERDF (European Regional Development Fund) (Walker and Lefevre, 2015). Carbiolane provides the plant's annual €3 million maintenance (Cousyn, 2014).

5. Lille Métropole's Paths Beyond

Métropole's 2013 approved Climate Plan set a carbon reduction target beyond that of the European Union: reducing emissions by 30 percent by 2020 (Covenant of Mayors, 2014). The City of Lille Roadmap & Vision 2050 continues LMCU's ongoing study of urban interactions that contribute to a low energy city. This 2014 vision document, produced internally by the departments of the LMCU and co-funded by the European Union, builds upon its politically-approved strategies for 2020. The document stipulates how new opportunities for renewable energy from resource recovery could be undertaken. These include not only expanding its utilization of sewerage sludge for additional biogas, but also recovering so-called "hidden" energy resources—waste, waste heat from data centers, waste water, and even un-

derground quarries (Imagine Low Energy Cities, EU).

6. Transferability

Strategic and systemic thinking comprised the backbone of LMCU's integrated planning. Through coordination and alignment of government action, it undertook place-based urban interventions aimed at capturing cross-sectoral synergies. In sum, LMCU's culture of innovation in development, its capacity for multi-party integration and its fiscal willingness collectively enabled its pursuit of effective synergies across scales and jurisdictions as well as between sectors and their technical domains. This significant initiative is readily transferable to other cities as most could similarly be involved in biogas production/distribution from sewage treatment plants and if so desired, from organic waste recovery centers.

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Mobility X.0: What is driving the future?

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Abstract: The mobility market is in transition. Climate change, increasing urbanization, competition for scarce urban space, technological transformation, new mobility services, and altered consumer behavior are some of these changes. The question is: How will the future of urban mobility look? And more importantly: What must be done today to shape the mobility world of tomorrow? Which national and local policies are necessary to decouple mobility and fossil resources?

Introduction

The transportation sector is one of the world's greatest contributors to greenhouse gas emissions and the main cause for air pollution in cities. Transportation causes 23 % of global anthropogenic CO₂ emissions with the highest share coming from road transport (73.9 %). The transportation sector is the largest consumer of oil worldwide, mainly due a sharp increase in traffic and its nearly full dependency on fossil fuels. More than half of global oil consumption, namely 53.4 %, is used in transport, 76.5 % of which is consumed by road transport. Of this, heavy-duty vehicles account for 34 % and light-duty vehicles for 66 % (ICCT 2016).

Figures in Europe are similar, with transportation representing almost a quarter of Europe's greenhouse gas emissions. Unlike other sectors, the transportation sector in Europe has missed its target to reduce CO₂ emissions over the last 25 years. On the contrary, CO₂ emissions have increased and remain higher compared to 1990 levels, with emissions having only decreased slightly since 2007 (European Commission 2017).

It is obvious that changes in the transportation sector are inevitable. But what are the major trends and challenges that are driving the future of mobility? How can we regulate and reverse the growing problems caused by transport?

Trends and challenges of mobility X.0: A European perspective

One major change is inevitable: In the future, vehicles with alternative driving technologies will replace con-

ventional fuel cars as the era of fossil fuel is coming to an end. Climate change, as well as the scarcity of resources and fossil fuels, requires a turn to renewable energies. This particularly applies to the transportation sector, which is unlike any other sector in its almost complete reliance on fossil fuels (Lennert and Schönduwe 2017). A timely penetration of alternative drive technologies in the transportation sector is necessary. Certainly, in this future mobility world, cars will still play a significant role for the individual's daily mobility. However, unlike today, the car of the future will be charged with electricity (battery or hydrogen) using regenerative energy sources. The much discussed and well-needed energy transition must be accompanied by a transformation in the transport sector. So far, little has been achieved in this respect. Looking at the share of renewables in the transportation sector, the numbers are disillusioning. For example, the majority of European countries have a renewable fuel share of about 5 %, with only minimal to growth over the last one or two decades. The link between renewable energies and electromobility is obvious. Worldwide, electric car stocks have been growing significantly over the last years. Cities offer an especially good environment for electric vehicles on four or even two wheels because of their high density and the correspondingly shorter distances. The urban infrastructure is adapting to these developments as charging infrastructures have become an integral part of today's cities. Inductive charging technology underneath roadways and parking lots may make manual handling with charging cables and plugs unnecessary in the future. In this new electric mobility world, the fluctuation of regenerative electricity supply

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and demand also requires buffers. Here, in turn, electric cars can be used for compensation. The electric car of the future will be part of an intelligent connected system (Canzler and Knie 2013). In the long term, electric cars will fully replace vehicles with an internal combustion engine.

Another trend is the changing perception of the private car. Once a private prestige object and the guarantee for freedom and self-mobility, the private car of today is transforming into just one of many mobility options. Smartphones and other digital devices become more important than obtaining a driver's license or the privately-owned car. This is particularly true for the younger urban generation (Kuhnimhof et al. 2012, Schönduwe et al. 2012). Rather, the private car of today stands for the rental vehicle around the corner; this is also thanks to the growing car sharing market. Reasons for this transforming perception of the car include high acquisition and operating costs, wasted time due to traffic jams or limited parking infrastructures. The discussions about banning fossil fuel cars from city centers foster these trends. The variety of new emerging mobility offers no longer require the ownership of a private car in conurbations. Rather, they are replaced by connected sharing services in combination with public transportation (Wappelhorst et al. 2015). In the future, the car will be part of the public mobility landscape and no longer a private issue.

The combination of different modes of transportation will be a self-evident daily mobility routine in the future. Multimodality, which is already increasing in the urban mobility landscape, will continue to grow. Whereas people who commute using predominantly their own cars seldom overlap with other transport modes, this is different for public transport users (Wappelhorst and Hinkeldein 2014). Nowadays and in the future, public transport will function as the backbone of urban mobility and different transport modes will be connected by mobility providers who will control the supply side. These developments have been made possible especially through technical innovation and digitalization: Smartphones or other technical devices will lead the way to the nearest, smartest, most efficient and cost-effective

mobility option. The combination of these new technologies allows a mobility which is in no way inferior to the freedom promised by the private car. Under certain circumstances, the perceived autonomy over time and space becomes even greater. In the more distant future, self-propelled, autonomous cars will conquer the city. Until then, smartphone apps and internet portals increasingly allow for the simple use of different providers and carriers. The change between modes of transport is becoming easier; billing can be accomplished across different transport modes through highly efficient back-end systems. This will all add up to a change in people's behavior and will significantly shape mobility behavior and the mobility landscape of the future.

Over the past few years, we have discovered a rapidly diversifying mobility market. The sharing economy has played an especially important role in changing the face of our cities. For example, car sharing memberships have increased significantly worldwide over the last decade. In Germany alone, 1.7 million people out of about 82 million inhabitants are currently members of a car sharing organization, through which they can use more than 17,000 conventional and electric cars from around the country. Research on car sharing proves that one car sharing car can replace up to 20 private cars in urban settings, contributing to an efficient use of existing vehicle fleets (bsc 2017). Similar studies also indicate that car sharing can foster the abolition of the private car. A survey carried out in the city of Berlin showed that 22 % of car sharing users had scrapped their private car in favor of car sharing. 72 % of whom stated that car sharing either played an important role or was the main reason for this decision as car sharing was sufficient to meet their daily mobility needs (BMUB 2016).

It is evident that current technological trends will need another 10-15 years to have an effect on CO2 emissions. In the short term, it is crucial to motivate humans, that is you and me, to reduce our CO2 emissions and to prioritize modes of self-mobility in the following order: Walking. Cycling. Public Transit. Individual motorized modes of transport. That should be the order. Local and national mobility should also prioritize this order when funding research, infrastructure and soft measures.

Behavioral Change Support Systems (BCSSs) constitute a major lever to achieve voluntary behavior changes because they are individualized and provide the right information during the stages of behavior change (Bamberg without date). BCSS are “information system[s] designed to form, alter or reinforce attitudes and/or behaviors without using deception, coercion or inducements” (Oinas-Kukkonen:491) that address the specific user needs in different stages of behavior change. No one wakes up in the morning and immediately changes their behavior forever. Behavior change involves progress through different stages of change. Let’s say you first consider a change (“I really should drive less.”), then a BCSS could provide information about alternative options, i.e. eco-driving, public transport routes, local car sharing providers. If you then wonder what you should change, a BCSS would help you to set a goal and take action (“OK, I will start taking my bike.”) by providing written change commitments (“I will start taking my bike this Monday at 8 am”) or sending friendly reminders. Lastly the BCSS helps you to cement the new behavior as a habit by praising the user or sending an electronic postcard with a note of gratitude from the local mayor.

In this regard, sharing operators and cities interested in fostering i.e. a sharing habit should focus on two aspects: timing and target groups. Timing is a major issue when changing habits and routines. Potential users should be provided by the right information at the right time. For instance, the birth of the first child or moving house imply a massive information need on public transit, car sharing, cycling and walking (Wappelhorst 2011). Sharing operators currently target mainly two groups: innovative technology-loving multioptionals and flexible car-lovers (Hinkeldein et al. 2012, Hinkeldein et al. 2015). The current increase in sharing users and usages will come to an end if additional target groups are not addressed accordingly. But sharing is not only about the car. The increasing number of bicycle and scooter sharing systems in urban cities are clear evidence of this. In the future, shared, public transport modes will be combined as needed. Furthermore, bicycle traffic will continue to rise, thanks to pedelecs and electric bikes which offer autonomy and mobility participation for a larger population. Cycling will also be linked with other modes of transport. In addition, electro-scooter and other electrically operated, exhaust-free means of trans-

port will continue to grow within the urban mobility landscape. In this diversifying mobility market, mobility needs are met spontaneously by booking the closest means of transportation by smartphone. This trend is already on its way. Virtual car fleets and spontaneous short-term rental of different transport modes promise a more efficient utilization of the scarce space, which becomes ever more precious in metropolitan regions. The growth of new mobility services makes the possession of privately owned transport modes unattractive and untimely. Flexible multi- and intermodal usage will be the future of mobility.

Shaping future mobility: Strategies to decarbonize transport

The trends as described above are already on their way. The key question is which European, national, regional and local policies are necessary to shape the urban mobility landscape and prepare it for a fossil fuel free mobility future?

Recently, the European Commission adapted an action plan titled “European Strategy for Low-Emission Mobility”. The strategy calls for an at least a 60 % lower rate of greenhouse gas emissions compared to 1990-levels by 2050 and demands a sharp reduction of air pollutants. To achieve these objectives, the strategy proclaims three key action fields: Firstly, improving the efficiency of the transport system. Secondly, scaling up the use of low-emission alternative energy for transport, and thirdly, moving towards low- and zero emission vehicles (European Commission 2016).

To decarbonize transport, the European Union has set different targets to reduce greenhouse gas emissions from transport and to minimize its dependency on oil. The “Renewable Energy Directive” sets a binding target of 10 % fuels coming from renewable energy by 2020 (European Parliament and The Council of the European Union 2009). The “Transport White Paper” requires a greenhouse gas reduction of at least 60 % by 2050 compared to 1990 and a 20 % reduction from 2008 levels by 2030. The paper includes targets that halve the use of conventionally fueled cars in urban transport by 2030 and phase them out by 2050 (European Commission 2011: 3). In addition, the European Commission has adopted different legislations including mandatory emission reduction targets for new cars. Currently, the limit for new passenger cars is 120 g CO₂/km which will be reduced to 95 g CO₂/km by 2020. Furthermore,

EU legislation requires for its Member States CO₂ labeling of new cars showing a car's fuel efficiency and CO₂ emissions (European Parliament and European Council 1999).

These regulations are a clear signal for manufacturers. At the same time, these measures are a strong tool to incentivize sustainable mobility behavior as this may help and encourage consumers to buy a zero or low emission car. Norway is clear evidence of this, where electric vehicle sales are the highest in Europe thanks to policies including tax incentives, a dense network of charging infrastructure and local regulations in favor of sustainable cars.

Many European countries provide these incentives on a national level. But what about the local authorities? Which possibilities do they have to decouple mobility and fossil fuels and to encourage an efficient local and regional mobility? The German government for example passed different regulations in the recent past to help municipalities in this respect (Wappelhorst 2016). One example is the German law on electromobility which came into force in June 2015. The law provides municipalities with the legal framework to privilege electric cars and, by that, to promote sustainable vehicles. Policies include parking privileges and free parking for electric vehicles (Bundesministeriums der Justiz und für Verbraucherschutz 2015). A new law similarly incentivizing car sharing was passed by the German Bundestag in April 2017. Thus, the legal framework is not only about replacing conventional cars by electric cars, but also about the efficient use of the existing car fleet. Furthermore, some of the large European cities have just committed themselves to similar policies including banning diesel fuel cars, introducing ultra-low emission zones, like in London, informing people about real emissions, as in London and Paris, and more cities are interested in following along a similar path (Tietge and Dias 2017).

Conclusion

Despite these developments, which can only offer a small insight into the complex mobility landscape, a lot of problems still need to be solved. Passenger car sales worldwide continue to grow. Transport by heavily polluting lorries, air traffic, and fuels are only some aspects where solutions are needed and problems remain unsolved. What do we need? Clearly, stricter regulation on CO₂ emissions limits. Without these regulations neither manufacturers nor consumers will be forced to the

urgently needed changes in the transport sector. Legal frameworks need to be adapted on a national level. This includes privileges for sustainable transport modes or new technologies like autonomous driving. Cities need to be enabled to make these changes. In the diverse and complex mobility world of today, which will become even more diverse and complex in the future, cities need to be enabled to regulate and manage these challenges. Networking and piloting will remain essential. Qualitative and quantitative data on mobility, transportation, and on how people behave are crucial. Discussions about the use of public space need to be raised reducing the dominance of cars and give way to more efficient forms of urban transport. These are only some examples. There is still a lot to be done on a local level, but also on a national level, and it is evident: Planning for the mobility future will remain a challenging task.

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Detroit and an ever-changing urban forest environment

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Abstract: Detroit was once a prominent hub of innovation and social, cultural and economic prominence in the early twentieth century. Its urban forest health coincided with the population trends that shaped this city over the past century. Reliance on monocultures and their corresponding loss due to various disease and insect vectors and persistent severe municipal budget constraints have led to the relentless reduction of the forest quality and integrity. This loss greatly impacted community health and simultaneously led to a change in resident preferences that would restrict non-governmental organizations from reestablishing this once comprehensive urban forest network. Non-governmental, non-profit agencies like The Greening of Detroit have emerged to attract funding and develop armies of volunteers to replant street and park trees and bolster the management and restoration of their city's urban forest. As part of this movement, additional community education, advocacy and engagement strategies have become mandatory steps in the process to reestablish the urban forest one resident at a time.

Introduction

Urban forests, especially those planted on municipal property, have long been one indicator of the health of the urban environment and largely contribute to the quality of life of its residents. The ecosystem services that trees provide, individually and as a planned network, often soften the harsh environment that dense urban systems create. Urban and community forests can strongly influence the physical/biological environment and mitigate many impacts of urban development by moderating climate, conserving energy, carbon dioxide, and water, improving air quality, controlling rainfall runoff and flooding, lowering noise levels, harboring wildlife, and enhancing the attractiveness of cities (Dwyer, McPherson, Schroeder and Rowntree, 1992). These benefits have long been valued by most urban residents but have only recently been quantified through decades of research by agencies such as the U.S. Forest Service. Despite the precise measurement of the value that trees provide, cultural and public perceptions can serve as a catalyst to limit the prioritization of funding, maintenance and/or restoration of urban forest networks. There are three strategies that researchers have developed

to address these preference disparities: (1) ignore cultural perceptions, (2) forfeit the ecological benefits of urban trees and not try to impose a canopy of mature shade trees on a community that will not support it, and (3) conduct an education program to show residents the benefits of the urban forest and enlist community support (Fraser and Kenney, 2000).

Change in the urban environment

Detroit was once known as the "Paris of the Midwest" in reference to the vast urban forest network across its 139 square miles. This early twentieth century resource was developed in conjunction with the industrial revolution, mass migration of the population to the city from rural areas, and helped create a significant middle class with more wealth. Detroit was a new, modern city and a shining example of how cities across the U.S. could be developed and managed to benefit its residents. As the automotive industry began outsourcing manufacturing from the urban center in the mid 1900s, along with other economic changes and population declines, municipal and corporate financial resources became more strained. By the 1950s, the municipal urban forest resource suf-

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ferred through less public and philanthropic funding, a lower prioritization of the maintenance and replanting, and finally a significant reduction of the integrity of the ubiquitous urban forest in this once prominent world city.

Starting in the 1960's, Dutch Elm Disease claimed large populations of American Elm trees on city streets and in more than 200 parks as foresters had abundantly overplanted this species throughout the city. It was estimated that more than 500,000 trees were lost in the two decades that followed the introduction of this devastating fungal disease.

During the 1990s, the Detroit urban forest began another cyclical downward spiral as a result of the introduction of another devastating tree vector: the Emerald Ash Borer. When budgets allowed, city foresters in the 1970s and 1980s chose to dominantly plant a new monoculture of White Ash, Green Ash, Silver Maple and Norway Maple as replacements for the lost American Elm population. Continually constrained forestry budgets failed to address the loss of more than 100,000 Ash trees while the short lived Maples quickly began reaching senescence in this pre-bankruptcy era. After the turn of the century, Detroit's forestry staff and budgets had become so limited that they were only able to focus on the backlog of tree removals and reactive maintenance actions after severe storms.

The diminished municipal replanting of trees on residential streets, in parks and around public schools was the catalyst for non-profit environmental organizations like The Greening of Detroit to informally adopt certain traditional environmental municipal services. These organizations leveraged federal, state and corporate funding while benefitting from the growing environmental volunteerism movement to begin providing community tree planting operations. As funding became more prevalent, these non-governmental organizations (NGOs) became the quasi-governmental city forestry agencies or significant partners in urban forestry planning, advocacy and implementation of tree planting and other environmental projects.

Population demographics and resident preferences for the dense urban canopy and the benefits they provide

began changing as The Greening of Detroit accepted more responsibility. In the 1980's, researchers in Detroit learned that park and street trees ranked high among six typical municipally provided services, second only to education (Getz, Karow and Kielbaso, 1982). Nearly two thirds of the residents interviewed indicated that more funds should be spent on park and street trees. The greatest level of support for more tree planting and maintenance operations correlated with high income individuals and white residents. With the continued population loss and the cultural concentration of an African American population, tree preference began shifting.

Pre-2010, residents requested and invited the organization to organize community tree planting events that averaged 20-50 trees per project. Community engagement was approached through community ambassadors that helped organize the planting event and recruit residents to plant trees in their neighborhood. In 2010, The Greening of Detroit received a large tranche of federal reforestation funding that led to larger planting events of 200-400 trees per week. This transition involved moving from a protocol where residents were tasked with gaining permission to plant a street tree from their neighbors to Greening of Detroit staff accomplishing this same task. The organization began shifting to a larger scale community engagement strategy that involved attending community meetings and using informational doorhangers to maximize process efficiency. During this time, foresters began documenting an increasing trend of vandalism, tree theft and residents rejecting the practice of street tree planting on the municipally owned property in front of their houses. Challenges began surfacing when residents were given a choice where traditional municipal forestry operations did not seek this permission. It was during this period that the organization began experiencing resident tree planting rejections due to cultural and systemic preferences recorded through interviews conducted by an independent researcher.

Many researchers have studied the cultural preferences of urban residents for trees and green spaces. A more recent study maintains that these preferences are intimately tied to the landscape histories of each group's country of origin (Battaglia et. al. 2014). Other studies also found that a significantly lower percentage of Afri-

can Americans said trees were important to quality of life (Lohr et. al, 2004) and that those interviewed tend to favor parks and recreations areas with fewer trees due to systemic concerns about safety and crime. (Gobster 2002; Brownlow 2006; Lewis and Hendricks 2006).

Increasing the urban tree canopy is vital for many reasons. Most significantly is alleviating asthma related attacks and deaths and heat island effects that negatively impact Detroit residents where income and access to health services are severe. Many obstacles prevent increasing tree canopy from a current 17.6% to the current goal of 35-40%; lack of funding is the most important followed by prioritization by municipal leaders and community acceptance of trees. Without a widespread community prioritization of tree planting and maintenance programs, the goal of increasing canopy cover across the city will be difficult. Additionally, if tree preferences by residents in low income neighborhoods preclude planting operations, the inequitable distribution of negative impacts found in these areas would continue to severely impact their individual and community health. Community education and engagement are key to promoting and advocating to achieving these goals.

Change in Urban Forestry approach

In 2008, Greening of Detroit foresters and community engagement specialists began developing a community education and engagement program to understand resident's bias while educating residents of the community benefits trees provide to affect a higher acceptance rate. Residents offered the lack of reasonable municipal tree maintenance and removal, rejection of the responsibility for raking seasonal leaf litter and previous damage of sanitary sewers, curbs and sidewalks as examples for bias against the planting of replacement trees. Greening of Detroit foresters named these resident rejection requests "no tree requests" and recorded rates ranging from 8-45%.

In 2011-2014, a researcher collaborating with The Greening of Detroit's community forestry program interviewed residents that proffered no tree requests. She found an average of 24% of the residents requested a "no tree request" that resulted in no tree planted. This was attributed to many systemic factors: concern about potential damage from a tree, interruption of sightlines and security, ongoing tree maintenance cost, eventual size and aesthetics of a tree, history of no maintenance by municipality, and an underlying power dynam-

ic emanating from a lack of choice and dissatisfaction with previous municipal programs (Carmichael, 2015). Many of these concerns were a direct correlation with the city's inability to manage the urban forest resource due to increasingly constrained budgets over the previous half century.

Additionally, Greening of Detroit foresters began investigating methods to increase demand for street tree plantings in their community. Initially, they chose to educate residents by sharing tree benefits as reported by U.S. Forest Service iTree research. These included increased stormwater infiltration that leads to reduced flooding, property values, oxygen production, shade and reduction of summer heat island effect, reduction of air contaminants to reduce asthma attacks and premature death (Detroit has highest asthma related deaths in Michigan). They discovered continued resistance and relatively no change in "no tree requests" and resident tree preferences.

In 2015, they adopted a paradigm shift in community education patterned after the Arbor Day Foundation: develop methods by which support for trees will be based on positive experiences with trees in their lifetime. This led to the development of a community education series titled Good Tree/Bad Tree that focused on the reasons residents experienced negative impacts with the four most prevalent tree species in Detroit (White Ash, Green Ash, Silver Maple and Norway Maple). These four trees represent nearly 36% of Detroit's 187,000 street trees and the vast majority of the dead, diseased and hazard trees with which residents were experiencing negative relationships, property damage and personal expense to remove trees on city property. This series was interactively presented at every community meeting and helped educate residents to understand the differing benefits and challenges of tree species selected by Greening foresters and those historically planted. This shift allowed Greening of Detroit staff to begin addressing residents concerns and biases and establish trust and a personal connection with city residents while demonstrating their expertise.

More importantly, the foresters and community engagement staff began involving residents at the beginning of the planning process about their choices with tree adoption, selection and prescribed ongoing maintenance on a personal level. Community engagement staff engaged residents in personal conversations as a group at

community meetings and often as one-on-one conversations on their front porches to understand their individual concerns and relationships with trees. The Greening staff built relationships with residents by inventorying the prevalent chronic neighborhood issues and need for additional resources and matched available municipality and/or other NGO's resources to mitigate residents concerns. Staff also developed and distributed a tree selection ballot tool to promote choice through the disclosure of mature tree height and spread, a representative image and the relative cost of ongoing maintenance for each tree choice to address the concerns found in Carmichael's research. Finally, community engagement staff attached a human name to each of the tree selections as an anthropomorphic strategy.

Detroit Forestry and Greening of Detroit staffs realize that shifting resident preferences and the restoration of community trust as existing hazard trees are removed will affect tree planting operations and the achievement of a healthy and sustainable urban tree canopy goal. Initial community engagement results regarding the tree selection ballot have been promising. During the fall 2015 planting season, foresters received zero no tree requests from residents as a result of this refined community education and engagement method for the first time in six years.

The Greening of Detroit staff is also engaged in developing new programs that will offer certificate training programs that lead to green industry jobs and provide environmental education programs to promote sustainable landscapes and healthy communities. These programs and continued focus on equitable and active listening, early involvement in the neighborhood redevelopment process, create demand for trees as Detroit emerges from bankruptcy and strategically envisions its return to a world class city

Conclusion

Urban trees and forests contribute to the well being of urban residents by influencing temperature, rainfall and flooding, air quality, crime, scenic quality and property values. Detroit has experienced a tremendous reduction in its urban forest quality and integrity in the past 50 years due to decimating diseases and pests, investments in monoculture planting and severe municipal forestry budget reductions. Nongovernmental organizations have accepted responsibility for tree planting and are developing a more inclusive process to educate and bring

community consensus to the redevelopment of the public forest resource. Through interviews and focus groups, Greening of Detroit staff and researchers have learned that initial resident preferences against community tree planting is about trust through early consultation and empowerment of choice and honest discussions about historical Detroit urban forestry standards including tree selection and maintenance practices.

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Ubiquitous Smart Cities: Roles and Responsibilities for Social Governance

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Abstract: The proliferation of Smart Cities around the world has introduced ubiquitous technologies and Big Data into urban life. These technologies have benefits for both more efficient urban administration and improved social welfare; however, ubiquitous administration entails special responsibilities that must be explicitly understood and upheld by bureaucracy and citizens.

Introduction

Twenty-first century public administration is entering uncharted territory in terms of the opportunities to exploit the proliferation Big Data and technologies for governance, particularly when set in the context of urban society. The Digital Age has brought great advancements for the potential of governance that must be tempered with consideration of society's tolerance and understanding of the technologies being used for its benefit. The ubiquitous mechanisms of the Smart City – domotics, Internet of Things (IoT) devices, RFID readers, CCTV with recognition software, and cellular traces – denote an atmosphere of constant dataveillance (Clarke, 1988; Degli Esposti, 2014) with the attendant risks of government being the custodian of so much information. In other words, the Smart City is not a faultless set of administrative hardware solutions to be installed in an urban environment with unfettered expectations of achieving utopia; it needs coherent policy agendas and due consideration of the roles and responsibilities for social governance mediated by ubiquitous data collection.

Smart City is used here to mean an urban environment utilizing ubiquitous information and communication technologies (ICT) infrastructures for enhanced admin-

istrative capacity. Ubiquitous ICT refers to devices and systems that are pervasive in the environment; they may serve to perform innocuous tasks like reading a license plate upon entering a garage to register a parking permit, or they may have more explicit interactions such as elevator deployment algorithms in large buildings. The ubiquitous ICT infrastructure is an omnipresent network that is built into a city for the purpose of increasing its intelligence, as both computational analysis and an atmosphere of surveillance. These enhancements are aimed to improve the functioning of the city, as well as improve the urban experience for the citizens. The character of the Smart City is often aligned with objectives of efficiency, resilience, and sustainability. There are now several major urban areas that have adopted the Smart City label: Amsterdam, Barcelona, Seoul, Singapore, and Stockholm stand out as vanguard examples. While all levels of government have a degree of ubiquitous data collection happening, it is more often focused and realized in a meaningful way at the local level. The Smart City is therefore the basic unit of ubiquitous governance, as it were.

This article is particularly concerned with the ubiquitous nature of ICT in Smart Cities and what this means

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for social governance. Social governance refers to the implementation of policy aiming to shape or regulate society's behaviors. In the Smart City, social governance is implemented by means of ICT that, by virtue of its ubiquitous installation, adds Big Data into the discussion. Figure 1 shows the simple progress of the concepts of interest; the four "stages" will be treated in turn in the following sections. Ubiquity in the Smart City is not a new issue (Lee et al., 2008; Rabari & Storper, 2015; Shin, 2009) and interest in dataveillance under Big Data has been growing (Dawes, 2010; Degli Esposti, 2014; Desouza & Jacob, 2014; Kim et al., 2014; Klauser & Albrechtslund, 2014). The intersection of these concepts with governance has also sparked recent research (Cid et al., 2015; Desouza & Jacob, 2014; Meijer & Bolivar, 2016). This paper thus continues the trajectory with the specific target of understanding the impact of ubiquitous Smart City governance on society.

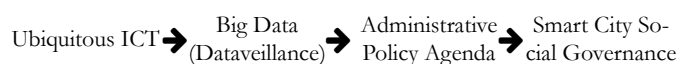


Figure 1. The progress of ubiquitous smart city governance concepts.

Ubiquitous ICT

The Smart City is predicated on ICT that enables the constant collection of data. If the monitoring instruments were of the pedestrian nature found in "normal" cities that merely counted events to provide basic data for quantitative analysis, then that would enable little more than some automated information collection for resource allocation algorithms. Ubiquitous ICT is a quantum leap forward in terms of both the variety of measurements and character of the observations that are possible, a veritable "digital skin" for sensing the urban environment (Rabari & Storper, 2015). The data is now rich with dimensions brought about by the network nature of the infrastructure, as an event can be recorded and linked to other events to provide a qualitative narrative (Batty et al., 2012).

For example, a resident in a ubiquitous urban environment would have their activity tagged and monitored from wake up (via domotics that record household power usage) to commute (public transportation smart chip charges) to work (security card log in). The

CCTV monitoring and advanced recognition software allows bureaucrats to "watch" everything a resident may do at essentially all times. Ubiquitous Smart Cities bring together video, cellular, internet, and other networked devices to know practically everything that happens in the built environment.

The capacities of urban administration took a giant leap forward with the advent and integration of Geographic Information Systems (GIS) into city management. The scope and depth of measurements available by the omnipresent Smart City ICT infrastructures mark the next major advance in governance: the potential shift from quantitative to qualitative analysis of urban activity for improved social welfare. The benefits to citizens range from safety and security enhancements to improved resource allocations and logistic solutions.

Big Data (Dataveillance)

The proliferation of ubiquitous monitoring and measurement has an attendant growth in the data that is gathered. Modern humans may believe they are more active and busy than ever before; whether or not that is true, the amount of data about their activity has increased at an exponential rate. The Smart City's ubiquitous ICT contributes to the data largesse by recording the innocuous and the intentional of the urban realm, so whether we are busier today than yesterday is immaterial as the means and capacity of observations increases. In other words, Big Data is a product of the watcher and not the watched.

Dataveillance – "the systematic monitoring of people or groups, by means of personal data systems in order to regulate or govern their behavior – sets the stage and reinforces the development of the data economy celebrated in the big data debate" (Esposti, 2014, p. 209). The merging of data and surveillance imparts ominous "Big Brother" overtones to the concept. The limit to any dark motivations in dataveillance rests squarely with the principles and objectives of the governing bodies.

In terms of governance, Big Data is a growing resource for information, assuming that the data is analyzed. The major benefits of Big Data for public administration are that it can enhance routine decision making by extending the limits of information as well as the ability to find

efficiencies through new analytics of previously disparate observations (Desouza & Jacob, 2014). For urban governance, the advent of Big Data is akin to chemistry's shift from cellular to molecular acuity in that the level and quantity of analysis available is significantly more detailed, which can only serve to improve the effectiveness of governance.

Administrative Policy Agenda

City administrations are geared toward improving citizens' lives through policies that direct efficient and effective service delivery. After the democratic mechanisms reveal what the people want, it is the duty of public administration to figure out what resources they have at their disposal to meet those desires with policy implementation. A public policy often sets out clear measures and evaluation methodologies before implementation with little room for adapting to the sort of behavioral anomalies that Big Data may expose.

The Smart City is empowered with a new set of tools that are advancing at or beyond the pace of the political process itself, occasionally resulting in the odd circumstance wherein the government has the ability to advance a policy agenda that is in front of the public's desires, i.e. a solution looking for a problem. The information provided by the Ubiquitous ICT + Big Data (Dataveillance) progression is both an object and an instrument of policy (Dawes, 2010); Smart City administrations collect the information to assess policy as well as have policies to collect information. There is due concern that governance does not demonstrate the technology ahead of the policy, as that would jeopardize the primacy of democracy to the delivery of its objectives.

The potential of ubiquitous ICT and Big Data for policy agendas is to have virtually immediate capacities for responsiveness. When a policy is implemented, the Smart City can know its effect and make adjustments in real time. This is predicated on having policies that are crafted with enough sophistication to leave room for bureaucracy to recognize and utilize information that has not yet emerged from the Big Data. An administration that can deftly apply its discretionary authority to integrate what the ubiquity reveals will have greater governance capacity than only looking for what it expects to see. The benefit to public administration is an advanced degree of sensitivity for the policy agenda, thus bringing the outputs of its activity closer to the outcomes that it desires.

Smart City Social Governance

Public administration's role and responsibility is to use the tools and techniques at its disposal for to improve the people's welfare. Ubiquity adds a unique dimension of social accountability for administration as the city monitors its citizens in new ways (Shin 2009). For the Smart City, this entails high levels of transparency in the processes of collection and analysis of the data. Beyond publicizing its findings and how they are being used, bureaucracy must be open to inviting citizens to participate in the analysis through crowdsourcing and Governance 3.0 vectors, whereby government is a collaborative effort mediated through the connectivity of the city. In this way, the social part of the Smart City governance is conducted in the virtual community network formed by the ICT devices, street-level activity, and administrators who bring it all together to inform better policy.

The citizens also have a part to play in the governance insofar as they are providers of the data that informs the administration. They must be aware of the distinction between their passivity and active participation in the ubiquitous realm. To this end, their role is to be consenting members of the process and be responsible for conducting their lives in accordance with the intentions of the ICT infrastructure. This is a responsibility for small things, like being sure to consistently swipe a security card at the door and properly sorting recyclables in the automated collection bins, as well bigger issues, such as voluntarily contributing to the feedback loop (again, through Governance 3.0) in order that policy can be adjusted to optimized to the needs of citizens.

The Case of Korea

The conceptual discussion of this paper is grounded in observation and experience in South Korea, where the Ubiquitous ICT + Big Data (Dataveillance) + Administrative Policy Agenda progression is well underway. Seoul is emerging as a global leader in Big Data applications as the city offers a plethora of open data for researchers to contribute to governance, from optimizing bus routes to garbage collection schedules. The Seoul Open Data Plaza (<http://data.seoul.go.kr/>) is a portal where citizens can see what data the city is collecting and contribute their own analyses into the discourse. Songdo – a new development in the city of Incheon – is an exemplar Smart City that demonstrates how ubiquity and environmentally-conscious design can be integrated into a coherent urban context. Songdo also demonstrates how

the technology can precede the policy, as many of its innovations have not been fully realized due to bureaucratic blockades from the parent city. Yet throughout Korea, community developments incorporate domotics and IoT networks to improve efficiencies in every regard. In a culture that prizes safety and security, the ubiquitous qualities are valued by citizens and administrators alike as improved means of implementing related policies. At present, the social governance in Korea remains of the passive sort insofar as public administration is not actively pursuing a Smart City policy agenda so much as providing the infrastructure and hoping for incremental improvements to social welfare.

Conclusion

The implications of the ubiquitous Smart City concepts for administrators is in the effects that the concepts have on behavior. More directly, administrators must be aware of how these concepts are realized in the application of policy and how it will impact citizens. The evolution of policy to embrace the dynamics of the Smart City is still in its infancy (Cid et al., 2015; Desouza & Jacob, 2014), perhaps requiring input from futurists to imagine the charter of a technological utopia. The idea of a “Smart City” evokes more than just gleaming buildings and the pleasant whoosh of automated services; it evokes a society that is efficient, resilient, and sustainable. It also promises citizens who are happier and more satisfied in their city by virtue of the benefits that the technologies bring to their lives.

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