Leading the Future City

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An Urban Future

Ours is an urban future. More than 50% of the world's population now lives in cities and it is projected to be at 75% by 2050 (Burdett & Rode, 2004, p.9). People are drawn to cities for opportunity while cities expand outward to consume ever more land to accommodate their swelling populations. At the dawn of the 20th century there were 16 cities with more than one million inhabitants; in the early years of the 21st century, more than 400 had surpassed this threshold (PRB, n.d.). According to the United Nations, the world's population growth in this century will happen almost exclusively in cities (United Nations, 2002 as cited by Cohen, 2006). There has been a second shift as well: large cities were principally located in the economically developed world before this century and now more than three-quarters of them are in the developing world (Cohen, 2004).

The challenge of leading these metropolises is complex – and mastering this complexity is essential to the viability of the human species and its social structures. Cities, however, are not new. They are as old as civilization. What differentiates leading contemporary cities from those of previous eras? Speed, scale, and sustainability are three dimensions (Campanella, 2008 p.281). Systems are a fourth:

- *Speed*: China is one nation urbanizing at an almost frantic pace; Campanella asserted that the growth of China's cities over a generation rivaled the growth of U.S. cities over one hundred years (2008, p. 281). The fastest growing mega-cities are places such as Lagos, Nigeria, Dhaka, Bangladesh, Mumbai, India, and Karachi, Pakistan (Burdett & Rode, 2004, p. 28). Inskeep (2011) has coined the term "instant city" to describe those cities that, since 1945, have grown significantly faster than the

countries of which they are a part. He noted that Karachi, Pakistan will add a greater number people in between 2010 and 2025 than the residents of Washington, D.C. – a population that has amassed over more than 200 years.

- *Scale*: Cities are growing in scale: in 1950, only two of the world's 20 largest cities had more than 10 million people; by 2005, all 20 exceeded that number (Soja & Kanai, 2008, p.60). Chonguing, China is now 99 times larger than New York City in land area (Campanella, 2008). Over the next 20 years, the world's cities are set to expand by an area equal to Germany, France, and Spain combined. Much of this growth will occur in what are now small- and medium-sized cities significantly increasing their scale (Callway, 2012).

- *Sustainability*. This new age of urbanization is occurring as the world grapples with the effects of climate change which may threaten some population centers and have a significant impact on numerous others. Many of the areas under greatest threat of climate change are also centers of the greatest population growth (Rogers, 2012). Cities have long been built near bodies of water, for example; if forecasts of rising sea levels are accurate (Nichols, 2004; IPCC, 2007), long familiar urban contours will be altered or erased. However cities themselves may be the best chance for an ecologically sustainable future because they are less resource intensive per capita (Glaeser, 2011, p. 13-15; Hern, 2010, p. 9).

- *Systems*: Cities are increasingly understood as complex systems with interdependent social, service, resource, infrastructure, and natural sub-systems (Harrison and Donnelly, 2011). Where leadership of a city might once have been relatively

straightforward, the complexity of the endeavor is now more apparent and thus must be addressed by leaders.

Another differentiation, as noted above, is that population concentration no longer correlates with wealth accumulation. We are entering an age where many of the largest cities will be among the poorest. They will lack the resources to provide even basic services to their populations. Conceptions of governance, infrastructure, and function are likely to be different as a result. Friedman asserted that the world is flat (2005) in that people in traditional centers of wealth must now compete with people around the globe operating under far different constraints: why have computer code written in Boston when someone in Bangalore will do it for a fraction of the price. Florida countered that the world is spiky (2005): despite global access to the tools to compete, economic activity is increasingly concentrated in a relatively few urban areas while other, sometimes larger, cities lack economic vitality.

Cities are the engines of prosperity for the world and for the countries in which they reside (Soja & Kanai, 2008, p.62). Taken individually, the metropolitan areas of the United States would rank as 47 of the world's top 100 economies as of 2004 (Florida, 2005). Even in the developing world, cities are more prosperous than rural areas (Glaeser, 2011, p. 74-75).

Four Types of Urban Areas

McNulty and Thompson (2010) presented a framework of four types of urban areas: Legacities, Technotopias, McCities, and Cities of Desire. Each of these may manifest individually or in combination within the formal boundaries of a city. Together, these four provide a glimpse at the contours of future cities.

Legacities are those long established urban centers such as London and New York. They have evolved over centuries into their current form. A major challenge leaders of Legacities face is rejuvenation and renewal in the face of aging populations and infrastructure. There is an emerging specialty of "urban gerontology" in city planning that concerns itself with remaking the city to accommodate its elderly citizens (Spinney, 2010). Infrastructure renewal may be more problematic as complex and expensive processes have developed over time, including environmental impact assessments, neighborhood consultations, review of the impact on historic structures, steps to ensure access for those with physical disabilities, and accommodation for multiple languages to name but a few. Legacities may also face high labor and land costs as well as the need for sophisticated technology. Boston's "Big Dig" suppression of the Central Artery took years longer than expected and ran $10 billion over budget (Stern, 2003). The new British Library that opened in London in 1998 took more than 35 controversy-ridden years of planning and construction (Maas, Sverdloy, & Waugh, 2009 p. 104; Building the British Library, n.d.).

Technotoptias are new-built urban areas that hope to attract the best and brightest from around the world by offering state-of-the-art technology, research laboratories, and other amenities. Singapore and Dubai are prime examples as is Lavasa, India (Kahn, 2011). London's Canary Wharf development is an example of a technotopia within a Legacity. Technotoptias arise when there is financial capital for infrastructure but not sufficient local human capital to ensure economic vitality, innovation, and competitiveness. These tend to be highly planned and centrally run cities or city-states. Singapore, a successful Technotopia was rated as the world's third most competitive city in 2012 by the Economist Intelligence Unit (Kennett, 2012). A version of the Technotopia is the eco-city which is designed and constructed in ways that minimize environmental impact, often through the deployment of the latest technology and

materials (Alusi, Eccles, Edmondson, & Zuzul, 2011). Challenges for leaders of Technotopias include duplicating the appeal of London or Shanghai through inanimate materials and financial compensation in hopes of attracting a critical mass of talented people who will, in turn, be a magnet for others. A city is its people first and infrastructure second (Glaeser, 2011; Hern, 2010, p. 164]); leaders in a Technotopia endeavor to reverse engineer a vibrant metropolis.

McCities are new-built urban areas that utilize common rather than cutting-edge planning tools, materials, and methods. Fifty-percent of the new floor space in the world is being built in China, yet much of it is being built such that the buildings use two-to-three times the energy than is common in the developed world (Jennings as cited by McKibben, 2010; McKibben, 2010, p. 70-71). These choices are a matter of both cost and speed. According to Campanella (2008, p. 14):

> "Since the 1980s, China has built more skyscrapers; more office buildings, more shopping malls and hotels; more housing estates and gated communities; more highways, bridges, subways and tunnels; more public parks, playgrounds, squares, and plazas; more golf courses and resorts and theme parks than any other nation on earth—indeed, than probably all other nations combined."

Much of this was done at "warp speed"—what has come to be known as "Shenzhen tempo": building a floor in a skyscraper every two-and-one-half days (Campanella, 2008, p. 281). While leaders in Beijing and Shanghai may boast about plans for Dongtan, the model eco-city envisioned for Chongming Island just off Shanghai – which has, it must be noted, stalled (Moore, 2008), more mundane urban development has continued at a rapid pace.

China is not the only home for McCities but it provides an ideal laboratory for examining the phenomenon. Leaders in McCities face an extraordinary challenge in balancing short- and long-term perspectives as well as finding a viable mix of residential and commercial development and providing basic infrastructure given the speed at which their cities are evolving.

Cities of Desire are better known as slums, shadow cities (Neuwirth, 2005), or squatter cities (Brand, 2006). I prefer the term "Cities of Desire" because these dense, seemingly chaotic, and largely unsanctioned concentrations of urban dwellers are full of aspiration. It is drawn from the expression "desire path" which describes erosion caused by people creating a preferred route between two points without regard to formally established walkways or roads, making it clear "where we want to go, and how we want to get there" (Browning, 2004, p. 66). People come to these cities seeking the shortest route to a better life just as people have come to cities for millennia (Campanella, 2008, p. 182) despite that some in the developed world find informal development to be negative (Harrison & Donnelly, 2011). These are the *favelas* of Rio, the Dharavi section of Mumbai, and the outskirts of Shenzhen, China. Poverty rates in cities of desire are often lower here than in the rural areas from which dwellers have come (Glaeser, 2011, p. 10); residents also report being happier than their rural counterparts (Glaeser, 2011, p. 74). Neuwirth (2005) predicted that three billion people – one third of the world's population – will live in such settlements by 2050.

Cities of Desire are often part of or adjacent to Legacities, hence Neuwrith's term "shadow cities," as residents seek entry into the economic life of the established settlement. They are often situated on the least desirable land and lack basic city services. Though some may have a reputation for high crime rates such as Rio's favelas (Arias & Rodrigues, 2006), others such as those in Mumbai are considered relatively safe (Glaeser, 2011, p. 107).

Leadership in Cities of Desire is as informal as the settlements themselves in that there is not a mayor, city council, or chamber of commerce. Leaders may be activists, gang members, or simply neighborhood elders. They must exercise their influence and authority that differ from those available to formal leaders in other urban settings.

Cities of Desire and Legacities are "natural cities" in that they have evolved organically over time while Technotopias and McCities are variations of "artificial cities" (Alexander, 1965) which are more tightly planned and which may be envisioned in a small number of iterations.

Given these disparate urban forms, are there insights on leadership that are common across them? Is there a single leadership model that traverses such divergent needs and circumstances?

Systems-centric Leadership

No matter the differences in their age, wealth, geography, political structure, or ethnic makeup, all cities are complex systems (McNulty, 2011a). Understanding this is the first step to discerning what might be universal challenges and approaches to urban leadership. Complex systems are dynamic; their components are interconnected and interdependent although there can be variation in the inter-relatedness within sub-systems and across the meta-system. Relationships between the components are more significant than the components themselves (Katz & Kahn, 1978 as cited by Schneider & Somers, 2006; Wheatley, 1999, p. 36) and any change to one element will foster change to all of the others. The more difficult it is to describe the relationships within the system, the more complex it is (Gell-Mann, 1994 as cited by Schneider & Somers, 2006). This is consistent with Alexander's assertion (1965) that the

complexity of a city is greater than can be comprehended by the human brain in a single design exercise.

Schneider and Somers (2006) examined complexity and systems theory in the context of organizations as complex adaptive systems and posited that leaders can be crucial to self-organization and as context setters. Such leaders work through influence rather than authority. Schneider and Somers advanced a theory that such influence could be exercised through indirectly affecting the variables of organizational identity and social movements that would, in turn, affect the ability of the system to self-organize, adapt, and evolve. Given Alexander's insight into urban complexity, Schneider and Somers' work at the organization-level may not be directly applicable at the level of a city. It is, however, directionally useful in establishing that there may be distinct attributes of leadership in complex systems and that leadership in such systems may not be rooted in a single individual.

Another aspect of leadership of complex systems is that not only does it not necessarily correlate with, and may be independent of or in opposition to, formal authority structures (Schneider & Somers, 2006). So, too, may leadership be exerted by multiple people either through collaboration or chance. Given that the most significant growth is expected in urban areas of the developing world and the inclusion of considerable informal City of Desire areas within the greater metropolitan areas of even well-established Legacities there, it would not be unexpected for new leadership models and methods to emerge based less on formal authority than other attributes.

McNulty (2011b) put forth a model of leadership "of a system," "in a system," and "with a system" reflecting where the leader saw him or herself in relation to the system. Each

perception suggests different points and methods for exerting agency: the individual or group who perceives themselves as leaders *of* a system may believe themselves as solo agents and believe themselves to have greater control of the system and act accordingly; leaders who see themselves *in* a system may perceive less direct control and rely more on influence, relationship building, and other indirect methods to effect change as they work with co-agents with perceived complementary leadership capacity. This alliance and coalition building may be undertaken with the desire to amass power and control or simply to engage a multiplicity of voices and resources; the leader who sees him or herself acting *with* a system is concerned not with a central plan for a city but rather with articulating the system's central desire. This latter leader may be less likely to believe that leadership should derive from a designated elite but rather see leadership potential throughout the system. Formal leadership roles and structures would be constructed only to the minimal extent needed to facilitate self-organization.

A systems perspective is, however, distinct. Many constituents in the system will worry about their components – how does this affect me? – while leaders must take a more expansive view – how does this affect us? For example, increasing density is commonly advocated as beneficial for cities as it typically lowers overall housing costs by increasing supply, lowers the carbon footprint by housing more people in more efficient multi-family buildings, and increasing the opportunities for chance encounters that spur creativity and innovation (e.g. Glaeser, 2011, Calthorpe, 2011, Hern, 2010). However, undertaking such an effort would also impose a cost on current property owners, the value of whose property is likely to suffer. In the long-term, the system will be better served by greater density yet in the short-term many stakeholders may be vociferous in their opposition to serving this greater good because they will pay a personal price in doing so. Leaders must endeavor to manage this tension.

Systems-centric leadership theory would suggest that no single leader can exert control over a complex system (Wheatley, 1999, p. 25). Leaders who believe that they can exert such control are confusing discrete sub-systems, such as a corporation or municipal agency, for the meta-system or are mistaken with regard to the extent of their own power. The "Arab Spring" (Anderson, 2011) and "Occupy" movements (Occupy, n.d.) demonstrated that formal leaders were not as fully in control of their systems as they believed: dictators fell and mayors were unable to remove protesters, respectively.

The future city will require effective leaders of sub-systems such as public sector agencies, private corporations, and non-profit organizations. They will also require leaders in the system working together and those that are fortunate will have a leader or leaders with the system who can move beyond self-interest to work to have the city be true to itself.

Mastering Tensions

It is argued here that leadership can be viewed as an attempt to optimize system function through the mastery of a series of tensions in the system: order versus disorder, public versus private, centralization versus decentralization, top down direction versus bottom up emergence, and basic needs versus higher order needs to name but a few. These are tensions in that a decision to move in one direction curtails the ability to derive benefits from the alternative; there is no objective ideal permanent point on the continuum – equilibrium is momentary at best in a dynamic system; and the choices may seem contradictory when they are actually complementary. The challenge may be in choosing the right tension to address at any given time (Dodd & Favaro, 2006).

A consideration of tensions within an urban system provides a conceptual framework for the examination of the choices and challenges faced by leaders no matter their position or the characteristics of the urban area in which they lead. Actions taken may be direct or indirect. The answers may be different, but the questions are largely the same.

In this paper, three tensions will be explored: order versus disorder, planning versus emergence, and physical infrastructure versus information infrastructure.

Order versus Disorder. The tension of order versus disorder, or chaos, is a rich one for exploration. One might think that order is highly desired as great effort is expended on regulations, physical devices such as crosswalks and stop lights, law enforcement, and other activities intended to formalized interactions in the metropolis: "a good city has to be safe and citizens have to be secure in both public and private" (Hern, 2010, p. 164). However, serendipity and the unexpected are among the most essential ingredients for a vital city. Cities free people from social convention and in doing so spur experimentation and innovation (Glaeser, 2011, p. 129). An engaging metropolis is never in stasis; it is constantly moving from order to apparent chaos and back to momentary order in a process of continual transformation. "Ideas move from person to person within dense urban spaces, and this exchange occasionally creates miracles of human creativity" (Glaeser, 2011, p. 19).

Thus a leader must on the one hand strive to enable the stability of certain core functions such as the delivery of clean water and removal of human waste, and on the other work to encourage an environment in which the unexpected can happen. People must be able to bump-and-connect with their fellows if the greatest benefits are to be derived from living in an urban setting. There are benefits to predictable and well-functioning governance (Inskeep, 2011, p.

243) yet conditions must not be so stultifying that they dampen the unpredictability of originality. This is a challenge for leaders in Technotopias and McCities whose physical plans are well-laid and who must stimulate the human dimensions: office parks and gated communities provide high levels of order but may do so at the expense of "random interactions and intellectual excitement" (Glaeser, 2011, p. 198).

In Cities of Desire, disorder may seem to reign supreme. However, there is in each a distinct order including complex social and economic networks. The challenge for leaders is to build upon this base to add only the additional order to catalyze community development. Efforts to relocate the poor to newly constructed communities with improved facilities can often leave residents poorer, socially and economically, than they were before because social and economic connections are disrupted (Inskeep, 2011, p. 95; Campanella, 2008, p. 171). Initiatives that respect the value of the existing community, no matter how disheveled its appearance, may have greater success: Certificates of tenure that provide some security to the residents of unauthorized settlements can lead to modest investments by residents that improve the physical infrastructure over time (Neuwirth, 2005). A long-term leasing arrangement in the Manangkasila settlement in Bangkok led to dramatic improvements in the physical environment while also preserving community structure (Boonyqbancha, 2011). In Medellin, Columbia, a cable car system provides convenient, rapid connections between informal settlements and the central public transport system making it easier for poor residents to commute to and from jobs in the formal economy (Smith, 2011). In each of these examples, authorities have carefully calibrated the order they attempt to impose on the system.

Further complicating decision making for the leader is that different stakeholders will define order and disorder differently. The introduction of bicycle lanes in the Legacities of New

York or Boston may delight bicyclists as it brings greater order to their commute while motorists may perceive that bicycle lanes increase disorder by encouraging more cyclists onto the roads (Schuler, 2011). Nor can leaders repeal the law of unintended consequences: Officials in Karachi may have thought that they were increasing order when they installed covered sewers in the Korangi neighborhood. However, the city did not have the resources to clean those sewers and the covering made them inaccessible for residents to clean. Debris accumulated such that the street level actually rose and the houses appeared to sink. From an attempt at order came greater disorder for residents (Inskeep, 2011, p. 217-218).

Order and disorder are complementary, not oppositional (Wheatley, 1999, p. 117). Disorder is not bad; it is a necessary part of transition and transformation. The alternative to evolution is extinction (Pascale, Milleman, & Gioja, 2001, p. 267). Seeing order and disorder in this way brings a leader closer to perceiving the city as a living, functioning system. The leader manages the tension between order and disorder by always seeking the edge of chaos, the "sweet spot for productive change" (Pascale, Milleman, & Gioja, 2001, p. 74) where the city can adapt, evolve, and transform.

The City of Desire may be that edge for the Legacity with which it cohabitates; for other Legacities and Technotopias, the edge may be found by attracting the Creative Class (Florida, 2002). The McCity may have to grow into productive disorder over time. Leaders may take comfort in the iterative nature of this process; there is no final victory, only a continual coping with changing circumstances, needs, challenges, and opportunities (Pascale, Milleman, & Gioja, 2001, p. 73).

Planning versus emergence. Closely related to the tension of order versus disorder is the tension of planning versus emergence which could also be expressed as centralization versus decentralization.

The formula for an economically successful city is conceptually fairly simple: combine educated workers, small entrepreneurs, and a creative interplay among different industries that spurs ideas and innovation (Glaeser, 2011, p. 132). These, in turn, rely on access to capital, talent, and markets in a sufficiently dense urban agglomeration (Soja & Kanai, 2008, p. 68) and must be supported by reliable and rigorous governance. How these ingredients are combined, however, can vary widely: some may seek to follow a strict recipe while others may prefer to trust that if one throws the right ingredients in the pot, something good is bound to result.

Leaders in any city would seem well-served to take steps to bolster education from the earliest levels up to and including research universities as education levels are a reliable indicator of urban growth, particularly in older cities, and increasing the percent of the population with college degrees boosts the wages for all workers (Glaeser, 2011, p. 63, 253). In the developing world, education pays dividends as well: Dossai (2011) asserted that girls in Africa who receive a formal education are less likely to contract HIV, will earn more income, and have smaller, healthier families. Delivering education may be accomplished through planning but also through helping set the conditions from which education can emerge: The IDP Foundation, for example, has initiated a micro-finance program that supports local education entrepreneurs who run affordable private schools as an alternative to the free, but poor quality public schools and expensive traditional private schools in Ghana (Pritzker, 2011). The foundation's programs do not establish schools but rather help existing schools overcome market and structural obstacles to their success.

Education, alone, however, is not sufficient. If it were, every college town in the world would be an economic powerhouse. Research universities, in particular, spawn new ideas that may lead to commercial opportunities. There must be fertile ground in which the innovation can take root and grow. How much of that can be planned and how much is best encouraged to emerge?

Cities are self-organizing systems (Allen, 1997, p. x) and such systems will change structures in order to preserve function. People will seek and find ways to exchange value as they have done for centuries. Planning has a mixed record: for example, the attempts by Gropius at Bahaus and LeCorbusier with L'Congrès Internationaux d'Architecture Moderne to spread well-designed, inexpensive housing for the working class resulted in what are now regarded as "hideous and soulless apartment blocks" (Lewis, 2008). Hern (2010, p. 60) urged striving for a city that "unfolds" over time rather than one that is overly orchestrated and suggested that "city-building leadership should not be left to experts and bureaucrats" (p.10). China's dramatic economic growth has come only after Deng Xioping orchestrated the move from a centrally planned economy to one that is far less formal if still more tightly constrained than those of the United States and Western Europe (Campanella, 2008, p. 18). Does New York owe its economic success to the tight grid layout of the streets in Manhattan or to its natural harbor that both facilitated transportation of goods and the influx of immigrants eager to work for a better life?

Planning and policy, however, are not without their usefulness. Glaeser (2011, p. 12, p. 168) indicated that "transportation technologies have always determined urban form" and that geographic use adapts to take advantage of the most useful transport. Planning decisions that make bicycles an easy, safe, inexpensive, and fast means of transport in cities such as Munich and Copenhagen ensure that many citizens will opt for them over an automobile; in many

European cities, the bicycle's "share of mode" is as high as 10% or more whereas Boston was pleased to see an increase from 1% to 2% in 2010 (McNulty, 2012). Glaeser (p. 167) further suggested that the combination of highways, poor urban schools, and the mortgage interest deduction have conspired against denser urban development in the United States. He noted that "almost half of the jobs in the top 98 metro areas are 10 or more miles from the city center" (p. 177) which all but guarantees that the car is the dominant form of transportation, bringing with it time-consuming commutes and high carbon emissions. Where public transit, walking, and bicycling are viable options, their share of mode is significant. Conversely, when these options are expensive, inconvenient, or not available, their share of mode is small and the automobile is the most frequent alternative (Brog & Mense, n.d.).

Consistent with this, Calthorpe (2011, plt. 4-5) has argued that high density urban neighborhoods in the Legacities of the United States have approximately one-third the carbon emissions, consume less than one-tenth the land, require about one-third the vehicle miles traveled, and have property values almost double those of low density suburban neighborhoods. Thus planning that enables or encourages high density development has significant environmental and economic benefits without the need to plan every block in detail. Glaeser's recommendations to limit the home mortgage deduction (2011, p. 265) is an example of a step leaders could take to remove the incentive toward sprawl.

Eisenstadt and Sull (2001) argued that businesses operating in fast-moving markets must be agile. To be successful they must structure their strategy as "simple rules" that enable them to be nimble in the midst of market confusion. Increasingly, cities face analogous competition and conditions, and may benefit from a similar philosophy: make hard-and-fast rules only where absolutely necessary and allow maximum freedom within those constraints. Eisenstadt and Sull

(2001) laid out three strategy "logics" and one can see how variations of them are being used by cities: *Position* in which one establishes, fortifies, and defends a position. One can see this in the competition between New York, London, Hong Kong, and Dubai to be the world's dominant financial center. *Resources* in which one leverages "unique, valuable, or inimitable resources" to create advantage. One can see this in the efforts of Shenzhen and other cities in south coastal China to use their geographic position, government support, and access to low cost labor to dominate global manufacturing. Finally there is the *Simple Rules* logic which is based on pursuing opportunities as they arise. Advantage arises from the agility of "key processes and simple rules" (p. 109). Houston, for example, is alone among major U.S. cities in that it does not have a zoning code. Developers are free to follow the market and the result is that housing has remained more affordable than in many other cities (Glaeser, 2011, p. 192). A position strategy is recommended in stable times; a resources strategy is appropriate in times of moderate change; and the simple rules strategy is preferable in the midst of ambiguity and rapid change. Urban leaders may do well to assess the rate of change and level of uncertainty in their cities as they determine a guiding strategy for the future.

Glaeser (2011, p. 161-162) offered three simple rules to harvest the greatest benefits from Legacities in the United States (and one imagines that variations could be developed for the other urban forms): replace complicated and lengthy permitting processes with a system of fees that take into account the impact of the proposed projects; severely limit historic preservation to that which is truly significant and not simply old; and give neighborhoods some "clearly delineated power to protect their special character" but not the power to stop all construction. He believed that these simple rules would eliminate the need to develop extensive regulations and processes that restrict building heights, uses, and styles. Instead they would enable the city to evolve and

transform. One need not agree with these specific rules to acknowledge that such an approach is a conceptual alternative to extensive top-down regulation.

Physical infrastructure versus information infrastructure. As theoretical as may seem the tension between order and disorder, the tension between physical infrastructure and information infrastructure is quite concrete. The former has been a challenge for as long as there have been cities: the need for roads, waste disposal, water delivery, markets, and such. Residents have likely been complaining about infrastructure shortcomings and mayors worrying about finding the budgetary resources to build and repair them since both were walking about the city in togas.

As cities grow and their economies mature, providing sufficient physical infrastructure becomes more expensive and more complex. As an example, The American Society of Civil Engineers (ASCE) gave the United States an overall grade of D on its 2009 Report Card for America's Infrastructure and estimated that the needed investment to raise that grade to A would be $2.2 trillion over five years. ASCE estimates that the U.S. invests 2.4% of its GDP on infrastructure while Europe invests 5% of GDP and China invests 9% of GDP (ASCE, 2009). While not all of this is investment in urban systems, even money spent in rural areas is done in part to connect them to cities and to enable goods and people to flow to and from cities.

The information infrastructure is a newer phenomenon yet it is quickly becoming essential for leading a contemporary city. One aspect of this is the deployment of technology to better see and understand the urban system; this is often referred to as the desire for "smart cities" (Harrison & Donnelly, 2011). Harrison and Donnelly (2011) cite several benefits cities have derived from these investments: lower resource consumption (New York), better utilization

of the existing infrastructure (Stockholm), new services that may be made available, improved commercial opportunities (Singapore), and improved resilience (Peterborough).

Second, as economies become more dependent upon information as a core component of economic as well as social networks, leaders must consider how a city's systems and processes can best optimize information flow as much as they ponder how goods will move efficiently through the metropolis. Coward and Salingaros (2005) have argued that cities have an information architecture that is as essential to understand as any physical architecture. They called upon planners to use an understanding of a city's patterns of information exchange to support heuristic urban evolution rather than imposing strict master plans. In this view, even the most rudimentary technological infrastructure should inform the development of physical infrastructure.

It must be noted that information infrastructure is not meant to replace physical infrastructure. In fact, it is integrated into much new construction and is integral to many traditional functions such as manufacturing. However it can be expensive and thus competes with physical infrastructure for resources and attention. Physical infrastructure has the advantage of being visible: one may get more credit for building a new bridge than for a series of sophisticated sensors that help traffic flow smoothly over a number of bridges.

However, it is now thought that for a city to function effectively at a system it must have sufficient complexity throughout its functions: "smart" cities should better meet the needs of their citizens than "dumb" cities because technology helps make the invisible system – comprising millions of individual actions and decisions – visible (Harrison & Donnelly, 2011). Leaders ignore information infrastructure at their peril. Balancing the tension between physical

and information infrastructure can be achieved by measuring investments based on the extent to which they improve the accuracy of perception. Even in Cities of Desire where there may be great need for physical infrastructure, utilizing technology to enhance perception and understanding may increase the likelihood that investments in physical infrastructure are prudent and effective. Once again, seemingly contradictory choices can be, in fact, complementary.

Perceiving Tensions

A framework for leaders to effectively manage tensions is the PUPA loop (Ashkenazi, 2011, personal communication): they must *perceive* what is happening, *understand* what this means, use that knowledge to *predict* what is likely to happen next, and take the suitable *actions*. Perception is where the vast majority of errors occur because if one perceives accurately one is more likely to understand, predict, and act in an effective manner; inaccurate perception makes it impossible to take the other steps appropriately except by dumb luck.

The PUPA loop can be employed with a systems perspective: what must be perceived is the system and the task of the leader is to embrace and foster those processes and instruments that enhance perception. For example, the city of Portland, Oregon developed its master plan to cover the years until 2035, its first in more than 30 years, through a high-engagement public process that covered more than zoning requirements; it explored the purpose of the city – why citizens would want to invest their time, treasure, and talent in this place – and the common values that they aspire to have guide their community (Vision PDX, 2008).

Portland has also invested in information technology in an attempt to make their urban system more visible. This systems-based attempt to model the interactions throughout Portland included 3,000 equations (Lindsay, n.d.) – a level of complexity not possible without

sophisticated technology and the ability to use it well. This model was designed with the hope that it could reveal interconnections and interdependencies not readily otherwise visible. It allows for virtual experimentation: for example, what is the likely effect of a transit fare increase on high school graduation rates, obesity levels, vehicle miles traveled and other variables?

Such models are not perfect but they do have the potential to elevate leadership decisions out of the danger of simplistic assumptions about the benefits or costs of any particular initiative or project. One must wonder whether some of the grand urban renewal projects of decades past, such as the demolition of Boston's West End neighborhood, might have been reconsidered if the far reaching negative effects that "improvement" would bring and their failure to cure social ills (Fried & Gleicher, 1961) could have been foretold through modeling. As urban areas evolve more quickly and at greater scale, traditional methods for accommodating those changes may strain or fail.

By exploring purpose, individual actors may be better able to determine how useful they are being in the system: What jobs are they helping people to do? What value are they perceived to create? By establishing shared values, the city is honoring the system: How do its citizens want their singular and collective lives to be lived? How are they willing to be held accountable for the quality of the community? By creating public performance metrics, they measure their contributions to the system: Are they progressing toward their objectives? Do course adjustments need to be made?

IBM utilized its Jam technology to bring together more than 300,000 employees globally to revisit its values in 2003 (Our values, n.d.). In 72 hours they developed shared values that spanned cultures, geography, and tenure. While a corporation is not a city, this exercise

demonstrates that a large, diverse group can be convened to co-create guidelines for its future. These values will illuminate how IBM manages the tensions it faces. Mind Mixer (www.mindmixer.com) is bringing a similarly technologically driven approach to urban design and other municipal issues.

Through perception initiatives such as these, leaders are better positioned to distinguish the meaning of activity in the system. They may see the tensions at work. This understanding may, in turn, help them to trust the self-organizational capabilities of complex systems as the system endeavors to be more true to itself. The urban future of Earth's inhabitants will be marked by increasing scope and scale. Sustainability will be a significant challenge. The leaders of the urban future will be required to engage complexity through the many tensions in the system.

Meadows (2008) identified ways to intervene in a system to effect change. The most common tools employed by city leaders fell at the bottom of this list (taxes, subsidies, and standards) or in the middle (information flows, punishment, incentives, and constraints). An approach that takes a higher view and embraces tensions may be a better path for leaders to advance to the top of Meadows' list: leveraging self-organization, altering system goals, or transcending the current governing paradigm.

Conclusion

Increasing scale and speed will only add to the complexity of leading the future city: there will more moving parts interacting at greater velocity. An increased understanding of systems may be useful in this regard.

Cities will continue to attract people, particularly poor people (Glaeser, 2011, p. 90). The number of people living in Cities of Desire is projected to double to two billion by 2030 (Smith, 2011b). Sheela Patel of Shack/Slum Dwellers International asserted that "…for a few decades to come, governments and cities will have neither the capacity nor the strategy to deal with existing slum dwellers" (Smith, 2011c). Speaking at the 2012 Planet Under Pressure conference, Professor Roberto Sánchez-Rodríguez at the University of California suggested *"*We need to move beyond traditional approaches to planning and be responsive to informal urban growth, to the value of ecosystem services, and to the need of multidimensional perspectives (social, economic, cultural, environmental, political, biophysical*)*" (Callway, 2012).

Climate change is projected to bring more extreme weather events and rising sea levels that will threaten many urban areas both rich and poor. What are now "100 year storms" have been projected to occur as frequently as every three to 20 years in the not-too-distant future (Chu, 2012). Sustainability, in its broadest sense, will require leaders to address a wide range of complex environmental, social, and economic challenges many of the factors in which are far beyond their control.

To navigate this treacherous and novel terrain, leaders will need to take a systems perspective and understand the leverage points for catalyzing change within them. Leaders need to be facile in managing tensions. There will be few easy or clear cut "right" answers; instead, there will be a continuous dynamic interplay among a multiplicity of forces where the leader must endeavor to perceive the central desire of the system and then exert influence to remove obstacles to the realization of that desire. It will require leaders to realize that there are many "complementary contradictions" (Ashkenazi, I. personal communication, March 10, 2012) where a counterintuitive action may be necessary to increase the likelihood that the desired result will

materialize: strategic disorder may catalyze greater order; an understanding of information flow may inform better physical designs; and an openness to emergence may accomplish ends which elude formal planning processes and methods.

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