04 Urban Pulse: (Re)Thinking Cities as Living Ecosystems

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ABSTRACT: Cities are often perceived as static, human-made constructs, but this article reimagines them as living, adaptive ecosystems. Drawing parallels between urban environments and biological systems, it argues that cities function as complex adaptive systems, evolving through decentralized interactions rather than top-down planning. The discussions relate to emergent behaviors in urban life, the role of resilience in city planning, and the tensions between state-led intervention and grassroots adaptability. Through case studies, focusing particularly on Bengaluru, the article examines how local communities and informal networks play a crucial role in shaping sustainable urban futures. It calls for a paradigm shift in city planning-one that would emphasize self-organization, adaptability, and the symbiotic relationship between built and natural environments.

"We shape cities, and they shape us."- Jan Gehl (2013)

Imagine walking through a bustling urban city.
The streets hum with life—cars zip down avenues, pedestrians weave through crowds, while markets, theatres, and cafes pulse with the collective energy of human interaction and lights flicker with a rhythm that seems almost alive. It's a choreography of countless individual actions, seamlessly creating the vibrant, living tapestry of urban life. In many ways, a city mirrors the intricate behaviors found in nature, such as an ant colony or a murmuration of starlings. Ted Schultz (2022), an entomologist discusses the phenomenon of evolutionary convergence and emergence within ant colonies that explains parts of their system acting in simple ways but produce collective behaviors that are remarkably sophisticated, without central direction. Ants don't have a leader barking orders, yet their colonies build intricate networks, solve complex problems, and adapt to challenges seamlessly. Similarly, individual birds follow basic rules—stay close, match speed, avoid collisions—but collectively, they form mesmerizing flocks that twist and turn as if guided by a single mind. Many zoologists believe rather than an individual being studied at a scale of colony or community helps to understand the construct of their complex social structures (Fuller-Wright, 2018).

Now think about cities. Like ant colonies and bird flocks, cities operate as emergent systems or or natural phenomena that enable urban life to function, interact, self-organize, adapt, and evolve as resilient systems. Millions of individuals—each making decisions based on their immediate surroundings—contribute to the ebb and flow of urban life. Traffic patterns, market economies, and even cultural trends emerge not because of a singular controlling entity but through countless interactions at the micro-level. Much like entomologists argue that ants should be studied as colonies rather than as individuals, viewing cities as living organisms rather than merely as collections of buildings offers a valuable heuristic or learning opportunity. This perspective helps us understand cities as complex, emergent systems that breathe, grow, and adapt, responding to the needs of their inhabitants and the pressure of their respective environment. This ontological shift—from traditional top-down city planning approaches, which often 'isolate the process from context and outcome' (Fainstein, 2005), to viewing cities as Complex Adaptive Systems (CAS) (Moroni & Cozzolino, 2019) — explores the politics of urban life, infrastructure, technological development, and the tension between natural growth and state interventions in and around city planning practices, reshaping and questioning the theoretical underpinning of contemporary city planning approaches.

City and Complexity

Although the concept of city planning is not new, the evolutionary understanding of cities and planning practices largely started in 1961 when Jacob (1961) urged us to consider the reality of how cities actually function, as opposed to how urban designers or planners envisioned them (Campanella, 2017). She unravelled the inherent drama, multiple layers, various actors, intricate process and hidden motives within and surrounding city planning practices. Subsequently, there has been a growth in literature recognizing cities as complex systems and its influence on the way we articulate urban phenomena (Moroni & Cozzolino, 2019).

Cities are complex systems due to the presence of multiple interconnected components (Moroni & Cozzolino, 2019) like actors, their social action and local practices, context, public policies, structure and interconnective networks that bind all of these components together. These components interact with each other simultaneously resulting in a complex, dynamic and difficult to predict system called cities. Portugali (2016) explains, "when we consider cities as a set of material components alone, the city is an artifact and as such a simple system; as a set of human components – the urban agents – the city is a complex system" (Moroni & Cozzolino, 2019).

Complex systems are often defined as large systems composed of numerous interconnected parts that continuously interact within a specific environment (Simon, 1996). Through these interactions, such systems exhibit the ability to react, adapt, and self-organize, much like urban living ecosystems. This self-organizing and adaptive nature enables complex systems to endure over time, even under changing conditions, by building resilience. These properties often give rise to emergent behaviors that are both non-trivial and difficult to predict (Heylighen et al., 2006; Tan et al., 2005). Recognizing cities as complex systems is essential, as it underscores their capacity to sustain human civilizations through endless triumphs and challenges. Cities demonstrate an inherent ability to adapt to uncertain conditions imposed by external forces, surviving and thriving by leveraging their diversity and redundancy to self-organize internally.

This nuanced understanding of cities as complex systems, encompassing heterogeneous structures and, more importantly, various human agents rather than material components alone, has a significant impact on emerging perspectives in city planning globally.

Tensions between Control and Emergence

While theoretical frameworks offer immense potential and promise, they also spark endless debates, questions, and criticism—particularly concerning the disconnect between these frameworks and their practical application in city planning. Despite the conceptualization of cities as CAS, state interventions often impose top-down control, overshadowing bottom-up emergence.
For instance, numerous scholars have observed that government-led smart city interventions, which leverage advanced technologies to enhance the quality of urban life, often prioritize online channels for interaction over direct engagement with human agents, effectively sidelining them in the process of city development (Brandt et al., 2018; Saunders & Baeck, 2015; Subbanarasimha et al., 2023). These interventions aim to track, monitor, and regulate human activities, ultimately influencing and shaping the trajectory of urban growth.

The tension between top-down and bottom-up approaches is not a new phenomenon. It has been a defining feature of human civilization's evolution, shaping hierarchical structures and governance throughout history. While top-down control plays a significant role, it is bottom-up emergence that enables cities to self-organize and adapt to both external interventions and internal disruptions. This adaptive capacity allows cities to thrive and endure even amidst uncertainty. A recent field study I conducted in Bengaluru on the bottom-up interactions among frontline workers, citizens, and government officials involved in a proposed solid waste management intervention under the smart city mission revealed that, despite widespread criticism of the city's unplanned growth (Aithal & Ramchandra, 2017; Paliath, 2024), it continues to

navigate through the ambiguous situations. This research (Subbanarasimha et al., 2023) highlights the pivotal role of informal interactions and end-users' work practices in sustaining waste management in Bengaluru, even during the worst phases of the COVID-19 pandemic and the country's longest lockdown. End-users—including frontline workers, civic groups, resident welfare associations, and even citizens operating beyond traditional boundaries—often innovate in diverse and resourceful ways to navigate the challenges posed by unplanned urban growth.

For example, civic groups at the ward level established micro-level planning initiatives, utilizing both physical and virtual platforms to address everyday challenges faced by urban residents and to bring local concerns to the attention of city officials. These bottom-up efforts not only fostered collaboration among stakeholders during the pandemic but also continue to empower communities to actively shape their urban environment today. Moreover, these urban agents demonstrate adaptability to external uncertainties such as lockdowns, floods, and workforce shortages. Their resilience, creativity, and redundancy have played a crucial role in sustaining the city's functionality during challenging times. Meanwhile, the community of Pourakarmikas—the frontline workers responsible for solid waste management in Bengaluru—also demonstrated remarkable resilience during the pandemic. They relied on their network to support one another through communal business relationships and peripheral economic opportunities, ensuring that waste collection continued uninterrupted despite the uncertainties. Their collective efforts not only sustained essential city services but also highlighted the critical role of bottom-up emergence in navigating crises.

This resilience is largely attributed to the numerous micro-level planning initiatives led by citizens and civic groups, including civil society organizations and resident welfare associations, all operating in parallel across the city. Human agents often function as makeshift infrastructure when planned urban systems break down, ensuring the city can sustain and adapt to unexpected disruptions. Along with technological advancements to sustain growing urban populations, it is time to recognize the role of human agents, their networks, and channels of interaction, which often sustain cities locally. Understanding these elements will enhance the experiential richness and local knowledge within the city planning process.

Embracing the relationship between human agents and cities, along with urban development, offers valuable insights into how these connections exist, evolve over time, and, in some aspects, remain consistent. However, this relationship is often overlooked in practice and may not always receive the attention it deserves. By reinforcing the concept of co-production and emphasizing the role of human agents in city planning, this article raises several important questions for reflection: What should cities optimize for? who decides what gets optimized, and for whom? Is it time to rethink cities as living ecosystems and embrace their inherent complexity? Rather than labeling uncertain situations, informal interactions, and non-linear networks as 'unplanned' or 'chaotic,' can we reconsider why these terms are used, and by whom? How are these uncertain situations addressed at the micro-level? What are the emergent behaviors of a city? Can we approach city development as a bi-directional process that embraces both control and emergence? Ultimately, will this shift enhance connectivity between governments and the cities they serve?

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