sustainability

MDPI

Editorial

Sustainability and Urban Metabolism

Massimo Palme [1,*] and Agnese Salvati [2]

[1] Escuela de Arquitectura, Universidad Católica del Norte, Antofagasta 1240000, Chile
[2] Institute of Energy Futures, Brunel University London, Uxbridge, Middlesex UB83PH, UK; agnese.salvati@brunel.ac.uk
* Correspondence: mpalme@ucn.cl

Received: 23 December 2019; Accepted: 29 December 2019; Published: 2 January 2020

The concept of urban metabolism was introduced by Wolman in 1965 [1], following insights and suggestions coming from ancient Marxism and the early ecologist theories.

The close relationship between urban metabolism and urban sustainability rests on the need to study all of the urban processes with an integrated and complex point of view for achieving the difficult challenge of closing the flows of materials, energy, water, and food across cities. It is known that cities are dissipative structures—as defined by Prigogine and Stengers [2] and investigated later by Lai et al. [3], Portugali [4], and Rees [5], among others—so residual entropy is always present. Nevertheless, there still exists the possibility to reduce—at minimum—this entropy by putting in place different strategies, such as reducing, reusing, and recycling all kinds of materials, or implementing nature-based solutions in urban planning.

Newman [6] proposed the metabolic approach as a new planning strategy in the late 1990s. More recently, many studies have focused on the relationship between sustainability and urban metabolism. Some of these had a huge impact on the scientific community and are considered milestones in this field: Kennedy et al. [7], Princetl et al. [8], Zhang et al. [9], Dijst et al. [10], Cui [11], Isalgué et al. [12], Butera [13], and Bettencourt and West [14].

Nevertheless, the research into the relationship between urban metabolism and sustainability is still under development; it is becoming more and more important, considering the current pace of world population's urbanization, economic growth, and climate changes. There is an urgent need for humanity to achieve a more ecological and sustainable society, and this challenge can only be achieved with a deep understanding of the complex societal, economic, energy, and environmental functioning of urban systems.

This special issue intends to contribute to the development of this knowledge, gathering together studies from various disciplines and geographical contexts. The contributions cover a large range of topics, crossing the boundaries between science and practice, from architecture and urban planning to engineering and social sciences. The 10 papers published come from different continents: Asia, Australia, South America, and Europe.

Some of the articles presented focus on some specific aspects of urban metabolism, such as the relationship between building mass and energy use (Morganti et al.), food supply from local production (Zazo-Maratalla et al.), and waste and resources management in cities (Longato et al.). Other papers analyse the urban energy fluxes related to climate and urban forms, focusing on the relationship between climate context, building density, and thermal performance (Rojas-Fernandez et al. and Watanabe et al.) and urban design, materials, and outdoor thermal comfort (Takebayashi and Kyogoku). Finally, four papers use concepts coming from various disciplines to propose interpretation frameworks, assessment methods, and regeneration strategies for cities. Bettigines et al. apply the scaling laws concept to analyse the energy intensity of cities, Jiao et al. propose novel indicators to measure the sustainability of Chinese cities, Assefa and Newman apply their extended metabolism model to slum regeneration, and Joensuu et al. put in evidence the interest of stakeholders in developing ecological

approaches in superblock design. We believe that all contributions provided novel and interesting insights into the knowledge of sustainability and urban metabolism. Enjoy the Special Issue!

List of Contributors:

1. Morganti, M.; Pagés-Ramón, A.; Coch, H.; Isalgué, A. Buildingmass and Energy Demand in Conventional Housing Typologies of the Mediterranean City
2. Bettigines, Y.; Meirelles, J.; Fernández, G.; Meinherz, F.; Hoekman, P.; Bouillard, P.; Athanassiadis, A. The Scale-Dependent Behaviour of Cities: A Cross-Cities Multiscale Driver Analysis of Urban Energy Use
3. Zazo-Moratalla, A.; Troncoso-González, I.; Moreirs-Muñoz, A. Regenerative FoodSystems to Restore Urban-Rural Relationships: Insights from the Concepción Metropolitan Area Foodshed (Chile)
4. Longato, D.; Lucertini, G.; Dalla Fontana, M.; Musco, F. Including Urban Metabolism Principles in Decision-Making: A Methodology for Planning Waste and Resource Management
5. Takebayashi, H.; Kyogoku, S. Thermal Environmental Design in Outdoor Space Focusing on Radiation Environment Influenced by Ground Cover Material and Solar Shading, through the Examination on the Redevelopment Buildings in Front of Central Osaka Station
6. Jiao, L.; Deng, F.; Liang, X. Sustainable Urbanization Synergy Degree Measures—A Case Study in Henan Province, China
7. Assefa, Z.; Newman, P. Slum Regeneration and Sustainability: Applying the Extended Metabolism Model and the SDGs
8. Rojas-Fernández, J.; Galán-Marín, C.; Roa-Fernández, J; Rivera-Gómez, C. Correlations between GIS_Based Urban Building Densification Analysis and Climate Guidelines for Mediterranean Coutyards
9. Watanabe, N.; Setoguchi, T.; Maeda, K.; Iwakuni, D.; Guo, Z.; Tsutsumi, T. Sustainable Block Design Process for High-Rise and High-Density Districts with Snow and Wind Simulations for Winter Cities
10. Joensuu, T.; Norvasuo, M.; Edelman, H. Stakeholders' interests in developing an energy ecosystem for the superblock—Case Hiedanranta

Funding: This research was founded by the Vice-rectory of Research and Technological Development of the UCN.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Wolman, A. The metabolism of cities. *Sci. Am.* **1965**, *213*, 179–190. [CrossRef] [PubMed]
2. Prigogine, I.; Stegers, I. *Order out of Chaos*; Bantam books: New York, NY, USA, 1984.
3. Lai, S.K.; Han, H.; Co, P.C. Are cities dissipative structures? *Int. J. Urban Sci.* **2013**, *17*, 46–55. [CrossRef]
4. Portugali, J. Self-organizing cities. *Futures* **1997**, *29*, 353–380. [CrossRef]
5. Rees, W. Cities as dissipative structures: Global change and the vulnerability of urban civilization. In *Sustainability Science*; Springer Nature: Stuttgart, Germany, 2012.
6. Newman, P. Sustainability and cities: Extending the metabolism model. *Landsc. Urban Plan.* **1999**, *44*, 219–226. [CrossRef]
7. Kennedy, C.; Cuddihy, J.; Engel-Yan, J. The changing metabolism of cities. *J. Ind. Ecol.* **2007**, *11*, 43–59. [CrossRef]
8. Princetl, S.; Bunje, P.; Holmes, T. An expanded urban metabolsim method: Toward a systems approach for assesing urban energy processes and causes. *Landsc. Urban Plan.* **2012**, *107*, 193–202. [CrossRef]
9. Zhang, Y.; Yang, Z.; Yu, X. Urban metabolism: A review of current knowledge and directions for future studies. *Environ. Sci. Technol.* **2015**, *49*, 11247–11263. [CrossRef] [PubMed]

10. Dijst, M.; Worrel, E.; Bocker, L.; Brunner, P.; Davoudi, S.; Geertman, S.; Harmsen, R.; Helbich, M.; Holtslag, A.A.M.; Kwan, M.-P.; et al. Exploring urban metabolsim—Towards an interdisciplinary perspective. *Resour. Conserv. Recycl.* **2018**, *132*, 190–203. [CrossRef]
11. Cui, X. How can cities support sustainability: A bibliometric analysis of urban metabolism. *Ecol. Indic.* **2018**, *93*, 704–717. [CrossRef]
12. Isalgué, A.; Coch, H.; Serra, R. Scaling laws and the modern city. *Phys. A Stat. Mech. Appl.* **2007**, *382*, 643–649. [CrossRef]
13. Butera, F. Urban development as a guided self-organization process. In *The City and Its Sciences*; Springer Nature: Stuttgart, Germany, 1998.
14. Bettencourt, L.; West, G. A unified theory of urban living. *Nature* **2010**, *467*, 912–913. [CrossRef] [PubMed]

© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).