

### **A Precis of Kennedy et al.'s Changing Metabolism of Cities**

In the paper "Changing Metabolism of Cities" by Kennedy et al., the authors conduct a literature review to analyze previous urban metabolism studies. They examine resource flows in various cities around the world to identify critical processes and patterns in urban metabolism. This information is used to assess the overall development trends of a city, including changes in water usage, material usage, nutrient flow, and energy sources. The authors argue for the need for sustainable development models to ensure that cities can develop without harming the environment or compromising future generations' ability to meet their needs.

The paper describes water as the largest component of urban metabolism. Per capita water use has generally increased since the 1970s, and over-exploitation of groundwater can lead to subsidence, pollution, and other problems. Achieving equilibrium in water resource management is important to ensure the sustainability of urban areas. The significance of material inputs and outputs in urban environments is also discussed, although data on the inputs is often lacking compared to other components such as water. Cities are becoming increasingly material-intensive, with per capita use of construction materials and domestic material consumption on the rise. Data on solid waste outputs show an upward trend, and transportation of materials over increasingly long distances into cities also impacts sustainability by increasing the amount of carbon emissions.

The quantification of urban energy fluxes and its role in urban metabolism is another factor discussed in the paper. The authors compare per capita energy consumption of several cities. A research study by Newman and Kenworthy describes how per capita transportation energy consumption is inversely proportional to urban population density<sup>2</sup>. The urban heat island effect is also discussed, which describes how pavement-ridden urban areas have higher relative air temperatures compared to more rural areas. Increasing temperatures have the potential to increase energy usage towards cooling, especially in the summer, which can create a negative feedback loop. Increased energy usage also impacts air pollution, as more carbon emissions are created due to energy demands. This, in turn, increases temperatures further due to the greenhouse gas effects.

Lastly, the paper discusses nutrient flow through urban systems and the consequences of improper management strategies. Improper management can lead to eutrophication of water bodies, groundwater pollution, and the release of heavy metals. Urban areas receive about 90% of their nitrogen and phosphorus from human activities, and combustion processes are increasingly linked to nitrogen emissions. Nutrient storage must also be considered, as accumulation can lead to negative environmental consequences, such as seeping into groundwater, polluting it. Fertility exchange, where urban sewage is returned to local farmland, is suggested for sustainable urban-nutrient management. However, challenges such as transportation and pharmaceuticals in wastewater make other resource recovery alternatives more attractive.

Overall, this paper provides a comprehensive review of urban metabolism and its application in understanding resource flows within cities. By analyzing resource flows and metabolism of eight cities worldwide, the authors provide insights into the complex interactions between urbanization, resource use, and environmental impacts. The paper emphasizes the growing ecological footprint of cities and the need for more efficient resource use and management to mitigate the impacts of higher resource use. However, the authors acknowledge that more research is needed to fully understand urban metabolism and the role of human behavior in shaping resource use patterns. Further studies can help policymakers and urban planners develop effective and sustainable strategies to manage urban metabolism and mitigate the negative impacts of higher resource use.

Transportation is a crucial factor that impacts urban metabolism and resource consumption. The infrastructure of urban metabolism distributes resources to residents using various transportation modes. Although the infrastructure and people in cities are often seen as separate systems, they need to be recognized as co-dependent because they influence one another<sup>3</sup>. Encouraging the use of public transit, cycling, and walking instead of driving a car can reduce transportation-related energy consumption and carbon emissions<sup>3</sup>. Moreover, government policies, such as providing subsidies for resource-intensive industries and implementing urban development strategies like complete street planning and mixed use land development, can also influence transport use patterns by shaping human behavior<sup>3</sup>.

### Works Cited

- [1] Kennedy, C., Cuddihy, J., & Engel-Yan, J. (2007). The changing metabolism of Cities. *Journal of Industrial Ecology*, 11(2), 43–59. <https://doi.org/10.1162/jie.2007.1107>
- [2] Newman, P. and J. Kenworthy. 1991. *Cities and automobile dependence: An international source-book*. Aldershot, UK: Avebury.
- [3] Fróes, Isabel, and Malene Køster Lasthein. "Co-Creating Sustainable Urban Metabolism towards Healthier Cities." *Urban Transformations* 2, no. 1 (2020). <https://doi.org/10.1186/s42854-020-00009-7>.

### **Reflection on my re-write**

In my rewrite, I focused on the broader context of transportation, which provided a more specific angle compared to the previous topic of human behavior. I used external sources to support my arguments and provided more detail about the methods used in the article in the introduction paragraph. To improve clarity, I added in-text citations to indicate where the information I used came from, as well as to make it more clear which parts of the text referred to which evidences. While making these changes, I made sure to keep the style of the précis the same, only changing the things according to the feedback that I received. Overall, I believe that these changes improved the précis and made it more focused and informative.