

2021 MCM-SJTU

Problem E: Urban Carrying Capacity

Background: Urbanization has been an important feature in the process of human development all throughout history. This trend is often associated with a sweeping population migrating from the countryside to the cities. According to data from the United Nations, a new city with 1.3 million inhabitants will be built every week for the next four decades [1].

With the fast-paced urbanization process, the continuous congregation of larger population, urban services, production, consumption, and social wealth have been occurring in most cities around the world. However, these factors have made cities vulnerable in terms of achieving sustainable development and providing comfortable living standards for urban inhabitants. Due to the worsening living environments in urban areas, particularly in mega-cities, concerns related to the **urban carrying capacity (UCC)** concept have often been voiced when debating whether the current rate of urban development has exceeded inherent limit of the city. According to the UCC concept, there is a certain inherent limit on a given urban area, beyond which will lead to irrecoverable changes, degradation or damages to the environment [2].

Despite plenty of discussions and explanations, UCC still lacks a widely accepted definition and standardized assessment method, which hampers its effective use in urban planning and management. As a team of consultant for Urban Sustainable Development Research Institute, your tasks are:

Problem:

Task 1: Identify factors related to UCC and explain their relationship. These factors may include but are not limited to population, transportation, infrastructure, economic development, natural resources, environmental impacts, etc.

Task 2: Based on the factors identified by your team in Task1, establish a comprehensive evaluation model of UCC. Please note that the influencing factors may be time-varying, which needs to be considered in your model.

Task 3: Evaluate the UCC of major cities in the world, list the top ten cities to have the most UCC.

Task 4: Discuss the influence of temporal factors: How will UCC in major cities in the future differ from the current one? Please use your model to predict the top ten UCC cities in 2050.

Task 5: Policy recommendation. According to the results of your model, whether the existing population of any city exceeds its UCC, if so, please give specific policy suggestions on how to coordinate the contradiction. If not, please give suggestions on how to ensure that the population does not exceed the city's UCC under the premise of sustainable development.

Task 6: One-page blog. Write a one-page blog to summarize your UCC evaluation model and policy recommendation.

Your submission should consist of:

- One-page Summary Sheet,
- One-page blog,
- One-page Table of Content,

Note: The MCM/ICM Contest now have a 25 page limit. The 25 page limit applies to the entire submission including the Summary Sheet, Solution, Reference List, Table of Contents, Notes, Appendices, Code and any problem specific requirements.

References:

- [1] Bentham, J. (2014). The scenario approach to possible futures for oil and natural gas. *Energy Policy*, 64, 87-92.
- [2] Wei, Y., Huang, C., Lam, P. T., Sha, Y., & Feng, Y. (2015). Using urban-carrying capacity as a benchmark for sustainable urban development: an empirical study of Beijing. *Sustainability*, 7(3), 3244-3268.

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