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Exploring the Potentialities of Emergy Accounting in Studying the Limits of Growth for Urban Productive Systems

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Abstract

Cities are important urban productive systems in which its main goal could be considered as the innovation supplier to generate economic growth. As well as all social organization managed by economies of scale, cities have a tendency of eventually reduce or even stop its growth. In this scenario, public policies are essential to avoid a potential collapse of society. The sustainability of cities have been studied through different methodological approaches, but few scientific works assessed the limits of its growth. This work aims to explore the potentialities of emergy accounting (with an "m") in the discussions about the limits of growth for urban productive systems. The cities named Araraquara, Bragança Paulista, Campinas, São Paulo, and Taubaté were considered as case study due to their socio-economic importance within São Paulo State boundaries, Brazil. Time leg considered was from 1999 to 2011. Results indicate that all assessed cities have the same development pattern as showed by the dynamics of "empower" (in seJ/yr), in which the differences are related to current development degree of cities. In parallel, all assessed cities showed an increase in their efficiency estimated by the conversion of input materials and energy (measured in seJ) into outputs of goods and services (measured in $), however, the efficiency stabilization along all evaluated period was not observed. This suggests that limits of growth as hypothesized in this work does not exist, or it was not reached yet, or even the time leg considered was not long enough to observe that stabilization. Although results did not allow to verify the limits of growth for the assessed cities, this work can be considered important due to its methodological approach used in assessing urban productive system, including the top-down approach, the input-output model of systems functioning, and the proposition of rainfall transformity calculates as the thermal exchange (14,150 seJ/J).

Keywords: *Cities; Emergy; Empower; Limits of growth; Rainfall transformity.*