Making Cities Work

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Engineering Perspective on Cities

A city is collection of processes – public, enterprise, and personal - that are founded on the natural and built environments, that are driven by and are intended to support the needs of the population, that produce and consume various resources and social outputs.

It's a complex system operating on multiple time scales.

Engineering Intention for Cities

To design, construct, operate, manage, and maintain a set of systems (machines) that make the city's processes as effective as possible at supporting the short-term and long-term needs of the its citizens for…

…economic development

…efficiency (cost, reliability, capacity…)

…accessibility (ease of use, choices, flexibility…)

…resilience (acute threats, long-term threats, unknown threats)

If there were a Science of Cities….

I would expect it to provide the intellectual foundations for designing engineering approaches to Making Cities Work….just as Physics provides theory for designing an electrical generator and Chemistry tells me how to produce a certain material….

It would provide methods for assessing Status and developing Forecasts

- Characteristics of the Built Environment (capacities, latencies, hysteresis, losses….)
- Characteristics of the Natural Environment (capacities, sources & sinks, constraints…)
- Forecasts & Predictions – What is the city doing right now and what is it going to be doing over many timescales – minutes, hours, days, months, years
- Resource availability patterns (water, food, energy, materials, infrastructure capacities…)
- Resource consumption patterns for personal, commercial, civic activities
- Economic activity (industries, value created, skills & assets…)
- Environment (weather, climate, natural hazards…)

…it would tell me what the levers do

- The short-term susceptibility of resource consumption to
  - Feedback to the consumers
  - Price signals
  - Social signals
- The long-term susceptibility of economic activity to
  - Investment in the built environment (public, private)
  - Evolution of the natural environment
  - Taxes and regulation
  - Policy signals
- How they interact across multiple resource domains

…so that I could build a control system for the city at multiple time scales

…and it would tell me the assumptions, dependencies and interdependencies of

- Climate
- Natural resources
- Water and energy
- Water and food
- Food and transportation
- Transportation and energy
- Infrastructure and services
- …external factors

…so that I could build a risk model and hence prioritize mitigation investments to ensure resilience