

PhD Courses in Civil Engineering,
Territorial Engineering
and Architecture

URBAN STUDIES

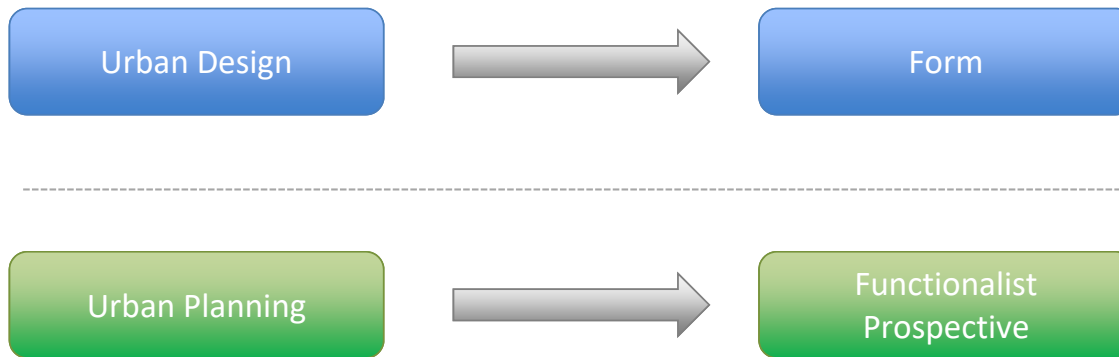
The urban territory. The city as a system

Prof. José Antunes Ferreira

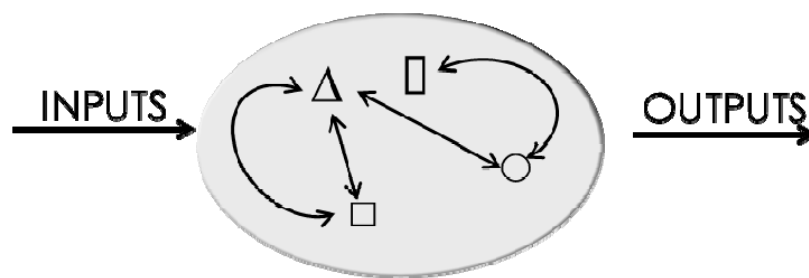
antunes.ferreira@tecnico.ulisboa.pt

Fernando Nunes da Silva

fnsilva@tecnico.ulisboa.pt



Systems Theory



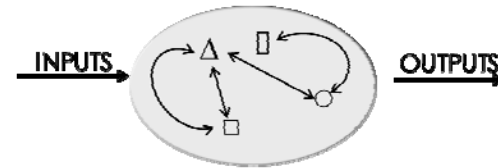
A **System** is a set of elements of different nature and the relationships between them, interacting with its environment

McLougline – decisions on the city must be analyzed in the light of the systems theory

The idea that systems could be controlled or ‘planned’ to meet certain goals or targets was a result of such logic

Most systems were not in quiet and passive equilibrium but in turmoil much of the time, while the idea of evolution to new conditions implying different structures and behaviors simply lay beyond this kind of thinking

System



The CITY is a system

Complex

Complex... Why?

- The elements of the city are structured in **subsystems** with different goals
- **Evolve** temporarily
- The **subsystems are interrelated**
- **Space** for locating **human activities**
- The inhabitants relate individually creating **social networks**
- City **interacts with its environment**



A very simple definition of a complex system is a system that is composed of complex sub systems.

A system is composed by **elements** (characterized by their attributes and the way they can change) and the **relations** among them (defined by their intensity and properties)

In the mid-20th century, the prevailing view of society was one which think about social structures alike to the way machines functioned.

But the metaphor of the **city as a machine** ignored self-determination and was only barely applicable in the most cursory ways to social problems.

In the early 21st century, it is clear that a radical shift in this metaphor is taking place. Cities and societies began to be think as **living organisms**, as biological rather than physical systems.

Cities should not be treated like machines but like living systems with the implication that life, hence city form, emerges from bottom to up, following the Darwinian paradigm (adaptation to external constraints and more chance to survive for the stronger ones).

Complexity

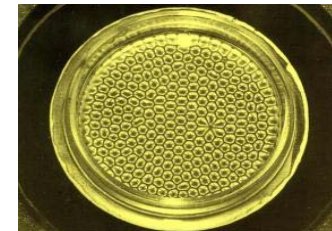
difficulty of foreseeing

great difficulty in governance



Henri Bénard experience

Application of an energy flow



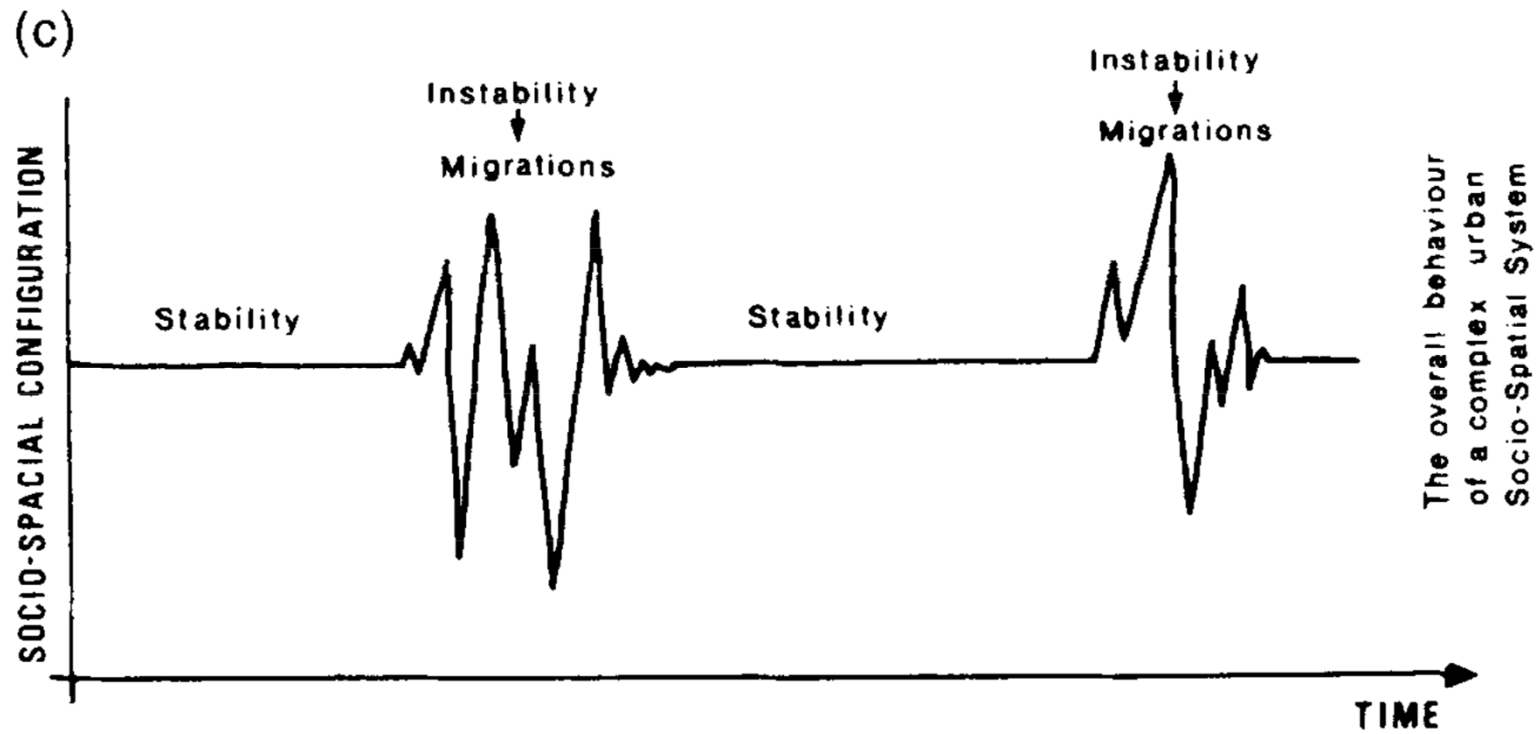
- ➔ **The system reach a stable structure**
- ➔ Allowed a **spontaneous self-organization** of the system
- ➔ Created **new structures and new forms of behaviour**

Systems which are ergodic are those whose dynamics are predictable in that they are well behaved and often converge to some stable equilibrium.

This criterion was stated by Harris (1970) as a key requirement for good urban models

Durlauf in fact has a much more precise definition of non-ergodic city which he defines as systems that lack any kind of probable behaviour over the long term.

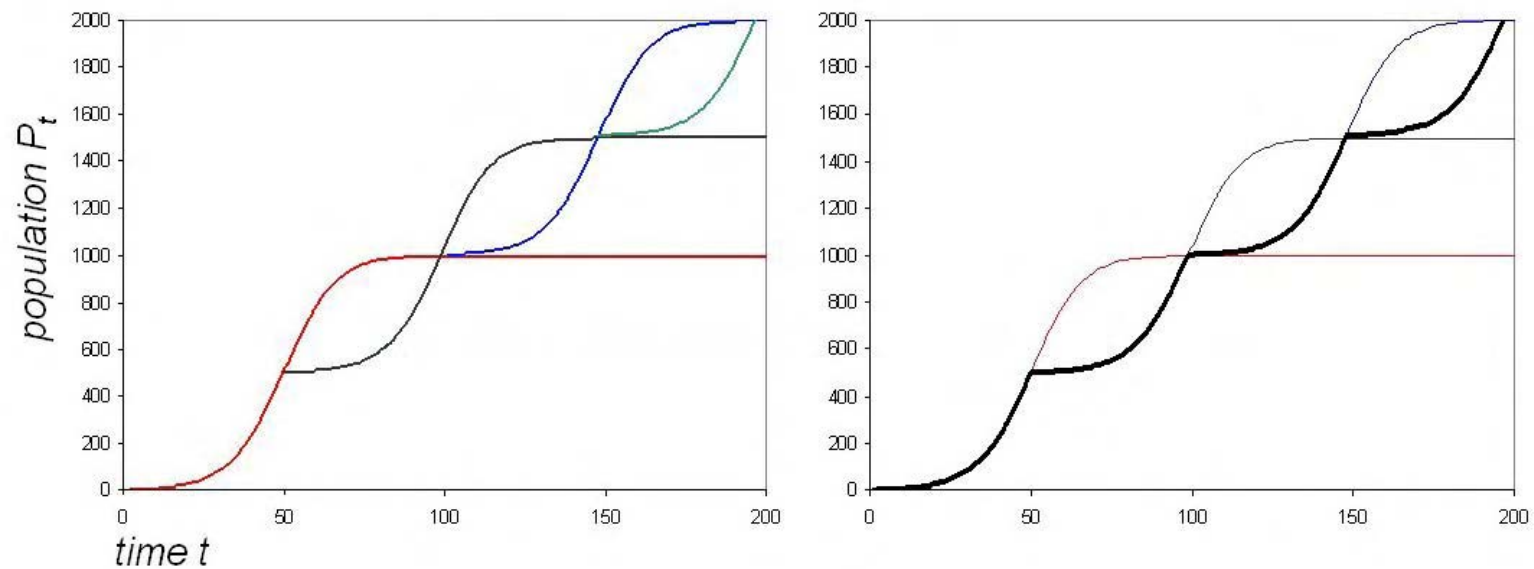
Such systems can be characterized by exogenous shocks that affect long term behaviour.



source: Portugali, J. (1997). Self-Organization and the City. *Futures*, 29(4/5), pp 356

Phase transitions or thresholds at which innovation occurs and pushes the system into a new regime, novelty and surprise in a process that is in reality likely to be fairly random in time (for we never know when such a shock might occur), and a sense that the usual state of the system is far from equilibrium

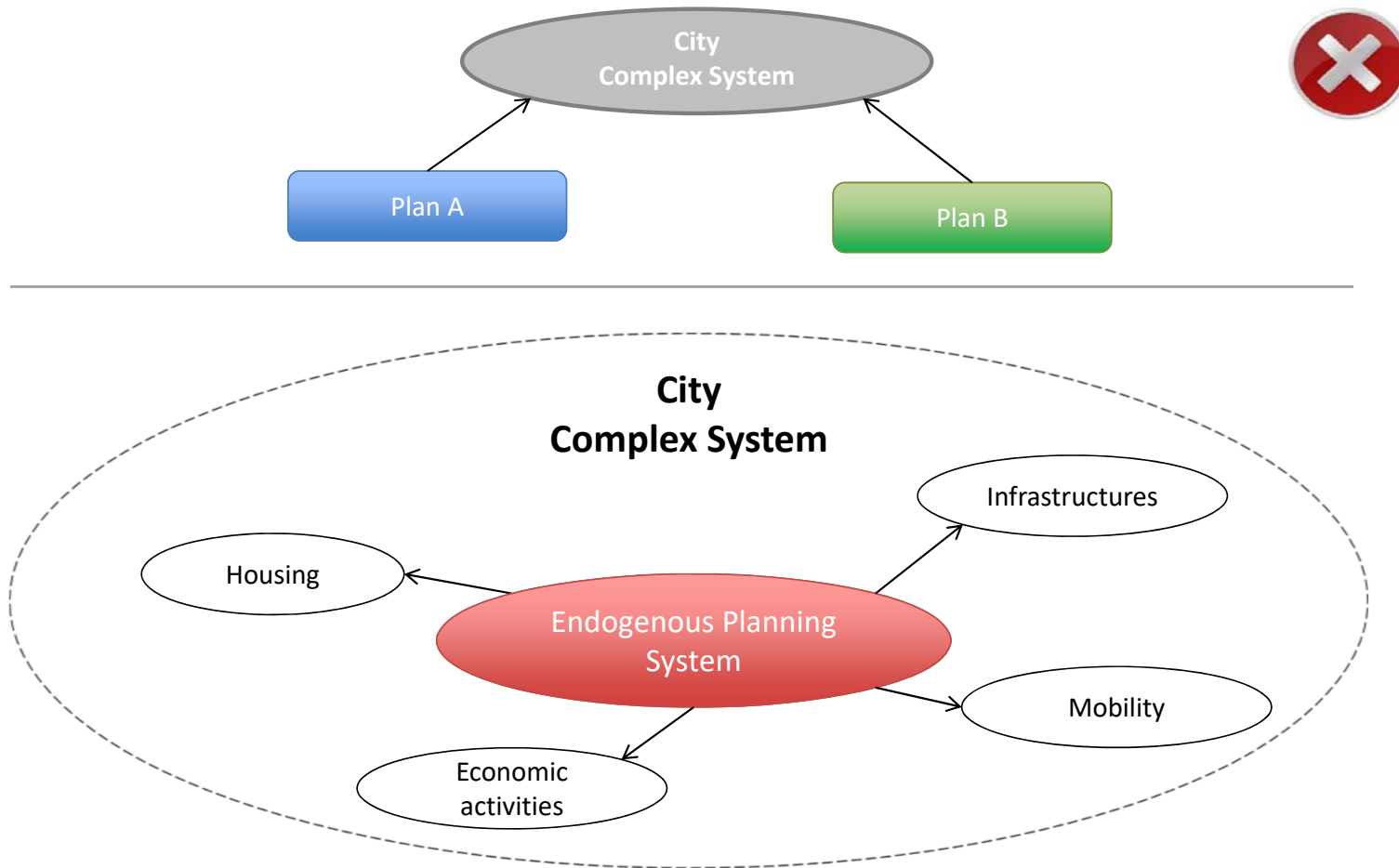
One of the features that this process implies is that growth is dominated by continual discontinuities or innovations, ‘perpetual novelty’ as Arthur (2005) refers to it. Growth is only ‘locked in’ to an equilibrium between the discontinuities.



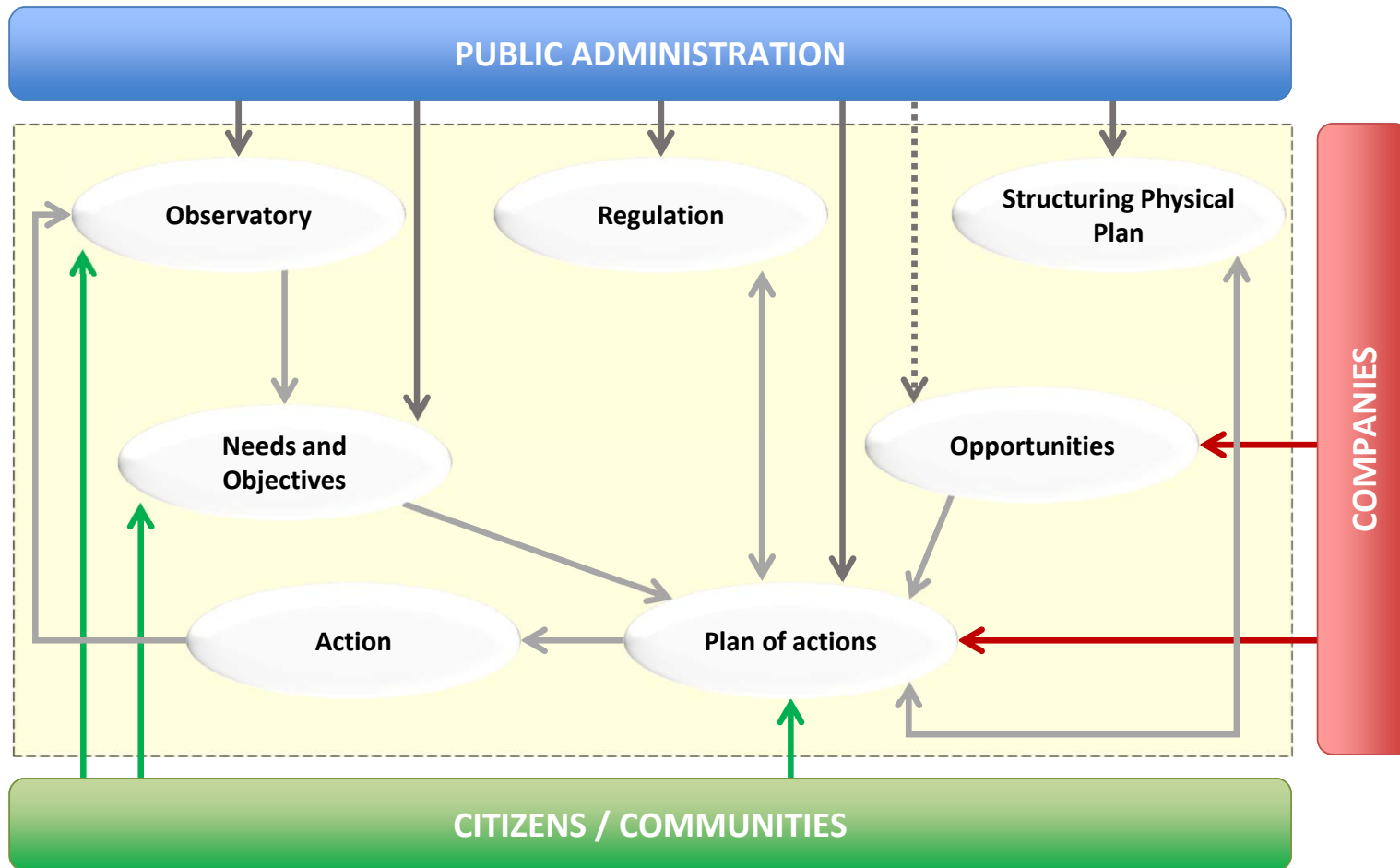
source: Batty, M. (2007). Complexity in city systems: understanding, evolution, and design

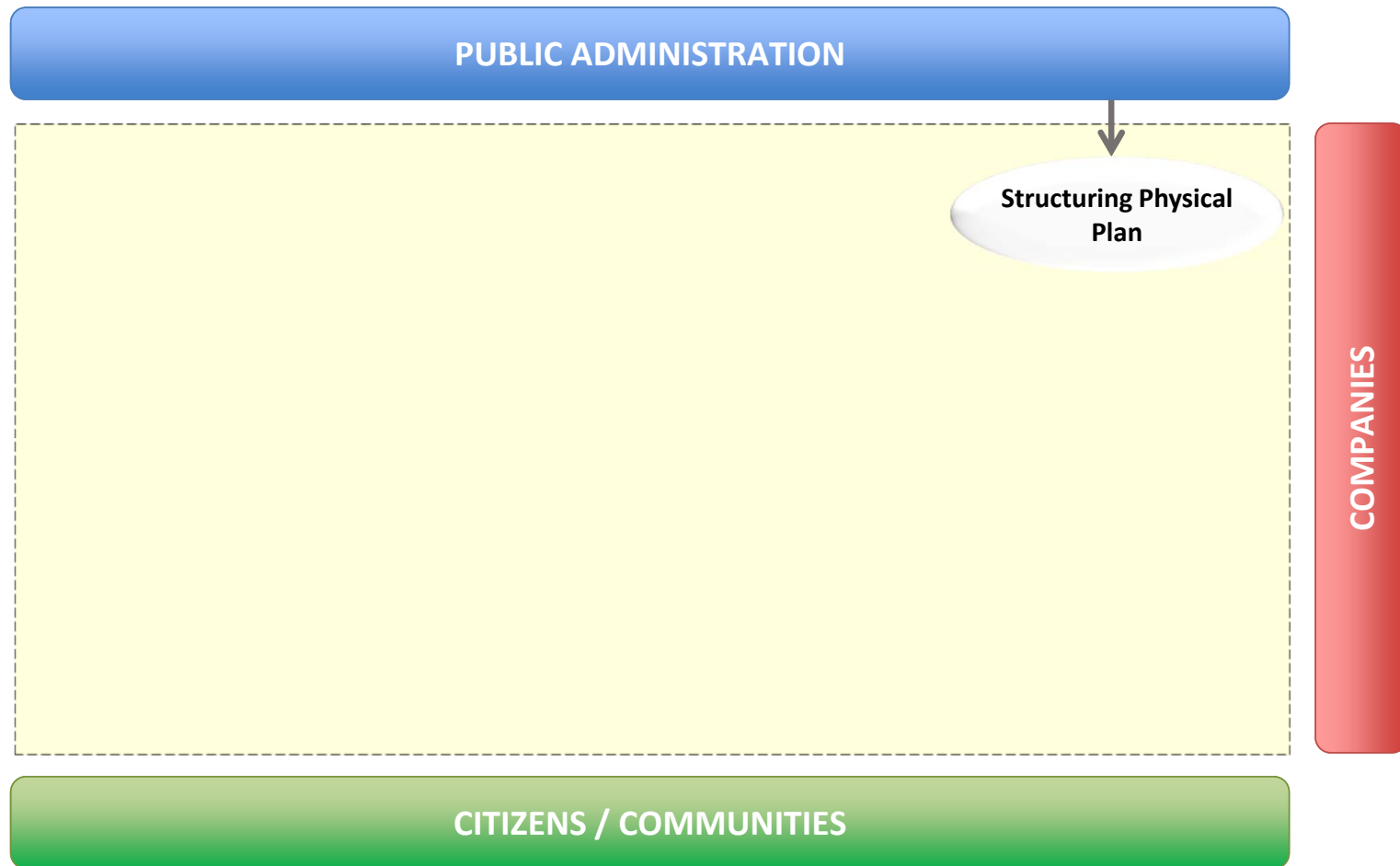
The notion of a top-down controller is simply impossible given the degree of complexity that modern cities reveals, and thus any successful control must probably operate from bottom to up.

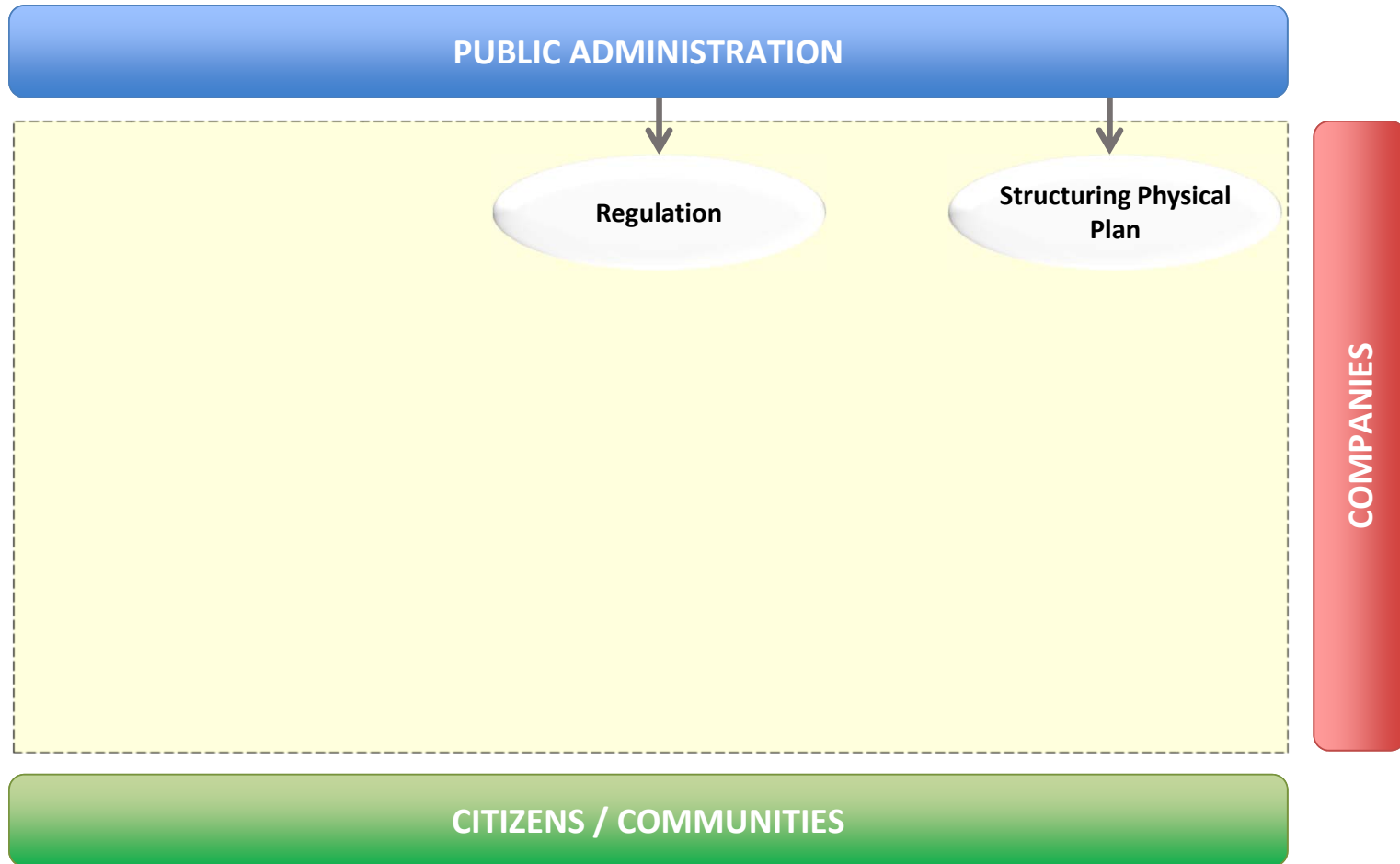
Development takes place by successive and often incremental adjustments.

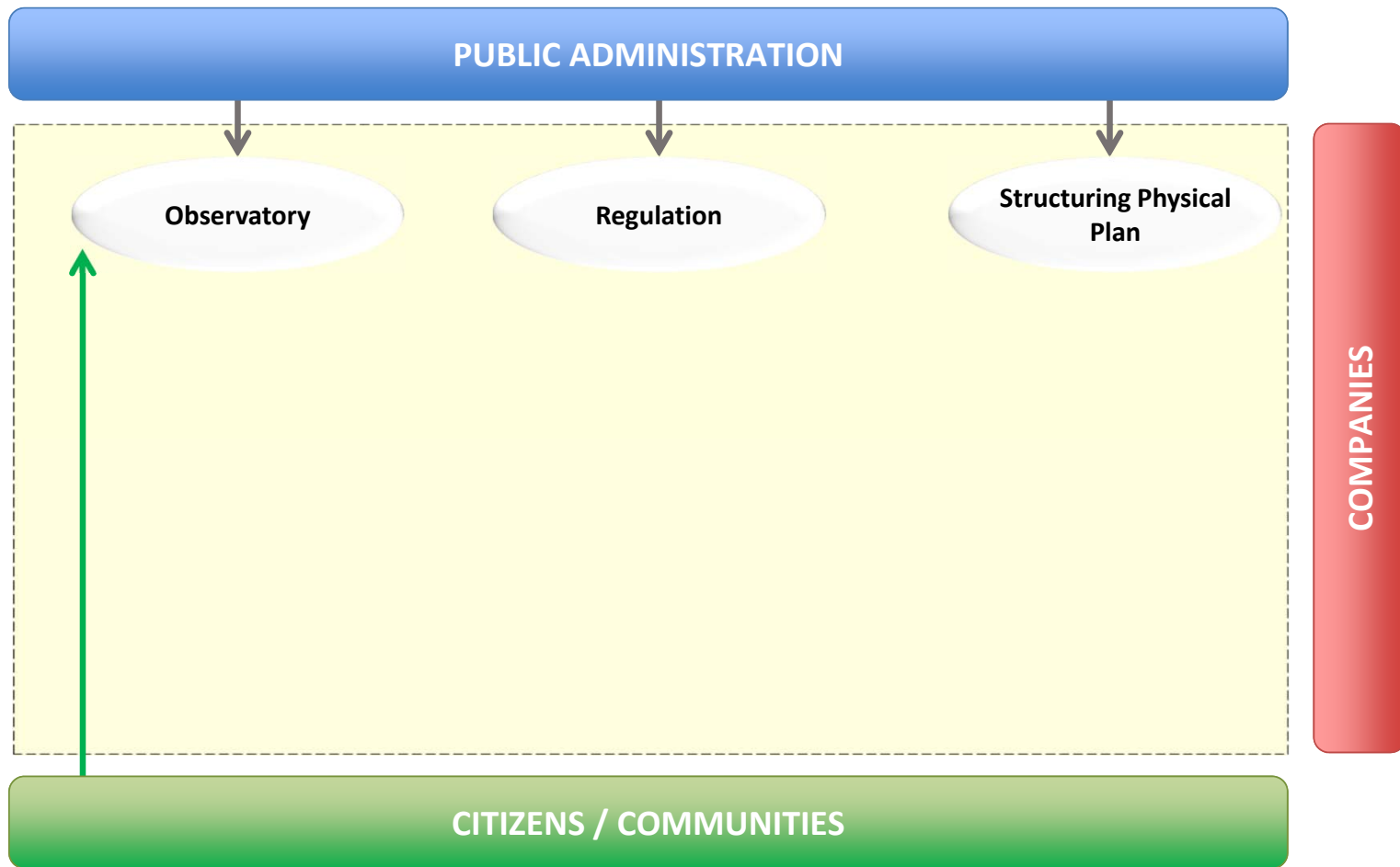


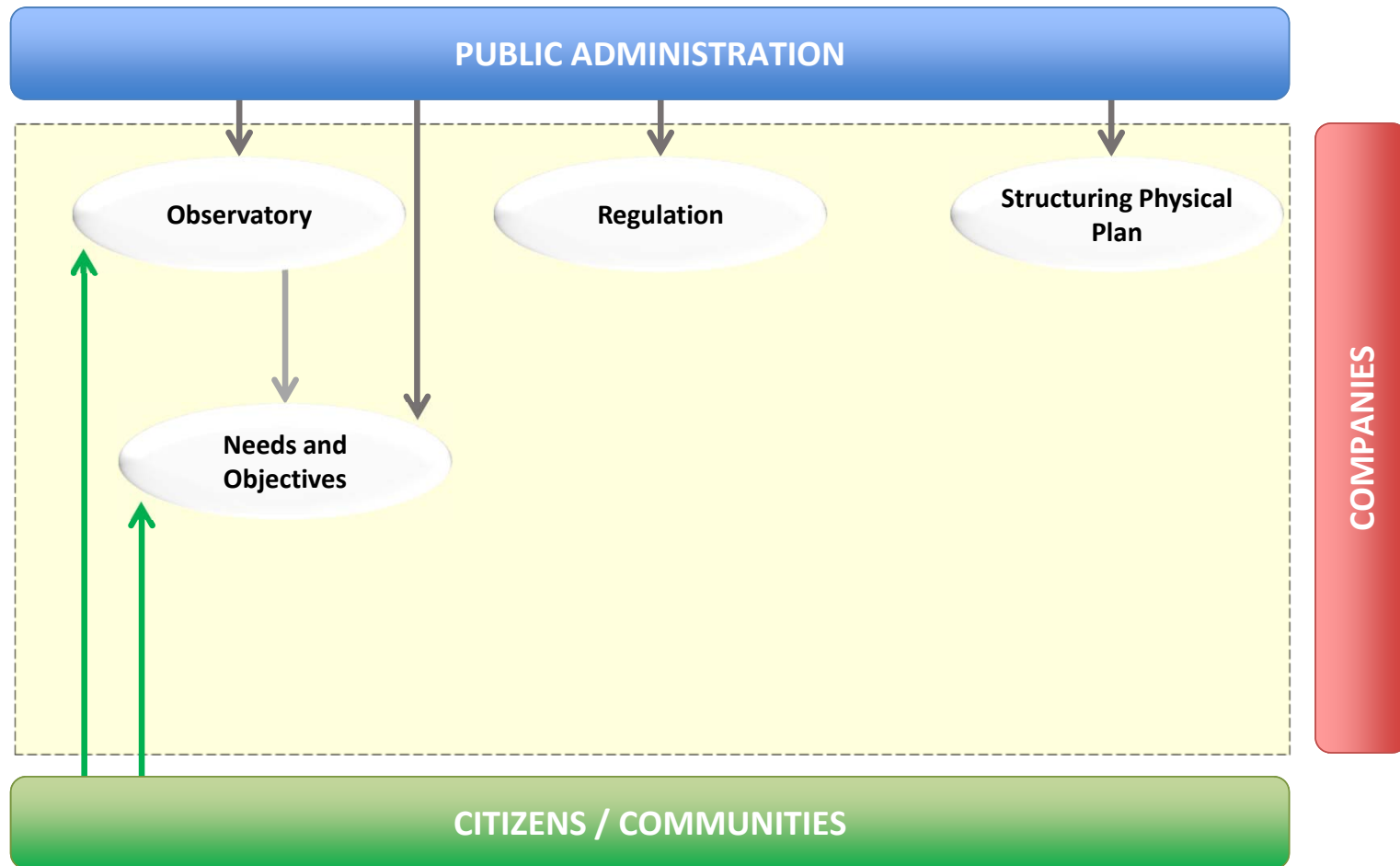


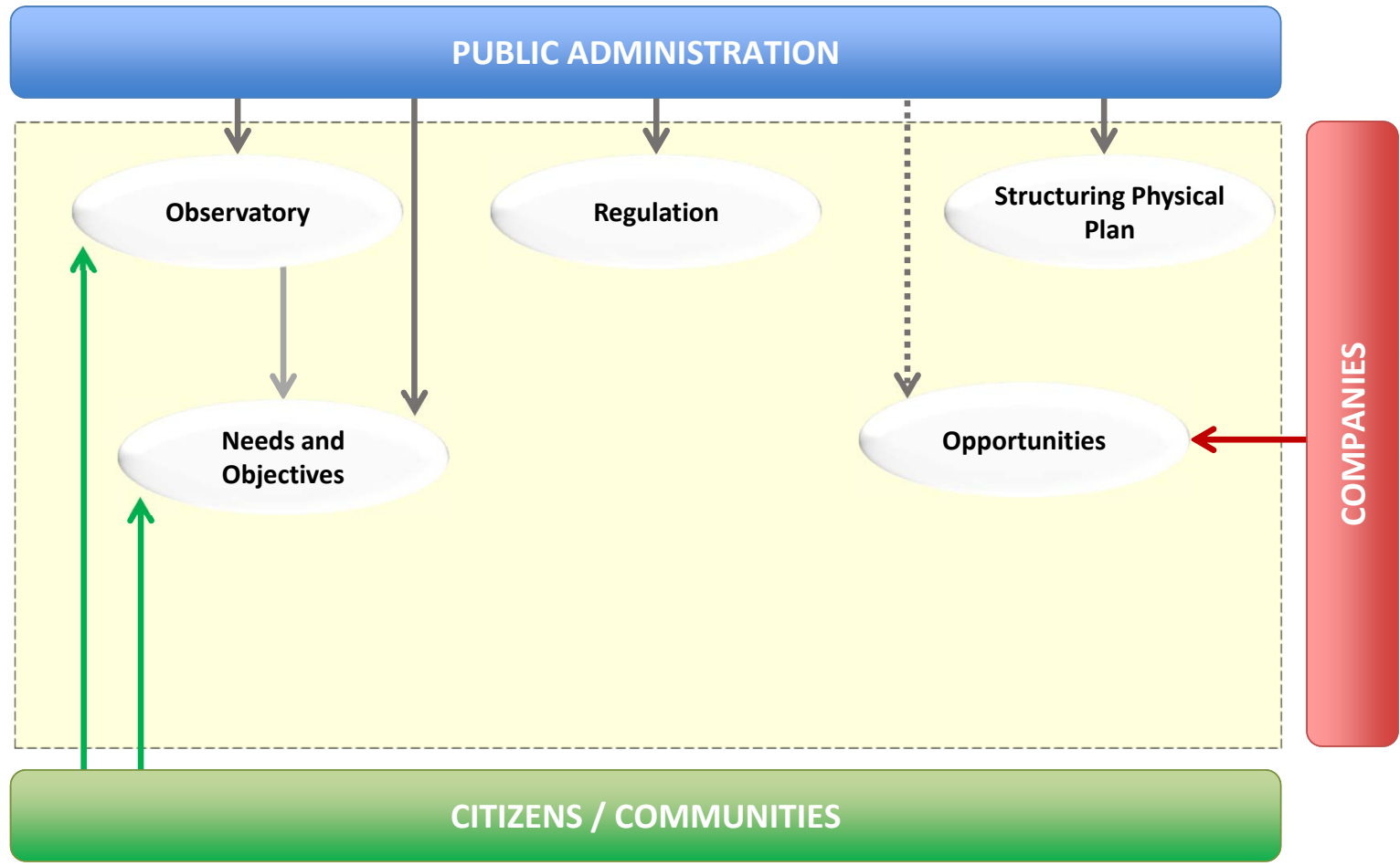


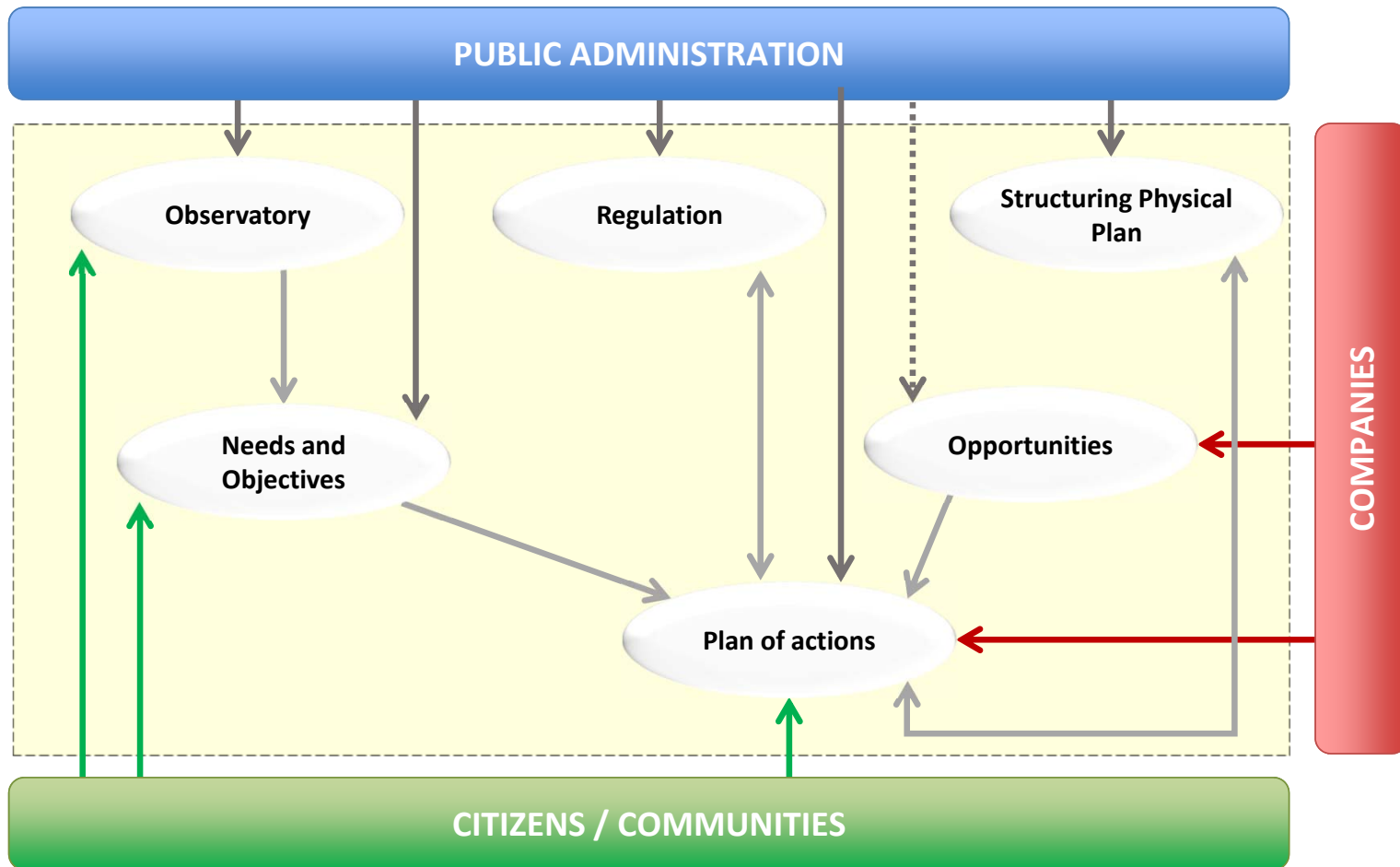


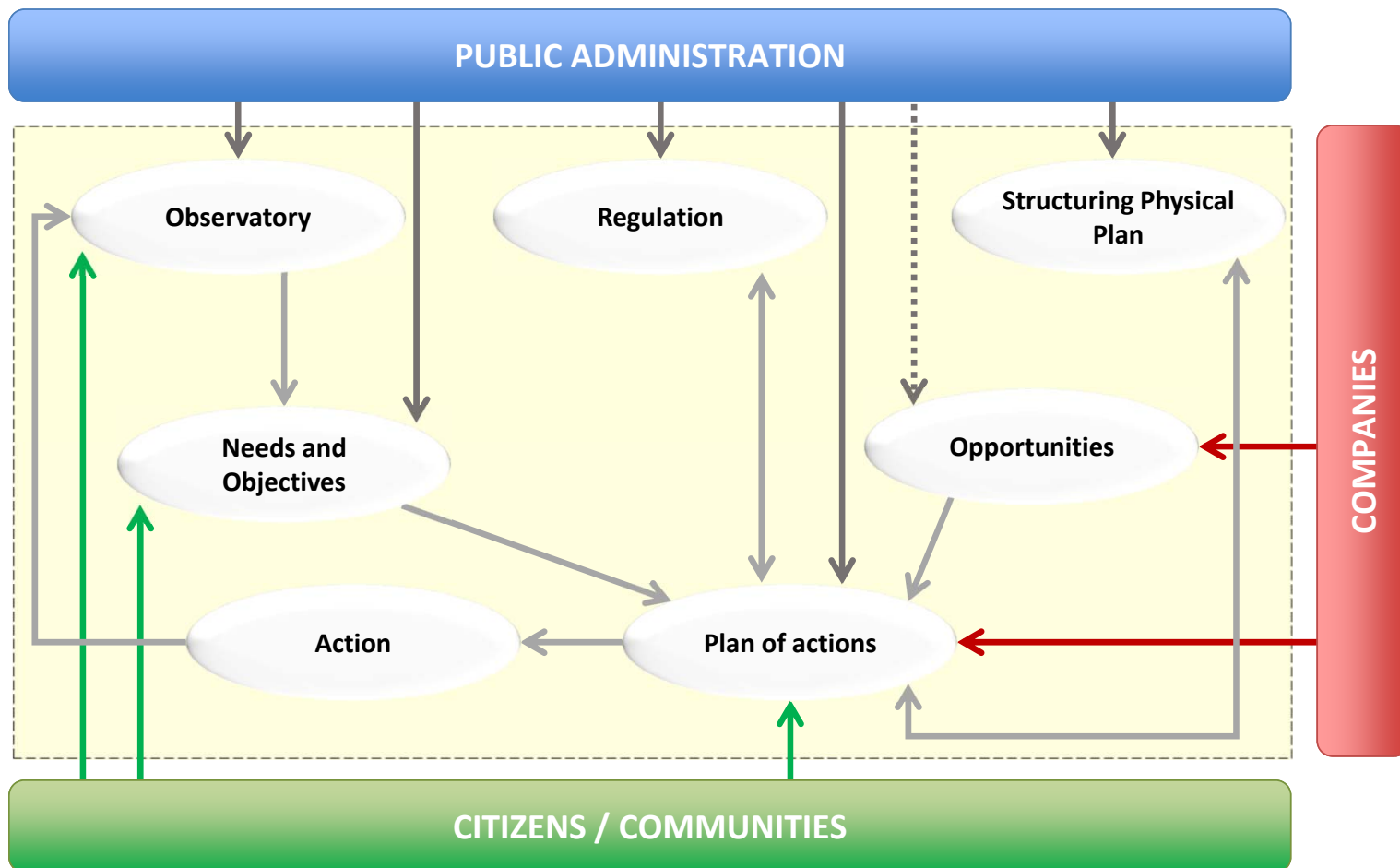












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