

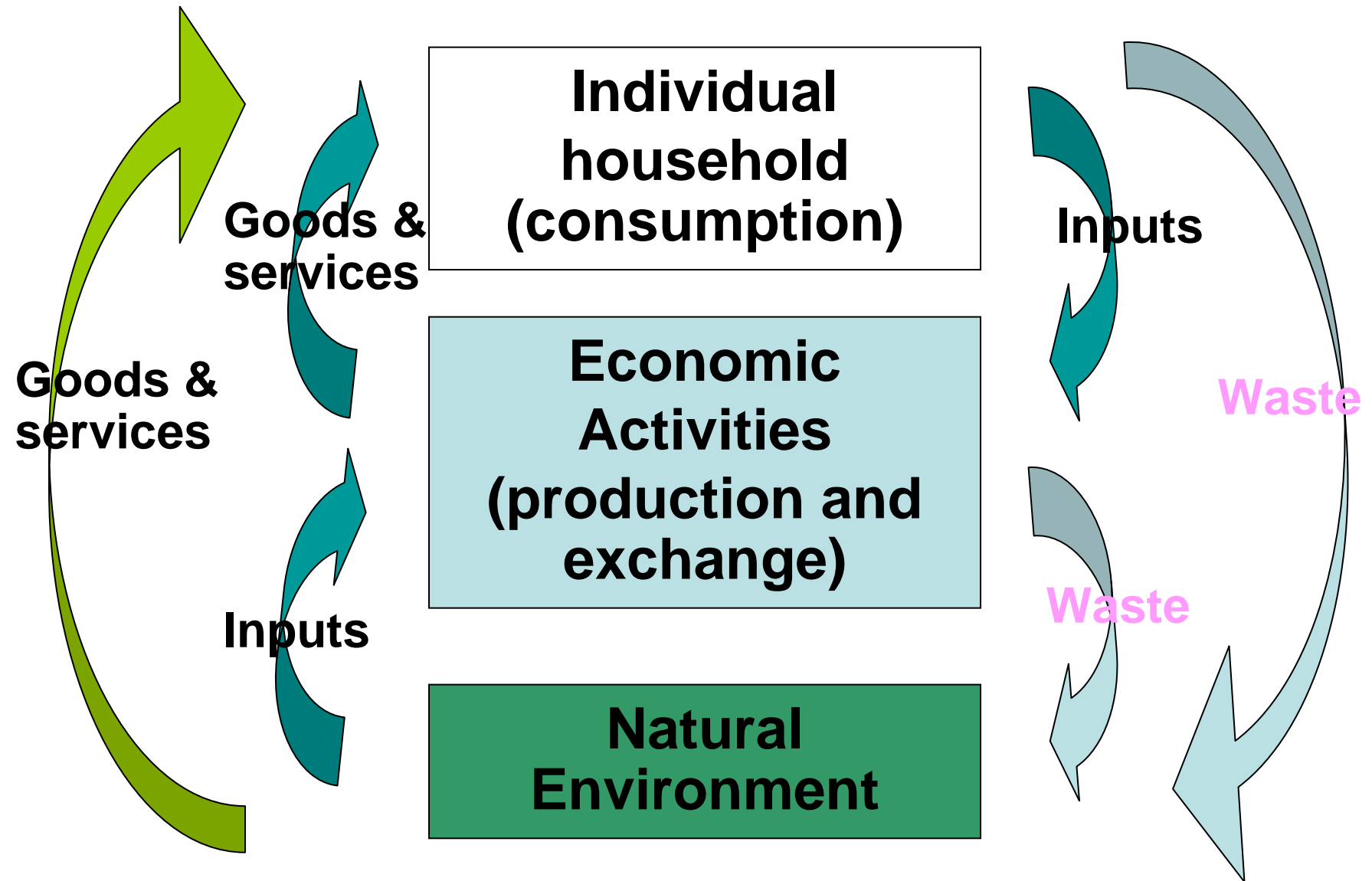
8. Sustainable Agriculture and Environment

Dragun & Tisdell, Ch 4
Eicher and Staats, Ch.26

Sustainable Development

- **What do we want to sustain?**
 - **Economic sustainability**
 - **Social sustainability**
 - **Biophysical & ecological sustainability**
 - ➔ **multi-dimensional, simultaneous sustainability**

Economic links with natural environment



Economic sustainability vs Ecological sustainability

- Can they go together ?
- Georgescu Roegen (1971, 1976)
 - Truly sustainable economic system is impossible because of the physical law of entropy
 - But there are a ways in which the decline of a system can be slowed

The Laws of Thermodynamics

- **The first law (the law of energy conservation)** says that all real-world processes involve transformations of **energy**, and that the total amount of **energy** is always conserved
 - nothing changes at all, and this is just the definition of a symmetry
 - something that remains invariant, indifferent or unchanged given certain transformations
 - the quantity of energy is conserved or remains symmetric under *all* transformations

- **The second law (the law of entropy)**
- “**Entropy**” refers to the dissipated potential
 - If a glass of hot liquid is placed in a colder room a potential exists and a flow of heat (**energy**) is spontaneously produced from the cup to the room until it (**energy**) is minimized (or the **entropy** is maximized) at which point the temperatures are the same and all flows stop

The second law states that

- the world acts spontaneously to minimize potentials (or equivalently maximize entropy)
- in all natural processes the entropy of the world always increases

*Ways in which the **decline** of an economic system can be slowed*

- How ?
 - Reducing economic demands
 - Discover new techniques
 - Economic reforms, social innovations:

Principal economic concept of sustainable development

- Income per head (standard of living, welfare) of future generations is no less than that of current generations
- Limitations
 - How to measure standard of living/ welfare
= maintain level of consumption
 - Generations of human beings “anthropocentric approach”
- How to achieve ?

- Solow and Swan's model of Growth theory

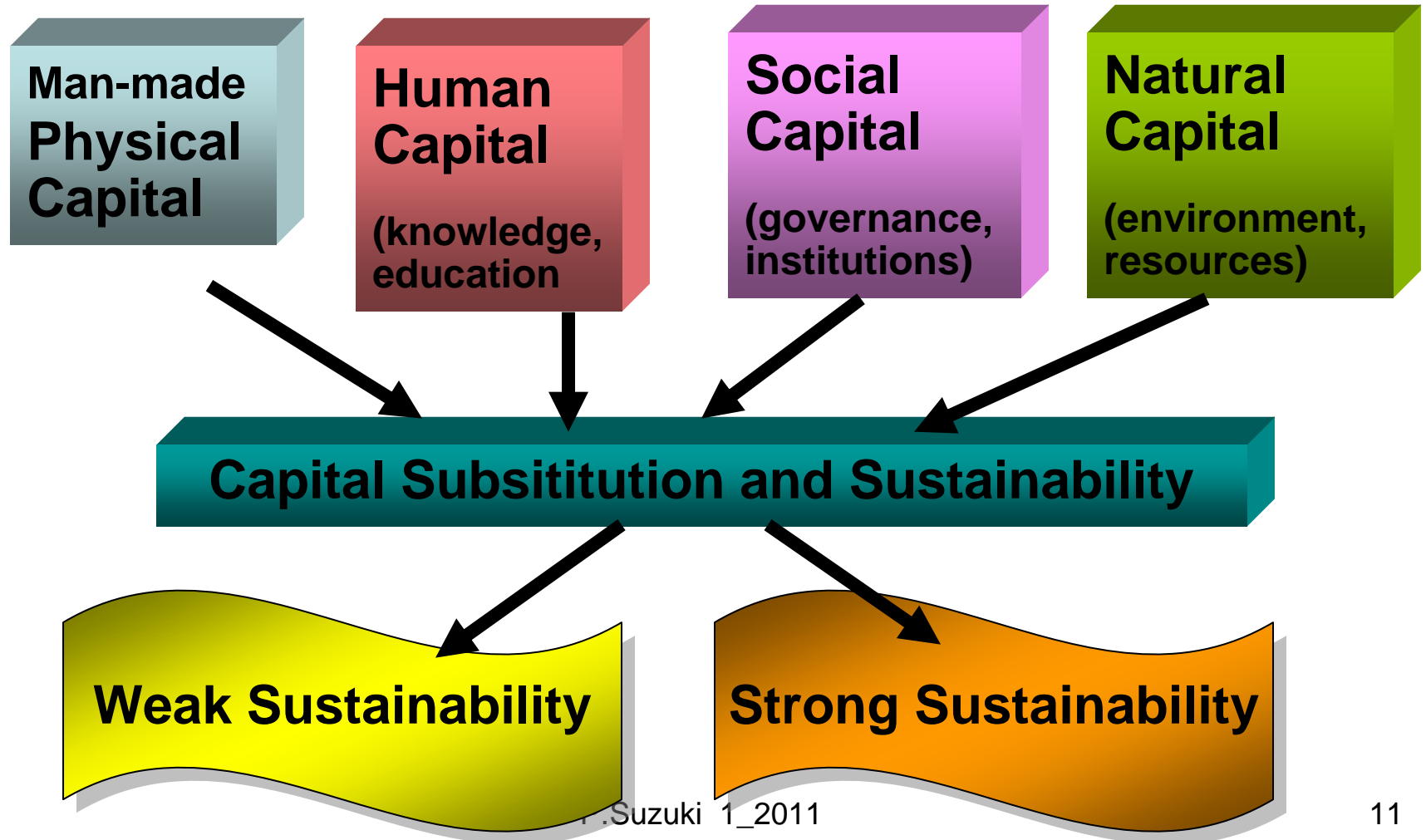
$$Q = f(L,K)$$

Implications

- Capital accumulation and technological progress are needed for economic growth and to reduce scarcity
- Technology is exogenous

- Romer's *new growth theory*
 - Add education
 - Technology is endogenous
- Both of growth theory ignore environmental constraints, optimism about technological progress and man-made capital

Total capital stock



Agriculture and Environment

- **Close linkage between agricultural systems and natural environments**
- **Conservation of NRs and Env is needed to sustain ag. development**
- **There are limits to production and the speed at which it can be increased**
- **Ag. is competing with other sector for NRs**

Agricultural Sustainability

- How to define ?
 1. The capacity to supply the expanding demand for agricultural commodities on increasingly favorable terms
 - ➔ the long-term decline in the real prices of ag. Commodities due to the growth of ag. Production is following a sustainable path

Agricultural Sustainability

2. “An ag. System which needlessly depletes, pollutes, or disrupts the ecological balance of natural systems is **unsustainable** and should be replaced by one which honors the longer-term biophysical constraints of nature” (Gordon K. Douglass)

→ the present population levels are already too large to be sustained

Agricultural Sustainability

3. “Alternative agriculture” emphasizes on sustaining both physical resource base and a broad set of community values

→ conventional science-based agriculture is bad not only for the environment but on rural people and rural communities

→ integrated approach of the physical and cultural dimensions of production and consumption

Sustainability: Application of econ. theory

- **Declining MP when a fixed factor (land) is used intensively**
 - **Change technology**
 - **Problems:**
 - » **No such technology**
 - » **No adoption of new technology**
- **Yield function drift downwards as time passed**
 - **Depends on production technique**

Choices of sustainable/unsustainable production path

- **Endogenous* factors determining**
 - Discount rate
 - Returns vs subsistence level of income
 - Need for capital accumulation for investment elsewhere
 - Availability of other sources of income
- * endogenous to an individual farm
- ** what are believed to be on a sustainable production path: *alternative agriculture; organic ag; low-input agriculture; agro-forestry*

- **Exogenous factors**
 - **Shortages of raw materials in the market**
 - **Can market adjust perfectly well and predictable ?**
 - **Social consequences**
 - **Institutional failure, including market failure**
 - **Externalities**
 - **Pure public goods**
 - **Property rights / Open-access to resources**
 - **Crown commodities**
 - **Communal control**
 - **State intervention**

Market Failures

	Exclusion	Non-exclusion
Rival	Pure private goods (green house horticulture)	Open-access (underground aquifers, marine resources)
Non-rival	Crown commodity (plant variety rights)	Pure public goods (biodiversity conservation)

Mixed cases

- **Correct institutional failure**
- **Incentive-Compatible Institutional design**