KIM

Knowledge and
innovation management

Universidade Vigo

SESSION 4

"INNOVATION SYSTEMS:

NATIONAL, REGIONAL AND SECTORAL FUNDAMENTALS"

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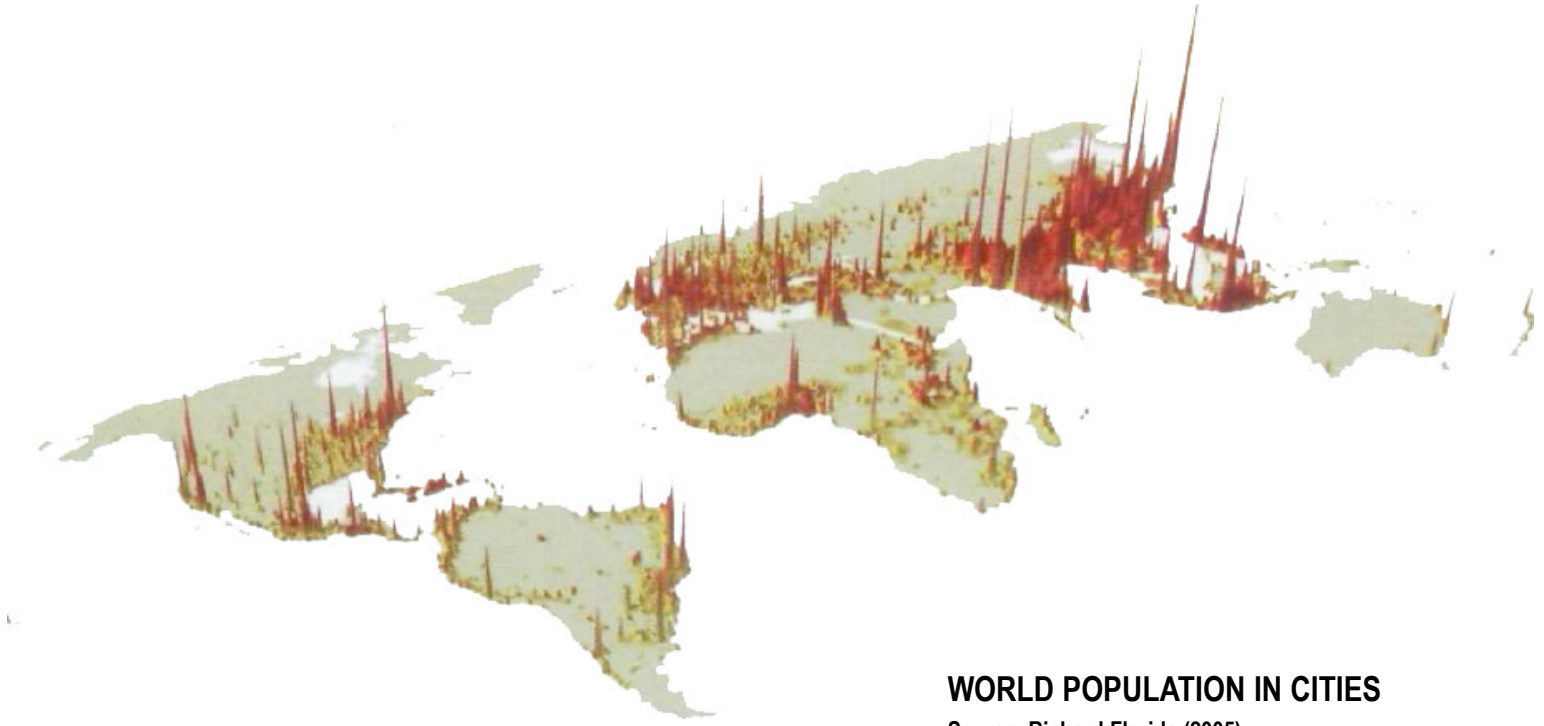
CONTENT

1. THE WORLD AND ITS ECONOMIC DIVERSITY
2. THE PERSPECTIVE OF INNOVATION SYSTEMS
   a) What are they and why are they important?
   b) Which types are we interested in?
   c) What are their elements?
3. NATIONAL SYSTEMS OF INNOVATION
4. REGIONAL SYSTEMS OF INNOVATION
5. SECTORAL SYSTEMS OF INNOVATION AND TECHNOLOGICAL TRAJECTORIES

THE WORLD AND ITS ECONOMIC DIVERSITY

- Population scattered around the globe.



WORLD POPULATION IN CITIES

Source: Richard Florida (2005)

THE WORLD AND ITS ECONOMIC DIVERSITY

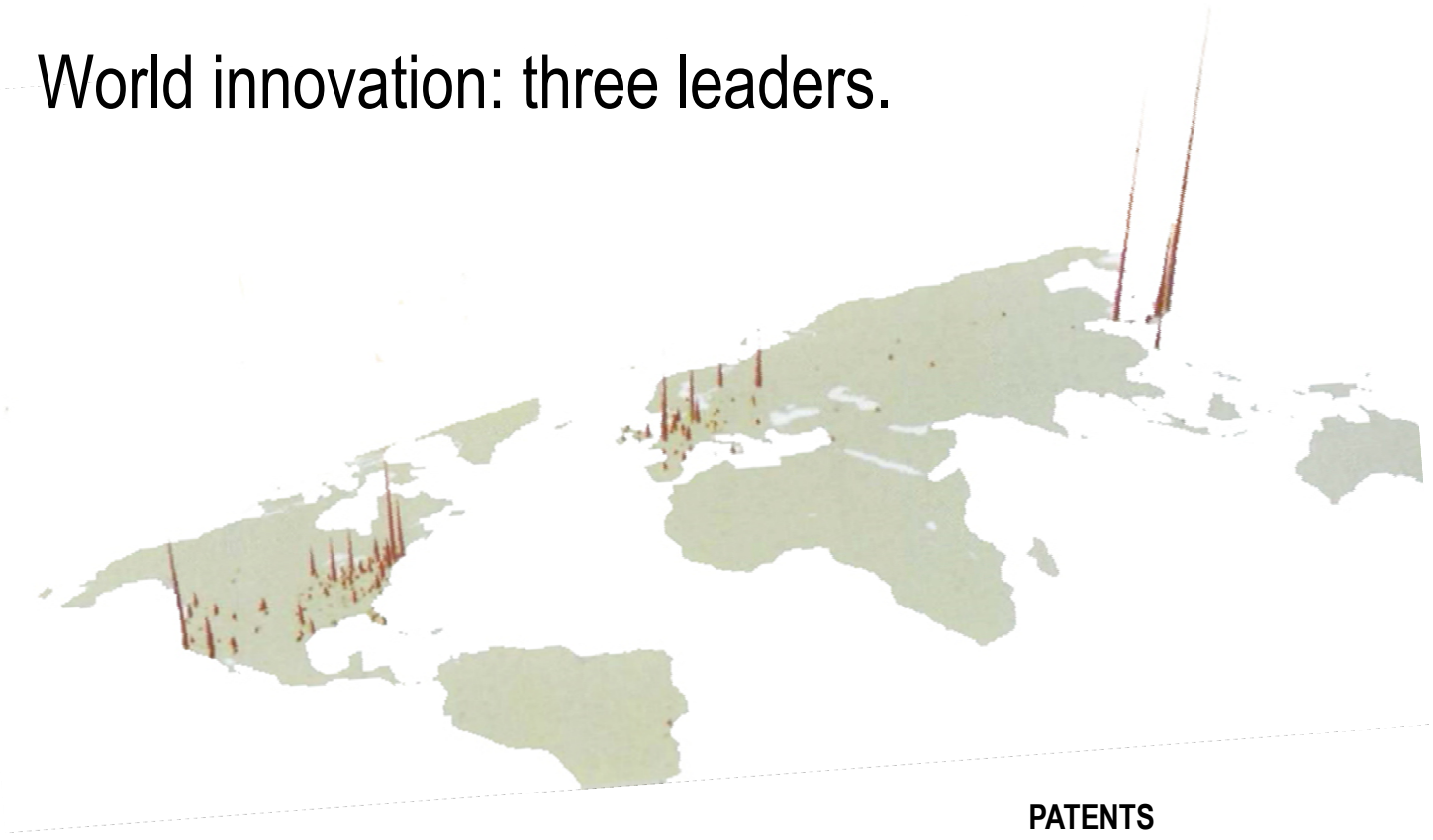
- Economic activity: few players.

LIGHT EMISSIONS

Source: Richard Florida (2005)

THE WORLD AND ITS ECONOMIC DIVERSITY

- World innovation: three leaders.



PATENTS

Source: Richard Florida (2005)

THE WORLD AND ITS ECONOMIC DIVERSITY

- Scientific knowledge nurturing innovation: USA and Europe.

SCIENTISTS WITH HIGHER IMPACT

Source: Richard Florida (2005)

WHY?

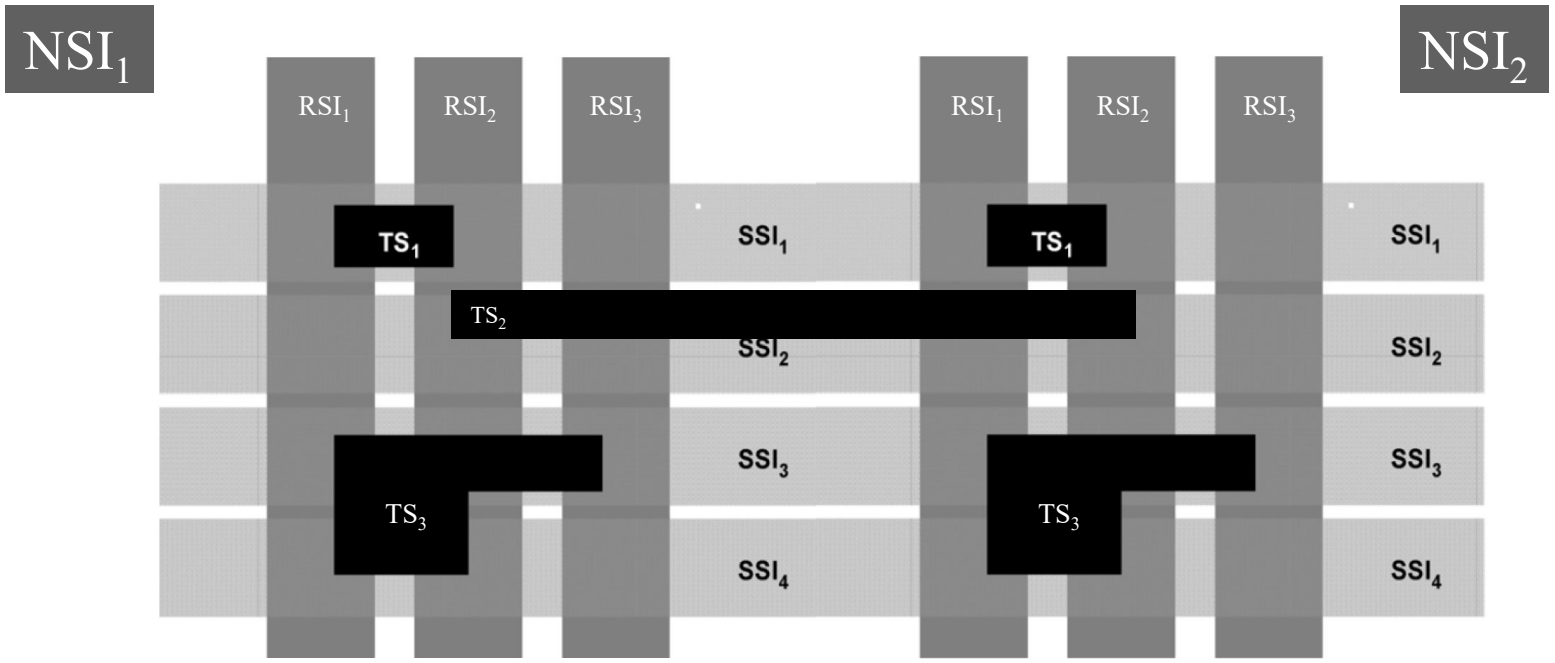
WHY INNOVATION SYSTEMS?

- To understand innovation, analysts must take a **systemic perspective**, given the iterative, multi-actor and non-linear process that shapes knowledge generation.
  - Innovation is the result of a complex set of relationships among firms, universities, government, financiers, research institutes and users/consumers.
  - These do not take place in a vacuum but are shaped by laws, policies and social norms.
- In order to properly frame this diversity of elements, the concept of an "innovation system" (IS) – **the ensemble of actors and conditions that enable the creation and flow of knowledge and technology into the economy** – has been increasingly adopted by national and regional authorities/agencies.

WHICH INNOVATION SYSTEMS?

- Innovation systems are usually analyzed at four different levels: national (NS), regional (RS), sectoral (SS) and technological (TS).
  - National or regional-level studies identify the boundaries of an IS with **geographical borders**, like those of a country or a specific region.
  - Sectoral level studies focus on all the **elements that interact "for the generation, adoption and use of technologies and products that pertain to a specific sector**" (Malerba, 2005).
  - Finally, technological-level studies **focus on a specific technology**, which may be a sub-element of a sectoral system (when the technology is exclusive to a sector, such as electric vehicle engines) or may cut across several sectors (when the focus is a more "generic" knowledge field that is used in several sectors, such as ICT) (Bergek et al, 2008).

WHICH INNOVATION SYSTEMS?



WHAT ARE THEIR ELEMENTS?

- In order to understand the functioning of an innovation system, it is necessary to understand its structure.
  - Regardless of the level of analysis chosen, innovation systems **generally include the same basic elements**: Higher Education Institutes (HEIs); Public Research Organizations (PROs); Government Agencies and Policies; Financial Organizations; Industry; Support Organizations (mainly network-enabling and political lobbying); and Institutions.
  - **In addition** to these elements, **a sectoral or technological perspective also includes a more detailed analysis of users** (Demand/Users), which can be an important source of innovation (Von Hippel, 2005), and builds on **a sound understanding of the technology** underlying the IS assessed.

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- SECTORAL SYSTEMS OF INNOVATION

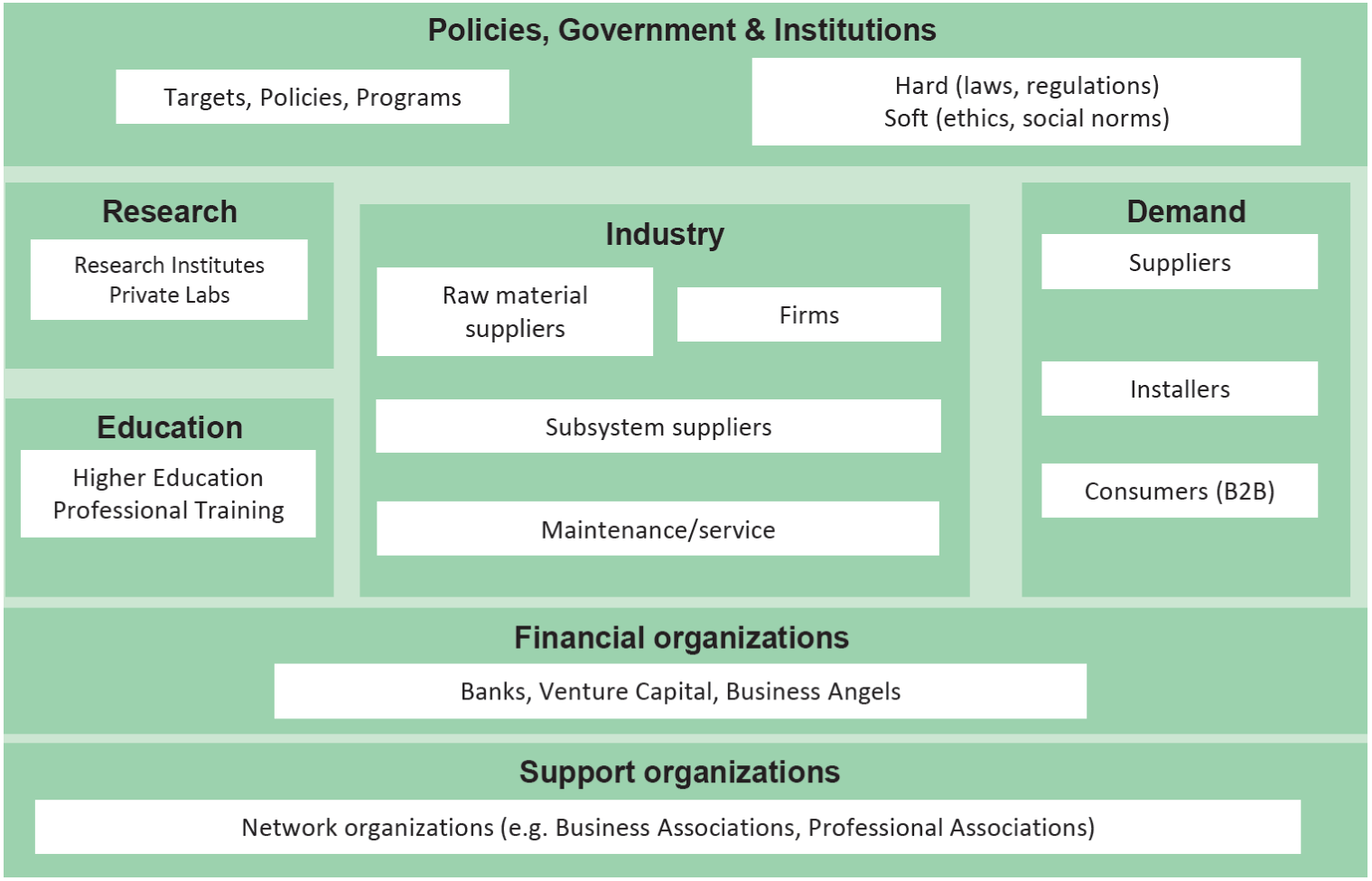
NATIONAL INNOVATION SYSTEM

- "That **set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies** and which provides the framework within which governments form and implement policies to **influence the innovation process**. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies" (Metcalfe, 1995;p.462-463).

NATIONAL INNOVATION SYSTEM

- **Institutions** (**rules of the game**): they are “sets of common habits, norms, routines, established practices, rules or laws that regulate the relations and interactions between individuals, groups and organizations,” (Edquist & Johnson, 1997).
- **Players or actors**: Firms, universities, venture capital organizations, public agencies responsible for innovation policy etc.

NATIONAL INNOVATION SYSTEM



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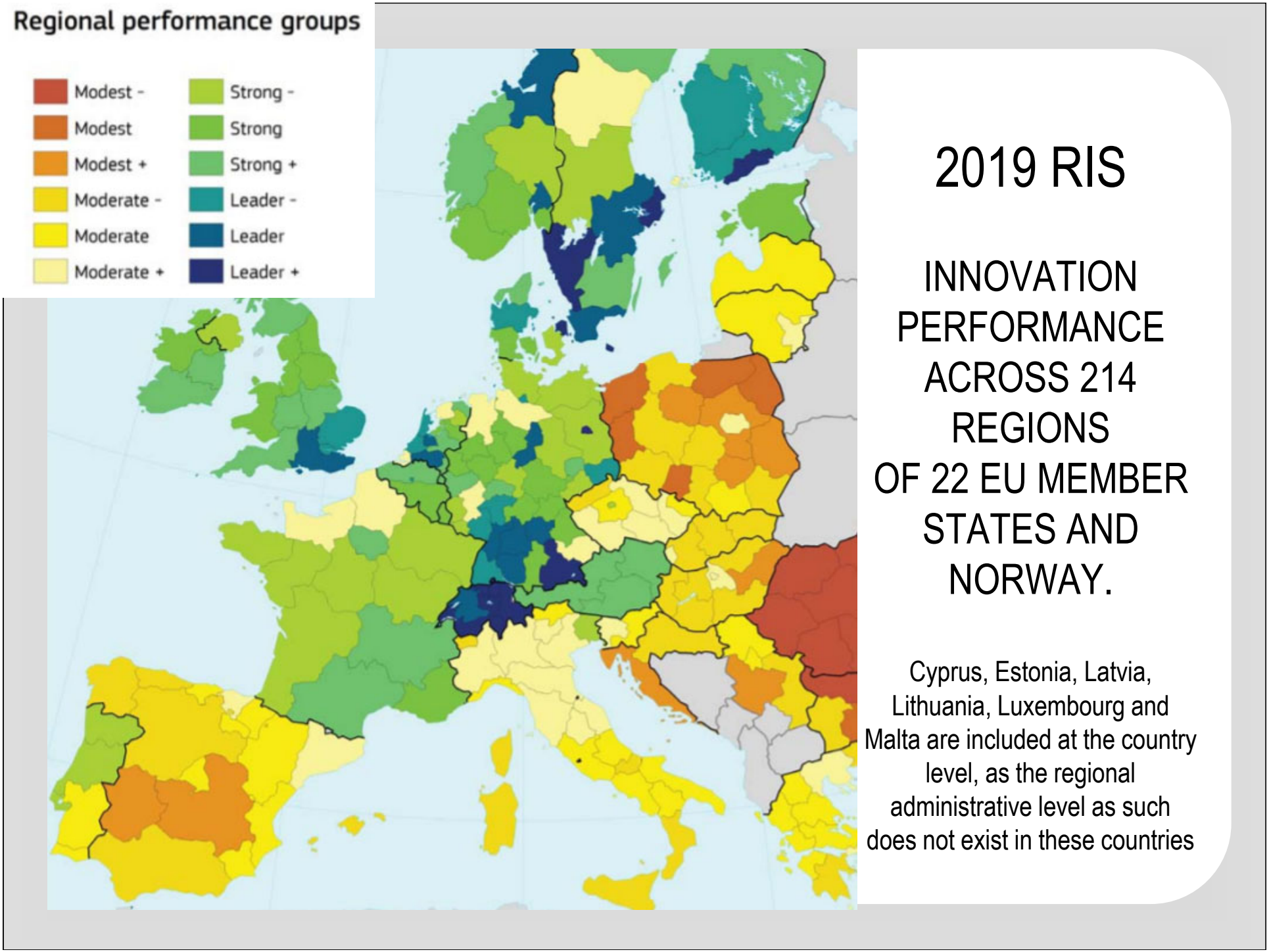

2019 RIS

INNOVATION PERFORMANCE ACROSS 214 REGIONS OF 22 EU MEMBER STATES AND NORWAY.

Cyprus, Estonia, Latvia, Lithuania, Luxembourg and Malta are included at the country level, as the regional administrative level as such does not exist in these countries

REGIONAL INNOVATION SYSTEM

- The rationale for a Regional Innovation System (RIS):
  - Innovation processes are not spread evenly across space, but they are concentrated in certain areas while being more or less absent in other regions. Why?
    - ✓ **Technological trajectories**: different localities have different sector specialisations & distinct sets of innovation processes.
    - ✓ Based on **tacit-sticky knowledge and localized learning**: most processes driving innovation occur locally because knowledge is embedded in people and face-to-face interaction is easier and cheaper at the regional level (distance decay effects in rate of knowledge & information links).
    - ✓ SMEs have spatially restricted search patterns for collaborative partnerships or technological inputs.
  - Hence, a one-size-fits-all approach to innovation policy that treats all regions in a similar way is not appropriate. This is the reason for **Smart Specialization Strategies** in Europe.

REGIONAL INNOVATION SYSTEM

- Fields and players:
  - ✓ Knowledge Generation:
    - (1) Public & private research laboratories, (2) Universities & Colleges for scientific & technical training; and (3) Firms that transfer knowledge
  - ✓ Knowledge Exploitation:
    - (1) Firms with regional & global value chain relationships; (2) Venture capitalists; and (3) Consultants

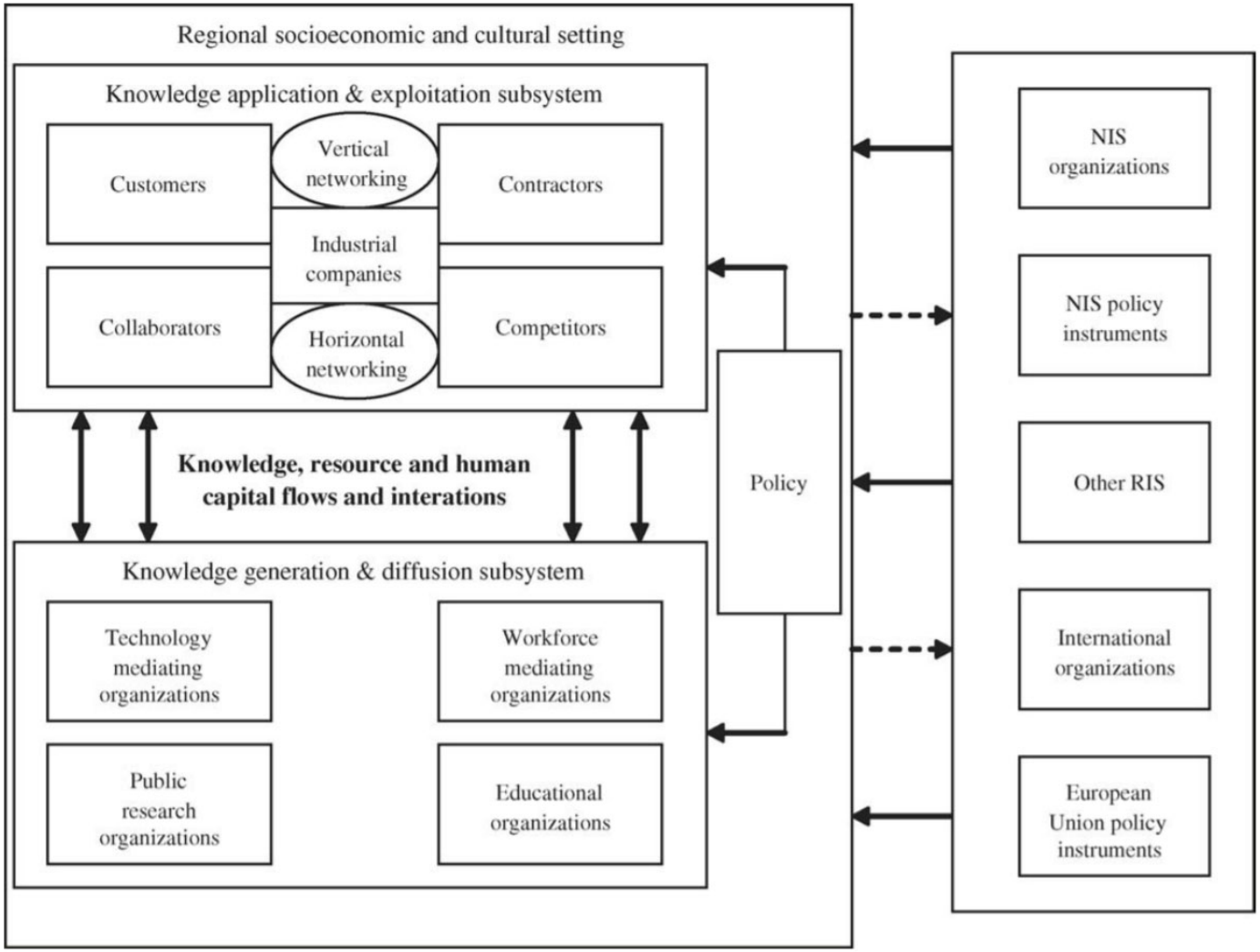

Fig. 1. Main structure of regional innovation systems (RIS). *Source*: Own modification of Autio (1998), p. 134.

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SECTORAL SYSTEMS OF INNOVATION

- Do firms that belong to different sectors innovate differently? What is in fact an «industry» or a «sector»?
  - Economics has not investigated this question at least until the 1980s.
  - Most of the literature studying **the international competitiveness of industries has traditionally focused on price- and cost-related factors**, rather than technology.
  - **In recent decades, however, the role of technological innovation for the competitiveness of industries has come to the forefront**, inspired by classical contributions of Schumpeter, Vernon and Posner.
- So… e.g.: do companies in the chemical industry tend to have different innovation strategies than firms in the software sector, or in the hotels and restaurant sector?

SECTORAL SYSTEMS OF INNOVATION

- The evolutionary view: why sectors matter.

Technological regimes

SECTORAL SYSTEMS OF INNOVATION

- The specific pattern of innovative activities in an industry can be explained as the outcome of different technological (learning) regimes (TR).
- **Technological regimes refer to the technological environment in which innovative activities are undertaken**. It is sector-specific, and it affects innovative outcomes and the competitiveness of industries
- So the specific pattern of innovation is explained by TR characteristics: **technological opportunities; properties of the knowledge base; appropriability; and cumulativeness.**

SECTORAL SYSTEMS OF INNOVATION

- TR characteristics:
  - **Technological opportunities** reflect the likelihood of innovating for any given amount of money invested in search.
  - **Appropriability** of innovations summarizes the possibilities of protecting innovations from imitation and of reaping profits from innovative activities.
  - **Cumulativeness** of technical advances is related to the fact that today knowledge and innovative activities form the base and the building blocks of tomorrow innovations.
  - **Properties of the knowledge** base: specificity, tacitness, complexity and independence.

SECTORAL SYSTEMS OF INNOVATION

- These characteristics lead to different types of industrial dynamics (two main patterns of innovation in industries):
  - **Schumpeter Mark I (widening)** is characterized by `creative destruction' with technological ease of entry and a fundamental role played by entrepreneurs and new firms, challenging established firms and continuously disrupting the current ways of production, organization and distribution.
  - **Schumpeter Mark II (deepening)** is characterized by `creative accumulation‘, where large established firms create relevant barriers to entry with the their accumulated stock of knowledge in specific technological areas, their competencies in R&D, production and distribution and their significant financial resources.

Schumpeter Mark I and II

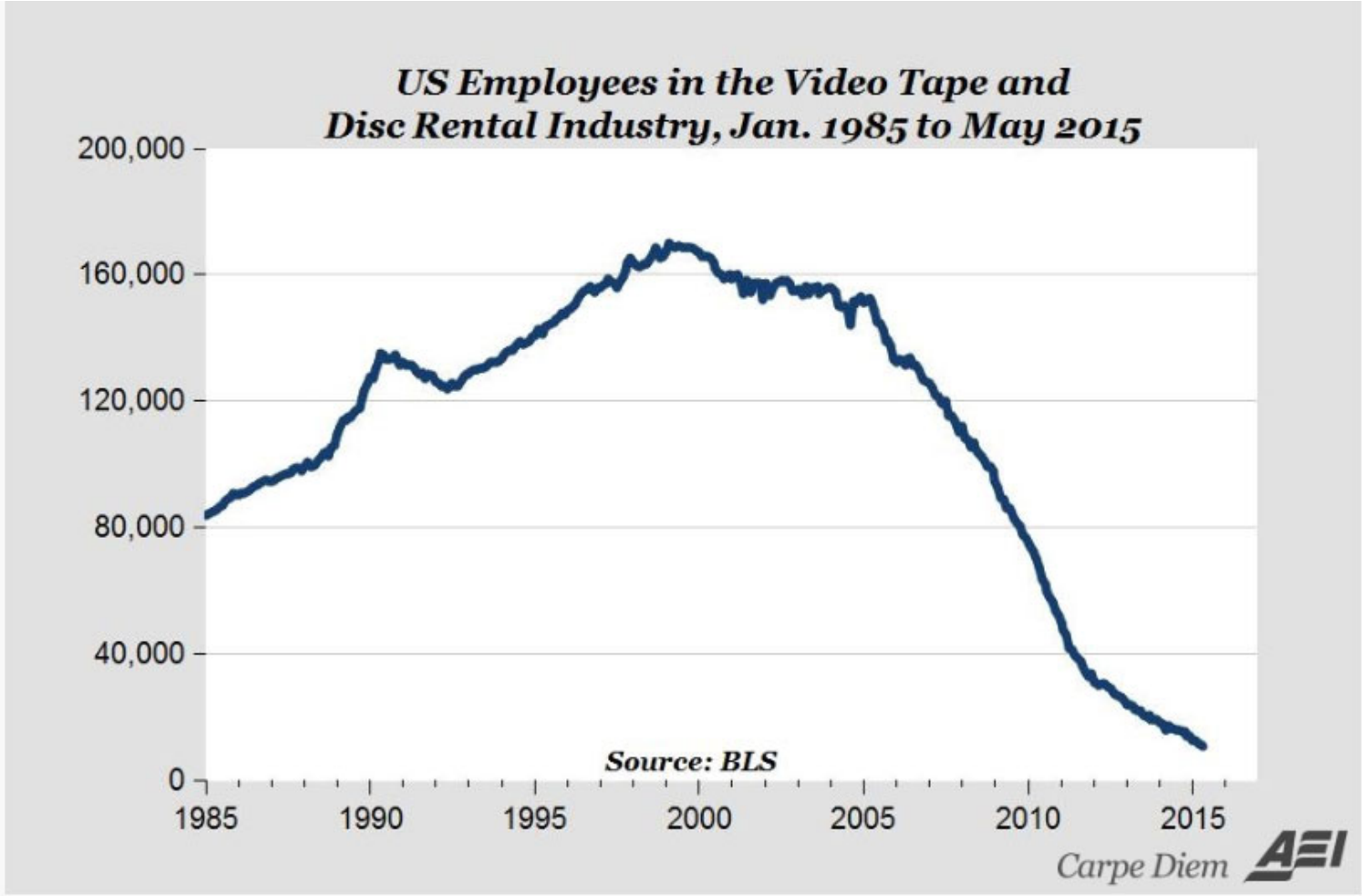
SMI

Food producers
Beverages
Tobacco
Household Goods
Personal Goods
Construction & Materials
Industrial Engineering
Industrial Metals
Industrial Transportation
Leisure Goods
Mobile Telecommunications
Software & Computer Services

SMII

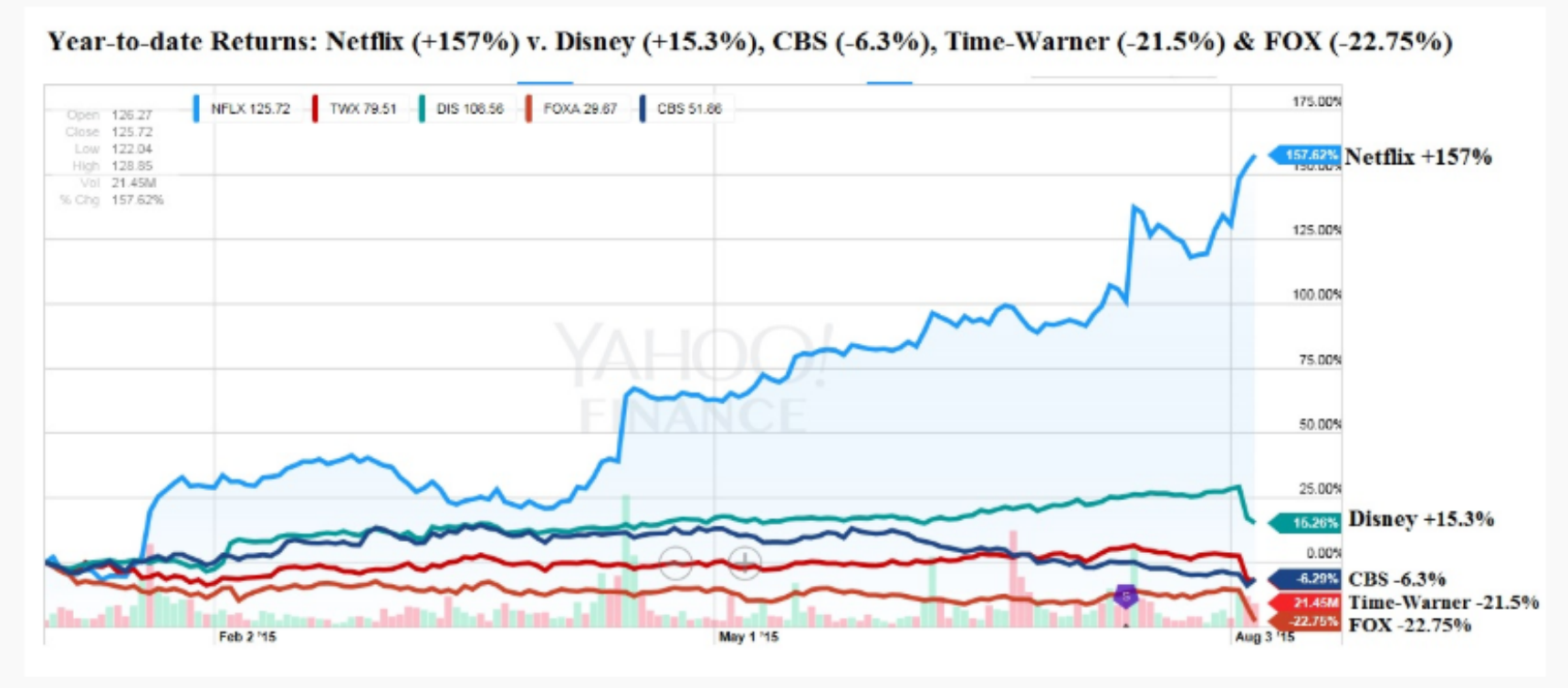
Aerospace & Defence
Oil and Gas Producers
Oil Equipment & Services
Chemicals
Pharmaceuticals, Biotechnology
Healthcare Equipment
Electronic, Electrical Equipment
Fixed Line Telecomm.
Technology Hardware & Equipment

Breschi, S., Malerba, F., & Orsenigo, L. (2000). Technological regimes and Schumpeterian patterns of innovation. *The economic journal*, *110*(463), 388-410.


US Employees in the Video Tape and
Disc Rental Industry, Jan. 1985 to May 2015
200,000
160,000
120,000
80,000
40,000
0
1985
1990
1995
2000
2005
2010
2015
Source: BLS
Carpe Diem
AEI

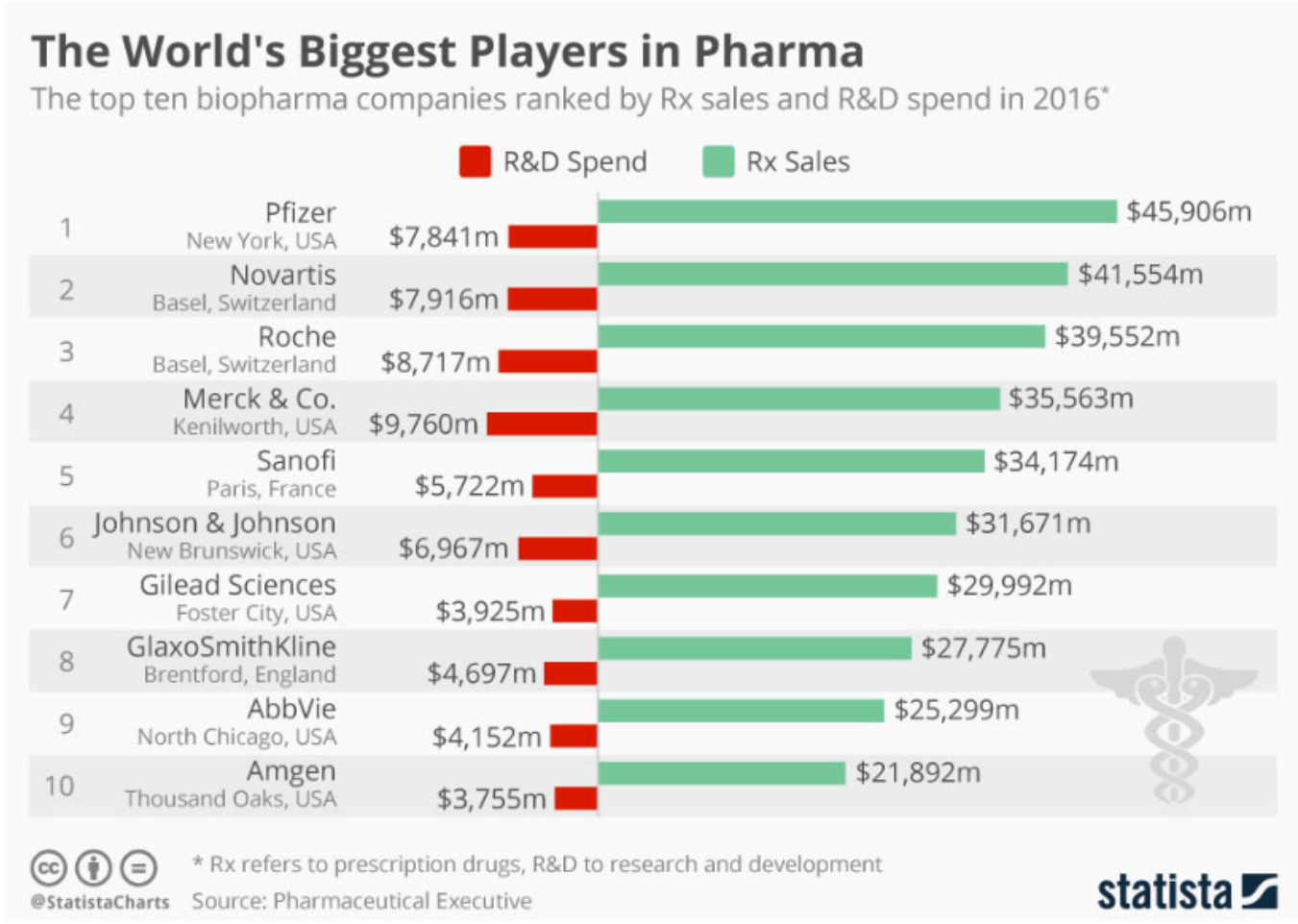
The Netflix effect in the **entertainment industry**

Mark I: creative destruction



Netflix expanded its business in 2010 with the introduction of streaming media while retaining the DVD and Blu-ray rental business initiated in 1997.

The pharmaceutical industry
Mark II: creative accumulation



SECTORAL SYSTEMS OF INNOVATION

Technological regimes and schumpeterian patterns of innovation:

so what?