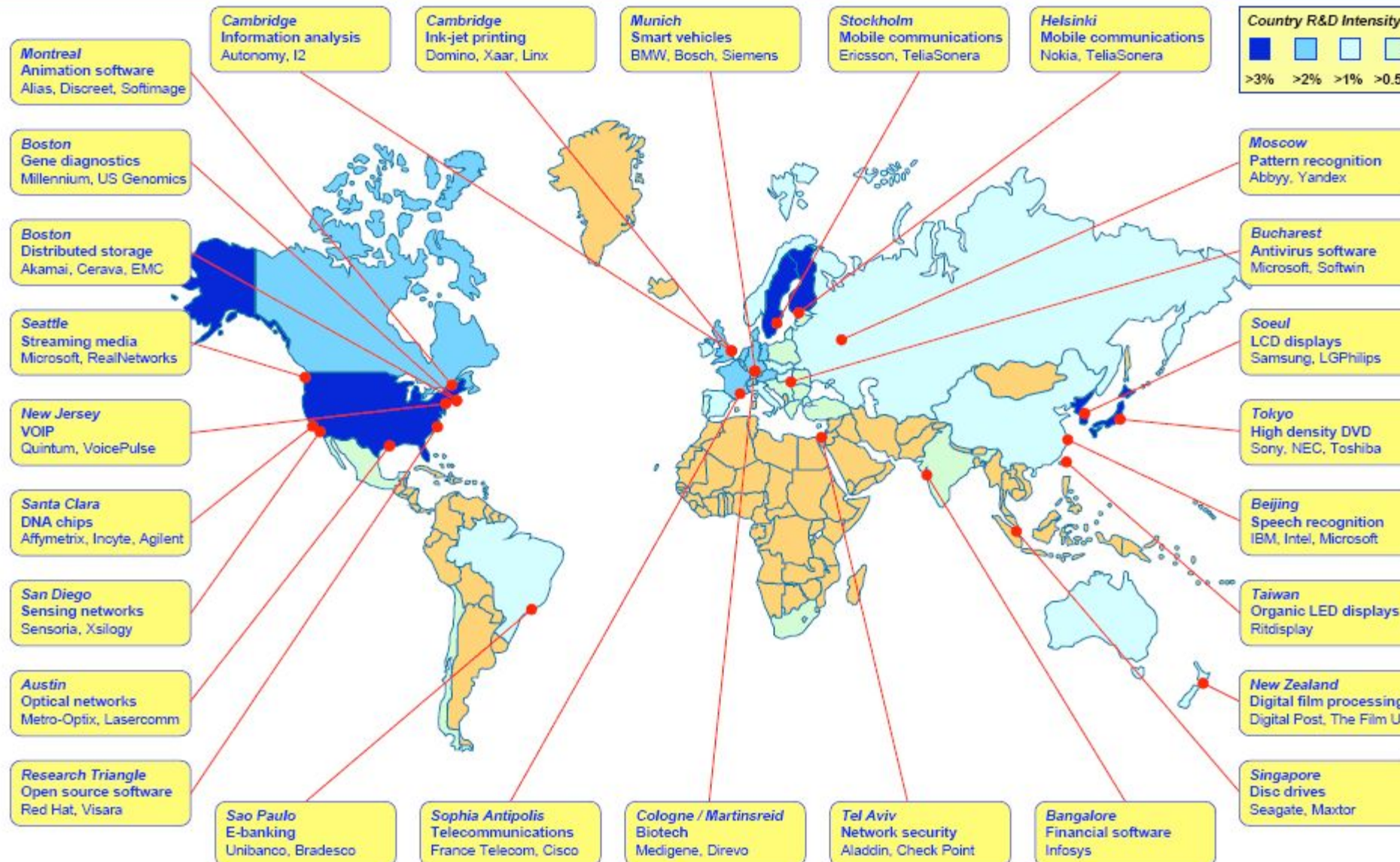


ECONOMICS OF INNOVATION

Lecture 6: Clusters, Innovation & the Division of Labour

Global innovation clusters, core technologies and key companies



Example of a cluster: Silicon Valley (Santa Clara County)

- **Silicon Valley** between San Jose and San Francisco in California is the classic cluster
- Centre of the US (and world) **computer industry**- and other high tech industries such as **biotechnology and clean technology**
- Grew out of electronics expertise in Stanford University, and US military spending on electronics
- Proliferation of **Start-ups** (e.g. Intel and Apple) with innovation culture and innovation strategy
- “**network firms**”
- Risk and venture capital resources

Silicon Valley



What is in Silicon Valley?



Universities

Venture
Capital



5 airports

Clusters

- Alfred Marshall (1890) talked about '**industrial districts**':
 - A local pool of specialized labour
 - Firms specializing in intermediate stages of production
 - Knowledge spillovers
- Interest in clusters revived in 1980s with '**new industrial districts**' and new work identifies the importance of:
 - supportive socio-cultural attributes that create an innovative culture (**way of doing things in the locality, tacit knowledge**)
 - a network of public and private institutions supporting firms in the locality
 - an intense set of backward, forward and horizontal linkages between firms based on non-market as well as market exchanges
- '**Clusters**' (the rebranded term) became a popular concept for innovation studies following the work of Porter (1990) and Krugman (1991)

What is a cluster?

A spectrum of Definitions

Phenomenon	Richness of Cluster	Difficulty of Measurement
Informal Knowledge Exchange	 Rich	 Hard
Explicit Collaboration		
Labour Mobility		
Marshallian Externalities		
Network Firms		
Companies Interdependent in a Value Chain		
Co-Location and Superior Performance		
Co-Location and Technological Proximity		
Co-Location		
	Shallow	Easy

What Characterizes Innovation Clusters?

- Geographical Concentration
- High Degree of Specialization
- Large Number of Start-ups and Small Firms
- Ease of Entry and Exit
- High Rate of Innovation

Share some examples of clusters in your region/country

- What cluster is it? In which industry?
- Size of the firms?
- Relationships among the firms?
- Performance of firms within the cluster?
- Why do firms cluster?

Why do companies cluster?

Advantages and Disadvantages

	Demand Side	Supply Side
Advantages	<ul style="list-style-type: none"> • Strong local customers • Reduced consumer search costs • Market share gains from clustering (Hotelling) • Reduced transaction costs • Information externalities 	<ul style="list-style-type: none"> • Strong local suppliers • Pool of specialised labour and other specialised inputs • Shared Infrastructure • Reduced transaction costs • Information externalities and knowledge spillovers • Facilitates Innovation
Disadvantages	<ul style="list-style-type: none"> • Competition in output markets 	<ul style="list-style-type: none"> • Competition in input markets (real estate, labour) – ‘overheating’ • Local infrastructure over-stretched • Congestion (e.g. in transportation) • Cartels • “New ideas need new space”

Statistical /econometric evidence

- Companies located in strong clusters often **grow faster** than average
- Strong clusters attract disproportionate amounts of **new firm entry** (“start-ups”)
- In high-tech industries (e.g. biotech), **proximity of the science base** (e.g. major university) attracts entry
- Strong clusters generate disproportionate amounts of **innovation and patenting**

Clusters and Innovation

- Recall the two perspectives on innovation (lecture 1)
 - Innovation stems from division of labour
(depth: **specialisation**)
 - Innovation stems from combination of diverse knowledge
(breadth: **diversity**)
- Both of these mechanisms can work better in the cluster than in isolation

How Do Clusters Facilitate Innovation?

- Division of labour, specialization
- Networking
- Ease of entry and exit
- Resource mobility

How Do Clusters Facilitate Innovation?

1. Division of Labour and Specialization

SMITH: Division of labour  Invention

MARX: Division of labour  Invention

RAE: Invention  Division of labour

How Do Clusters Facilitate Innovation?

1. Division of Labour and Specialization

- A large number of firms in the same industry allows firms to specialize in what they are good at
- They can provide specialist goods and services and cluster firms can draw on a range of specialised suppliers
- These will include specialised firms that support innovation in the cluster (patent agents, venture capital firms etc.)

Why are companies in clusters more specialised?

- **Transactions costs are lower in clusters**
 - Reduced costs of coordinating inputs with company requirements
 - Reduced costs of communication with suppliers
 - Reduced risk of opportunistic behaviour
- If transactions costs are low it makes sense to outsource to specialist supplier who enjoys economies of scale
- Companies that **specialise enjoy economies of scale**
Therefore: companies tend to specialise in part of the vertical chain and outsource the rest

Why are companies in clusters more specialised?

- “The Division of Labour is limited by the Extent of the Market” (Adam Smith)
- As we move from dispersed production serving a small area to clustered production serving a large area, **the extent of the market is increased**
- And thus a greater division of labour emerges

How Do Clusters Facilitate Innovation?

- Division of labour
- **Networking**
- Ease of entry and exit
- Resource mobility

How Do Clusters Facilitate Innovation?

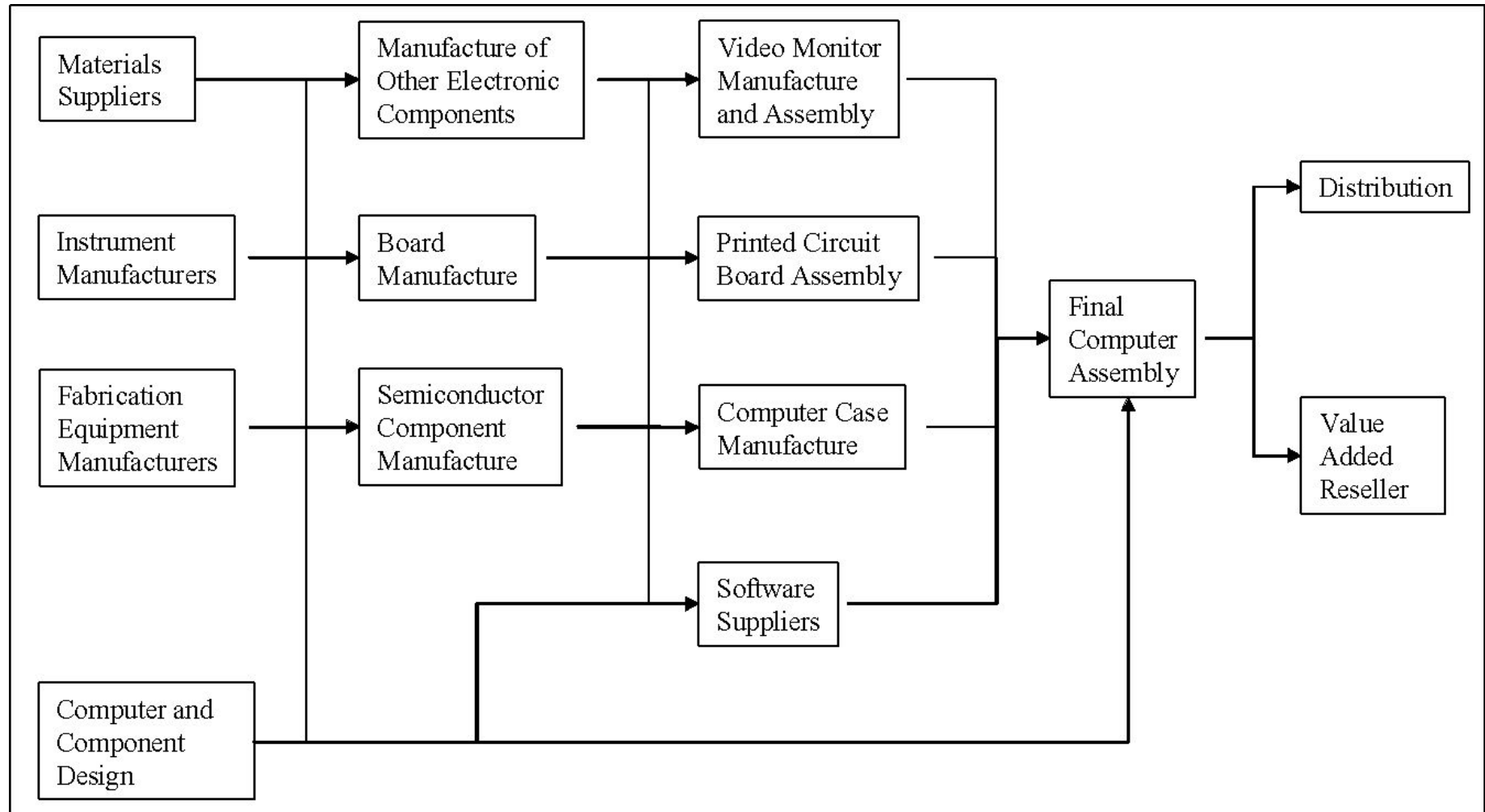
2. Networking

- Innovation does not happen in isolation but draws on other firms for ideas, knowledge and services- **innovation is a multiplayer game, not a solo act.**
- Tight-knit groups of people working in the same field but within a number of different firms located in close proximity can facilitate networking within the cluster- **a knowledge community**
- Cluster firms know a lot about what their competitors are doing

Exploiting networks in a cluster

- Networks are about linkages and connections bringing together suppliers, customers, collaborators, research centres to produce innovations
- Networks consists of firms with complementary capabilities and resources
- Networks come with their own challenges:
 - How to manage beyond firm boundaries?
 - Self interest vs. system interests?
 - Trust? Free riders?

Division of Labour in Computer Manufacture



Vertical Integration (1960s) in Computer Industry

- In early 1960s, IBM dominated the computer industry
- IBM had a high degree of vertical integration, and made almost all the components of its computers **“in house”**
- This included the semiconductor components, peripherals (disk drives, tapes etc.), software, operating systems, and assembly

Network Firms (1980s onwards) in Computer Industry

- Contrast this with the history of Apple, one of the pioneers in the PC market
- Apple, founded in Silicon Valley, was at that time just a design company - designing computers
- Apple produced no components and did almost no assembly - all that was **outsourced** to other companies, *many of which were also in Silicon Valley*
- Apple was once described as the ultimate **network firm**

How Do Clusters Facilitate Innovation?

- Division of labour
- Networking
- **Ease of entry and exit**
- Resource mobility

How Do Clusters Facilitate Innovation?

3. Ease of Entry and Exit

- A tradition of start-ups: small and young companies
- Lower sunk costs for entrepreneur scientists
- 'OK to fail' culture

How Do Clusters Facilitate Innovation?

4. Resource Mobility (especially labour)

- If people move between companies, so do ideas.
- Movement encourages an active market for 'skills'.
- Firms well aware of what other cluster firms are doing.



Case Study

- Procter and Gamble is a multinational company well known for its wide range of consumer products, covering everything from snacks to hygiene products and detergents.
- Employs 7500 scientists and spends \$5 million on Research and Development annually.
- Until the year 2000, they operated with the '**invented here**' model doing their innovations in house.
- In 2000, they moved to a new strategy '**connect and develop**' to exploit the ideas and innovations of external partners such as universities and other companies.
- Every year P&G produces a 'top 10 needs' based on consumer research and reach out to their broad network with the 'problem' and search for technology providers.
- Once a technology provider is identified, they negotiate the terms of licensing the technology and often undertake product development in-house.

Questions

- 1) What are the advantages and disadvantages of the 'connect and develop' model over the 'invented here' model from P&G's perspective?
- 2) What is the role of P&G in this network? What capabilities are required to perform this role well?
- 3) Why are technology providers (these may be universities or companies) willing to take part in such a network?
- 4) P&G does not only work with a local network but a global one that includes firms all around the world. What are the advantages and disadvantages of global networks?

Lecture 6: Clusters, Innovation & the Division of Labour

Summary

1. Clusters
2. Division of Labour

Thanks for your attention!
Any Questions?