

Master EMI
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Innovation systems

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Introduction



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Evolution of focus in innovation studies

- Economics of technology (1970s)
- Economics of innovation (1980s)
- Economics of knowledge (1990s)
- Economics of creativity (2000s)



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Innovation as a central strategy for firms and nations

- Creating and developing new products, processes and/or markets is at least an opportunity for the development of micro and macro entities
- It is even sometimes a necessity for survival in a globalized, ever-changing world
- Nevertheless only a minority of entrepreneurs consider creative/innovative activities as day-to-day business: it is a secondary concern because operational business issues claim the entrepreneur's full attention
- Therefore many ideas « stay on the shelf » due to lack of time, money, partners or knowledge



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Defining creativity

- Creativity is at the core of every progress in society, in particular at the origin of economic innovation.
- Creativity corresponds to a positive mental attitude towards anything that is new.
- "*Creativity is the ability to produce work that is both **novel** (i.e., original, unexpected) and **appropriate** (i.e., useful, adaptive concerning task constraints).*" Sternberg/Labort (2008)



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Promoting innovation

- *Creativity* is the activity of producing new ideas; it is necessary but not sufficient for innovation and growth
- Willingness to *innovate* is at the core of entrepreneurial spirit (Schumpeterian approach)
- Successful introduction of new ideas requires entrepreneurial attitude and capabilities in various fields, for instance:
 - Analyzing technical as well as commercial feasibility
 - Dealing with financial issues (at every stage of the innovation process)
 - Playing on inter-organizational networks (nobody can innovate alone) and negotiating partnership agreements
- There are recipes for innovation management (and creativity management) at firms' level.
- There are public policies as well, at all geographical levels: national systems, regional (sub-national) entities, local territories like cities or science parks...



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Core questions for this presentation

- What is creativity?
- What is innovation ?
- What are innovation systems ?
- Why innovation policies ?



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Chap1

Innovation economics: fundamentals



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Joseph A. Schumpeter (1883-1950): the father of innovation theories



- Principle of “creative destruction” (*schöpferische Zerstörung*)
- Main works: *Business Cycles: A theoretical, historical and statistical analysis of the Capitalist process* (1939); *Capitalism, Socialism and Democracy* (1942)
- Innovations according to Schumpeter:
 - New markets or products
 - New equipment
 - New sources of labor and raw materials
 - New methods of organization or management
 - New methods of transportation or communication
 - New methods of advertising and marketing
 - ...



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Three dimensions of creativity

Field	Activity	Result	Measure
Science	Basic research	Scientific discovery	Publications
Technology	Applied research	Invention	Patents (other IP rights)
Economy/ society	Industrial and commercial development	Innovation	Sales, profits, jobs



Innovation and creativity

- Innovation means :

New idea + entrepreneurship

- The new knowledge (idea) is not necessarily in science and/or technology: can be in the fields of organisation, culture, arts, lifestyle, etc...
- It is not necessarily formal knowledge (in that case, IP does not apply and/or is not necessary)
- Innovation can be the result of creativity in regular economic sectors, in regular commercial organisations. Another interesting field is the development of « creative industries ».



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Innovation and networks

- Nobody innovates alone:
 - Partners
 - Strategic alliances
 - Clients
 - Suppliers
 - Research centers
 - etc.
 - Externalities, material or immaterial infrastructures,
 - Knowledge communities



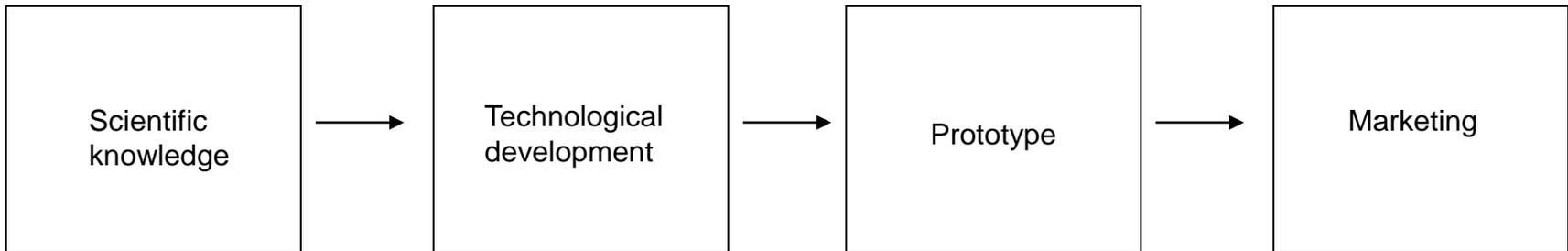
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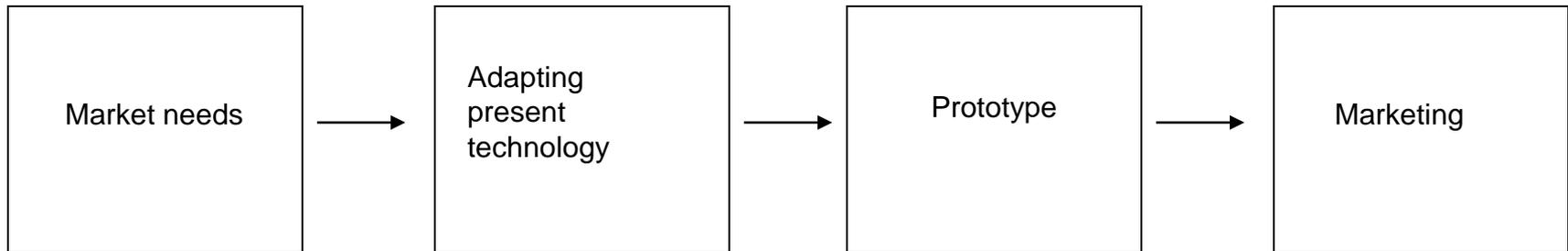
Innovation models: « technology push » vs « demand pull »

- Science-pushed process (*Schumpeter 1*)

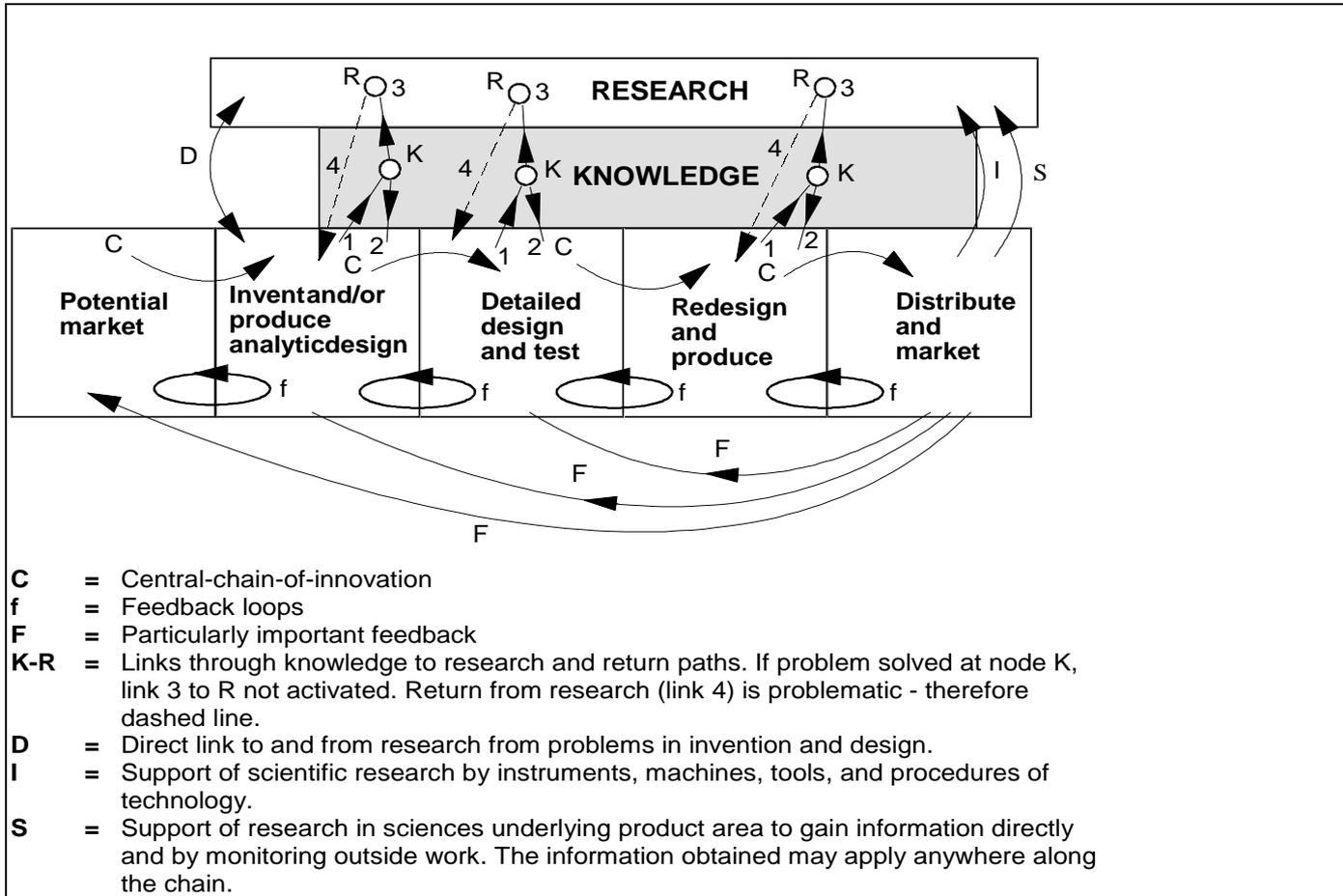


Technology push *versus* demand pull

- Market-pulled process (*Schmookler*)



“Chain-linked model” (Kline & Rosenberg, 1986)



Chap2

Innovation economics: main topics in the literature



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The understanding of knowledge as an economic factor

1. Knowledge regarded as a public good: Arrow (1962) and Nelson (1959)

- it spills over, primarily, from universities and research labs, and it is freely available to firms

2. Knowledge as a quasi-proprietary good: (Nelson & Winter, 1982)

- the firm regarded as the privileged locus of knowledge creation and accumulation.
- firms can appropriate and protect a fraction of the knowledge it creates by means of property rights



The understanding of knowledge as an economic factor (2)

3. Knowledge as a collective process.

- knowledge generated by interactions among many economic agents (Griliches, 1992; David, 1993; Cooke, 2002)
- from *learning by using* (Nathan Rosenberg) to *learning by interacting* (Bengt-Åke Lundvall)
- Interrelation among firms, universities and public labs are considered vital for the *generation, dissemination* and *absorption* of new knowledge. The spillovers of knowledge generate positive externalities to firms by stimulating innovation activities and productivity.

4. Spatial dimension of knowledge networking and collective creativity

- Concepts of national and regional innovation systems (NIS, RIS)
 - NIS: Nelson, 1993; (+Freeman, Pavitt, etc.)
 - RIS: Cooke et al., 1997; Braczyk et al., 1998
- Triple Helix model (Etzkowitz, Leydesdorff, 2000)



Back to basics: Alfred Marshall (1890)

The *Industrial District* argument

- Increasing returns to **scale**, or *economies of scale*:
 - increased levels of output → lower average costs
- Economies of scale may also be **external** to the firm (*externalities*): an increase in industry-wide output **within a given geographical area** decreases average costs for the individual firm. There are 2 types of externalities:
- **(1) Pecuniary externalities** (transmitted by the market):
 - asset-sharing: infrastructures, etc.
 - supply of specific goods and services by specialized suppliers
 - the creation of a local labour market pool
- **(2) Knowledge externalities**
 - Knowledge created by one firm may spill over to other firms.
 - Knowledge spillovers increase the stock of knowledge available for each individual firm
 - It may positively affect the regionally residing firms' ability to innovate
- **Remark 1:** Knowledge externalities are *dynamic* (more typically than pecuniary externalities)
- **Remark 2:** In order to benefit from knowledge externalities firms must work on similar things and use each others' research (Griliches, 1979) or personal skills.



Comments

(mostly quoting G. van der Panne (2004))

- Most of this knowledge is tacit. *Tacit knowledge* is ill-documented, uncodified and can only be acquired through the process of social interaction. Hence, knowledge spillovers are geographically bounded to the region in which the new economic knowledge is created (Feldman and Audretsch, 1999)
- Question: do agglomeration economies arise between firms belonging to the same or to different industries. As put forward by Glaeser *et al.* (1992) as the **Marshall-Arrow-Romer (MAR)** model, knowledge is predominantly industry-specific.
- Knowledge spillovers may therefore arise between firms within the same industry and can only be supported by regional concentrations of a particular industry. These intra-industry spillovers are known as localization or '*specialization*' externalities.
- **Jacobs (1969)** by contrast, argues that knowledge may spill over between complementary rather than similar industries as ideas developed by one industry can be applied in other industries.
- The exchange of complementary knowledge across diverse firms and economic agents facilitates search and experimentation in innovation. Therefore, a diversified local production structure leads to increasing returns and gives rise to urbanization or '*diversification*' externalities.



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Marshallian specialization or Jacobian diversification ?

The issue:

- A. Marshall (1890) *Principles of economics*:

Firms of the **same specialization** tend to cluster in specific locations where they benefit from physical externalities like common infrastructures, but also knowledge externalities through manpower and other interfaces (“the secrets are in the air”)

- J Jacobs (1969) *The economy of cities*:

Knowledge spills over between **different industries**, causing diversified production structures to be more innovative

G. van de Panne (2004):

“The literature on innovation and agglomeration externalities remains inconclusive as to whether specialized or diversified local production structures favor local innovative activity”

“In addition, ambiguity exists as to whether local market power or competition is favorable.”

The Dutch case (van der Panne):

“The results show that the Marshallian specialization thesis holds, though more pronounced for R&D intensive and small firms.

Fierce local competition within an industry negatively affects innovativeness in that particular industry”



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Marshallian specialization or Jacobian diversification : further comments

- **Marshallian** externalities correspond to the (internal model of) *economies of scale*. **Jacobian** externalities correspond to *economies of scope*.
- Theory of **clusters**:
 - The *Italian district* model (Becattini, etc.) implies specialization - in a mixed situation of cooperation/competition among the firms.
→ Marshallian hypothesis
 - The M. Porter model of *innovative cluster* considers inside competition as a positive and even necessary condition for competitiveness, and considers a whole variety of actors.
→ closer to Jacobian hypothesis, although the cluster is (broadly) specialized



Knowledge (stock, flow and creation) as characteristics of territories (1)

- Knowledge spillovers are geographically bounded : Audretsch and Feldman, 1996; Acs et al., 2002)
- They are more generally affected by cognitive, social, organizational, and institutional *distance*: Torre and Rallet (2005), Boschma (2005).
- The active role of territorial actors (institutional approach)
 - Relevance of institutions among other actors: differences in economic behaviours and outcomes are primarily related to differences in institutions (Hodgson, 1988, 1998; Whitley, 1992, 2003; Saxenian, 1994; Gertler, 1997).
 - Relevance of cultural attitudes as well as cultural assets (Hussler 2004)
- Competitive advantage in the areas of education and R&D
 - the role of universities in the process of knowledge spillovers (Jaffe, 1989; Anselin, 1997; Audretsch and Feldman, 1996)
 - significant positive correlation between firms' concentration and university location (Varga, 2000; Audretsch and Lehmann, 2005).

(1) Source: the KIT Report (© ESPON & BEST – Politecnico di Milano, 2011)

Understanding knowledge and creativity as territory-specific

Notable differences in the functioning of the local innovation systems in the United States and Europe.

- Feldman and Audretsch (1999) find that there is no evidence of specialization externalities, whilst diversity externalities are at work in the case of US metropolitan areas
- Those results are disputed by several analyses based on European data (Paci and Usai, 1999, 2000; Massard and Riou, 2002; Greunz, 2003; and Moreno et al., 2006)



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The role of human capital on productivity level and growth

- Solow (1957) growth model
- Mankiw et al. (1992) extended the Solow model by explicitly introducing **human capital** as an ordinary input in the production function.
- **Endogenous growth models** (Lucas, 1988; Romer, 1989) directly relate human capital to the adoption of technology and underlined the positive interaction between knowledge, capabilities and innovative ability.
- Cohen and Levinthal (1990) introduce the concept of firm's **absorptive capacity**, giving rise to a strand of the literature on the characteristics of firms, regions and countries: how efficiently do they understand and absorb external knowledge.



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Human capital and absorptive capacities as competitive advantages

- **Human capital** is a stock of knowledge accumulated by education and/or experience. It is both:
 - Enhancing the endogeneous growth capabilities of firms, regions or countries (like a production factor in a Solow type of model)
 - Allowing those actors to identify and utilize knowledge from outside (Cohen&Levinthal argument).
- Rauch (1993) finds *at the regional level* that a higher availability of well educated labour force represents an advantage for the localization of innovative firms, thus promoting local productivity.
- Abreu et al. (2008), on UK data, investigate the impact of firms' *absorptive capacity* on the regional variations in innovation performance. They find that innovation requires the appropriate human capital.
- Bronzini and Piselli (2009) assess the role of the technological knowledge, as measured by the *stock of R&D capital*, the *human capital*, and the *stock of public infrastructure*, in enhancing the levels of Total Factor Productivity (TFP) of Italian regions over the period 1980-2001. Human capital turns out to have the strongest impact on productivity.
- Dettori et al. (2010) investigate the determinants of the TFP levels by analyzing the role played by *intangible factors* like human capital, social capital and technological capital for a sample of 199 European regions over the period 1985-2006. They prove the role played by intangible capital in enhancing *economic growth* and *social cohesion*.



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