

**Bocconi University – Ph.D. School**

***ECONOMICS OF INNOVATION AND TECHNOLOGICAL CHANGE***

**Fall 2014-15**

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The course will introduce the students to theories, models and empirical evidence on technological change and innovation, with the goal to provide a broad overview of the field and to identify the main research questions. The topics of the course will range from the sources, characteristics and impact of technological change and innovation, to innovation and the dynamics of firms, industries and the economy, to the role of technology in the catching up and competitiveness of firms, industries and countries. The program consists of 12 major topics, one for each class.

- **TECHNOLOGY, INNOVATION AND EVOLUTIONARY THEORY**
- **THE SCHUMPETERIAN FIRM**
- **SCHUMPETERIAN COMPETITION: MODELS AND EVIDENCE**
- **INNOVATION, MARKET STRUCTURE AND INDUSTRY DYNAMICS**
- **MODELLING INNOVATION AND INDUSTRY EVOLUTION**
- **DEMAND AND INNOVATION**
- **THE DIFFUSION OF NEW TECHNOLOGIES**
- **PATENTS AND IPR**
- **R&D COLLABORATIONS AND THE CLUSTERING OF INNOVATORS**
- **INNOVATION SYSTEMS AND INSTITUTIONS**
- **TECHNOLOGY, CATCHING UP AND NEW EMERGING LEADERS**
- **PUBLIC POLICY FOR TECHNOLOGY, INNOVATION AND DIFFUSION**

Each class will be structured in the following way. FM will introduce the topics by addressing the main issues in a broad way. Discussion will follow. In the last part of the class, there will be students presentations of specific papers related to the topics: the main research questions and the way they have been addressed and answered in the papers presented in class will be discussed. All students are required to read the assigned readings before the class and to be able to discuss them in class.

**Evaluation:**

**-Participation and discussion in class: ¼ of final grade**

**-Presentation of papers: ¼ of final grade**

**-Term paper: ½ of final grade**

**The term paper will be a short paper (max 15 pages) which can be:**

- a) a review and critique of some papers regarding a specific topic of the course;**
- b) a proposal concerning original research in one of the topics examined in the course.**

## **PROGRAM OF THE COURSE AND READING LIST**

**Each class will have mandatory readings (\*\* are mandatory).**

**For each topic, additional readings are provided for the students interested in that specific topic either for the paper-review or the paper-proposal**

### **1. TECHNOLOGY, INNOVATION AND EVOLUTIONARY THEORY**

\*\* Fagerberg J. “Innovation: a guide to the literature” in Fagerberg J. Mowery D. Nelson R. (ed) *Handbook of innovation* Oxford University Press 2004

\*\* Dosi G., Nelson R. Technological change and industrial dynamics as evolutionary processes *LEM* Pisa 2009/April, also in Hall B. Rosenberg N. *Handbook of the Economics of Innovation* Elsevier 2010

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*A useful book containing several relevant articles is:*

Malerba F. Brusoni S. *Perspectives on innovation* Cambridge University Press Cambridge 2007

*Useful handbooks are:*

Fagerberg J. Mowery D. Nelson R. *Handbook of Innovation* Oxford University Press 2004

Hall B. Rosenberg N. *Handbook of the Economics of Innovation* Elsevier 2010

*Classic works:*

Nelson-R., Winter S., *An evolutionary theory of economic change*, Harvard University Press, 1982

Nelson R., Recent evolutionary theorizing about economic change, *JEL*, 1995

R., Rosenberg N., “An overview of innovation”, in Landau R. and Rosenberg N., *The positive sum strategy*, National Academy Press, 1986

### **2. THE SCHUMPETERIAN FIRM**

\*\* Dosi G. Nelson R. Winter S. *The nature and dynamics of organizational capabilities* Oxford University Press 2001 *Chapter 1*

\*\* Katkalo S. Pitelis C. Teece D. On the nature and scope of dynamic capabilities *Industrial and corporate change* August 2010

Winter S. Towards a new Schumpeterian theory of the firm *Industrial and Corporate Change* 2006, 1

Teece D. Dynamic Capabilities: Routines versus Entrepreneurial Action *Journal of Management Studies* 49:8 December 2012

Winter S. Understanding dynamic capabilities *Strategic Management Journal* 24, 2003

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### 3. SCHUMPETERIAN COMPETITION: MODELS AND EVIDENCE

\*\* Breschi S., Malerba F., Orsenigo L., Technological regimes and sectoral patterns of innovation, *Economic Journal*, 2000

\*\*Suarez F. and Lanzolla G. The role of environmental dynamics in building a first mover advantage *Academy of management review* 2007 32, 377-392.

\*\*Bergek A. et al. Technological discontinuities and the challenge for incumbent firms: destruction, disruption or creative accumulation? *Research Policy* 42 (2013) 1210-1224

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Adner R. Snow D. Old technology responses to new technology threats *Industrial and corporate change* 2010 n. 5

Franco A. Sarkar MB and Agarwal R. Swift and smart: the moderating effects of technological capabilities on the market pioneering-firm survival relationship *Management Science* 2009, n. 11 vol 55

Klenner P. Ex-ante evaluation of disruptive susceptibility in established value networks- When are markets ready for disruptive innovations? *Research Policy* 42 (2013) p. 914-927

Kim J. and Lee C. Technological regimes and the persistence of first-mover advantages *Industrial and Corporate Change* 2011 n 5 1305-334

Peneder M. Technological regimes and the variety of innovation behavior: creating integrated taxonomies of firms and sectors *Research Policy* 2010 39, 323-334

Castellacci F. and Zheng Technological regimes, Schumpeterian patterns of innovation and firm level productivity growth *Industrial and corporate change* 2010 19, 1829-1865

Geroski, P. Markides, Constantinos (2005). *Fast second: How smart companies bypass radical innovation to enter and dominate new markets*. San Francisco: Jossey-Bass.

Klepper S. Firm survival and the evolution of oligopoly *RAND Journal of Economics* 33, 37-61, 2000

Klepper, S. Simons, K. The making of an Oligopoly: Firm survival and technological change in the evolution of the U.S. Tire Industry. *Journal of Political Economy*, 2000

Henderson R. "Underinvestment and incompetence as responses to radical innovation: evidence from the photolithographic alignment industry" *RAND Journal of Economics* 1993

Castellacci F. Technological Regimes and sectoral differences in productivity growth *Industrial and Corporate Change* 2007

#### **4. INNOVATION, MARKET STRUCTURE AND INDUSTRY DYNAMICS**

\*\* Malerba F. Innovation and the dynamics of industries: progress and challenges *International Journal of Industrial Organization* 2007

\*\* Dahl M. Sorenson O. The who, why and how of spin-offs *Industrial and Corporate change* 2013 September

\*\* Jacobides M. and Winter S. The co-evolution of capabilities and transaction costs: explaining the institutional structure of production *Strategic Management Journal* 2005 26, 395-413

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Klepper S. Sleeper S. *Entry by spin-off* *Management Science* 2005

Karniouchina V et al Extending the firm vs industry debate: does industry life cycle stage matter? *Strategic Management Journal* 34, 2013, 1010-1018

Shane S. Technology regimes and new firm formation *Management Science* 2001 47, 1173-1190

Geroski, Paul (2003). *The evolution of new markets* Oxford University Press

Dosi G. Statistical regularities in the evolution of industries in Malerba F. Brusoni F. *Perspectives on innovation* Cambridge University Press 2007

Klepper S. Thompson P Submarket and the evolution of market structure *Rand Journal of Economics* 2007

Bartelsman E. Scarpetta S. Schivardi F Comparative analysis of firm demographics and survival: micro-evidence from the OECD countries *Industrial and Corporate Change* 2005 14

Carrol G. Hannan M. *The demography of corporations and industries* Princeton University Press 1999

#### **5. MODELLING INNOVATION AND INDUSTRY EVOLUTION**

\*\* Klepper S. “Entry, exit, growth and innovation over the product life cycle” *American Economic Review* 86, 562-583, 1996

\*\* Malerba F., Nelson R., Orsenigo L., Winter S. , “A history friendly model of the coevolution of the computer and semiconductor industries” *Industrial and Corporate change* 2008

\*\* Jacobides M. How capabilities differences, transaction costs and learning curves interact to shape vertical scope *Organization Science* 2008 v. 19, n2

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Cabral L. Industry shake outs *Industrial and Corporate Change* 2012 (3)

Lenox M. Rockart S. Lewin A. Interdependency, competition and the distribution of firms and industry profits *Management Science* 2006, n.5

Lopolito A. et al Emerging innovation niches: an agent based model *Research Policy* 2013 n.12 1225-1238

Fagiolo G. Windrum P. Moneta A. Empirical validation of Agent based models. A critical survey *LEM Working paper* Pisa 2006

Brenner T. Murmann P. The use of simulations in developing models of industrial dynamics *Max Plank Institute of Economics research Working paper* Jena 2003

Kim C. Lee K. Innovation, technological regimes and organizational selection in industry evolution: a HFM of the DRAM industry *Industrial and Corporate Change* 2003,12

Malerba F., Orsenigo L., 2002, Innovation and market structure in the dynamics of the pharmaceutical industry and biotechnology: towards a history friendly model” *Industrial and Corporate Change* 2002

## **6. DEMAND AND INNOVATION**

\*\* Von Hippel E. “*Democratizing innovation*” MIT Press 2004 Introductory chapter

\*\* Adner R. When are technologies disruptive: a demand based view of the emergence of competition *Strategic Management Journal* 2003, 8

\*\* Chatterji A. Fabrizio K. How do Product users Influence Corporate Invention? *Organization Science* 2012 n.4 p. 971-987

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Fontana and Malerba Demand as a source of entry and the survival of new semiconductor firms *Industrial and corporate change* 2010 n. 5

Buenstorf G. and Klepper S. Submarket dynamics and innovation: the case of the US tire industry *Industrial and corporate change* 2010 n.5

Adner R. Levinthal D. Demand heterogeneity and technology evolution: implications for product and process innovation *Management Science* 2001, 47

Malerba F. Nelson R. Orsenigo L. Winter S. Demand, innovation, and the dynamics of market structure: The role of experimental users and diverse preferences, *Journal of Evolutionary Economics* 2007

## **7. THE DIFFUSION OF INNOVATION**

\*\* Geroski P. , 2000. Models of technology diffusion, *Research Policy* vol. 29(4-5),

\*\* Kay N. Rerun the tape of history and QWERTY always wins *Research Policy* 2013 (42) p. 1175-1187

\*\* Greve H. Fast and expensive: the diffusion of a disappointing innovation *Strategic Management Journal* 2011 32

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Nelson RR, Peterhandl A. and Sampat B. Why and how innovation get adopted: a tale of four models *Industrial and Corporate Change* n.5 2004

Battisti G. Stoneman P. Inter and intra firm effects in the diffusion of new process technology  
*Research Policy* 2003

Thoma G. Striving for a large market: evidence from a general purpose technology in action  
*Industrial and corporate change* 2009 18 p107-138

Hall B. "Innovation and diffusion" in J. Fagerberg et al. *Handbook of innovation* Oxford University Press 2004

Bresnahan T. General purpose technologies *Handbook of Economics of Innovation* North Holland 2010

Choi J.P, Herd behaviour, the "penguin effect" and the suppression of informational diffusion: an analysis of informational externalities and payoff interdependency, *Rand Journal of Economics*, 1997, 28/3, pp.407-425

## **8. PATENTS AND IPR**

\*\* Cohen W. Goto A. Nagata A. Nelson R. Walsh J. R&D spillovers, patents and the incentives to innovate in Japan and the US *Research Policy* 2002

\*\* Hall B. Ziedonis R. The patent paradox revisited: an empirical study of patenting behaviour in the US semiconductor industry: 1979-1995 *Rand Journal of Economics* Spring 2001

\*\* Bronwyn Hall Patents and Patent Policy *Oxford Review of Economic Policy* 2007 23, 4

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Rassenfosse et al The worldwide count of priority patents: a new indicator of inventive activity  
*Research Policy* 2013 (42) p. 720-737

Forero Pinedo The impact of stronger intellectual property rights on science and technology in developing countries *Research Policy* 2006, 35

Jaffe A. Trajtenberg M. *Patents, citations and innovations* MIT Press 2001

Arora A. Ceccagnoli A R&D and the patent premium *International Journal of Industrial Organization* 2008

Mazzoleni R., Nelson R., The benefits and cost of strong patent protection *Research Policy* 1998

Scotchmer S. *Innovation and incentives* MIT Press 2004 Introduction

Gallini N., How well is the US patent system working?, *Journal of Economic Perspectives*, 2002

Dosi G. Marengo L. Pasquali How much should society fuel the greed of innovators *Research policy* 2006 n. 35

## 9. R&D COLLABORATIONS AND THE CLUSTERING OF INNOVATORS

\*\* Powell W. and Grodal S. "Networks of innovators" in J.Fagerberg et al. *Handbook of innovation* Oxford University Press 2004

\*\* Baum J. Cowan R. Jonard N. Network independent partner selection and the evolution of innovation networks *Management Science* 2010

\*\* Breschi S. and Lissoni F. Mobility of skilled workers and co-invention networks *Journal of Economic Geography* 2009

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Cowan R. Jonard N. Knowledge portfolio and the organization of innovation networks *Academy of Management Review* 2009

Cowan R. "Network models of innovation and knowledge diffusion" in Breschi and Malerba Oxford University Press 2005

Cassiman B. Veugelers R. "R-D cooperation and spillovers: some empirical evidence from Belgium", *American Economic Review*, 2002

Bettencourt L. M. A., Lobo, J. Strumsky, D., "Invention in the City: Increasing Returns in Patenting as a Scaling Function of Metropolitan Size", *Research Policy* 36, 107-120, 2007

Breschi S., Lissoni F., "Knowledge Spillovers and Local Innovation Systems: A Critical Survey", *Industrial and Corporate Change*, vol. 10 n. 4, 975-1005, 2001

Zucker L.G., Darby M.R., Armstrong J., "Geographically localised knowledge: spillovers or markets?", *Economic Inquiry* 36, January 1998, 65-86

## 10. INNOVATION SYSTEMS AND INSTITUTIONS

\*\* Malerba F. Sectoral systems of innovation: how and why innovation differs across sectors" in *Handbook of Innovation* J.Fagerberg, D.Mowery and R.Nelson (ed). Cambridge University Press, Cambridge 2005

\*\*Adner R. Kapoor R. Value creation in innovation ecosystems: *Strategic Management Journal* 2010 31 306-333

\*\*Murmam P. The coevolution of industries and important features of their environments *Organizational Science* 2013 n.1 58-78

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Mairesse J. Mohnen P. Using innovation surveys for econometric analysis *Handbook of Economics of Innovation* North Holland 2010

Fagerberg J. Mowery D. Nightingale P. The heterogeneity of innovation: evidence from the Community Innovation Surveys *Industrial and Corporate Change* 2012 n.5 1175-1180

Fatas-Villafranca, Sanchez-Choliz and Janre G. "Modeling the co-evolution of national industries and institutions" *Industrial and corporate change* 2008 n. 17

Malerba F., *Sectoral systems of innovation*, Cambridge University Press, 2004

Nelson R., Sampat B., Making sense of institutions as a factor shaping economic performance, *Journal of Economic Behaviour and Organization* 2001

M.O. Sullivan "Finance and innovation" *Handbook of innovation* Oxford University Press 2005 c.9

## **11. TECHNOLOGY, CATCHING UP AND NEW EMERGING LEADERS**

\*\* Malerba F. and Nelson R. Catching up in different sectoral systems: evidence from six industries *Industrial and Corporate Change* 2011

\*\* Lee K., Lim C. Technological Regimes, Catching-up and Leapfrogging: the Findings from Korean Industries, *Research Policy*, Vol.30, No.2, 459-483. 2001

\*\* Rodrik D. 2008. "Second-Best Institutions," *American Economic Review*

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Fagerberg J. Verpagen S and Srholec M. "Innovation and Economic Development," Working Papers on Innovation Studies Centre for Technology, Innovation and Culture, University of Oslo, revised Oct 2009.

Dodgson M., Mathews J., Kastle T., Hu M. The evolving nature of Taiwan's national innovation system. The case of biotechnology innovation networks, *Research Policy* 2008 37(3): 430-445.

Amsden A., Chu W. , *Beyond Late Development*, MIT press, 2003 Cambridge

Gereffi G., Humphrey J., Sturgeon T. The Governance of Global Value Chain, *Review of International Political Economy*, 2005 Vol. 12, No.1, 78-100.

Kim L. *From Imitation to Innovation: the Dynamics of Korea's Technological Learning*, Harvard Business School Press, Cambridge MA 1997 .

Lee K. Making a Technological Catch-up: Barriers and Opportunities, *Asian Journal of Technology Innovation*, Vol.13, No.2, 97-131 2005

## **12. PUBLIC POLICY FOR TECHNOLOGY, INNOVATION AND DIFFUSION**

\*\* Cimoli M. Dosi G. Nelson R. Stiglitz J. Institutions and policies shaping industrial development *LEM WP series* 2006/2

\*\* Aghion P. David P. Foray D. Linking policy research and practice in STG systems: many obstacles but some ways forward *Research Policy* 2009 , 38(4) 681-693 (also in Stanford Institute of Economic Policy Research 2006 October)

\*\* Bleda M. Del Rio P the market failure and the system failure rationale in technological innovation systems *Research Policy* 2013 42, 1035-1052



- Malerba F. Increase learning, break knowledge lock-ins and foster dynamic complementarities: evolutionary and system perspectives on technology policy in industrial dynamics in D. Foray (ed) *The new Economics of Technology Policy* Elgar 2009
- Hyytinen A. Toivanen O Do financial constraints hold back innovation and growth? Evidence on the role of public policy *Research Policy* 2005 34 p.1385-1403
- Hall B., Lerner J. The financing of R&D and innovation in *Handbook of Economics of innovation* North Holland 2010
- Lundvall B.A. Borrás S. Science, technology and innovation policy *Handbook of Innovation* 2005
- Mowery D., The practice of technology policy, in P. Stoneman (ed), *Handbook of the Economics of Innovation and Technological Change* Basil Blackwell, Oxford, 1995 pp.513-557
- David P., Some new standards for the economics of standardization in the information age, in Dasgupta p. Stoneman,. (eds) *Economic policy and technological performance*, Cambridge University Press, Cambridge, 1987