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## INNOVATION

**Period:** 2021/22 – II sem.

**Class times:** Thursday 8:30-10:00 and  
10:20-11:50

**Instructor:**

Prof. Myriam Mariani

Dept. of Mgmt. & Tech. - Room 4-B2-10

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### Course description

This course focuses on innovation and technical change, their determinants at the individual, firm, geographical and institutional level, and the consequences that they produce on business organizations, industries, and countries' welfare.

For a selection of papers in the reading list, each lecture will identify the key questions and testable hypotheses. It will then present the empirical setting, data and challenges to answer the questions. Finally, it will discuss the solutions and identification strategies proposed by the authors. The instructor will stimulate discussion with students on the material presented. Students are required to read papers with \* before coming to classes.

### Class format and teaching approach

The course material will be based on classical contributions on the economics and management of innovation and technical change, combined with recently published articles. The articles in the reading list are divided into three groups. Those with an asterisk (\*) are presented and discussed in class. Papers in the main list without an asterisk, cover topics related to those in the first group, and together with those labeled with an asterisk, are required material for the final exam. Finally, the third group of readings at the end of the syllabus are suggested to students who have an interest in the specific topic and want to read more about it. The slides presented during the course sessions are intended to support the learning process. The main readings and the slides will be made available on Blackboard, respectively before and after the sessions.

Students attending this course will complete an assignment that consists in the writing of a paper abstract and introduction on a research idea related to innovation. The outcome of this exercise will consist in three or four pages that mimic the first part of a research paper.

## Evaluation and grading policy

Students will be evaluated according to the following criteria:

Course requirements	Weight
Final written exam	60%
Class assignment	40%
Bonus for class participation	X

## Sessions and readings

### Session 1 (February 3, 2021) 8:30-11:50

#### Introduction to the course.

#### Ideas and innovation: background and implications

\* Arora A., Belenzon S., Pataconi A., 2018. The decline of Science in corporate R&D. *Strategic Management Journal* 39(1): 3-32

\* Bloom, N., Jones, C.I., Van Reenen J., Webb M., 2020. "Are Ideas Getting Harder to Find?" *American Economic Review*, 110(4):1104-44.

\* Aghion P., Howitt P., 1998. Section 1.6 "Monopoly rents as a reward of technological progress" (pp. 35-39) in *Endogenous Growth Theory*, The MIT Press, Cambridge, Massachusetts

Mokyr, J., 2005. The Intellectual Origins of Modern Economic Growth. *Journal of Economic History* 65(2): 285

David, P.A., 1990. The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox *American Economic Review* 80 (2), Papers and Proceedings, 355-361.

Rosenberg, N., 1963. Technological Change in the Machine Tool Industry, 1840-1910. *Journal of Economic History*, 23(4), 414-443.

Dosi, G., 1982. Technological paradigms and technological trajectories. A suggested integration of the determinants and directions of technical change. *Research Policy* 11, 147-162.

Breschi S., Malerba F., Orsenigo L., 2000. Technological regimes and sectoral patterns of innovation, *The Economic Journal* 110(463): 388-410

### Session 2 (February 10, 2021) 8:30-11:50

#### The production of innovations: firm-level factors

\* Cohen W.M, Levinthal D.A., 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152. Special Issue: Technology, Organizations, and Innovation

\* Bhaskarabhatla A., Cabral L., Hedge D., Peeters T., 2021. Are inventors or firms the engines of innovation? *Management Science* 67(6): 3899-3920

\* Cassiman, B., Veugelers, R., 2006. In Search of Complementarity in Innovation Strategy: Internal R&D and External Knowledge Acquisition. *Management Science* 52(1):68-82

Levinthal, D., March J.G., 1993. The Myopia of Learning. *Strategic Management Journal* 14, 95-112.

Christensen, C.M., 1997. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Chapter: "Introduction", Harvard Business School Press, Boston MA, ix-xxiv.



Franco A., Sarkar MB, Echambadi R. and Agarwal R., 2009. Swift and Smart? The Moderating Effects of Technological Capabilities on the Market Pioneering - Firm Survival Relationship. *Management Science* 55(11): 1842-1860.

### **Session 3 (February 17, 2021) 8:30-11:50**

#### **The production of innovations: Who becomes an inventor? Individual level studies**

\* Bell A, Chetty R, Jaravel X, Petkova N, Van Reenen J., 2019. Who becomes an inventor in America? The importance of exposure to innovation. *Quarterly Journal of Economics*. 134(2):647–713

\* Hoisl, K., Kongsted H.C., Mariani M., 2022. Lost Marie Curies: Parental impact on the Probability of Becoming an Inventor. *Management Science* (forthcoming)

\* Jensen K, Kovacs K, Sorenson O., 2018. Gender differences in obtaining and maintaining patent rights. *Nature Biotechnology* 36(4):307–309.

Aghion P, Akcigit U, Hyytinen A, Toivanen O., 2018. The social origins of inventors. Working paper 24110, NBER

Toivanen O, Väänänen L., 2016. Education and invention. *Review of Economics and Statistics*. 98(2):382–396.

### **Session 4 (March 3, 2021) 8:30-11:50**

#### **The production of innovations: the role of location and spatial proximity**

\*Jaffe, A.B., Trajtenberg M., Henderson R., 1993. Geographic Knowledge Spillovers as Evidenced by Patent Citations, *Quarterly Journal of Economics* 108: 577–98.

\*Breschi, S., Lissoni L., 2009 Mobility of Skilled Workers and Co-Invention Networks: An Anatomy of Localized Knowledge Flows, *Journal of Economic Geography* 9: 439–468

\*Almeida, P., Kogut B., 1999. Localization of Knowledge and the Mobility of Engineers in Regional Networks. *Management Science*, 45: 905-917.

\*Thompson, P., Fox-Kean M., 2005. Patent Citations and the Geography of Knowledge Spillovers: A Reassessment, *American Economic Review* 95 (2), 450–460.

\*Thompson, P., 2006. Patent Citations and the Geography of Knowledge Spillovers: Evidence from Inventor- and Examiner-Added Citations, *Review of Economics and Statistics* 88: 383–388.

\*Jaffe, A. B., Trajtenberg M., Fogarty M.S., 2000. Knowledge Spillovers and Patent Citations: Evidence from a Survey of Inventors, *American Economic Review* 90 (2): 215–218.

Giuri P., Mariani M., 2013. When Distance Disappears: Inventors, Education, and the Locus of Knowledge Spillovers, *The Review of Economics and Statistics*, 95(2): 449-464

Gittelman, M., 2007. Does Geography Matter for Science-Based Firms? Epistemic Communities and the Geography of Research and Patenting in Biotechnology, *Organization Science* 18: 724–741.

Catalini C., 2017. "Microgeography and the Direction of Inventive Activity. *Management Science* 64(9):4348-4364

### **Session 5 (March 10, 2021) 8:30-11:50**

#### **Intellectual property rights and the incentives to innovate (\* will be added during the break)**

Griliches, Z., 1990. Patent Statistics as Economic Indicators: A Survey *Journal of Economic Literature*, 28:1661-1707.

- Gallini, N. and Scotchmer S. 2002. Intellectual Property: What is the Best Incentive System. *Innovation Policy and the Economy* 2: 51-77.
- Cohen, W., Nelson R, and Walsh J.P. 2000. Protecting their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not). *NBER Working Paper #7552*.
- Stern, S. 2004. Do Scientists Pay to Be Scientists? *Management Science* 50(6): 835-853.
- Ziedonis, R. 2004. Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms. *Management Science*, 50(6):804-820.
- Winter S. 2006. the Logic of appropriability: from Schumpeter to Arrow to Teece. *Research Policy* 35: 1100-1106
- Williams, H. L. 2013. "Intellectual Property Rights and Innovation: Evidence from the Human Genome." *Journal of Political Economy* 121(1): 1-27.
- Moser, P. 2013. Patents and Innovation: Evidence from Economic History. *Journal of Economic Perspectives* 27(1): 23-44.
- Moser, P., and Nicholas, T. 2013. Prizes, Publicity, And Patents: Non-Monetary Awards As A Mechanism To Encourage Innovation. *Journal of Industrial Economics* 61(3): 763-788.
- Giorelli M. and Moser P., 2020. Copyright and Creativity: Evidence from Italian Opera in the Napoleonic Age. *Journal of Political Economy*, 128(11): 4163-210
- Boldrin, M. and Levine D. 2002. The Case Against Intellectual Property. *American Economic Association Papers & Proceedings* 92(2): 209–212.

#### **Session 6 (March 17, 2021) 8:30-11:50**

**Innovation studies: empirical methods and measurement (Experiments, Matching, DiD, RDD, IV)** (\* will be added during the break)

- Furman, J. and Stern S. 2011. Climbing Atop the Shoulders of Giants: The Impact of Institutions on Cumulative Knowledge Production. *American Economic Review* 101(5): 1933-1963.
- Azoulay, P., Fons-Rosen C., and Graff Zivin J.S. 2019. Does Science Advance One Funeral at a Time? *American Economic Review* 109(8): 2889-2920
- Hoisl, K., Kongsted H.C., Mariani M., 2022. Lost Marie Curies: Parental impact on the Probability of Becoming an Inventor. *Management Science* (forthcoming)
- Teodoridis, F. 2018 Understanding Team Knowledge Production: The Interrelated Roles of Technology and Expertise *Management Science* 64(8): 3625–3648
- Jacob, B. A., Lefgren L.. 2011. The Impact of Research Grant Funding on Research Productivity. *Journal of Public Economics* 95(9-10): 1168-1177.
- Kerr, W. R., Lerner, J. and Schoar A.. 2014. The Consequences of Entrepreneurial Finance: Evidence from Angel Financings. *Review of Financial Studies* 27(1): 20-55
- Nagaraj, A., 2018. Does Copyright Affect Reuse? Evidence from Google Books and Wikipedia, *Management Science*
- Nagaraj, A., 2021. The Private Impact of Public Data: Landsat Satellite Maps increased Gold Discoveries and encouraged entry, *Management Science*
- Bikard, M., 2020. Simultaneous Discoveries as a Research Tool: Method and Promise. *Strategic Management Journal*
- Hoisl K., and Mariani M. 2017. It's a Man's Job. Income and the Gender Gap in Industrial Research. *Management Science*, 63(3): 766-790



## Faculty Bio.

Myriam Mariani is a professor of applied economics at Bocconi University, where she is also the director of the MSc EMIT (Economics and Management of Innovation and Technology). She earned a PhD from the Marche Polytechnic University, and completed a two years post-doc Marie Curie fellowship at MERIT (Maastricht Economic Research Institute on Innovation and Technology). Her work focuses on inventors' job progressions, motivations and knowledge transmission. She also studies gender inequalities in innovation. Her research appeared in Management Science, Academy of Management Journal, Organization Science, Strategic Management Journal, Research Policy and the Review of Economics and Statistics.

## Additional reading related to each session's topic \*\*\*\*\*

### Session 1: Ideas and innovation: background and implications

#### Additional readings:

Romer P.M. 1990. Endogenous Technical Change. *Journal of Political Economy* 98(5): 71-109

Arrow, K. 1962. "Economic Welfare and the Allocation of Resources for Invention" In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, pp. 609-625. Princeton, NJ: Princeton University Press. READ pp, 609-618

Aghion P. and Howitt P. 1992. A model of growth through Creative Destruction. *Econometrica* 60(2) 323-351

Jones, Benjamin F. 2009. The Burden of Knowledge and the 'Death of the Renaissance Man: Is Innovation Getting Harder?' *Review of Economic Studies* 76(1): 283-317.

Mowery, D. and R.R. Nelson (eds.) 1999 *The Sources of Industrial Leadership*, Cambridge UK, Cambridge University Press.

Freeman, C. and L. Soete 1997. *The Economics of Industrial Innovation*, 2<sup>nd</sup> edition, Cambridge, MA, MIT Press, Part I, 1-189.

Hall B. 2016. *Economics of Research and Development*. Edward Elgar Publishing

Rosenberg, N., and Trajtenberg M. 2004. A General-Purpose Technology at Work: The Corliss Steam Engine in the Late Nineteenth Century United States. *Journal of Economic History* 64(1): 61-95

Varian, Hal R. 2004. Review of Mokyr's 'Gifts of Athena' *Journal of Economic Literature* 42(3): 805-810.

Henderson and Clark (1990) Henderson, R. M., & Clark, K. B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35(1), 9-30.

Nelson, R.R. 1962. "The Link Between Science and Invention: The Case of the Transistor", in *The Rate and Direction of Inventive Activity*, Princeton University Press, Princeton NJ, 549-583.

Romer, Paul. 1996. Why, Indeed, in America? Theory, History and the Origins of Modern Economic Growth. *American Economic Review* 86(2):202-206.

### Session 2: The production of innovations: micro firm-level factors

#### Additional readings:

Wuchty, Stefan, Benjamin F. Jones, and Brian Uzzi. 2007. The Increasing Dominance of Teams in Production of Knowledge. *Science* 316(5827): 1036-1039.

Malerba F., Nelson R., Orsenigo L., Winter S., 1999 History friendly models of industry evolution: the computer industry *Industrial and Corporate Change*, 8: 3-40



- Malerba F., Nelson R., Orsenigo L., Winter S. 2016 *Innovation and industry evolution*. Cambridge University Press
- von Hippel E 2005 *Democratizing Innovation* MIT Press, Cambridge, MA
- von Hippel, E. 1986 Lead Users: A Source of Novel Product Concepts. *Management Science* 32(7): 791-805
- von Hippel, E. 1994. "Sticky information" and the locus of problem solving: Implications for innovation. *Management Science* 40(4): 429-439.
- von Hippel, E. and von Krogh G., 2003. Open Source Software and the Private-Collective Innovation Model: Issues for Organization Science. *Organization Science* 14(2): 209-223.
- Klepper, S., 1996. Entry, exit, growth, and innovation over the product life cycle. *American Economic Review* 86, 562-583.
- Laursen, K., Salter, A. 2006 Open for Innovation: The Role of Openness in Explaining Innovation Performance Among U.K. Manufacturing Firms. *Strategic Management Journal* 27: 131-150
- Luthje, C., C. Herstatt and E. Von Hippel 2005 User-innovators and "local information": The case of mountain biking. *Research Policy* 34: 951-965.
- Arora, A., Fosfuri A., Gambardella A., 1994 *Markets for Technology: the Economics of Innovation and Corporate Strategy* Cambridge MA: The MIT Press
- Cohen, Wesley M., and Daniel A. Levinthal. 1989. Innovation and Learning: The Two Faces of R & D. *The Economic Journal* 99, 397: pp. 569-596

### **Session 3: The production of innovations: Who becomes an inventor? Individual (super micro) level studies**

#### Additional readings:

- Moser, P., Voena, A., Waldinger F.. 2014. German-Jewish Emigres and US Invention. *American Economic Review* 104(10): 3222-3255
- Kerr, W. R., Lincoln W. F. 2010. The Supply Side of Innovation: H1-B Visa Reforms and U.S. Ethnic Invention. *Journal of Labor Economics* 28(3): 473-508
- Gaulè P., M. Piacentini 2013 Chinese Graduate Students and U.S. Scientific Productivity. *Review of Economics and Statistics* 95 (2): 698-701
- Azoulay, P. Graff Zivin J., Wang J. 2010. "Superstar Extinction." *Quarterly Journal of Economics* 125(2): 549-589.
- Waldinger, F. 2012. Peer Effects in Science: Evidence from the Dismissal of Scientists in Nazi Germany. *Review of Economic Studies* 79(2): 838-861.
- Van Reenen J. 2021, Innovation and human capital policy. NBER working paper 28713

### **Session 4: The production of innovations: the role of location and spatial proximity**

- Griliches, Z., 1992. The search for R&D Spillovers. *The Scandinavian Journal of Economics*, 94: 29-47.
- Audretsch, D., Feldman M., 1996. R&D Spillovers and the Geography of Innovation and Production, *American Economic Review*, 86, 3: 630-640
- Chung W., Alcacer J., 2002. Knowledge Seeking and Location Choice of Foreign Direct Investment in the United States, *Management Science* 48(12): 1534-1554.
- Shaver, J. M., Flyer F., 2000. Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States, *Strategic Management Journal*, 21(12): 1175-1193.

### **Session 5 : Intellectual property rights and the incentives to innovate**

Additional readings:

- Hall B. Ziedonis R. 2001. The patent paradox revisited: an empirical study of patenting behaviour in the US semiconductor industry: 1979-1995 *Rand Journal of Economics*
- Toivanen, O., Väänänen, L. 2012. Returns to inventors, *Review of Economics and Statistics*, 94(4), 1173-1190.
- Teece D. 1986. Profiting from technological innovation *Research Policy* 15: 285:305
- Scotchmer, S. 1991. Standing on the Shoulders of Giants: Cumulative Research and the Patent Law. *Journal of Economic Perspectives* 5(1): 29-41.
- Galasso, A. and Schankerman M. 2015. Patents and Cumulative Innovation: Causal Evidence from the Courts. *Quarterly Journal of Economics* 130(1): 317-369.
- Bessen, J. 2002. Patents and the Diffusion of Technical Information. *Economics Letters* 86(1): 121-128.
- Graham, Stuart, and Deepak Hegde. 2015. Disclosing Patents' Secrets. *Science* 347 (6219): 236-237.
- Rivette, K. G., and Kline D. 2000. Discovering New Value in Intellectual Property. *Harvard Business Review* 78(1): 54-66.
- Anton, J. J., and Yao D. A. 2004. Little Patents and Big Secrets: Managing Intellectual Property. *RAND Journal of Economics* 35(1): 1-22.
- Lemley, M.A. 2008. The Surprising Virtues of Treating Trade Secrets as IP Rights. *Stanford Law Review* 61(2): 311-353.
- Hall, B. H., Helmers, C., Rogers, M., and Sena, V. 2014. The Choice Between Formal and Informal Intellectual Property: A Review. *Journal of Economic Literature* 52(2): 375-423.
- Moser, P. 2012. Innovation without Patents: Evidence from World's Fairs. *Journal of Law and Economics* 55(1): 43-74.

**Session 6: Innovation studies: empirical methods and measurement (Experiments, Matching, DiD, RDD, IV)**

Additional readings:

- Boudreau, K. J., Lakhani, K.R. and Menietti M., 2016. Performance Responses to Competition across Skill-Levels in Rank Order Tournaments: Field Evidence and Implications for Tournament Design. *RAND Journal of Economics*, 47(1): 140-165
- Boudreau, K. J., Lakhani, K.R. 2015. Open Disclosure of Innovations, Incentives and Follow-on Reuse: Theory on Processes of Cumulative Innovation and a Field Experiment in Computational Biology. *Research Policy* 44(1): 4-19.
- Azoulay, P., Li, C., and Stuart T., 2017. Social Influence Given (Partially) Deliberate Matching: Career Imprints in the Creation of Academic Entrepreneurs. *American Sociological Review* 122(4):1223-1271

