TECHNOLOGY AND INNOVATION MANAGEMENT

Course Description

This course provides the tools for understanding innovative activities, their sources, the modes of knowledge exchange among different actors through the market for technology and other channels of knowledge transfer, the implications for the strategic management of intellectual property, and competitive strategy. The program, with its 5 modules, centers on the idea that a deep theoretical understanding of the drivers of change in established firms and startup is crucially important for both scholars and business practitioners. Moreover, the program will cover aspects related to the financing of innovation, technology diffusion and firms' survival, knowledge flows and network analysis.

The course introduces students to topics at the core of the debate amongst scholars, business practitioners and policy-makers. The readings selected address a variety of relevant questions and propose a rich set of research methods.

The course is organized in five modules. The first two modules are targeted to students of the *PhD Program in Business for Society* and the P*hD Program in Economics and Statistics (Track in Big Data & Analytics for Business (BIDAB)*. The third module is dedicated to students of the PhD Program in Business for Society while the fourth and the fifth module are targeted to the PhD Program in Economics and Statistics (Track in Data Science for Business).

Business for Society	**Economics and Statistics**
Module 1: The sources of innovation and the strategic management of intellectual property	
Module 2 Collaborative innovation and internationalization of R&D	
Module 3 Business model innovation and innovative startups	
	Module 4 The financing of innovation
	Module 5 Technology diffusion, firms' survival and knowledge

Course Requirements

For each topic, we will read and discuss a few articles. The set of articles for each lecture may include theoretical and empirical work, or both. The instructor will lead discussion seminars, students will be involved in presentations, in groups or individually.

Grading

Students' performance will be evaluated on the basis of class participation (50%) and a final assignment (50%). The final grade of the Technology and Innovation Management course will be calculated as the average of grades on active participation the final assignment.

1. Course preparation, attendance and active discussion in the seminars (worth 50% of the final grade).

The quality of classes depends on students' active participation. Class participation is evaluated on the daily assigned readings, which will be presented and discussed by students during their presentations. Before each class all students must prepare by reading the papers required. Students must attend each class for the entire period. Failure to do so will result in a failing grade for the course.

Article Synopsis/Critique Format

You should distribute and present in class for 5-10 minutes the synopsis of the paper assigned before the class, followed by comments from and discussion with the other students, as well as the instructor. The synopsis should be preferably be 1 page but no more than 2 pages (11 point font and single-spaced) and reproduce the structure of a typical paper which contains the following sections (sections 3 through 5 do not apply for theory papers, only for empirical ones), with a header showing the complete reference for the article.

1- Research question (1 sentence ending in ?)
2- Hypotheses (or Propositions) and the theoretical arguments supporting each of them
3- Explanations of the key constructs in the paper
4- Population and sample characteristics
5- Methods (operationalization of key variables, data sources, and statistical specification)
6- Results (i.e. whether hypotheses were supported or not, use abbreviations like H1 for Hypothesis 1)
7- Key findings/conclusions and interpretations thereof
8- Limitations: a) the ones identified by the author/s and, more importantly, b) any additional you might find, particularly any fatal flaws you might uncover
9- Your assessment of the strengths/weaknesses of the study, arguments, or methods, and its contributions to the literature
10- Avenues for future research, especially your own ideas (and not just the author/s')

2. Completion of one Final Individual Assignment (50%of the final grade). Students are required to write a research proposal on a topic chosen amongst the topics covered by the different Modules. The topic will have to be approved by the instructor.

A typical research proposal (minimum 3 - max 5 pages) has the following structure:

- Introduction, which will explain the importance and relevance of the study to academic research, business practitioners or policy makers
- Literature review (aimed at identifying a research gap)
- Research question (s)
- Research methodology
- Expected findings
- Contributions (theoretical and empirical)
- References

Module 1 – The sources of innovation and the strategic management of intellectual property

PhD Program in Business for Society and P*hD Program in Economics and Statistics (Track in Data Science for Business*

(Salvatore Torrisi)

This module introduces 'classical' topics in the economics and management of innovation from a theoretical and empirical perspective by drawing on different streams of research – from the economics of science and technology to empirical studies of innovative activity. More precisely, this module deals with the relationship between market structure and innovation. Moreover, it focuses on IPR management, with a particular attention to the relationship between the exploitation of IPR and competitive strategy.

Readings

Part 1. The sources of innovation: Science, industrial R&D and individual creativity

Audretsch, D. B. (1997). Technological Regimes, Industrial Demography and the Evolution of Industrial Structures'. *Industrial and Corporate Change*, 6 (1): 49-82. (*)

Cohen, W.M. (1995). Empirical Studies of Innovative Activity. In Stoneman, P. (ed.) (1995), *Handbook of the Economics of Innovation and Technological Change*, Basil Blackwell, Oxford: 182–264. (*)

Dasgupta P. and P.A. David, (1994). Toward a new economics of science. *Research Policy,* **23:** 487–521 (*).

Sauerman, H. and Cohen W. M. 2010. What Makes Them Tick? Employee Motives and Firm Innovation. *Management Science*, 56(12): 2134–2153 (*)

Part 2. Strategic management of intellectual property and the market for technology

Arora, A., Fosfuri, G. and A. Gambardella (2001). Markets for Technology and their Implications for orporate Strategy. *Industrial and Corporate Change*, 10: 419-451. (*)

Clarkson, G., and Toh, P. K., 2010, "'Keep out' signs: the role of deterrence in the competition for resources". *Strategic Management Journal*, 31(11): 1202–1225.(*)

Cohen, W.M., Goto, A. Nagata, A. Nelson, R.R. and Walsh, J.P. (2002). R&D spillovers, patents and the incentives to innovate in Japan and the United States. *Research Policy*, 31: 1349–1367. (*)

Corsino, M., Mariani, M. and Torrisi, S. (2019). Firm Strategic Behavior and the Measurement of Knowledge Flows with Patent Citations. *Strategic Management Journal*, 40 (7): 1040-1069.

Gambardella, A., Giuri and Torrisi, S. (2014). Markets for technology. In: M. Dodgson, D. Gann, N. Phillips. *Handbook of Innovation Management.* Oxford University Press, Oxford: 229-247. (*)

Gans, J. S. and Stern, S. (2003). The product market and the market for "ideas": commercialization strategies for technology entrepreneurs. *Research Policy*, 32, pp. 333-350. (*)

Hall, B. H., and R. H. Ziedonis (2001). The patent paradox revisited: an empirical study of patenting in the US semiconductor industry, 1979-1995. *Rand Journal of Economics*, 32: 101-128. (*)

Torrisi, S., Gambardella, A., Giuri, P., Harhoff, D., Hoisl, K. and Mariani, M. (2016). Used, blocking and sleeping patents: Empirical evidence from a large-scale inventor survey, *Research Policy*, 45(7): 1374-1385.

Walsh, J.P., Lee, Y., Jung, T., 2016. Win, Lose or Draw? The Fate of Patented Inventions, *Research Policy*, 45 (7): 1362–1373 (*).

Module 2 – Collaborative innovation and internationalization of R&D

PhD Program in Business for Society and P*hD Program in Economics and Statistics (Track in Data Science for Business*

(Lorena D'Agostino).

This module examines the innovation process across organizational and geographical boundaries. The first part of this module is about collaboration strategies and open approaches to innovation. As an increasingly significant part of innovation is undertook by firms in collaboration with external actors (i.e. other firms, universities, individuals), firms must be able to balance the internal and external sourcing of knowledge, and assess the advances and disadvantages of different types of collaboration and modes of innovation. The second part builds on the geography of innovation and international business literature by providing an overview of the motivations to place innovation activities in foreign locations and the factors that favor an effective management of international R&D.

Readings

Part 1. Collaboration strategies and Open innovation

Cassiman, B., & Valentini, G. (2016). Open innovation: are inbound and outbound knowledge flows really complementary?. *Strategic Management Journal*, *37*(6), 1034-1046.

Chesbrough, Henry and Bogers, Marcel "Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation" in Henry Chesbrough, Wim Vanhaverbeke and Joel West, eds., New Frontiers in Open Innovation, Oxford: Oxford University Press, 2014. Available at SSRN: https://ssrn.com/abstract=2427233 (*)

Felin, T., & Zenger, T. R. (2014). Closed or open innovation? Problem solving and the governance choice. *Research policy*, *43*(5), 914-925.

Hagedoorn, J. (1993). Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences. *Strategic management journal*, *14*(5), 371-385. (*)

Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic management journal*, *27*(2), 131-150. (*)

Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic management journal*, *17*(S2), 77-91. (*)

Rosenkopf, L., & Almeida, P. (2003). Overcoming local search through alliances and mobility. *Management science*, *49*(6), 751-766.

Part 2. The internationalization of innovation

Alcácer, J., & Delgado, M. (2016). Spatial organization of firms and location choices through the value chain. *Management science*, 62(11), 3213-3234 (*)

Ambos, B., & Schlegelmilch, B. B. (2004). The use of international R&D teams: An empirical investigation of selected contingency factors. *Journal of World Business*, 39(1), 37-48. (*)

Cantwell, J. A. and Mudambi, R. (2005). 'MNE competence-creating subsidiary mandates'. *Strategic Management Journal*, 26, 1109–28. (*)

Castellani, D., Jimenez, A., & Zanfei, A. (2013). How remote are R&D labs? Distance factors and international innovative activities. *Journal of International Business Studies*, 44(7), 649-675 (*)

Hung, T. M., Contractor, F., & Lo, Y. J. (2021). Manage the value and liability of offshoring innovation. *International Business Review*, 101923.

Lee, J. Y., Choi, B. C., Ghauri, P. N., & Park, B. I. (2021). Knowledge centralization and international R&D team performance: Unpacking the moderating roles of team-specific characteristics. *Journal of Business Research*, *128*, 627-640.

Mudambi, R. (2008). 'Location, control and innovation in knowledge-intensive industries'. *Journal of Economic Geography*, 8, 699–725. (*)

Module 3 - Business Model Innovation & Innovative Startups *(Track in Business for Society)*

(Roberto Chierici)

This module is aimed at providing students with knowledge related to business strategy, focusing on the increasingly important role of business model innovation in shaping competitive advantage, especially in the startup context. The first part of this module is about business model innovation, a topic motivated by the fact that the capacity to create and renew organizational business model is one of the fundamental sources of competitiveness and value creation and appears to be crucial to the growth of the firm and its performance. The second part of the course will focus on innovative startups by offering an overview of their

creation process and analysing the internal and external factors affecting the creation of a new business venture.

Readings

Part 1. Business Model Innovation

Foss, N. J., & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go?. Journal of Management, 43(1), 200-227. (*)

Chesbrough, H., & Rosenbloom, R. S. (2002). The role of the business model in capturing value from innovation: Evidence from xerox corporation's technology spin-off firms. Industrial and Corporate Change, 11, 529–555. (*)

Markides, C. C. (2013). Business model innovation: what can the ambidexterity literature teach us?. Academy of Management Perspectives, 27(4), 313-323. (*)

Del Bosco, B., Chierici, R., & Mazzucchelli, A. (2019). Fostering entrepreneurship: An innovative business model to link innovation and new venture creation. Review of Managerial Science, 13(3), 561-574. (*)

Part 2. Innovative Startups

Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. Academy of Management Review, 25(1), 217-226. (*)

Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. Small business economics, 32(1), 15-30. (*)

Fritsch, M., & Aamoucke, R. (2013). Regional public research, higher education, and innovative start-ups: An empirical investigation. Small Business Economics, 41(4), 865-885. (*)

Del Bosco, B., Mazzucchelli, A., Chierici, R., Di Gregorio, A. (2021). Innovative startup creation: the effect of local factors and demographic characteristics of entrepreneurs. International Entrepreneurship and Management Journal, 17, 145–164 (*)

Module 4 **The financing of innovation** *(PhD Program in Economics and Statistics – track in Data Science for Business)*

(Francesca Di Pietro)

This module deals with important aspects of financing the start, the orderly development and the growth of an innovation in established companies or innovative enterprises. The goal of the course is to introduce participants into the field of entrepreneurial finance research and the problems, theories and methods that are prevalent in (empirical) research on financing entrepreneurship. Lectures will offer a perspective on entrepreneurial finance as a scholarly field, the main topics and approaches associated, and the most established research designs and methodologies adopted by scholars in the field.

Readings

Part 1. Introduction to Entrepreneurship/ Overview and Classics

- Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), pp. 217-226. (*)
- Simon, M., Houghton, S. M., & Aquino, K. (2000). Cognitive biases, risk perception, and venture formation: How individuals decide to start companies. *Journal of business venturing*, *15*(2), 113-134. (*)
- Alvarez, S. A., & Barney, J. B. (2007). Discovery and creation: alternative theories of entrepreneurial action. Strategic Entrepreneurship Journal, 1(1-2): 11–26. (*)
- Baker, T., & Nelson, R. E. (2005). Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage. Administrative Science Quarterly, 50: 329–366. (*)
- Shane, S. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. Organization Science, 11(4): 448-469. (*)
- Sarasvathy, S. D. (2001). Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. Academy of Management Review, 26(2): 243-263(*)

Part 2. Central concepts in entrepreneurial finance

- Lerner, J., Nanda, R., 2020. Venture Capital's Role in Financing Innovation: What We Know and How Much We Still Need to Learn, Journal of Economic Perspectives 34 (3), 237–261 (*)
- Gompers P. A., Gornall W., Kaplan S. N., Strebulaev I. A. 2020. How do venture capitalists make decisions? Journal of Financial Economics 135 (2020) 169–190. (*)
- Chemmanur, T.J., Krishnan, K., Nandy, D. (2011). "How Does Venture Capital Financing Improve Efficiency in Private Firms? A Look Beneath the Surface". The Review of Financial Studies 24, 4037-4090
- Croce, A., Martí, J., Murtinu, S. 2013. The impact of venture capital on the productivity growth of European entrepreneurial firms: 'Screening' or 'value added' effect?. Journal of Business Venturing 28(4), 489-510 (*)
- Colombo, M.G., Murtinu, S., 2017. Venture Capital Investments in Europe and Portfolio Firms' Economic Performance: Independent versus Corporate Investors. Journal of Economics & Management Strategy, 26(1), 35-66
- Colombo, M.G., Cumming, D., Vismara, S., 2016. Governmental venture capital for innovative young firms. Journal of Technology Transfer, 2016, 41(1), 10-24 (*)
- Connelly, B. L., Certo, S. T., Ireland, R. D., Reutzel, C. R. 2011. Signaling theory: A review and assessment. Journal of Management, 37: 39-67 (*)

Additional readings:

- Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of financial economics*, *67*(2), 217-248.
- Myers, Stewart C. "Capital structure puzzle." *NBER Working Paper* w1393 (1984).

Part 3. New financing tools for innovation

- Drover, W., Busenitz, L., Matusik, S., Townsend, D., Anglin, A., Dushnitsky, G. 2017. A review and road map of entrepreneurial equity financing research: Venture capital, corporate venture capital, angel investment, crowdfunding, and accelerators. Journal of Management, 43: 1820-1853(*)
- Colombo, O. (2021). The use of signals in new-venture financing: A review and research agenda. Journal of Management, 47(1), 237-259. (*)
- Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business*

Venturing, *29*(1), 1–16. https://doi.org/10.1016/J.JBUSVENT.2013.06.005(*)

- Colombo, M.G., Franzoni, C., Rossi Lamastra, C. 2015. Internal social capital and the attraction of early contributions in crowdfunding, Entrepreneurship Theory & Practice, 2015, 39 (1), pp. 75-100.
- Butticè, Vincenzo, Francesca Di Pietro, and Francesca Tenca. "Is equity crowdfunding always good? Deal structure and the attraction of venture capital investors." *Journal of Corporate Finance* 65 (2020): 101773. (*)
- Di Pietro, F., Grilli, L., & Masciarelli, F. (2020). Talking about a revolution? Costly and costless signals and the role of innovativeness in equity crowdfunding. *Journal of Small Business Management*, 1-32. (*)

Additional readings:

Di Pietro, F. (2020). *Crowdfunding for Entrepreneurs: Developing Strategic Advantage Through Entrepreneurial Finance*. New York: Routledge.

Module 5 Technology diffusion, firms' survival and knowled*ge Sharing (**PhD Program in Economics and Statistics (Track in Data Science for Business)*

(Marco Guerzoni)

This module aims at exploring data science as a tool for the economics and management of innovation and technological change. Each class, after a short theoretical introduction, shows with real-data how different families of data science algorithms can enrich knowledge about specific issues in innovation studies. Each class is also conceived as a hands-on collective work with data application with R. We apply three data science techniques to some classic problems in the field: prediction for technology diffusion and firms' survivals, network analysis for mapping knowledge flows, and text mining for capturing knowledge trends with patent data and journal articles.

Readings

Part 1. Predicting technology diffusion and firms' survival

Rogers, Everett M. "A prospective and retrospective look at the diffusion model." Journal of health communication 9.S1 (2004): 13-19.

Rogers, E. M. 1962. Diffusion of innovations, New York: Free Press. (chapter 1, 6, 7) (*)

Bargagli-Stoffi, F.J., Niederreiter, J. and Riccaboni, M., 2021. Supervised learning for the prediction of firm dynamics. In Data Science for Economics and Finance (pp. 19-41). Springer, Cham. (*)

Hyytinen, Ari, Mika Pajarinen, and Petri Rouvinen. "Does innovativeness reduce startup survival rates?." Journal of business venturing 30.4 (2015): 564-581. (*)

Guerzoni, M., Nava, C. R., & Nuccio, M. (2021). Start-ups survival through a crisis. Combining machine learning with econometrics to measure innovation.

Part 2. Network analysis for mapping knowledge flows

Velyka, A., & Guerzoni, M. (2020). Velyka, Anna, and Marco Guerzoni. "The more you ask, the less you get: the negative impact of collaborative overload on performance." arXiv preprint arXiv:2004.13545 (2020). (*)

Cantner, Uwe, and Holger Graf. "The network of innovators in Jena: An application of social network analysis." Research policy 35.4 (2006): 463-480. (*)

Ter Wal, Anne LJ, and Ron A. Boschma. "Applying social network analysis in economic geography: framing some key analytic issues." The Annals of Regional Science 43.3 (2009): 739-756. (*)

Part 3. Text mining and knowledge trends

Blei, David M., and John D. Lafferty. "Topic models." Text mining. Chapman and Hall/CRC, 2009. 101-124. (*)

Suominen, Arho, Hannes Toivanen, and Marko Seppänen. "Firms' knowledge profiles: Mapping patent data with unsupervised learning." Technological Forecasting and Social Change 115 (2017): 131-142. (*)

Ambrosino, Angela, et al. "What topic modeling could reveal about the evolution of economics." Journal of Economic Methodology 25.4 (2018): 329-348. (*)

(*) research papers that all students are supposed to read before the class.

Course Schedule

Time	Instructor	Topic
19/5/2022, 14.00-18.00	Salvatore Torrisi	Introduction to Module 1
20/5/2022 14.00-16.00	Lorena D'Agostino	Introduction to module 2
20/5/2022 16.00-18.00	Roberto Chierici	Introduction to Model 3
26/5/2022	Lorena D'Agostino	Module 2 - student presentations
26/5/2022 16.00-18.00	Roberto Chierici	Module 3 – student presetnations
27/5/2022 14.00-18.00	Salvatore Torrisi	Module 1. Student presentations
9/6/2022	Lorena D'Agostino	Module 1 – student presentation
10/6/2022	Lorena D'Agostino	Module 2 – student presentation
16/6/2022 14.00-18.00	Roberto Chierici	Module 3 – student presentation

17/6/2022 9.00-13.00	Roberto Chierici	Module 3 – student presentation
To be defined	Francesca Di Pietro Marco Guerzoni	Modules 4 and 5