Collective Learning:
The growth, diffusion, and valuation of knowledge

Instructor: Cesar A. Hidalgo, PhD

Synopsis

Why was Netflix able to outcompete Blockbuster? What role did migrants play in the early industrialization of the United States? How did Sony become a leader in audio equipment? This course will answer these and other questions by introducing students to the basic facts and theories explaining the growth, diffusion, and valuation of knowledge. By the end of this course, students will be equipped with a basic understanding of a century's worth of research on the temporal and spatial dynamics of knowledge and with a practical understanding of some of the tools used to study its growth, diffusion, and valuation.

This course will cover multiple aspects of collective learning, from the organizational learning literature focused on firms and teams, to recent work on economic complexity studying knowledge accumulation and diffusion in cities and nations.

This course is divided into five units. The first unit motivates the study of knowledge using practical policy examples and then moves to an introduction of the characteristics that make the study of knowledge both interesting and challenging (non-fungibility, non-rivalry, tacit and explicit knowledge, architectural knowledge, transactive memory, etc.). The second unit focuses on the temporal accumulation of knowledge (e.g. learning curves, progress curves, experience curves, forgetting curves), on the connection between different types of learnig curves (e.g. disruptive innovation theory), and on the mechanisms that make transitions among learning curves difficult (e.g. architectural knowledge). The third unit focuses on the diffusion of knowledge across geographies, social networks, and activities, and will review classic and recent research on the role of migrants and social networks on the diffusion of knowledge together with the key concepts needed to understand knowledge diffusion, such as the idea of absorptive capacity. The fourth unit will explore methods to quantify the value of knowledge agglomerations that can help explain national and international variations in economic growth, inequality, and emissions. The fifth and final unit will focus on policy implications and broader lessons.

Requirements:
This course is open to all senior undergraduate students, Master's students, and PhD students.

Starting Week
September 9, 2024

Syllabus:
3 hours per week (2 x 90 minute sessions).

Week 1: Introduction & Learning Curves
Week 2: Experience Curves, Disruptive Innovation
Week 3: Architectural Knowledge & Forgetting Curves
Week 4: Geographical Knowledge Diffusion I and II
Week 5: Relatedness I and II
Week 6: Relatedness III and Economic Complexity I
Week 7: Economic Complexity II & III
Week 8: Lessons and Policy Implications
Week 9: Class project presentations I
Week 9: Class project presentations II (if needed).

REFERENCES:

Abernathy, W.J. & Wayne, K., 1974, Limits of the Learning Curve, Harvard Business Review, (September 1974).

Alshamsi, A., Pinheiro, F.L. & Hidalgo, C.A., 2018, 'Optimal diversification strategies in the networks of related products and of related research areas', Nature Communications, 9(1), 1328.

Argote, L. & Epple, D., 1990, 'Learning Curves in Manufacturing', Science, 247(4945), 920–924.

Audretsch, D.B. & Feldman, M.P., 1996, 'R&D Spillovers and the Geography of Innovation and Production', The American Economic Review, 86(3), 630–640.

Audretsch, D.B. & Feldman, M.P., 2004, 'Chapter 61 - Knowledge Spillovers and the Geography of Innovation', in J.V. Henderson & J.-F. Thisse (eds.), Handbook of Regional and Urban Economics, Cities and Geography., vol. 4, pp. 2713–2739, Elsevier.

Balland, P.A., Boschma, R., Crespo, J. & Rigby, D.L., 2018, 'Smart specialization policy in the European Union: relatedness, knowledge complexity and regional diversification', Regional Studies, 1–17.

Balland, P.A., Jara-Figueroa, C., Petralia, S., Steijn, M., Rigby, D.L. & Hidalgo, C., 2018, Complex Economic Activities Concentrate in Large Cities, Social Science Research Network, Rochester, NY.

Balland, P.-A. & Rigby, D., 2017, 'The Geography of Complex Knowledge', Economic Geography, 93(1), 1–23.

Boschma, R., 2005, 'Proximity and Innovation: A Critical Assessment', Regional Studies, 39(1), 61–74.

Boschma, R., Balland, P.-A. & Kogler, D.F., 2015, 'Relatedness and technological change in cities: the rise and fall of technological knowledge in US metropolitan areas from 1981 to 2010', Industrial and Corporate Change, 24(1), 223–250.

Breschi, S. & Lissoni, F., 2005, 'Knowledge Networks from Patent Data', in H.F. Moed, W. Glänzel & U. Schmoch (eds.), Handbook of Quantitative Science and Technology Research: The Use of Publication and Patent Statistics in Studies of S&T Systems, pp. 613–643, Springer Netherlands, Dordrecht.

Fink, T.M.A. & Reeves, M., 2019, 'How much can we influence the rate of innovation?', Science Advances, 5(1), eaat6107.

Fink, T.M.A., Reeves, M., Palma, R. & Farr, R.S., 2017, 'Serendipity and strategy in rapid innovation', Nature Communications, 8(1), 2002.

Fleming, L. & Sorenson, O., 2001, 'Technology as a complex adaptive system: evidence from patent data', Research Policy, 30(7), 1019–1039.

Florida, R., 2019a, How Housing Supply Became the Most Controversial Issue in Urbanism, CityLab.

Florida, R., 2019b, Blue-Collar and Service Workers Fare Better Outside Superstar Cities, CityLab.

Guevara, M.R., Hartmann, D., Aristarán, M., Mendoza, M. & Hidalgo, C.A., 2016, 'The research space: using career paths to predict the evolution of the research output of individuals, institutions, and nations', Scientometrics, 109(3), 1695–1709.

Hartmann, D., Guevara, M.R., Jara-Figueroa, C., Aristarán, M. & Hidalgo, C.A., 2017, 'Linking Economic Complexity, Institutions, and Income Inequality', World Development, 93, 75–93.

Hausmann, R. & Hidalgo, C.A., 2011, 'The network structure of economic output', Journal of Economic Growth, 1–34.

Hausmann, R., Hidalgo, C.A., Bustos, S., Coscia, M., Simoes, A. & Yildirim, M.A., 2014, The atlas of economic complexity: Mapping paths to prosperity, MIT Press.

Henderson, Rebecca M., and Kim B. Clark. "Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms." *Administrative science quarterly* (1990): 9-30.

Henrich, J., 2015, The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter, Princeton University Press, Princeton.

Hidalgo, C.A., 2018, 'Economic complexity: From useless to keystone', Nature Physics, 14(1), 9–10.

Hidalgo, C.A., Balland, P.-A., Boschma, R., Delgado, M., Feldman, M., Frenken, K., Glaeser, E., He, C., Kogler, D.F., Morrison, A., Neffke, F., Rigby, D., Stern, S., Zheng, S. & Zhu, S., 2018, The Principle of Relatedness, in A.J. Morales, C. Gershenson, D. Braha, A.A. Minai & Y. Bar-Yam (eds.), Unifying Themes in Complex Systems IX, Springer Proceedings in Complexity., 451–457, Springer International Publishing.
Hidalgo, C.A. & Hausmann, R., 2009, 'The building blocks of economic complexity', Proceedings of the National Academy of Sciences, 106(26), 10570–10575.

Hidalgo, C.A., Klinger, B., Barabási, A.-L. & Hausmann, R., 2007, 'The Product Space Conditions the Development of Nations', Science, 317(5837), 482–487.

Hidalgo, C. A. (2021). Economic complexity theory and applications. Nature Reviews Physics, 3(2), 92-113.

Jaffe, A.B., Trajtenberg, M. & Henderson, R., 1993, 'Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations', The Quarterly Journal of Economics, 108(3), 577–598.

Jara-Figueroa, C., Jun, B., Glaeser, E.L. & Hidalgo, C.A., 2018, 'The role of industry-specific, occupation-specific, and location-specific knowledge in the growth and survival of new firms', Proceedings of the National Academy of Sciences, 115(50), 12646–12653.

Jara-Figueroa, C., Yu, A.Z. & Hidalgo, C.A., 2019, 'How the medium shapes the message: Printing and the rise of the arts and sciences', PLOS ONE, 14(2), e0205771.

Lee, K. & Malerba, F., 2017, 'Catch-up cycles and changes in industrial leadership:Windows of opportunity and responses of firms and countries in the evolution of sectoral systems', Research Policy, 46(2), 338–351.

Lee, K., Szapiro, M. & Mao, Z., 2018, 'From Global Value Chains (GVC) to Innovation Systems for Local Value Chains and Knowledge Creation', The European Journal of Development Research, 30(3), 424–441.

Cohen, Wesley M., and Daniel A. Levinthal. "Absorptive capacity: A new perspective on learning and innovation." *Administrative science quarterly* (1990): 128-152.

Rapoport, H., 2016, 'Migration and globalization: what's in it for developing countries?', International Journal of Manpower, 37(7), 1209–1226.

Rodríguez-Pose, A., 2018, The revenge of the places that don't matter, VoxEU.org.

Ronen, S., Gonçalves, B., Hu, K.Z., Vespignani, A., Pinker, S. & Hidalgo, C.A., 2014, 'Links that speak: The global language network and its association with global fame', Proceedings of the National Academy of Sciences, 111(52), E5616–E5622.

Zheng, S., Sun, W., Wu, J. & Kahn, M.E., 2017, 'The birth of edge cities in China: Measuring the effects of industrial parks policy', Journal of Urban Economics, 100, 80–103.

Zhu, S., He, C. & Zhou, Y., 2017, 'How to jump further and catch up? Path-breaking in an uneven industry space', Journal of Economic Geography, 17(3), 521–545.