Department of Political Science
UNIVERSITY OF TORONTO

The Political Economy of Technology: From the Auto-Industrial to the Digital Age

POL 409S/2307S
Fall, 2016-2017

Wednesday, 2:00 – 4:00 pm
University College, Room 67
Office Hours: Wednesday, 4:00 – 5:30 pm

David A. Wolfe
MU 367S - 946-8922
Email: david.wolfe@utoronto.ca

This course surveys a broad range of issues concerning the relationship between technological change and social and political development from a theoretical, historical and comparative perspective. The principal objectives are to explore the growing centrality of science and technology in political affairs generally, and its current significance for public policy in particular; to examine the conceptual tools that political economy brings to bear on an analysis of the nature of technological change; and to assess the implications of the development of social and political institutions at the national and international level for the process of technological innovation in the current period and the policy implications of that relationship.

The course will be based on a seminar format. Assignments for the course will consist of seminar participation and a major paper. The exact format for the conduct of the seminars will be discussed and agreed upon at the first class. Essays should be chosen from the topics outlined for each term. Variations upon these themes will be considered at the instructor's prerogative. Undergraduate essays are to be 4,000 words long and graduate essays 6,000 words long. Undergraduates must submit a five page outline and annotated bibliography before reading week. Each will count for 10% of the final grade. Essays are due the final week of the term. The paper will count for 70% of the final grade (60 % for undergraduates). Seminar participation and presentations will be worth 30%.

Required readings for each week are marked with an (*). Students are encouraged to read as many of the required readings for each week as possible.

Recommended Text:

Manuel Castells, *The Rise of the Network Society*, Vol. 1, rev. ed.

POL 409S/2307S Course Readings available online.

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TOPICS: First Term

1. Introduction to the course and discussion of outlines

2. What is Technology?

3. Long Waves and Technological Change

4. Science and Technology in the Fourth Kondratiev

5. The IT Revolution – A New Techno-Economic Paradigm?

6. The 'New' E-conomy – Economic Impact of the IT Revolution

7. The Algorithmic Revolution or "Why Software is Eating the World"

8. The Fourth Industrial Revolution and the ICT-Auto Interface

9. Technology and Globalization

10. Global Production Networks and IT

11. The State of the Digital Economy and Innovation Policy in Canada

12. The IT Paradigm and the Future of Economic Growth

Readings by Topic

Readings marked by an asterisk (*) are required readings on each topic.

1. Introduction to the course and discussion of outlines

2. What is Technology?

*W. Brian Arthur, *The Nature of Technology: What It is and How It Evolves*, ch. 2, 9

*Robert L. Heilbroner, "Do Machines Make History?" *Technology and Culture* 8 (July 1967)

*Joel Mokyr, "Evolution and the Dynamics of Technological Change," in *The Lever of Riches*, pp. 273-99.

*Bill Buxton, "The Long Nose of Innovation," *Business Week*, Jan. 2, 2008.

J. David Bolter, *Turing's Man: Western Culture in the Computer Age*, ch. 2

Jean-Jacques Salomon, "What is Technology? The Issue of its Origins and Definitions," *History and Technology* 1 (1984)

Nathan Rosenberg, "The Historiography of Technical Progress," in *Inside the Black Box*

Lewis Mumford, *Technics and Civilization*

Donald Mackenzie, "Marx and the Machine," *Technology and Culture* 25 (July 1984)

3. Innovation and Long Waves

*Giovanni Dosi, "Technological Paradigms and Technological Trajectories," in *Long Waves in the World Economy*, ed. C. Freeman, pp. 78-101.

*C. Freeman and F. Louca, "Introduction: Technological Change and Long Waves in Economic Development," in *As Time Goes By: From the Industrial Revolutions to the Information Revolution*, pp. 139-151.

*Carlota Perez, "Technological revolutions and techno-economic paradigms," *Cambridge Journal of Economics* 34 (2010): 185-202.

*William R. Thompson, "Long waves, technological innovation, and relative decline," *International Organization* 1990: 44:2 (Spring): 201-33.

Giovanni Dosi and Richard R. Nelson, "Technical Change and Industrial Dynamics as Evolutionary Processes," in B.H. Hall and N. Rosenberg, eds, *Handbook of the Economics of Innovation*, Vol. II, pp. 51-127.

Carlota Perez, *Technological Revolutions and Financial Capital*, pp. 3-32.

C. Freeman and C. Perez, "Structural Crises of Adjustment: Business Cycles and Investment Behaviour," in Dosi, ed., *Technical Change and Economic Theory*, pp. 38-66.

Thomas P. Hughes, "The Dynamics of Technological Change," in *Technology and Enterprise in Historical Perspective*, ed. G. Dosi, R. Giannetti and P.A. Toninelli, pp. 97-117.

Chris Freeman, "The Economics of Technological Change," *Cambridge Journal of Economics* 1994: 463-514.

Andrew Tylecote, *The Long Wave in the World Economy*, ch. 1, pp. 7-27.

J.J. Van Duijn, *The Long Wave in Economic Life*

Luc Soete, "Technical Innovation and long waves: an inquiry into the nature and wealth of Christopher Freeman's thinking," in *Technology and the Human Prospect*, ed. Roy Macleod

C. Freeman, J. Clark, and L. Soete, *Unemployment and Technical Innovation*, ch. 2-4

George Modelski and William R. Thompson, *Leading Sectors and World Powers*

Joseph Schumpeter, *Capitalism, Socialism and Democracy*, esp. ch. 7

Christopher Freeman, ed., *Long Waves in the World Economy*

4. Science and Technology in the Fourth Kondratiev

*C. Freeman and F. Louca, *As Time Goes By*, pp. 272-300

*Richard R. Nelson and Gavin Wright, "The Rise and Fall of American Technological Leadership," *Journal of Economic Literature* 30 (December 1992)

or

*Richard R. Nelson, "US Technological Leadership: Where did it come from and where did it go?" *Research Policy* 19 (1990)

*Linda Weiss, *America Inc.? Innovation and Enterprise in the National Security State*, ch. 2

*National Research Council of the National Academies, *Innovation in Information Technology*, ch. 1

Mowery, D.C. and Langlois, R. 1996. "Spinning Off and Spinning On (?): The Federal Government Role in the Development of the U.S. Computer Software Industry," *Research Policy* 25: 947-966.

David C. Mowery and Nathan Rosenberg, *Technology and the Pursuit of Economic Growth*

Donald E. Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation*

Henry Ergas, "Does Technology Policy Matter?" in *Technology and Global Industry*, ed. Bruce R. Guile and Harvey Brooks

David Mowery and Nathan Rosenberg, *Paths of Innovation: Technological Innovation in 20th Century America*

Annemieke J.M. Roobeek, *Beyond the Technology Race: An Analysis of Technology Policy in Seven Industrial Countries*, ch. 3

C. Freeman, J. Clark, and L. Soete, *Unemployment and Technical Innovation*, ch. 6, 7, 8

OECD, *Technical Change and Economic Policy*

David. M. Hart, *Forged Consensus: Science, Technology and Economic Policy in the United States, 1921-1953*

Daniel L. Kleinman, *Politics on the Endless Frontier: Postwar Research Policy in the United States*

Harvey Brooks, "National Science Policy and Technological Innovation," in *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, ed. R. Landau and N. Rosenberg

5. The IT Revolution – A New Techno-Economic Paradigm?

*Manuel Castells, *The Rise of the Network Economy*, ch. 1

*C. Freeman and F. Louca, *As Time Goes By*, pp. 301-335

*Carlota Perez, *Technological Revolutions and Financial Capital*, pp. 36-59.

*Alexander J. Field, "The Information Technology Boom," ch. 5 of *A Great Leap Forward: 1930s Depression and U.S. Economic Growth*.

*Richard N. Langlois, "Organizing the Electronic Century," in Giovanni Dosi et al, eds, *The Third Industrial Revolution in Global Business*, pp. 119-167.

Paul A. David, "Computer and Dynamo: The Modern Productivity Paradox in a Not-Too-Distant Mirror," in OECD, *Technology and Productivity: The Challenge for Economic Policy*

Bo Carlsson, "The Digital Economy: what is new and what is not?" *Structural Change and Economic Dynamics* 15 (2004): 245-64.

C. Freeman and L. Soete, *Work for all or Mass Unemployment: Computerized Technical Change in the 21st Century*

George Gilder, *Microcosm*

George Gilder, *Telecosm*

Daniel E. Sichel, *The Computer Revolution: An Economic Perspective*

Tom Forester, *High-Tech Society: The Story of the Information Technology Revolution*

Peter Schwartz and Peter Leyden, *The Long Boom: A Vision for the Coming Age of Prosperity*

6. The 'New' E-conomy – Economic Impact of the IT Revolution

*Manuel Castells, *The Internet Galaxy*, ch. 3

*David Mowery and Timothy Simcoe, "The Internet," in Benn Steil, et al., *Technological Innovation and Economic Performance*

*National Academies of Sciences, Engineering and Medicine, *Continuing Innovation in Information Technology*, 2016.

*Marianna Mazucato, *The Entrepreneurial State*, ch. 5

Gregory Tassey, "Strategic Shifts in the IT Economy, " ch. 7 of *The Technology Imperative*

Roger Alcaly, *The New Economy*, ch. 1, 2 (pp. 52-60)

Peter F. Cowhey and Jonathan D. Aronson, *Transforming Global Information and Communication Markets*.

Erik Brynjolfsson and Adam Saunders, *Wired for Innovation: How Information Technology is Reshaping the Economy?*

Manuel Castells, *Communication Power*

Martin Fransman, *Telecoms in the Internet Age: From Boom to Bust to ...*

John Naughton, *A Brief History of the Future: The origins of the Internet*

Dan Schiller, *Digital Capitalism: Networking the Global Market System*

National Research Council, *The Internet's Coming of Age*

OECD, *The New Economy: Beyond the Hype*

OECD, *A New Economy: The Changing Role of Innovation and Information Technology in Growth*

7. The Algorithmic Revolution or "Why Software is Eating the World"

*Marc Andreesen, "Why Software is Eating the World," *Wall Street Journal,* Sept. 11, 2011. Available online: http://www.wsj.com/articles/SB10001424053111903480904576512250915629460/

*Martin Kenney and John Zysman, "The Rise of the Platform Economy," *Issues in Science and Technology* Spring 2016

*John Zysman et al. "Services with Everything: The ICT-Enabled Digital Transformation of Services," in Dan Breznitz and John Zysman, eds, *The Third Globalization*

*Shih, Willy. 2015. "Does Hardware Even Matter Anymore?" *Harvard Business Review*, 9 June, Https://hbr.org/2015/06/does-hardware-even-matter-anymore?

*Andrew McAfee and Erik Brynjolfsson. "Human Work in the Robotic Future: Policy for the Age of Automation." *Foreign Affairs*, July/August 2016.

Marc Andreesen and Ben Horowitz, "Software Programs the World," Podcast available online: http://a16z.com/2016/07/10/software-programs-the-world/

Erik Brynjolfsson and Andrew McAfee, *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*

Brie-IGCC E-conomy Project, *Tracking a Transformation: E-Commerce and the Terms of Competition in Industries*

John Zysman and Abraham Newman, eds, *How Revolutionary was the Digital Revolution?*

Steven Weber, *The Success of Open Source*

8. The Fourth Industrial Revolution and the ICT-Auto Interface

*W. Brian Arthur, "The Second Economy," *McKinsey Quarterly*, (October 2011): 1-9.

*Klaus Schwab, *The Fourth Industrial Revolution,* pp. 6-26.

*National Science and Technology Council, *Preparing for the Future of AI*, pp. 1-30. Available online: https://www.whitehouse.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf.

*Riccardo Coppola and Maurizio Morisio, "Connected Car: Technologies, Issues, Future Trends," *ACM Computing Surveys* 49:3 (October 2016): 1-36.

*Steve Carlisle, "The Future of Mobility," J.D Power 2016 TalkAUTO Canada.

Anja Schulze, John Paul MacDuffie and Florian A Täube, "Introduction: knowledge generation and innovation diffusion in the global automotive industry– change and stability during turbulent times," *Industrial and Corporate Change* 2015: 1-9

McKinsey&Company, *Automotive revolution– perspective towards 2030: How the convergence of disruptive technology-driven trends could transform the auto industry*

Stephen J. Ezell, *A Policymaker's Guide to Smart Manufacturing*, Information Technology and Innovation Foundation, 2016.

Acatech, National Academy of Science and Engineering, *Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative INDUSTRIE 4.0*

McKinsey Global Institute, *The Internet of Things: Mapping the Value Beyond the Hype*, 2015.

Peter C. Evans and Marco Annunziato, *Industrial Internet: Pushing the Boundaries of Minds and Machines*, GE Vision Paper, 2012.

9. Technology and Globalization

*Manuel Castells, *The Rise of the Network Society*, ch. 2 (pp. 92-147)

*James Manyika et al. *Digital Globalization: The New Era of Global Flows*, McKinsey Global Institute, 2015, pp 1-41.

*National Research Council, *Rising to the Challenge: U.S. Innovation Policy for the Global Economy*, ch. 1, pp. 23-41.

*Gregory Tassey, "The Globalization of Technology," ch. 1 of *The Technology Imperative*

Keith Smith, "Globalisation and Innovation Systems: Policy Issues," in Ruud E. Smits et al., eds, *The Theory and Practice of Innovation Policy*

Michael Borrus and John Zysman, "Globalization with Borders: The Rise of Wintelism as the Future of Global Competition," *Industry and Innovation*: (December 1997)

Linda Garcia, "The Globalization of Telecommunications and Information," in William J. Drake, ed., *The New Information Infrastructure: Strategies for US Policy*

OECD, "Technology and Globalisation," ch. 10 in *Technology and the Economy: The Key Relationships*

J. Niosi, ed., "The Internationalization of R&D," special issue of *Research Policy* (1999)

F. Myer-Krahmer, ed., *Globalisation of R&D and Technology Markets*

OECD, *Internationalisation of Industrial R&D: Patterns and Trends*

Council on Competitiveness, *Going Global: The New Shape of American Innovation*

S. Ostry and R.R. Nelson, *Techno-Nationalism and Techno-Globalism*

10. The IT Paradigm and Global Production Networks

*Manuel Castells, *The Rise of the Network Society*, ch. 3

*Jason Dedrick, Kenneth Kramer and Greg Linden, "Who Profits from Innovation in Global Value Chains? A Study of the iPod and Notebook PCs," Industry Studies Association Working Paper WP-2008-15.

or

*Greg Linden, Jason Dedrick and Kenneth L. Kraemer, "Innovation and Job Creation in a Global Economy: The Case of Apple's iPod," *Journal of International Commerce & Economics*

*Philip Cooke, "Qualitative Analysis and Comparison of Firm and System Incumbents in the New ICT Global Innovation Network," European Planning Studies 21:9 (2013): 1323-1340.

*Juan Alcácer, John Cantwell and Lucia Piscitello, "Internationalization in the information age: A new era for places, firms and international business networks," *Journal of International Business Studies* 47 (2016): 499-512.

Henry Wai-chung Yeung, *Strategic Coupling: East Asian Industrial Transformation in the New Global Economy*

Parrilli, M.D., Nadvi, K. and Yeung, H.W., 2013. "Local and Regional Development in Global Value Chains, Production Networks and Innovation Networks: A Comparative Review and the Challenges for Future Research," *European Planning Studies* 21(7): 967-988.

John Cantwell and Grazia Santangelo, "The new geography of corporate research in Information and Communications Technology (ICT)," *Journal of Evolutionary Economics* 12 (2002): 163-97.

Eric Thun, "The Globalization of Production," in John Ravenhill, ed., *Global Political Economy*, 2nd ed.

Martin Kenney and Richard Florida, eds, *Locating Global Advantage: Industry Dynamics in the International Economy*

Schmitz, H. and Strambach, S. 2009. "The organizational decomposition of innovation and global distribution of innovative activities: insights and research agenda," *International Journal of Technological Learning, Innovation and Development* 2(4): 231-249.

Coe, N. Hess, M., Yeung, H.W., Dicken, P. and Henderson, J. 2004. "'Globalizing' regional development: a global production networks perspective," *Transactions of the Institute of British Geographers* 29: 468-484.

Coe, N., Dicken, P. and Hess, M. 2008. "Global Production Networks: Realizing the Potential," *Journal of Economic Geography* 8:271-295.

Jeffrey T. Macher, David C. Mowery and Timothy S. Simcoe, "e-Business and the Disintegration of the Semiconductor Industry Value Chain," *Industry and Innovation* 9:3 (Dec. 2002): 155-81.

11. The State of the Digital Economy and Innovation Policy in Canada

*David A. Wolfe, "A Policy Agenda for the Digital Economy," Innovation Policy Lab White Paper No. 2. Available online: munkschool.utoronto.ca/ipl/

*Council of Canadian Academies, *The State of Industrial R&D in Canada*, ch. 6 and 7 available online: scienceadvice.ca

and

*Council of Canadian Academies, *Paradox Lost: Explaining Canada's Research Strengths and Innovation Weakness* available online at: scienceadvice.ca

*Peter W.B. Phillips and David Castle, "Science and Technology in Canada: Government Investment at a Crossroads," in *How Ottawa Spends, 2012-2013*, ed. G. Bruce Doern and Christopher Stoney

*Adam Chowaniec, "R&D and the Culture of Risk in Canada," (Mimeo)

Government of Canada, *Mobilizing Science and Technology to Canada's Advantage*, Ottawa, 2007

Science Technology and Innovation Council, *State of the Nation 2012*

Council of Canadian Academies, *Innovation and Business Strategy: Why Canada Falls Short,* 2009.

Expert Panel on Federal Support to Research and Development, *Innovation Canada: A Call to Action*, Ottawa, 2011.

12. The IT Paradigm and the Future of Economic Growth

*Robert Gordon, "Is U.S. Economic Growth Over? Faltering Innovation Confronts The Six Headwinds," CEPR Policy Insight No. 63, September. 2012. Online

or

*Robert J. Gordon, *The Rise and Fall of American Economic Growth*, ch. 17

*Kevin Kelly, "The Post-Productive Economy," http://www.kk.org/thetechnium/archives/2013/01/the_post-produc.php.

*Erik Brynjolfsson and Andrew McAfee, *The Second Machine Age*, ch. 2, 15

*Carlota Perez, "Capitalism, Technology and a Green Global Golden Age," in Michael Jacobs and Mariana Mazzucato, eds, *Rethinking Capitalism*, pp. 191-217.

Robert Boyer, "The long-term historical outlook after the Internet bubble," ch. 7 of *The Future of Economic Growth: As New Becomes Old*

Tyler Cowen, *The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will(Eventually) Feel Better*

Kevin Kelly, *What Technology Wants*

William Lazonick, *Sustainable Prosperity in the New Economy*

Michael J. Mandel, *The Internet Depression: The Boom, The Bust and Beyond*