Digital Transformation of the World Economy

SYLLABUS
SEMESTER II, ACADEMIC YEAR 2018-2019
INSTRUCTOR: DR. MILOVANTSEVA
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COURSE PREREQUISITES

There are no prerequisites. While a background in any relevant discipline would be helpful, a sincere interest in a conceptual understanding of the material is all a student needs. Advanced level of English is instrumental for doing well in this course.

COURSE TYPE AND METHODS OF INSTRUCTION

This course is elective. All lectures and seminars are face-to-face engagements. Possible field trips may be included in lieu of lecture meetings, subject to sites and time availability.

COURSE DESCRIPTION

This course provides interdisciplinary perspective and practical experience on how information and communication technology (ICT) has been transforming the economy. The main feature of this course is that students will engage in digital economy itself, not just learn about it or discuss others participate in it.

We will cover a little bit of material across key issues of the process of world’s digital transformation, and the goal is to connect ideas together and engage in the digital economy through a group project. Topics include critical components of digital ecosystem, place of information technology in the theories of and its impact on economic growth, role of information technology in evolving economic relations, and socioeconomic implications of digital transformation. The emphasis is on (a) appreciating the effect of emerging technologies on global economy and (b) on developing skills for taking advantage of economic opportunities afforded by digitalization.

LEARNING OBJECTIVES

The primary objective is to encourage critical thinking about the impact of digitalization on economic processes worldwide and its role in the society. This will involve connecting economic theory with other disciplines. A second objective is to gain skills in collaborative writing and to learn information literacy. This will include group work in digital environment. And a third objective is to engage in digital economy itself. This will be achieved through working on a team
entrepreneurial project via putting together several basic components of a start-up investment proposal.

The knowledge and skills gained in this course will contribute to students’ toolkit necessary for (a) anticipating and shaping the impact of emerging technologies and (b) reacting quickly to changing circumstances in rapidly evolving digital economy.

The emphasis will be on active learning. At times, students may be asked to complete the readings or watch video materials before class to get more out of learning activities integrated with in-class meetings.

_Caveat_. This course covers key exciting innovative developments in today’s economy. However, it will not attempt to provide an in-depth literature survey of the field, nor will it include detailed technical discussions of each technology or aspire to achieve a comprehensive review of emerging technologies. We will jump around several topics where a common theme – digital transformation – is what holds everything together.

**LEARNING OUTCOMES**

At the end of the semester, students will be knowledgeable about:

1) The nature and extent of the digital transformation,
2) How to evaluate various challenges that digital transformation of world economy presents, and
3) The likely global implications of digital economy evolvement.

**COURSE TEXTS**

There is no textbook in this course. However, readings and video materials will be assigned for each session. We will make our best effort to help find required and optional materials and ask you to let us know right away if provided internet links for resources are no longer useful.
GRADING SYSTEM

Essay (50%) Individual or group paper in the format of a draft of some basic elements of start-up investment proposal. Due: at sixth seminar.

Exam (50%) Take-home final exam in the format of final start-up investment proposal. Due: TBA.

GUIDELINES FOR KNOWLEDGE ASSESSMENT

Ability to effectively communicate your ideas and articulate relevant and potent questions is an important skill to have in the digital era. Attending classes, learning online materials and taking active part in class discussions and activities is the best way to hone this skill and to maximize your overall course performance.

Attendance and participation are not compulsory; however, they will be tracked: during each lecture you will be asked to perform some tasks and at the end of each lecture - to write three take-home points. These data will be used in assigning your final grade. That is, if you attend and actively work on at least 12 lectures, your final course grade will be increased by one point.

COURSE POLICIES

It is students’ responsibility to be thorough familiar with university’s plagiarism policy. Cheating and disruptive behavior in any form are never allowed. The instructor reserves the right to alter any topics covered or assignments with appropriate notice. Information about changes and additional materials will be announced in class and posted to class cloud drive or emailed. The institutional university policies will be used for resolving any organizational or administrative issues not included in this syllabus. Although, I enjoy interacting with students after class, this is not always feasible due to other professional obligations. I would prefer for students to contact me via email (nmilovantseva@hse.ru) for arranging personal or group consultations.

EQUIPMENT SUPPORT

General up-to-date equipment, adequate for slides presentation and video viewing.
| #  | Topic                                                      | Academic hours |
|----|------------------------------------------------------------|----------------|
| 1  | Introduction                                              | 2              |
| 2  | Economic theory for digital transformation                 | 2              |
| 3  | Creating conditions for and driving digital innovation    | 2              |
| 4  | Advances in computing                                     | 2              |
| 5  | Advances in communication                                 | 2              |
| 6  | Big data                                                  | 2              |
| 7  | Artificial intelligence. Machine learning                 | 2              |
| 8  | Blockchain and cryptocurrency                             | 4              |
| 9  | Alternative finance                                       | 2              |
| 10 | Platform economy                                          | 2              |
| 11 | Future of work                                            | 2              |
| 12 | Startup Village; Skolkovo Innovation Center               | 4              |
| 13 | Technology and economic development. Digital inequalities | 2              |
| 14 | Cybersecurity. Cyberegulation                             | 2              |
| 15 | Environmental impact of digital transition                | 2              |
| 16 | Cases: Balance between tradition and technology; new monopolies | 2    |
|    | Total                                                     | 36             |
COURSE TOPICS DESCRIPTION

1. INTRODUCTION
Welcome and course requirements. Broad overview of industrial revolutions and digital transformation. Reasons for increasing concern about the rate and direction of change in digital technologies. Why digital transformation matters for the word economy? Does rapid innovation mean the change is inevitable? What are the consequences of the direction of change?

Required Reading
Negroponte, N. (1995) 'Being Digital', New York: Alfred A. Knopf. Pp. 3-61 (available electronically at HSE library).

Zuboff, S. (2015) 'Big other: Surveillance capitalism and the prospects of an information civilization'. Journal of Information Technology, 30(1): 75-89.

Optional Materials
Archibugi, D. (2016) ‘Blade Runner economics: Will innovation lead the economic recovery?’, 5th revision. https://papers.ssrn.com/sol3/papers2.cfm?abstract_id=2557335

Balakrishnan, H., Terman, C., Verghese, G. (2012) ‘Why Digital? Communication Abstractions and Digital Signaling’. MI.T. 6.02 Lecture Notes https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/readings/MIT6_2F12_chap04.pdf

Schwab, K. 2016. The Fourth Industrial Revolution: what it means, how to respond.

2. ECONOMIC THEORY FOR DIGITAL TRANSFORMATION
Theoretic explanations of how change happens. Three perspectives on digital transformation. Neoclassical economics perspective. Institutional economics perspective. Political economy perspective. Comparing and contrasting market-led, market-reform and political economy perspectives on digital transformation. How different traditions of economic inquiry treat markets and power relations? Which economic theoretical assumptions influence neoclassical and institutional perspectives on the history and future of digital technology innovation?


**Required Reading**

Fuchs, C. (2009) 'Information and communication technologies and society: A contribution to the critique of the political economy of the internet'. European Journal of Communication, 24(1): 69-87.

Steinmueller, W. E. (2007), ‘Economics of Information and Communication Technologies: Building Blocks and Implications” in R. Mansell, C. A. Avergou, D. Quah and R. Silverstone (eds.), The Oxford Handbook of Information and Communication Technologies, Oxford University Press, pp. 196-219.

**Optional Materials**

Fuchs, C. 2016. 'Baidu, Weibo and Renren: The global political economy of social media in China'. Asian Journal of Communication, 26(1): 14-41.

Perez, C. (2010) 'Technological revolutions and techno-economic paradigms'. Cambridge Journal Economics, 34(1): 185-202.

Perez, C. and Soete, L. 1988. 'Catching up in technology: Entry barriers and windows of opportunity'. In G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete (Eds). Technical change and economic theory, (pp. 458-479). London: Pinter Publishers.

Schot, J. and Kanger, L. (2016) Deep transitions: Emergence, acceleration, stabilization and directionality. SPRU Working Paper Series SWPS 2016-15, University of Sussex, Falmer.

Juma, C. (2016) Innovation and its enemies: Why people resist new technologies. Oxford: Oxford University Press.

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3. **CREATING CONDITIONS FOR AND DRIVING DIGITAL INNOVATION**

The link between technological change and economic policy making. Policies designed to create conditions for digital innovation. Startups as drivers of digital innovation.

**Required Reading**

Blank, S. (2013) ‘Why the Lean Start-Up Changes Everything’. Harvard Business Review.
Steinmueller, W. E. (2010) 'Economics of technology policy'. In B. H. Hall and N. Rosenberg (Eds). Handbook of the economics of innovation, (pp. 1181-1218): Elservier Science.

Assignment

Enroll in Computer Science 101 at https://lagunita.stanford.edu/courses/Engineering/CS101/Summer2014/about

Optional Materials

Noam, E. (2014) 'Cloud TV: Toward the next generation of network policy debates'. Telecommunications Policy, 38: 684-692.

Blank, S. (2018) ‘How to Start a Startup’ https://steveblank.com/books-for-startups/

Marien, I. and Prodnik, J. A. 2014. 'Digital inclusion and user (dis)empowerment: A critical perspective'. Info: The Journal of Policy, Regulation and Strategy for Telecommunications, 16(6): 35-47.

Jorgenson, D. W. and Vu, K. M. (2016) 'The ICT revolution, world economic growth, and policy issues'. Telecommunications Policy, 40: 383-397.

4. ADVANCES IN COMPUTING
Exponential progress of processing power. Revolutionary changes in materials. Connecting power of computing to advances in other fields. Application, generality, computing power and potential of quantum computing.

Required Reading

Negroponte, N. (1995) ‘Being Digital’, New York: Alfred A. Knopf. Pp. 62-75 (available electronically at HSE library).

Written notes for lecture Computer Hardware (Week 3) Computer Science 101 at https://lagunita.stanford.edu/courses/Engineering/CS101/Summer2014/about

Optional Materials

Tapscott, D. (1996) ‘The Digital Economy’, New York: McGraw-Hill. Pp. 96-120.
5. ADVANCES IN COMMUNICATION

Brief history of the development of the Internet and Internet Protocol (IP). Area networking. Domain name system (DNS). Rapid growth, congestion, service attacks, cyber threats. Evolution of mobile infrastructure and equipment. Wireless. Network security and privacy. Censorship. Net Neutrality.

Required Reading

Balakrishnan, H., Terman, C., Verghese, G. (2012) ‘Bits, Signals, and Packets’. MIT 6.02 Lecture Notes
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/readings/MIT6_02F12_chap01.pdf

Garnham, N. and Fuchs, C. (2014) ‘Revisiting the political economy of communication’. Triple C - Cognition, Communication and Co-operation, 12(1): 102-141.

Optional Materials

Negroponte, N. (1995) ‘Being Digital’, New York: Alfred A. Knopf. Pp.184-195 (available electronically at HSE library).

6. BIG DATA

Transformative economic significance of big data. Big data in business and social science research. Advantages and types of big data. Data creation and collection. Data ownership. Data protection. Data science.

Required Reading

Einav, L., Levin, J. 2014. Economics in the Age of Big Data. Science 346 (6210): 715 (available electronically at HSE library).

Pew Research Center (2019) “Facebook Algorithms and Personal Data”
http://www.pewinternet.org/2019/01/16/facebook-algorithms-and-personal-data/

Optional Materials
Chetty, R., Hendren, N., Katz, L.F. 2016. “The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment.” *American Economic Review* 106 (4): 855–902. [Non-technical summary](#).

Jenkins, H.W. 2017. *The Zuckerberg Effigy*. *The Wall Street Journal* (available through HSE library).

Kozyrkov, C. (2018) ‘What on earth is data science?’ [https://hackernoon.com/what-on-earth-is-data-science-eb1237d8cb37](https://hackernoon.com/what-on-earth-is-data-science-eb1237d8cb37)

Cheat Sheets for AI, Neural Networks, Machine Learning, Deep Learning & Big Data [https://becominghuman.ai/cheat-sheets-for-ai-neural-networks-machine-learning-deep-learning-big-data-678c51b4b463](https://becominghuman.ai/cheat-sheets-for-ai-neural-networks-machine-learning-deep-learning-big-data-678c51b4b463)

### 7. ARTIFICIAL INTELLIGENCE. MACHINE LEARNING

History of AI development. Algorithms and data. The basics of deep learning. Basics of machine learning methods. Regression analysis vs. machine learning. AI’s present and potential role in various industries. Economic and societal implications of AI progress. Militarization of AI advances.

*Video viewing:* ‘Do You Trust This Computer?’

*Required Reading*

Pyle, D., San José, C. An executive’s guide to machine learning. *McKinsey Quarterly*, June 2015.

*Optional Materials*

Agrawal, A., Gans, J., Goldfarb, A. (2018) ‘Prediction Machines’ [https://www.predictionmachines.ai/](https://www.predictionmachines.ai/)

Andrew Ng’s online course on Deep Learning, Stanford (Review)

### 8. BLOCKCHAIN AND CRYPTOCURRENCY

Overview of money and currency. Alternative currencies. Blockchain technology and bitcoin. State of cryptocurrency. Strengths and limitations of smart contracts. The promise of blockchain. Basics of distributed ledger, cryptography and block mining. Economic debate on private money. Digital assets. Potential role of cryptocurrency in an economy and in
international financial system. Motivations for cryptocurrency from regulatory, social and individual points of view. The future of cryptocurrency and blockchain. Non-monetary use of blockchain. Potential of blockchain technology across industries.

 Required Reading

Nakamoto, S. (2008) Bitcoin: A Peer-to-Peer Electronic Cash System.

Suarez, S. L. (2016) 'Poor people's money: The politics of mobile money in Mexico and Kenya'. Telecommunications Policy, 40: 945-955.

Niforos et al. (2017) Blockchain: Opportunities for Private Enterprises in Emerging Markets. HSBC (2017) Trust in Technology.

 Optional Materials

Hileman, G., Rauchs, M. 2017. Global Cryptocurrency Benchmarking Study, Cambridge, UK.

Roland Berger Strategy Consultants. 2015. The Digital Transformation of Industry.

9. ALTERNATIVE FINANCE
Financial innovation. Capital markets. Potential disruption of international financial markets. Fintech. Role of alternative finance in solving the global problems of poverty and inequality. State of the world in international finance development.

 Required Reading

Hileman, G., Rauchs, M. (2017) Global Cryptocurrency Benchmarking Study, Cambridge, UK.

Dietz et al. (2017) Remaking the bank for an ecosystem world. McKinsey & Co Report.

 Optional Materials

Ziegler, et al., 2018. The 3rd European Alternative Finance Industry Report, Cambridge, UK.

Dietz et al. 2017. Remaking the bank for an ecosystem world. McKinsey & Co Report.
10. PLATFORM ECONOMY
Rebalancing relationship between physical products and digital platforms. Key technologies. Economic consequences. The way companies like Alibaba, Amazon or Facebook operate.

Required Reading

Gawer, A. (2009) 'Platform dynamics and strategies: From products to services'. In A. Gawer (Ed.). Platforms, markets and innovation, (pp. 45-76). Cheltenham: Edward Elgar Publishers.

Hagiu, A. (2014) Strategic decisions for multisided platforms. MIT Sloan Management Review, 55(2): 71-80.

Optional Materials

McAfee, A., Brynjolfsson, E. (2018) ‘Machine, Platform, Crowd: Harnessing Our Digital Future’. W.W. Norton and Company.

McElheran, K. (2016) ‘Only as strong as the weakest link.’ MIT IDE Research Brief, Vol. 2016.10.

11. FUTURE OF WORK
Job displacing effects of innovations in digital technologies. Disruption to jobs and skills. Changes in the labor market. The biases of humans and machines in a connected world. Reduction in various types of jobs affected by the advances in AI and automation using robots. Good jobs and the growing gig economy. Implications for social and economic inequality.

Required Reading

Freeman, C., Soete, L. (1994) 'The biggest technological juggernaut that ever rolled: Information and communication technology (ICT) and its employment effects'. Work for all or mass unemployment? Computerised technical change into the 21st century, (pp. 39-66). London: Pinter.

Sundararajan, A. (2016) ‘The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism.’ Cambridge, MA: MIT Press.
Berger, T. and Frey, C. B. (2016) ‘Digitalisation, deindustrialisation and the future of work.’ OECD Social, Employment and Migration Working Papers, No. 193. Paris.

Optional Materials

OECD (2017) ‘The Future of Global Value Chains Business as Usual or “A New Normal”?’ STI Policy Note.

12. STARTUP VILLAGE
Field work at Skolkovo Innovation Center: https://startupvillage.ru/en/

Catch-up week, no reading

13. TECHNOLOGY AND ECONOMIC DEVELOPMENT
General purpose technologies. Technology and sustainable development. Role of digital tools in adopting technological solutions. Fourth industrial revolution and globalization 4.0. Digital dividends. Digital divides.

Required Reading

Atkinson, A. B. (2015) Inequality: What can be done? Cambridge, MA: Harvard University Press, Chapter 1: Setting the Scene pp. 9-16 only; Chapter ‘Technological Change and Countervailing Power’, pp. 115-132

Bresnahan, T. F. and Trajtenberg, M. (1995) 'General purpose technologies "engines of growth?"'. Journal of Econometrics, 65(1): 83-108.

Optional Materials

Bresnahan, T. (2010) 'General purpose technologies'. In B. H. Hall and N. Rosenberg (Eds). Handbook of the economics of innovation, Volume 2, (pp. 761-791), Elsevier Science.

Dutta, Soumitra, et al. (2018) ‘The Global Innovation Index 2018: Energizing the World with Innovation’ https://www.globalinnovationindex.org/gii-2018-report

Wessels, B. (2013) 'The reproduction and reconfiguration of inequality: Differentiation and class, status and power in the dynamics of digital divides'. In M. Ragnedda and G. W. Muschert
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(Eds). The digital divide: The internet and social inequality in international perspective, (pp. 17-28). New York: Routledge.

Chalaby, J. K. (2016) 'Television and globalization: The TV content global value chain'. Journal of Communication, 66: 35-59.

van Ark. (2016) The Productivity Paradox of the New Digital Economy. International Productivity Monitor, 31.

Talbot, D. (2016) The Unacceptable Persistence of the Digital Divide. MIT Technology Review.

The Future of Global Value Chains Business as Usual or “A New Normal”? STI Policy Note, September 2017, OECD.

14. CYBERSECURITY. CYBER-REGULATION

Important terms in cyber security. Location, types and classification of data. History and evolution of cyber threats. The kill chain. Preventing and diffusing breaches.

Required Reading

Fischer, E. (2016) ‘Cybersecurity Issues and Challenges: In Brief’. Congressional Research Services.  
https://pdfs.semanticscholar.org/65e3/4c9bb7330fcec378394b5d308b6a323947d.pdf

von Solms, R., van Niekerk, J. (2013) ‘From information security to cyber security’. Computers & Security, Volume 38, Pp. 97-102.

Optional Materials

European Commission (2012) ‘Ethical and Regulatory Challenges to Science and Research Policy at the Global Level’. Brussels: European Commission.

15. ENVIRONMENTAL IMPACT OF DIGITAL TRANSITION

Rapid replacement of equipment. Components of electronic equipment. E-waste. Potential toxicity. WEEE, RoHS. Innovative environmental policies: EU, California. Critical materials. Life-cycle analysis. Cradle-to grave approach. Methods of impact assessment.
Required Reading

Milovantseva, N., Saphores, J. (2013) ‘Time bomb or hidden treasure? Characteristics of Junk TVs and of the US households who store them’. Waste Management. 2013. No. 33(3). P. 519-529.

Saphores, J., Milovantseva, N. (2013) ‘E-waste and the digital transition: Results from a survey of US households.’ JOM. 2011. No. 63(8). Pp. 14-17.

Optional Materials

Ogunseitan, O.A., Schoenung, J.M., Saphores, J-D.M., Shapiro, A.A. (2009) ‘The Electronics Revolution: From E-Wonderland to E-Wasteland.’ Science, 326, Pp. 670-671.

16. CASES: BALANCE BETWEEN TRADITION AND TECHNOLOGY; NEW MONOPOLIES

In this lecture we will discuss application of economic theory to cases of new monopolies, broadband strategies, audio-visual digital transformation and mobile service digital transformation.

Required Reading

Bangerter, B., Talwar, S., Arefi, R., and Stewart, K. (2014) ‘Networks and devices for the 5G era’, IEEE Communications Magazine, Feb.: 90-95.

Noam, E. (2014) 'Cloud TV: Toward the next generation of network policy debates'. Telecommunications Policy, 38: 684-692.

Pon, B., Seppala, T., and Kenney, M. (2014) 'Android and the demise of operating system-based power: Firm strategy and platform control in the post-PC world'. Telecommunications Policy, 38: 979-991.

Optional Materials

Fox, J. 2014. What Still Makes Silicon Valley So Special. Harvard Business Review.

Kongaut, C. and Bohlin, E. (2015) 'Towards broadband targets on the EU digital agenda 2020: Discussion on the demand side of broadband policy'. Info: The Journal of Policy, Regulation and Strategy for Telecommunications, 17(3): 1-15.