DRAFT

BSP4003A/BSN4811 Innovation and Productivity, 4MCs

BSP4003B/BSN4811A Innovation and Productivity (with Econometrics), 5MCs

Tuesday, 11am-2pm BIZ2-02-02	I.P.L. Png Riady Building, Level 6, Room 38 iplpng@gmail.com

A key challenge for Singapore and other developed economies is to sustain economic growth. Growth can be based on working harder (more labour, more investment, more resources) or working smarter (raising productivity). Innovation contributes to working smarter -- getting more from the same resources.

This module introduces recent research in productivity, innovation, and entrepreneurship, focusing on implications for economic policy and business strategy. The module will be highly interactive and apply multiple disciplines including economics, psychology, and management. Students will present research papers, analyze data, write reports, and engage in discussion.

The prerequisite is basic knowledge of microeconomics, statistics, and algebra.

The following syllabus is subject to revision and will be updated online. Please refer to the IVLE for the current version.

Assessment (BSP4003A/BSN4811), 4MCs

- Class participation: 20%
- Research papers -- presentation and slides: 25%
- Discussion questions and field study -- presentation and slides: 25%
- Examination: 30%

Assessment (BSP4003B/BSN4811A), 5MCs

- Class participation: 20%
- Research papers -- presentation and slides: 15%
- Discussion questions and field study -- presentation and slides: 15%
- Empirical exercises -- presentation and slides: 20%
- Examination: 30%

The assignments are due at the start of class according to the time-table. Note: Penalty of 25% for submission after the deadline.

BSP4003A/BSN4811 (4MCs) and BSP4003B/BSN4811A (5MCs) are recognized for the Economics major. http://www.fas.nus.edu.sg/ecs/undergraduate/matriculated_16-17%20onwards.html#maj

Syllabus

(# All to read; ^ Student presentation; + For reference only)

Date	Subject	Assignment
#1 Jan 15	Introduction Productivity • TFP • Estimation • Sources Policy evaluation	Readings # Chad Syverson, "What Determines Productivity?" *Journal of Economic Literature*, Vol. 49 No. 2, 2011, 326-365. # Martin Wolf, "The long wait for a productivity resurgence", *Financial Times*, 13 June 2018. # "An Evaluation of the Impact of Enterprise Singapore's Loan Schemes", *Economic Survey of Singapore*, 2018 Quarter 1, 44--52. Questions (In-class discussion; no presentation) 1. Comment on a serious mistake in Mr Wolf's essay. 2. Comment on the empirical strategy of the evaluation of the evaluation of Enterprise Singapore's loans.

Date	Subject	Assignment
#2 Jan 22	Productivity • Management • Customer	Readings # Nicholas Bloom, Benn Eifert, et al., "Does management matter? Evidence from India", *Quarterly Journal of Economics*, Vol. 128 No. 1, February 2013, 1-51. # Ju-ye Lee and Simon Freebody, "Management Practices in Singapore", Policy, Research and Benchmarking Working Group, National Productivity and Continuing Education Council, (undated). Questions (In-class discussion; no presentation) 1. Bloom et al. show that $250,000 of consulting raises profit by $350,000. Why didn't the manufacturers engage consultants before Bloom et al's experiment? 2. Refer to the Lee and Freebody study. Suppose that you estimate a company-level regression to explain the management score of Singapore businesses. What explanatory variables would you include? What are the signs of the coefficients that you expect?

Date	Subject	Assignment
#3 Jan 29	Innovation strategy	*Empirical exercise #1* NUS Overseas Colleges and Entrepreneurship. Readings ^ Navi Radjou and Jaideep Prabhu, Frugal Innovation: How to

		do more with Less, Public Affairs, 2014 (Chapters 1-2) [HD45 Rad 2014]. Questions for presentation: 1. Summarize the authors' recommended strategies to increase innovation. 2. Compare the recommended strategies to possible alternatives. 3. How would you test the authors' recommendations? Describe the study – whether laboratory experiment, field experiment, or observational study.

Date	Subject	Assignment
#4 (Sat, Feb 3)	Innovation strategy, cont'd	Readings # Philip Anderson and Michael L. Tushman, "Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change", *Administrative Science Quarterly*, Vol. 35 No. 4, December 1990, 604-34. # "Crossed lines in the boardroom", *Economist*, 15 November 2018. ^ Clayton M. Christensen, *The Innovator's Dilemma*, Harvard Business Review Press, 1997, Introduction. ^ Andrew A. King and Baljir Baatartogtokh, "How useful is the theory of disruptive innovation?" *MIT Sloan Management Review*, Vol. 57 No. 1, 2015, 77-90. ^ Jill Lepore, The Disruption Machine, *New Yorker*, 23 June 2014. Questions (In-class discussion; no presentation) 1. Anderson and Tushman (1990: 614-615) argue that "In regimes of low appropriability, a single dominant design will emerge following each technological discontinuity … majority of potential adopters will await the emergence of an industry standard before purchasing a new product or installing a new process technology". Discuss in the context of smartphones -- comparing the iOS, Android, and other systems. 2. Comment on a mistake in the *Economist* report. Questions for presentation: 3. How can Clayton Christensen's theory of "disruptive innovation" help managers? Does it matter whether it is consistent with the empirical evidence? 4. In The Innovator's Dilemma, Clayton Christensen applies his theory of disruptive innovation to electric cars. The key limitation of electric cars is limited driving range. He suggested that manufacturers target markets where limited range would be less concerning, "growing, crowded, noisy, polluted cities of Southeast Asia.

		Vehicles can sit on Bangkok's roads all day, mostly idling in traffic jams … Electric motors would not need to run and hence would not drain the battery while idling" (page 211). Please comment.

Date	Subject	Assignment
#5 Feb 12	Creativity • Types • Measures • Influences	*Empirical exercise #2*: Supermarket self-service payment. # Beth A. Hennessey and Teresa M. Amabile, "Creativity", *Annual Review of Psychology*, Vol. 61, 2010, 569-98. # Adam M. Grant and James W. Berry, "The Necessity of Others is the Mother of Invention: Intrinsic and Prosocial Motivations, Perspective Taking, and Creativity", *Academy of Management Journal*, 2011, Vol. 54, No. 1, 73-96. ^ Angela K.-y. Leung, et al. "Embodied metaphors and creative "acts"", *Psychological Science*, Vol. 23 No. 5, 2012, 502-509. ^ Marily Oppezzo and Daniel L. Schwartz, "Give Your Ideas Some Legs: The Positive Effect of Walking on Creative Thinking", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol. 40 No. 4, 2014, 1142. ^ Ranjana K. Mehta, Ashley E. Shortz, and Mark E. Benden, "Standing Up for Learning: A Pilot Investigation on the Neurocognitive Benefits of Stand-Biased School Desks", *International Journal of Environmental Research and Public Health,* Vol. 13 No 1, 2016. Questions (In-class discussion; no presentation) 1. Amabile defines creativity as the production of ideas or outcomes that are novel and appropriate to some goal. How does this model apply to totally new, blue-sky inventions (eg, electricity, nuclear physics, Internet) as contrasted with problem-driven innovations (eg, electric vis-a-vis petrol-engine car)? 2. Amabile's Consensual Assessment Technique uses experts to rate creativity. Compare it to the divergent thinking test as a measure of creativity. 3. If individual creativity is purely neurological, what are the implications for management and policy? 4. Experiments in behavioural economics typically pay incentives to encourage the subjects to work hard. How would such payments affect the laboratory experiment carried out by Grant and Berry (2011)? Questions for presentation: 5. Both the Leung et al. (2012) and Oppezzo and Schwartz (2014) studies find that physical activity stimulates creativity. Compare their explanations for this effect. 6. Why does walking stimulate divergent thinking, but not convergent thinking? 7. When economists conduct randomized controlled trials,

		they typically check for selection (control and treatment groups are similar in observable characteristics) and spillovers from the treatment to control groups. In the walking experiments, what would you check? 8. Refer to either Leung et al. (2012) or Oppezzo and Schwartz (2014). How would variation of creativity by age or gender affect their findings and managerial implications? 9. Mehta et al. (2016) did not include a control group. However, they argue that the experimental period of 27 weeks was too short for development of the brain or school teaching to have affected cognitive performance. Do you agree?

Date	Subject	Assignment
#6 Feb 19	Site visit: …	Questions: At the end of the visit, please contribute to the IVLE Forum. 1. What did you learn from the visit that can be generalized to other organizations? 2. Suggest other ways by which … could increase productivity in a cost-effective way.

Date	Subject	Assignment
#7 Mar 5	Human resource management • Incentives • Job rotation • Suggestions • Quality circles • Satisfaction	**#** Nicholas Bloom and John Van Reenen, "Human resource management and productivity", *Handbook of Labor Economics*, Vol. 4, 2011, 1697-1767. **#** Lazear, Edward P. "Performance pay and productivity", *American Economic Review*, Vol. 90 No. 5, 2000, 1346-1361. # Florian Ederer and Gustavo Manso, "Is Pay for Performance Detrimental to Innovation?" *Management Science*, Vol. 59, No. 7, July 2013, 1496-1513. ^ Michael Gibbs, Susanne Neckermann, and Christoph Siemroth, "A Field Experiment in Motivating Employee Ideas", *Review of Economics and Statistics*, Vol. 99, No. 4, October 2017, 577-590. ^ Li, Shelley Xin and Tatiana Sandino, Effects of an Information Sharing System on Employee Creativity, Engagement, and Performance (August 14, 2017). SSRN Working paper 3022205. + Petri Böckerman and Pekka Ilmakunnas, "The Job Satisfaction-Productivity Nexus: A Study Using Matched Survey and Register Data", *Industrial & Labor Relations Review*, Vol. 65 No. 2, April 2012, 244-262. Questions (In-class discussion; no presentation) 1. Should Ederer and Manso (2013) have tested for interaction between the treatments and gender? 2. Discuss the external validity of the Ederer and Manso

		(2013) findings. Questions for presentation: 3. In the Gibbs et al. (2017) experiment, suppose that control groups knew about the rewards given to treatment groups. How might that affect the behaviour of control and treatment groups? 4. Gibbs et al. (2017) controlled for age, gender, and tenure. How might these individual characteristics have affected the response to incentives? 5. Li and Sandino (2017) theorize that an information sharing system (ISS) would increase creativity and engagement of workers, and so, increase sales. Based on this theory, compare the predicted coefficients in two regressions with sales as the dependent variable: (i) Explanatory variable: ISS x Post; (ii) Explanatory variables: ISS x Post, value, novelty, attendance. 6. Considering the main languages of the target customers, evaluate the effectiveness of the sample posters in Li and Sandino (2017) Figure 1.

Date	Subject	Assignment
#8 Mar 12	Human resource management • Selection • Training	# Virginia Stuart, "Prime Time", *UNH Magazine*, Fall 2013. ^ Matthew J. Lindquist, Joeri Sol, and Mirjam Van Praag, "Why Do Entrepreneurial Parents Have Entrepreneurial Children?" *Journal of Labor Economics*, Vol. 33 No. 2, April 2015. Questions for presentation: 1. Referring to the Lindquist et al. (2015) study, discuss whether entrepreneurs are born or nurtured. 2. What do the Stuart essay and Lindquist et al. (2015) study tell us about the role of selection in increasing productivity and innovation in an organization? 3. Lindquist et al. (2015) discuss several environmental mechanisms that affect entrepreneurship. In light of their discussion, what kinds of policies or programmes (e.g. NUS Overseas College) do you think are more likely or less likely to be effective in promoting entrepreneurship?

Date	Subject	Assignment
#9 Mar 19	Learning • Experience • Knowledge decay • Bench-marking • Spillovers	*Empirical exercise #3*: Learning in cardiac surgery. # C. Lanier Benkard, "Learning and Forgetting: The Dynamics of Aircraft Production", *American Economic Review*, Vol. 90 No. 4, 2000, 1034-54. # Wesley M. Cohen and D. A. Levinthal, "Absorptive capacity: A

		new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35 No. 1, March 1990, 128-152. # Amitabh Chandra, "Economics Meets the Geography of Medicine", Harvard University, September 2012. ^ Xiqian Cai, Jie Gong, Yi Lu, and Songfa Zhong, "Recover Overnight? Work Interruption and Worker Productivity", *Management Science*, Vol. 64, No. 8, August 2018, 3469-3970. + Igal Hendel and Yossi Spiegel, "Small Steps for Workers, a Giant Leap for Productivity", *American Economic Journal: Applied Economics*, Vol. 6 No. 1, 2014, 73-90. Questions for presentation: 1. In the Cai et al. study, why is it important that workers do not choose which product or machine to work on? 2. Referring to the Cai et al. study, suppose that workers work to achieve a target level of income. How would a machine breakdown affect the worker's subsequent effort and productivity? Questions for presentation (due in Session #9) 3. Consider the sources of learning that increase organizational productivity. Which of these are subject to decay and to what extent? 4. "The more of its competitors' spillovers there are…, the more incentive the firm has to invest in its own R&D" (Cohen and Levinthal 1990). Discuss whether own and spillover R&D are complements or substitutes. 5. How do the estimates of Cohen and Levinthal (1990) bear on the models in Figures 1 and 2? 6. Referring to Chandra (2012), discuss whether organizations should invest in learning from best practices of others? 7. How does research into learning in the aircraft manufacturing industry apply to other industries?

Date	Subject	Assignment
#10 Mar 26	Adoption of innovations • Innovation cycle • Absorptive capacity • Incentives • Network effects	# Michael L. Katz and Carl Shapiro, "Systems competition and network effects", *Journal of Economic Perspectives*, Vol. 8 No. 2, Spring 1994, 93-115. ^ Steven F. Bolling, et al. "Predictors of Mitral Valve Repair: Clinical and Surgeon Factors", *Annals of Thoracic Surgery*, Vol 90 No. 6, 2010, 1904-1912. (Ignore the section, "Technical Details"; Note: Mistake in footnote to Fig. 1: Horizontal axis represents surgeon-specific annual mitral valve ~~repair~~ volume.) ^ David Atkins, et al., "Organizational Barriers to Technology Adoption: Evidence from Soccer-Ball Producers in Pakistan", *Quarterly Journal of Economics*, Vol. 132, No. 3, 1 August 2017, 1101-1164 [Ignore Sections V.B, VII, VIII, and online

		Appendix]. ^ Michaël Aklin, et al. “Economics of Household Technology Adoption in Developing Countries: Evidence from Solar Technology Adoption in Rural India”, *Energy Economics*, Vol. 72, May 2018, 35-46. Questions (In-class discussion; no presentation) 1. With network effects, current adoption depends on past adoptions by others. Discuss the challenges in estimating network effects. Questions for presentation: 2. Repair of the mitral heart valve requires more surgical skill than replacing the valve. Bolling et al. (2010) found that surgeons who carry out more valve surgeries were more likely to repair than replace. What are possible reasons for this result? 3. Besides the variables that Bolling et al. (2010) studied, what are three other variables that you would include in an analysis of whether a surgeon repairs the valve rather than replaces? 4. In the Atkins et al. (2014) study, the businesses that did not respond to the initial survey tended to be larger than those that did respond. Discuss the possible reasons and implications. 5. To better understand the diffusion of the new soccer ball making technology, why should we study the management of the diemakers?

Date	Subject	Assignment
#11 Apr 2	Geography • Clustering • Knowledge spillovers • Professional mobility • Location choice	*Empirical exercise #4*: Patenting among Singapore publicly-listed companies. # Gerald Carlino and William R. Kerr, “Agglomeration and Innovation”, Chapter 6 in Gilles Duranton, J. Vernon Henderson, and William C. Strange, *Handbook of Regional and Urban Economics*, Vol. 5B, Amsterdam: North Holland 2015, 349-404 (Exclude Sect 4.3.1) # I.P.L. Png, Teaching Note: Clusters, 2017. ^ Jarle Moen, “Is Mobility of Technical Personnel a Source of R&D Spillovers?” *Journal of Labor Economics*, Vol. 23, No. 1, January 2005, 81-114. ^ I.P.L. Png, “Fukui: Eye-glass Prefecture”, 2018. Questions for presentation: 1. Moen (2005) finds that workers in more R&D-intensive industries earn relatively less in the earlier years and more in later years. How does this theory apply to (a) doctors and (b) satellite engineers? How

		does it apply to a small labour market like Singapore? 2. Refer to questions in Png (2018). Questions for presentation (due in Session #11) 3. How would improvements in information and communication technologies change the effect of geographical proximity on innovation? 4. Suppose that the total factor productivity of businesses is positively correlated with the stock of knowledge in the vicinity. Does this mean that businesses benefit from a positive externality?

Date	Subject	Assignment
#12 Apr 9	Appropriability • Patents • Trade secrecy • Covenants not to compete	^ Teece, David J., "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy", *Research Policy*, Vol. 15, No. 6, 1986, 285-305. ^ Heidi L. Williams, "Intellectual Property Rights and Innovation: Evidence from the Human Genome", *Journal of Political Economy*, Vol. 121 No. 1, 2013, 1-27. ^ Matt Marx, Deborah Strumsky, and Lee Fleming, "Mobility, Skills, and the Michigan non-compete experiment", *Management Science*, Vol. 55, No. 6, June 2009, 875-889. ^ I.P.L. Png, "Law and Innovation: Evidence from State Trade Secrets Laws", *Review of Economics and Statistics*, Vol. 99 No. 1, March 2017, 167-179. Questions for presentation: 1. Does stronger protection of intellectual property increase innovation? 2. How do knowledge spillovers depend on the laws of intellectual property rights, trade secrets, and employment? 3. "Although subsequent court decisions have upheld some of EMI's patent claims, once the product was in the market it could be reverse engineered and its essential features copied" (Teece 1986: 298). Please discuss. 4. Williams' (2013), Table 1, shows that more innovations were derived from Celera genes than non-Celera genes. Does that suggest that Celera's patenting encouraged subsequent innovation? 5. How does follow-on innovation from Celera genes depend on the efficiency of the market for licensing? 6. Marx et al. (2009) show that mobility is lower in a state that enforces non-competition agreements. From society's viewpoint, is this good or bad? 7. The Michigan Antitrust Reform Act of 1985 (MARA) provided an exception that that the statute repealed by MARA would "remain in force for the purpose" of

		enforcing any liability under the repealed act. This means that any pre-existing non-competition agreement would *not* be enforceable. Given this, how would the MARA have affected mobility over time? What does this imply for the findings of Marx et al. (2009)? 8. The UTSA was associated with more R&D among larger and more R&D intensive companies (Png 2017). Is that good or bad for society?

#13 Apr 16		Final examination (open-book)