Commercializing Technology Innovations

Turning Visions into Value

208 Hudson Hall / 12:00-2:30pm on Mondays (Class 1 on 08/26/24)

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CTI Syllabus for Fall 2024 (Revised on 08/25/24)

INTRODUCTION

Innovation—The Glowing Review: Innovation is a hallmark of U.S. economic growth and prosperity; it fuels competitive differentiation which is increasingly important as globalization threatens jobs through price competition. The business press is flooded with quotes from corporate executives citing innovation as a key to maintaining a sustainable competitive advantage for big business, university and government researchers forecasting the market-changing implications of their inventions, private-equity investors reveling in returns based upon savvy high-tech investments, and entrepreneurs making millions on their novel ideas.

Innovation—The Stark Reality: Few ideas ever make money. Nine in ten new ventures fail (depending upon the statistics you read and your definitions of venture and failure). The return on investment for most patents is negative. Infringement suits cost millions and are not worth the investment unless the stakes and probability of success are high. The best ideas often lose in the marketplace due to issues of high cost and low market acceptance. First-to-market innovations are often eclipsed by fast followers, and intellectual property (if not the inventor) sometimes expires before an innovation finds market success.

Is the commercialization of inventions art or science? Is it like playing chess or poker? Do you make money on lots of base hits or just a few home runs? The answer is yes to all of the above. Commercialization is complex, but one must strive to make it simple.

Can one course teach you how to ideate and guarantee you will make money on it? Obviously not; an entire career cannot offer that warranty. One course can, however, provide you with a framework for thinking about innovation, tools for evaluating opportunities, techniques for forming marketing strategies, and real-world projects to bring these topics to life.

COURSE OVERVIEW

Commercializing Technology Innovations (CTI) is designed to demystify the journey from idea creation to value extraction through the use of concrete tools and real-world exercises & projects. Inventions have many sources (e.g., individuals, companies, universities, government labs) and many vehicles for commercialization (e.g., licensing, new products, enhanced products, and new ventures). Through this course, students will learn to think more broadly about technology innovation, commercialization options, and value-extraction strategies. The intent of the course is to arm each student with tangible tools for turning visions into value regardless of career path (i.e., these tools are applicable whether you become an entrepreneur, work in a large corporation, help a non-profit entity, and so on).

By design, CTI is not limited to a single field of study (e.g., R&D, new product development, new ventures, technology transfer, inventor literature) or to a particular commercialization pathway (e.g., new venture creation, new product development, or technology transfer/licensing). Rather, CTI draws upon and celebrates the often unappreciated synergy among all of the aforementioned fields of industrial practice.

The course objective is to enable students to answer the following:

- **Innovation Framework:** What are the steps between idea creation and value extraction? What questions should one consider throughout the commercialization process to stay on track?
- **Evaluation Process:** If so few ideas make money, then what methods exist to identify commercial "diamonds in the rough?" What evaluation factors are relevant, and how do you uncover data on each?
- **Value Extraction Strategies:** What are the different ways one can extract value from an idea? What are the pros and cons of each path? How do you decide which path is best?
- **Commercialization Tools:** If pursuing the commercialization of an idea, what techniques can be used to minimize risk and increase rewards?

How will this course realize such objectives? The mission of CTI is built upon the following elements:

- **Framework:** We will review various frameworks for commercializing innovations. Among these, Professor Holmes' framework called The Innovation EDGE™ "may" be presented. In each class, you should consider how the various tools we learn fit into these frameworks (some tools fall within one topic while others transcend multiple topics). These frameworks are simply offered for education, not imposed as a commercialization panacea.
- **Tools:** As engineers, we like to learn tools (black boxes of utility with known inputs & outputs). While commercialization is not an exact science, this course will equip you with tools for use in the class and beyond which include the following: *commercialization frameworks/fundamentals, sources of innovation, IP strategy, evaluation criteria and processes, market intelligence gathering, technology marketing, business models, business planning, licensing, negotiation, valuation, and networking.*
- **Projects:** With a practicum feel, student teams will complete a variety of industry-based projects that relate to some facet of commercialization. Each student will participate in one semester-long, team project which will be a substantial part of the course grade. *Projects will be discussed via communications (e.g., e-mails, meetings) outside of this syllabus.* Past sponsors have provided high praise to CTI student teams. CTI alumni have said that these projects provided outstanding, real-world learning opportunities along with strong resume bullets and content for job interviews. *See a list of past projects via the Web site Professor Holmes uses to harvest practicum projects from industry each semester (https://sites.google.com/acuityedge.com/duke-cti-practicum) – over 135 projects have been successfully completed in CTI since course inception in 2005.*
- **Innovator Readings:** It is important to recognize the contributions/journeys of past innovators. Selected classes "may" be supplemented with readings about innovators of note. In many cases, we will learn that the success of an innovation was through the contributions of a team, not just the genius of a lone inventor. *Innovator readings will only be used if time allows within the course.*
- **Literature:** We will balance the project emphasis of this course with literature on commercialization and innovation from well-known sources. The purpose of the readings will be to reinforce class content while also introducing additional topics. Many readings are drawn from *Harvard Business Review* and *IRI's Research-Technology Management* (both recent articles and classics). Beyond required readings, other literature resources are identified within the syllabus. Other readings can be recommended upon request. Readings will be provided by Prof. Holmes via library links or excerpt handouts (and will be updated as the semester progresses).
- **Current Events:** The commercialization of innovation is happening every day. Current commercialization examples will be surfaced and discussed in class as appropriate. Students are encouraged to initiate insightful dialog on the course bulletin board (or during class sessions) regarding current events they identify which are relevant to the class.
- **Interactivity:** Student-student, student-instructor, and student-industry interactions are critical for a full educational experience. These interactions (conducted remotely this semester) may be fostered through in-class discussions/examples, bulletin-board discussions, and meetings/teleconferences with industry groups driving each project.
- **Surveys:** The instructor will periodically survey the class (formally and informally) to solicit feedback on course elements, course quality, and other topics.

GRADING

Class sessions will be split between lecture and class interactions including assignment discussions, exercises, project presentations, guest speakers, and general Q&A. Grading will be conducted approximately as follows:

- **50% Practicum Project:** *Projects will be discussed in documentation outside of the syllabus.* ***Maintaining extremely professional interactions with industry contacts is a crucial component of one's project grade.*** The project grade encompasses all presentations and reports associated with the project.

- **25% Assignments:** Various assignments will be distributed during the semester. Assignment quantity, relative point value, start date, and due dates will be adjusted during the course of the semester as Professor Holmes deems appropriate based upon class needs and project performance. Assignments may be team based or individual based and will be indicated for each assignment. Assignment details will be communicated during lectures, via email, and/or posted on Canvas.
- **25% Course Participation:** Includes insightful, well-timed interactions with Prof. Holmes, on any course bulletin board (if created), within teams (remotely), and with industry contacts (sponsors). Interactions are judged based on quality, not quantity. This semester (due to Duke MEMP's new attendance policy), class attendance will also be included in course participation.

LOGISTICS

- **Lecture Delivery & Timing:** *Class will meet at the time and location listed in the page 1 header of this syllabus* unless otherwise noted by the instructor. Timing of mid-class breaks, if any (typically ~10 minutes), is at the discretion of the instructor. *Lecture content will be recorded and accessible via Canvas for student access from any time zone and region (for remote CTI students).* Feel free to contact Professor Holmes at 919-721-1562 (cell) or joseph.holmes@duke.edu to address questions outside of class.
- **Non-Lecture Interactions & Timing:** *These interactions will be student-student (in teams), student-Holmes (one-on-one, mostly remote), and team-Holmes (team guidance, mostly remote) as needed. In particular, Holmes will schedule Zoom meetings with each team on both an ad hoc and regular basis as semester details evolve. At any time, students are welcome to contact Professor Holmes at 919-721-1562 (cell) or joseph.holmes@duke.edu (or jholmes@acuityedge.com) to address questions outside of class. Prof. Holmes stays extremely busy with Duke and non-Duke work, so one must follow up if you seek a meeting or phone call.*
- **Course Materials:** The instructor will provide all course materials; distribution will typically be electronic (e.g., via e-mail and/or Canvas). No texts/books are required. The instructor draws reading materials from reading-list excerpts and articles from renowned innovation / commercialization sources. Materials will likely be released to students on a week-to-week basis (i.e., not all materials will be provided at the onset of the course, since reading selections and supplemental materials may be revised as the semester progresses).
- **Assignment Submissions:** All assignments should be submitted in electronic form. Late submissions will receive zero credit for all but the most extreme circumstances (though extra tolerance will obviously be provided if you are out sick, etc.). Assignment instructions by the instructor (which will be made clear via email and Canvas postings) always take priority over syllabus notations (i.e., you must pay attention to lecture content, Canvas postings, and especially email communications throughout the semester to ensure compliance).
- **Syllabus Revisions:** The syllabus may be revised throughout the semester at the discretion of the instructor. Teaching notes and special cases will be developed by the instructor and will be disseminated before and/or during the appropriate classes. The instructor may choose to alter course plans via e-mail announcements rather than editing and redistributing a copy of this syllabus.
- **Canvas:** Professor Holmes will use Canvas, but may use it sparingly until the second or third week of the semester. Until that time, he will be communicating with each student via e-mail regarding announcements and course materials. **Prof. Holmes typically uses e-mail as the first line of communication with CTI students.**
- **Auditing Course:** See Professor Holmes about requirements to audit course. Audit students are allowed to attend lectures but are **not** allowed to participate on project teams (unfair to and awkward for students taking the course for a grade to have audit students involved) - **no exceptions.**

MILESTONES OF INTEREST

While other important activities will occur, milestones of interest will include the following (where all dates are tentative and subject to change at the discretion of the instructor):

- ❖ Introduction, Course Overview, Practicum Overview (Aug. 26)
- ❖ Team Assignments – conduct sponsor kickoff meetings/interviews shortly thereafter (~week of Sept. 2 or 9)
- ❖ Screening Report Due (in-class team presentations on ~ Sept. 23 or 30 - to be announced)
- ❖ Assessment Report Due (in-class team presentations on ~ Nov. 4 or Nov. 11 - to be announced)
- ❖ Final Reports & Presentations Due (~ Dec. 9 – will be announced if revised)

DIRECT IMPACT OF COVID-19 (ignore this section unless pandemic issues arise this semester)

The changes to CTI to best accommodate students in light of the pandemic have been summarized already throughout this syllabus, but some reiterations are as follows (not in play as Fall 2024 begins):

- Lectures are currently planned to be live but will also be recorded and accessible via Canvas.
- Student-professor interactions will be more remote than onsite (via email, phone, Zoom, etc.)
- Student-student interactions can be onsite or remote (respect your team members).

Does (did) the pandemic impact CTI? Of course, but in many ways the impacts are negligible. Having run a virtual consultancy since 2000 and CTI since 2005, Prof. Holmes knows firsthand that virtual teams can be highly effective in meeting client needs (often far more efficient than onsite teams). For the coming months (not in play as Fall 2024 begins), prove you can deliver as part of the "new normal" in the event that some of your meetings need to be virtual.

DUKE UNIVERSITY STANCE RELATED TO COVID-19 COMPLIANCE

Visit the websites provided by Duke (see your advisor, if needed) to ensure you remain compliant with any pandemic-related requirements. If for any reason any activity is observed during CTI that you find unsafe or uncomfortable, then bring that activity to Prof. Holmes' attention immediately. Our goal is to stay safe together!

USING CHATGPT & OTHER AI TOOLS ON CTI-ORIENTED ASSIGNMENTS (new as of Fall 2023/2024)

Prof. Holmes reserves the right to take some time to get acquainted with any Duke (or Duke MEMP) policies (or wishes) related to this topic. Until further notice, however, Prof. Holmes' stance is as follows:

- Historically, Holmes has always said that there is nearly no way to "cheat" in CTI. It is difficult to envision how you could get anyone else to invest the time required to generate the content necessary to do CTI-based work for you. In fact, some portion of CTI is actually focused on trying to get you to draw information from outside sources (e.g., industry experts).
- Using that same spirit, you are allowed to use ChatGPT (or other AI tools) in CTI until further notice. That said, you should not hide when you are using such tools.
- In fact, we may have an exercise where students compete to see the best way to use ChatGPT (or other AI tools) to add value to CTI-related work.
- While Holmes will permit (if not encourage) the use of AI Tools, Holmes is also a staunch believer in the Duke Honor code and in high ethics (as Holmes will discuss in class). Holmes has a particular sensitivity in how students portray their CTI experience on their LinkedIn profiles (where only Student Consultant is permitted).
- *AI Tool Cautions:*
    - If you submit something in a report then you must cite your source (whether using ChatGPT or not)
    - If you submit something in a report, you own it (you can't say, "…but Chat GPT told me to include it, so it must be correct")

POTENTIAL TOPICS & READINGS (to be updated as the semester progresses)

Course Topics	Learning Objective / Agenda	Potential Readings
Detailed Course Overview	Understand course expectations, content, sequence, grading, etc. Conduct Q&A.	*CTI Syllabus
Introduction to Innovation EDGE™ : (**E**volve, **D**rive, **G**ate, **E**xtract)	Introduce commercialization framework for course. Connect framework with tools and projects.	*Innovation EDGE™ Article (8 pgs)
Overview of commercialization frameworks & processes	Compare and contrast literature frameworks, including the Innovation EDGE™.	**Commercializing New Technologies* (excerpt, 30 pgs)
Screening & Evaluation	Explore various screening criteria & processes practitioners use to evaluate commercial potential. A preferred screening method is proposed and analyzed: Commercialization Compass™.	*Preliminary Innovation Evaluation System (7 pgs-Web) *The Inventor's Bible (8 pgs) Diffusion of Innovation Theory (11 pgs-Web) Winning With New Products (7 pgs)
Innovation & Technology Marketing	Learn the fundamentals of innovation and technology marketing. Compare and contrast product vs. technology marketing.	*Marketing Myopia (16 pgs) The Long Tail (9 pgs) The Myth of Communication (6 pages)
Open Innovation & Innovation Sources	Consider places for finding innovative solutions to solve problems. Appreciate new age of open innovation as introduced by Chesbrough and ultimately employed by Procter & Gamble.	Discovering New Value in IP (11 pgs) *Era of Open Innovation (8 pgs) *Connect and Develop – Inside Procter & Gamble's New Model for Innovation (9 pgs)
Evaluation - Analysis Tools (Value Chain, SWOT, Growth-Share Matrix, etc.)	Discuss variety of market and strategic analysis tools common in business and how said tools can influence commercialization analyses.	Holmes teaching notes (no outside readings)
Patent Basics & Strategy	Learn IP basics (especially patents), discuss timing/strategy implications, and understand the heart of statutes 101 (utility), 102 (novelty), 103 (non-obviousness).	*The Patent King (19 pages)
Business Plan Development	Learn basics of business plan development (executive summary and full plan). Discuss distinctions among assessments, marketing plans, and business plans.	*How to Write a Great Business Plan (11 pgs) *The Business Plan, New Venture Creation (11 pgs)
Business Models	Distinguish technologies from business models. Learn how innovations in both are of equal importance.	*Why Business Models Matter (10 pgs) *Blue Ocean Strategy (9 pgs)
Licensing & Negotiation	Learn the basics of IP licensing and deal structures. Discuss risk/reward tempering licensing represents compared to new venture creation. Discuss negotiation basics – how to cut win-win deals.	*Use of The 25 Percent Rule in Valuing IP (11 pgs) Turning Negotiation into a Corporate Capability (14 pgs)
IP Valuation	View a snapshot of business & IP "value estimation." Understand fundamentals while making simplifying assumptions for ballpark estimations/modeling.	Sharpening the Intangibles Edge (8 pgs)
Networking, Partnerships, and the Social Side of Innovation	Discuss the importance of developing/managing a strong contact network, the criticality of early-stage partnering, and how the social side of innovation is key.	*Excerpt from *How Breakthroughs Happen* (28 pgs)
Commercialization Fundamentals (NPD Best Practices, Crossing the Chasm, Innovator's Dilemma)	Learn some of the classic concepts and theories in commercialization and innovation management. Connect theory to practice.	Benchmarking Best NPD Practices: Part 1 (13 pgs); Part 2 (10 pgs); Part 3 (13 pgs) Crossing the Chasm Info (2 pgs-Web) Innovators Dilemma/Sol'n (2 pgs-Web)

** Most likely readings to be covered this semester (other readings only utilized if time permits during the semester)*

RESOURCES

Below are selected books Professor Holmes considers to be key ingredients to a well-rounded business and commercialization education:

Adner, Ron. *The Wide Lens: A New Strategy for Innovation.* New York: Penguin Group, 2012.

Anthony, Scott. *The Little Black Book of Innovation: How It Works / How to Do It*. Boston: Harvard Business Review Press, 2012.

Ashton, Kevin. *How To Fly A Horse: The Secret History of Creation, Invention, and Discovery.* New York: Doubleday, 2015.

Berger, Jonah. *Contagious: Why Things Catch On.* New York: Simon & Schuster, 2013.

Berger, Warren. *A More Beautiful Question: The Power of Inquiry to Spark Breakthrough Ideas.* New York: Bloomsbury, 2014.

Blake, Jenny. *Pivot: The Only Move That Matters is Your Next One.* New York: Portfolio / Penguin, 2017.

Christensen, Clayton. *The Innovator's Dilemma*. Boston: Harvard Business School Press, 2003.

Christensen, Clayton. *The Innovator's Solution: Creating and Sustaining Successful Growth*. Boston: Harvard Business School Press, 2003.

Collins, Jim, and Jerry I. Porras. *Built to Last*. New York: Collins, 2004.

Collins, Jim. *Good to Great*. New York: HarperCollins, 2001.

Collins, Philip. *The Art of Speeches and Presentations: The Secrets of Making People Remember What You Say.* West Sussex: John Wiley & Sons, 2012.

Cooper, Robert G. *Winning at New Products: Accelerating the Process from Idea to Launch*. Oxford: Perseus Publishing, 2001.

Docie, Ronald Louis, Sr. *The Inventor's Bible: How to Market and License Your Brilliant Ideas*. Berkeley: Ten Speed Press, 2001.

Doerr, John. Measure What Matters: *How Google, Bono, and the Gates Foundation Rock the World with OKRs.* New York: Portfolio/Penguin, 2018.

DuDell, Michael Parrish. *Shark Tank Jumpstart Your Business: How to Launch and Grow a Business From Concept to Cash*. Hyperion Books, 2013.

Feld, Brad and Mendelson, Jason. *Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist*. New Jersey: John Wiley & Sons, 2013.

Ferrazzi, Keith and Tahl Raz. *Never Eat Alone : And Other Secrets to Success, One Relationship at a Time*. New York: Doubleday, 2005.

Gladwell, Malcolm. *The Tipping Point: How Little Things Can Make a Big Difference*. New York: Little, Brown and Company, 2002.

Godin, Seth. *Free Prize Inside : The Next Big Marketing Idea*. New York: The Penguin Group, 2004.

Godin, Seth. *Purple Cow: Transform Your Business by Being Remarkable*. New York: The Penguin Group, 2003.

Govindarajan, Vijay and Trimble, Chris. *The Other Side of Innovation: Solving the Execution Challenge.* Boston: Harvard Business Review Press, 2010.

Hargadon, Andrew. *How Breakthroughs Happen: The Surprising Truth About How Companies Innovate*. Boston: Harvard Business School Press, 2003.

Harvard Business Review Paperback Series. *Harvard Business Review on Innovation*. Boston: Harvard Business School Press, 2001.

Heath, Chip, Heath, Dan, and Kahlenberg, Charles. *Made to Stick: Why Some Ideas Die And Others Survive.* New York: Random House Publishing Group, 2008.

Higgins, James. *Strategy: Formulation, Implementation, and Control*. Forth Worth: Dryden Press, 1984.

Isaacson, Walter. *Steve Jobs.* New York: Simon & Schuster Paperbacks, 2013.

Jolly, Vijay K. *Commercializing New Technologies*. Boston: Harvard Business School Press, 1997.

Johnson, Steven, *Where Good Ideas Come From: The Natural History of Innovation*. New York: Riverhead Books, 2010.

Kim, W. Chan and Mauborgne, Renee, *Blue Ocean Strategy: How to Create Uncontested Market Space and Make Competition Irrelevant*. Harvard Business School Press, February 2005.

King, Rick. *Making Money With Your Technology*. Prepared for the National Aeronautics and Space Administration (see www.preflightventures.com)

Knapp, Jake. *Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days.* New York: Simon & Schuster, 2016.

McMakin, Tom and Fletcher, Doug. *How Clients Buy: A Practical Guide to Business Development for Consulting and Professional Services.* New Jersey: John Wiley & Sons, 2018.

Moore, Geoffrey. *Crossing the Chasm*. New York: Collins, 2002.

Muir, Albert E. *The Technology Transfer System: Inventions - Marketing - Licensing - Patenting - Setting - Practice - Management – Policy*. New York: Latham Book, 1997.

Osterwalder, Alexander and Pigneur, Yves, *Business Model Generation*, John Wiley & Sons, 2010.

Parr, Russell L. and Patrick H. Sullivan, eds. *Technology Licensing: Corporate Strategies for Maximizing Value.* New York: Wiley, 1996.

Razgaitis, Richard. *Early-Stage Technologies: Valuation and Pricing*. New York: John Wiley & Sons, 1999.

Ries, Eric. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.* New York: New York: Crown Business, 2011.

Rogers, Everett. *Diffusion of Innovations*. New York: Free Press, 2003.

Schramm, Carl. *Burn the Business Plan: What Great Entrepreneurs Really Do.* New York: Simon & Schuster, 2018.

Stephan, McJohn. *Intellectual Property Examples & Explanations: Examples and Explanations*. New York: Aspen Publishers, 2003.

Stone, Brad. *The Everything Store: Jeff Bezos and the Age of Amazon*. New York: Little, Brown and Company, 2014.

Stone, Brad. *The Upstarts: How Uber, Airbnb, and the Killer Companies of the New Silicon Valley Are Changing the World.* New York: Little, Brown and Company, 2017.

Vance, Ashlee. *Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future*. New York: HarperCollins Publishers, 2017.

Wawro, Thaddeus. *Radicals & Visionaries: Entrepreneurs Who Revolutionized the 20th Century*. Entrepreneur Press, 2005.

Wiefels, Paul. *The Chasm Companion: A Fieldbook to Crossing the Chasm and Inside the Tornado*. New York: HarperCollins, 2002.

Wise, Sean and Feld, Brad. *Startup Opportunities.* New Jersey: John Wiley & Sons, 2017.