



Brian Abraham

Curriculum Vitae

2016

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CURRICULUM VITAE

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EDUCATION

2015	Post Doc	University of Florida, Gainesville, FL, Entrepreneurship.
2002	MBA	F.W. Olin Graduate School of Business at Babson College, Wellesley, MA.
1993	Post Doc	Tufts University Graduate School of Arts & Sciences, Medford, MA, Chemistry.
1993	PhD	Tufts University Graduate School of Arts & Sciences, Medford, MA, Chemistry.
1988	BA	Skidmore College, Saratoga Springs, NY, Chemistry.
1988	BA	Skidmore College, Saratoga Springs, NY, Spanish.

PROFESSIONAL HISTORY

2014 – Present **University of St. Thomas (Minneapolis, MN)** **Associate Dean**
St. Thomas is a 10,000 student private catholic university in Minnesota.

- ☐ Teach Entrepreneurship.
- ☐ Responsible for all aspects of the business operations.
- ☐ Engage with students and faculty to create new ventures.
- ☐ Manage a fund for investment purposes into new ventures.
- ☐ Fully orchestrate business plan competitions.
- ☐ Develop and new degree offerings and course curriculum content.
- ☐ Work with state agencies on developing an entrepreneurial ecosystem.
- ☐ Provide scholarships for students engaged in entrepreneurial activities.
- ☐ Raised \$22,750,000 in benefactor funding.
- ☐ Recruit and manage CEOs for developing new ventures.
- ☐ Provide infrastructure support for the new ventures.

2012 - 2014 **Spartan Innovations (East Lansing, MI)** **Executive Director**
Michigan State University's new venture creation group.

- ☐ Teach Entrepreneurship at Michigan State University.
- ☐ Responsible for all aspects of the business operations.
- ☐ Engage with students and faculty to create new ventures.
- ☐ Manage a fund for investment purposes into new ventures.
- ☐ Fully orchestrate business plan competitions.
- ☐ Develop and advise on new course curriculum content.
- ☐ Work with state agencies on developing an entrepreneurial ecosystem.
- ☐ Provide scholarships for students engaged in entrepreneurial activities.
- ☐ Interact with funding sources to develop attractive deal structures.
- ☐ Recruit and manage CEOs for developing new ventures.
- ☐ Provide infrastructure support for the new ventures.

- 2003 - Present** **Babson College (Wellesley, MA)** *Adjunct Professor*
The Ohio State University (Columbus, OH) *Adjunct Professor*
Michigan State University (East Lansing, MI) *Adjunct Professor*
- ☐ Developed and delivered courses on technology entrepreneurship, technology commercialization, intellectual property, and licensing.
 - ☐ The courses combined the case method with textbook and journal article readings in areas of New Venture Creation, Corporate Entrepreneurship, Technology Development, Innovation, and Commercialization.
 - ☐ Guest lectured to the Babson Executive Education Center on a variety of topics including entrepreneurship, corporate entrepreneurship and matrix management.
 - ☐ Continue to maintain relationships with all institutions.
- 2011 - Present** **ProteQ (Reston, VA)** *Founder*
ProteQ is an international technology and innovation management firm.
- ☐ Responsible for all aspects of the business operations.
 - ☐ Developed the business model and infrastructure to support company growth.
 - ☐ Increased corporate efficiencies and lowered overhead by over 25%.
 - ☐ Increased revenue and profitability in the first year after acquisition.
 - ☐ Diversified the client base to include private sector customers.
- 2009 - 2011** **Groveland Capital (Minneapolis, MN)** *Founder*
Groveland Capital is hedge fund focused on fixed income opportunities.
- ☐ Developed the company business model and managed operations.
 - ☐ Raised several million dollars of capital to initiate trading.
 - ☐ Posted 9.91% net returns from January through August 2010.
 - ☐ Recognized by Deutsche Bank as a top performer.
 - ☐ Sold my interest in the firm to purchase ProteQ.
- 2008 - 2009** **Whitebox Advisors (Minneapolis, MN)** *Director of Private Investme*
Whitebox Advisors is a \$6 BB hedge fund executing multiple strategies.
- ☐ Directed private investment activities across a variety of instruments.
 - ☐ Managed a \$300MM portfolio of private investments.
 - ☐ Evaluated opportunities and provide financing through equity and debt.
 - ☐ LeAd activist CEO within portfolio firms with a sampling as follows:
- IdleAire** *Knoxville, TN \$50MM truck stop technology service provider.*
- ☐ Restructured the firm and eliminated \$30MM in fixed costs.
 - ☐ Turned a \$100MM annual loss into a \$5MM annual profit.
 - ☐ Expanded the business footprint while lowering the operational costs.
- Riverland Biofuels** *Canton, IL \$100MM Ethanol Manufacturing facility.*
- ☐ Led the emergence from bankruptcy, completion of construction and operational start-up.
 - ☐ Arranged for additional financing for operational needs.
 - ☐ Negotiated with vendors to complete the plant and bring it into operational capacity.
- Sutura [NASDAQ:SUTU]** *Fountain Valley, CA a medical device developer.*
- ☐ Led the commercialization efforts of the lead products.
 - ☐ Provided leadership and positioning to acquisition liquidity event.
 - ☐ Repositioned the firm to maximize shareholder return.

PROFESSIONAL HISTORY (CONTINUED)

- 2005 – 2008** **Bluefin Robotics (Cambridge, MA)** **CEO**
Bluefin Robotics is a \$16.5 million undersea robotics technology company.
- ☐ Acquired the firm for \$17.5MM, received offers of \$50MM+ two years later.
 - ☐ Increased revenue 100% and profitability 300% in two years.
 - ☐ Increased operational efficiencies by over 100%.
 - ☐ Transitioned the firm from R&D to R&D and manufacturing.
 - ☐ Developed and implemented algorithm based business models.
 - ☐ Managed all Research and Development functions of the firm.
 - ☐ Implemented Six Sigma production methodologies.
 - ☐ Implemented ERP, Salesforce and other IT solutions for efficiency gains.
 - ☐ Established an international distribution network.
- 2001 – 2008** **Battelle (Columbus, OH)** **Director of Technology Development**
Battelle Memorial Institute is a \$4 billion not for profit scientific research institute.
- ☐ Managed all technology commercialization activities.
 - ☐ Managed industrial customer base.
 - ☐ Grew sales >30% per year with a 100% increase in profitability.
 - ☐ Developed and managed merger and acquisition strategies.
 - ☐ Developed and managed client technology projects.
 - ☐ Managed a multi-million dollar research and development program.
 - ☐ Provided entrepreneurship expertise to corporate officers.
 - ☐ Developed internal processes and tools to evaluate potential investment opportunities, acquisitions, partnerships and launching of new ventures.
- 1998 – 2001** **Bruker Biosciences (Billerica, MA)** **Division Manager**
Bruker Biosciences is a \$260 million publicly traded analytical instrumentation business serving the defense, academic, and life sciences markets.
- ☐ Managed the field portable technologies division.
 - ☐ Participated as a member of the management team to develop an S-1 for the Securities and Exchange Commission, in preparation for a successful Initial Public Offering.
 - ☐ Technical responsibilities included research and development, technology acquisition and transfer, manufacturing and application for highly technical analytical systems including mass spectrometers, Fourier transform mass spectrometers, ion mobility spectrometers, surface enhanced Raman spectrometers, Fourier transform infrared spectrometers, and solid-state detection systems.
 - ☐ Directed the national and international marketing activities for the division product line including establishing indigenous international sales, distribution and service points.
 - ☐ Evaluated, negotiated, closed and incorporated strategic corporate mergers/acquisitions.
 - ☐ Managed an international, interdisciplinary team of scientists and business managers to develop technologies and penetrate markets in the US, Canada, Latin America, South America, Scandinavia, Europe, and the Middle East.

PROFESSIONAL HISTORY (CONTINUED)

- 1995 – 1998** **Target Environmental (Columbia, MD)** **Vice President**
Target Environmental was a \$2 million privately held consulting firm developing and transitioning detection products and services to the environmental market.
- ☐ Served as Vice President and Laboratory Director for analytical operations.
 - ☐ Directed all aspects of technical operations including method development, novel instrument design and fabrication, final data analysis, QA/QC director, hiring and training employees, establishing seminars and workshops, procurement of contracts, development and application of field technologies in support of environmental investigations/programs.
 - ☐ Directed the research and applications of a multidisciplinary team of scientist in all fields of analytical chemistry and engineering including novel methods development and instrument design for a variety of technologies including MS, AES, IR, AA, Fluorescence, ECD, FID, TCD and PID-based technologies with a variety of sample preparation and separation techniques.
- 1993 – 1995** **SiteWorks (Northborough, MA)** **Co-Founder/Vice President**
SiteWorks was a \$1 million start-up firm specializing in developing and transitioning high technology detection products to various markets.
- ☐ Directed all aspects of operations including business and technical execution.
 - ☐ Raised \$600,000 in private equity capital.
 - ☐ Submitted and procured funding for grant proposals to develop new technologies and developed methods to be utilized interactively with these novel technologies for environmental applications.
 - ☐ Directed the research of several Ph.D. candidates in all fields of analytical chemistry.
 - ☐ Brought the firm to acquisition within two years for a 100% ROI.

CONSULTATION EXPERIENCE

Board of Advisors **Worcester Polytechnic Institute** **Worcester, MA**
Serve as a member of the Robotics Engineering Advisory Board. Worcester Polytechnic Institute is establishing the country's first undergraduate major in Robotics. In my capacity as advisor, I help establish the curriculum and integration of student project groups with industry partners.

Board of Advisors **Homeland Security Leadership Alliance** **Washington, DC**
Serve as a member of the Board of Advisors to this not for profit organization focused on collecting and disseminating information to the country's private and public sector leadership teams. Advise the organization on matters regarding technology development, technology transition and business processes.

Board of Advisors **Anzentech Partners** **Cambridge, MA**
Serve as a member of the Board of Advisors to this consulting firm specializing in advising private and public sector organizations on funding opportunities. Additional responsibilities include advising the Managing Director on matters relating to teaming partnerships and business structures.

Lecturer **University of Maryland** **College Park, MD**
Served as a guest lecturer at the University of Maryland at College Park Robert H. Smith School of Business. Lectured on the topics of entrepreneurship and intrapreneurship (corporate entrepreneurship) related to new venture creation, product launch, and licensing. Prepare lesson plans and deliver lectures related to theoretical and real world examples of entrepreneurial accomplishments, failures, tools, processes, and structures related to bringing new products to market in a high technology atmosphere.

Development Consultant **Viking Instruments** **Chantilly, VA**
Project manager for the development and incorporation of analytical methodologies for the analysis of chemical warfare agents into a remote controlled process monitoring GC/MS system. Responsibilities included the development of the analytical methodologies, the design and installation of technology hardware and the development of the standard operating procedures and corrective action criteria for the analytical system. The US Department of Defense is using the resulting technology in a remote chemical warfare agent munitions destruction system.

Technology Consultant **Plexus Scientific** **Silver Spring, MD**
Consultant for the application of novel technologies, methodologies and doctrine to remediate contaminated properties and equipment. Assisted in reviewing and developing work-plans for use on federal facilities to assist in implementing technological solution to decontamination actions. Technologies and methodologies developed and proposed are currently in use on several facilities nationwide.

Analytical Consultant **EAI Corporation** **Abingdon, MD**
Methods development project manager for the detection and quantification of chemical warfare analytes and degradation products by mass spectrometry. The results of the work performed supported the establishment of the United States National Laboratory responsible for all chemical warfare agent analysis determinations performed in the Western Hemisphere in support of the United Nations and the Chemical Weapons Convention of 1993.

AWARDS

- 2007** Massachusetts High Technology Council. Semi-Finalist. CEO of the Year.
- 2006** Battelle Memorial Institute Rewards and Recognition Program.
- 2005** Battelle Memorial Institute Rewards and Recognition Program.
- 2004** Battelle Memorial Institute Rewards and Recognition Program.
- 2003** Battelle Memorial Institute Rewards and Recognition Program.
- 2003** Honored Member, Strathmore's Who's Who, 2003-2004 Edition.
- 2002** Summa Cum Laude.
F.W. Olin Graduate School of Business at Babson College, Wellesley, MA, MBA.
- 2002** Beta Gamma Sigma.
Business School High Scholastic Achievement Honor Society, Babson College Chapter.
- 2002** Douglas Prize Finalist.
F.W. Olin Graduate School of Business at Babson College, Wellesley, MA,
MBA Program Business Plan Competition.
- 2002** Moot Corp[®] Competition. Access Venture Partners Challenge Winner.
The University of Texas at Austin.
McCombs School of Business International Business Plan Competition.

CONTINUING EDUCATION

- 2015** AACSB Postdoctoral Bridge Program.
University of Florida, Gainesville, FL.
- 2014** Price-Babson Symposium for Entrepreneurship Educators.
Babson College/Olin College, Wellesley, MA
- 2006** Price-Babson-Olin SyE3.
Babson College/Olin College, Wellesley, MA
- 2006** Corporate Restructuring, Mergers and Acquisitions.
Harvard Business School, Boston, MA
- 2006** Six Sigma Blackbelt Training.
Pivotal Resources, Minneapolis, MN
- 2005** Six Sigma Blackbelt Training.
Pivotal Resources, Miami, FL
- 2004** Building Competitive Strategies.
Babson College Executive Education, Wellesley, MA
- 2003** Private Equity: Surviving the Down Cycle.
Harvard Business School, Boston, MA
- 2003** Developing and Managing a Successful Technology and Product Strategy.
Massachusetts Institute of Technology Sloan School of Management, Cambridge, MA

NEW VENTURES

Firm	Role	Status
Futures Hockey	Founder	Active
ProteQ	Founder	Sold
CleanTech Open Midwest	Managing Director	Active
Abraham Family Office	Founder	Active
Unique Pontoons	Advisor	Active
Glorious Hugs	Advisor	Active
Brightside	Advisor	Active
CourseWeaver	Founder	Active
Practicare	Founder	Active
Treeborn	Founder	Active
Shock Engineworks	Founder	Inactive
Lifeblood	Founder	Active
Phenometrics	Advisor	Active
SkyQ	Founder	Active
Thermetrics	Founder	Active
Groveland Capital	Founder	Active
Sutura	CEO	Sold
Riverland Biofuels	Founder	Sold
Riverland Ag	Advisor	Sold
DVI Liquidating Trust	Trustee	Active
IdleAir	CEO	Sold
Bluefin Robotics	CEO	Active
Feed Resource	Advisor	Active
Blueshift	Advisor	Inactive
Anzentech Partners	Advisor	Active
StrideKick	Advisor	Sold
Ion Signature Technology	Founder	Active
WiMax	Advisor	Active
Hermetrics	Advisor	Active
Inanovate	Advisor	Active
Keely	Founder	Active
Prophetec	Advisor	Active
Battelle BioVentures	Founder	Inactive
Viking Instruments	CEO	Sold
Custom Analytical Technologies	Founder	Inactive
SiteWorks, Inc.	Founder	Sold
Datashark	Founder	Active

PUBLICATIONS/PRESENTATIONS

Abraham, B.M., "Running the Center as an Entrepreneurial Venture", Global Consortium of Entrepreneurship Centers (GCEC), October 29 – November 1, 2015 (Gainesville, FL).

Abraham, B.M., "Innovation Challenges", The Institute for Public Policy and Social Research (IPPSR), March 19, 2014 (Lansing, MI).

Abraham, B.M., "Financing Innovation and Entrepreneurs", Council of Development Finance Agencies, December 12, 2013 (East Lansing, MI).

Abraham, B.M., "Entrepreneurship", MSU Global Foxfire Event Keynote Speaker, November 6, 2012 (East Lansing, MI).

Abraham, B.M., "UUVs as Force Multipliers", Maritime Security and Domain Awareness, October 4-5, 2007 (San Diego, CA).

Abraham, B.M., "Increasing Operational Applications for Autonomous Underwater Vehicles", Ocean Tech Expo Panel Moderator, September 5-7, 2007 (Providence, RI).

Abraham, B.M., "Matrix Management in Large, Complex Organizations", Babson Executive Education, Babson College, July 24-25, 2007 (Wellesley, MA).

Abraham, B.M., "MTR 100: Second Annual Listing of the Year's 100 Most Influential Subsea Technology Companies", Marine Technology Reporter, July 2007 (Interview and Profile).

Abraham, B.M., Willcox, S., Wallsmith, C, Bales, J, "A Bluefin-21 Based System for the US Navy's Littoral Combat Ship Program", Underwater Defense Technologies Symposium, June 2007 (Naples, Italy).

Abraham, B.M., "AUVs as Force Multipliers", Robotics and Unmanned Systems, May 16-18, 2007 (Washington, DC).

Abraham, B.M., Trauthwein, G, "Bluefin Robotics is Sailing Along", Marine Technology Reporter, March 2007 (Interview and Profile).

Abraham, B.M., Bales, J., "Autonomous Underwater Vehicles and Their Role in Port Security", AUVSI, March 2007 (Melbourne, Australia).

Abraham, B.M., Bales, J., "Bluefin's AUVs: Current and Potential Low Observability Missions", Underwater Defense Technologies Symposium, December 2006 (San Diego, CA).

Abraham, B.M., "Entrepreneurial Strategies for Innovation and Growth", Babson Executive Education, Babson College, November 1 - 3, 2006 (Wellesley, MA).

Abraham, B.M., "Innovation", Ohio Business Week Foundation, Youngstown State University, July 2006 (Youngstown, OH).

PUBLICATIONS/PRESENTATIONS

Abraham, B.M., "Modular Autonomous Underwater Vehicles", Underwater Defense Technologies Symposium, June 2006 (Hamburg, Germany).

Abraham, B.M., "The Role of AUVs in Oceanographic Research", Marine Science Congressional Briefing", April 2006 (North Dartmouth, MA).

Abraham, B.M., "Entrepreneurial Strategies for Innovation and Growth", Babson Executive Education, Babson College, May 22-24, 2006 (Wellesley, MA).

Vigon, B., Abraham, B., Brunetti, T., Erickson, M, Hattrup, M., "Technology Transfer Lessons Learned and Applications to DoD Organizations from Other Federal Agencies and the Private Sector", Air & Waste Management Association 98th Conference and Exhibition, June 21-24, 2005 (Minneapolis, MN).

Abraham, B.M., "International Defense Technology Transfer", *Egyptian Army Officer Conference*, January, 2003 (Cairo, Egypt).

Abraham, B.M., "Entrepreneurship and Corporate Entrepreneurship", University of Maryland at College Park, Robert H. Smith School of Business, October 2002 (College Park, Maryland).

Abraham, B.M. and McMahon, R., "New Venture Creation: Biomanufacturing", Douglass Prize Competition, F.W. Olin Graduate School of Business at Babson College, April 2002 (Wellesley, MA).

Abraham, B.M. and McMahon, R., "New Venture Creation: Biomanufacturing", MOOT Corp., University of Texas at Austin McCombs School of Business, March 2002 (Austin, Texas).

Abraham, B.M., "The Role of Field Analytics in Military Reconnaissance", *Egyptian Army Officer Conference*, July 2000 (Cairo, Egypt).

Abraham, B.M., "Ion Trap Mass Spectrometry in the Identification of Biological and Chemical Warfare Agents", Kuwaiti Institute for Scientific Research, October 1999 (Kuwait).

Abraham, B.M., "Development and Application of a Drug RAID Ion Mobility Spectrometer", *Gordon Conference*, August 8-13, 1999 (Newport, RI).

Abraham, B.M., "Passive Open-Path FTIR Monitoring of Chemical Weapons Destruction in Iraq", *Fourth Joint Workshop on Standoff Detection for Chemical and Biological Defense*, October 26-30, 1998 (Williamsburg, VA).

Abraham, B.M., "Analytical Support of Natural Attenuation Assessments", *1998 EnviroExpo*, May 5-7, 1998 (Boston, MA).

Abraham, B.M. (chairman), "Passive Soil Gas Sampling", *Superfund XVIII*, December 2-4, 1997 (Washington, DC).

Abraham, B.M. (chairman), "Accelerated Site Characterization", *IBC Environmental Conference*, February 25-26, 1997 (Washington, DC).

PUBLICATIONS/PRESENTATIONS

ASTM D18.01.01 Task Group Member for producing the standard for "Expedited Site Characterization", *ASTM Committee D18.01.01*, June 1996 (Washington, DC).

Abraham, B.M. and Barber, M.E., "Accelerated Site Investigation Using Field Screening Methods", *Louisiana Hazardous Waste Symposium*, April 10-12, 1995 (New Orleans, LA).

Abraham, B.M., "Barriers and Pitfalls to Implementation of Remote Sensing and Field Analytical Technologies", *Commercialization of Chemical Sensors and Field Deployable Instrumentation for Environmental Applications*, March 1-3, 1996 (Chicago, IL).

Abraham, B.M. and Barber, M.E., "Accelerated Site Investigation Using Field Screening Methods: Preparing for Success", *Technology Transfer Symposium*, February 28, 1995 (Anchorage, Alaska).

Robbat, A., Jr. and Abraham, B.M., "Method for the Determination of Polychlorinated Biphenyls Using a Mobile Gas Chromatograph/Mass Spectrometer", *USEPA Compendium of Field Analytical Methods*.

Robbat, A., Jr., Xyrafas, G., and Abraham, B.M., "A Fast Field Method for Identification of Organics in Soil", p I-350, *Sixth Annual Waste Testing and Quality Assurance Symposium*, July 16-20, 1990 (Washington, DC).

Robbat, A., Jr., and Abraham, B.M., "Thermal Desorption Gas Chromatography/Mass Spectrometry Fast Field Methods for the Detection of Organic Compounds", *Second International Symposium on Field Screening Methods for Hazardous Wastes and Toxic Chemicals*, February 12-24, 1991 (Las Vegas, NV).

Robbat, A., Jr., and Abraham, B.M., "Method for the Determination of Polycyclic Aromatic Hydrocarbons Using a Mobile Gas Chromatograph/Mass Spectrometer", *USEPA Compendium of Field Analytical Methods*.

Robbat, A., Jr., Abraham, B.M., and Xyrafas, G., "Method for the Determination of Volatile Organic Compounds Using a Mobile Gas Chromatograph/Mass Spectrometer", *USEPA Compendium of Field Analytical Methods*.

Abraham, B.M. and Barber, M.E., "Accelerated Site Investigation Using Field Screening Methods: A Case Study of a Team Approach", *Field Screening Methods for Hazardous Wastes and Toxic Chemicals Symposium*, February 22-24, 1995 (Las Vegas, NV).

McDonald, W.C., Erickson, M.D., Abraham, B.M., and Robbat, A., *Environmental Science & Technology*, 1994, Volume 28, No. 7, pp. 336A-343A.

Abraham, B.M., Liu, T.Y., and Robbat, A., Jr., *Hazardous Waste & Hazardous Materials Journal*, 1993, Volume 10, Number 4, pp. 461-473.

Abraham, B.M., "Field Analytical Chemistry: A Short Course on Developments and Applications of New Technologies and Methodologies", *Neptune & Company Workshop*, September 10-15, 1992 (Denver, CO).

PUBLICATIONS/PRESENTATIONS

Robbat, A., Jr., Liu, T.Y., and Abraham, B.M., Analytical Chemistry, 1992, 64(13), pp. 1477-1483.

Robbat, A., Jr., Liu, T.Y., and Abraham, B.M., Analytical Chemistry, 1992, 64(4), pp. 358-364.

RESEARCH

PREDICTEK

Introduction: While the probability of success for a startup venture has been well debated, very little progress has been made to identify the causal relationship between the first and second order drivers for success as defined through a complex set of dependent variables while isolating the stochastic non-causal correlations.

Stakeholders of technology-based firms would benefit from tools that provide a predictive, non-intuitive evaluation of the business model risk/value based on factors that constantly interplay between both business (endogenous and exogenous) as well as technical. Such a model would create significant economic value through better positioning for success and quickly eliminating from consideration potentially fatally flawed models.

Hypothesis: There is a mathematical model that can be generated to predict the success of a firm that builds a business model around technology. There is a compelling need for a predictive tool that is more dynamic than a formal subjective valuation analysis and project plan. This predictive algorithm would identify critical risk factors and the statistical relevance of these risk factors to the success of the firm. This model would be measurably superior to the less sophisticated, often intuition-based, assessments, used by industry to venture hundreds of millions of dollars of research investment money. By identifying and managing these risk factors, the probability of success of the firm will increase by a quantifiable amount.

Background: Many studies have been performed to determine why technology firms fail. Some studies (i.e., SAPPHO, Rensselaer Radical Innovation Research Project) have tried to model the ingredients for success using a qualitative approach with limited statistical analysis applied. It appears that there has not been a predictive algorithm developed to model the statistical relevancy of key success parameters to final outcomes.

Approach: The approach to this study will be as follows:

- ❑ Select an industry driven by high technology innovations where the risk and commensurate reward are both relatively high.
- ❑ Develop a definition of success that has multi-dimensional utility: venture capital, entrepreneur, economic development, etc.
- ❑ Assemble a list of attributes that have been cited as likely causes for the success or failure of the business model. For example, in the therapeutic biopharmaceutical market time to market is considered a key to achieving success. Additional factors could include attributes such as economic welfare (unemployment rate, GDP, etc.), patents issued in the space, average level of education in the firm, etc.

- ❑ Assemble a list of potential tangential attributes that, while not frequently cited, are measurable and may impact the technology sector.
- ❑ Using primary field-based research and secondary research, assemble the attribute data points into a database.
- ❑ Analyze the database to determine which parameters are statistically relevant. An additional analysis will provide dependency data. Successively iterate the database to derive a final set of parameters that define success or, conversely, risk factors. Utilize statistical modeling tools (i.e., regression, Bayesian, Monte Carlo analysis).

Questions Answered: This research is aimed toward understanding the relevant parameters that could predict success in a specific industry segment focused on developing business models in the high technology space. The data analyzed should provide a final statistically relevant listing of key factors critical to this success with a weighting factor to determine how much business risk is mitigated if the factor were favorably employed. This research would be beneficial to entrepreneurs, investors (individuals, angels, VC, banks), governmental economic groups (economic development boards, Department of Commerce), existing firms and technology development entities (DARPA, HSARPA), and academicians.

Continuing Research: The approach to generating this predictive algorithm can be replicated to other technology sectors and the models can be validated as predictive models as further technology firms evolve.

Deliverables: The key deliverable will be a series (2-3) of peer reviewed journal papers that could form the basis of a text.

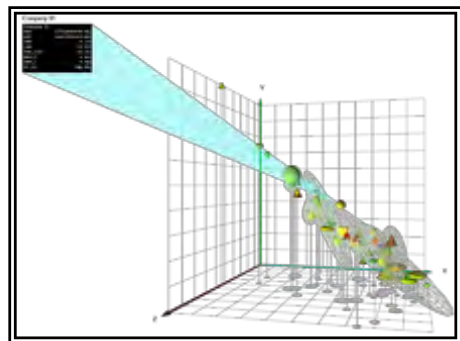
MULTIVARIATE FINANCIAL ANALYSIS CONTEXTUALIZATION

Multivariate financial analysis contextualization across a spectrum of uncorrelated investment opportunities poses a vexing challenge due to the volume of data, dynamic value updating and discerning relevant variable baseline deviations. The domain application targets the high yield bond universe in order to understand attractive investment opportunities that meet criteria as defined by a multivariate model. The opportunity space studied encompasses 400 potential investments to date across a wide array of disparate organizations. Further, the analytical variables modeled often span multiple orders of magnitude across the opportunity space. In order to monitor these opportunities dynamically, a visualization tool has been developed that plots each investment opportunity in three-dimensional space utilizing the x, y and z-axes as well as color, data point shape and size representing the multivariate analysis. The data points are initially plotted statically with each factor mathematically filtered and scaled to facilitate observational analysis. Real-time financial data is then streamed into the model updating the data points. Differences between the static and real-time data are calculated, filtered and analyzed against pre-established control limits. In the event a data variable for an investment opportunity falls outside the control limits, the data point object will flash alerting the analyst of a significant change in the investment opportunity. The paper describes the data visualization tool, the mathematical treatment of the data pools and the utility of the tool for investment analysis.

Development Plan

The end goal of this research program is to develop a commercially viable data visualization software system that allows the user to feed data into the tool to generate a holographic image of the variables of interest. Further, the tool would be able to provide real-time warning signals to the user of a significant change in the data set that warrants attention and further research. The tool will allow the user to be able to make immediate decisions while analyzing thousands of data points simultaneously. There are three discrete phases of development for this program of research.

Phase I: Two-dimensional Beta. The first phase of the program focused on implementation of the software system to test the viability and result in a pragmatic tool for analytical research. In this phase, a useful dataset was developed for the analysis of financial instrument performance. The dataset then underwent dimensionality reduction from 20,000 data points across 400 financial instruments to a visual representation of 400 variables plotted utilizing the following six factors in an x-y-z coordinate plane: +x, +y, +z, color, size and shape. Additionally, each factor was assessed for control limit significance and control limits were set such that the visual representation of each instrument would begin flashing when any control limit for that instrument was breached. Additionally, but selecting one of the objects with a cursor,



the user can view the raw data behind the datapoint. The work effort performed in this phase has resulted in an installable dedicated ribbon of the Excel main window. Upon selection of a range of tabular data, the visualization tool will load. Data rows are represented by orb shapes whose coordinates, color, shape, size and blinking state provide information in a user-readable form. Shown above the prototype.

Phase II: Two-dimensional Beta Enhancement. The second phase of this research program will extend the coordinate plane axes into the negative space thereby providing seven additional mapping territories. This will allow the user to 1) increase the number of raw datapoints significantly and 2) spread the datapoints out further in space to enhance spatial resolution. In addition to adding this dimensionality, the tool will be housed in an orb and be able to rotate on any axis for optimized viewing.

Phase III: Three-dimensional Beta. The final phase of this research program takes the developed tool from Phase II and converts it into a holographic image for true three-dimensional analysis. The tool, currently developed as a rotating orb, will be projected as a holographic image for a team of analysts to be able to simultaneously view the data objects and data objects breaching control limits in order to enhance the user's speed and quality of decision-making.

Target Journals

IEEE Transactions on Visualization and Computer Graphics (TVCG): The IEEE Transactions on Visualization and Computer Graphics (TVCG) is published bimonthly. Its Editorial Board strives to publish papers that present important research results and state-of-the-art seminal papers within TVCG's scope. These include subjects related to visualization and computer graphics techniques, systems, software, hardware, and user interface issues. Specific topics include, but are not limited to: a) visualization techniques and methodologies; b) visualization systems and software; c) volume visualization; d) flow visualization; e) information visualization; f) multivariate visualization; g) modeling and surfaces; h) rendering techniques and methodologies; i) graphics systems and software; j) animation and simulation; k) user interfaces; l) virtual reality; m) visual programming and program visualization; and n) applications.

Financial Analysts Journal: The FAJ plays a key role in advancing the educational goal of CFA Institute by linking innovative researchers and thinkers to the broad practitioner community. CFA Institute is committed to supporting the FAJ's purpose and role, as defined in its mission statement, and to ensuring that the FAJ's policies and procedures comply with best practice for research journals. The goal of the Financial Analysts Journal is to advance the knowledge and understanding of the practice of investment management through the publication of high-quality, practitioner-relevant research. The FAJ should serve as a bridge between academic research and practice by seeking academically rigorous papers that have direct relevance to practitioners, a forum for presenting practitioner research, and a forum for the perspectives of leading practitioners, academics, and regulators about our industry.

DEFINING AN ENTREPRENEURIAL ECOSYSTEM AS A METAPHOR

Abstract

Different regional metropolitan areas in the United States have experienced varying degrees of entrepreneurial activity. The entrepreneurial activity is driven by a number of factors that have been largely well documented in the scholarly literature. Recently these collections of activities have been unified and defined under the generalized term ecosystem, in part, due to the network effects of the activities contributing to total entrepreneurial activity regionally. Although prevalent in the literature and periodicals, the term ecosystem, as it pertains to entrepreneurship lacks a formalized definition since its adoption from ecology.

While the terminology of ecosystem has been in use by a variety of disciplines since the early 1900's, porting the terminology to entrepreneurial activity requires an analysis of the components necessary to define an ecosystem within this context. The components need to be identified and analyzed as inputs, throughputs (or networks) and outputs. Scientific terminology, while valuable to our understanding of existence, requires appropriate translation across disciplines. One cannot simply leverage a definition from ecology and apply it to another discipline without first providing a proper framework for the translation. With a proper framework defined, however, it is perfectly appropriate to adopt the ecology concept of ecosystem and adapt it to regional entrepreneurial activity.

While governmental and private agencies attempt to rank different geographic regions in terms of their economic activity, traditional evaluation of the inputs, networks effects and outputs defining these activities vary among studies. The overarching goals of these studies have been focused on the relative economic activity of regions in an attempt to find gaps in the local economy and take proactive measures to fill those gaps. Additionally, national and international trend analysis informs government agencies and policymakers on future needs for development. Both contemporary adjustments and prospective planning require a basis of understanding of the parameters of measurement for ecosystem maturation. An analysis of historical studies provides a cross section of common traits of regional activity that might form the basis of a definition of ecosystem in the context of entrepreneurship. These traits span areas of financial capital, human capital, social capital, policy, regional norms and university engagement. Within these areas, specific attributes are delineated to elicit relative strength of the activity and commonality among regions for output measurements. A possible definition of an entrepreneurial ecosystem is presented with associated inputs, outputs, interactions and interdependencies.

The various factors adapt over time in response to endogenous and exogenous forces. Given the adaptability of these factors, and the similarity of the adaptive behavior to the classic ecological definition of "ecosystem", we present the notion of an entrepreneurial ecosystem through complex adaptive system theory.

Introduction

First introduced into the scientific lexicon in the early 1900s [Tansley], the terminology of ecosystem has been used broadly to describe groupings of activities, organisms or entities that seem to work together for some desired outcome. While it is reasonable to adopt existing terminologies to describe disparate and ranging topics, it is certainly important to properly define the context within which the terminology is being used to avoid misuse of the terminology [Tansley, Pickett]. Tansley described the concept of ecosystem through the following observation:

Though the organisms may claim our prime interest, when we are trying to think fundamentally, we cannot separate them from their special environments, with which they form one physical system.

While this is the most directly attributed quote defining the original concept of ecosystem, it is sufficient to extrapolate to other contexts outside of ecology. From this conceptual framework, there has been a multitude of applications of the terminology ecosystem toward a wide range of disciplines. While it is certainly appropriate to leverage terminology from one scientific discipline to another, it is paramount for the user to properly define the translational meaning of the terminology within the new context. Lacking formal definition, at best, leaves a highly subjective and personalized view of entrepreneurial ecosystems. At worst, the lack of a definition can lead to misuse and abuse of the terminology.

While factors of economic growth and prosperity have been discussed in the literature from seminal philosophical discussions [Smith] to complex technical analyses [i.e., Faria], the concept of regional corridors or ecosystems has arisen. In the case of corridor studies, most are focused on emerging markets [Yigitcanlar, Masviriyakul] whereas the ecosystem studies focus more heavily upon established markets [Muegge and others] especially as it pertains to technological advancements. This difference in focus is an artifact of the difference between prospective and retrospective analysis. In the case of corridors, studies lean toward understanding existing localized resources in an attempt to define potentially successful interconnections leading to further economic prosperity. In the case of ecosystem analysis, studies tend to analyze existing localized economic drivers and network connections to understand these relationships in retrospect. This analysis is not intended to compare and contrast these approaches but provide a context of moderation around a set of activities common to both.

When considering whether or not an ecosystem is established, it is important to understand the historical perspective of the term. In addition to the excellent work performed by Acs, there are quite a few scholarly articles that look at specific regions around the world [Li, Florida and others] providing insight into factors contributing to either higher, or lower, entrepreneurial output. While the measurement of entrepreneurial impact can take many different forms, most would recognize areas such as Silicon Valley as a leader in generating regional and global economic activity as a result of the regional inputs (human and social capital, financial capital, policy and university influence). While regional inputs and agents are well-studied factors in

Silicon Valley, other regions rely more heavily on policy as a key tool to foster increasing levels of activity. For example, many states, subsequent to the series of Jobs Act inspired legislative actions [Small Company Capital Formation (H.R. 1070), Entrepreneur Access to Capital (H.R. 2930), Access to Capital for Job Creators (H.R. 2940), Democratizing Access to Capital Act (S.1791), and the CROWDFUND (Capital Raising Online While Deterring Fraud and Unethical Non-Disclosure) Act (S.1970)], have adopted state level legislation to promote crowd funding for equity. While the authors believe this legislation to be weak, it is a clear example of policy attempting to support entrepreneurial outcomes and ecosystem growth. Other examples include legislation that offers tax incentives to investment groups that encourage further new venture creation and the solidification of regional ecosystems. For example, Minnesota offers an angel tax credit that provides a 25% credit to investors for investing in specific target areas. New York, through their Startup-NY program, offers tax-free zones for businesses locating in certain areas. These are but a few examples of regional efforts to promote investment and entrepreneurial activity.

There have been numerous studies on the inputs and outputs of the so-called ecosystem, but a strong definition has proven elusive. For example, Malecki describes regions in terms of research and development and knowledge networks with a strong focus on interdependencies among agents within a regional system. Similarly, Block wrote about spillover effects and how knowledge spillovers into a network are realized and influence outcomes with a specific focus on economic activity outcomes.

Other studies [Heikkilä] have offered potential models for the components within an ecosystem and some discussion of interdependencies. Much of this work can be traced back to the description of a layered ecosystem [Moore] that shows a comprehensive group of activities, however these activities are quite numerous with varying degrees of impact and interdependency, therefore a more streamlined model should be presented. Moore provides an analogy of a business ecosystem in the context of a biological ecosystem stating that both gradually grow from disparate elements into a community. Further, he discusses the different stages of development. While he cites specific case study examples and while Moore was focused largely on the inputs – for example suppliers, producers and competitors – Merlin and others were focused on the impact of such inputs on a variety of agents within the regional systems. Further, Kenney's work focuses on aspects of a regional system such as lawyers, venture monies, board members and bankers. Clearly, these agents play roles within a regional system, however this too is limiting. A further limitation to the study is the narrow focus on three industry verticals (Semiconductor, Telecom and Biotechnology) and narrowing further on publicly traded securities. While relevant within the domain of publicly traded firms within these three industries, conclusions regarding other forms of entrepreneurial activity would be difficult to be drawn.

It is very difficult to discuss entrepreneurial ecosystems without addressing the notion of economic activity as an output. While there are a number of different measurements of economic development activity [Acs and Storey] whether it is a measure of patent productivity per capita [Griffiths], government policy [Kenney, Audretsch, Hechavarria]

or new knowledge creation [Gonzales-pernia], most of the studies to date have been limited by specific geography, activities or industries. For example, Adner provides a nice framework of understanding upstream inputs and downstream outputs. He further elaborates on the interdependencies. Nevertheless, his analysis is contextualized within a specific industry – semiconductor. Gonzales-pernia discusses factors impacting a regional innovation capability with a few simplistic hypotheses, but couples the research closely to the concept of research and development, limited in terms of industry segments.

If we are to discuss entrepreneurial inputs and outputs in the context of regional ecosystems, we need to look at a more complete picture of the regional economies. Only by understanding all the inputs and outputs, and the measures by which we assess activity, will we be able to make strong comparisons and draw concrete conclusions as to the relative health of a region. While the Global Entrepreneurship Monitor does a nice job describing activities within different regions, these compilations of study require further granularity to be useful to implement action plans to produce additional regional activity and outcomes.

Ecosystem: A Theoretical Perspective

What I want to do here is to offer definitions of ecosystem and entrepreneurship, then discuss the morphing of ecosystem from ecology to business. From there, I will apply the definition of entrepreneurship in terms of business to the concept of an ecosystem.

The literature on the topic of ecosystems reaches back to Tansley's work that was further elaborated upon by the works of Tian and others. From this research it is clear that the term "entrepreneurial ecosystem" lacks a formal definition. This paper will provide the framework for a formal definition that can be used across different regions. From the early works of Tansley, an ecosystem is defined as:

"The whole system...including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment".

In his work, and in subsequent works, an ecosystem was described as containing two types of components: biotic and abiotic referring to the living and non-living parts of the system.

While the origin of the concept was ecologically based, a derivation can be defined in business terms. However, there are significant differences between the original intent of the term and current business-context usage. For example, in the ecological context, the organisms and subsystems tend to adapt to the overall conditions of the system similar to a Darwinian model. In this instance the adaptation is more incumbent on biotic adaptation to abiotic conditions present. While there certainly are instances of the biotic component altering abiotic conditions, this is typically at a microcosmic level. This is especially true when one considers the origins of the concept of ecosystem and the biotic components discussed. In these instances largely low intelligence agents are

considered in which case the biotic components' ability to assess, understand and strategize collective network impacts on the abiotic systems would be severely limited.

In contrast, for business ecosystems, agents work to craft the subsystems in order to create and improve the ecosystem. In this instance, there is a two-way adaptation. In one direction, the biotic agents work to change the abiotic conditions to improve successful outcomes. This occurs on both a microcosmic as well as further regional, and in some cases, global level. The biotic agents tend to work in a networked fashion to assess, understand and strategize collective network impacts on the abiotic agents in an attempt to design more successful collective outcomes. In the other direction, the biotic agents adapt themselves to abiotic conditions that cannot be altered or where the return on investment for the change is not acceptable.

In order to assess the utility of the term ecosystem, we need to better understand the biotic and abiotic components existing within entrepreneurial regional frameworks. These require analysis from categorization (what are the components) and network effect standpoints. From a biotic standpoint we will focus attention to human capital aspects of a so-called ecosystem. From an abiotic standpoint we will focus on non-human capital components such as university influence and policy. It is recognized that these abiotic components certainly have biotic influence, however the same is true in an ecological sense.

Perhaps the first step in the process to defining an entrepreneurial ecosystem is found in the porting of the term ecosystem to business. One of the earliest mentions of the term ecosystem in a business context can be found in the work of James Moore to describe strategic planning [Moore]. Moore furthered the discussion in his book *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*. In this work, Moore gave us a definition of a business ecosystem as follows:

An economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles.

Moore's work on this topic remained true to the ecological roots of the terminology as he viewed the business community as an evolving system exhibiting adaptive behaviors as the agents work toward a symbiotic relationship aimed at mutual beneficial outcomes. Given the propensity for other disciplines to port terminology to different fields, it is important to remain as true to the origins of the concept as possible. As we explore the application of the concept of ecosystem to entrepreneurship, we will remain closely aligned with Tansley's work, and subsequent work describing ecosystem agents and

behaviors.

From Moore's work, others have adapted the terminology of business ecosystem to a variety of industries within varying societal and political. Further, business ecosystems have been described in a variety of regions around the world by multiple authors. Regions of analysis have been studied on a number of scales. For example, in the United States, reports and studies are numerous at the state, region, metropolitan, city and even neighborhood levels.

As we approach a definition for an entrepreneurial ecosystem, we will refrain from casting judgment regarding the health of such an ecosystem, just as our predecessors have done with their definitional frameworks. We use the base work by Tansley as a starting point for our definition of ecosystem. From there, we consider the contribution of Moore from a macro perspective as he applied the term ecosystem to business. Further we consider the varying applications of business ecosystem to both industries and regions. From this base understanding, we can arrive at a fairly simple definition of entrepreneurial ecosystem as follows:

A regional system of agents, networked through defined frameworks, working symbiotically to produce Total Early-Stage Entrepreneurial Activity.

Total Early-Stage Entrepreneurial Activity is a measure of output used by the team of researchers who publish the Global Entrepreneurship Monitor. There are other output definitions used such as the Kaufman Foundation's work, metrics measured by various economic development agencies typically revolving around job creation, and universities through AUTM measures. Regardless, the measure of Total Early-Stage Entrepreneurial Activity (TEA) will be the focus of this analysis.

Given the application of adaptive complex systems to regional areas targeting TEA, the following analysis delves more specifically into the agents, networks and frameworks involved in such an ecosystem as a complex adaptive system.

Criteria Defining an Ecosystem Versus a Metaphor

In this section I evaluate the literature to summarize the inputs studied from definitional, network and impact perspectives. From this research I plan to develop a table as part of the conclusions that concatenates this research into thematic areas to provide a structured framework for definition. Once defined, further in depth examination of the subcomponents of the themes might provide additional insight into the structures and operational effectiveness of the regional ecosystems.

In order to transform the entrepreneurial ecosystem terminology from metaphor to a defined notion, we need to look to the literature to understand the relevant criteria for analysis. The literature tends to be focused into two separate areas: regional ecosystems internationally and unique challenges of these regions and thematic ecosystems focused on specific industry sectors or business concepts. For example, Sheriff provides an analysis of the entrepreneurial ecosystem in Africa with a strong

focus on governmental policy. Similarly, Kshetri provides an analysis of the ecosystems in South Korea and Estonia. This study suggests similarities between the two nations, but contrasts the needs on factors such as corporate governance, government policies, and basic infrastructural components. Other studies tend to focus on strategy [Zahra], university engagement [Goldstien] and high technology [Roja] aspects of ecosystems.

In addition to these regional and thematic studies regarding ecosystems, there have been studies performed by academics, non-governmental organizations (NGOs) and governmental economic development groups focused on topics such as corridors, clusters and alleys. With regard to corridors and alleys, most of the work in this area is sponsored work by regional governmental agencies with varying degrees of empirical study. From a scholarly literature standpoint, we find works covering aspects of cluster theory from the seminal publication of Michael Porter to a series of research papers including Zhao's work. Zhao, like many other researchers, researched clusters in specific geographic areas: in this case Germany, The Netherlands and China. In this paper, Zhao looked at a number of different variables within clusters (environment, supply, demand, etc.) and suggested how the network effects vary between regions leading to varying degrees of innovation performance.

The authors suggest there are a small number of directly impactful inputs necessary to establish the existence of an entrepreneurial ecosystem. Bembenek provides one of the more intriguing studies. In his recent work, he views the entrepreneurial ecosystem, like Zahra, through a lens of strategic thought. However, whereas Zahra provides us a framework of analysis comparing independent ventures, corporate ventures and established companies through provided ecosystem models, Bembenek focuses on more structural factors such as governmental policies, university interactions and other network effects. Nevertheless, the research focuses more strongly on strategic management approaches to ecosystems as opposed to providing a definitional framework. We suggest there are at least five critical components of an entrepreneurial ecosystem: financial capital, human and social capital, policy and university engagement.

Defining and Conceptualizing an Entrepreneurial Ecosystem

In this section I look at the scholarly literature to define disparate views of the defining qualities of entrepreneurial firms. I present these definitions and provide my definition used to qualify entrepreneurial regional activity. Additionally, I continue to search for additional literature that discusses the inputs to an ecosystem in the context of entrepreneurship, however the literature appears to be thin.

First ported from the context of ecology to entrepreneurship by Moore [1993], the term ecosystem lacks formalized definition relative entrepreneurial activity.

Prior to examining the concept of ecosystem, we must establish the definition of "entrepreneurial" in the context of regional activity. The US Government Small Business Administration defines small businesses by revenue and employee count, however there is variation between different North American Industrial Classification

System (NAICS) codes. This is fascinating since it points to a lack of agreement at the policymaker level, on what constitutes a small business. Nevertheless, we cannot confuse small businesses with entrepreneurial businesses. While there is clearly overlap between the two, they are not synonymous. Our research will focus on entrepreneurial businesses.

It is important to focus on the business entity since they can be identified and tracked through filings ranging from SS-4 (obtaining an employer identification number) through to payroll filings and further filings as the business becomes more mature.

There are many different definitions of entrepreneurship. From the 13th century we have the verb *entreprendre* meaning “to do something” or to “undertake”. This was derived from the Latin *entre* (to swim out) and *prendes* (to grasp). From there, we have the 16th century noun *entrepreneur* used to refer to somebody who undertakes a business venture. We can fast forward through a variety of definitions by Say, Schumpeter and Drucker, among others.

Some classic definitions of entrepreneur include the following:

- ♥ Jean Baptiste Say (1816): The entrepreneur shifts economic resources out of an area of lower and into an area of higher productivity and greater yield.
- ♥ Frank Knight (1921): Entrepreneurs attempt to predict and act upon change within markets.
- ♥ Joseph Schumpeter (1934): Innovators who change the status quo to set up new products and new services.
- ♥ David McClelland (1961): A person with a high need for achievement who is energetic and a moderate risk taker.
- ♥ Peter Drucker (1964): [An entrepreneur] searches for change, responds to it and exploits opportunities. Innovation is a specific tool of an entrepreneur hence an effective entrepreneur converts a source into a resource.
- ♥ Harvey Leibenstein (1968): Entrepreneurs have the special ability to connect different markets and make up for market failures and deficiencies.
- ♥ Peter Kilby (1971): Imitative entrepreneurs do not innovate, but bring technologies innovated by others into another context.
- ♥ Albert Shapero (1975): Those who take initiative, accept risk of failure and have an internal locus of control.
- ♥ Israel Kirzner (1979): The entrepreneur recognizes and acts upon market opportunities. The entrepreneur is essentially an arbitrageur.
- ♥ Gartner (1988): The creation of new organizations.
- ♥ Ronald D. May (2013): Someone who commercializes his or her own innovation.

Further classic definitions of entrepreneurship include the following:

- ♥ Richard Cantillon (1730): Entrepreneurship is defined as self-employment of any sort. Entrepreneurs buy at certain prices in the present and sell at uncertain prices in the future. The entrepreneur is a bearer of uncertainty.
- ♥ Penrose (1963): Entrepreneurial activity involves identifying opportunities within the economic system. Managerial capacities are different from entrepreneurial capacities
- ♥ Howard H. Stevenson (1975): The pursuit of opportunity without regard to resources currently controlled.
- ♥ Andrew Zacharakis (2010): A way of thinking and acting that is opportunity obsessed, holistic in approach, and leadership balanced.

Gartner's definition of entrepreneurship as the creation of new organizations works well within the context of well-received studies by the Global Entrepreneurship Monitor publishing group and the Kauffman Foundation. Both of these groups look at regional activity from a standpoint of relative output as measured by new venture creation.

Armed with a working definition through which to analyze the concept of ecosystem, we need to understand the factors involved within the context of an ecosystem. When considering entrepreneurial activity and evaluating a definitional concept for an entrepreneurial ecosystem, we must take into account factors such as inputs to the ecosystem, throughputs within the ecosystem and outputs of the ecosystem.

An analogous system would be the consideration of how neurons work within humans. While we will take a few liberties with the detailed scientific treatment, this analogy will provide a basis for understanding. A neuron is a cell that transmits nerve impulses in the form of electrical pulse. In this case, the input is the nerve stimulus. The neuron acts as the throughput. The output would be the end result of the electrical signal delivery such as movement of a limb.

A second analogy can be taken from chemistry. When running a reaction in a laboratory, the inputs would be the raw chemicals and catalysts used to initiate the reaction along with any energy inputs. The throughputs would be any intermediate conversions of the chemicals, the technology and apparatus to run the reaction and the laboratory within which the reaction is run. The output would be the chemical product plus any byproducts. These outputs can be measured.

Inputs

As in any complex system of interactions, any attempt to define ecosystem in the context of entrepreneurship must take into account system inputs such as human capital, social capital, financial capital, policy and intellectual capital. These variables would be system inputs. The degree to which an entrepreneurial ecosystem generates output would certainly be impacted by the existence and magnitude of factors such as these.

Throughputs

Ecosystem throughputs involve the interconnectivity of the inputs within the framework to drive outputs.

In terms of entrepreneurship, we look at frameworks from a perspective of fixed asset and capital allocations to entrepreneurial activity. These assets can take many forms including university structures, incubators, co-working spaces, accelerators and government subsidized facilities. Another framework would be the presence of existing corporate venturing offices or other such larger business activity contributing to entrepreneurial output. The driving factor is the requirement for these facilities and groups to be focused entrepreneurial activity.

Outputs

Total Entrepreneurial Activity (TEA) is an index calculated on a national basis that measures new venture creation. Similarly, the Kauffman Foundation calculates entrepreneurial activity as the percent of individuals (ages 20 to 64) who do not own a business in one month that start a business the following month with the caveat that they worked on the business for more than fifteen hours per week. It becomes clear that if we are to define an entrepreneurial ecosystem formally, then a key output must be the level of entrepreneurial activity within that ecosystem.

Ecosystem Inputs

Financial Capital

Financial capital in the United States is clustered around three major markets: Silicon Valley, Boston and New York. While the National Venture Capital Association cites nearly 400 venture capital firms, the author's count approaches 1,100. Many different periodicals and professional studies converge on as much as 75% of this capital being concentrated in California and New England. Regardless, it has been shown that most early stage capital is not derived through venture capital, but rather through informal investment [Freeear]. Among informal investors we find three forms of capital, the entrepreneur's net worth, the family and friends capital and angel capital. Of these, only angel capital has been studied to a significant enough degree for analysis. In addition to angel capital, the authors suggest access to national and regional governmental support plays a role in the relative health of an entrepreneurial ecosystem.

In terms of angel capital, there are striations within this investor category. Angel Capitalists exist in every state in the United States. They vary from single individuals acting as self-proclaimed angel capitalists to the relatively recently coined category of Super Angels. They tend to vary significantly in terms of their organizational structures, visibility within ecosystems and investment decision-making processes. By comparison, venture capital groups tend to be standardized in terms of structure, visibility and decision-making process. No further proof is necessary than obtaining due diligence criteria lists from amongst a variety of venture capital groups around the country. Further, the National Venture Capital Association has standardized documentation used

by venture capital groups to analyze and consummate a transaction. Despite the lack of uniformity within the angel capital community, according to the Angel Capital Association (ACA) there are an estimated 300,000 angel investors in the United States. Also according to ACA, in 2013 angels invested \$24.8 billion in 71,000 deals whereas venture capitalists invested \$29.6 billion in 4,050 deals. Of these deals, the angel investors invested in 32,000 seed deals whereas the venture capital groups invested in 120 seed deals resulting in angel capital accounting for approximately 90% of external startup capital.

Other sources of commonly identified capital would include an entrepreneur's personal access to capital directly or indirectly through family and friends. These capital sources point toward a regional analysis of relative wealth and the density of family offices. Regional relative wealth would be an interesting area for further research to determine if there is a correlation between relative regional wealth and startup capital.

Other sources of that is not commonly discussed in the academic literature include family office funds, endowment funds, hedge fund private investments, but most significantly state and federal agency capital, typically in the form of debt instruments. Family office funds, endowment funds and hedge fund private investments are difficult to analyze due to the private nature of the entities. State and federal agency funding activities, however, are well documented and are analyzed in this paper within the policy section.

Human and Social Capital

In this section I look at population density, levels of education, pay scales and propensity for new venture tolerance. I will also tie in the discussion surrounding university contributions to regional human capital.

The impact of human and social capital on entrepreneurial activity has been studied in a variety of contexts including rural China [Liu], impoverished nations such as Nigeria [Mitra], and narrowly focused regions such as upper Bavaria [Fertala]. Studies have also been focused on the impact of human and social capital on industry specific entrepreneurial efforts such as high technology segments [Hsiao]. We are focused largely on the higher-level view – as opposed to regional or industry focused – view of the influence of human and social capital on entrepreneurial ecosystems. In order to discuss these two parameters, we need to adopt working definitions from the scholarly literature appropriate for the context.

Of the two concepts, human capital is the easier to define from the scholarly works. While it is highly referenced in the literature, most uses revolve around the same definition. For the purposes of analyzing the human capital impact on entrepreneurial ecosystems, we lean toward Becker's work where he defines human capital from the standpoints of education, experience, skills and intelligence. Through this lens, we recognize the tight coupling between human capital and the impact of higher educational presence. The latter will be discussed in further detail.

Social capital is a more difficult concept to define. Many researchers ascribed varying definitions to this notion over the years. Scholarly discussions range from journal articles to entire texts written on the topic [Lin]. Within Lin's work we find strong elements suggesting a definition that includes the relationship between social capital and access to information and skills to increase power. In this instance, we can view social capital as a means for entrepreneurs to leverage social networks to capitalize on such information and skills asymmetrically to other agents within an ecosystem.

There have been numerous studies regarding human and social capital and their impact on entrepreneurship. For example, Venkataraman studied regional entrepreneurship in the context of seven factors with a heavy focus on human and social capital as well as from an entrepreneur's perspective [1997]. Others [Arenius, Aldrich] focused on the network aspects of social capital. Cable and Shane [1997], to the argument of asymmetrical information, discuss social capital in the context of access to funding. Cable and Shane's subsequent work in 2002 delved even deeper into this examination. Indeed there is a large body of study describing the impact of social capital in a variety of contexts that lead to economic outcomes.

Perhaps the most interesting study that attempts to link these concepts in cohesive framework of understanding is by Hsiao (2013). Although Hsiao focuses largely on high technology ventures, the base research he cites forms the basis for the human and social capital analysis. Hsiao also leverages case studies in his research to augment his position.

Intellectual Capital

In this section I look at the role of intellectual capital in an entrepreneurial ecosystem. I use the term intellectual capital as opposed to intellectual property purposefully. Intellectual capital is a much broader recognized categorization of the output of intelligent thought whereas intellectual property is a narrowly defined legal term. I still have a significant amount of research to perform here, but the foundational articles have been reviewed.

A review of the various economic development studies and university reports, especially through AUTM, would indicate that intellectual capital, or at least intellectual property, fuels regional economies. An example of these forms of publication includes the URC (University Research Corridor) Economic Impact and Benchmark Report Series. Typically these reports measure outputs in terms of job growth for regional economic development groups and revenue generation in terms of university reports. These reports are difficult to leverage due to the lack of peer review and the risk of overly optimistic bias due to external pressures.

The scholarly literature on intellectual capital and the impact of this input on entrepreneurial output is surprisingly thin. And, in contrast, there is a wide degree of ambiguity regarding the value creation nature of intellectual capital within an entrepreneurial ecosystem. In areas where intellectual capital, in the form of intellectual property, is necessary for an entrepreneurial firm (such as therapeutics), there still

remains ambiguity. Some argue that intellectual property leads to job growth and wealth creation in various regions such as the United States [Sharma], China [Gross], and a variety of other regions. Meanwhile, others suggest the broad nature of claims unexploited inhibits entrepreneurial outcomes [Heller]. There are a number of very strong journal articles discussing this area in terms of property rights [Harper]. Although he does an excellent job of showing the network effects within property rights structures, the aperture of his lens is very broad to include Harper takes a very broad view of property and is not necessarily a good representation for the purposes of our analysis.

Policy

To this section I will add the role national programs such as SBIR and STTR programs, IRS R&D tax incentives and other early stage development support such as SBA loans and SBDC support. I will also discuss the role of regional activities including support programs such as subsidized internship programs, state investment funds and other early stage regional support functions.

Policy focused on economic development outcomes exists at federal, state and, in many cases, local levels. Policy varies from country to country, state-to-state and local region by local region. There have been a number of studies [Acs, Rocha, Wagner, Audretsch] focused on individual regions, industry segments, or specific types of policies such as taxation and economic development. For example, Audretsch provides very good overview materials pertaining to regional economic development. Rocha and Wagner provide studies of Germany. Wagner's empirical research indicates clustering of population growth tends to positively influence entrepreneurial activity, which could be interesting to understand from a network, employment availability or simply larger volume of population standpoints. Similarly, Rocha takes a cluster approach to analyzing Germany and differentiating industry agglomerations from clusters and concluding both must be considered together by policy makers.

There have also been a number of very good overview papers [Kim, van Stel, Hechavarria] that provide cross-regional analysis. Kim's work centered on a regression model empirical treatment of data across 28 OECD (Organization for Economic Co-operation and Development) countries assessing factors such as finance, labor and tax policy. Kim found that (finance policy) government spending on economic affairs and education was the most impactful to increasing entrepreneurial activity. They also found government spending on new venture incentives from a labor policy standpoint positively impacted entrepreneurial activity, which is what would have been anticipated. Similarly predictable, lower taxes lead to increased entrepreneurial activity. Through this work, Kim was able to provide a data driven analysis showing how governmental policy impacts entrepreneurial activity.

van Stel's work spanned 39 countries and showed no significant impact on entrepreneurial activity from an administrative startup cost standpoint. This is very interesting since we would have expected ease of company formation to have an impact. This work also found significant differences between impacts on entrepreneurship derived from necessity versus desire as defined in the Global

Entrepreneurship Monitor series of studies. The data van Stel observed is a higher propensity for informal company formation in areas of necessity where government regulation is less accommodating. Perhaps most interesting is the finding that the labor market has a higher impact on entrepreneurial activity than government regulations in the context of ease of starting businesses.

Ecosystem Throughputs

In this section I show the linkage between the roles of an ecosystem and offer both scholarly views of these networks as well as my experience operating within these networks. This will include the interactions, interdependencies and functionalities of an ecosystem. The primary focus will be network effects that impact entrepreneurial output on a generically regional level.

Tian describes networks of interconnected businesses as a framework for business ecosystems. While not focused on the entrepreneurial ecosystem, this work provides a discussion of linkages and interconnectivity in an agent based approach. Other studies describe ecosystem dynamics [Lansiti, van Liere], innovation impacts [Chesbrough], supply chain [Tsay] and several studies oriented toward game theory [Cachon, Kearns, and others]. Despite this research, a formalized definition for the framework of an entrepreneurial ecosystem has not surfaced. Rearranging Tansley's work, it is clear we view an ecosystem as an environment in which a complex set of factors network with each other. For the purposes of an entrepreneurial ecosystem, we must view these interactions further through a lens of outcomes. Therefore, for the purposes of definition, one must define environment, factors and outcomes to begin to understand how we might define an entrepreneurial ecosystem.

Business systems change and adapt over time. These adaptations can be seen through the emergence of new business models most notably seen through the democratization of the Internet. They can also be seen through the changing landscape of entrepreneurial support frameworks as many supporting entities have evolved from providing incubators, to providing accelerators to providing co-working spaces. Not to be discounted is the growing globalization of commerce and its impact on networks and frameworks where networks are the dynamic interactions between entities within an ecosystem and frameworks are the structural foundations upon which the interactions occur. Ultimately the view of the system has to take into account the components (agents) that interact and adapt or learn [Holland] to optimize conditions for increase survival and output.

Complex adaptive systems have been applied to a number of entrepreneurial ecosystems. Included in these studies is Morris' [2011] application of the theory to a localized inner city community with an interventional approach. Further, Harper [2014] applied the theoretical lens to property rights as they relate largely to intellectual property and networks of transference of value to entrepreneurship. Etemad et. al. [2004], using dynamic open complex adaptive systems, published this and several subsequent papers looking at small firms on an international basis and a multi-layered approach focusing on the entrepreneurial layer, an enterprise layer and a market layer

of interrelating cross-layer networking. With surprisingly few citations, Hench et. al. [1999] applied a non-linear dynamical complex adaptive systems approach to entrepreneurship more generally and provides a very nice historical perspective leading to the theoretical application including application to a Newtonian-Mechanical model.

University Engagement

In this section I analyze higher education's role in entrepreneurial output. While this is a very complex area and worthy of a series of articles, I will focus this section on commercialization outcomes and human capital. It is my experience the latter is the more formidable driver of entrepreneurial activity. I will also summarize a variety of studies performed on the university impact on regional economies by briefly reviewing the literature in the areas of knowledge spillovers, network effects and human capital creation. I will also state that this is an area that will be investigated further.

There is a tremendous volume of literature analyzing the impact of Universities within regional ecosystems largely in terms of outputs and typically within the context of economic development activity. Many of these works focus on the technology commercialization aspects of universities and are focused on very specific universities or localized regions. Others focus on the university-industry collaborative relationships [Audretsch and Phillips]. A few researchers such as Anders take a survey approach. These works are most helpful in our understanding of the impact of higher education on the fostering of entrepreneurial ecosystems.

While the Bayh-Dole Act of 1980 was well-intended legislation, there have been a number of unintended consequences as universities created offices for technology transfer. The Act allowed universities, among other entities, to take ownership for commercial use of intellectual property developed under federally funded research dollars. There is very little scholarly treatment of the university role in entrepreneurial ecosystem development prior to 1980. One of the unintended consequences of the Bayh-Dole act includes a refocusing of university assets to commercialization activities applying pressures to shift from basic research to more applied research. Another consequence is seen in the lack of productivity of the technology transfer offices created. There are many reasons attributed to this lack of productivity including the works presented by Phan and Siegel [2006] as well as Graff, Heiman and Zilberman [2002]. In the latter work, we find many common problems associated with these offices from both structural and personnel standpoints. These problems are exhibited in a number of manners. For example, many technology transfer groups within a university setting tend to license technologies to corporations and entrepreneurs in exchange for both royalties and, in the case of entrepreneurs, equity. The authors suggest this is a conflict of interest and these offices should select either royalties or equity. In deriving royalties, a university is decreasing shareholder value within the entrepreneurial organization. In taking an equity position, the university is hoping for an increase in shareholder value. The authors would propose these universities can contribute more to the entrepreneurial ecosystem by either taking an equity position or issuing a convertible note.

Regardless of the history of university attempts to bolster the regional economy through technology transfer, the existence of the university contributes strongly to the region in terms of knowledge spillovers, network effects and creation of human capital. The following is a discussion on the different forms of higher education agency and their suggested impacts on the regional entrepreneurial economy in the formation and strengthening of an ecosystem.

While universities impact inputs directly, it is the institutional framework where we will focus. Universities contribute to the intellectual capital of a region through developing intellectual capital in the forms of intellectual property, human capital and social capital. These are realized through both intentional programming and spillover impacts. Most importantly, universities provide further frameworks for progressing entrepreneurial outcomes. This is realized through curricular, co-curricular and community activities. While aimed at positioning the university within the region from a reputational standpoint, the represented as both intentional .

Incubators, Accelerators, Co-Working Spaces and Corporate Venturing

In this section I look at the roles of each of these spaces as they support entrepreneurial throughput.

Incubators, accelerators, co-working spaces and corporate venturing entities operate off of different business models. While there has been a maturity cycle from incubator to accelerator to co-working spaces, they all still co-exist however the co-working space model seems to be gaining further appeal in recent years. Corporate venturing offices, on the other hand, are very different from the other three frameworks. The commonality among the four is they are frameworks for producing entrepreneurial outcome. We use the term framework since these are more than simply space allocations. These agent structures all offer varying degrees of network impacts to the members.

Business incubators are typically working spaces rented to new companies at a discount in exchange for business services and/or equity. Typical services provided include business planning, strategy, networking, capital introductions and general management support. Some business incubators take equity positions in their “tenant” in exchange for further subsidized rent and services. Nearly all incubators charge rent and many are further subsidized by governmental agencies. The incubator business model is largely skewed toward a real estate model. The National Business Incubation Association estimates there are 7,000 incubators worldwide.

Business accelerators differ from business incubators in several ways. First, many accelerators are not physical spaces. Accelerators place a heavier focus on mentoring businesses through structured programming. A great example of this can be found with the CleanTech Open organization. CleanTech Open runs an accelerator for companies operating in the clean technology space. Upon admission into the accelerator, the client firms are taken through a series of bootcamps and workshops to help better position their business model for success. CleanTech Open does not offer office space, but rather focuses on the mentoring and maturation of the client businesses. Other

accelerators tend to work similarly with a heavy focus on the mentorship and less focus on the real estate component. Some accelerators are launched to advance a common good and depend on sponsorships, such as CleanTech Open. Others are sponsored by regional economic groups focused on increasing output within specific market segments. Others are sponsored by specific companies interested in fostering new approaches to current business models for future partnerships or acquisition. There are a number of motivational factors supporting the existence of different accelerators.

Co-working spaces work predominantly on a real estate model. While they do offer varying degrees of programming, the programming tends not to be company specific mentorship. The programming is more community based for all members of the co-working space. Most co-working spaces operate on a membership model as opposed to a rent model. This is largely to avoid legal issues associated with tenancy. Memberships tend to be tiered in cost depending on the needs of the member. At a low end, a member can use a desk space for a limited number of days per week. At a higher end, a member can use a dedicated space for multiple people on a 24/7 basis. Co-working spaces are gaining in popularity in the United States. A few of the more established spaces include CoCo in Minnesota and Workbar in Massachusetts.

Corporate Venturing is another business model within the framework of an ecosystem. Corporate Venture groups typically occupy a physical space subsidized in part, or in full, by the sponsor corporation. This business model, while a closed system, is meant to create new products and services often through the creation of an entrepreneurial unit, sometimes call a strategic entrepreneurial unit. In these cases, intellectual capital developed inside or outside the host corporation is scouted by a manager and identified as possessing qualities aligning with the venture group's mission. Upon identifying this intellectual capital, the venture group will internalize the concept and work more in the mode of an incubator for the concept. Typically the sponsor corporation will take a significant ownership position in the developed concepts.

Ecosystem Outputs

It is not yet clear to me that I will need this section since I am focusing more on the inputs and network. I have already stated TEA as the output measure I prefer in terms of quantification of activity.

I am considering two options here:

- 1) Provide a synopsis of some of the major regions in terms of TEA. In this section I review the economic literature that points to regional growth in relationship to new ventures and analyze their measurement systems (new jobs, tax base, wage increases, etc.). Most of the references here will be derived from the Global Entrepreneurship Monitor as well as individual state reports. Interestingly, both are self-reporting mechanisms and largely lack an impartial review of the data. Specifically, states have been long known for multiple counting of data points that, when discovered, have over-estimated output values.*
- 2) Consider a more technical approach to the paper. In this case I can compare the inputs and throughputs of a few regional systems. Through this comparison, I can attempt to understand the relative impact of each factor within the systems for comparison. For example, within a few different ecosystems, does the presence of more incubators, accelerators and co-working spaces translate into higher TEA or is there some optimum level given the number of inputs in the region above which there are diminishing returns.*

Conclusions

In this section I will draw conclusions from the analysis of the scholarly literature coupled with my experience and will suggest a number of factors to be considered when applying the term ecosystem in the context of entrepreneurial output. I will also suggest other terminology for those regions lacking significant factors. In these cases, these regions would not necessarily qualify as an ecosystem due to the lack of factors required. I also hope to provide a table of the various factors studied in the literature, a categorization of these factors into higher-level themes and the literature references for these factors. If this table proves to be as helpful as anticipated, it will provide a structural framework defining an entrepreneurial ecosystem and the interconnection of the factors.

The secondary literature (peer reviewed, business focused and popular) refers to the notion of ecosystem as it is applied to business and, further, entrepreneurship. Given the use of this terminology it is important to provide a working definitional framework for additional research and analysis. This paper outlines the relevant scholarly articles leading to an understanding of what we might define as an ecosystem including inputs, throughputs and outputs. Coupling this analysis with personal experience operating within various regions we can arrive at a definition of entrepreneurial ecosystem. The works of Tansley, Moore, and many others informs this definition. We strive to maintain an ecological theme to define an entrepreneurial ecosystem.

To arrive at a definition, we need to take into account inputs, throughputs and outputs common to a variety of regions. Within the context of throughputs we need to understand symbiotic networks effects as well as lattice frameworks within which interchange takes place. Taking into account these factors, the secondary research on these topics and personal experience, we arrive at a definition of entrepreneurial ecosystem as:

A regional system of agents, networked through defined frameworks, working symbiotically to produce Total Early-Stage Entrepreneurial Activity.

There is a lot of room for further research on this topic in a variety of areas, not the least of which are technical arguments surrounding the factors of inputs and throughputs. Specifically, further analysis is needed to determine the relative impact of each inputs and throughputs in terms of TEA. Moreover, a technical study of the proposed inputs and throughputs in multiple regions is necessary to support the definitional concept.

Suggestions for Further Research

The research presented suggests further research is necessary to understand detailed impacts of each of the inputs as well as the outputs discussed. For example, there appears to be a strong need for more detailed research in the following areas:

Social Capital

A detailed examination of the role of social capital in entrepreneurial venture formation in the United States warrants further investigation. This would be research focused on social capital formation and leverage to the benefit of the success of a new venture. An additional research topic would be a study of the impact of social capital on entrepreneurial ecosystems in the United States. This would be an in-depth analysis of one of the key factors presented in this literature review as it relates to entrepreneurship in regional ecosystems,

Financial Capital

A detailed examination of the role of financial capital in entrepreneurial venture formation in the United States can also be specifically studied. This would be a detailed analysis of the different forms of capital (equity, debt and hybrid) for the entrepreneurial venture. It would focus on the forms of capital, but also the prevalence of capital over time. An extension of this research could include an analysis of the role of financial capital in developing, growing and fortifying entrepreneurial ecosystems in the United States. This would focus on a comparative analysis between at least three regions. The first region would certainly be Silicon Valley. A second region would be Michigan. Michigan is a fascinating study in entrepreneurship. A third region for contrast could be Idaho where there is very little activity.

University Impact

This is a very rich area for research. Data is available and there seems to be a disparity between reports at the state level, university level and nongovernmental and governmental agency levels. The research could focus on the role of the university in entrepreneurial venture creation and ecosystem developments. This research has ramifications spreading from tenure policies to commercialization claims to the very nature of a shift from basic to applied research in the university setting.

- 👤 *Analyze an ecosystem critically in terms of venture creation and spillover. Venture creation can be directly measured through state filings of new ventures. More specifically, filings of the 940 and W2 forms that are more relevant to payroll indicating job creation.*

Beyond these areas, comparative studies between the United States and other regions would merit study. These studies could examine regions on the basis of government structures, neighboring country impacts (EU, NAFTA, etc.) and societal norm differences (tolerance of risk, bankruptcy issues, etc.). The output measures of entrepreneurial ecosystems offer another rich area of academic study both from definitional and measurement standpoints as well as from comparative analysis across geographies and industry segments. These research areas can be presented in the form of theoretical and empirical studies. The prelude of the theoretical framework would be followed by the empirical studies.

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RECOMMENDATIONS MICHAEL CAMP



March 11, 2014

To Whom it May Concern:

I am writing in support of Brian Abraham's application for your open position in entrepreneurship education. I first met Brian when he was managing commercialization activities for Battelle Memorial Institute in Columbus, Ohio. We were developing an interdisciplinary, graduate, technology-based entrepreneurship education program at Ohio State. I learned that Brian had extensive experience developing and teaching courses in this area, having worked at Babson for several years.

Brian joined Fisher College as an adjunct instructor even while gainfully employed at Battelle to design and teach the practicum course for our new program. His teaching performance was stellar. He developed the course and launched in the fall. Though he was only able to teach the class that one time due to relocating, the course is still being taught today very much how Brian originally designed it.

Brian is a conscientious instructor. He poured over dozens of cases, readings, texts, and instructor materials to decide the best materials for the class. Having taught at Babson, he was a winner from the start. He has extensive C-level experience in a number of technology startup companies, including leading at least one turnaround acquisition for Battelle. He is able to utilize his experience to support his teaching, but, being theoretically driven, he does not over rely on "war stories." Brian's classes are fresh, focused, and of high quality, and his attention to detail ensures the integrity of the learning experience for the student.

More recently, I have had the privilege of working with Brian directly to develop the strategic plan and curricular program structure at Spartan Innovations at Michigan State University. Though Spartan Innovations is only a few years old, Brian has the young enterprise on a comprehensive development plan to identify pipeline venture opportunities, create and deliver quality instruction (graduate and undergraduate) and execute live ventures in the community based on university technologies.

Center for Entrepreneurship

256 Mason Hall • 250 Woodruff Avenue • Columbus, OH 43210
Telephone: 614-292-4065 • Fax: 614-292-4664

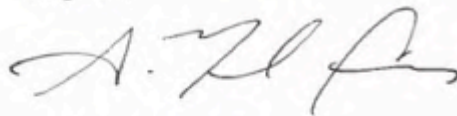
Page Two

I have worked with hundreds of universities during my consulting, philanthropic and academic careers, and the plan Brian has developed is one of the most progressive I have ever reviewed. His vision and ability to get the job done are critical to realizing real world results through academic programs.

Brian is thoughtful, caring and innovative. Many of the creative ideas he developed in our class a decade ago are still a part of how we teach technology-based entrepreneurship at Ohio State. And, many of his approaches are included in his operations and courses at Michigan State. As the architect of the Ohio State programs, I have the responsibility of building out the curriculum and outreach programs. I would have Brian back without hesitation if he was in the Columbus area and we had an opening. But regardless of where he is working, Brian would make a great entrepreneurship instructor or center director.

I highly recommend Brain Abraham to you for consideration of the opening in entrepreneurship education at your institution. Please contact me if you would like to discuss this recommendation further.

Regards,

A handwritten signature in black ink, appearing to read "S. Michael Camp". The signature is fluid and cursive, with a large initial "S" and "M".

S. Michael Camp, PhD
Executive Director

STEPHEN SPINELLI



2 April 2009
RE: Brian Abraham

To those interested in an outstanding entrepreneurship professor:

I have known Brian Abraham for most of a decade. Our relationship began when Brian took my entrepreneurship class. He immediately distinguished himself. Brian is keenly analytical, including both quantitative and qualitative skills. In class Brian was *always* on time, prepared and engaged in the discussion. It was during my early relationship that Brian showed an early and consistent ability to see entrepreneurship as a holistic process. His interdisciplinary understanding of key issues, leading to clear and measurable outcomes, is a foundation for competitive advantage.


After graduation Brian proactively engaged the College in a relationship with his employer. Brian carefully nurtured the relationship and it evolved into the basis for a unique entrepreneurship curriculum we called the "Entrepreneurship Intensity Track". In this curriculum, technology developed outside of the college was reviewed by students, faculty and company executive and screened for potential commercialization. Technology from the vetted inventory was selected by students for business plan development and launch in a year long series of entrepreneurship modules at the College. This unique and exciting curriculum would not have been developed and launched without Brian Abraham's leadership, guidance and hard work.

These two experiences led me to recruit Brian as an adjunct professor at Babson College. Brian can teach many aspects of the entrepreneurial process but we focused on technology entrepreneurship. Brian's record on commitment and creativity developed during class and curriculum development became embedded as reputation in his role as adjunct professor of entrepreneurship. Brian was collegial and sharing with other faculty. He was supportive and encouraging of students. He involved entrepreneurs and their companies in his class. Brian acted much more like a full time faculty member, supporting governance with his time and advice; helping to raise money and engaging in research activities.

While at Babson I hired 10 full time entrepreneurship faculty and 2 dozen adjuncts. Brian was one of my best choices. Any school teaching entrepreneurship would be elevated by having Brian on the faculty. I simply cannot imagine a better candidate.

Please feel free to call or email me if you have questions or require clarification or amplification of anything I've written.

Good luck,



Stephen Spinelli, Jr., Ph.D.

OFFICE OF THE PRESIDENT

School House Lane & Henry Avenue, Philadelphia, Pa 19144-5497
215.951.2970 • 215.951.2569 FAX • www.PhilaU.edu

CANDIDA BRUSH



Nov. 4, 2010

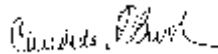
To: Crown College
Subject: Recommendation for Professor Brian Abraham
From: Prof. Candida Brush, Chair- Entrepreneurship Division
Babson College

I am writing to provide a strong endorsement for one of our former part-time faculty, Dr. Brian Abraham. Brian has significant experience in technology based (robotics and bio-science) start-ups (as CEO and founder) and has a Ph.D in Chemistry and MBA from Babson College. He has published several articles and therefore, could be academically qualified. He moved to Minnesota a few years ago and is interested in connecting back to the academic community.

We were fortunate to have Brian teach in our MBA program. Brian taught two courses for us, Technology Entrepreneurship and Technology Commercialization Screening between 2004 and 2007. He developed both courses and refined these over the years. His initial teaching ratings were average, but Brian worked to improve to an excellent level (1.5 on a 5 point scale). His background and experience in technology ventures as well as in general management were terrific assets to his teaching. I note that we have not yet found a suitable replacement for Brian

As a colleague, I can't say enough about Brian. He truly cares about mentoring students and is willing to work with them to help them launch businesses. He is very interested in working on programs and would be an excellent person to help in a Center or other administrative role. I would highly recommend Brian as a teacher, mentor, administrator or in any other role where he could work with students working to launch technology based ventures and/or general management. Please let me know if I can be of any further assistance.

Best regards,



Candida G. Brush, Professor of Entrepreneurship
Franklin W. Olin Chair in Entrepreneurship
Chair- Entrepreneurship Division
Babson College
Arthur M. Blank Center for Entrepreneurship
Wellesley, MA 02457
781-239-5014 (p)
781-239-4178 (f)

SYLLABI

BABSON COLLEGE



**TECHNOLOGY ENTREPRENEURSHIP
EPS 7505-71**

**BRIAN ABRAHAM, MBA, PH.D.
SPRING 2007
BABSON COLLEGE**

**LOCATION: OLIN 220
DAY: WEDNESDAY
TIME: 1830 - 2100**

Dr. Brian Abraham

Office: Blank 101

Phone: 617-715-7082

Email: babraham@bluefinrobotics.com

Office Hours: Class days one hour prior to class and by appointment

GENERAL INFORMATION

STUDENT RESPONSIBILITIES

General: Students are expected to come to class prepared to discuss the assigned cases and readings. Where possible, discuss the cases with other students prior to class. Case discussions will be led primarily by the students with the professor serving to guide the dialogue.

Missed Classes: For missed classes, a one page write-up of the case is due to me no later than one hour prior to class by email.

Objective: By the end of the course, the students will have been exposed to the appropriate due diligence techniques required to assess technologies and market opportunities for technologies. In depth focus will be placed on student-inspired opportunities with a goal to determine whether the opportunities unearthed are suitable for further exploration as a potential new venture.

Note: Any student entitled to an academic accommodation based on the impact of a documented disability should contact me privately during office hours to discuss his or her specific needs.

COURSE DESCRIPTION

Overview: New and emerging technologies create opportunities for entrepreneurs and entrepreneurial organizations to compete more efficiently in established markets and create new markets. Formal and anecdotal training are needed to properly assess market needs to determine if there is a potential technology solution that can meet the identified market need. Moreover, there is a significant amount of training required to perform proper technology due diligence to ensure the successful identification, acquisition and/or development of the technology prior to product launch. This class will provide the basis of learning in order to approach both the market and technology due diligence necessary to avoid common mistakes in technology entrepreneurship.

There are two common approaches to technology entrepreneurship: technology push and market pull. Technology push arises when a new technology is created that exhibits unique characteristics that can radically innovate market segments. Market pull arises when unmet or underserved market needs are identified that can be filled with a novel technological solution. This class will discuss both approaches. The course will progress from technology development/acquisition, through market assessment, business model development, venture funding, and finally preparing to launch.

Target Students: This course will be valuable to students interested in entrepreneurship and corporate entrepreneurship focused in high technology fields. Specifically, this course will target those students who are interested in the following high technology areas: launching a new product or venture, capital fundraising, management and consulting.

Format: Class format will incorporate a combination of lecture, case analysis and group exercises. This course is supported using case studies, textbook and additional readings to augment the lecture materials. The course content is focused on market opportunity identification, technology opportunity identification, technology commercialization, licensing

issues/concerns, product launch strategies and general management decision-making in high technology focused ventures. Half of class will consist of a discussion of the cases. The other half of class discussion will include lecture and training covering the reading topics and a question and answer period regarding the readings and assignments.

SYLLABUS

Class 1: January 24, 2007 – Introduction

- Reading Radical Innovation, Preface
Radical Innovation, Chapter 1
[Four Products: Predicting Diffusion \(Harvard\)](#)
- Class Introduction to Course

-----Break-----
Lecture – Radical Innovation/Incremental Improvement
[Four Products: Predicting Diffusion \(Harvard\)](#)

Class 2: January 31, 2007 – Technology Transfer

- Reading Radical Innovation, Chapter 2
University Research and Offices of Technology Transfer
[Milcom: An External Partnership to Commercialize Military Technologies](#)
- Class Lecture: Technology Transfer, IP & Library Resources

-----Break-----
[Milcom: An External Partnership to Commercialize Military Technologies](#)
[Technology Reviews](#)

Class 3: February 7, 2007 – Technology Development

- Reading Radical Innovation, Chapter 3
[Patents and Licensing \(UVA: Darden\)](#)
[Three Dimensional Printing \(UVA: Darden\)](#)
[Alpha-Beta Technology, Inc.: Pioneering Carbohydrate Technology \(Harvard\)](#)
- Class Lecture: Technology Development
[Alpha-Beta Technology, Inc.: Pioneering Carbohydrate Technology \(Harvard\)](#)

-----Break-----
[Three Dimensional Printing \(UVA: Darden\)](#)

Class 4: February 14, 2007 – Technology Push

- Reading Radical Innovation: Chapter 4
[Performance Indicator \(Harvard\)](#)
- Class [Performance Indicator \(Harvard\)](#)

-----Break-----
 Value Chain Exercise
 Clayton Christensen Video

SYLLABUS (CONTINUED)

Class 5: February 21, 2007 – Market Pull

Reading Radical Innovation, Chapter 5
[Disruptive Technology a Heartbeat Away: Ecton, Inc. \(Harvard\)](#)

Class Quiz

-----Break-----

[Disruptive Technology a Heartbeat Away: Ecton, Inc. \(Harvard\)](#)

Lecture: Possible Performance Indicator Visit

Class 6: February 28, 2007 – Market Pull

Reading Radical Innovation, Chapter 6
[Techsonic Industries, Inc.: Hummingbird – New Products \(Harvard\)](#)

Class Lecture: Market Pull

-----Break-----

[Techsonic Industries, Inc.: Hummingbird – New Products \(Harvard\)](#)

Distribute Comdial Case; Quiz Return

Class 7: March 7, 2007 – Creating Standards

Reading Radical Innovation, Chapter 7
[Rambus, Inc.: Commercializing the Billion Dollar Idea \(A\), \(Harvard\)](#)

Class Lecture: Creating Standards

-----Break-----

[Rambus, Inc.: Commercializing the Billion Dollar Idea \(A\), \(Harvard\)](#)

Class 8: March 14, 2007 – Lead User Research

Reading Radical Innovation, Chapter 8
[Commercializing Technology: Imaginative Understanding of User Needs \(HBS\)](#)
[Innovation at 3M Corp. \(A\) \(Harvard\)](#)

Class Lecture: Lead User Research

-----Break-----

[Innovation at 3M Corp. \(A\) \(Harvard\)](#)

Collect/Discuss Comdial

Class 9: March 28, 2007 – Strategy

Reading Radical Innovation, Chapter 9
[Trexel \(Harvard\)](#)

Class Guest Speaker: Rana Gupta, Director, Navigator Technology Ventures

-----Break-----

Lecture: Formulating Strategy

[Trexel \(Harvard\)](#)

Market Share Exercise

SYLLABUS (CONTINUED)

Class 10: April 4, 2007 – Funding

Reading Radical Innovation, Chapter 10
Radical Innovation, Epilogue
[Alex Laats at NBX Corporation](#)

Class Dean Rice Visit

-----Break-----

[Alex Laats at NBX Corporation](#)
Dilution Exercise

Class 11: April 11, 2007 – Preparing to Launch

Reading Radical Innovation, Chapter 10
Radical Innovation, Epilogue
[Pharmalife A: Deciding Whether to Build a Web-Based Services Company from Scratch](#)

Class Lecture: Preparing to Launch

-----Break-----

[Pharmalife A: Deciding Whether to Build a Web-Based Services Company from Scratch](#)

Class 12: April 18, 2007 – Lessons Learned

Reading [New Product Commercialization: Common Mistakes \(Harvard\)](#)
[Bringing Technology to Market: A Macro View of Technology Transfer and Commercialization](#)

Class Lecture: Lessons Learned

-----Break-----

Complete Evaluation Forms

Class 13: April 25, 2007 – Group Work

Reading No reading assigned

Class Student Paper and Presentation Preparation In-Class

-----Break-----

Class 14: May 2, 2007 – Presentations

Reading No reading assigned

Class Student Presentations

-----Break-----

Student Presentations

ASSIGNMENTS AND GRADING

Class Participation (Individual @ 25%)

I will assign three points for each class for participation (attendance = 1, engagement = 1, survey response = 1). Students are expected to actively participate during the case analysis portion of the class discussion. The level and quality of the participation by each student will be subjectively analyzed and contribute to the overall grade. If a student misses a class, a one page write-up of the case is due to me no later than one hour prior to the start of class. Survey responses received after the start of class will not be counted. In the unlikely event you can't access Blackboard to respond, you need to send me an email prior to class.

Quiz (Individual @ 25%)

There will be an in-class short answer quiz early in the semester focusing on the cases, readings and text. The purpose of the quiz is to provide early performance feedback to the students.

Case Analysis (Individual @ 25%)

Each student will be required to perform an analysis of an assigned case. The analysis will address specific questions that will be posed to the student to address. Proper grammar, spelling and punctuation will be assessed as part of the grade since the purpose of the exercise is to clearly and effectively articulate your analysis of the case.

Final Paper and Presentation (Group @ 25%)

Each group will either identify a developed technology or outline the concept for a new technology that could fit an unmet or underserved market need. The final deliverable is a presentation and paper that includes a discussion on how the technology will be developed and launched. The types of questions and analysis to be discussed include the following:

- What is the technology and market need served? Is this a technology push or market pull?
- Is this a radical innovation or incremental improvement?
- Is this a disruptive or sustaining technology?
- What is the market need and why does this need exist?
- How large is the market and what is the growth rate?
- Why is the current solution/technology not addressing the market need?
- Who are the market leaders in supplying technological solutions to this market?
- How do the market leaders compete (i.e., price, quality). What are the barriers to entry?
- How will you capture the technology (license, R&D, etc.)?
- Who are the competitors and what is the market value chain and market power landscape?
- What is the cost to capture this technology?
- Compare/contrast this technology with the incumbent/competing technologies include a SWOT (strengths, weaknesses, opportunities and threats) analysis.
- Explain the uncertainties associated with bringing this technology to market.
- What is the cost of bringing this technology to market? What are the likely funding mechanisms? How might you position the technology to attract the appropriate funding?
- What barriers to entry might you erect in anticipation of a market offering and potential backlash from incumbents/competitors?
- What is the business model(s) that you envision? What are the next steps?

The format for the final paper and presentation is as follows:

- Presentation: PowerPoint presentation for 5 minutes followed by 10 minute Q&A.
- Paper:
 - Cover page with group member names.
 - Less than 10 page analysis using 1" margins and 1.5 line spaces, paginated and stapled (no binders please).
 - Proper citation of references.

COURSE MATERIALS

Radical Innovation: How Mature Companies Can Outsmart Upstarts

Richard Leifer, Christopher M. McDermott, Gina Colarelli O'Connor, Lois S. Peters, Mark Rice, and Robert W. Veryzer. Harvard Business School Press, Boston, MA, 2000.

Case Studies and Readings (Coursepack)

[Four Products: Predicting Diffusion \(Harvard\)](#)

[University Research and Offices of Technology Transfer \(California Management Review\)](#)

[Milcom: An External Partnership to Commercialize Military Technologies](#)

[Patents and Licensing \(UVA: Darden\)](#)

[Three Dimensional Printing \(UVA: Darden\)](#)

[Alpha-Beta Technology, Inc.: Pioneering Carbohydrate Technology \(Harvard\)](#)

[Performance Indicator \(Harvard\)](#)

[Disruptive Technology a Heartbeat Away: Ecton, Inc. \(Harvard\)](#)

[Techsonic Industries, Inc.: Hummingbird – New Products \(Harvard\)](#)

[Rambus, Inc.: Commercializing the Billion Dollar Idea \(A\), \(Harvard\)](#)

[Commercializing Technology: Imaginative Understanding of User Needs \(HBS\)](#)

[Innovation at 3M Corp. \(A\) \(Harvard\)](#)

[Trexel \(Harvard\)](#)

[Alex Laats at NBX Corporation](#)

[Pharmalife A: Deciding Whether to Build a Web-Based Services Company from Scratch](#)

[New Product Commercialization: Common Mistakes \(Harvard\)](#)

[Bringing Technology to Market: A Macro View of Technology Transfer and Commercialization](#)

Additional Resources (Not Required)

- Open Innovation – Chesbrough
- The Innovator's Dilemma – Christensen
- The Innovator's Solution - Christensen
- Achieving Planned Innovation - Bacon and Butler
- The Sources of Innovation - von Hippel
- Product Design and Development – Eppinger
- Creating Breakthrough Products - Cagan and Vogel
- Blockbusters - Lynn and Reilly
- Product Innovation Strategy: Pure & Simple – Robert
- The Art of Innovation – Kelley
- Rules for Revolutionaries – Kawasaki
- Winning at New Products - Cooper
- Profiting from Innovation - Howard and Guile
- New Ideas About New Ideas – Shira P. White
- New Venture Creation - Timmons

THE OHIO STATE UNIVERSITY



**TECHNOLOGY ENTREPRENEURSHIP AND COMMERCIALIZATION
(BUS-MHR 894.61)**

BRIAN ABRAHAM, MBA, PH.D.

S. MICHAEL CAMP, PH.D.

FALL 2004

THE OHIO STATE UNIVERSITY

FISHER COLLEGE OF BUSINESS

WEDNESDAYS 1830 - 2148

LOCATION: 315 GERLACH HALL

GENERAL INFORMATION

Instructors: Brian Abraham, MBA, Ph.D.
S. Michael Camp, Ph.D.

Office: TBD

Phone: Brian Abraham: 614-424-3851
Michael Camp: 614-292-3045

Email: Brian Abraham: **abrahamb@battelle.org**
Michael Camp: **camp_1@cob.osu.edu**

Office Hours: Class days one half hour prior to class and by appointment

TEACHING METHOD

We will use a combination of case method, text book, readings, lecture materials and outside assignments throughout the course. Each class session is described in detail below.

STUDENT RESPONSIBILITIES

General: To maximize the learning experience, students are expected to come to class fully prepared to discuss the assigned cases and readings. Where possible, discuss the cases with other students prior to class. The case discussions will be lead primarily by the students with the professor serving to guide the dialogue.

Missed Classes: If a student misses a class, a one page write-up of the case is due no later than one hour prior to the start of the class. I will assign three points for each class for participation. One point will be assigned for engaging in the class dialogue, a second point for preparation, and a third point for responding to posted surveys.

Objective: By the end of the course, the students will have been exposed to the appropriate due diligence techniques required to properly assess technologies and market opportunities for technologies. In depth focus will be placed on student-inspired opportunities with a goal to determine whether the opportunities unearthed are suitable for further exploration as a potential new venture.

COURSE DESCRIPTION

Overview: In order to be successful in high technology entrepreneurship, there are technology –related skills that are necessary beyond traditional business skills and entrepreneurial zeal. These should include technological opportunity assessment and technology acquisition/development. The primary objective of this course is to give the student the formalized training necessary to begin to understand and improve upon their skills in these areas. The end deliverable will require the student to identify an unmet or underserved market need and a potential technological solution to serve this need with the goal of helping the student establish the basis for new venture creation or product launch.

New and emerging technologies create opportunities for entrepreneurs and entrepreneurial organizations to compete more efficiently in established markets and create new markets. Formal and anecdotal training are needed to properly assess market needs to determine if there is a potential technology solution that can meet the identified market need. Moreover, there is a significant amount of training required to perform proper technology due diligence to ensure the successful identification, acquisition and/or development of the technology prior to product launch. This class will provide the basis of learning in order to approach both the market and technology due diligence necessary to avoid common mistakes in technology entrepreneurship.

There are two common general approaches to technology entrepreneurship: technology push and market pull. Technology push arises when scientific researchers and organizations create a new technology that exhibits unique characteristics that has the potential to radically innovate market segments. Market pull arises when unmet or underserved market needs are identified that can be filled with a novel technological solution. This class will discuss both approaches. The course will progress from technology development/acquisition, through market assessment, business model development, venture funding, and finally preparing to launch.

Target Students: This course will be valuable to students interested in entrepreneurship and corporate entrepreneurship focused in high technology fields. Specifically, this course will target those students who are interested in launching a new venture or new product in a high technology area. Additionally, this course is applicable to students interested in high technology areas with focused interest in capital funding, consulting and management.

Format: This course is supported using case studies, textbook and additional readings to augment the lecture materials. The course content is focused on market opportunity identification, technology opportunity identification, intellectual property considerations, technology commercialization, licensing issues/concerns, product launch strategies and general management decision-making in high technology focused ventures. Half of class will consist of a discussion of the cases. The other half of class will include lecture and training covering the reading topics and a question and answer period regarding the readings and assignments.

SYLLABUS

Class 1 – September 22: Introduction

- Reading Radical Innovation, Preface
Radical Innovation, Chapter 1
[Four Products: Predicting Diffusion \(Harvard\)](#)
- Class Introduction to Course
Lecture – Radical Innovation/Incremental Improvement
-----Break-----
[Four Products: Predicting Diffusion \(Harvard\)](#)
-----Break-----
Class Exercise/Group Meetings
 Present, review and discuss technologies available for assessment

Class 2 – September 29: Technology Transfer

- Reading Radical Innovation, Chapter 2
University Research and Offices of Technology Transfer
[Milcom: An External Partnership to Commercialize Military Technologies](#)
- Class Lecture: Technology Transfer, IP & Available Resources
-----Break-----
[Milcom: An External Partnership to Commercialize Military Technologies](#)
-----Break-----
Class Exercise/Group Meetings
 Group organization and discussion

Class 3 – October 6: Technology Development

- Reading Radical Innovation, Chapter 3
[Patents and Licensing \(UVA: Darden\)](#)
[Three Dimensional Printing \(UVA: Darden\)](#)
- Class Lecture: Technology Development
-----Break-----
[Three Dimensional Printing \(UVA: Darden\)](#)
-----Break-----
Class Exercise/Group Meetings
 Group organization and discussion

Class 4 – October 13: Technology Push

- Reading Radical Innovation: Chapter 4
[Performance Indicator \(Harvard\)](#)
- Class Lecture: Technology Push
-----Break-----
[Performance Indicator \(Harvard\)](#)
-----Break-----
Quiz
Class Exercise/Group Meetings
 Performance Indicator Exercise

SYLLABUS (CONTINUED)

Class 5 – October 20: Market Pull

Reading Radical Innovation, Chapter 5
[Disruptive Technology a Heartbeat Away: Ecton, Inc. \(Harvard\)](#)
Class Lecture: Robb Osinski (Performance Indicator)

-----Break-----

[Disruptive Technology a Heartbeat Away: Ecton, Inc. \(Harvard\)](#)

-----Break-----

Quiz Return
Distribute Comdial (assignment and template)
Class Exercise/Group Meetings
 Group meetings

Class 6 – October 27: Creating Standards

Reading Radical Innovation, Chapter 6
[Rambus, Inc.: Commercializing the Billion Dollar Idea \(A\), \(Harvard\)](#)
Class Lecture: Creating Standards

-----Break-----

[Rambus, Inc.: Commercializing the Billion Dollar Idea \(A\), \(Harvard\)](#)

-----Break-----

Class Exercise/Group Meetings
 Group update presentations and discussion
 Group meetings

Class 7 – November 3: Lead User Research

Reading Radical Innovation, Chapter 7
[Commercializing Technology: Imaginative Understanding of User Needs \(HBS\) Innovation at 3M Corp. \(A\) \(Harvard\)](#)

Class Lecture: Lead User Research

-----Break-----

[Innovation at 3M Corp. \(A\) \(Harvard\)](#)

-----Break-----

Collect/Discuss Comdial
Class Exercise/Group Meetings
 Lead User/Kano/Quality Functional Deployment

Class 8 – November 10: Strategy

Reading Radical Innovation, Chapter 8
[Trexel \(Harvard\)](#)

Class Lecture: Formulating Strategy

-----Break-----

[Trexel \(Harvard\)](#)

-----Break-----

SYLLABUS (CONTINUED)

Class 9 – November 17: Funding

Reading Radical Innovation, Chapter 9
[Alex Laats at NBX Corporation](#)

Class Guest Lecturer

-----Break-----

[Alex Laats at NBX Corporation](#)

-----Break-----

Class Exercise/Group Meetings

- Group update presentations and discussion

Class 10 – December 1: Presentations

Reading Radical Innovation, Chapter 10 and Epilogue

Class Lecture/Course Wrap-Up
Student Presentations

-----Break-----

Student Presentations

COURSE MATERIALS

Radical Innovation: How Mature Companies Can Outsmart Upstarts

- Richard Leifer, Christopher M. McDermott, Gina Colarelli O'Connor, Lois S. Peters, Mark Rice, and Robert W. Veryzer.
- Harvard Business School Press, Boston, MA, 2000.

Case Studies

- See Syllabus – available as a course pack

Articles

- See Syllabus – available as a course pack

Additional Resources (Not Required)

- Open Innovation – Chesbrough
- The Innovator's Dilemma – Christensen
- The Innovator's Solution - Christensen
- Achieving Planned Innovation - Bacon and Butler
- The Sources of Innovation - von Hippel
- Successful Innovation - The Economist
- Product Design and Development – Eppinger
- Creating Breakthrough Products - Cagan and Vogel
- Blockbusters - Lynn and Reilly
- Product Innovation Strategy: Pure & Simple – Robert
- The Art of Innovation – Kelley
- Rules for Revolutionaries – Kawasaki
- Winning at New Products - Cooper
- Profiting from Innovation - Howard and Guile
- New Ideas About New Ideas – Shira P. White
- New Venture Creation - Timmons

ASSIGNMENTS AND GRADING

Class Participation (Individual @ 30%)

Students are expected to actively participate during the case analysis portion of the class discussion. The level and quality of the participation by each student will be subjectively analyzed and contribute to the overall grade. If a student misses a class, a one page write-up of the case is due to me no later than one hour prior to class. I will assign three points for each class for participation. One point will be assigned for engaging in the class dialogue, a second point for preparation, and a third point for responding to posted surveys.

Quiz (Individual @ 20%)

There will be an in-class quiz early in the semester. The quiz will focus on the readings and text book. The purpose of the quiz is to determine retention of the material and provide early feedback to the students. The format will be primarily short answer.

Case Analysis (Individual @ 20%)

During the semester, each student will be required to perform an analysis of an assigned case. The analysis will address specific questions that will be posed to the student to address. Proper grammar, spelling and punctuation will be assessed as part of the grade since the purpose of the exercise is to clearly and effectively articulate your analysis of the case.

The format for the case analysis is as follows:

- Cover page.
- Less than five page analysis using 1" margins and 1.5 line spaces, paginated and stapled.
- Proper citation of references if used.

ASSIGNMENTS AND GRADING (CONTINUED)

Final Paper and Presentation (Group @ 30%)

Each group will either identify a developed technology that is accessible or outline the concept for a new technology that could fit an unmet or underserved market need. The final deliverable is a written paper that includes a description of the unmet/underserved need, rough schematic or flow diagram of the technological solution as well as a discussion on how the technology will be developed and launched. The types of questions and analysis to be discussed include the following:

- What is the market need and why does this need exist?
- How large is the market and what is the growth rate?
- Why is the current solution/technology not addressing the market need?
- Who are the market leaders in supplying technological solutions to this market?
- How do the market leaders compete (i.e., price, quality). What are the barriers to entry?
- How will you capture the technology (license, R&D, etc.)?
- What is the cost to capture this technology?
- What is the first-order net present value that can be anticipated by acquiring and launching this technology?
- Discuss the technology and the origin of the technology (organically inspired, university technology transfer, etc.)
- What is the level of maturity of the technology and how can you verify this level of maturity?
 - For example, a hardware technology would be considered advanced at this stage there a working breadboard with the associated technical data package including engineering drawings and bill of materials. A hardware technology would be considered early stage if there is laboratory proof of principle, first order theoretical calculations and rough sketches.
- Compare/contrast this technology with the incumbent/competing technologies include a SWOT (strengths, weaknesses, opportunities and threats) analysis.
- What level of effort would be required to bring this technology to market?
 - Consider financial requirement, additional team members, partnerships, etc.
- What is the cost of bringing this technology to market? What are the likely funding mechanisms? How might you position the technology to attract the appropriate funding?
- What barriers to entry might you erect in anticipation of a market offering and potential backlash from incumbents/competitors?
- What is the business model(s) that you envision?
- What are the next steps?

The format for the final paper and presentation is as follows:

- Presentation: PowerPoint presentation for 5 minutes followed by 10 minute Q&A.
- Paper:
 - Cover page with group member names.
 - Less than 10 page analysis using 1" margins and 1.5 line spaces, paginated and stapled (no binders please).
 - Proper citation of references.

Additionally, each group will prepare a PowerPoint presentation and 5-minute discussion on their market opportunity in a "Rocket Pitch" or "Elevator Pitch" format aimed at capturing

the attention of private equity sponsors or other interested parties. One representative from each group should be prepared to deliver the pitch.

MICHIGAN STATE UNIVERSITY

**ENTREPRENEURSHIP: NEW VENTURE STRATEGY
MGT 852**

**BRIAN ABRAHAM, MBA, PH.D.
SPRING 2014
MICHIGAN STATE UNIVERSITY**

**MONDAYS AND WEDNESDAYS
1420 - 1540
BUSINESS COLLEGE
645 N. SHAW LANE
BUILDING 80
ROOM N102 BCC**

**TEXT
ENTREPRENEURSHIP, SECOND EDITION.
WILLIAM BYGRAVE & ANDREW ZACHARAKIS. JOHN WILEY & SONS, INC. OCTOBER
2011.**

Dr. Brian Abraham

Office: 325 East Grand River, Suite 355

Phone: 612-325-1528

Email: babraham@spartaninnovations.org

Office Hours: Class days one hour prior to class and by appointment

SYLLABUS

Objective: Students will learn the appropriate techniques required to assess New Venture Creation opportunities. In depth focus will be placed on student-inspired opportunities with a goal of launching a New Venture. Students are expected to come to class prepared to discuss the assigned readings. Where possible, discuss the cases with other students prior to class. Case discussions will be led primarily by the students with the professor serving to guide the dialogue.

Overview: New and emerging business models create opportunities for entrepreneurs to disrupt established markets and create new markets. Formal and anecdotal training are needed to properly assess market needs to determine if there is a potential business model solution that can meet the identified market need. Moreover, there is a significant amount of training required to perform proper due diligence to ensure the successful identification, development and launch of the New Venture. This class will provide the basis of learning in order to approach New Venture Creation in a thoughtful manner to avoid common Entrepreneurial mistakes. The course will progress from product development/acquisition, through market assessment, business model development, venture funding, and finally preparing to launch.

Format: Class format will incorporate a combination of lecture, case analysis and group exercises. This course is supported using textbook readings and case studies. The course content is focused on market opportunity identification, product opportunity identification, product commercialization, licensing issues/concerns, product launch strategies and general management decision-making in New Ventures. Half of the classes will consist of a discussion of the cases. The other half of the classes will include lecture and training covering the reading topics and a question and answer period regarding the readings and assignments.

Target Students: This course will be valuable to students interested in entrepreneurship. Specifically, this course will target those students who are interested in launching a new product or venture, capital fundraising, management and consulting.

ASSIGNMENTS AND GRADING

Class Participation (Individual @ 25%): Students are expected to actively participate during class discussion. The level and quality of the participation by each student will be subjectively analyzed and contribute to the overall grade.

Mid-Term Quiz (Individual @ 25%): There will be an in-class short answer quiz focusing on the materials covered. The purpose of the quiz is to provide performance feedback to the students.

Case Analysis (Individual @ 25%): Each student will perform a case analysis. The case, with instructions, will be handed out in class.

Final Paper and Presentation (Group @ 25%): Each group will develop a New Venture that could fit an unmet or underserved market need. The final deliverable is a presentation and paper that includes a discussion on how the technology will be developed and launched.

Class	Date	Reading	Assignments
1	January 8	Chapter 1: The Power of Entrepreneurship	None
2	January 13	Chapter 2: The Entrepreneurial Process	None
3	January 15	Case: Alison Barnard	None
4	January 22	Chapter 3: Opportunity Recognition, Shaping and Reshaping	None
5	January 27	Case: Jim Poss	None
6	January 29	Library Resources and Training	None
7	February 3	Chapter 4: Understanding Your Business Model and Developing Your Strategy	Executive Summary Due
8	February 5	Case: Adam Aircraft	None
9	February 10	Chapter 5: Entrepreneurial Marketing	None
10	February 12	Social Media and Marketing	None
11	February 17	Team Dynamics	None
12	February 19	Chapter 6: Building the Founding Team	Income Statement Due
13	February 24	Chapter 7: The Business Planning Process	None
14	February 26	None	Midterm Quiz/Case Handed Out
15	March 10	Midterm Review	None
16	March 12	Chapter 8: Building Your Pro-Forma Financial Statements	None
17	March 17	Case: Disruptive Technology A Heartbeat Away: Ecton, Inc.	None
18	March 19	Disruptive Technologies	None
19	March 24	Chapter 9: Financing Entrepreneurial Ventures Worldwide	None
20	March 26	Techsonic Industries Inc.: Hummingbird – New Products	Case Due
21	March 31	Chapter 10: Raising Money for Starting and Growing Businesses	None
22	April 2	Capital Fundraising	None
23	April 7	Chapter 11: Debt and Other Forms of Financing	None
24	April 9	Case: Feed Resource Recovery	None
25	April 14	Chapter 12: Legal and Tax Issues	None
26	April 16	Case: Alex Laats	None
27	April 21	In Class Group Work	None
28	April 23	Chapter 13: Intellectual Property	None
29	April 28	Final	In Class Presentations – Papers Due

UNIVERSITY OF ST. THOMAS

Opus College of Business Mission

Inspired by Catholic intellectual tradition, the Opus College of Business develops effective, principled business leaders who think globally, act ethically and create enduring value for society.

Spring 2015

**Health Care MBA
ENTR707: Innovation**

Meeting Time and Location

- 🏛️ Module 0: Pre-Read (May 14)
May 14: Read *Performance Indicator* and *Alex Laats and NBX Corporation*
- 🏛️ Module 1: Opportunity Recognition (May 14 – 28, 2015)
May 15: TMH301 1:00PM to 5:00PM
May 16: TMH301 9:00AM to 5:00PM
May 17 – 28: Online
- 🏛️ Module 2: Opportunity Exploration (May 29 – June 23, 2015)
May 29 – June 23: Online
- 🏛️ Module 3: Opportunity Exploitation (June 24 – July 17, 2015)
June 24 – July 17: Online

Faculty

Brian Abraham, MBA, PH.D.
Associate Dean
Opus College of Business
Schulze School of Entrepreneurship
1000 LaSalle Avenue
Schulze 435
Minneapolis, MN 55403-2005
612.325.1528
brian.abraham@stthomas.edu
LinkedIn

Office Hours

Virtual Office Hours (by appointment). You can reach me by phone or email, and will respond to all messages within 48 hours. However, a message sent over the weekend will be responded to within 72 hours.

Course Description

New and emerging concepts create opportunities for entrepreneurs and entrepreneurial organizations to compete more efficiently in established markets and facilitate the creation of new markets. Formal and anecdotal training are needed to properly assess market needs to determine if there is a potential solution that can meet the identified market need. Moreover, there is a significant amount of training required to perform proper due diligence to ensure the successful identification, acquisition and/or development of the solution prior to launch. This class will provide the basis of learning in order to approach both the market and solution due diligence necessary to avoid common mistakes in entrepreneurial practice.

This course is designed to help the general manager understand what it takes to create corporate environments where entrepreneurial ideas can flourish, to identify and evaluate new opportunities, and to transform innovations into profitable businesses. In short, students will develop the skills and knowledge necessary for applying the entrepreneurial process within the corporate context. While we will be analyzing innovation through a new venture creation lens, the learning objectives are translatable within a corporate setting. We will be using a module format that will take the participant through the three phases of innovation: opportunity recognition, opportunity exploration and opportunity exploitation as represented by the following diagram:



Course Objectives

The primary objective of this course is to give the student the formalized training necessary to begin to understand and master skills to become entrepreneurial.

In order to be a successful innovator, three skill-based areas of understanding are necessary beyond traditional management training: Opportunity Recognition, Opportunity Exploration and Opportunity Exploitation. The primary objective of this course is to give the student the formalized training necessary to begin to master these skill-based areas. This understanding will enable the student to identify an unmet or underserved market need, conceptualize a solution, understand the market parameters and establish the basis for innovation.

Learning Objectives

- 🏛️ Distinguish different classifications of entrepreneurial/innovative paradigms,
- 🏛️ Demonstrate an understanding of the entrepreneurial mindset,
- 🏛️ Categorize the entrepreneurs within an entrepreneurial group classification,
- 🏛️ Explain the basic principles behind Opportunity Recognition,
- 🏛️ Compose your thoughts on different approaches to Opportunity Recognition,
- 🏛️ Recognize the difference between an idea, an opportunity and a business model,
- 🏛️ Distinguish entrepreneurial marketing from traditional larger corporate marketing,
- 🏛️ Demonstrate an understanding of team dynamics in an innovation atmosphere,
- 🏛️ Analyze different business models,
- 🏛️ Summarize the strengths and weaknesses of an assigned business model,
- 🏛️ Discuss the merits of an investment opportunity,
- 🏛️ Calculate the value of an exit opportunity,
- 🏛️ Compute the value of an innovation under defined conditions,
- 🏛️ Debate the merits of a specific business model, and
- 🏛️ Contrast different forms of financing.

Texts and Cases

As a basic text, we will use:

Bygrave, W., & Zacharakis, A. (2014). Entrepreneurship. Hoboken, NJ: John Wiley & Sons, Inc. 3rd Edition.

We will also be using the following case studies:

Corts, K.S. (2003). Performance Indicator. HBS No. 9-702-480. Boston, MA: Harvard Business School Publishing.

Shane, S. (1999). Alex Laats and NBX Corporation. Darden No. UVA-ENT-0005. Charlottesville, VA: Darden Business Publishing.

Grading

Grading will be based upon quiz results and discussion board participation as follows:

- 🏛️ Quizzes: 150 Points,
- 🏛️ Papers: 600 Points, and
- 🏛️ Discussion Board: 150 Points.

Discussion board grading will be based not only on mere participation, but also the quality of the participation. Quizzes will be based solely on the textbook readings. You are not to read the cases at the end of the chapters.

Plagiarism

Plagiarism is the dishonest act of presenting the words or thoughts of another writer as if they were your own. You commit plagiarism whenever you use a source in any way without indicating that you have used it. If you quote anything at all, even a phrase, you must put quotation marks around it, or set it off from your text; if you summarize or paraphrase an author's words, you must clearly indicate where the summary or paraphrase begins and ends; if you use an author's idea, you must say that you are doing so. In every instance, you must also formally acknowledge the written source from which you took the material.






If there is anything about plagiarism you do not understand, ask your instructor. The university is preparing a document on appropriate use of materials from the Internet and other computer related sources. This document will become an addendum to the Student Handbook of the Graduate School of Business.

Expectations Regarding Work Outside of Class

This is a 3-credit course. It is expected that students will spend a minimum of 9 hours of study time in class sessions and on assigned readings, written assignments, problems, case analyses, papers, projects and other work outside of class per week. It should also be noted that students might need to spend more time than this minimum requirement. The specific chapter readings and cases listed in this syllabus and in any supplemental materials provided by the instructor.

Course Requirements/Policies/Expectations

It is every student's responsibility to be fully aware of each of the following OCB/UST course policies.

-  Academic Integrity,
-  Student Access to Faculty,
-  Disabilities Enhancement Program,
-  Disclaimer of Syllabus as a Contract, and
-  Expectations of Students.

For the full policies, see the following:

<http://www.stthomas.edu/business/students/policies/>

<http://www.stthomas.edu/business/students/policies/expectations.html>.

Policies

Disability Resources

I want to ensure that the classroom environment is conducive to your learning and ask that you discuss with me any concerns that are interfering with your learning as they arise. Classroom accommodations will be provided for students with documented disabilities. Further information is available at:
www.stthomas.edu/enhancementprog/.

Student Access to Faculty

The UST Opus College of Business faculty members recognize that student access to faculty is an important part of the University of St. Thomas educational experience. The faculty members also recognize that regularly scheduled office hours alone do not meet the diverse needs of all constituents. Changes in technology, student demographics, and multiple campus locations create new challenges and opportunities.

Therefore, be it resolved that the UST Opus College of Business faculty maintains a policy on student access to faculty stating how students shall have access to faculty outside of class through a combination of office hours, phone, email, and other electronic communications. All faculty members are required to be available by appointment for face-to-face meetings with students. Faculty should respond to voicemail, email, and other student-initiated communications within 48 hours on normal business days. Additional contact requirements or office hours may vary by program depending on each program's needs, student population, and physical location, as determined by faculty and program staff. Each course syllabus will describe the program's general policy or provide a link to the policy URL. Each course syllabus also will describe how the faculty member will implement the policy.

Academic Integrity

Students are obliged to refrain from acts that they know or, under the circumstances, have reason to believe, will impair the integrity of the university. Violations of academic integrity include, but are not limited to, cheating, plagiarism, unauthorized multiple submissions, knowingly furnishing false or incomplete information to any agent of the university for inclusion in academic records, and falsification, forgery, alteration, destruction, or misuse of official university documents or seal.

As stated in the University of St. Thomas Academic Integrity Policy, the minimum sanction for cheating or plagiarism is failure on the work involved. It is the responsibility of all students to be fully aware of the conditions and consequences of violating the UST Academic Integrity Policy.

Expectations of Students

As a member of the Opus College of Business (OCB) community, I accept that it is my responsibility to act in a professional manner and take personal responsibility for my own education by:

- 🏛️ Preparing fully for each class; completing assignments on time, honestly, and to the best of my ability.
- 🏛️ Participating in class discussions without dominating the discourse.
- 🏛️ Participating fully in group-based assignments, to include providing constructive and candid assessment of self and others in group-oriented projects.
- 🏛️ Seeking the applications of material learned in past courses.

It is anticipated that students will model professionalism within the OCB community by:

- 🏛️ Using professional language and communicating politely and respectfully with classmates and instructors.
- 🏛️ Conducting themselves ethically, honestly, and with integrity in all situations and not tolerating academic dishonesty in others.
- 🏛️ Treating all members of the OCB community with trust, respect, and professional civility regardless of their race, color, creed, religion, ancestry, national origin, sex, sexual orientation, disability status, age, marital status, or status with regard to public assistance, discouraging the use of inappropriate humor designed to denigrate individuals or groups, and insisting on the same from others.
- 🏛️ Being fair and impartial when giving feedback on the performance of other community members.

Disclaimer

This syllabus is not a contract, but a plan for action. The instructors reserve the right to alter its stipulations, upon prior notification to students, if and when educational circumstances warrant changes.

Calendar

The course takes the student through the key modules in innovation. Beginning with a Pre-Read/Introductory module, we will then step through three critical modules for innovation/entrepreneurship.

- 🏛️ Module 0: Pre-read,
- 🏛️ Module 1: Opportunity Recognition,
- 🏛️ Module 2: Opportunity Exploration, and
- 🏛️ Module 3: Opportunity Exploitation.

Please note that this schedule is subject to modification. When there is a change, both the syllabus and BlackBoard site will be updated accordingly.

Module 0: Pre-Read Module

Prior to our first session, pre-read both cases posted on Blackboard in the Pre-Read Module. The cases are *Performance Indicator* and *Alex Laats and NBX Corporation*.

Class Sessions

- 🏛️ Read *Performance Indicator* and *Alex Laats and NBX Corporation*.

Learning Objectives

- 🏛️ Navigate and confirm an understanding of the course Blackboard site,
- 🏛️ Introduce yourself (name, work affiliation, academic background) to your colleagues on the discussion board, and
- 🏛️ Examine both cases in preparation for class discussion.

Assignments

- 🏛️ Review the Blackboard site,
- 🏛️ Post your introduction on the discussion board of the Blackboard site,
- 🏛️ Read both cases posted: *Performance Indicator* and *Alex Laats and NBX Corporation*, and
- 🏛️ Reflect on how the innovators in each case are approaching their potential opportunities.

Module 1: Opportunity Recognition (May 14 – May 28, 2015)

During this module we will study the historical and global perspective of innovation and entrepreneurship and begin to understand the entrepreneurial mindset, techniques to uncover opportunities and begin to approach shaping potential solutions to opportunities from an innovation perspective.

Class Sessions

- 🏛️ May 15: TMH301 1:00PM to 5:00PM
- 🏛️ May 16: TMH301 9:00AM to 5:00PM
- 🏛️ May 17 – 28: Online

Learning Objectives

- 🏛️ Distinguish different classifications of entrepreneurial/innovative paradigms,
- 🏛️ Demonstrate an understanding of the entrepreneurial mindset,
- 🏛️ Categorize entrepreneurs within an entrepreneurial group classification (*Performance Indicator*),
- 🏛️ Explain the basic principles behind Opportunity Recognition, and
- 🏛️ Compose your thoughts on different approaches to Opportunity Recognition (*Performance Indicator*).

Assignments

- 🏛️ Read the following chapters (but not the cases at the end of the chapters):
Chapter 1: The Power of Entrepreneurship,
Chapter 2: The Entrepreneurial Process, and
Chapter 3: Opportunity Recognition, Shaping and Reshaping.
- 🏛️ Submit a one page group paper addressing the following question:
What is your opinion (positive or negative) of how Rob and Bob are approaching Opportunity Recognition?
 Grading Rubric:
 How Compelling is the Concept – Why or Why Not? (100 points)
 What is the Value Chain? (100 points)
- 🏛️ Participate in the discussion board question (50 points):
Analyze the product offering from Bluefin Robotics
(<http://www.bluefinrobotics.com>).
What market opportunities are they trying to exploit and what types of problems – market and/or technical – do you think they might face?
- 🏛️ Quiz (50 points): There will be an on-line, end of module-timed quiz.
- 🏛️ Reflect: I will post:
 A video discussing *Bluefin Robotics* for your review, and
 A video discussing the paper assignment.

Module 2: Opportunity Exploration (May 29 – June 23, 2015)

We will study the techniques used to develop a business model based upon the Opportunity Recognition module. We will look at strategy, marketing, modeling, teams and financial statement development. Business models are necessary for both new ventures and existing company product and service launches.

Class Sessions

- 🏛️ May 29 – June 23: Online.

Learning Objectives

- 🏛️ Recognize the difference between an idea, an opportunity and a business model,
- 🏛️ Distinguish entrepreneurial marketing from traditional larger corporate marketing,
- 🏛️ Demonstrate an understanding of team dynamics in an innovation atmosphere,
- 🏛️ Analyze different business models (*Performance Indicator* and *IdleAire*), and
- 🏛️ Summarize the strengths and weaknesses of an assigned business model (*IdleAire*).

Assignments

- 🏛️ Read the following chapters (but not the cases at the end of the chapters):
Chapter 4: Understanding Your Business Model and Developing Your Strategy,
Chapter 5: Entrepreneurial Marketing,
Chapter 6: Building The Founding Team,
Chapter 7: The Business Planning Process, and
Chapter 8: Building Your Pro Forma Financial Statements.
- 🏛️ Submit a one page group paper addressing the following question:
What are the strengths and weaknesses of the Performance Indicator business model?
Grading Rubric:
 - What are the Market Forces? (100 points)
 - What challenges with Performance Indicator face? (100 points)
- 🏛️ Participate in the discussion board question (50 points):
Analyze the product offering from IdleAire (<https://www.idleair.com>). What are the strengths and weaknesses of their business model?
- 🏛️ Quiz (50 points): There will be an on-line, end of module-timed quiz.
- 🏛️ Reflect: I will post:
A video discussing *IdleAire* for your review, and
A video discussing the paper assignment.

Module 3: Opportunity Exploitation (June 24 – July 18, 2015)

We will study the techniques used to position a new venture or product/service offering within the framework of pre-launch, launch, and growth phases. We will also look at some exit mechanisms and spend some time on erecting barriers to entry.

Class Sessions

- 🏛️ June 24 – July 18: Online.

Learning Objectives

- 🏛️ Discuss the merits of an investment opportunity (Nobles Medical Technologies),
- 🏛️ Calculate the value of an exit opportunity (Alex Laats and NBX Corporation),
- 🏛️ Compute the value of an innovation under defined conditions (Performance Indicator),
- 🏛️ Debate the merits of a specific business model (Nobles Medical Technologies), and
- 🏛️ Contrast different forms of financing.

Assignments

- 🏛️ Read the following chapters (but not the cases at the end of the chapters):
Chapter 9: Facing Entrepreneurial Ventures Worldwide,
Chapter 10: Raising Money For Starting And Growing Businesses,
Chapter 11: Debt And Other Forms Of Financing,
Chapter 12: Legal And Tax Issues, Including Intellectual Property, and
Chapter 13: Entrepreneurial Growth.
- 🏛️ Submit a one page group paper addressing one of the following two questions:
If Bridgestone adopted the technology for their Precept brand, who would benefit the most and by how much?
If Alex sells NBX for \$100,000,000 dollars at the end of the case, how much money will Alex and his management team walk away with?
Grading Rubric:
 - Explain your approach to performing a calculation. (100 points)
 - Present your calculation. (100 points)
- 🏛️ Participate in the discussion board question:
Review the business of Nobles Medical Technologies (<http://noblesmedicaltechnology.com/home.html>). Perform some web searching. Is this a team you would back as an investor, why or why not?
- 🏛️ Quiz (50 points): There will be an on-line, end of module-timed quiz.
- 🏛️ Reflect: I will post:
A video discussing *Nobles Medical Technologies II* for your review, and
A video discussing the paper assignment.

TRANSCRIPTS

UNIVERSITY OF FLORIDA



105 Hough Hall
 PO Box 117150
 Gainesville, FL 32611-7150
 Tel 352-273-3208
 Fax 352-392-2086

POST-DOCTORAL BRIDGE PROGRAM TRANSCRIPT

PARTICIPANT INFORMATION	
NAME: Brian Abraham	PDBP COMPLETION DATE: July 26, 2015
DOCTORAL DEGREES: Chemistry	INSTITUTION: Tufts University

ACADEMIC RECORD		
AREA OF SPECIALIZATION: INTERNATIONAL BUSINESS & ENTREPRENEURSHIP		
COURSES	PROFESSORS	STATUS
Entrepreneurship	Michael Morris	Pass
International Finance	Andy Naranjo	High Pass
Strategic Management	Gwen Lee	Pass
International Business	John Kraft	Pass
Teaching with the case method	Fred Sturdivant	Pass
Negotiations	Robert Thomas	Pass
Teaching in Business Schools	Stephen Asare, Mahendrarajah Nimalendran, Craig Tapley, Robert Thomas, Tawnya Means	Pass
Business Ethics and Corporate Social Responsibility	Michelle Darnell	Pass
Teaching Entrepreneurship	William Rossi	Pass
Independent Literature Review	Michael Morris	High Pass
Career Portfolio	John Kraft	Pass
Participant Journals	John Kraft	Pass
Total Contact Hours*		280

* Contact Hours: Each of the four courses is worth 3 credits per course and involves 150 contact hours with 12.5 contact hours per credit. Five weekend meetings consist of a Friday, Saturday, Sunday schedule with 20 contact hours per weekend with a total 100 contact hours. The independent literature review involves 30 contact hours. PDBP participants are graded according to the following scale: High Pass, Pass, Low Pass, and Fail.

AACSB Certification: Upon successful completion of the Postdoctoral Bridge Program, graduates of the Postdoctoral Bridge Program acquire AQ (Academically Qualified) status based on the 2003 standards or SA (Scholarly Academic) status based on 2013 standards, granted through the AACSB for five years. AQ/SA status qualifies PDBP graduates to work as professors in business schools. For further information, please visit <http://www.aacsb.edu/BridgetoBusiness>

The Foundation for The Gator Nation
 An Equal Opportunity Institution



BABSON COLLEGE

BABSON COLLEGE, BABSON PARK, WELLESLEY, MASS. 02457-0310

Mr. Brian M. Abraham
 Id Number: 999-89-7132
 Entrance Date: 01/01/2000
 Date of Birth: 12/19/1965
 Report Date: 02/05/2015

Degree Granted: MBA
 05/18/2002 Summa Cum Laude

Program: Graduate
 Curriculum: Evening Program

Page 1 of 1

Course Id	Title	Grade	Hours	Points																		
Spring 1999-00																						
ACC7000	FIN ACCT THEORY	A-	3.00	11.01																		
MOB7010	ORGANZL BEHAVIOR	B+	3.00	9.99																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">21.00</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">3.60</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">21.00</td> <td style="text-align: center;">6.00</td> <td style="text-align: center;">3.50</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	6.00	6.00	21.00	6.00	3.60	Cumulative	6.00	6.00	21.00	6.00	3.50
	Attempted	Earned	Points	Divisor	GPA																	
Term	6.00	6.00	21.00	6.00	3.60																	
Cumulative	6.00	6.00	21.00	6.00	3.50																	
Summer I 1999-00																						
ACC7010	MGRl ASP ACCT	A	3.00	12.00																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">3.00</td> <td style="text-align: center;">3.00</td> <td style="text-align: center;">12.00</td> <td style="text-align: center;">3.00</td> <td style="text-align: center;">4.00</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">33.00</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">3.67</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	3.00	3.00	12.00	3.00	4.00	Cumulative	9.00	9.00	33.00	9.00	3.67
	Attempted	Earned	Points	Divisor	GPA																	
Term	3.00	3.00	12.00	3.00	4.00																	
Cumulative	9.00	9.00	33.00	9.00	3.67																	
Summer II 1999-00																						
QTM7010	STATISTICS	A	3.00	12.00																		
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	Attempted	Earned	Points	Divisor	GPA																	
Term	3.00	3.00	12.00	3.00	4.00																	
Cumulative	12.00	12.00	45.00	12.00	3.75																	
Fall 2000-01																						
ECN7000	MICRO FOUND BUSNS	A-	3.00	11.01																		
MKT7000	MKTNG SYSTEMS	A-	3.00	11.01																		
QTM7020	QUANT FOUND OF DS	B+	3.00	9.99																		
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	Attempted	Earned	Points	Divisor	GPA																	
Term	9.00	9.00	32.01	9.00	3.56																	
Cumulative	21.00	21.00	77.01	21.00	3.67																	
Spring 2000-01																						
ACC7576	COST SYSTEMS DESIGN	A	3.00	12.00																		
ECN7010	MACRO & MON SYST	A-	3.00	11.01																		
OPS7000	MANAGING OPERATNS	A-	3.00	11.01																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">34.02</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">3.78</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">30.00</td> <td style="text-align: center;">30.00</td> <td style="text-align: center;">111.03</td> <td style="text-align: center;">30.00</td> <td style="text-align: center;">3.70</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	9.00	9.00	34.02	9.00	3.78	Cumulative	30.00	30.00	111.03	30.00	3.70
	Attempted	Earned	Points	Divisor	GPA																	
Term	9.00	9.00	34.02	9.00	3.78																	
Cumulative	30.00	30.00	111.03	30.00	3.70																	
Summer 2000-01																						
EPS8570	EIT: IMMERSION	A-	1.50	5.51																		
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	Attempted	Earned	Points	Divisor	GPA																	
Term	1.50	1.50	5.51	1.50	3.67																	
Cumulative	31.50	31.50	116.54	31.50	3.70																	

Course Id	Title	Grade	Hours	Points																		
Summer I 2000-01																						
EPS8575	EIT OPPORT RECOG	A	1.50	6.00																		
FIN7000	MGRl FINANCE	B+	3.00	9.99																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">4.50</td> <td style="text-align: center;">4.50</td> <td style="text-align: center;">15.99</td> <td style="text-align: center;">4.50</td> <td style="text-align: center;">3.55</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">36.00</td> <td style="text-align: center;">36.00</td> <td style="text-align: center;">132.53</td> <td style="text-align: center;">36.00</td> <td style="text-align: center;">3.66</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	4.50	4.50	15.99	4.50	3.55	Cumulative	36.00	36.00	132.53	36.00	3.66
	Attempted	Earned	Points	Divisor	GPA																	
Term	4.50	4.50	15.99	4.50	3.55																	
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LAW7000	LAW I	A-	3.00	11.01																		
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	Attempted	Earned	Points	Divisor	GPA																	
Term	3.00	3.00	11.01	3.00	3.67																	
Cumulative	39.00	39.00	143.54	39.00	3.68																	
Fall 2001-02																						
EPS8571	EIT: EXPLORATION	A	3.00	12.00																		
EPS8572	EIT: INVESTIGATION	A	3.00	12.00																		
MOB7000	STRATEGIC MGMT	A	3.00	12.00																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">36.00</td> <td style="text-align: center;">9.00</td> <td style="text-align: center;">4.00</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">48.00</td> <td style="text-align: center;">48.00</td> <td style="text-align: center;">179.54</td> <td style="text-align: center;">48.00</td> <td style="text-align: center;">3.74</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	9.00	9.00	36.00	9.00	4.00	Cumulative	48.00	48.00	179.54	48.00	3.74
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Term	9.00	9.00	36.00	9.00	4.00																	
Cumulative	48.00	48.00	179.54	48.00	3.74																	
Spring 2001-02																						
ACC7580	RESEARCH	A	3.00	12.00																		
EPS8573	EIT: REFINEMENT	A	3.00	12.00																		
EPS8574	EIT: LAUNCH	A	3.00	12.00																		
MBA7385	GLOBAL TREND: LA	A	1.50	6.00																		
MOB7568	S. AMER BUS OPPOR	A	1.50	6.00																		
<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">Attempted</td> <td style="text-align: center;">Earned</td> <td style="text-align: center;">Points</td> <td style="text-align: center;">Divisor</td> <td style="text-align: center;">GPA</td> </tr> <tr> <td style="text-align: center;">Term</td> <td style="text-align: center;">12.00</td> <td style="text-align: center;">12.00</td> <td style="text-align: center;">48.00</td> <td style="text-align: center;">12.00</td> <td style="text-align: center;">4.00</td> </tr> <tr> <td style="text-align: center;">Cumulative</td> <td style="text-align: center;">60.00</td> <td style="text-align: center;">60.00</td> <td style="text-align: center;">227.54</td> <td style="text-align: center;">60.00</td> <td style="text-align: center;">3.79</td> </tr> </table>						Attempted	Earned	Points	Divisor	GPA	Term	12.00	12.00	48.00	12.00	4.00	Cumulative	60.00	60.00	227.54	60.00	3.79
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Term	12.00	12.00	48.00	12.00	4.00																	
Cumulative	60.00	60.00	227.54	60.00	3.79																	
End of Transcript																						

Linda E. Kean

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TUFTS UNIVERSITY

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Name: Brian Michael Abraham
Student ID: 1090006
Birthdate: 12/19/44#

Send To: Ms. Angie Holland
 University of South Florida
 PO Box 117150
 Gainesville, FL 32611

Degree: Doctor of Philosophy
Center Date: 05/23/1993
 Chemistry

Shuman College
 Bachelor of Arts

Graduate School of Arts and Sciences
 Chemistry (PhD)
 Course: CHEM 0193
 Description: Med Spain Health-play



Arts, Sciences, & Engineering
 Dowling Hall
 Medford, MA 02155

TUFTS UNIVERSITY
 Academic Record

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Print Date: 02/12/2015 Page 1 of 3

Term	Course	Description	Attempted	Earned	Grade
Fall Term 1988	CHEM 0031	Physical Chem I/White	1.00	1.00	C-
	CHEM 0081	Credit Excluded			
	CHEM 0151	Inorganic Chemistry I Credit Excluded Physical Organic Chem	1.00	1.00	B-
Spring Term 1989	CHEM 0141	Instrumental Analysis	1.00	1.00	B
	CHEM 0297	Graduate Research Pnd	5.00	3.00	
Second Summer Term 1987	CE 0207	Environmental Law	1.00	1.00	B-
	CEM 0297	Graduate Research Pnd	2.00	2.00	A
Fall Term 1989			2.00	2.00	
			7.00	5.00	
Term	Attempted	Earned	Grade		
Cumulative	1.00	1.00			
	1.00	1.00			

Tufts Credits

Second Summer Term 1987

Fall Term 1989

Spring Term 1989

Attempted **Earned** **Grade**

Term **Course** **Description** **Attempted** **Earned** **Grade**

Cumulative **1.00** **1.00** **B-**

1.00 **1.00** **A**

2.00 **2.00**

7.00 **5.00**

This officially sealed and signed transcript is printed on blue SGHS-START security paper with the name of the university printed in white type across the face of the document. A raised seal is not required. This graduation, term and five word CDPRV appear as a blind image. Request document a seal to the right is deleted.

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Arts, Sciences, & Engineering
Downing Hall
Medford, MA 02155

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Academic Record

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Name: **Brian Michael Abraham** Birthdate: 12/19/48##

Print Date: 02/12/2015 Page 2 of 3

Course	Description	Term	Attempted	Earned	Grade
CHEM 0248	Spec Topic Analytic Chem	Spring Term 1990	2.00	2.00	A
CHEM 0298	Graduate Research Prod	Cumulative	9.00	7.00	A
Graduate School of Arts and Sciences Chemistry (MS)					
CHEM 0193	Special Topics	Fall Term 1990	1.00	1.00	A
CHEM 0193	Special Topics	Cumulative	10.00	8.00	A
Graduate School of Arts and Sciences Chemistry (PhD)					
CHEM 0502	Doctoral Degree Cont.	Spring Term 1992	0.00	0.00	...
CHEM 0502	Doctoral Degree Cont.	Cumulative	13.00	11.00	...
Graduate School of Arts and Sciences Chemistry (PhD)					
CHEM 0502	Doctoral Degree Cont.	Fall Term 1992	0.00	0.00	...
CHEM 0502	Doctoral Degree Cont.	Cumulative	13.00	11.00	...
Graduate School of Arts and Sciences Chemistry (PhD)					
CHEM 0502	Doctoral Degree Cont.	Spring Term 1993	0.00	0.00	C/AB
CHEM 0502	Doctoral Degree Cont.	Cumulative	12.00	10.00	C/AB

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 Academic Record

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Name: **Brian Michael Abraham**
 Student ID: **10900085** Birthdate: **12/19/1988**
 Term: **Attended** Earned: **0.00**
 Cumulative: **13.00** **11.0**

Totals: **13.00** **11.0**

DISSERTATION TITLE:
 DEVELOPMENT OF AN ON-SITE GAS CHROMATOGRAPHY MASS SPECTROMETER FOR RAPID DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS AND POLYCHLORINATED BIPHENYLS AT HAZARDOUS WASTE SITE

End of Transcript



This document is sealed and signed/transcript is printed on plain SECURITY STAR® security paper with the name of the university printed in white type across the face of the document. A metal seal is not required. The institution name and the word COPY appear as a blind image. Help document is sealed to the right is colored.

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