Class I – 2000

Strategic Sourcing of Product Development Services - A Decision Making Framework
Neil Dempsey, Salvador Barragan-Perez (both from Xerox), and Charles Cappellino (Goulds Pumps); Sandra Rothenberg, faculty advisor; Rich Penwell (Xerox) and Barry Erickson (Goulds Pumps), industry advisors. (This project was presented at the Management Roundtable conference on Product and Process Leadership in Boston, April 2001, and published in the Journal of Supply Chain Management).

Execution of an extended enterprise sourcing model for product development services is an essential endeavor in today's highly competitive and fast paced global economy. This project explores the critical challenges that must be overcome as companies seek to implement the extended enterprise, including supplier capability assessment, the impact on maintenance of technical competencies, and confusion over roles and responsibilities. A four-step framework is developed to assist product development managers in making effective sourcing decisions.

The Governance Mechanisms that Influence the Success of International Strategic Alliances
Ed Solcz, Mike Piccirilli, and Bill Williams (all from Xerox); Sue Hartman, faculty advisor; Charles Gardiner (Xerox), industry advisor.

This project examines three primary factors that influence the success of international strategic alliances: the selection of an alliance partner, the choice of organizational form or governance structure, and the management processes used to govern the relationship. A diagnostic/prescriptive tool is developed to determine the likelihood of alliance success. Along with a concise set of lessons learned, utilization of the tool will enhance the probability of success for future alliances.

Collaborative Design and Development to Accelerate Durable Goods Design and Manufacturing
Gary Faguy, Tom Lambert, David Thompson, and Kris Walker (all from Xerox); John Ettlie, faculty advisor; Tony Federico and Audrey Pantas (both from Xerox), industry advisors.

The ever increasing demand for new products at benchmark quality levels necessitates the engagement of partners. Enabled by the Internet and advanced software, a new breed of collaborative design tools is emerging that will solve many of the problems experienced while partnering. Our research shows that two major organizational limitations must be solved in order for assembled products companies to embrace these critical tools: 1) internal resources must be optimized by creating true concurrent design practices across global geographies, and 2) partnerships must be extended in an effort to virtualize resources.

Applying Self-Organizing Principles to Product Development in a Globally Distributed Environment
Mike Monahan, Gene DiTomasso, and Tony Fantanzo (all from Xerox); Paul Stiebitz, faculty advisor; Dave Zawadzki (Xerox), industry advisor.

Command and control style management is often too slow or inefficient to manage complex organizations in a turbulent marketplace. There is a tendency for these organizations to suffer from process paralysis. Globalization of product design among business partners in a web-based environment represents a paradigm shift in new product development which requires fundamentally new ways of architecting, designing and manufacturing products. This project examines ways in which governing principles of complex adaptive systems can be utilized to improve the architecting, design and management processes of products developed in globally distributed environments.

Technology Infrastructure Services at Customer Sites
Anthony Nozzi and Amy Opela (both from Xerox); Sudhakar Paidy, faculty advisor; Jack Hennessy (Xerox), industry advisor.

Employees located at customer sites often do not have access to electronic information services provided to employees at internally connected sites. This project undertakes the development of an information systems architecture that enables the delivery of employee services and access to internal corporate resources at remote sites. A business and technical feasibility analysis forms a solid foundation for full-scale development and implementation.
Platform Element Dynamics in a Multi-Product Development Environment
Hamidah Mansor and Mark Troia (both from Xerox); John Ettlie, faculty advisor; Tony Federico (Xerox), industry advisor.

One popular approach designed to improve product delivery and lower cost is to develop a family of products based on a common platform. Despite mounds of literature and years of industry experience associated with platform implementation, there continue to be significant challenges with this approach. In this project a strategic framework is constructed to evaluate the factors affecting platform strategy. A structure is provided to assess the platform development process against its organizational infrastructure and in the context of continuous technology evolution. New ideas are forwarded to improve the platform development process and identify a complementary organizational infrastructure. A technology roadmap for future platforms is also identified.

The Application of Software Process Improvement (SPI) and CMM to the New Product Development Process and Financial Results
Anthony Bradley and Chris Shafer (both from Xerox); Mike Lutz, faculty advisor; Steve Schlonski (Xerox), industry advisor.

SPI initiatives are commonplace in today's software development companies. Logically, these initiatives should translate into more efficient product development and, therefore, to improved productivity and cost savings. This project examines SPI activities in a number of companies to determine financial impact and NPD process performance impact. Guidelines are provided to help managers make intelligent decisions about the application of CMM to SPI initiatives as a function of organizational size and structure, project type and scope.

Class II – 2001

Application of a Model for Effective Personality Profiling of Key Decision Makers for Use in Competitive Intelligence
Nancy Dibella (Kodak), Bob Gerardi (Xerox), Peter Kelch (Kodak), and Bill Messner (Veeco-CVC); Bob Barbato, faculty advisor; Tim Kindler (Kodak), industry advisor.

Developing models that forecast competitive behavior provides important strategic advantages. Unfortunately, a key decision maker's personality and style of thinking are absent from most competitive intelligence models. This paper builds upon an established model for personality profiling and develops a process for gathering, analyzing, and characterizing the behavioral pattern of key decision makers. A scorecard is proposed and the process validated through case studies.

Methods for Improving the Technology Readiness Assessment Process within New Product Development
Nick Evevsky (Xerox), Tom Maurer (Xerox), and Tom Wright (Kodak); Wayne Walter and Lou Fantozzi, faculty advisors; Alex Horvath and Bill Atkinson (both from Kodak), industry advisors.

Although significant improvements have been made to stage-gate processes and tools, may commercialization projects still fail as a result of inadequate risk assessment and risk management associated with new technologies. The authors identify several opportunities to improve the effectiveness of technology readiness assessment activities. A model is developed to address these opportunities, and a methodology is proposed for applying the decision model to existing stage-gate processes. The model is tested and verified on twenty projects.

The Role of Architecture in Defining the Business Strategy for New Product Development
Jeff Drawe (Xerox), Dave Erdtmann (Kodak), and Mary Roux (Xerox); Paul Stiebietz, faculty advisor; Nancy Rees (Xerox), industry advisor.

In search for sustainable growth, mature companies continually formulate new business strategies. At the same time, these companies are exploring new product architectures and technologies as a source of competitive advantage. Oftentimes, unfortunately, these activities take place independently because companies fail to comprehend the interdependencies. In this paper, a framework is presented that identifies key aspects and architectural decisions needed by firms to develop radically new business concepts. Three case studies are analyzed and were found to support the hypothesis that product architecture decisions play a critical role in building new business concepts.
Linking architecture with business concept development allows companies to consider the entire value stream in its NPD strategy.

**Technology Clusters - Improving Technology Transfer**
Anne Bohan (Kodak), Lisa DeLouise (Xerox), and Paul Wegman (Xerox); Richard DeMartino, faculty advisor; Bud Hippisley (PIANY), industry advisor.

Regional industrial specialization has long been a recognized phenomenon, but the utilization of industrial clusters as a framework for economic development has not been exploited until recently. This paper explores the tenets of industrial cluster theory and applies them to the Rochester regional photonics cluster, to better understand the underpinnings of the cluster and to identify barriers to economic growth. A framework is developed and used to derive recommendations for facilitating growth of the Rochester regional photonics cluster.

**Practical Guide to Assessing Organizational Readiness for Capitalizing on Virtual Teams**
Joe Hancock (Xerox) and Mark Jankowski (Cliftronics); Sue Hartman, faculty advisor; Mark Kowalski (Cliftronics), industry advisor.

The use of virtual teams in new product development has many established benefits; however, organizations have had difficulty implementing virtual teams with any level of consistency. This paper presents a practical new tool, called the Virtual Teaming Scorecard, to help project managers assess whether their organization is capable of leveraging virtual teams to meet project objectives. Decision criteria are provided, along with decision support and real-world examples for each assessment characteristic. A case study illustrates utilization of the scorecard to predict the likelihood of success in a product development program.

**Start-up Acceleration of NPD**
Jodi Aboujoudi (Xerox), Joe Rouhana (Xerox), and Mark Muscato (Xerox); Sandra Rothenberg, faculty advisor; Ron Ippolito (Xerox), industry advisor.

Increasingly complex products and shorter product development cycle times impose significant challenges for teams and managers. This Capstone project seeks to better understand root causes associated with sluggish performance early in a project's life cycle. An in-depth examination of a recent project is undertaken along with historical data analysis from 180 other projects. Suggestions are offered for addressing the sources of slow progress during the early stages of NPD.

**Selecting Winning Product Ideas in Mature Manufacturing Companies**
Mark Amico (Xerox), Sue Burek (Kodak), and Zhenze Hu (Bausch & Lomb); Stelios Zyglidopoulos, faculty advisor; Gary Allen (Kodak), industry advisor.

This project examines the extent to which a popular screening tool can be applied to mature industries, and looks for opportunities to enhance the underlying model. Several hypotheses are developed and tested against data collected on 21 projects from three companies. Results from the study are utilized to adjust the model and provide recommendations for mature companies interested in improving their idea selection processes.

**Radical Innovation: An Analysis of Strategy and Capabilities of Corporations in Upstate NY**
Nick Ganzon (Goulds Pumps), Mike Moorehead (Bausch & Lomb), and Jack Rieger (Kodak); Bob Boehner, faculty advisor; Gary Einhaus (Kodak), industry advisor.

Established companies are usually successful at incremental innovation but have difficulties with radical innovation characteristic of new or unstable markets. Qualitative research based on interviews and published data were collected from five companies in upstate New York. Based on these studies, the authors describe best practices, and practices to avoid, to help companies create a culture of radical innovation that can coexist with capabilities for incremental innovation. A radical innovation capability model is proposed to enable companies to track progress in capability development.

Class III – 2002
Radical Innovation in Medium Size Companies
Patricia Dwyer (Kodak), Connie Treese (Xerox); Richard DeMartino (RIT) and Heidi Neck (Babson College), faculty advisors; Jim Russell (Xerox), industry advisor.

Unlike large enterprises and small startup companies, medium-sized firms ($100-$500MM in revenues) have been below the radar screen with respect to investigations of their unique challenges and assets for innovation implementation. Like large firms, medium-sized firms have institutionalized process-oriented structures to some degree. Like smaller companies, medium-sized firms have limited resources to support R&D or to defend commercialization of groundbreaking products. This exploratory study examines radical innovation in medium-size firms to uncover contextual issues unique to firms in this size category. Specific focus areas include: strategic view of radical innovation, decision-making framework, metrics utilized to approve and track projects, team structure, and other operational aspects of innovation.

An Exploration into the Fuzzy Front End of Innovation
Dhirendra Damji (Xerox), Scott Latona (Branson Ultrasonics), Rajesh Mehta (Kodak), Eric Mundt (Gleason); Bob Barbato (and John Striebich), faculty advisors; Zaki Mustafa (AirFlow Catalyst Systems), industry advisor.

A firm's ability to balance its efficient and rational tendencies against its entrepreneurial drive and innovation process has a strong influence on a company's ability to create new products. This paper examines the least understood segment of the innovation pipeline, the initial stage of the pipeline or fuzzy front end. By drawing strong parallels between the entrepreneurial process and the processes at the front end of the innovation process, and validating them with primary data, the authors offer a new framework for the fuzzy front end along with suggestions to help companies improve.

Strategic Alliances: Dynamic Factors That Can Change a Firm's Competitiveness
Mike Flood (Xerox) and Melissa McCullough; Sandra Rothenberg (and Stelios Zyglidopoulos), faculty advisors; Joe Gunzelmann (Xerox), industry advisor.

Strategic alliances have become an essential component of corporate business strategy, yet statistics suggest that up to 70% of alliances fail to deliver on their objectives. The authors examine the dynamic behavior of alliances, with an emphasis on those factors which originally influenced alliance formation. A framework for analysis of an alliance's environment is provided, and five cases are studied to test validity of the model and provide recommendations for alliance formation and management.

Creating Competitive Advantage in Commodity Markets: The Implications of Product Modularity on the Product Development Process
Johanne Korrie and Terry Street (both from Xerox), Giana Phelan (Kodak); Bob Boehner, faculty advisor; Daniel McCue (Xerox), industry advisor.

As the basis of competition moves away from features and functions to price and product variety, it becomes too complex, time-consuming, and expensive to develop integrated products. Consequently, companies must eventually modularize their designs; yet, the ability to create a product-based differentiation strategy is difficult in industries with modular product architectures. This paper examines how leading firms that compete in modular markets sustain competitive advantage, and how their product differentiation methodology affects the product development process. Six distinct approaches are identified and then examined at firms that have successfully adopted each approach.

Discovery of Hidden Assets in Large and Small Companies
Jim Abraham (Vanlab), Matt Lowenstein and Win Trafton (both from Kodak); Sue Hartman, faculty advisor; Karel Czanderna (Whirlpool), industry advisor.

Traditional methods of coupling a company's capabilities with the needs of customers are well known, yet maintaining a competitive advantage through these capabilities is a constant concern. Adrian Slywotzky and Richard Wise in, "The Growth Crisis and How to Escape It" have coined the term "hidden assets" and described how companies can leverage these assets to provide solutions that meet higher-order customer needs. This paper focuses on a methodology to help uncover a company's hidden assets, one that considers core competencies, strategic assets,
capabilities, and strategic alignment. Hypotheses are tested through interviews at a series of large and small companies.

Class IV – 2003

Disruptive Indicators and an Early Warning Methodology
Peter Cucci (Xerox), Greg Eisenbach (Kodak), Megan Weiner (Kodak); Robert Boehner, faculty advisor; Edward Mauro (Kodak), industry advisor.

Clayton Christensen has shown how disruptive innovations can affect an incumbent company's products and competitive position. This paper explores whether or not a disruptive event is predictable. In particular, conditions are examined under which radically different customer solutions and business models are required to compete. Using Geoffrey Moore's technology adoption model in conjunction with Christensen's theory of disruptive innovation, three case studies are critiqued and early indicators identified. These indicators are then applied to a situation that is predicted to happen, to demonstrate that organizations can respond proactively.

Tacit Knowledge Transfer -- The Integrator's Dilemma
Ted Foos (Bausch & Lomb), Gary Schum (Kodak); Sandra Rothenberg, faculty advisor; Cheryl Kisicki (Bausch & Lomb) industry advisor.

This project centers on the challenges associated with internalizing and integrating tacit knowledge from an external partner. The authors investigate factors such as contracts, due diligence, and trust, that may influence the transfer of tacit knowledge from one organization to another. Suggestions are made for improving transfer and retention of tacit knowledge to improve the success of alliances and acquisitions.

A Commercialization Framework for Making Strategic Make, Buy, and Sell Decisions
Dan Czuprynski (Kodak), Wayne Didas (Kodak), Lisa Simpson (Bausch & Lomb); Sue Hartman, faculty advisor; Gary Einhaus (Kodak), industry advisor.

This project is focused on providing a strategic framework for make/buy/sell decisions. Areas investigated include decision making, new product commercialization, and value chain participation with the goal of developing a collection of recommended practices for the firm to improve their make/buy/sell decision making capability. A strategic framework is provided for integration with the product commercialization process. Four industry segments were researched to learn how decisions are really made. These decision models were evaluated against recommended practices and a newly developed decision making maturity model.

Class V – 2004

Creating Competitive Advantage in Commodity Markets: The Implications of the 4th Stage of Basis of Competition and Product Modularity on the Product Development Process
Johanne M. Korrie, Giana M. Phelan, and Bob Boehner.

Clayton Christensen describes the evolution of markets in terms of a shifting basis of competition. Christensen defines "Basis of competition" as the primary criteria used by mainstream customers in making purchase decisions. Christensen observes that as markets mature the basis of competition shifts from product functionality to reliability, then to convenience and ultimately to price. We have observed that the fourth stage in the basis of competition is price plus product variety.

Organizational Culture And Quantitative Tools
Garthel D. Larkin, Mark Trzyzowski

The Research Team endeavored to study the question: Is there a linkage between Organizational Culture and the use of Quantitative Tools in New Product Development organizations? Clearly, practitioners of management science know the benefits of using such Quantitative Tools, but experimental evidence could not be found through a literature search. For this reason, the study was modeled to collect evidence that would connect aspects of
Organizational Culture to persons that are capable users of Quantitative Tools. Two Survey methods were used to gather data for correlation analysis. Both quantitative and qualitative techniques were used.

**Examining the Implications of the Integral / Modular / Re-integral Hypothesis of Product Architecture: A Study of the Contemporary Camera, Automobile and Disk Drive Industries**  
*Joseph Miska, James Nargi, and Mary Schlitzer*

Generally, in the early stages of the evolution of a product and the supporting industry, products tend to be integral in design and architecture. Typically a single company or several working independently will develop a whole new product and bring it to market. The companies are often vertically integrated and the products are usually tightly integral in nature, meaning that the design and performance of one part of the product is very dependent on the design and performance of the rest of the product. It is also well accepted that, as products mature and evolve and as new players enter markets; technologies will disperse; products will develop modular architectures; outsourcing of components, modules, manufacturing or all three will become the norm; and product designs will tend to converge around a standard, modular architecture.

**Class VI – 2005**

**Using Technological Growth Curves for Business Decision Making**  
*Matile D. Malimabe*

In this paper, a methodology is presented for improving product forecasting by integrating already established methods of forecasting technological product diffusion. The goal is to present them in a manner that will be easier for a general manager to understand the forecasts and therefore make the right decisions regarding product development and deployment in the market place.

"What is the Right Platform Development Strategy for a Small, High-Tech Company?"  
*Brian J. Bessel, Thomas A. Patrick, and Kenneth A. Rosys*

New, innovative products are the lifeblood of any company. This is especially true for small companies that need to rapidly develop and deliver new products to satisfy the "hand to mouth" nature of their operation. Our experience is that platform developments are done differently in small companies as compared to large companies. We believed that this is true for most, but not all, small, high technology companies.

**Strategic Thinking and Resource Management in Small to Mid-Size Printing Companies**  
*Robert Strach and Jeff Miller*

In today's increasingly competitive business environment, characterized by global competition, global markets, and fragmentation in many industries, it is imperative that firms have a clear strategy for meeting organizational goals. Strategy, within the scope of this study, is defined as the process of creating fit between the firm's value creating resources and capabilities and a specific target market. Small to mid-size companies (SME's) in the printing industry are faced with even a larger challenge in strategic planning, with limited resources available to focus on developing formal strategies and the impact of making incorrect decisions. Very little research has been conducted within the printing industry to identify how small companies develop strategic plans and make decisions for the future. Interviews with industry trade associations (PIA/GATF, FTA and TLMI) indicated that there is little assistance available for planning due to the diversity within segments. The associations offer assistance with general management issues that apply industry wide, but assistance is not available for making the difficult decisions associated within niche segments.

**Class VII – 2006**

**Convergence of Market and Technology Opportunities in Derivative Product Development: A Project Selection Framework**  
*Carol-Lynn Goldstein, Matthew R. McLaughlin, and Jeanne M. Wesline*
Firms today increasingly seek to leverage product platforms via derivative product versions of the base platform, but successfully doing so is a significant challenge. Numerous enablers are required, such as robust product development processes, effective and well trained organizations, R&D activities that are aligned to support product strategies, and a clearly defined corporate strategy. In derivative product development, however, firms struggle with identifying the optimum derivatives to develop and bring to market. Evaluating which feature functions to improve upon, which technologies to incorporate, which markets to pursue, and ultimately which derivative product to develop is an uncertain proposition that has huge implications on future profitability. There exist numerous tools and processes whose purpose is to provide guidance in these activities, yet a limited number are known to apply specifically to derivative product concept generation and selection. More importantly though, through extensive literature research, we have observed the lack of a complete process to guide firms in this regard. It is the intent of this capstone project to offer a foundation for such a framework. Case studies performed with leading firms involved in platform product development have provided insight into common pitfalls, issues, and countermeasures to these. Our research has lead us to propose a generic derivative concept generation and selection framework, that while not a fully enumerated process, is nonetheless intended to be the basis for additional contribution and refinement.

Partnering to Productize Technology: Putting Best Practices to Test in Developing and Launching New Products
Ravi K Nareppa and David S. Shuman

Having performed an in-depth review of available literature on the topic of innovation and partnering, one could conclude that there are many companies that systematically process ideas and incorporate them into new products. While examples abound of larger companies performing collaborations, we became curious about how concepts and inventions can be passed from the unaffiliated inventor to the corporate world. Cases where individual or small teams of inventors were able to find a home for their technology with large companies were few. Thus it was decided that perhaps the best way we might gain in-depth knowledge on this topic was to develop a product of our own and try to make some contacts with potential partners.

Open Innovation Inside & Out: Recommendations to Xerox & Delphi
Nancy Jia, Shelly Hamilton, and David Anderson

Since Henry Chesbrough coined the term Open Innovation in his 2003 book Open Innovation: The New Imperative for Creating and Profiting from Technology, Open Innovation has become a buzz phrase in the business world and numerous publications have been released on the topic. Unfortunately most of the literature is limited in scope to the aspect of Open Innovation which deals with leveraging ideas originating outside the four walls of the firm and in general fails to provide practical advice from an established firm's perspective.

New Process Implementation: A Multi-Dimensional Approach
Jason R. Calus, James M. Ellis, and Brian R. Fletcher

In December 2004, the authors of this Capstone enrolled in Rochester Institute of Technology's Master of Science in Product Development program, representing their sponsoring organization, ITT Space Systems Division. Over the past two years, the Capstone authors participated in this innovative, interdisciplinary leadership program that emphasizes cross-functional, end-to-end product development. Despite their varied educational backgrounds, the authors discovered that they have a common area of interest, that being change management. With that in mind, the authors employed a team-based approach in relation to the Capstone, in order to benefit from each other's experiences and abilities. Additionally, the team recognized that to maximize their graduate education, it would be beneficial for the Capstone to incorporate a case study involving a recent change at Space Systems Division. The subsequent paragraphs, within this Executive Summary, provide the background regarding the Capstone's real-world scenario.

Achieving Growth for Large Pharmaceutical Corporations through Strategic Licensing
X. Michael Liu

Product development in the pharmaceutical industry has become a lengthy, risky, costly and extremely complex process. Few pharmaceutical companies today have the breadth of internal proficiency and resources required to continuously develop sufficient new products to keep their pipelines filled. Many large pharmaceutical corporations
have utilized mechanisms such as licensing, alliances and acquisitions to obtain new products/technology and fuel growth.

Class VIII – 2007

Growth as a Process: Leveraging PSG's Core Business to Achieve Growth Through Innovation and Adjacencies
_Alicia Campbell, David Cipolla, and Rod Proulx_

The Xerox Production Systems Group (PSG), like many other businesses today, experiences the pressures to grow in a competitive environment, while continually focusing on cost reductions and improving existing technologies. While operational efficiency is critical to optimizing profits of a business it is equally important to increase top line growth to perpetuate the business. Ironically, demands from financial markets can entice management teams into having a shorter than optimal time horizon when dealing with sustainable growth. Some companies, including Whirlpool and Pitney Bowes, have found methods of growth through innovation processes that are sustainable over time. Our challenge, and the purpose of this capstone project, is to understand the methods and processes of companies that have used innovation to achieve success. And from these processes and our understanding of the PSG innovation processes and culture, we will choose the elements that best fit within the PSG environment, and synthesize these elements into a single sustainable innovative process to drive growth from the core.

Knowledge Transfer: Developing a Framework for Knowledge Transfer within the Product Development Process
_Timothy Carter, Michael Lopez, Kimberly Wayman_

Success in product development is essential to a corporation's survival. To succeed in product development a corporation must effectively transfer the knowledge created during the development of its products from one development phase to the next. Many corporations today are dying because they are not exploiting the knowledge that lies beneath their feet. The necessity to transfer explicit and tacit knowledge more effectively has intensified in recent years due to the changing landscape of new product development and the increase in global competition. The accelerated rate at which technology is changing has significantly reduced the product development life cycle. This paper will concentrate its efforts around Corning Incorporated and Sensis Corporation.

Foundations for Strategic Outsourcing
_J. Hunter, M. Raymond, and D. Wood_

It is no longer the question of when or if your company is going to outsource, it is now a matter of how you execute your plan, such that you and your outsourcing partner both come out winners. Many companies have fallen victim to the ideology that great fortunes can be saved by outsourcing. Through lack of knowledge, not evaluating the long-term big picture, poor planning, or other reasons - companies are spending more to outsource than originally intended or just plain failing such that both parties lose.

New Process Implementation: A Multi-Dimensional Approach
_Jason R. Calus, James M. Ellis, and Brian R. Fletcher_

In December 2004, the authors of this Capstone enrolled in Rochester Institute of Technology's Master of Science in Product Development program, representing their sponsoring organization, ITT Space Systems Division. Over the past two years, the Capstone authors participated in this innovative, interdisciplinary leadership program that emphasizes cross-functional, end-to-end product development. Despite their varied educational backgrounds, the authors discovered that they have a common area of interest, that being change management. With that in mind, the authors employed a team-based approach in relation to the Capstone, in order to benefit from each other's experiences and abilities. Additionally, the team recognized that to maximize their graduate education, it would be beneficial for the Capstone to incorporate a case study involving a recent change at Space Systems Division. The subsequent paragraphs, within this Executive Summary, provide the background regarding the Capstone's real-world scenario.

Immersion & Iteration: Leading Edge Approaches for Early Stage Product Planning
_Christopher Bondy, Jack Rahill, and Michael L. Povio_
Developing and delivering products that truly delight customers is surprisingly more of a unique occurrence than most would believe. Amongst the vast array of mediocre products reside a few elite products that customers truly seek out to acquire beyond anything else offered in the marketplace-these products are truly "breakthrough" products. Breakthrough in that they provide customer benefits that address the unmet and unspoken wants and needs of the customer. Breakthrough products deliver value in a manner that excites the customer by the almost intuitive way these products resonate with their real world requirements. From the developers' perspective, breakthrough products define markets, steal market share and deliver better profit margins than incremental products that only provide sustaining business results.


*Diego A. Pereda, Joel Spano, and Roderick F. Zimmerman*

To win in the marketplace, manufacturers must develop product or services that are differentiated from all the others in a manner which resonate with the end user. Understanding the customer and how to meet their needs is more important than best practice and process efficiency. Some studies suggest as many as 40% of projects fail because of failure to understand the customer needs. {Bove, 1994, p.57} There is evidence that suggests understanding customer needs is the foundation for delivering a successful product. The work of Hewlett Packard's manager Edith Wilson, Don Clausing and the by The MIT Commission on Industrial Productivity are used to validate the importance of understanding customer needs to develop successful products.

**Effectively Integrating Design Thinking into the NPD Process**

*Dale Ryan, Ellery Wong & Tom Pierce*

Current front-end processes for product concept generation are generally stuck in over-analytical methods that only yield either easily-duplicated incremental innovation or highly risky radical innovation. Incremental innovation is usually driven by Marketing, which is listening to the firm's current set of customers and looking to merely extend the firm's already-successful products. Radical innovation is usually driven by new technology from the R&D department, championed by an executive as a pet project. Without deep knowledge of customers' needs, the tech-driven innovation will likely not sell. Without input from new technology, the customer-driven innovation will never find new customers and markets. We need to bring together the questions of "What can we do?" and "What do customers need?" to answer the fundamental question of "What is the best product for us to develop?" However, even getting the Marketing and R&D people together is insufficient.

**From Products to Services: A Case Study on Transitioning to Services-led Strategy**

*Jeffrey Earl, Steve Hart, David Lomenzo*

Performance is the initial basis of competition because when new products emerge, they are generally focused on pure functionality. For example, during the 1970s rigid disk drive manufacturers competed based on hard disk capacity because mainstream customers, who were mainframe computer makers, demanded capacity. Other attributes were important in defining the minimum configuration required to "play the game" - such as a 14" diameter form factor - but the key differentiating attribute was drive capacity. Performance overshoot occurs because the trajectory of product improvement is generally steeper than the trajectory of customer demand.

**Challenges in Incorporation Sustainability into Product Development**

*S.A. Athalye, S.K. Govindarajan, C.A. Lopez*

Our study began with an overview of the role of internal factors in how a firm implements a sustainability strategy. We conclude that, in general, the literature was too normative to guide implementation of a corporate sustainability strategy or initiative at the level of the product development value chain. Therefore, we sought to understand how senior and mid-level managers in a business division actually implement such a strategy. Using a qualitative approach, we studied two business divisions at two different large, multinational firms that are relatively early in their development of an integrated sustainability strategy. Our findings provide insight into the role of internal factors at the level of a business division as it attempts to incorporate sustainability into product development.
Technology Transfer: Does Company Size Matter? A Comparison of SME's vs. Large Corporations
James Apolito, Shawn Chawgo, Jennifer Rice

The following capstone begins with an evaluation of scholarly works in an attempt to characterize the current state of the art on the subject of technology transfer, particularly with regard to transfer programs and practices which aid SME's in commercializing new technologies. A survey was then conducted with three large firms who develop highly differentiated products and are known in their respective industries as leading-edge producers. The questions asked during the survey were carefully chosen to unveil both best practices and shortcomings encountered during their transfer efforts. The same survey was then given to seven SME's for the same reason as stated before. The results of the surveys in combination with information gathered from the current knowledge base was then used to develop a model that could be implemented to assist companies of all sizes in the commercialization of new technologies. Also, key enablers of technology transfer will be identified and discussed.

Class X – 2009

Commercialization of Radical Innovation
Charles Dickinson, Kevin Kolmetz, Michael McVeigh, John Solpietro

This Capstone project looks at a Rochester start-up nanomaterials company, Cerion, and a potential product offering that they are considering commercializing. This product could be considered a "radical innovation", and Cerion would be attempting to bring it into a very established market - the catalytic converter industry. The Capstone team has looked at relevant academic literature for advice on how to do such a thing, in addition to doing some market research to help advise Cerion as to whether or not it is worth bringing to market. We will be presenting our findings and recommendations at the Capstone presentation.

Developing New Products For Emerging Markets: A Competency Based Approach
K.C. Kang, M.M. Place, D.R. Seyler

Our research covers the development of new products designed for the "middle class" in emerging markets which represent an attractive segment for Multi-National Corporations (MNCs). When Goldman Sachs first published their landmark paper in 2003 ("Dreaming with BRICs: The Path to 2050"), an emerging middle class of more than 250 million was estimated. By 2007, the emerging middle class reached 400 million and is rapidly growing towards the number estimated by Goldman Sachs for the year 2013; 800 million. If that forecast holds true, by that date the BRIC countries will have a total middle class size larger than the population of Western Europe, USA and Japan combined. (BRIC = Brazil, Russia, India, China). Unfortunately, MNCs are strategically disadvantaged in developing new products for the emerging BRIC markets due geographical, economic, social, culture, infrastructure and governmental differences. The lack of solid market data forces MNCs to develop Country Portfolio Analysis by extrapolating inferences from macro economic data such as GDP, levels of consumer wealth, and peoples propensity to consume. These approaches can result in inaccuracies and are symptoms of a larger root cause - MNCs often rely on predictable business models and transpose basic assumptions of their home market, usually developed countries, to BRIC. To become a market leader, MNCs must seriously look at their business model and strategic framework that has been built on years of experience in developed markets. Our work suggests that deeply embedded values, processes and resources will need to be adjusted. BRIC should be viewed through a different lens and the business model modified to win in Emerging Markets.

"Holistic Approach to Lessons Learned in the New Product Development Process"
Matthew Pankow, Michael Sculley, and Robin Louvain

It is the assertion of the authors that in order to be effective at organizational learning, a company needs a more structured, holistic approach to its lessons-learned process. This approach needs to be built on a foundation of strong management support and a culture where learning is promoted. The formal lessons-learned process needs to be integrated into the product development process throughout the project: leveraging lessons learned at the start of the project, lessons learned during project execution, a post-project review that focuses on the processes used to implement the project and a post-launch review that looks at the result of the product in the market. The holistic approach must learn from the results and put these lessons into action.
Leveraging Production Waste Streams: Enablers of Successful By-Product Exchange — An Exploratory Study
Trevor Gyles, Alicia Mruthyunjaya, Franly Sanchez, Jerry Valentino

As the topic of sustainability continues to gain momentum, companies are seeking ways to integrate beneficial methods into their product development process. These initiatives need to cut across all the functions within the organization. Decisions made throughout the product development process affect the sustainability of the product from raw material extraction, to production process impacts, to end of life disposal. Each organization within the product development cycle needs to understand the impact their decisions have on the environment. Our research begins with the study of industrial ecosystems, focusing on the positive impacts they have on the sustainability and the value they provide participants. By utilizing waste as raw materials, companies can continue to cycle technical and biological nutrients eliminating the scatter of these to the natural environment. If more of these relationships are established, resources will be used more optimally across the entire ecosystem. Our research focuses on the characteristics that enable these exchanges to occur and provides insights on the role product development is playing in this realm.

Class XI – 2010

Decision Criteria for Backshoring or Retaining Advanced Manufacturing, New Product Development, and R&D Activities Onshore
Linn Hoover (Xerox), Derek Schmitt (Xerox), Matthew Ochs (Xerox)

There is emerging evidence of companies "backshoring" work that had previously been offshored as well as companies retaining advanced manufacturing, new product development, and R&D “onshore”. This capstone project identified twenty decision criteria cited by companies for retaining or backshoring these activities to the US, and defines units of measure for each criterion. A decision-making process is proposed including concept selection and decision modeling tools to assist senior managers as they evaluate options regarding onshore/offshore or offshore/backshore.

Inefficiencies in Management Customer Software Problems: A Case Study on Opportunities to Improved the Customer Software Problem Management Process
David Campbell (Xerox), Alan Dawson (Xerox), Timothy Dioguardi (Xerox)

This paper discusses the complexities of software and how companies manage the customer software support process, to identify inefficiencies and to formulate improvement strategies. Common issues include ineffective communication, decentralized information technology (IT) systems, and a lack of dedicated software maintenance teams. Opportunities exist to improve the customer software problem management (CSPM) process which can provide competitive advantage through the efficient resolution of customer software problems.

Identifying Success Factors for Inter-firm Online Collaboration Within the New Product Development Process
James Guentner (Xerox), Matthew Hoffmann (Xerox), and Seth Merritt (Xerox)

Online collaboration and the success factors that enable its adoption within an extended new product development (NPD) team are not well understood, causing companies to underutilize social media within the NPD process. This paper attempts to understand whether these tools can be effectively used to improve NPD, and what the success factors are for deploying and utilizing online collaboration tools. A qualitative repertory grid technique is used to solicit antecedents, success factors and consequences from social media experts.

Enablers and Barriers to Successful Platform-based Product Development
David Havens (Xerox), Jens Jorgensen (Ortho-Clinical Diagnostics), Paul Salvatore (Alstom Transport)

Product development teams are facing continued pressure to develop more products in less time and with fewer resources. Platform-based developed is commonly seen as a solution to increase capacity of the product
development pipeline. This paper focuses on identifying enablers and barriers to successful platform-based product development by utilizing data from successful and unsuccessful platform development teams working under similar constraints. Key enablers include institutionalizing systems engineering, development and communication of product development roadmaps, augmentation of phase gate review process and critical parameter characterization. Augmentation of phase gate review process includes a recommendation to focus product development justification on point products and product development on a family of products. Operational recommendations are considered possible without significant changes to existing processes and organizational structures.

Harris I – 2011

Component Obsolescence: Managing Lifecycle Differences in Commercial Products for the Department of Defense
Scott Bartholemew, Travis Brown, Glen Dragon, Aaron Smykowski.

The Department of Defense (DoD) is constantly looking to improve its communications capabilities. In order to meet cutting edge technological needs, producers of military products must utilize the latest commercial, off-the-shelf (COTS) components. COTS components often have a primary use in the high volume commercial markets (eg. smart phones) which are characterized by short product lifecycles to satisfy consumer needs and remain competitive. Most tactical military products have a very long design, production and support period that can often exceed ten years. Given the lifecycle mismatch, an obsolescence management process is essential for a producer of military products to effectively manage obsolescence.

Lean Concepts and the Ideation Phase of New Product Development
John Giorgi, John Serio, Mehran Sabzehi, Brian Wenink.

Lean methods have been widely studied and practiced by many manufacturing and product development organizations. While manufacturing has garnered much of the attention, product development has also been examined as companies take a holistic view of how their business processes can be continuously improved through lean thinking. This paper looks at the application of lean philosophies such as fast failure, continuous improvement, and pull processing to idea genesis, selection, and new product introduction. Findings suggest that companies with innovation processes that exhibited the most lean behaviors were also most satisfied with their performance.

Listening to the Voices: Identifying Critical Success Factors of World-Class Voice of the Customer Processes
James McCusker, Joshua Ostrander, Joseph Presicci, Bret Woz.

Companies all create products and services for customers but there is considerable variation in how customer information is gathered and utilized. Needs and wants, usually referred to as “Voice of the Customer” (VoC), consists of many things obtained in many ways, and most companies struggle with the VoC process. Companies in government and military markets struggle even more and their VoC process are oftentimes more difficult to understand and less thoroughly studied. This paper focuses on the differences between these two market types for the purpose of development insights and offering suggestions to organizations looking for world-class VoC elicitation techniques.

Class XII – 2012

A Communication Methodology to Improve Collaboration in Cross-Functional Teams in the New Product Development Arena
Allison Matusick (Corning), Margot Sandy (Fisher-Price), Tim Weiskopff (Greatbatch).

Collaboration within cross-functional teams has been studied extensively, but counterproductive conflict continues to be an obstacle to team performance. This project examines how teams can better identify a set of tools to mitigate or avoid conflict, and then develops a robust toolset for application within the New Product Development domain.

Right-Sourcing Product Development
Jason Stanbro (Bausch & Lomb), Don Moran (OrthoClinical Diagnostics), Doug Axtell (Reflexite).
Appropriate sourcing of new product development requires that organizations consider a myriad of factors, both internal and external. This paper carefully examines both successful and unsuccessful outsourcing relationships as well as insourcing arrangements, to help identify critical decision criteria and their impact on “right-sourcing.” Finally, a tool is developed to help organizations make more informed sourcing decisions.

Agile Principles in Regulated Development Environments
Sam Saif, Prasad Puzhankara (Welch-Allyn), Savio Soares (Welch-Allyn), Eric Zolner (TRW).

This project explores the application of “Agile” product development methodologies to companies in heavily regulated industries. Although agile principles have been utilized extensively, application to medical device development and to other regulated industries has been limited and the results disappointing. Three case studies are examined and recommendations are provided for incorporating Agile principles in regulated product development processes.

Harris II – 2012

ROADS - Robust Organization Analysis and Design Synthesis

Today’s leaders face unrelenting pressure to utilize the resources and energy of their organizations for growth, often by harnessing policies informed by best practices. Leaders must also monitor the enterprise to validate whether policies product desired outputs, and then respond effectively. This project identifies analytical methods to help select and apply guiding principles to organizational challenges, and proposes a new methodology called “Robust Organization Analysis and Design Synthesis (ROADS)” founded on systems engineering principles.

New Product Development Analysis of a Federal Vendor
Justin McMillan, Kevin Muto, Jeff Prokop, Roy Sumarsono.

In spite of extensive research on new product development, little attention has been given to firms known as “global vendors” to the federal government. This project will attempt to characterize and identify key practices employed by one of “top 100” federal vendors, compared to best practices captured in the literature and associated with commercial enterprises. The goal is a plan to improve NPD performance at federal vendors.

Towards Empowerment: A Methodology Linking Psychological and Structural Empowerment
Chris Rericha, Bill Egert, Andrew Pierson.

Current literature on empowerment has largely been focused on either structural or psychological elements of empowerment. This project investigates the links between these two characterizations and proposes a novel methodology for identifying structural obstacles to greater psychological empowerment.

Business Model Evaluation
Eduardo Martony, Michael Cote.

In today’s competitive environment, companies need a strong business model that articulates how the organization creates and captures value. Assessment of a business model requires not only a fundamental understanding but also how to use the business model and how to identify which components are critical for success. This paper uncovers some of the mysteries surrounding business models and offers suggestions on how to effectively evaluate them.

Class XIII – 2013

Oliver Miller (Flightline Systems) and Michael Kenward
Although profits can be made from aquaculture on a commercial scale, there is a high degree of risk associated with this type of business venture. This capstone team investigates root causes for aquaculture businesses failure.

**An Investigation of Requirements Engineering Errors in Safety-Critical Product Development**  
*Paul Ebert (Welch-Allyn)*

This research presents a qualitative case study of how and where errors are introduced in the requirements engineering process of a medical device manufacturer. Causes are explored and proposals for process improvement are provided.

**Leveraging Enterprise IT Systems to Develop VoC for New Product Development**  
*Zhassulan Amirov (Gunlocke) and Richard Ray (ATMI)*

This capstone project explores the opportunity to leverage enterprise IT business systems to augment conventional VoC processes.

**Harris III – 2013**

**Statistical Worldview Analytical Metric Indicator**  
*Jack Fitzgerald, Tom Walter, Bill Eign*

Using metrics to measure performance is well understood, but metrics can also aid in predicting the success of a product development effort. This paper focuses on the evaluation of metrics to help practitioners determine if chosen measures are, in fact, effective. The paper will introduce a new tool called the “Statistical Worldview Analytical Metric Indicator” to help determine if a metric correlates with the success of an organization’s product development efforts.

**Approximate Life-Cycle Cost Estimation – A Case Study**  
*Chuck Munson, Josh Jones, Chin So*

A lifecycle estimating (ALE) model is developed to help improve planning through better information, and to provide opportunities for design trades, design to cost targeting, and cost reduction initiatives. An artificial neural network (ANN) methodology is employed to develop the model.

**Patterns of Waste in Product Development**  
*EJ Ryder, Jason Simmons, Sam Mendolia*

This paper examines product development models and how they facilitate the identification of waste patterns, and provides insights for specific projects and organizations on how to identify waste. Once characterized, waste can be reduced or eliminated.