

Innovation Report

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Taking Charge of **●** Our Future



NORTHWESTERN
UNIVERSITY

June, 2007

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Competing on Innovation

Innovation as a business strategy is in vogue. Yet, innovation in business has existed for decades. Only its popularity as a strategic guidepost has waxed and waned with the times. Most important is how to leverage innovation for sustainable business growth. According to Harvard Business School Professor Rosabeth Moss Kanter, the real key is to learn and embrace lessons from past business innovation strategies and avoid repeating “the same mistakes.” Her article, “Innovation: The Classic Traps” in *Harvard Business Review*, November 2006, highlights challenges and remedies for innovation success. Professor Kanter provides recommendations in four areas: Strategy Lessons, Process Lessons, Structure Lessons and Skills Lessons.

Strategy Lessons:

- Not every innovation idea has to be a blockbuster. Sufficient numbers of small or incremental innovations can lead to big profits.
- Don’t just focus on new product development: Transformative ideas can come from any function – for instance, marketing production, finance, or distribution.
- Successful innovators use an “innovation pyramid,” with several big bets at the top that get most of the investment; a portfolio of promising midrange ideas in the test stage; and a broad base of early stage ideas or incremental innovations. Ideas and influence can flow up or down the pyramid.

Examples: IBM holds an “InnovationJam” to bring the minds of its entire technical organization together through the web to collaborate and share ideas. Gillette hosts an “Innovation Fair” to promote innovative ideas from all across the organization, including non-traditional innovation functions such as the legal department.

Process Lessons:

- Tight controls strangle innovation. The planning, budgeting, and reviews applied to existing businesses will squeeze the life out of an innovation effort.
- Companies should expect deviations from plans: If employees are rewarded simply for doing what they committed to do, rather than acting as circumstances would suggest, their employers will stifle and drive out innovation.

Examples: Both IBM and BBC have created mechanisms to set aside funds for innovation projects that are not forecast-able or predictable.

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Structure Lessons:

- While loosening formal controls, companies should tighten interpersonal communications between innovation efforts and the rest of the business.
- Game-changing innovations often cut across established channels or combine elements of existing capacity in new ways.
- If companies create two classes of corporate citizens – supplying the innovators with more perks, privileges, and prestige – those in the existing business will make every effort to crush the innovation.

Examples: Steelcase launched Design Center to foster informal conversation and creativity among various business units and potential innovators. Williams-Sonoma launched its web division as a tool to enhance its existing business operations and first deployed a tool to assist with bridal registries.

Skills Lessons:

- Even the most technical of innovations requires strong leaders with great relationship and communication skills.
- Members of successful innovation teams stick together through the development of an idea, even if the company's approach to career timing requires faster job rotation.
- Because innovations need connectors – people who know how to find partners in the mainstream business or outside world – they flourish in cultures that encourage collaboration.

Professor Kanter's high-level business innovation lessons and strategies can serve as a fundamental guidepost for Illinois companies, entrepreneurs and innovators.

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Building Future Innovation Talent

As scientific, engineering, manufacturing and business knowledge become increasingly widespread in our “flat” world, the ability to innovate becomes a more and more important source of competitive advantage. But what really is innovation? Simply put, it is the ability to identify and fill unmet needs. Innovations can take the form of new products, services, business models, distribution strategies, and so on. There is no one way to innovate. Indeed, in today’s world, one needs a carefully coordinated set of innovation strategies to obtain the greatest benefit.

Innovation is by no means the same thing as creativity, but creativity is a prerequisite. At Northwestern University, we argue that creativity is a birthright (one need only watch a four year old for an afternoon to see this), but that it needs constant cultivation. Innovative institutions are those that foster creativity and in doing so, accept the risk of failure. Innovation, however, unlike creativity, is a discipline. Individuals need to be taught how to identify needs, how to develop new concepts for meeting those needs, how to optimize those concepts and put them into practice.

Innovation is also a “team sport.” Individuals must learn how to work in cross-disciplinary teams and how to communicate their ideas effectively to multiple audiences, including teammates, management, clients, and other stakeholders.

Within the McCormick School of Engineering and Applied Science, we have developed a number of programs aimed at educating innovative engineers. In all of these programs, we use design as a pathway to innovation. For instance, since 1999, every first-year engineering student has taken a two-quarter course entitled Engineering Design and Communication (EDC). In EDC, students work in teams of four to tackle real problems presented by real clients. Guided by both an engineering professor and a writing professor, students learn to structure ill-defined problems, write specifications, brainstorm solutions, build prototypes, test and get feedback from users, and iterate toward improved designs.

In 2003, we formed the Institute for Design Engineering and Applications (IDEA) to extend design education throughout the curriculum. IDEA offers courses in areas such as human-centered design, multi-disciplinary design, and intellectual property. Students in IDEA develop portfolios of their design work and can earn a Certificate in Engineering Design or even a Bachelor’s in Manufacturing and Design Engineering.

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Ultimately, innovation education must connect core disciplines such as engineering to business practice. For this reason, we will begin to offer a dual business and engineering design degree (MSEDI) in the 2007-2008 academic year. This two year program builds upon the existing MMM program that leads to a Kellogg MBA as well as a McCormick Master's of Engineering. The new program will introduce topics such as Design Research, Innovation Frontiers, User Experience Design, Service Design and Platform Design.

Like the programs mentioned above, this new program will complement conventional pedagogical techniques such as lectures, reading and case discussions, with project-based work. We believe quite strongly that innovation requires a healthy component of "thinking with the hands." In other words, it does not suffice to discuss innovation in the classroom. It is necessary as well for students to get their hands dirty. They must build, test, debug, and re-build. They must develop deep expertise in some domain, be it engineering, graphics, marketing, the web, or another.

But even as they do this, they must recognize that innovation requires much more than deep expertise. When students can not only develop their own expertise, but can also work in cross-disciplinary groups of experts and appreciate the broader business, social and environmental context of their work; when they can solve not only well-defined problems but those that are poorly-defined; then they are ready to innovate.

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Implications for Higher Education

The development of products and services requires skills that cut across disciplines. Design and innovation are important components in these endeavors, and although this is hardly a new observation, these domains have become increasingly important in this world of distributed and outsourced design, manufacturing, and distribution. The design industry now plays a far more important role in engineering products and services than ever before.

Designers, though, work differently than engineers, and their tools are qualitative, observational, and artistic. These sometimes do not mesh well the more formal, quantitative analyses and methods of engineers. Northwestern University's Robert R. McCormick School of Engineering and Applied Science is making a significant effort to bridge this gap. It introduces engineers to "design thinking," the qualitative, synthetic, observational approach used by designers, where discovering the real need and going through multiple iterative cycles of design, build, and test are essential components. Northwestern has developed several courses, certificate and degree programs within the McCormick School of Engineering and Applied Science that focus upon five critical components of design: the engineering infrastructure, the methods used in design research, idea creation, design iteration, and, especially, the human side of products and services. Products and services are designed for people. Without a full understanding of the needs and activities of people, the best engineering efforts will fail.

Promoting Innovative Thinking in Engineering: a Great IDEA

IDEA is the Institute for Design Engineering and Applications at the Robert R. McCormick School of Engineering and Applied Science. Since its inception in 2003, IDEA's goal has been to help promote a "culture of design." IDEA provides students with a strong foundation in creativity, modern design process, cross-disciplinary teamwork, effective communication, and adaptive learning. Students are able to immerse themselves in authentic engineering design problems, and work through these problems from initial conception to complete solutions. "Design entails starting with poorly understood situations containing broad, imperfectly shared ideas, and gradually structuring these ideas to come up with solutions to problems," says Julio M. Ottino, dean of McCormick. "We see design-think as a process that opens horizons and opens minds. For us, design-think provides a pathway toward innovation."

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IDEA offers students the opportunity to learn about innovation by working on exciting and meaningful projects through several academic programs:

- Engineering Design and Communication (EDC) provides all McCormick undergraduates with an introduction to the design process and technical communication
- The Certificate in Engineering Design (CiED) helps McCormick undergraduates develop a set of design skills that will prove valuable in their careers.
- The BS in Manufacturing and Design Engineering (MaDE) offers a complete degree program for students interested in product and process design, manufacturing systems, and manufacturing management.
- The Masters in Product Development (MPD) program offers a part time program for mid-to-senior level technically trained professionals who are involved in product development and design.
- Beginning in Fall, 2007, Northwestern will launch the Master of Science in Engineering Design and Innovation (EDI) as a new degree program. Students build on their undergraduate degree gaining greater depth in a focused engineering discipline, but also learn the essentials of modern product development and gain breadth in a self-selected field such as business, art or social science.

About EDC

Engineering Design and Communication (EDC) was launched as a pilot program at Northwestern University in 1996, and has grown to become a required two-quarter course for all first-year engineering students. The course is designed and taught by faculty from both the engineering school and the university's Writing Program. In EDC, students work in small teams to tackle real-world design problems brought to them by individuals, not-for-profit organizations, entrepreneurs and industry. Students learn about the design process, about written, spoken, and graphical communication, and about teamwork and collaboration.

About MaDE

The mission of the MaDE program is to educate engineers in all aspects of product realization from product design to manufacturing technologies and operations, and to provide students with the ability to integrate various design and manufacturing processes into an effective system.

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About CiED

The certificate in engineering design program helps McCormick undergraduates develop a set of design skills that will prove valuable in their careers. The program focuses on innovative engineering design in a team-based, cross-disciplinary setting. "Innovative design" here implies both identifying and solving real-world problems.

About MPD

The Master of Product Development grew out of the founding co-directors' passion for product development. Walter Herbst spent his entire career building Herbst LaZar Bell, the largest privately held design and product development firm in the country. Rich Lueptow started his career in biomedical product development, but joined Northwestern University 16 years ago, enticed by its excellent reputation. Both recognized many shared their passion for product development, but realized there was no venue for the fine-tuning of product development skills. Thus, the MPD program was born at the McCormick School of Engineering and Applied Science.

About EDI

EDI has been created for the new engineering graduate who loves and intends to practice engineering, but who wants to work side-by-side with designers, social scientists, managers and other engineers. Students learn valuable skills such as rapid prototyping and model making, and complete a variety of design projects. EDI has been designed to help that person flourish in today's fast-paced, innovation-driven work environment. Core courses include Fundamentals of Engineering Design & Innovation; Innovation Frontiers; and Differentiation by Design, among others.

Promoting Innovative Thinking across Multiple Disciplines: NUvention

NUvention is an interdisciplinary program of McCormick's Center for Entrepreneurship and Innovation that brings together faculty from McCormick, the School of Law, the Feinberg School of Medicine, and the Kellogg School of Management to develop courses where students experience the entire innovation/business life cycle of a healthcare-related solution, from ideation to prototyping and business plan development. Based on the highly successful Stanford BioDesign program, the centerpiece of this program is a 6-month, 2 quarter sequence course and project that equips students with the skills necessary to identify unmet clinical needs and develop technological solutions to address these needs in the healthcare marketplace.

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As part of the program, interdisciplinary teams of students are responsible for creating deliverables and achieving innovation milestones, such as a formal needs assessment and specification, a patent draft, a prototype/proof of concept, a clinical trials structure, a business plan, and a final presentation to an investor panel. Each team receives mentorship support from Northwestern faculty, clinicians, and alumni offering legal, biotech/biomedical engineering, and business and industry expertise. Institutional resources such as the SBOC (Small Business Opportunities Center), NCCR (Northwestern Center for Clinical Research), NUCATs (Northwestern University Clinical and Translational Research Program), CEI (Center for Entrepreneurship and Innovation) are also leveraged to consult on each team project. NUvention will be funded by gifts from major medical technology companies and venture capitalists, who will also serve as advisors to the faculty. This is truly a multidisciplinary, multidimensional effort.

Outside Support

The culture of design and innovation that Northwestern University, or any university, strives to promote has to be supported by industry, government and other outside resources. Northwestern has been very fortunate to have received significant corporate support recently from several sources, most notably the Ford Foundation, and Gordon and Carole Segal, co-founders of Crate and Barrel. In 2005 Northwestern opened the Ford Motor Company Engineering Design Center, a state-of-the-art facility that houses McCormick's design programs. It is the home of IDEA, as well as several other engineering departments and programs. Resources for student designers include machine tools, rapid prototyping equipment, CAD stations, meeting rooms and classrooms, etc.

This spring it was announced that Gordon and Carole Segal, co-founders of Crate and Barrel, have made a significant donation to establish a new institute for design at Northwestern University. The generous gift will create **The Segal Design Institute**, which will significantly expand the University's existing undergraduate design curriculum in the McCormick School of Engineering and Applied Science, support the development of new master's degree programs and fund research on design. The new institute builds on McCormick's longstanding commitment to design.

"We need to create and nurture individuals who can anticipate, identify and fill the needs of society," said Carole Browe Segal. "The Segal Design Institute will support creative design education for Northwestern students to meet those needs today and well into the future."

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Conclusion

Innovation does not just happen. To some extent, innovative ways of thinking can be taught, and certainly it can be nurtured. Our responsibility at institutions of higher education is to provide opportunities and the right environment for students to learn and practice innovation by designing programs and curricula to support innovation outcomes. It requires the commitment of the administration, a multidisciplinary academic approach, and the support of government and industry.