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ERDMAN CENTER FOR OPERATIONS AND TECHNOLOGY MANAGEMENT

OPERATIONS and TECHNOLOGY MATTERS

What is Nanotechnology?

Nanotechnology refers broadly to a field of applied science and technology whose unifying theme is the control of matter on the atomic and molecular scale, normally 1 to 100 nanometers, and the fabrication of devices within that size range. One nanometer is equivalent to 1 billionth of a meter or 3.28 billionths of a foot.

Nanotechnology can be seen as an extension of existing sciences into the nanoscale. It is a highly multidisciplinary field, drawing from areas such as applied physics, materials science, device physics, chemical engineering, mechanical engineering, and electrical engineering. Much speculation exists as to what new science and technology may result from these lines of research.

National Institute of Health Bioengineering Consortium at http://www.becon.nih.gov/nstc_def_nano.htm
Wikipedia at http://en.wikipedia.org/wiki/Nanotechnology

In This Issue...

Erdman Center website:
www.bus.wisc.edu/erdman

Nanotechnology: Bigger Is No Longer Better

History and Scope

The term Nanotechnology was introduced by Nori Taniguchi in 1974 at the Tokyo International Conference on Production Engineering[1]. However, progress started with the invention of the scanning tunneling microscope by IBM Corp's Heinrich Rohrer and Gerd Karl Binnig in 1981[2]. Today, nanotechnology is enabling unique products with diverse uses. Flexible sheets with electron-emitting nanotubes and light-emitting quantum dots will change the way screens and monitors project images, nanobots will enable repair of nervous systems, and nanomotors will allow nanofactories to produce atomically engineered products. The major challenge faced today by nanotechnology developers is how to take the technology from the lab to the marketplace in a profitable fashion.

Current Nanotech Uses

Although many nanotech firms struggle to link accomplishments in the lab to profits in industry, some "basic" forms of nanotechnology have already made a splash in the commercial market. General Motors uses a scratch-resistant, lightweight, rust-proof plastic nanocomposite in auto bumpers and side panels. Similar nanocomposites are used in several Wilson golf clubs.

Kodak is producing OLED (organic light emitting diodes) screens that are used in car stereos and cell phones. OLEDs enable thinner, lighter, less power consuming displays. Nanoledge makes carbon nanotubes for commercial uses, of which one use is in a tennis racket, made by Babolat. The yoke of the racket bends less during ball impact, improving the player's performance. Nanotubes are synthesized atomic carbon tubes that are thousands of times stronger than steel at fractions of the weight. They also have extraordinary electrical and thermal properties. Once companies like Nanoledge can scale-up their production from grams, to pounds, to tons, and can do so while controlling the type of nanotube they produce, everywhere strength and weight are a factor - such as in the aerospace, automobile, and airplane industries - they will make a major impact.

Continued on page 2

Nanotechnology: Bigger Is No Longer Better continued

These are just a few of the currently employed applications of nanotechnology. According to market research firm Lux Research, $32 billion worth of goods sold in 2005 included some type of nanotechnology.[3]

Operations Management Issues in Nano-Manufacturing
Engineers face many challenges implementing nano-producing techniques in a large-scale production setting. Many of these techniques have been proven successful on a small scale in a lab under stringent conditions such meticulous climate control, extreme levels of sterility, and generators capable of producing 10,000°F plasma. Needless to say, such requirements make it nearly impossible to control large-scale production.Take imprint lithography, for example. This is a currently used technique for producing nano-polymers and semiconductor chips. The process uses a large series of molds to imprint polymers through pressure and heating. The major problem with such a technique is that it is difficult and costly to align and calibrate the molds, which need to be accurate down to a few billionths of an inch. Furthermore, the mechanical imprint contacts are sensitive to particles and defects. Therefore, lithographic approaches require very clean environments.

New production methods under development, such as self assembly, attempt to address these limiting issues. Self assembly relies on weak atomic and molecular interactions to form nano-structures and could be an efficient means of building complex molecules. If successful, this technique will be substantially cheaper than lithographic techniques. Ultimately, nanotech firms must find an efficient method of manipulating molecules on an industrial scale, develop repeatable processes, and determine how can they be controlled and effectively applied to strategies of nanofabrication before hoping to turn a profit.

Supply Chain Issues in Nano-Manufacturing
The supply and distribution of ready-to-market nano-based products is another paramount challenge faced by the nanotech industry. In addition to the typical supply-chain factors to be considered when setting up manufacturing facilities such as proximity to research centers, raw material suppliers, and end product users, and availability of capable employees, nanotech firms must face further obstacles related to the unique properties of nanomaterials.

Storage and transportation of these particles in bulk raises problems with respect to safety, quality, cost and timeliness. It is not yet clear how much, and under what conditions, nanomaterial can be safely transported. Typically in research laboratories, the scientists themselves isolate nanoparticles. However, for mass production this is not feasible. With the present transportation and delivery methods, it is difficult to monitor the quality of nanomaterials.

Consider the transportation of nanotubes for example. The current methods include adsorbing nanotubes in special matrices prior to transportation and recovering them when required, or transporting them in either a non aqueous medium or in deoxygenated water. The cost of each of these mediums is very high and often implausible for startup companies with small budgets. Because of the unique and varying properties of nanomaterials, an industry-wide accepted standards system needs to be developed to ensure the quality of these products throughout the manufacturing and distribution process.

Nano Fast Facts

- The prefix “nano” comes from a Greek word meaning dwarf. A nanometer is one billionth of a meter. If a nanometer were as wide as a pin head, then a meter would be the distance from Washington, D.C. to Atlanta, Ga.
- Sunscreen, khaki pants, tennis balls, and computer hard drives all contain nanoscale manufactured parts or materials. Nanoscale particles are used in some sunscreens to block ultraviolet light. Certain brands of khakis are made with a nanowhiskers surface to resists stains. Premium tennis balls can be sealed with nanoparticles which double the balls’ useful life. Computer hard drives have read heads (the stylus that reads magnetic bits) made with films only nanometers thick.
- In our macroscopic world, objects obey laws of physics; objects can be in only one place at a time. In the nanoscale world, objects follow a different set of laws - of quantum mechanics. In this world, one atom CAN be in two places at once and two atoms can be “entangled” even though they are apart. A computer stores its information in “bits” represented by a 1 or a 0. The beauty of quantum computing is that each bit in a computer could be 1, 0, or 1 AND 0 at the same time. It’s more information in much less space, which allows much faster processing. The “bits” are atoms, photons or other nanomaterials. Each bit can exist in two different “quantum” states or a blend of those two states.

National Science and Technology Council, Nanotechnology: Shaping the World, Atom by Atom, December 1999

Financial Challenges Faced by Nanotech Firms

"Research indicates that the time to market for commercial applications of nanoelectric based devices is shrinking with years[5]." Brokerages such as Merrill Lynch & Co. and Punk, Ziegle & Co. are scouring the markets for nano-focused companies and putting them into nano indexes. However investors have varying views on whether nanotechnology is an alluring market or a dot-com like bubble. Part of the confusion is caused by the sheer scope of applications that nanoparticles offer and their economic impact on diverse industries. As stated by GE's Advanced Technology Leader, Margaret Blohm, "I lose sleep at night because expectations are so high."

Minimal support from venture capitalists, low patenting rates, and low levels of investment by industry are some detrimental issues for nanotech development. The small amount of venture capital invested in nanotechnology is largely due to a shortage of suitable investment targets. Many nanotech companies lack focused business models, commercial experience, and exit strategies, which leaves them viewed as a risky investment for venture capitalists.

The explanation for low industrial investment is a failure to motivate wider industrial interest. Understanding the technologies and their commercial uses is a common problem. A company contemplating investment in nanotechnology development will be dissuaded by the obvious challenges (production scale-up, health and safety concerns) if they do not comprehend the less obvious opportunities that nanotechnology will provide. Ultimately, the nanotech financial issue is a circular one. Investment firms haven't contributed much money into nanotechnology because they don't see many appealing investment opportunities. Industry firms don't want to sink too many resources into developing nanotech products and applications because they don't think they'll get support from outside investors.

Perhaps the solution to this problem will come from the larger industry players with more internal assets validating the use of nanotechnology, such as Eddie Bauer, Wilson, and GM are doing. These successful applications could serve as examples of nanotech's validity in industry to venture capitalists, and consequently improve funding opportunities for smaller nanotech firms.

The Future of Nanotechnology

In 2005, companies earned $32 billion from products incorporating nanotechnology and this figure is expected to reach $1 trillion by the year 2015. Further, in 2005 nanotech R&D expenses totaled $3.2 billion. This year, more than $10 billion will be spent on nanotech R&D, and $12 billion by the year 2008[6].

"What we are seeing is the beginning of a revolution, caused by our ability to work on the same scale as nature. Nanotechnology will affect every aspect of our lives, from the medicines we use, to the power of our computers, the energy supplies we require, the food we eat, the cars we drive, the buildings we live in, and the clothes we wear. And it will happen sooner than most people think. By 2010 you won't be able to count the number of businesses affected by nanotechnology."

Tim Harper,
Founder and Chief Executive Director
European NanoBusiness Association.[7]

These steeply increasing sums indicate that nanotechnology is here to stay. It has already rooted itself in several commercial industries. But as nano-manufacturing and distribution techniques improve over the next several decades, expect to see the emergence of nanotechnology in virtually all industries.

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Focus on a Board Member

Mike Kalinowski
Kimberly Clark, Neenah, WI
Director, Supply Chain Analysis,
Consumer Business

Mike Kalinowski is the Director of Supply Analysis for Kimberly-Clark's (KC) Consumer Products Business responsible for developing strategy and analyzing opportunities to improve order fulfillment. Key challenges include updating the Distribution Center network of over 50 sites to improve delivery and cost results; providing guidance on changes to the manufacturing footprint; cost management; and helping develop market-oriented strategies to improve KC's position with top customers.

Mike has an undergraduate degree in Economics from UW-Milwaukee, attended graduate school at Northwestern University and has an MBA from East Texas State University. Mike started with KC directly from graduate school. He has worked at three different staff offices and three different plants during his 27 year career. During that time, he has held a number of supply chain roles, including transportation, distribution, and export management. Mike is the lead supply chain recruiter for Kimberly-Clark at UW-Madison. Candidates from the OTM programs (both MBA and undergraduates) are well suited to fill roles in distribution, production planning, purchasing and other related areas at KC. Mike's been a strong supporter of the OTM program, including speaking in classes, conferring with faculty, and sponsoring scholarships to undergraduate students in OTM and Supply Chain Management. Here are his recommendations for students.

"Students in Operations Management obviously need strong analytic skills, but need to look further if they are to be successful in business. Key emerging skills include project management, and especially communication. More and more we see the need for technical people to sell their ideas and findings to general managers, who often have a limited understanding of issues, analysis, and business opportunities. Our Operations Management people often find themselves playing key roles on project teams, requiring them to understand, anticipate, and address the needs of others who often do not have a direct reporting relationship. Excellent communication skills are critical in these situations."

OTM September Orientation: Miller's and Brewers Baseball

This past September, OTM students, faculty, and staff took a trip to Milwaukee to tour the Miller Brewery and attend a Brewers baseball game. Taking place at the end of new student orientation week, this event was a great way for the new OTM students to become acquainted with each other. The experience began at the Miller Brewery, where Don Reid, Miller's Director of Supply Chain, took us on a behind-the-scenes tour of the brewery. Don granted us access to areas usually restricted to tourists, which allowed for close-up examinations of Miller's cutting-edge brewing and bottling technologies.

The tour was followed by a presentation in the Miller Champagne Room, where we enjoyed fresh Miller beverages while learning how Miller Brewing addressed its operational challenges. Don Reid first discussed Miller's supply chain strategy. Kevin Leis, Director of Forecasting, followed with a presentation on forecasting and its effect on the brewery's production levels.

Next we traveled to Miller Park, home of Major League Baseball's Milwaukee Brewers. Tailgating commenced outside the stadium with a bratwurst cookout. The baseball game was exciting down to the final pitch, with the Brewer's defeating the Pittsburg Pirates, 3-2.

Special thanks to Gavin Hattersley, Senior VP in Finance, and Sue Bennett, Director of Supply Chain & Operations Services, for organizing the tour. Lunch was provided by Frank Jakubczak, owner and operator of the European Homemade Sausage Shop.

Summer 2007 Internships

Puneet Arora – National Guardian Life
National Guardian Life Insurance Company has consistently been rated one of America's most successful independent mutual life insurance companies. My primary responsibility was to restructure the company's business continuity and disaster recovery effort. I conducted a business impact analysis to identify mission critical business functions and quantify post-disaster recovery time objectives. I mapped, in detail, the work processes for each of the critical business functions and integrated them into a Business Continuity and Disaster Recovery plan. National Guardian was able to conduct its first ever off-site deployment based on my design for a business continuity exercise.

Jia-Hui Chen – Morris Materials Handling
Morris Material Handling (MMH) is a leading manufacturer of industrial cranes and hoists. MMH sells its products throughout North America and has facilities in the USA, Canada, and Mexico. In 2006, MMH was acquired by Konecrane, a European crane company based in Finland.

In 2006, MMH's purchasing costs were approximately $70 million. My responsibility this summer was to generate cost savings by identifying cheaper alternative vendors and outsourcing opportunities. To aid me in this task, I utilized the purchasing database stored in MMH's integrated ERP purchasing system. Access to this information allowed me to track purchase frequency and material pricing in order to spot potential sources for savings.

I determined that adopting a "cherry-picking" strategy in purchasing would lead to substantial company savings. This strategy involves buying each item from the cheapest vendor rather than buying all items from one or two vendors for the sake of convenience.

Stephen Hendriks – Harley-Davidson
Harley-Davidson Motor Company, the only major U.S.-based motorcycle manufacturer, produces heavyweight motorcycles and offers a complete line of motorcycle parts, accessories, apparel, and general merchandise.

Continued on page 7

OTM Class of 2008

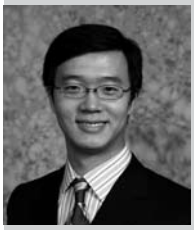
Puneet Arora
OMI Marine Services LLC, Houston, Texas
Operations maintenance and management, testing and supervision.
Bachelor of Marine Engineering, Kolkata, India

Jia-Hui (Daniel) Chen
Capital Securities Corporation, Taipei, Taiwan
Financial analysis, comparison, consultation.
Master of Business Administration coursework, Denver, Colorado
Bachelor of Science, Mechanical Engineering, National Central University, Jhongli, Taiwan

Stephen Hendriks
FedEx Kinko's, Atlanta, Georgia
Project management, production processes, leadership, management and training.
Bachelor of Business Administration (Management Information Systems), The University of Georgia, Athens, Georgia

Ozgur Isil
Bemis Company, Oshkosh, Wisconsin
Project management, engineering, forecast and budgeting.
Bachelor of Science, Mechanical Engineering
University of Texas at Austin, Texas

Jaehyun Lee
Hyundai Motor Company, Hwaesung, Korea
Research and development, planning, process improvement.
Master of Science, Mechanical Engineering, Hanyang University of Graduate School,
Bachelor of Science, Mechanical Engineering, Hanyang University, Korea



Haibo Li
Beijing Hyundai Motor Company, Beijing, China
Project engineer, production management and training.
Bachelor of Engineering in Mechanical Engineering, Tsinghua University, Beijing, China

Seongjoo Shin
Ministry of Commerce, Industry and Energy, Seoul, Korea
IT professional with experience in process automation, innovation development, and resource promotion.
Bachelor in Computer Science, Seoul National University, Korea

Erdman Center Alumni- Where are they now?

Nathalie LeCoutour-Rajwar
(MTM 2001)
Portland, OR

What is your current job, including title, responsibilities?
I currently work as a Master Scheduler (one of four) for Tensolite, in Vancouver, Washington. Tensolite makes high-performance interconnects and cable assemblies for aerospace, test and measurement industry, and the military. I am responsible for four product lines: High Density Shielded Interconnect ®, Network Cable, Thermoplastic, and Cable Manufacturing.

What major projects have you been working on in your career?
Implementation of an ERP module: PRISM Baan Process Solutions, Planning and Scheduling. It was purchased in the 1990s as part of the overall ERP system, but was never implemented, so everything was still done manually. Initially headed by an IT contractor, this project was going sour, encountering strong resistance from the planners and the production floor. As a result, the implementation of the first phase failed, resulting in the system having to be shut down temporarily. At that point I was asked to take over. I met with each party involved, laying out what was currently being done. All three planners had over twenty years experience with the company, and were absolutely convinced that "that thing" would never be smart enough. I spent a great deal of time learning about the module and the tailoring options with the help of the consultant and the documentation. Prof. Urban Wemmerlöv's classes on Production Planning and Change Management were very much in my mind at the time. After about six months of development, communication and training, we were ready to go live, and did so without a glitch - a major accomplishment given the outcome of the first phase.

What was your first position upon graduation from the Erdman Center?
My first position was as an Operations Analyst at Sorrento Lactalis, in Buffalo, NY. Sorrento makes Italian cheese and is a subsidiary of Lactalis, the second-largest dairy group worldwide. A lot of my projects were Production Planning or Inventory Control-related, which eventually led to the position of Production Planning Manager (managing three planners, with the same number of years experience as me, was quite interesting, but by that time I had their buy-in).

How do you think the MTM/OTM helped in your career success?
A lot! The MTM program gave me a much wider perspective. Some classes to mention were Quality and Productivity with Prof. Mark Finster and Quick Response Manufacturing with Prof. Rajan Suri. Team work and class concepts were useful in a lean environment like Tensolite. Also, my internship with Sorrento, led to a job offer.

Knowing what you know now, what advice do you have for your fellow MTM/OTM students?
Take on challenges and new opportunities whenever possible. Although they might not appear to exactly match your expectations, or may seem impossible to achieve, they are wonderful experiences. Embrace them!

Graduate donates first paycheck

Tony Tang, MBA '06, wanted to give back in a significant way to the UW-Madison School of Business. He decided that the best way to show his support and thanks for the education he received in operations and technology management would be to gift the entire sum of his first paycheck, more than $5,000, to the Erdman Center. "My experience in the Erdman Center and with Director Urban Wemmerlöv was priceless - not only as a head start to a great career, but also in helping me form life values," said Tony. "I am fortunate to maintain ties with the university by giving back and I hope other students and alumni have the same opportunities I did."

Tony Tang
MBA '06

INTERNSHIPS continued from page 5

My responsibilities at Harley-Davidson were primarily focused around a capital expansion project at their Pilgrim Road facility, north of Milwaukee. The project aimed at creating greater flexibility in Powertrain production for their heavyweight class of motorcycles.

One of my major accomplishments was finalizing a pilot program designed to obtain ergonomic feedback from operators on the Powertrain production line. This involved creating an Excel tool that enabled key decision makers to perform sensitivity analyses in search of ideal operating conditions for the proposed conveyor system. I also performed an audit of the assembly department's extensive asset list in order to mitigate depreciation expenses incurred along with scrubbing the list for misallocated and non-current equipment.

Jaehyun Lee – Case New Holland
Case New Holland is a manufacturer of agriculture and construction equipment with annual revenues exceeding $13 billion. It has 11 plants in North America and a market presence in 160 countries.

As an intern in logistics, I was able to focus on two projects. The first was to manage an EDI (Electronic Data Interchange) project being implemented at CNH.The second project was to optimize outbound transportation by using the OTM (Oracle Transportation Management) program. I describe only the first project here. The EDI project enabled me to work closely with nine employees having different functions and responsibilities such as IT, negotiation with carriers, and freight settlement. Throughout the regular meetings, used to form consensus and to share information during the project, I developed standardized work processes, consolidated data, distributed timelines and identified the bottleneck within the current EDI process. I restructured the project and developed managerial controls for senior managers. By the last day of my internship, the new EDI process was implemented with 18 carriers (20% of the project), meeting and exceeding expectations at CNH.

Haibo Li – Case New Holland
I worked in CNH's logistic department. My role was to analyze inbound material transportation costs at the Fargo and Grand Island plants. This analysis involved standardizing packaging and shipment modes, calculating optimal inventories, and performing warehouse time studies. Standardization and optimization would result in projected savings of $200K. My warehouse time studies involved trips to Fargo, ND and Grand Island, NE to collect warehouse productivity data. My analysis exposed opportunities for improving operations and a potential cost savings of $150K.

OTM CLASS OF 2009

Sarah Baranowski
WASSER Studios, Seattle, WA
Management consultant, program director,
project management, leadership and development.
Bachelor of Arts, Journalism and English
University of Wisconsin - Madison, Wisconsin

Mukund Chavan
TATA Power Company, Mumbai, India
Portfolio management, resource planning,
strategy and leadership.
Bachelor of Engineering, Mechanical Engineering
University of Pune, India

Eric Hennen
Intertek Caleb Brett, Signal Hill, CA
Supervision, development, and analytics.
Bachelor of Arts, Chemistry
Whitman College, Walla Walla, WA

Sang-Ho Hyun
LG-PHILIPS LCD, South Korea, Kumi
Management, strategy, leadership, and automation.
Bachelor of Engineering, Mechanical Engineering
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Bachelor of Engineering, Production Engineering
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Bachelor of Business Administration,
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Leadership, training, customer relationship management,
and quality improvement.
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UNS Institute of Engineering & Technology, UP, India

Erdman Center for Operations and Technology Management

"Home of the OTM Program"

Operations and Technology Management (OTM) is a cross-functional area of study that is concerned with the development, implementation, and improvement of processes, technologies, and management systems for the purpose of designing, making, and delivering goods and services in an efficient and effective manner that brings value to the customer. This MBA program leverages the students' backgrounds in engineering and science in generating new skills in business process improvements, IT implementation, the strategic use of technology, economic analysis, and management of change.

OTM graduates' career goals include leadership positions in operations, supply chain, information technology management, business development, and consulting. They have been placed in a variety of large and small organizations, including Abbott Labs, Accenture, Capital One, Celerant, Cisco, DaimlerChrysler, Deere & Co, Deloitte Consulting, Delphi, Eaton, EPIC Systems, General Motors, Goodyear, Grainger, Guidant, Harley-Davidson, HP, i2, Intel, Johnson Controls, Johnson Diversey, Kimberly-Clark, Novartis, Philips Broadband Networks, Promega, Samsung, Schlumberger, Sonoco, Sorrento Lactalis, Spectrum, TRW, ZS Associates, and others.

The OTM program is administered by the Erdman Center and guided by an Academic Advisory Board comprising faculty from the School of Business and the College of Engineering. Also linked to the program is an Industrial Advisory Board with members drawn from 20+ organizations.

For more information on the OTM program at the University of Wisconsin-Madison School of Business, please go to *www.bus.wisc.edu/erdman*.

The OTM Newsletter

ERDMAN CENTER

The Newsletter is produced by the MBA students in the Operations and Technology Management Program under the supervision of Center Executive Director Urban Wemmerlöv. The objective is to inform professionals, faculty, and students of the Erdman Center of activities and events in the field of operations and technology management.

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