

## CORPORATE SURVIVAL

## Foresight tools help chart technological choices

**H**ow much of a competitive advantage does a company gain by correctly anticipating the potential of an emerging technology?

A huge one. Conversely, companies that make a less-than-ideal choice may face a less-than-ideal future.

As business manager for new product development at SANS Fibres in South Africa, Mike Cawood understands the critical importance of picking technology winners to his company's success. Cawood and SANS currently are applying the tools of technology foresight as a way to ensure the choices the company makes now result in a profitable future.

Cawood first learned about technology foresight through a course taught by Rias J. van Wyk, director of the Management of Technology (MOT) program at the University of Minnesota.

The MOT program and the Center for the Development of Technological Leadership (CDTL), which administers the MOT program, each play a role in bringing technology foresight tools to corporations and organizations. The MOT curriculum includes a course on technology foresight. CDTL is exploring ways to share information about technology foresight and to bring those responsible for such activities together for further networking.

What is technology foresight?

*Technology foresight involves the process and tools used to identify major trends and critical technologies that will shape the future.*

"In the MOT program, we define foresight as a structured anticipation of the future together with the intent to act on this outlook," says van Wyk. "We grow foresight by blending forecasts of individual events into a big picture. In the case of technology foresight, this amounts to a coherent

view of the technological landscape." Simply put, technology foresight involves the process and tools used to identify major trends and critical technologies that will shape the future. Furthermore, it requires the use of sophisticated information gathering and analysis.

*The roots for today's technology foresight go back to just after World War II, when the government wanted a method to assess their research investments.*



BY RIAS VAN WYK

## ON TECHNOLOGY FORESIGHT

Different managers use different approaches. Some like relying on a resident technological guru. Some are comfortable with consultants. The approach that we favor in the MOT program may be described as "corporate-wide technology foresight." It has three ingredients:

- ▶ Procedures
- ▶ Skills
- ▶ Information

Special procedures have been developed for strategic technology scanning and for its integration into corporate governance and strategy. These procedures require cooperation among three participants: the technology team, the strategy team, and the board. The board mandates the foresight activity and the strategists set the planning procedures. The technology team maps, tracks, and forecasts changes in the technological landscape, identifying "landmark technologies" to screen for high-potential "candidates." These high-potential technologies then become the target for development by the corporation.

These procedures require a unique set of skills. Research has led to the development of dedicated "mind" tools for analyzing and forecasting technologies—tools based on the latest views concerning the fundamental structure of technology.

Corporate-wide technology foresight requires a high-level information base. A macro-map of technological trends, the first of its kind in the world, serves as an explorer's guide for scanners who have to prospect for new technologies.

In practice, technology foresight is usually associated with guiding the corporate destiny. But foresight sometimes becomes such a pervasive corporate culture that it influences not only overall strategy but also different functional areas. Typical areas include new product development, process refinement, and information technology innovation.

As the Center for the Development of Technological Leadership moves toward more offerings in the area of technology foresight, the existing base will prove a valuable platform on which to grow many applications.

A leading authority on strategic technology analysis, van Wyk has developed a common language for understanding technologies and organizing the technological landscape. The MOT course on foresight includes the overview of the technological landscape and the process.

"The whole area of foresight to me is a very critical component of MOT," says Avram Bar-Cohen, CDTL director. "It's a management area well-suited to scientists and engineers because it requires technical knowledge."

The roots for today's technology foresight go back to just after World War II, when the government wanted a method to assess their research investments. They brought experts together, building a bank of their ideas. They fed those ideas back and forth until the experts reached a consensus. Later, technology road maps evolved, which looked at the potential of technologies to meet future needs. The more recent tools of technology analysis and the development of technological landscapes offer a broader method to understand trends.

"You use a set of tools to gather information and build a model for the future with as much certainty as possible," says Bar-Cohen. "At CDTL, we aim to share the knowledge about technology foresight with our students and with the community at large. We can serve as a central source for what's working and for learning more about what's not."

# Developments

## Time for Change



*Avram Bar-Cohen,  
Director*

Former 3M Corporate Scientist Lockwood Carlson knows the importance of technology forecasting. Carlson used the principles while at 3M and now consults with companies. “Without that perspective, companies tend to get wrapped up with what’s happening now and run the risk of becoming blindsided.”

Because of its expertise in technology foresight, the center is in a unique position to help companies with their educational needs in this area, says Carlson, chair of CDTL’s Advisory Board. CDTL has sponsored seminars on the subject and hosted a technology foresight forum for corporate leaders in November.

For SANS Fibres, the investment in technology foresight comes at an opportune time. The company produces polyester polymer, as well as nylon and polyester continuous filament fibres, for local and export markets.

“The company realized that many of its products and markets were at a mature stage in their life cycle and that it was necessary to find a process that would assist in identifying new opportunities for the company,” says Cawood. “This process helps eliminate some of the risks associated with entering a new business.”

SANS Fibres began its technology foresight work about 18 months ago. “We have completed the essential steps, which have allowed us to identify our first project and probe a number of other technologies,” he says.

“Technology foresight helps heighten the awareness in the organization to the technological advances that are occurring, much in the same way an organization monitors economic and other indicators. To SANS Fibres, it means being alert to the technology changes that could lead to an opportunity or threat to the business.”

Each season brings change. As the bright reds and yellows of fall fade into winter, a time of change approaches for me personally and professionally and for the Center for the Development of Technological Leadership (CDTL).

In January, I will begin a new phase of my professional career as chair of the Department of Mechanical Engineering at the University of Maryland. Leaving CDTL and the University was not an easy decision for me, but I am looking forward to returning to the East Coast, my home for many years, and tackling the challenges offered by this position.

When I began teaching classes in what was then a very new Management of Technology (MOT) program for CDTL, I knew that I had found a special place. I enjoyed the dynamics of the MOT classroom—the give-and-take between students and faculty that makes for a one-of-a-kind educational experience.

During the last six years, I’ve been honored to assume various leadership roles—from associate director to acting director to director. I’m pleased to look back and reflect on the progress that the center has made.

We’ve continued to strengthen and differentiate the MOT program as a degree that offers engineers, scientists, and technical professionals insight into the business of managing technology. We’ve sharpened the focus on the strategic deployment of technology, which makes us very different than any other business or technical degree program. As a result, MOT enrollment has grown.

We also successfully launched three additional master of science degree programs—in manufacturing systems engineering, software engineering, and infrastructure systems engineering. In doing so, CDTL responded to the educational needs of Minnesota’s technical community. We even took our show on the road to Rochester where we’ve developed special educational packages based on feedback from the Rochester high-tech community.

Internally, we developed a strategic plan to streamline and bring consistency to the delivery of our programs and services. We assembled and convened a new advisory board that helped to validate the center’s strategic directions and fine tune CDTL’s responses to new opportunities and changing market conditions.

We’ve moved forward thanks to the tremendous efforts of CDTL staff who work hard to make the delivery of programs seamless and professional and to our outstanding University-wide faculty who bring the latest theories and practices to the classroom and are skilled at making the learning easy.

I will miss the MOT classroom. I will miss CDTL and the energy of its staff, faculty, students, alumni, and industry supporters. I truly have gained much from my years at CDTL. Thank you for giving me the opportunity to serve you and for making me part of your professional lives. Minnesota’s “you betcha” attitude, limitless reservoir of innovative ideas and talented technologists, the shimmering lakes, crisp autumn days, and glowing sunset skies will be with me forever.



MOT alumni  
cited as one of  
the region's top  
young executives

# Rising Fast

**W**hen Jon Carlson tackles a challenge, he marshals all available forces to the task. He moves fast and nimbly—as recent public recognition demonstrates.

In May, *CityBusiness* featured Carlson's rising star. As part of its "Forty under age 40" special issue, the Twin Cities publication named Carlson to its list of the region's top young executives. Just a month before, Carlson reached a new career level when Braun Intertec promoted him to vice

president of environmental consulting. At age 35, he is also one of the youngest members ever on the Braun Intertec board of directors.

"I've always been very driven to succeed in every challenge I have faced," he says. "I think that's why I have gotten to where I am at such a relatively young age."

Carlson joined the environmental and engineering consulting firm as an environmental technician in 1988. He came to Braun Intertec fresh from the University of Minnesota where he had just earned his undergraduate degrees

in geology and geophysics. In 1997, he decided to return to the University as a student in the Management of Technology (MOT) program.

The timing was right. Braun Intertec offered Carlson opportunities for professional growth, and his responsibilities continued to expand. He had managed projects, helped open an office in Milwaukee, Wis., and assumed supervisory duties. But he worried that his experiences with one company might insulate him from access to other approaches.

"I wanted to gain exposure to some different perspectives, but I didn't want to leave Braun Intertec to experience those perspectives," says Carlson. "I was attracted to the MOT program because of its technical focus



Recognized as one of the region's top young executives, Jon Carlson (MOT '99), vice president of environmental consulting at Braun Intertec, also enjoys managing projects. Here, he's on-the-job at a mixed-income housing redevelopment site in north Minneapolis.

and its emphasis on scientists and engineers.”

With the demands of leading reorganization efforts at work, the pressures of attending the MOT program, and a family at home, Carlson needed all his drive—and support on all fronts—during the two years that he spent in the program. In turn, he walked away with some important insights and tools to use as he continued to move forward in his career.

“I became more and more aware of the ways that strategy can shape the course of action,” he says. “We were faced with several strategic challenges at Braun Intertec, and the strategic planning and change management skills I learned in the MOT program immediately proved useful.”

He also applied what he learned in the information technology area. In his capstone project, he explored ways to implement improved information technology systems at Braun Intertec. The company is currently in the process of incorporating many aspects of the project's blueprint for change.

The opportunity for further application of his newfound knowledge and skills soon arose. In 1999, the company faced one of its biggest challenges: the successful transition to maintain employee ownership when the company's founder and first-generation owners decided to retire.

The chief executive officer selected Carlson to lead a small group of senior management. The team successfully addressed transition issues, keeping

the company employee owned. They also developed a plan that reinforced the company's core competencies as a way to improve financial performance and better position the company for growth. One of the keys to this success was better integration of the company's environmental and geotechnical services, which has resulted in more efficient operations and better client service.

“The business units that comprise the ‘more integrated’ Braun Intertec have had many good years back-to-back, and the senior management team largely consists of the managers of these business units,” says Carlson. “I am proud to say we are one of those rare ‘highly effective teams,’ and we have a good vision of how we are going to grow together.”

Carlson's management resume includes his positions as vice president and board member, but he also continues to hold another title that he values, project manager. “It's very rewarding to assist clients with their environmental and engineering issues, especially those appreciative clients who openly recognize your efforts.” Currently, he is lending his environmental technical expertise to a mixed-income housing redevelopment project in north Minneapolis near highways 55 and 94.

The MOT program offers a unique learning environment, one that Carlson remembers with fondness. “Two things I miss most about the program are learning something new each week and the opportunity to participate in the give-and-take of ideas and approaches with others from different companies,” he says.

The tools that Carlson learned in the program, such as strategic planning, technology forecasting, research, and marketing, all continue to influence his daily work. “I find the program has helped me in many ways. I expect I will continue to realize other ways in which the program has helped me as my career progresses.”

# Together Again



They work together. They attended school together. They just received promotions. Pam and Larry Zalesky (SE '01) make a great team.

**W**hen Pam Zalesky began investigating educational options, it seemed only natural that she would involve her husband, Larry Zalesky, in evaluating those options.

They met on the job in the early 1990s, eventually married, and continued working together in the same division of Deltec, a medical device manufacturer based in Arden Hills, Minn.

Each plays a different role at work—Pam focuses on the project management side and Larry on technical issues. They and the other members of the division ultimately are responsible for developing the software that runs Deltec's drug infusion pumps.

Make no mistake, the two enjoy the time that they spend together at work and at home. So, for them, the decision to add another joint activity, the pursuit of a master's degree program, made perfect sense.

In spring 2001, the two graduated with master of science degrees in software engineering from the University of Minnesota. And in October 2001, Deltec promoted the two: Larry is now a senior principal engineer and Pam is now a senior project engineer.

Initially, Pam wasn't even thinking about returning to graduate school or looking for a degree program. All she had wanted was a seminar or class on the latest in software requirements. As a result of her search, she attended a seminar with Matts Heimdahl,

associate professor of computer science and director of graduate studies for the program. The more she learned about the program, the more she liked. In turn, Larry found courses that appealed to him.

“I wanted a graduate degree with a technical emphasis,” says Larry. “I liked the software engineering classes in design.” Adds Pam, “It all came back to the course design and content. I could see the relevance.”

The two began taking classes, efficiently balancing their work and home lives with their course work. A large white board, used to record possible ideas and solutions, became a fixture in their home. They organized so efficiently that the program required only a few joint sacrifices: They had to scrap their annual vacation to Mexico, and they had to accept the idea that the house wasn’t always perfect and the refrigerator wasn’t always full.

In return, they gained knowledge that continues to benefit them.

“I first learned what I know about software engineering on the job,” says Pam, who completed her undergraduate program in electrical engineering. “The program reinforced much of my on-the-job learning and allowed me to develop additional skills. It has helped me in my career.”

Larry also took ideas from class back to work. He applied concepts from class to improve embedded systems’ architectures and also collaborated with Pam on their capstone project, which leveraged their on-the-job expertise with what they learned in class.

## *Larry and Pam Zalesky add graduate degrees to their list of joint pursuits*

As part of the capstone, they explored the software issues behind the use of palm pilots in drug delivery. The idea is straightforward. A palm pilot receives a drug protocol for a patient from a computer. Health care professionals use the pilot to control drug delivery at the bedside, helping to reduce the possibility of human error in a piece of equipment that can mean the difference between life and death for some patients. The capstone was the start of work that continues today and offers potential for the future.

Although they work together well, the Zaleskys also count their interaction with fellow students and faculty as significant contributors to their positive educational experience. “It’s unusual when you have an opportunity to work side-by-side with highly qualified professionals from different organizations,” says Pam. “It was an added plus to learn from a group of your peers.”

Faculty offered cutting-edge knowledge about the field and shared that knowledge in effective ways, says Larry. “They were able to go above and beyond,” says Pam.

The Zaleskys rate the program highly and value their time spent in the program. “It’s a marvelous program for professionals who are interested in coming back and honing their technical skills,” says Pam. “I recommended it to quite a few people.”

# Education

Professionals apply  
new insights to  
improve the  
infrastructure of  
their cities

**W**hen Girma Daka walks the streets of St. Paul, he looks at the concrete very differently than the average pedestrian does.

As a civil engineer for the city of St. Paul, Daka designs and inspects city streets. As a student in the infrastructure systems engineering program at the University of Minnesota, he comes armed with some new tools to tackle his on-the-job challenges.

In the city of Albert Lea, Jamie Mehle plans yearly construction projects for the city, writing specifica-

tions and managing and inspecting projects. He, too, finds new insights from his participation in the program that help him do his job better.

Bob Cockriel has spent more than 20 years in public works and currently manages Bloomington's sewer and water systems as the city's utilities superintendent. He and two other students in the program are collaborating on a capstone project to recommend an infrastructure data management process that will help their cities do more with less.

Girma Daka applies what he's learning as a student in the infrastructure systems degree program to his job as a civil engineer for the city of St. Paul.



# at work

The infrastructure systems engineering degree program offers professionals the kind of education that benefits them and their cities, whether large or small, whether urban, suburban, or rural.

“With the aging of all aspects of the infrastructure across the nation, cities are being faced with more and more problems,” says Mehle. “The program teaches ways to keep the aging infrastructure going longer. Smaller cities, such as Albert Lea, do not have a large staff to do all the research and work that would be required to learn these things on their own. This program really helps in that.”

With original infrastructure that dates back from the 1900s to the 1940s, Albert Lea now needs to update and replace much of its utilities, sidewalks, and street surfacing. “I have been able to look at different ways of maintaining our infrastructure and lengthening its life.”

Mehle points to the program’s public interactions course as a particular asset. “Every class time I would learn something that I could use the next day at work.”

The program covers topics that are relevant to on-the-job challenges, he says. The part-time nature of the program makes it easier for Mehle to take what he learns and immediately apply it. It also makes it possible for him to pursue a master’s degree while working full time.

“The students have a great opportunity to learn about new technologies and methods to solve infrastructure problems,” he says. “The program is teaching me many ways to manage and improve the life of all aspects of the city’s infrastructure.”

**“What I’m learning from the program really prepares me not only for my current role but also for contributing to the bigger picture.”**

Daka recognized the potential of the program immediately. “When I heard about this particular program, I was very excited,” he says. “This is really a great program for me.”

The program’s combination of engineering and management offers the right mix for engineers to tackle infrastructure issues, he says. “In this program, I can learn management tools and ways to apply new technology.”

In his computer applications class, Daka discovered new design tools, as well as efficient ways to increase access to data that others need for their jobs. The application of new knowledge is one way that cities benefit, Daka says. The program also helps cities in broader ways.

Like many cities, counties, and public agencies, St. Paul faces a possible shortage in engineering talent, as many of its most experienced engineers retire within the next decade. “I am hoping to learn enough from this program that I will be prepared for future challenges.”

Daka also values the contributions of his classmates to courses and to his overall education. “The program brings together students who work in different communities and agencies, both public and private. Their experience adds so much.”

For Cockriel, who focuses on the management of a large sewer and water system, gaining an understand-

ing of all parts of the infrastructure only improves his ability to do his job.

“It’s an eye-opening experience,” he says. “It’s given me a much broader base to appreciate the issues and how one part of the system impacts the other parts of the system.”

That perspective now shapes the way that Cockriel approaches his job. It’s not just a question now of the best location for a pipe. It’s a question of whether the pipe will interfere with a loop detector system for traffic control or with another function. Better systems management also helps the city meet the challenge of making progress even more quickly than in the past and with fewer resources.

Cockriel and fellow students from St. Peter and Shoreview have joined forces on a project to recommend an infrastructure data management process. Such a process moves the cities away from paper record management and allows them to take better advantage of new technologies, such as geographical information systems, for improving service.

“I have learned something from each class, even if it doesn’t appear to apply directly to my work,” he says. “What I’m learning from the program really prepares me not only for my current role but also for contributing to the bigger picture.”

# A NEW COURSE



Manufacturing systems engineering student benefits from her latest challenge



**L**anise Stufft had just completed a seven-week bicycle trip from Seattle to Washington D.C. when she began considering her next challenge. She wanted to continue learning, and it seemed like a good time to return to school.

With the same endurance and patience that her cross-country bicycle journey required, Stufft recently completed her first year in the manufacturing systems engineering program at the University of Minnesota. She saw it as an opportunity for her and her company, FSI, which manufactures equipment for the semiconductor industry.

“I was ready for a change in my job routine,” says Stufft, a manufacturing engineer in the new product development area. “I wanted to advance my career and learn new subjects so I could have the option of moving away from engineering into management.”

Stufft selected the master of science in manufacturing systems engineering program because of its courses. “Many of them were geared to improving operations and making systems more efficient. These are the kind of courses that seemed very applicable to me. I could envision using the information to increase revenue and improve operations. The benefit to me was more immediate.”

On the job, the pressure to design and manufacture new products in less time continues to increase, says Stufft.

After completing a seven-week bicycle trip, Lanise Stufft, manufacturing engineer for FSI, decided on a new challenge—pursuing a master of science in manufacturing systems engineering degree.

"The course on concurrent engineering opened my eyes to what other companies were doing for reducing their new product development cycle."

In her capstone project, Stufft plans to investigate methods of reducing production time on the floor, a project that relates directly to her work and that will benefit her company.

The program also gives Stufft a new perspective on how engineering decisions impact the whole company. She particularly enjoyed the manufacturing business processes course, which looked at the relationship between engineering and business. The understanding that she gained makes it easier to evaluate the true advantages of engineering and operations decisions, she says.

Her classmates also help broaden her own perspective. "You come in contact with engineers from outside of your company, and you have the opportunity to find out how other companies are approaching manufacturing technology issues and to get feedback on your own ideas."

At the end of her program, Stufft will look forward to new challenges on the job and maybe on the biking trail. She's ready for both.

"The program has allowed me to expand my career goals and objectives," she says. "I am much more confident when it comes to operations and business, and I think that will make me much more valuable."

## On the Move

### Manufacturing Systems

**Mike Mrugala** (*MS '00*), formerly a mechanical engineer at Lake Region Manufacturing Company, is now engineering manager at PMT Medical, Chanhassen.

**Alain Rault** (*MS '00*) is now Procurement Quality Manager for ATMI Packaging in Bloomington. In August, he welcomed twin baby girls to his family.

**Luis Rodriguez** (*MS '01*), formerly reliability engineer, is now lead design engineer at Guidant Corp., St. Paul. He develops the manufacturing processes for new products.

### Software Engineering

**S. Ola Bildtsen** (*SE '00*), formerly graphics programmer at Network Computing Services Inc, joined Nistevo Corporation as a senior engineer.

**Ralph Foy** (*SE '00*), formerly technical architect at Breakaway Solution is now I/T manager for Fortis Inc., Woodbury, where he manages both

technical architects and middleware developers. Foy is also an adjunct instructor for the University's College of Continuing Education.

### Management of Technology

**Chris Manrodt** (*MOT '02*) was promoted from senior electrical engineer to product and applications planning manager for cardiac rhythm patient management at Medtronic Inc.

**Jeff Holm** (*MOT '00*) is now senior engineering manager at LSI Logic Corp. in Bloomington.

**Brett Karjalainen** (*MOT '97*) left Imation Corp. to accept the position of director of strategic marketing and planning at Seagate Technology in Longmont, CO.

**Jessie Ni** (*MOT '00*) is now project manager at R & D Systems in Minneapolis.

**Troy Pesola** (*MOT '01*), product marketing manager for Storage Tek, Minneapolis, received his company's "Unleashed Mind Award" for

his involvement in their annual engineering symposium. He presented information on strategic technology analysis (STA) and its generation of a common language for communicating about technologies. He also presented the topic at IBM's SHARE conference.

**Lee Schultz** (*MOT '99*), formerly at Seagate Technology, is now intellectual property counsel for Lockheed Martin Corp. in Owego, NY.

**Jay Swenson** (*MOT '99*) was promoted from marketing manager to vice president of business development at SBS Technologies Inc. in Eagan.



### MS Alumni Celebrate at Saints Game

It was a sensational August night as Manufacturing Systems alumni, family, and friends gathered for what has become an annual outing to see a St. Paul Saints baseball game. Alumni attending included MS '00 graduates Christine LaPoint, Ray Radziszewski, and Ryan Saline, as well as MS '01 graduates John Grant, Grant Mauch, Luis Rodrigueuz-Hernandez, and A.C. Shepherd. Also at the event were MS '99 graduate Mark Sentman and current MSE '02 students Kalman Bundy and Bill McNaughton. The celebration included a pre-game picnic at the ballpark and prize drawings throughout the game.

## Doug Ernie named interim director

Institute of Technology (IT) Dean H. Ted Davis has appointed Douglas (Doug) Ernie, associate professor of electrical and computer engineering, as interim director of the Center for Technological Leadership (CDTL). The center's current director, Avram Bar-Cohen, is leaving in January to become head of the University of Maryland's mechanical engineering department. Ernie received his Ph.D. in physics from the University of Minnesota. He is also the director of UNITE, IT's distance education unit.

Davis also selected members for a search committee, which includes faculty and

industry representatives, as well as Rias van Wyk, director of graduate studies for the Management of Technology (MOT) program, Lockwood Carlson, CDTL Advisory Board chair, and Rose Jones, CDTL associate director. Over the next few months, the search committee will meet to start the search, interview candidates, and make their recommendations to the dean.

## Seagate/CDTL co-host MOT luncheon

Seagate Technology Inc. and CDTL co-hosted a Sept. 21 luncheon for the com-

pany's 10 MOT alumni and seven current students.

Kevin Eassa, senior vice president of Seagate Recording Media and Recording Heads Manufacturing Operations, kicked off the event by talking about the importance of programs such as MOT. Dave Aune, vice president of Advanced Systems Research and Development at Seagate, spoke about the impact of technology management on Seagate and the role that MOT program graduates play in helping identify critical new technologies. Garnie McCormick, director of global leadership and learning, also greeted students. Steve Nava from Global Leadership and Learning coordinated the event.

*CenterPoint* is published by the Center for the Development of Technological Leadership (CDTL), Institute of Technology, University of Minnesota. Direct comments or questions to: Editor, The Center for the Development of Technological Leadership, Suite 510, 1300 South Second Street, Minneapolis, MN 55454-1082. (612)624-5747. Fax:(612)624-7510.

The Center for the Development of Technological Leadership (CDTL) was established in 1987 with an endowment from the Honeywell Foundation. The mission of CDTL is to be the educational provider of choice for high-tech industry's technical professionals, managers, and leaders.

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