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PICMET '99
Portland State University, Engineering and Technology Management Department
Portland, OR 97207-0751, USA

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PICMET '99

Portland International Conference on Management of Engineering and Technology
July 25-29, 1999
Portland, Oregon–USA

Technology & Innovation Management:

Setting the Pace for the Third Millennium

CONFERENCE BULLETIN

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PICMET '99

Portland International Conference on Management of Engineering and Technology

Technology & Innovation Management: Setting the Pace for the Third Millennium

July 25 - 29, 1999
Portland Oregon, USA

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Engineering Management Program

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July 25, 1999

Dear PICMET guests:

It is with great pleasure that I welcome you to PICMET '99.

The planning of this Conference started the day after PICMET '97. Hundreds of people worked very hard for two years to make it a successful event. The 49-person Organizing Committee spent countless days and nights to work on every aspect of the Conference. The "Core Team," made up of graduate students from the department of Engineering and Technology Management at Portland State University, put a Herculean effort to address every issue, to solve every problem that occurred. Their ever-increasing enthusiasm made the planning and organizing of PICMET '99 a tremendously rewarding effort for all people involved. The five Regional Coordinators represented PICMET around the world, contacted authors and reviewers and provided a strong conduit between PICMET and the worldwide Technology Management community. The Program Committee consisting of 84 international experts provided invaluable assistance by organizing sessions, reviewing papers and making accept/reject recommendations about the submissions. The 24-member Advisory Council provided guidance for the strategic direction of conference. The Board of Directors met regularly to oversee the progress and to make the critical decisions. More than 750 papers were initially submitted to PICMET '99. About 500 of them are scheduled for presentation in the conference over the next four days. The authors represent more than 240 universities and 100 non-academic organizations such as research institutes, industrial corporations and government agencies in roughly 45 countries. The presentations will be made in paper sessions, poster sessions, panel discussions and plenaries. Finally, several public and private organizations saw the value of PICMET '99 and provided financial support for it.

We acknowledge all of the people and organizations which supported PICMET, and extend our deep gratitude and thanks to every one of them.

Nine workshops are scheduled on Sunday, July 25 followed by the technical program featuring four plenaries, twenty one panels and special sessions, two Executive Forums, 127 paper sessions and six poster sessions, Monday through Thursday. The Executive Forums will be held from 11:30 to 13:30 on Monday and Tuesday. Top executives from leading semiconductor companies will discuss the technology trends in semiconductor industry in Monday's Executive Forum. The executives from highly successful start-up companies and venture capital firms will address the issues around entrepreneurship in the technology era in Tuesday's Executive Forum. In addition, site visits have been arranged to several technology-based companies in Oregon for the guests to tour the facilities and to exchange ideas with the developers and managers of technology in those companies.

Approximately 550 presentations will be made at PICMET ’99. They are clustered into twenty six major tracks alphabetically listed below.

Collaboration for Technology Management
Decision Making in Technology Management
Entrepreneurship
Environmental Issues in Technology Management
Industry Applications
Information/Knowledge Management
International Issues in Technology Management
Management of Engineers and Scientists
Management of Technological Innovation
Manufacturing Management
New Product Development
New Venture Management
Policy Issues in Technology Management
Program/Project Management
Quality Management
R&D Management
Resource Management
Strategic Management of Technology
Supply Chain Management
Technology Management
Technology Management Education
Technology Marketing
Technology Planning and Forecasting
Technology Transfer
Technology-Based Organizations
Virtual Enterprises

We believe PICMET ’99 will have a major impact on the growth of the field and will contribute significantly to research, education and implementation of Technology Management. We hope you will find it beneficial and enjoyable.

All of us at PICMET wish you a productive week, complete with active participation in the technical activities as well as networking opportunities throughout the Conference.

Sincerely,

Dundar F. Kocaoglu
Conference Chair

PICMET ’99

PORTLAND INTERNATIONAL CONFERENCE ON MANAGEMENT OF ENGINEERING AND TECHNOLOGY

Portland, Oregon - U.S.A. • July 25-29, 1999

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PICMET ’99

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PICMET committee members hard at work.

PICMET ’99

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A 24-member International Advisory Council provides advice and counsel on the strategic directions of PICMET and the identification of the critical issues of technology management that are addressed at the conference. The members are listed below.

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PICMET ’99

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PICMET '99

STUDENT PAPER AWARD WINNNERS

The number of students doing significant research in the area of Engineering and Technology Management was demonstrated by the twenty-six nominations received. This made the selection process difficult but the three awardees stood out for their contributions.

Charles Weber
Massachusetts Institute of Technology

A Yield Management Strategy for Semiconductor Manufacturing Based on Information Theory

Advisor: Eric von Hippel

Co-Authors: Vijay Sankaran, SEMATECH
Kenneth W. Tobin, Jr., Oak Ridge National Laboratories
Gary Scher, Sleuthworks, Inc.

Abstract: A model based on information theory, which allows technology managers to choose the optimal strategies for yield management in the semiconductor industry, is presented. The knowledge extraction rate per experimentation cycle and knowledge extraction rate per unit time serve as benchmarking metrics for yield learning. They enable managers to make objective comparisons of apparently unrelated technologies. Combinations of four yield analysis tools — electrical testing, automatic defect classification, spatial signature analysis and wafer position analysis — are examined in detail to determine an optimal yield management strategy for both the R&D and volume production environments.

Beril Coskun, Assistant Coordinator and Liono Setiowijoso, Information Systems

Patrik Johnsson
Växjö University

Achieving the Potential Benefits of Advanced Manufacturing Technology - A Study of Swedish Metalworking Companies

Advisor: David J. Sherwin

Abstract: The paper empirically concludes that a key to success for heavy users of advanced manufacturing technology is to improve the infrastructure (worker empowerment, training, self-managed teams, quality leadership and inter-functional design teams), to emphasize decentralized preventive maintenance, and to develop a manufacturing strategy where flexibility is an important capability.

Roger E. Brill
University of Central Florida

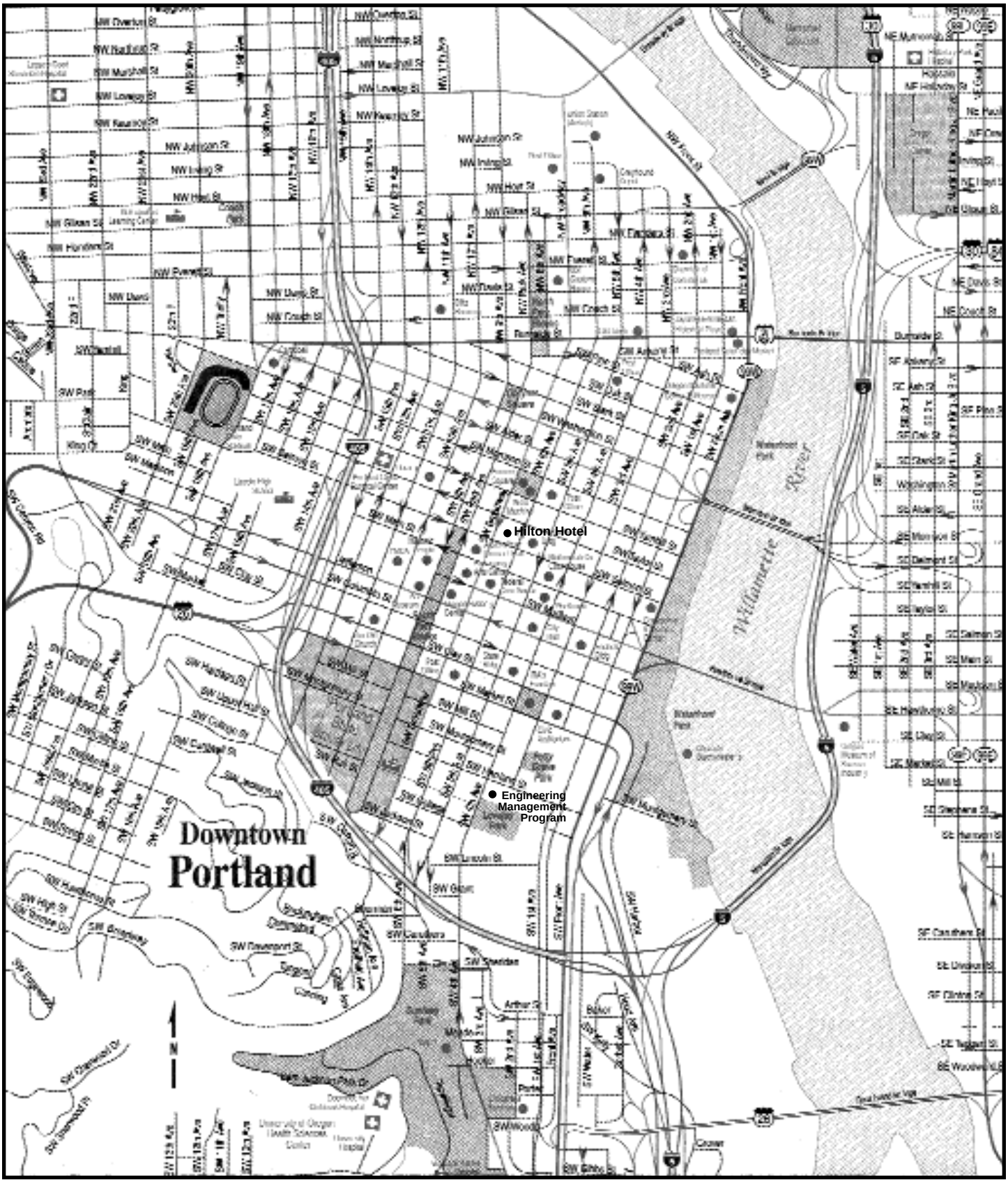
Improving Information Technology Systems Through Adaptive User Interfaces

Advisor : James M. Ragusa

Co-Author: James M. Ragusa

Abstract: The "information overload" problem anticipated for the future will be compounded as information expands exponentially in the next millenium. This paper describes past and present research efforts designed to improve information technology (IT) systems through the creation of adaptive user interfaces.

Portland City Map



General Information

CONFERENCE FOCUS

Technology Management is rapidly emerging as the major challenge of the coming decades. As the technology age moves forward with a high speed characterized by rapid changes, the leaders of technology are distinguishing themselves from those that fall behind, by developing and implementing innovative approaches to managing technology. The line of demarcation between success and failure is getting sharper and sharper. The unmistakable difference between the two is the degree of effectiveness in management of technology. The focus of PICMET '99 is that phenomenon. It addresses all aspects of managing technology with specific emphasis on **technology and innovation management for the third millennium.** PICMET '99 provides an invaluable opportunity for exchange of ideas, information, research results and experiences in development and implementation of technology management concepts. The leading decision makers, scholars and practitioners of technology management from more than forty countries will discuss existing and emerging issues in technology management, and will present multiple perspectives in addressing them.

WHO SHOULD ATTEND

This high-impact conference will set the stage and define the directions of technology management for decades to come. The world's leading experts from academic institutions, industrial corporations and government agencies will participate in the discussions. The conference is essential for:

- Presidents and CEOs of technology-based corporations
- Vice presidents of engineering, R&D and technology in industrial organizations
- R&D managers
- Engineering, manufacturing, operations, quality and marketing managers in technology-based organizations
- Project and product managers
- Information systems managers in industrial and service organizations
- Technology Management researchers
- Government officials responsible for science and technology programs
- Educators in engineering management, technology management, manufacturing management, technology marketing, software management, information systems management, project management, and technology-focused MBA programs
- Engineering and Technology Management Program Heads
- Students in Engineering Management, Management of Technology and related programs
- Government officials responsible for technology policy
- Engineers and scientists moving from technical specialty to management positions while maintaining their identity in technical fields.

REGISTRATION

Registration Policy - All PICMET attendees, including speakers and session chairs, must register and pay the registration fee to have access to the sessions and other events as specified on the registration form included in this bulletin.

On-site registration - PICMET registration will be located at the Mezzanine level of the Portland Hilton Hotel during the following hours:

Sunday, July 25	7:30 - 21:30
Monday, July 26	7:30 - 17:00
Tuesday, July 27	7:30 - 17:00
Wednesday, July 28	7:30 - 17:00
Thursday, July, 29	7:30 - 12:00

The registration fee allows admittance to all technical sessions, the exhibits area and the social events as specified on the registration form. Name badges must be worn to all PICMET sessions, functions and events. If you attend tutorials or the events not covered by the registration fee, you will be required to pay an additional fee.

Catch a ride on a Portland trolley car

General Information

E-MAIL CENTERS

E-Mail terminals have been set up in the registration area to give you the opportunity to check your mail and to send messages through TELNET. You will need your host name/address, login name and password to use the system.

SESSION AND PAPER DESIGNATIONS

The sessions are identified by a four-digit code as follows:

First digit shows the day	M: Monday T: Tuesday W: Wednesday H: Thursday
Second digit shows the time	A: 08:00-09:30 B: 10:00-11:30 C: 13:30-15:00 D: 15:30-17:00 E: 17:15-18:45 F: 10:30-13:30 G: 14:00-17:00

Time slots A-E are for plenary, paper and panel sessions; F and G are for poster sessions.

Third and fourth digits show the room	01: Galleria-1 02: Galleria-2 03: Galleria-3 04: Parlor B 05: Parlor C 06: Studio Suite 07: Directors Suite 08: Council Suite 09: Forum Suite 10: Cabinet Suite 11: Executive Suite 12: Senate Suite 13: Pavilion East 14: Pavilion West

Presentations in each session are given consecutive numbers following the session number. For example, paper TD-05.2 is the second paper on Tuesday at 15:30 ñ 17:00 in Parlor C.

AUDIO/VISUAL EQUIPMENT

Each session is equipped with an overhead projector, a flipchart and a screen, and an LCD projector. If other special equipment is needed, every effort will be made to obtain it. The Plaza Suite on the Mezzanine level is designated as the Authors Room. If you need information about anything else concerning the conference, the Information desk in the registration area will try to help you.

PICMET VOLUNTEERS

PICMET Volunteers wearing burgundy colored golf shirts with the PICMET logo will assist the participants throughout the conference. If you need help in locating the room where your session will be held, finding a replacement bulb for the projector, or making a last-minute change in your transparencies, you can contact the PICMET Volunteers. They will do their best to help you. If you need information about anything else concerning the conference, the Information Desk in the registration area will try to help you.

PRESENTATION GUIDELINES

The Sessions - The sessions are 90 minutes long, some with three, some with four papers. Each Author will have 18-25 minutes for their presentation followed by about five minutes for questions.

Guidelines for Session Chairs - If you are chairing a session, please follow the guidelines below:

- Contact the speaker before your session starts.
- Check the equipment in the room. If something does not work or if anything else is needed, contact the PICMET Volunteer responsible for your room.
- Introduce each speaker.
- Coordinate the time allocated to each speaker so that each has about equal time, allowing for questions from the audience.
- Fill out the Session Summary Form and leave it on the table or give it to the PICMET Volunteer at the end of the session. (The form will be available in the room or given to the session chair by the PICMET Volunteer at the beginning of the session.)

Guidelines for the Speakers - If you are presenting a paper, please follow the guidelines below:

- Introduce yourself to your session chair, and provide him/her with a brief background statement that he/she can use in introducing you to the audience.
- Limit your presentation to 18-25 minutes to that every speaker in the session has approximately the same length of time.
- Allow about five minutes for questions form the audience.

HILTON BUSINESS CENTER

A fully equipped business office is available at the Lobby floor of the hotel. A wide range of services are available from 8:00 a.m. to 5:00 p.m. Monday through Friday.

THE CITY OF ROSES

Portland: The Town That Was Almost Boston

The Lewis and Clark Expedition. The arrival of the Hudson Bay Trading Company. The Oregon Trail migration. The Lovejoy-Petyygrove coin toss?

While the first three events are easily associated with Oregon's early history, Asa Lovejoy and Francis Pettygroves's momentous coin toss is a little less familiar. But without Lovejoy's quarter and Pettygrove's penny, Portland, Oregon's largest city, might never have been born.

It all began in 1843 when Tennessee drifter William Overton and Massachusetts lawyer Asa Lovejoy beached their canoe on the banks of the Willamette River. Overcome by the beauty of the area, Overton saw great potential for this mountain-ringed, timber-rich land. His only problem was that he lacked the 25 cents needed to file a land claim. So, he struck a bargain with Lovejoy: In return for a quarter, Overton would share his claim to the 640-acre site known as "The Clearing."

Soon bored with clearing trees and building roads, Overton drifted on, selling his half of the claim to Francis W. Pettygrove. The new partners, Lovejoy and Pettygrove, however, couldn't decide on a name for their budding township. Lovejoy was determined to name the site for his hometown of Boston, while Pettygrove was equally adamant about his native Portland, Maine. They decided to flip a coin, now known as the "Portland Penny," to settle the argument. Pettygrove won on two tosses out of three.

Lovejoy and Pettygrove were confident that Portland, with its deep water and abundant natural resources, would one day become a popular and prosperous port. They might have been shocked, however, to learn how popular it soon became and for what sort of activities.

Portland has a dark history that began in the late 1800s with Joseph "Bunco" Kelly, a hotelier notorious for kidnapping young men and selling them to ship captains. Many bar owners and hotel operators relied on the shanghai trade to supplement their business, and Kelly was one of the best. Paid by unscrupulous captains to intoxicate potential crew members, Kelly would deliver his drunken quarry to waiting ships. The unfortunate men would wake up the next day — stranded at sea and forced to work for indefinite periods of time.

Kelly often bragged that he could gather a full crew in less than 12 hours. Inevitably a ship captain would challenge him. One evening, in his quest to fulfill a boast, Kelly ran across a group who had stumbled upon the open cellar of a mortuary. Thinking the cellar was a part of the Snug Harbor Pub, the men had each consumed cups of embalming fluid, which they had mistaken for liquor. When Kelly found them, several had died and others were dying. Claiming the dead were merely unconscious from too much drink, Kelly sold all 22 to a captain whose ship sailed before the truth was discovered.

In another attempt to make a quick buck, Kelly delivered a dime-store Indian heavily wrapped in blankets to the ship. When the captain learned the next morning that his new crew member was a wooden statue, he became so angry that he threw it overboard. It was recovered by two men operating a dredge nearly 60 years later.

"Sweet Mary," the proprietor of a brothel, is another interesting figure in Portland's history of the late 1800s. In order to elude taxes and city laws, she operated her bordello on a barge that ran up and down the Willamette River. Technically, she was outside everyone's jurisdiction.

The turn-of-the-century, however, seems to have brought a close to Portland's colorful early years. Secure jobs in lumber mills and wealth from providing goods to the California Gold Rush helped to stabilize the economy, giving the city's population more time to regulate the seedy activities of its busy waterfront.

Personifying this shift in attitude was Simon Benson, a teetotalling lumber baron and philanthropist. While walking through his mill one day, Benson noticed the smell of alcohol on his workers' breath. When Benson asked these men why they drank in the middle of the day, they replied there was no fresh drinking water to be found downtown. Upon hearing this, Benson proceeded to build 20 freshwater drinking fountains, now known as Benson Bubblers. Beer consumption in the city reportedly decreased by 25 percent after the fountains were installed.

Simon Benson's water fountains still bubble invitingly on Portland's downtown streets. And around the fountains has grown a city of parks, outdoor artwork, coffee carts, microbreweries, bridges and bookstores. Portland is a people town, whose pedestrian-friendly city blocks are half the size of those in other towns, where the outdoor benches are crowded with readers enjoying good books and spring sunshine, and where limits on growth have kept the surrounding countryside within a 20-minute drive of the city's core.

To many Portland is still the paradise that captured William Overton's enthusiasm so many years ago. Not a bad investment for a quarter.

Courtesy of the Portland Oregon Visitors Association

The City of Roses

The following information about Portland is provided compliments of Portland Guide: Discovering Oregon, Published Quarterly by Skies America Publishing Company.

GETTING AROUND PORTLAND

Portland's public transportation is made up of the MAX (Metropolitan Area Express) train and Tri-Met buses. Buses and Max are free within a downtown area known as Fareless Square. Outside Fareless Square, fares range from $1.05 to $1.35, less for seniors, the disabled and youths. Tickets are interchangeable and can be purchased aboard buses or from ticket machines along the MAX line.

CLIMATE

The temperature in Portland varies between 56˚F (13˚ C) in the evening to 80˚F (27˚C) during the day, in July in Portland. The low humidity makes summer months very pleasant and comfortable. You may need a sweater or light jacket in the evening.

ATTRACTIONS

Bricks and ambiance are the two main ingredients that make up **Pioneer Courthouse Square.** Bordered by 6th and Broadway and Yamhill and Morrison, this people-watching common place is host to not only year-round events, but also to everyday brown-baggers and those wanting simply to rest and take in their surroundings. Starbuck's and Powell's Travel Bookstore also can be found on this popular property recognized locally as Portland's living room.

THE BREWERS FESTIVAL

Along with several nicknames such as the City of Roses, the God's Country, the Stumptown, Portland is also known as the Microbrewery Capitol of the World. You will see living proof of this nickname when you enjoy the Oregon Brewers Festival at the Governor Tom McCall Waterfront Park on July 23-25. The Park is located on the banks of the Willamette River, a pleasant 5-minute walk from the Hilton Hotel. Local restaurants, independent brewers and a local band will be featured throughout the weekend. Beer lovers have been coming to Portland form all over the world since 1988 for this annual event; 80,000 people are expected this year. If you like good beer, make it a point not to miss it. For more information, you may want to visit the web page at www.oregonbrewfest.com.

OMSI

Situated on the east bank of the Willamette River, the Oregon Museum of Science and Industry (OMSI) is the fifth-largest science museum in the country. Among OMSI's many attractions are six exhibit halls, the multi-storied OMNIMAX Theater and the Murdock Sky Theater. Visitors can play computer games, explore new technologies and even beam a message into space. Call for hours and admission prices. 1945 SE Water Ave., (503) 797-4000.

TOM McCALL WATERFRONT PARK

It's hard to believe this three-mile stretch along the Willamette River was once a busy expressway. Rather than impatient motorists, the park is now occupied with new types of movers—joggers, bikers and rollerbladers, as well as pedestrians in the mood for nothing more energetic than a stroll. Bordered by Front Ave., (Bill Naito Pkwy.), Tom McCall Waterfront Park is taken up during the warmer months with cultural and musical events, as well as overheated folks hoping to cool off in the Salmon Street Springs Fountain at the end of SW Salmon St. A Cruise along the Willamette on the Portland Spirit (conveniently docked by Salmon Street Springs Fountain) is another way to cool down while seeing Portland from a different vantage point.

PORTLAND ART MUSEUM

The Portland Art Museum lays claim to an impressive painting collection which includes the works of such masters as Renoir and Monet. The museum also houses permanent collections of Native-American, Asian, Pre-Columbian and West African art, as well as English silver and modern sculpture. Call for hours and admission prices. 1219 SW Park Ave., (503) 226-2811.

OREGON HISTORY CENTER

Located in the heart of Portland's Park Blocks, the Oregon History Center's permanent and changing exhibits deal with Oregon and the Pacific Northwest, yesterday, today and tomorrow. The exhibits offer a combination of history and interactive technology for the enjoyment of visitors and residents alike. Call for hours and admission prices. 1200 SW Park Ave., (503) 222-1741.

THE CITY OF ROSES

THE GROTTO

Spread out over 62 beautifully wooded acres, the Grotto serves as both religious shrine and breathtaking garden. Carved into the base of a 110-foot cliff, Our Lady's Grotto enshrines a marble replica of Michelangelo's Pietá. An elevator connects the upper and lower levels of the sanctuary, with the upper level offering sweeping views of the Columbia River and Mt. St. Helens. Call for hours. NE 85th Ave. and Sandy Blvd., (503) 254-7371.

PITTOCK MANSION

One thousand feet above the city of Portland towers the stately Pittock Mansion. This historic 1914 property is an elegant, 22-room estate that sits on 46 acres of manicured grounds. The numerous hiking trails that surround the property are open to the public daily until nightfall. The Fate Lodge Restaurant, once a gardener's cottage, now serves lunch and afternoon tea during the week. Call for hours and admission prices to the mansion. 3229 NW Pittock Dr., (503) 823-3624.

POWELL'S CITY OF BOOKS

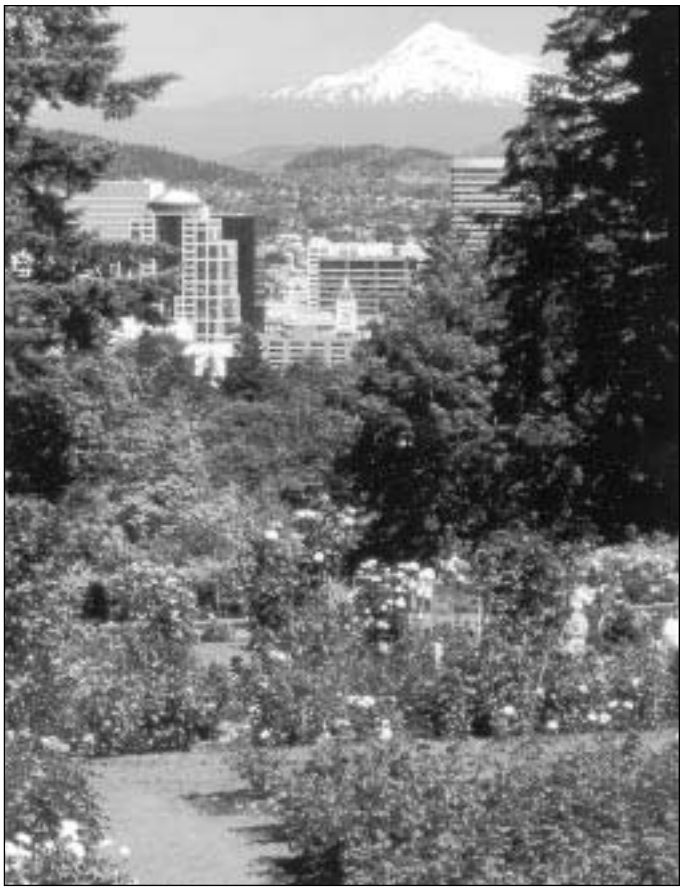
To avid readers, Powell's is Mecca. More than just a bookstore, Powell's is a Portland institution. The largest independently owned bookstore in the country, Powell's has more than one million volumes and covers a city block. For the easily confused (as well as many of the regulars), Powell's map helps guide browsers from one room to the next. Call for hours. 1005 W. Burnside, (503) 228-4651.

SATURDAY MARKET

In the great tradition of open-air markets, Portland's Saturday Market first assembled some 17 years ago beneath the Burnside Bridge, and has since become one of Portland's most frequented attractions. This weekend exhibition is filled with handmade items, food and sporadic entertainment. It runs every weekend from March through Christmas. It is open weekends, admission is free. Call (503) 222-6072 for hours.

WASHINGTON PARK

Washington Park is not only one of Portland's most beautiful sights, it also contains many of the city's favorite haunts. Lying within the park's expansive boundaries are not only the requisite children's play area, tennis courts and picnic areas, but such wonderful surprises as Metro Washington Park Zoo, Japanese Garden, World Forestry Center, Hoyt Arboretum and the International Rose Test Gardens. Read on for more information on these attractions.



A view of Mt. Hood from the Rose Garden.

THE OREGON ZOO

This award-winning, 64-acre zoo is home to more than 875 animals representing more than 200 species. Among the zoo's many highlights is its African savannah exhibit which spotlights black rhinoceroses, giraffes, impalas, birds and zebras. The zoo's Asian elephant breeding program is world renowned. Its much-loved Packy, born in 1962, was, at the time, the first Asian elephant born in the Western Hemisphere in 44 years. Call for hours and admission prices. 4001 SW Canyon Rd., (503) 226-1561 or (503) 226-ROAR.

JAPANESE GARDEN

Portland's Japanese Garden is considered one of the most beautiful and authentic Japanese gardens outside of Japan. Five gardens make up these gorgeous grounds—the traditional Flat Garden (Hira-niwa), the serene Strolling Pond Garden (Chisen Kaiyui-Shiki), the Tea Garden (Rojiniwa) which includes a ceremonial tea house, the Sand and Stone Garden (Seki-Tei), and a miniature Natural Garden (Shukeiyen). Call for hours and admission prices. 611 SW Kingston Ave., (503) 223-1321.

THE CITY OF ROSES

WORLD FORESTRY CENTER

Providing a dramatic introduction to the World Forestry Center is the 70-foot tall "talking tree," which illustrates the basic principles of tree growth. Also at the Center is a dramatic permanent exhibit entitles "Smithsonian Tropical Rainforests: A Disappearing Treasure." This Smithsonian exhibit features displays of tropical plants and animals, and tells the story of three families through life-size dioramas. A 15-minute multi-media show explores the heart of the rainforest in Borneo. Also at the World Forestry Center is a walk-through exhibit of Old Growth Forests which offers a Northwest perspective on forest ecology and conservation issues. Call for hours and admission prices. 4033 SW Canyon Rd., (503) 228-1367.

HOYT ARBORETUM

Ten miles of trails filled with an astounding 700 species of trees and shrubs as well as breathtaking views make up Washington Park's Hoyt Arboretum. The nation's largest assortment of conifer species can be found on the arboretum's 175 acres. Spiraling up the southwest corner of the arboretum is the Vietnam Veterans' Living Memorial, which honors Oregonians who died or are still missing from that conflict. 4000 SW Fairview Blvd., (503) 823-3654.

INTERNATIONAL ROSE TEST GARDEN

Whether you want to take in spectacular scenery or the luscious smell of fragrant roses, the International Rose Test Garden offers both. Approximately 10,000 plants, among which are more than 400 varieties of roses, flourish high above a breathtaking city view. Established in 1917, the International Rose Test Garden is the oldest operating test garden in the country. Admission is free year-round. 400 SW Kingston Ave.

SHOPPING

Shopping Portland's Downtown

Portland's downtown area is just plain fun to shop. While all roads lead to Damascus, at times it seems all shops open to Pioneer Courthouse Square—or some other equally delightful Portland landmark. A shopping trip in Portland is not just a nearly always successful mission, but a sightseeing excursion as well. Here are just a few of Portland's downtown shopping staples.

At Meier & Frank, shoppers can update their wardrobe, buy a mattress and matching bedroom set, check out the gourmet kitchen gadgets, and pick out that stereo system for the kid's birthday or fine china for that friend's wedding. 621 SW 5th Ave. (and branches at most of the major malls), (503) 223-0512.

Nordstrom is famed for its emphasis on service and its upscale yet not stuffy fashion. Clothing offerings for men, women and children run the gamut from tres chic to tres trendy. 701 SW Broadway (and most major malls), (503) 224-6666.

If you're looking for elegance—understated or otherwise—Saks Fifth Avenue is the place to shop. American and European designer wear for both men and women is spread over two levels, as is Saks' own line of clothing. SW Fourth and Fifth Aves., (503) 226-3200.

Portland's Mall Scene

A mall is not a mall is not a mall—something Portland recognized early on. Shoppers will find a measure of eclecticism within the following area malls:

Pioneer Place is four airy levels of glass, greenery and fountains. Saks Fifth Avenue anchors Pioneer Place's 80 specialty shops. 700 SW Fifth Ave., (503) 228-5800.

Nestled in the John's Landing area along the Willamette River, the Water Tower offers a collection of specialty shops and restaurants in quaint surroundings. 5331 SW Macadam Ave., (503) 228-9431.

Just this side of the Columbia River is Jantzen Beach Center. Recently renovated, it offers wonderful surprises including a 1921 C.S. Parker carousel. 1405 Jantzen Beach Center, (503) 289-5555.

The nation's first major mall, Lloyd Center offers some 200 specialty shops in addition to familiar anchors. An ice rink offers entertainment. Bordered by Multnomah and Broadway, 9th and 15th Streets, (503) 282-2511.

Washington Square pulls shoppers into its many specialty shops with the help of several popular anchor stores. 9585 SW Washington Square Rd., off Hwy. 217, (503) 639-8860.

Clackamas Town Center's 185 specialty shops and popular anchors are offset by an ice rink. 12000 SE 82nd, (503) 653-6913.

GALLERIES

The Pearl District, loosely bordered by W. Burnside and NW Hoyt, and NW 13th and NW Park, represents a good share of the gallery arena and comes to serious life on First Thursday each month with after-hours gallery scensters.

Galleries can also be found in fairly concentrated numbers in the Skidmore District (roughly between Front and Fourth Aves. from SW Oak to NW Glisan St.) and the city's downtown core. Not to be overlooked are galleries throughout the metro area as well.

EXECUTIVE FORUMS

There are two special Executive Forums to discuss the critical issues in technology management from a top-level perspective. They are open to all PICMET '99 participants. The registration fee is $35 each.

The panelists are high-level executives in technology-driven companies, start-up firms and venture capital partnerships. Each panelist will present his ideas for 5-10 minutes. A question/answer period will follow the presentations. The questions may be directed to a specific speaker or to the entire panel.

The Executive Forums will take place at the Alexander's Restaurant from 11:30 to 13:30 on Monday, July 26 and Tuesday, July 27. Alexander's is on the top floor of the Hilton. The $35 registration fee includes the lunch.

Executive Forum-1

TECHNOLOGY TRENDS IN SEMICONDUCTOR INDUSTRY

Key executives from semiconductor firms will address the critical issues, strategic directions and trends of the industry in this Executive Forum.

Tom Long

Don Van Luvanee

Moderator: Tom Long, Director of Programs, Planar Systems, Inc.

Panelists: Joe Laughlin, President & CEO, Laughlin-Wilt Group, Inc.; Sunit Rikhi, Director of Automation, Portland Technology Development, Intel Corporation; Steve Sharp, President & CEO, TriQuint Semiconductor, Inc.; Don Van Luvanee, President & CEO, Electro Scientific Industries

Date: Monday, July 26, 1999

Time: 11:30 -13:30

Location: Alexander's Restaurant
(Top floor of Portland Hilton)

Executive Forum-2

ENTREPRENEURSHIP IN THE TECHNOLOGY ERA

Key executives from highly successful start-up firms, venture capital partnerships and NASDAQ Stock Exchange will examine the issues, risks and opportunities involved in entrepreneurship in a rapidly changing technological environment in this Executive Forum.

Dick Knight

Gerry Langeler

Moderator: Dick Knight, President & COO, Sarif, Inc.

Panelists: Gary Burke, Vice President, NASDAQ Stock Exchange; Scott Gibson, Co-Founder and former President of Sequent Computers; Gerry Langeler, Co-Founder of Mentor Graphics, and Partner, Olympic Venture Partners; William H. Newman, General Partner, Shaw Venture Partners

Date: Tuesday, July 27, 1999

Time: 11:30 -13:30

Location: Alexander's Restaurant
(Top floor of Portland Hilton)

SOCIAL EVENTS

There will be a variety of social events to facilitate informal interaction of the participants at PICMET '99.

Wine and Cheese Ice Breaker

Date: Sunday, July 25

Time: 18:30 - 21:30

Location: Hilton Hotel Pavilion Room

Meet other conference attendees, renew old acquaintances and begin new friendships and collaborations at this opening reception in the Hilton's Pavilion Room. Included in registration fee.*

Dinner at the Oregon History Center

Date: Monday, July 26

Time: 19:30 - 22:00

Location: Oregon History Center, 1200 SW Park Ave.

Located just a few blocks from the Portland Hilton, this museum has a wide array of exhibits about Oregon and the Pacific Northwest. There will be a delectable selection of dinner items, served buffet style. Included in registration fee.*

Awards Banquet

Date: Tuesday, July 27

Time: 19:30 - 22:00 (cash bar 18:30 - 19:30)

PICMET guests sample Northwest cuisine

Spectacular views from the dining room on the Spirit of Portland

Location: Hilton Hotel Ballroom

This is the main social event of the conference. Keynote speeches will be delivered, and the PICMET '99 "Leadership in Technology Management Award" and the "Outstanding Student Paper Awards" will be presented at the banquet. Guests will have a relaxed evening with a taste of delicious Northwest cuisine. Three dinner choices are: fresh **salmon, duck** prepared Northwest style with fruit chutney, and **vegetarian plate** with fresh vegetables. Included in registration fee.*

Dinner Cruise

Date: Wednesday, July 28

Time: 18:30 - 21:30

Location: Portland Spirit Cruise Ship

Conference participants who sign up for the dinner cruise will board the Portland Spirit at downtown Portland's Riverplace Marina and head south on the Willamette River to the city of Lake Oswego. Dinner will be served buffet style, and there will be a cash bar. The boat will return to the Marina just as the sun is setting and the city lights are shining on the water. Space is limited. Price is $75 and includes transportation between the hotel and the marina. Busses will board at the Hilton at 18:15 and will bring the participants back to the hotel after the cruise.

**The one-day registration does not cover any of the social events. The student registration fee includes the Sunday evening wine and cheese ice-breaker, but does not cover Monday or Tuesday evening events. Tickets for these events may be purchased at the registration desk.*

TRAVEL AND EXCURSIONS

Spirit of Portland

TRAVEL

PICMET has designated **Joan Sher at GK Ltd. Travel** in Portland, Oregon, as the official travel agent for the conference. She will advise you and help you plan your trip, including car rentals, pre and post conference trips, and tours while in Portland. It is impossible to list all the exciting trips and breathtaking scenery easily available from Portland. Central and Southern Oregon, British Columbia, Alaska, Hawaii, San Francisco, Las Vegas and Reno are just a few examples. Joan will arrange a personalized trip for you on request.

Joan Sher can be contacted by phone (**1-800-200-0344** or **1-503-244-0344**), fax (**503-244-3503**), or e-mail **(Joan-gktvl@aol.com).** She is available for all your travel needs during your visit to Portland and the Pacific Northwest.

Joan will also be hosting PICMET's **hospitality desk** during the conference, so if you need advice or want to make last-minute travel arrangements, she will be there to help you.

CAR RENTAL

Hertz has been designated the official car rental company for PICMET '99. Hertz is offering special rates for conference participants from July 18th to August 5th. You can arrange car rentals by calling 1-800-654-2240 and referring to file number CV47197.

Hertz

EXCURSIONS

Several tours are offered to PICMET '99 participants to give the guests an opportunity to see some of Oregon's spectacular scenery.

We strongly recommend that you preregister for these tours because of limited space. The registration form on page 10 can be used for that purpose. PICMET reserves the right to cancel a tour if minimum reqirements are not met. In that case, preregistered guests will be offered other alternatives.

Mt. Hood and Columbia Gorge, Sunday, July 25, 1999
($60; departs 8:45, returns 17:30; price of lunch not included)

Treat yourself to a scenic wonderland as you enjoy one the most outstanding one-day excursions in America. Don't forget to bring your camera and plenty of film! Mt. Hood dominates the horizon as you leave the Willamette Valley and enter the forest-covered slopes of the Cascade Mountains. You will follow the historic "Barlow Trail" to Government Camp. It is now just a few miles to Timberline Lodge at the 6,000 foot level of Oregon's Highest mountain peak. Next, depart Mt. Hood for the famous apple and pear orchards of the picturesque Hood River Valley. The next stop is Multnomah Falls. Located in the famous Columbia River Gorge, the waterfall cascades a spectacular 620 feet to the gorge floor. Then follow the Old Scenic Highway to Crown Point, where from high above the mighty river you are treated to a 35-mile long panoramic view of the Gorge.

Portland City Tour, Monday, July 26, 1999
($30; departs 12:45, returns 16:00)

This tour begins by winding through the streets of downtown, Old Town and Chinatown while learning the humble beginnings of this now cosmopolitan city. It is just a few minutes' drive up into the West Hills overlooking downtown Portland. In sprawling Washington Park you will visit the world-renowned International Rose Test Garden. Next, tour through the lovely Arlington Heights residential area and the Hoyt Arboretum. Enjoy a scenic ride to the magnificent Pittock Mansion nestled in Portland's West Hills. Tour this French Renaissance mansion built in 1909 and take in the panoramic view of the snow-capped peaks of the Cascades, the Willamette River, the Columbia River and Portland from the mansion's grounds. Continue on through the tree-lined streets of the Portland Heights residential area before heading back into downtown (admission to Pittock Mansion included).

TRAVEL AND EXCURSIONS

Northern Oregon Coast, Tuesday, July 27, 1999
($60; departs 8:45, returns 18:00; price of lunch not included)

Traveling westward from Portland, magnificent valleys flourishing with orchards and wineries come into view before entering the towering Douglas Fir forests of the Oregon Coast Mountain Range. The first stop will be Seaside, Oregon, a favorite vacation spot for northwesterners and a charming and bustling coastal resort community. Seaside is home of the Lewis and Clark Trail Monument, the site where Lewis and Clark first saw the Pacific Ocean. Enjoy unique specialty shops, fun attractions or enjoy a walk on the long stretch of sandy beach. While visiting Seaside you will also have plenty of time for a leisurely lunch in one of the many fine seafood restaurants.

Your tour continues south on Highway 101 to Cannon Beach. This quaint artists' community filled with many galleries and interesting shops also affords a spectacular view of Haystack Rock, one of Oregon's most photographed sites. Continuing south to the historic Tillamook Bay area, the next stop will be a visit to the Tillamook Cheese Factory, one of the Oregon coast's most popular attractions. From there you will return to Portland, once again crossing the beautiful Oregon Coast Mountain Range.

Portland Hilton

SITE VISITS

Half-day site visits are being arranged to the following companies during PICMET '99:

Intel Corporation–Visit the Intel plant and museum in Hillsboro where more than 10,000 Intel employees are located. The site visit will include a presentation on Intel Corporation. (Five visits: Monday, July 26-morning/afternoon; Tuesday, July 27-morning/afternoon; Wednesday, July 28-morning.)

LSI Logic–PICMET participants will visit one of the newest fab facilities for state-of-the-art application-specific integrated circuits. (Tuesday, July 27-afternoon.)

Freightliner–Although Portland is not the center of the automotive industry, one of the world's largest truck manufacturers is located here. A division of Mercedes Benz (now Daimler Chrysler), Freightliner builds big-size trucks in its plant in North Portland. The site visit will be a tour of the assembly line. (Tuesday, July 27-morning.)

TRI-MET–Portland's new high speed light rail system is a showcase for mass transportation in metropolitan areas experiencing rapid growth. The PICMET guests will take a trip on MAX, visit the control room and see one of the deepest tunnels built for a transportation system in the world. (Tuesday, July 27-afternoon.)

Planar Corp.–The world's leading manufacturer of high end electroluminescent flat panel displays will show its manufacturing facilities and clean room to PICMET participants. (Wednesday, July 28-afternoon.)

The bus schedule for site visits are as follows:
Morning: Leave Hilton at 8:30, return at 11:30,
Afternoon: Leave Hilton at 13:30, return at 16:30.

The cost of each site visit is $25.

Space is limited for these site visits. They will be offered on a first-come first-served basis.

If you are interested in participating in any of the site visits, please indicate it on the registration form.

WORKSHOPS

Nine workshops are scheduled on **Sunday, July 25, 1999**

WS-1 to **WS-4** are half-day morning workshops from 8:00 to 12:00 (Registration fee: $150).

WS-5 to **WS-8** are half-day afternoon workshops from 13:00 to 17:00 (Registration fee: $150).

WS-9 is a full-day session from 8:00 to 17:00 (Registration fee: $275).

When a PICMET guest registers for a morning and an afternoon workshop, the fee for the two workshops is $275. Handouts and coffee breaks are included in the registration. Participants registering for a full-day workshop, or two half-day workshops (one morning, one afternoon) receive a lunch as part of their registrations

MORNING WORKSHOPS (8:00 - 12:00)

WS-1: Technological Forecasting, *by Joseph P. Martino, University of Dayton, Dayton, Ohio–USA.*

This tutorial will provide an introduction to technological forecasting methods and practices. Topics included will be growth curves, trends, scoring models, measures of technology, environmental monitoring, and applications to R&D planning.

WS-2: Adapting Your Project Management Style: The Key to Project Success, *by Aaron J. Shenhar, Stevens Institute of Technology, Hoboken, New Jersey–USA.*

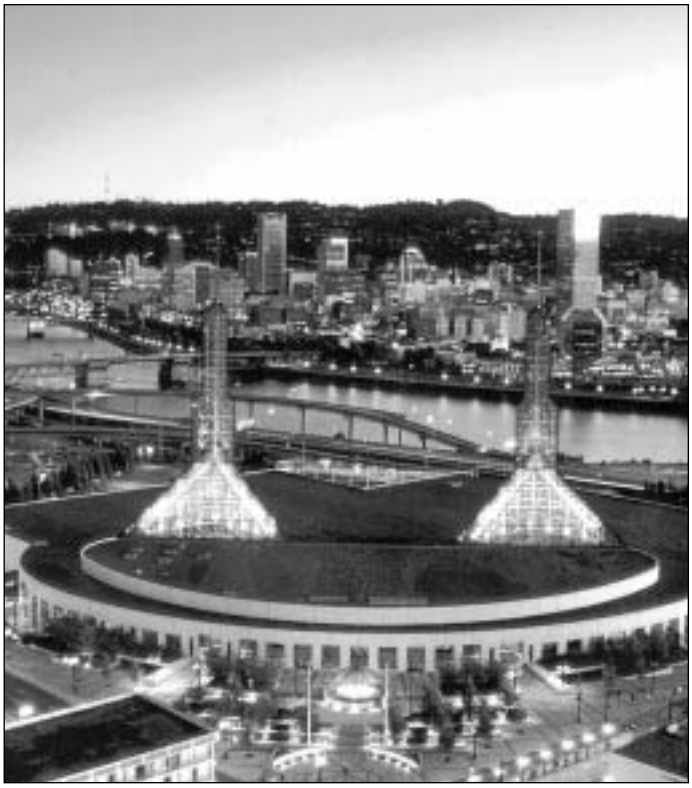
This seminar will take you beyond the tools and applications into the next century of project management development. Effective project management requires a particular "state of mind," and a proper attitude and style. Yet no two projects are alike, and project management is all but universal. Thus, the proper project management attitude depends on the specific project type and its environment. In this seminar you will learn how to identify your project characteristics and develop your specific management style. Based on the framework presented in this seminar, you will also be able to conceptually integrate the entire project landscape—from the strategic and long-term issues to the day-to-day operational problems—and apply better practices as well as specific guidelines for different kinds of projects.

WS-3: TRIZ: The Exciting New Technology for Systematic Innovation, *by Ellen Domb, The PQR Group, Upland, CA–USA.*

Many people think that "creativity" means brainstorming and similar approaches that rely on the mood of the participants. TRIZ (theory of inventive problem solving) is different. TRIZ is data-based creativity and is not dependent of the feelings or emotions of the people who are using it. The research that created TRIZ examined over 2 million patents to find out what the factors were that made great, creative, innovative inventions different from the run-of-the-mill inventions. The researchers took those factors and organized them so that people with any kind of problem (not just technical inventions) can analyze the problem and apply these principles of creativity. In this workshop you will learn to analyze your problems and to apply the tools of TRIZ to develop creative solutions. You will get TRIZ reference materials to that you can continue to pursue what you have learned on the job.

WS-4: Achieving Return on Critical Knowledge, *by Joyce A. Thompsen, Zenger-Miller, Eden Prairie, Minnesota–USA.*

Critical knowledge areas represent unique bodies of knowledge which lie at the core of the value proposition for an enterprise. A new business formula entitled Return on Critical Knowledge, or ROCK, is presented. A case study of an integrated strategic approach to driving greater ROCK is included.



At twilight the downtown skylights and Willamette River can be seen beyond the Oregon Convention Center.

WORKSHOPS

AFTERNOON WORKSHOPS (13:00 - 17:00)

WS-5: Selecting A Culturally Responsive Project and Team Management Strategy, *by Dragan Z. Milosevic, Portland State University, Pinnell •Busch, Inc., Portland, Oregon–USA.*

If you are an American or international involved in a multicultural project team, this workshop is the right place for you. You will receive a menu of culturally responsive strategies for the work at home or abroad. Watch out, though, because you are not expected to use the traditional paradigm of "When in Rome, do as the Romans do" multicultural project/team management. Rather, you will recognize the specifics of the situation and a variety of scenarios before you select what best suits your needs. Instructional design includes hands-on, real-world experience.

WS-6: Managing High-Technology Projects, *by Hans J. Thamhain, Bentley College–USA.*

This intensive workshop provides seasoned managers and project leaders with a forum for discussing technology-based project management concepts, tools, and techniques. The emphasis is on best-in-class practices applied to new product projects. Participants will be exposed to the latest techniques for tracking and controlling projects, compressing the time-to-market cycle, managing innovations under cost and time pressures, and dealing with risk, conflict, and commitment.

WS-7: Recognizing and Evaluating Strategic Competences: Second Generation Methods, *by John Mills, Mike Bourne, Huw Richards,University of Cambridge–England; Mike Lewis, Warwick Business School–England.*

Practicing managers need usable and useful tools to assist them develop and manage their technology strategy. This workshop will outline an action research/case study methodology for developing and testing such tools; describe a tool designed to identify strategically important competencies; and involve delegates in a participative case study to demonstrate how this tool is used in practice.

WS-8: Innovation Acceleration Methodologies, *by Gideon Samid, Technion–Israel Institute of Technology, Haifa–Israel.*

Management and innovation, once two separate poles on the technology globe, have now merged and emerged as a winning proposition: applying quantified tools to the elusive process of realizing new knowledge and applying it for a set purpose from a method based on using cost estimate credibility as a metric for innovation progress. Another metric is based on quantified measurements of the quality of the textual explanation of the innovated subject. Up-to-date results will be reported at the conference.

FULL-DAY WORKSHOP (8:00 - 17:00)

WS-9: Breakthrough Thinking, *by Gerald Nadler, University of Southern California–USA.*

Breakthrough thinking improves significantly all parts of a project—from determining whether there should be a project, planning the project management process through each step in the project, to the wrap-up report, implementation, and continuing improvement. Its full spectrum creativity and systems concept show how all organizational and project considerations are most effectively integrated.

PROGRAM SCHEDULE - MONDAY JULY 26, 1999

		Ballroom Level					Third Floor							Mezzanine Floor	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Galleria I	Galleria II	Galleria III	Parlor B	Parlor C	Studio Suite	Directors Suite	Council Suite	Forum Suite	Cabinet Suite	Executive Suite	Senate Suite	Pavilion East	Pavilion West
MA	8:00-9:30													PLENARY - 1 : Strategy	
	9:30-10:00	COFFEE BREAK													
MB	10:00-11:30	Environmental Issues in Technology Management (1)	Technology Marketing (1)	PANEL: Developing and Testing Practical Tools for Developing Strategy and Managing Technology	Project / Program Management (1)		Information / Knowledge Management (1)	Technology Planning and Forecasting (1)	Collaboration for Technology Management (1)	PANEL: IEEE Transactions on Engineering Management: Strategic Directions and Critical Issues	International Issues in Technology Management (1)	New Venture Management (1)	Supply Chain Management (1)	Industry Applications (1) The Utility Industry	POSTER SESSION - 1 MF 10:30 to 13:30
	11:30-13:30	EXECUTIVE FORUM-1: TECHNOLOGY TRENDS IN THE SEMICONDUCTOR INDUSTRY (ALEXANDER'S RESTAURANT - TOP FLOOR OF THE PORTLAND HILTON)													
MC	13:30-15:00		Technology Marketing (2)	Management of Technological Innovation (1)	Project / Program Management (2)	Technology Management Education (1)	Information / Knowledge Management (2) Achieving Return on Critical Knowledge	Technology Planning and Forecasting (2)	Collaboration for Technology Management (2)		International Issues in Technology Management (2)	New Venture Management (2)	Supply Chain Management (2)	Industry Applications (2) The Chemical and Petroleum Industry	
	15:00-15:30	COFFEE BREAK													
MD	15:30-17:00	New Product Development (1)	R&D Management (1)	Management of Technological Innovation (2)	Project / Program Management (3)	Technology Management Education (2) PANEL: Innovative MOT Education for the New Millennium	Information / Knowledge Management (3)	Technology Management (1) Technological Intelligence Deriving from Electronic Information Resources	Collaboration for Technology Management (3)	PANEL: Managing An External Research Program	Data Envelopment Analysis (1)	Virtual Enterprises (1)	Manufacturing Management (1)	Industry Applications (3) The Automotive Industry	POSTER SESSION - 2 MG 14:00 - 17:00
	17:00-17:15	COFFEE BREAK													
ME	17:15-18:45	New Product Development (2)	R&D Management (2)	Management of Technological Innovation (3)	Project / Program Management (4)	Technology Management Education (3)	Information / Knowledge Management (4)	Technology Management (2)	Collaboration for Technology Management (4)	PANEL: Engineering & Technology Management Journals	Data Envelopment Analysis (2)	Virtual Enterprises (2)	Manufacturing Management (2)	Industry Applications (4) The Service Sector	

PROGRAM SCHEDULE - TUESDAY JULY 27, 1999

		Ballroom Level					Third Floor							Mezzanine Floor	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Galleria I	Galleria II	Galleria III	Parlor B	Parlor C	Studio Suite	Directors Suite	Council Suite	Forum Suite	Cabinet Suite	Executive Suite	Senate Suite	Pavilion East	Pavilion West
TA	8:00-9:30													PLENARY -2: International Issues in Technology Management	
	9:30-10:00	COFFEE BREAK													
TB	10:00-11:30	New Product Development (3)	R&D Management (3)	Management of Technological Innovation (4)	Technology Transfer (1)	PANEL: Making the Corporate Culture Produce Increased Profits	Information / Knowledge Management (5)	Technology Management (3)	Collaboration for Technology Management (5)	PANEL: Women in Engineering Management	Decision Making (1)	Virtual Enterprises (1)	Manufacturing Management (3)	Industry Applications (5) The Semiconductor Manufacturing Industry	POSTER SESSION - 3 TF 10:30 - 13:30
	11:30-13:30	EXECUTIVE FORUM-2: ENTREPENEURSHIP IN THE TECHNOLOGY ERA (ALEXANDER'S RESTAURANT - TOP FLOOR OF THE PORTLAND HILTON)													
TC	13:30-15:00	New Product Development (4)	R&D Management (4)	Management of Technological Innovation (5)	Technology Transfer (2)	Technology Management Education (4)	Information / Knowledge Management (6)	Technology Management (4)	Collaboration for Technology Management (6)	PANEL: Outsourcing Technology for New Product Development	International Issues in Technology Management (3)	Technology-Based Organizations (1)	Manufacturing Management (4)	Industry Applications (6) Software Development	
	15:00-15:30	COFFEE BREAK													
TD	15:30-17:00	New Product Development (5)	R&D Management (5)	Management of Technological Innovation (6)	Technology Transfer (3)	PANEL: Technology Management Education (5)	Information / Knowledge Management (7)	Technology Management (5)	Strategic Management of Technology (1)		Management of Engineers and Scientists (1)	Technology-Based Organizations (2)	Quality Management (1)	Industry Applications (7) Service Sector	POSTER SESSION - 4 TG 14:00 - 17:00

PROGRAM SCHEDULE - WEDNESDAY JULY 28, 1999

		Ballroom Level					Third Floor							Mezzanine Floor	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Galleria I	Galleria II	Galleria III	Parlor B	Parlor C	Studio Suite	Directors Suite	Council Suite	Forum Suite	Cabinet Suite	Executive Suite	Senate Suite	Pavilion East	Pavilion West
WA	8:00-9:30													PLENARY - 3: Collaborations	
	9:30-10:00	COFFEE BREAK													
WB	10:00-11:30	New Product Development (6)	R&D Management (6)	Management of Technological Innovation (7)	Entrepreneur-ship (2)	Technology Management Education (6) SPECIAL SESSION Preparing Leaders for the Next Century	Information / Knowledge Management (8)	Technology Management (6)	Strategic Management of Technology (2)	PANEL: Technological Forecasting and Social Change: Looking Back and Looking Ahead	International Issues in Technology Management (4)	Technology-Based Organizations (3)	Quality Management (2)	Industry Applications (8) Software and Hardware Development	POSTER SESSION - 5 WF 10:30 - 13:30
	11:30-13:30	LUNCH BREAK													
WC	13:30-15:00	New Product Development (7)	R&D Management (7)	Management of Technological Innovation (8)	Entrepreneur-ship (2)	Technology Management Education (7)	Information / Knowledge Management (9)	Technology Management (7)	Strategic Management of Technology (3)	PANEL: Private-Public Sector Partner-ships for Knowledge Transfer and Commercial-ization	International Issues in Technology Management (5)	Technology-Based Organizations (4)	Quality Management (3)	Industry Applications (9) Health Care	
	15:00-15:30	COFFEE BREAK													
WD	15:30-17:00		R&D Management (8)	Management of Technological Innovation (9)		Technology Management Education (8)	Information / Knowledge Management (10)		Strategic Management of Technology (4)	PANEL: IEEE- USA	International Issues in Technology Management (6) PANEL: Managing a Technology in a World of Shift-ing Boundaries	Technology-Based Organizations (5)	Quality Management (4)	Industry Applications (10) The Automotive Industry	POSTER SESSION - 6 WG 14:00 - 17:00

PROGRAM SCHEDULE - THURSDAY JULY 29, 1999

		Ballroom Level					Third Floor							Mezzanine Floor	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Galleria I	Galleria II	Galleria III	Parlor B	Parlor C	Studio Suite	Directors Suite	Council Suite	Forum Suite	Cabinet Suite	Executive Suite	Senate Suite	Pavilion East	Pavilion West
HA	8:00-9:30													Plenary 4: Innovation	
	9:30-10:00	COFFEE BREAK													
HB	10:00-11:30	Policy Issues in Technology Management (1)	R&D Management (9)	PANEL: The Technologies and Technology Management of ESI - Electro Scientific Industries, Inc.		Technology Management Education (9)	Information / Knowledge Management (11)	Decision Making (2)	Strategic Management of Technology (5)	PANEL: Engineering Management Program Heads Meeting	PANEL: Engineering and Technology Management: Doctoral Student Colloquium	PANEL: Technology Based Organiz-ation: Applying Technology to improve the Practical of Management	Environmental Issues in Technology Management (2)	Industry Applications (11)	Resource Management (1)
	11:30-13:30	LUNCH BREAK													
HC	13:30-15:00	Policy Issues in Technology Management (2)	R&D Management (10)	PANEL: Organization and Individual Influences in Adoption of Internet Technology	Technology Management Education (10)	PANEL: Innovation and Organizational Change Program at NSF	Management of Engineers and Scientists (2)	Strategic Management of Technology (6)	PANEL: Planning Session for PICMET '01					Industry Applications (12) The Semiconductor Industry	Resource Management (2)

PLENARY SESSIONS

Four plenaries will be presented at PICMET'99. The session titles, schedules and plenary speakers are listed below.

Plenary Session - 1

STRATEGIC MANAGEMENT OF TECHNOLOGY FOR THE 21ST CENTURY

Date: Monday, July 26, 1999
Time: 08:00 - 09:30
Room: Pavilion Room - Mezzanine Floor

Moderator: Dr. Erwin "Al" Herman is Vice President and General Manager of Planar Advance, Inc., a wholly owned subsidiary of Planar Systems since 1994. He served as President and General Manager of a $30 million subsidiary of Tektronix, Inc. with responsibility for three strategic business units from 1987 to 1994. Prior to that he was a Vice President at Gould, Inc. for nine years. Al Herman received his B.A. in Mathematics from Kent State University in 1970, M.B.A. in Finance and Marketing from University of Oregon in 1990, and Ph.D. in Systems Science/ Engineering Management from Portland State University in 1998, while continuing to work as a high-level executive in industry. His Ph.D. research was on technology strategies in the U.S. electronics industry.

Speaker: Dr. Graham R. Mitchell is the Bladstrom Visiting Professor at the Wharton School of the University of Pennsylvania, and Director of the Wharton Program in Technological Innovation. Between 1993 and 1997 he was the U.S. Assistant Secretary of Commerce for Technology Policy. Appointed by the President and confirmed by the Senate, his responsibilities included the development and implementation of policies to increase the role of technology in enhancing the well being and competitiveness of the United States. He was also charged with promoting the interests of the United States in developing international science and technology policies, programs and partnerships with the trading partners of the U.S. Before joining the Administration he served as the Director of Planning and Forecasting for GTE. Prior to that, he was with General Electric for 12 years, in various positions, including manager of research, engineering and business development in operations and with the Corporate Research and Development Center.

Dr. Mitchell has served as a director of the Industrial Research Institute, and authored numerous papers on technology, management and policy. He holds 7 U.S. patents and is the recipient of several major honors. He holds a B.S. and Ph.D. in Electrical Engineering from the University of Westminster, London, England.

Plenary Session - 2

INTERNATIONAL PERSPECTIVES ON TECHNOLOGY MANAGEMENT

Date: Tuesday, July 27, 1999
Time: 08:00 - 09:30
Room: Pavilion Room - Mezzanine Floor

Moderator: Dr. Gunnar Hambraeus is the former president and chairman of the Royal Swedish Academy of Engineering Sciences. He is also the chairman of the Scandinavia-Japan Sasakawa Foundation. He holds a B.S. from Uppsala University, a master's in electrical engineering from the Royal Institute of Technology in Stockholm, and a Ph.D. from Chalmers University.

He has served as secretary for the State Council of Technical Research, technical advisor to the Swedish Embassy in Washington, D.C., editor in chief of Teknisk Tidskrift, and chief of staff to the International Atomic Energy Agency in Vienna. From 1969-70 Dr. Hambraeus was president and publisher of the Swedish Technical Press. He then became president (1971-82) and chairman (1983-85) of the Royal Swedish Academy of Engineering Sciences. He has also served as chairman of the Swedish Science Attache Service and as a member of the governing boards of numerous Swedish companies.

Dr. Hambraeus is currently of the boards of Swedish Telecom, Forshcda and Bruker Spectrospin. He is a member of Jakob Wallenberg and Wallenberg International Foundations, the IBM European Science Prize Jury, the Sweden America Foundation, and the Karlshamn Research Foundation. He has published numerous articles and papers on science and R&D policies, energy policy, and information technology.

Speaker: Dr. Kwan Rim is the President of Samsung Advanced Institute of Technology (SAIT), the central research laboratory of the Samsung Group. He

PLENARY SESSIONS

received his M.S. in Mechanical Engineering in 1958 and Ph.D. in Theoretical and Applied Mechanics in 1960, both from Northwestern University in the USA. In 1960 he joined the Department of Mechanics and Hydraulics of the University of Iowa, and was an engineering faculty member there until 1995. His administrative experience at Iowa includes: Chairman of the Department of Mechanics and Hydraulics (1971-74), Associate Dean of Engineering (1974-79), Chairman of the Division of Materials Engineering (1978-84), and Chairman of the Department of Biomedical Engineering (1984-90). He is the founder of the Biomedical Engineering Program at Iowa as well as the Iowa Institute of Biomedical Engineering. Dr. Rim held the U.S. National Science Foundation's SEED (Scientists and Engineers for Economic Development) Professorship in 1976-77, served as the President of the Korea Advanced Institute of Science and Technology (KAIST) from 1982 to 1984, and as a Visiting Professor in Japan in 1992. He has also served on the boards of directors of numerous educational and research institutes, including Saudi Arabian National Center for Science and Technology, Korea Advanced Institute of Science and Technology, Korea Institute of Machinery and Metals, and Korea Institute of Electronic Technology. His academic area is biomechanics, and his service interest includes technology transfer and international technical cooperation. He was the 1992 recipient of the Outstanding Biomedical Engineering Educator Award from the American Society for Engineering Education. He also served on the President's Council on Science and Technology of the Republic of Korea.

Speaker: Dr. Hans Danielmeyer is the Vice President of Japanese-German Center in Berlin, and a professor at the Univesrity of Munich. Previously he held various positions in industry and academia including Senior Vice President of Siemens and a member of the Board, Vice President of Siemens AG's Corporate Research and Technology, Foundation President of the Technical University of Hamburg, and chair of experimental solid state physics at the University of Hamburg. He is on the boards of several R&D institutions and prize committees.

Plenary Session - 3

COLLABORATION FOR TECHNOLOGY MANAGEMENT

Date: Wednesday, July 28, 1999
Time: 08:00 - 09:30
Room: Pavilion Room - Mezzanine Floor

Moderator: Dr. Frederick Betz is Professor of Technology Management at the University of Maryland. He received his doctorate in physics and then changed fields to operations research and management science. His long-term interest has been in the management of science and technology. He taught at several business schools and then became a science administrator at the National Science Foundation for many years. He is the author Strategic Technology Management and Managing Technological Innovation.

Speaker: Dr. Rosalie Zobel was born in England on March 18, 1943, received a bachelor's degree in physics from Nottingham University, UK, in 1964, and a PhD in radiation physics from London University of 1967. She started her career in the in the information technology industry in ICL in 1967, and later held positions as a systems engineer in CERN (Centre Européen pour la Recherche Nucléaire), Geneva, Switzerland, the Atomic Energy Research Establishment, Harwell, UK, and the Max Plank Institut für Plasmaphysik, Garching, Germany. At the latter she became operations manager of the first CRAY Supercomputer centre in continental Europe. In 1981 she moved to the USA and took up a position in the AT&T Headquarters, Basking Ridge, USA. She held positions as senior marketing manager for open systems software both for the USA and international markets, and was responsible from 1983-1986 for the international UNIX business. In 1986 she became senior marketing manager for information technology products in

PLENARY SESSIONS

AT&T Japan. She returned to Europe in 1988 as Deputy Head of Unit of the European Community's ESPRIT Business Systems unit. In 1991 she launced the EC initiative in Open Microprocessor systems (OMI). She is currently head of EC unit "Business systems, multimedia and microprocessor applications," and EU-coordinator of the G7 Pilot Project "Global Marketplace for SMEs."

Plenary Session - 4

MANAGEMENT OF INNOVATION FOR EMERGING TECHNOLOGIES

Date: Thursday, July 29, 1999
Time: 08:00 - 09:30
Room:Pavilion Room - Mezzanine Floor

Moderator: Dr. Gerhard Beenen is the Vice President of Engineering and Technology for the Tektronix Measurement Business Division where he oversees centralized engineering resources, strategic and advanced technologies, and global engineering resources. He has worked for Tektronix since 1982, in a variety of positions including analytical scientist, engineering project manager, quality engineering manager, manufacturing manager, and general manager of Tektronix' Cable Network Analysis product line. Dr. Gerhard received his B.S. degree in chemistry from the University of Wisconsin and a Ph.D. in Analytical Chemistry from Oregon State University.

Speaker: Dr. Michael Menke is President of Value Creation Associates. Prior to it, he was with SDG (Strategic Decisions Group) as one of its founders. Dr. Menke has published extensively on technology strategies, R&D management, innovation, decision making, and best practices in industry. He provides consulting and training services in the same areas. His clients include major corporations, academic institutions and government agencies. (Picture from the 1997 Album)

Speaker: Dr. Robert P. Colwell is an Intel Fellow in the Microprocessor Products Group and Director of the IA-32 Architecture in Intel Corporation. He is currently leading the architecture team designing the next generation microprocessor. Colwell joined Intel in 1990 as a Senior Architect on the Pentium® Pro project, and became manager of the Architecture Group two years later. Prior to his work at Intel, Colwell was a CPU architect at VLIW pioneer Multiflow Computer from 1985 until its demise in 1990. From 1980 to 1985 he worked part time as a hardware design engineer at workstation vendor Perq Systems, while attending graduate school at Carnegie Mellon University's Electrical and Computer Engineering Department. He was a member of the technical staff at the Bell Telephone Labs from 1977 to 1980, working on the BellMac series of microprocessors.

Dr. Colwell received his BSEE degree in Electrical Engineering from the University of Pittsburgh in 1977, MSEE in Electrical Engineering from Carnegie-Mellon University in 1978, and his Ph.D. from Carnegie-Mellon University in 1985. He is the recipient fo numerous awards for his achievements.

COMMENTS

General comments from the participants of PICMET '97:

"Very good event"

"Great job"

"Excellent conference"

"Excellent organization"

"Smooth going preparation and registration"

"Meticulous and impeccable"

"Everybody who is somebody is here. Nobody who is anybody can afford to miss this Conference."

"How did you get all these top people to agree to participate in PICMET?"

"I am impressed with the caliber of the speakers. Attending just one plenary session was worth the trip."

"I participated in lots of conferences. This is the best I have ever seen."

"If something happens to this hotel tonight, who is going to manage technology in the world tomorrow?"

"The leading companies are setting the standards in their industries. This conference set the standard for technology management in all industries."

"This is a wonderful conference. Thank you for the opportunity to participate in it."

"We all talk about 'world class'. PICMET showed us what 'world class' is."

"I got very good ideas and concepts to take back to my work place"

"The information I obtained on program offerings at different institutions was most valuable for me"

"Congratulations to everyone for a job well done"

What the participants liked most about PICMET '97:

Conference organization and staff (24 responses): Quality of the organization, helpful students, friendly the staff, dedicated volunteers

Quality of the attendees (11 responses): Breadth and variety of attendees, mix of academia and industry, international mix

Quality of the technical program (9 responses): Plenary sessions, paper sessions, workshops

Papers and topics (20 responses): Selection of topics, mix of topics, range of topics, diversity of topics, large choice of presentations, quality of papers, variety of papers, range of papers, organization of papers

Conference deliverables (12 responses): PICMET web page, use of e-mail and the web, continuous communication with authors, the proceedings, CD ROM,

Networking (17 responses): Networking with bright people, exchange of ideas, meeting competent people in the technology management field, making contact

Others (12 responses): Weather, timing, size of the conference, location in Portland

What the participants liked least about PICMET '97, and what was done for PICMET '99 to alleviate them:

There were too many no shows in PICMET '97
Only the pre-registered authors have been included in PICMET '99

There were too many parallel paper sessions
Poster sessions were introduced in PICMET '99

Some papers did not fit their session
Sessions were organized in PICMET '99 on the basis of the authors' own definition of the match between their paper and the topical categories

There was not enough space at the cruise
The cruise ship used in PICMET'99 has more than twice the space as the one in PICMET'97.

There was noise in the hallways during sessions
Coffee is being served only on one level in PICMET '99. It is the open area near the PICMET registration desk

Proceedings was too heavy
PICMET '99 Proceedings Vol-1 is half as big. It contains one-page summaries and is sufficient during the conference. Proceedings Vol-2 is on CD-ROM. The "Technology and Innovation Management" book is for reference use, representing the entire field, for use in the office. The proceedings will be 2-volumes, each one half as big as the '97 proceedings.

More industry interaction was needed.
PICMET '99 has site visits, two Executive Forums by high-tech executives, and an entire track of sessions on industry applications sessions.

PAPERS AND PANELS

MB-01 **Monday, July 26, 1999**
10:00 - 11:30 **Galleria-1**

Environmental Issues in Technology Management 1
Chair: Amy Saberiyan, NEEK Engineering

MB-01.1 - Clean Manufacturing Strategies Under the Influence of Public Policy

Markus Biehl, International University in Germany
Cheryl Gaimon, Georgia Institute of Technology

A firm's transition toward clean manufacturing (CM) is largely driven by public policy. The pursuit of CM focuses on reducing the amount and toxicity of waste from manufacturing processes. This research examines the optimal transition of a firm's CM capabilities in response to various forms of public policy including penalties, subsidies, and cost sharing.

MB-01.2 - Technology and Innovation Management Strategies for Green Manufacturing

Anurag Sharma, National University of Singapore
S. Ong, National University of Singapore
A.Y. Nee, National University of Singapore

The rapid pace of technological advancements gives rise to a sense and growing concern for environmental degradation caused by the industrial units. This has brought into focus the need for strategic management of Technical Innovations and Life Cycle Engineering to further the cause of Green Manufacturing. In the present paper, a systems approach, integrating life cycle engineering with technology and innovations, manufacturing systems and environmental and ecological systems is discussed in the context of modern-day manufacturing. The paper highlights the strategies for achieving Green Productivity and Green Manufacturing.

MB-01.3 - How to Break Down Sustainable Development to Management of Technology and Innovation

Heinz Hubner, Universitaet-Gh Kassel

"Technology & Innovation Management ... will establish the direction of the third millennium" (PICMET '99). To minimize possible undesired ecological effects along with manufacturing and utilization of technology and products, "Sustainable Development" is well suited as a vision for further development. The paper describes related procedures and instruments; results of a project, comparing wheel/rail with electromagnetic levitation technology for high-speed trains with special emphasis on resource efficiency are showing the practicability of related tools.

MB-02 **Monday, July 26, 1999**
10:00 - 11:30 **Galleria-2**

Technology Marketing 1
Chair: Hugo Tschirky, Swiss Federal Institute of Technology

MB-02.1 - International Dynamics of Product Market Competition

Kenneth Simons, University of London

A sample of product markets is compared across the US, UK, and other nations. Technological and product-related characteristics, rather than national environments, appear to determine much of the evolution of competition in particular product markets. New means to understand technological and competitive dynamics of product markets may be feasible, using common behavioral patterns to classify industries.

MB-02.2 - An Exploratory Study of Electronic Marketing on the Internet in a Concentrated Marketplace

Ziqi Liao, Nanyang Technological University

This paper presents a regression model to quantify the impact of various aspects related to virtual marketing. The results suggest that transaction security, prices and kinds of products offered, service quality of vendors, consumers' knowledge on information technology and level of Internet usage have impacts on the propensity of consumers to electronic retail business in Singapore.

MB-02.3 - Creating Customer Value in New Technology-based Services

Jeanke van der Haar, Stork N.V. SBU Aerospace
Ron G.M. Kemp, University of Groningen
Onno W. F. Omta, University of Groningen

Conducting market research for new and innovative products is complicated by the fact that customers have no experience with them. In this paper we will argue how a conjoint analysis can be used to measure the gap between the intended value map of the company and the desired value map of its customers to predict market success of new products and services. For this study a customer value model has been developed that describes how customers choose between products and how a company can base its business development activities on these choices. To test the customer value model, a case study has been conducted at a large R&D intensive company in office equipment to augment a technical product with additional services. In a conjoint analysis different service offers were simulated as in a real-world purchase situation. Based on the results, types of newly designed services that increase the expected value to the customers could be brought forward. For the company at issue, the current findings have been the starting point for a new way of looking at business development, monitoring changes in customers perceptions, and adapting the offered customer value to these changes.

PANEL: MB-03 **Monday, July 26, 1999**
10:00 - 11:30 **Galleria-3**

Developing and Testing Practical Tools for Developing Strategy and Managing Technology
Moderator: Michael Bourne, University of Cambridge

Panelist(s): John F Mills, University of Cambridge
Michael J Gregory, University of Cambridge

Practicing managers need usable, useful and worthwhile tools to assist them with the development of their strategy and management of their technology. This panel will outline the action research methodology used to develop and test tools and processes for doing this; provide an example of one such tool for the identification of core competences and capabilities; and give an interactive demonstration of how this tool is used in companies through involving the delegates in a participative case study.

MB-04 **Monday, July 26, 1999**
10:00 - 11:30 **Parlor B**

Program/ Project Management 1
Chair: Matthew J Liberatore, Villanova University

MB-04.1 - Emerging Project Management Techniques: A Managerial Assessment

Hans Thamhain, Bentley College

Modern project management tools and techniques have been investigated with focus on their applications to complex project situations. The paper identifies criteria for effective project control, and makes specific recommendations for effective use of these techniques in complex and technology-based project environments.

MB-04.2 - Project Management Standardization and its Impacts on Project Effectiveness

Lane Inman, Seagate Software
Dragan Milosevic, Portland State University

Despite a decade or more of work on standardized project management, SPM, we barely know the results of such essentially costly efforts. Presumably, SPM should lead to higher operational effectiveness expressed in terms of more successful fulfillment of project cost, schedule, customer satisfaction, and quality goals. But does SPM lead to higher operational effectiveness? That is exactly the question that senior managers accustomed to the return on investment parlance ask. That is also a question that our research study addresses. And, on the basis of the survey of 235 project participants, this study provides evidence that standardized project management is a strategy that enhances projects' effectiveness.

MB-04.3 - Metrics and Critical Success Factors for Managing Organizations by Projects

Don White, California Polytechnic State University
John Patton, Cadence Management Corp

Managing Organizations By Projects (MOBP) is becoming increasingly attractive for firms to implement their strategic plans in rapidly changing environments. The paper covers the importance of tightly linking the MOBP and strategic planning processes, the Critical Success Factors (CSFs) for effective strategic implementation, metrics to measure performance and identify continuous improvements, and several example highlights from actual experience with numerous companies.

MB-06 **Monday, July 26, 1999**
10:00 - 11:30 **Studio**

Information/ Knowledge Management 1
Chair: Sergio Takahashi, University of Sao Paulo

MB-06.1 - Managing Knowledge for Technological Innovation

Kumar Nochur, Vidya Technologies, Inc.

Successful innovation depends on the creative synthesis of information and knowledge about customer needs and technological capabilities. Within the R&D function, critical expertise often resides with researchers in the form of tacit knowledge. This paper discusses how both tacit and explicit technical knowledge can be leveraged to enhance technological innovation.

MB-06.2 - Organizational Learning Among High Performance Teams

Fernanda Ferrari, Sao Paulo University
Sergio Takahashi, University of Sao Paulo

This paper focuses on the technical and behavior learning among the teams, in the tacit and explicit level, through theoretical revision and case studies in service companies. The paper will emphasize the teams' skills, the exchange mechanisms that improve these skills and the organizational context that influence them.

MB-07 **Monday, July 26, 1999**
10:00 - 11:30 **Directors**

Technology Planning and Forecasting 1
Chair: Yolanda A Castano, University of Oviedo

MB-07.1 - How to Learn About the Future

Yolanda Castano, University of Oviedo

System dynamics models provide a useful tool for analyzing the scope of the effect that the policies adopted are going to have on the performance of R&D projects. In this way, it is possible to evaluate possible alternatives, in order to choose that decision which improves the process.

MB-07.2 - Technology Foresight as a Key Element in Make-or-Buy Strategy

David Probert, University of Cambridge
Laura Canez, Unversity of Cambridge
Robert Phaal, Cambridge University

This paper discusses the need to foresee technology requirements and trends when undertaking a make-or-buy analysis. Decisions that seem "right" today may not be right for the future. Technology analysis requirements for make-or-buy strategy are reviewed along with the contribution of current and emerging technology foresight techniques.

MB-07.3 - Identifying the Future Applications of an Emerging Technology: The Case of Virtual Reality
Jeff Butler, Manchester Business School
Tim Watts, Manchester Business School

A business process model is presented to articulate and illustrate the benefits of using V-R. The model can encourage managers to re-examine their innovation strategy. It facilitates a broad evaluation of the relevance of V-R. Systems developers can anticipate and stimulate customer requirements and expose latent management needs.

MB-08 **Monday, July 26, 1999**
10:00 - 11:30 **Council**

Collaboration for Technology Management 1
Chair: Frederick Betz, University of Maryland

MB-08.1 - No Trust, No Risk, No Gain: The Role of Trust and Risk in Technological Strategic Alliances

Andreas Hoecht, University of Portsmouth
Paul Trott, University of Portsmouth

This paper sets out to explore the notion of trust with respect to technological cooperation and strategic alliances. Increasingly technology collaborations are being viewed as a way of accelerating the process of acquiring and developing knowledge, rather than by following the traditional go-it-alone model. There is, however, limited discussion within the business and management literature concerning the risks involved in technological collaboration. The literature on strategic alliances continues to grow. This research is varied and vibrant, yet large and fragmented. This paper reviews the business and management literature and proposes a trust and risk framework to help companies involved in technological collaborations. The framework offers a different way of examining potential alliances and collaboration in particular with respect to trust and knowledge leakage.

MB-08.2 - Why Collaborate? Exploring Industry's Strategic Objectives for Establishing Industry-University Technology Relationships

Michael Santoro, Lehigh University
Alok Chakrabarti, New Jersey Institute of Technology

This study examined the strategic objectives that industrial firms have for establishing industry-university technology relationships. Results from this multi-method, exploratory field study show that three clusters of firms surfaced: collegial players, aggressive players, and targeted players. The implications of these findings for both industry and universities are discussed.

MB-08.3 - Collaboration in Technology Management - A Modeling Method for Workflow Management Supporting Decentralized Organizational Forms

Wilhelm Dangelmaier, University of Paderborn
Dirk Foerster, Heinz Nixdorf Institute
Stephan Kress, University of Paderborn
Ruediger Wenski, University of Paderborn
Joao Jose Pinto Ferreira, INSEC

Fast changes in technology make a flexible management of organizational units absolutely necessary. To decrease the effort for process coordination even for decentralized activities workflow management is seen as a supporting methodology. This paper presents a modeling method supporting planning, execution and control of decentralized organizational structures.

PANEL: MB-09 **Monday, July 26, 1999**
10:00 - 11:30 **Forum**

IEEE Transactions on Engineering Management: Strategic Directions and Critical Issues
Moderator: Dundar F. Kocaoglu, Portland State University

Panelist(s): R. Balachandra, Northeastern University
Fred Betz, University of Maryland
Alok Chakrabarti, New Jersey Institute of Technology
Burton V Dean, San Jose State University
George F Farris, Rutgers University
Cheryl Gaimon, Georgia Institute of Technology
Jeffrey K Liker, University of Michigan
Ilze Zigurs, University of Colorado, Boulder

The IEEE Transactions on Engineering Management is 45 years old this year. Published quarterly since 1954, it is the oldest refereed research journal providing leadership in the field of Engineering and Technology Management. The editor-in-chief and department editors will discuss the strategic issues and directions of the journal and answer the questions of the participants in this session.

MB-10 **Monday, July 26, 1999**
10:00 - 11:30 **Cabinet**

International Issues in Technology Management - 1
Chair: Kerstin Cuhls, Fraunhofer Institute for Systems and Innovation Research (ISI)

MB-10.1 - The German Foresight Study '98 on the Global Development of Science and Technology

Kerstin Cuhls, Fraunhofer Institute for Systems and Innovation Research (ISI)
Knut Blind, Fraunhofer Institute for Systems and Innovation Research (ISI)

The German foresight study on the global development of science and technology was published in 1998 by the Fraunhofer Institute for Systems and Innovation Research (ISI) on behalf of the Federal German Ministry for Education, Research, Science and Technology (BMBF). The study makes use of the Delphi method with a time horizon of 30 years, and is conducted once more in a cooperation with the Japanese National Institute of Science and Technology Policy (NISTEP). 30% of the topics are comparable. Not only emerging technologies but also 19 megatrends were asked for. The Delphi process is organized with a steering group and expert panels for the preparation of topics, a two round Delphi with feedback and an implementation phase with workshops. The Delphi process is still going on.

MB-10.2 - Impact Assessment of a Responsive Technology in the Production of Infrastructural Works: Experience from Namibian Labour-Based Programme in the SME Construction

Hina MuAshekele, Univesity of Namibia

This paper proposes a model to assess the impact of an alternative production technology management system, in the employment and income distribution, in countries with high unemployment and limited financial resources. The criteria for the responsive technology, RT, as an alternative production technology management system is outlined and the RT concept defined. The Labour based construction method, as an alternative method as applied in the construction sector of the Namibian Small and Medium Enterprise (SME), was used as an example.

MB-10.3 - Comparison of the Socio-Cultural, Economic, Governmental, and Infrastructure Environments in Singapore and the Philippines from Technology Management Perspective

Leonard Olive, Oregon Bureau of Transportation Engineering and Development
Uthai Chulapongwanich, Portland State University
Carol Radabaugh, LSI Logic Corp.
Charlie Mack, Underwriters Laboratory
Susan Adam, Tektronix Inc.
Swaminathan Jayasankar, TRW Supply Chain Integration
Lowell Rogers, Black & Veatch Corp.
Carlos Andino, Portland State University

The purpose of this paper is to develop and apply a methodology for the comparison of different countries as potential business investment alternatives. This paper focuses on the geographical region of Southeast Asia, with the contrasting countries of the Philippines and Singapore having been selected as case studies. Four key country characteristics (socio-cultural issue, economic conditions, governmental factors, and infrastructure) are studied in order to evaluate the attractiveness and feasibility of a mid- to high-tech American company conducting business in one of these countries.

MB-11 **Monday, July 26, 1999**
10:00 - 11:30 **Executive**

New Venture Management-1
Chair: Dilek C Karaomerlioglu, Chalmers University of Technology

MB-11.1 - Building A Biotechnology Cluster

Dilek C. Karaomerlioglu, Chalmers University of Technology

The paper discusses the growth of a high-technology cluster based on biotechnology. Based on the experience of the biotechnology cluster in Ohio, we explore how a cluster of industries can be built in a region. We highlight the institutions, industrial structure, and technological features that determine the cluster formation process.

MB-11.2 - Product Concept Creation in New Business Development

Masanori Namba, Kawasaki Steel Corp.
Kiyoshi Niwa, University of Tokyo

The conception capability for a new product concept is increasingly more important as the source of competition power for a business firm. To develop an innovative product in a new business market, which has been diversified to a different field, is a challenging and very difficult task. To succeed at the task, securing and /or training of a concept creator (Hereinafter, a person who plans the concept of a new product and promotes to be a business is called a concept creator) becomes one of the most important tasks. In the case of Kawasaki Steel Corporation (KSC) which diversified into the LSI business field, the strategy of joint use of "collaborative development" and "internal incubation" was effective to develop concept creator. Moreover, KSC established a development subsidiary that is concentrating on creating a new break-through type innovative product in Berkeley, California, U.S.A. using this methodology.

MB-11.3 - Some Characterization of R&D Based Venture Firms in

Japan - New Styles of Management

Tomomichi Yoshikawa, Yokohama City University

In Japan, especially after the 1990s, a large number of R&D-based small venture firms were established. This relatively new phenomena indicates that the new type of firm is quite different from traditional SMEs. Some of them do not produce their product; rather, they are developing a new product based on product technology. On the contrary, traditional small and medium enterprises (SMEs) are well known as competitive parts suppliers to assembly makers based on process technology. We have interviewed more than 40 R&D based venture firms, analyzed their characterizations in terms of technology, market, marketability, product differentiation, product life, increasing return and innovation process.

MB-11.4 - Financing of Innovative Technology Based Ventures: Study in Indian Context

Vimal Kumar, Government of India
P.K. Jain, Indian Institute of Technology

At the present stage of globalisation of the Indian economy, it is being further realised that innovative technology-based ventures are imperative. Ever-increasing competitiveness in the technological arena around the globe on the one hand and the requirement of low-cost funds for such ventures on the other hand have made the subject a matter of serious concern to policy makers. The paper presents the financing of innovative technology-based ventures in the Indian context. The study is based on a stratified sample covering all major stake holder segments. It reveals that the funding mechanisms, inter-alia, are beset with higher interest rates & lack of long-term vision.

MB-12 **Monday, July 26, 1999**
10:00 - 11:30 **Senate**

Supply Chain Management - 1
Chair: David J Sherwin, Vaxjo University

MB-12.1 - A Distributed GDSS for Supply Chain Management

Zice Song, Nanyang Technological University
Robert de Souza, Nanyang Technological University
Chaoyang Liu, Nanyang Technological University

In this paper, the authors propose a novel framework for implementing the distributed group decision support system for supply chain management. It enables the decision-maker to have both what-if and what-best scenarios. Market mechanism, especially the price system, is applied as the coordination mechanism of the group optimization to obtain Pareto optimal solutions.

MB-12.2 - Buyer-Seller Relationships in the Supply Chain: Factors Affecting Customer and Seller Commitment

Chickery Kasouf, Worcester Polytechnic Institute
Kevin Celuch, Illinois State University
Samukta Warty, Worcester Polytechnic Institute

Original equipment manufacturers (OEMs) need to develop a supply chain that is willing to invest in product development, yet sellers are often skeptical of the buyer's commitment and thus apprehensive about making investments in project specific assets. This paper proposes a bilateral model to explain buyer-seller relationships.

MB-12.3 - Modularization in NPD and Supplier-Buyer Partnerships: A Mathematical Modeling Approach

Juliana Hsuan, Copenhagen Business School

Modularization facilitates supply chain management as it substantially reduces and standardizes manufacturing processes, subsequently altering the nature of firms' supplier-buyer partnerships. The mathematical model analyzes the opportunities for modularization with respect to interface constraints at component, module, sub-system, and system levels, and how it is influenced by supplier-buyer partnerships.

MB-13 **Monday, July 26, 1999**
10:00 - 11:30 **Pavilion East**

Industry Applications-1: Utility Industry
Chair: Janice L Forrester, Cytera Systems, Inc.

MB-13.1 - Managing Information Technology for Improving Service Quality in the Electric Utility Industry

Pratyush Bharati, Rensselaer Polytechnic Institute
Daniel Berg, Rensselaer Polytechnic Institute

Service quality has become increasingly important. Information Technology (IT) is integral to a service organization. The challenge is to manage IT to enhance service quality. Concepts from management information systems, communications and strategy have integrated in a conceptual model, which describes the management of IT to improve service quality. The model is backed by recent data.

MB-13.2 - A Multi-Objective Economic Model to Assess and Evaluate Capital Expenditures Associated with a Foreign Utility

Gregory Jones, Enron/ Portland General Operations Company
Daniel Jones, Enron/Portland General Operations Company

The privatization of the global energy market has presented unique problems and issues to the investor. With these unique problems and issues, the need arises for creative solutions when bringing innovative technology to a utility. The objective of the model presented herein is to assist the decision-maker in the assessment of the costs/benefits of implementing innovative technology programs into the financial performance of a utility.

MB-13.3 - A System Approach Towards an Effective IT Strategy for Modern Electric Utilities

Kam-Hoong Cheong, Royal Institute of Technology
Magnus Haglind, KTH

An increasing number of electric utilities are attempting to formulate an effective information technology (IT) strategy to assist them in confronting the newly deregulated, rapidly changing business environment. Through a case study and a quantitative survey, this paper uncovers some of the weaknesses of existing IT strategy and proposes a system approach towards achieving a more effective IT strategy.

MB-13.4 - Time Wars: Is There a Declining Financial Justification for Rapid Technical Advance in the Telecommunications Industry?

Donald Hicks, University of Texas at Dallas

Seeking to use rapid technical advance to establish their competitiveness, telecom equipment manufacturers and services providers must face questions about whether massive internal R&D investment remains financially justified. Supplementing identity-preserving innovation strategies such as internal R&D investment and strategic (embodied R&D) procurement, more spontaneous identity-transforming producer alliances have surged as an alternative route to rapid technical advance.

MC-02 **Monday, July 26, 1999**
13:30 - 15:00 **Galleria-2**

Technology Marketing 2
Chair: Robert Harmon, Portland State University

MC-02.1 - Channel Strategy in the Data Projector Industry

Candace Petersen, C. Petersen Consulting
Robert Harmon, Portland State University

Channel strategy in technology markets often lags in importance behind product, pricing and marketing communication decisions. Intensifying competition and technology advances, such as Internet-based commerce, are elevating channel decisions as a source of competitive advantage. This paper focuses on the factors that are influencing channel strategy in the data projector industry.

MC-02.2 - The Influence of Certain Angles and Shapes, and Their Relevance for Marketing and Industrial Design

Jean-Pierre Mathieu, ESCNA
Rene Thieblemont, Universite de Savoie
Yvon Gousty, Domaine University de Saint-Jerome

The aim of this article is to introduce, in the field of marketing research, the influence of shapes - which are used in advertisement images as well as product packaging and design - on consumer behavior through his opinion on the products' overall aesthetics and harmony. Amongst the explanations found , shape recognition and the use that marketing can make of it must be taken as tools both innovative and complementary that can used to complete the pre-existing research. We shall use, in order to demonstrate our hypothesis, an application of angular shapes on image as it is used in advertisements.

MC-02.3 - Systematic Analysis of Technology Market of China and Its Systematic Forecast in 2000

Xingsan Qian, University of Shanghai for Science and Technology
Jinghong Zhu, University of Shanghai for Science and Technology
Wang Lin, University of Shangai for Science and Technology

This paper discusses system forecasting and system analyzing for development of technology markets in China. It mainly applies the multi-dimension statistic analysis methods to forecast the technology market in 2000. This system forecasting is based on the data of Chinese technology market developed in 1987-1995.

MC-03 **Monday, July 26, 1999**
13:30 - 15:00 **Galleria-3**

Management of Technological Innovation 1
Chair: Michael Bourne, University of Cambridge

MC-03.1 - TRIZ: The Science of Systematic Innovation

Ellen Domb, The PQR Group

TRIZ is the acronym for "Theory of Inventive Problem Solving" in Russian. The TRIZ methodology was developed between 1946 and 1985, and is now in use world-wide. It is a systematic, left-brain creativity method, and is very well-suited to the development of new and improved products, services, and systems.

MC-03.2 - Categorizing Organization Design for Innovation Management

Huw Richards, University of Cambridge
Ken Platts, University of Cambridge
Michael Bourne, University of Cambridge
Andy Neely, University of Cambridge

Why are some manufacturing companies able to effect new management processes, while others fall at the first hurdle? Does their organization's design influence success or failure? We test seven survey questions, derived from Mintzberg's (1981) paper "Organization design : fashion or fit?", intended to categorise a company's organization design.

MC-04 **Monday, July 26, 1999**
13:30 - 15:00 **Parlor B**

Program/ Project Managament 2
Chair: Allen T Pierce, Portland General Electric

MC-04.1 - Strategic Project Management: The New Framework

Aaron Shenhar, Stevens Institute of Technology

The purpose of this paper is to suggest a framework for a new research agenda for project management in the coming years. The idea is to focus research on the competitive potential of project management and promote deeper conceptual understanding, integrative practices, and wider-based education. Based on ideas which emerged in our previous studies, the paper deals with some strategic, cultural, organizational, and operational issues which are often neglected in the current practice and education in project management.

MC-04.2 - Innovation Project Management: A New Zealand Approach

Bob Mills, The University of Waikato
Alan Langdon, The University of Waikato
Conan Fee, The Univerisy of Waikato
Chris Kirk, Massey University

The innovation project management practices in six successful New Zealand companies involved in the electronics, food and forestry sectors have been investigated. The study supports earlier work with seven R&D purchasers and providers and suggests there is need of a new approach to manage the complete technology innovation process.

MC-04.3 - How to Improve Project Management

Yolanda Castano, University of Oviedo

The purpose of this work is to increase the knowledge and understanding of development projects dynamics in order to improve their performance. This paper criticizes the employment of some organization practices, and defends some structural and cultural changes - autonomous team, preventive quality policies, tolerance of failure - which provide the success of process.

MC-04.4 - New Challenges in Project Management: The Third Millennium Scenario

Ravikiran Kalluri, Bell Atlantic Network Integration

At the dawn of the third millennium, the world is witnessing revolutionary breakthroughs in technology to enhance the standard of human living. This has led to a heightened demand for technologically superior products with high quality. The industry has responded to this challenge with a relentless pursuit towards perfection. But this never ending struggle to exceed the buyer's expectations has put an ever increasing pressure on project managers to shorten development cycles without compromising on quality. The key to success lies in enabling a seamless flow of information across diverse groups and fostering better insight into the multivariate business objectives prevalent today. An example is presented along with an implemented solution.

MC-05 **Monday, July 26, 1999**
13:30 - 15:00 **Parlor C**

Technology Management Education 1
Chair: Michael A Driscoll, Portland State University

MC-05.1 - Growth and Development into the Millennium

Luis Curran, British Columbia Institute of Technology
Jim Hendry, British Columbia Institute of Technology

Critical to the continuing success of any technology management educational program is its ability to provide accessibility to candidates from anywhere. From inception through to continuing development, access must be one of the primary goals in development in order to maintain the vitality, growth and dissemination of the pro-

gram. This paper outlines the development of the Bachelor of Technology degree in Technology Management at the British Columbia Institute of Technology in Vancouver, Canada, from its inception to the present.

MC-05.2 - Graduate Management of Technology Education: A Global Survey

Satish Nambisan, National University of Singapore
David Wilemon, Syracuse University

This study provides a status report on graduate MOT education world-wide and highlights the emerging trends in terms of program themes, technologies, and management issues addressed. We conducted an international survey of graduate MOT programs in North America, Europe, and the Asia-Pacific regions. In this paper we report the preliminary results of our study.

MC-05.3 - Engineering Schools as a Major Actor in the Management of Innovation

Christian Allies, Ecole Universitaire d'Ingeniurs de Lille
Pierre Legrand, EUDIL Ecole Universite Sciences et Technologie de Lille
Serge Peytavin, ISIM Institute des Sciences de L'Ingenieur Montpellier 2
Michel Troquet, CUST Centre Universitaire de Science et Technolgie

Engineering schools in France were quick to develop relations with industry and participate in economic development by integrating technological evolution. We will define our position in accordance with a European description in order to show how higher education can be considered as a major actor in the management of innovation.

MC-06 **Monday, July 26, 1999**
13:30 - 15:00 **Studio**

Information/Knowledge Management 2: Achieving Return on Critical Knowledge -1
Chair: Joyce A Thompsen, Achieve Global

MC-06.1 - Organizational Physics: Knowledge is Elementary

John Center, Center Associates

How does one relate to, understand, predict, describe, explain changes in the organization or state of the organization? Answers to these questions lie in the world of physics - organizational physics. This paper explores how to apply concepts and laws of classical physics to managing organizations - specifically the laws of motion and laws of thermodynamics. It further dives into applying concepts and ideas of modern physics to the same purpose. The paper proposes that knowledge, or packets of knowledge, plays the role of elementary particles and forces.

MC-06.2 - The Role of Communication and Information Flow in Leveraging Critical Knowledge to Create Market Value

Richard Vicenzi, Principal, The Solutions Group

Value creation occurs when knowledge and ideas are leveraged through communication and access to information into intellectual capital, and intellectual capital is leveraged through innovation into market value. This requires both networked resources and ad hoc linkages between employees as well as appropriate external alliances. Conditions requred to sustain authentic, meaningful, values-driven relationships that generate leverage are outlined. Implications for management and leadership in knowledge-based organizations are discussed.

MC-06.3 - Return on Investment in Intellectual Capital

Kenneth Moten, Lockheed Martin Astronautics

In today's marketplace, companies that survive and prosper will build alliances with international partners and have global strategies at the core. Those companies will also realize that their number one business discriminator is intellectual capital. The day of capital investment and technology being the essential competitive advantage is a thing of the past. A major challenge is to recruit the best and brightest and maintain that advantage over time. Companies that transfer knowledge and encourage innovation throughout the organization in order to maximize effectiveness will be the most successful. This paper will review issues and strategies to maximize the organizational effectiveness of intellectual capital.

MC-06.4 - Knowledge Management Audits

Earl Joseph, Walden University

The purpose of knowledge management audits (KMA) is to identify and measure the worth of critical knowledge to the corporation/institution. A number of embryonic KMA tools are described and illustrated with a number of case-based applications.

MC-07 **Monday, July 26, 1999**
13:30 - 15:00 **Directors**

Technology Planning and Forecasting 2
Chair: Fred Y Phillips, Oregon Graduate Institute of Sci. & Tech.

MC-07.1 - Creating Alternative Futures: Introducing Non-Linear Considerations into the Management of Technology

John Peterson, Lucent Technologies Inc.
John Anderson, NASA Headquarters
Michael Radnor, Northwestern University

In a departure from arduous formal scenario planning, a futures approach based upon NASA's Horizon Mission Methodology adapted to the emerging "MATI" model of the technology intensive firm will be presented. It has the virtues of being an infomal, flexible and adaptable planning technique which can easily become an embedded management skill. Although not a cure-all for business problems, it does provide a framework for interweaving vision with creative solutions and options.

MC-07.2 - A Method for Detecting a Shift in a Trend

Fred Phillips, Oregon Graduate Institute of Sci. & Tech.

A technological or policy change can shift a trend in a tracked quality to a new regime (slope). A new piercewise-linear regression captures this shift. This method is developed and applied to historical data on the price of polyvinyl chloride.

MC-07.3 - Flexibility in Technology Forecasting, Planning and Implementation: A Two Phase Idea Management Study

Chitra Sharma, Indian Institute of Technology
A.D. Gupta, Indian Institute of Technology
Sushil, Indian Institute of Technology

Idea management encompasses all fundamental operations with ideas to deal with a complex issue. This paper describes a two phase idea management study carried out in the Indian engineering industry to incorporate flexibility in technology forecasting, planning, and implementation activities of the industry. Modified idea-writing and interpretive structural modeling (ISM) were used to generate, classify and structure the ideas.

MC-07.4 - Chaos Theory in Technology Forecasting

Clement Wang, National University of Singapore
Xuan Rui Liu, National University of Singapore
Daoling Xu, National University of Singapore

We describe how chaos theory can be used in technological forecast-

ing. The paper proposes that technology evolutions be regarded as a nonlinear process exhibiting bifurcation, transient chaos and order state. It also examines the utility of this approach by introducing artificial neural networks and drawing implications for managerial decision making needs.

MC-08 **Monday, July 26, 1999**
13:30 - 15:00 **Council**

Collaboration for Technology Management 2
Chair: Robert D Dryden, Portland State University

MC-08.1 - A Model for Integrating the Industrial Sector with Universities

Ghaleb Abbasi, University of Jordan
Jamal Assbeihat, Amman College for Engineering Technology

The objective of this paper is to present a model for integrating the abilities of both public universities and the industry. After inspecting the current environment, analyzing factors affecting the integration process, and examining statistical data, an integrated model was proposed. This model was composed of three main elements: universities, industry, and the Education-Industry Interface Unit.

MC-08.2 - An Empirical Knowledge-Based Framework for Analyzing Government-University-Industry Strategic Research Partnerships

Elias Carayannis, The George Washington University
Jeffrey Alexander, Washington CORE

In an effort to leverage R&D resources, the United States and other countries are promoting government-university-industry (GUI) strategic research partnerships. Our paper develops a framework for assessing such partnerships using case studies from the U.S. (the Microelectronics Advanced Research Corporation or MARCO), France (MEDEA) and Germany (Fraunhofer).

MC-08.3 - Comparative Practices of European Union (EU) and ASEAN Firms on Technology-Based Interactions with Universities

Chee Meng Yap, National University of Singapore
Siaw Kiang Chou, National University of Singapore
Ingo Thybussek, Aachen University of Technology
Werner Gocht, Aachen University of Technology
Vincenzo Pozzolo, COREP

A survey of 28 firms in ASEAN and 18 firms in EU on university-industry collaboration provided some interesting observations. Firms in the two regions employ different structures for managing technology, use different numbers and types of technology sources. The number of university services and the motivation for collaboration with universities also differ across the two regions. The only similarity is the dissatisfaction with the working relationships with the university.

MC-10 **Monday, July 26, 1999**
13:30 - 15:00 **Cabinet**

International Issues in Technology Management 2:
Chair: Dietmar H Winzker, Cubex Engineering Mgmt Systems (Pty) Ltd

MC-10.1 - Engineering Management at the University of Pretoria: The First 10 Years

Antonie de Klerk, University of Pretoria

This paper provides an overview of the evolution of the Engineering Management Program at the University of Pretoria and the department that has grown from the program. It suggests some views on the discipline of engineering management, offers a number of observations and "lessons learned", and describes several academic spinoff products.

MC-10.2 - Quality Assurance in Engineering Education

L.M. Masu, University of Durban-Westville

The need of the hour is to go for assessment and accreditation of institutions of higher learning. How can one go about this? What is meant by quality in higher education? Can one think of a process that is suitable for Africa without compromising standards? This paper addresses such typical and yet important questions as well as describing the philosophy and logic for assessment and accreditation procedures in engineering education in Africa.

MC-10.3 - Management of Engineering Educational Institutions Through Objectional Process

W.A.B. Kunje, University of Malawi

The objective of Management of Engineering Education Institutions through Objective Process is that managers are able to visualize the educational institution as becing composed of compoentent systems that are dynamic with well-defined basic purposes or goals that are based on the instituion's overall goal. Because of this, they are able to effectively plan and execute achieve results more economically.

MC-11 **Monday, July 26, 1999**
13:30 - 15:00 **Executive**

New Venture Management-2: Opportunity Screening and Investment Decisions for New Technology Based Ventures
Chair: Paul Guild, University of Waterloo

MC-11.1 - Decision Criteria Used by Investors to Screen Technology-Based Ventures

Jagdeep Bachher, University of Waterloo
Enrique Diaz DeLeon, University of Waterloo
Paul Guild, University of Waterloo

We investigate the decision-making criteria used by Canadian business angels, and venture capitalists to screen investment proposals from early stage technology-based ventures. This paper summarizes the main areas of interest to the investors when screening proposals for the first time. We found evidence that business angels focus on the characteristics of the venture offering and venture capitalists (PVCs and PVCFs) are primarily interested in understanding the characteristics of the entrepreneur(s) at the screening stage.

MC-11.2 - Assessing New Venture Technological Viability

Douglas Sparkes, University of Waterloo
Paul Guild, University of Waterloo

A framework for the early assessment of seed-stage small, knowledge-intensive technology-based ventures is discussed. The focus of the framework is on the technological viability of the venture, specifically its technological capability. The analysis focuses on the required competencies of the venture and how this matches with the available knowledge-base. Competence maps and knowledge maps are discussed as potentially useful tools in this analysis.

MC-11.3 - Opportunity Screening Criteria for New Information Technology Ventures

Orla Hegarty, University of Waterloo
Paul Guild, University of Waterloo

This paper gives preliminary results from a study that seeks to

identify investment criteria for new technology based ventures in the information technology (IT) industry. Information was gathered from the existing literature on the evaluation of technology and solicited through opportunity screening software tools used by two established information technology firms. Criteria most notably absent in the industry tools were those specific to assessing the technology as well as those pertaining to the economic implications of the opportunity. Practitioners looking to fund or lend to technology based ventures will benefit from a clearer understanding of how these opportunities are screened and what criteria tend to be ignored.

MC-11.4 - Brazilian Constraints to Venture Capital

Joao Filho, IPT
Marly Monteiro De Carvalho, Cidade Universitaria
Solange Machado, Sao Paulo University
Roque Rabechini Jr., Technological Research Inst. of Sao Paulo State

This paper conceptually discusses the Venture Capital mechanism and its constraints to apply it in the Brazilian economy. The main constraints are related to the high interest rates of government bills, the low liquidity and high concentration of the Brazilian stock market, and the lack of expertise in the evaluation and management of risky projects.

MC-12 **Monday, July 26, 1999**
13:30 - 15:00 **Senate**

Supply Chain Management -2
Chair: Lynne F Baxter, Heriot-Watt University

MC-12.1 - Time and the Virtual Supply Chain

Lynne Baxter, Heriot-Watt University

Simulated supply chains, such as temporary links between organisations supported by technology, are becoming increasingly popular as a way of reducing cycle time and minimising risk. The paper describes a virtual supply network of specialist electronic service and repair companies based in Europe and analyses it by utilising organization theory.

MC-12.2 - Understanding the Supply Chain Impact of a Manufacturing Process Change

Larry Whitman, Wichita State University
Jamie Rogers, University of Texas at Arlington
Mary Johnson, University of Texas at Arlington
Brian Huff, Universtiy of Texas at Arlington

Frequently when implementing new and maturing technologies, the impact to the entire supply chain is overlooked. This paper describes how total supply chain issues are considered in a new technology implementation. Examples from previous experience are also discussed in this paper.

MC-12.3 - Supply Chain Management in the Global Market: The Role of Postponement

Richard Barnes, Arthur Andersen
Jamshid Hosseini, Marquette University

This paper addresses the role of postponement in integrating and managing the supply chain and, thereby, gaining time-based competitive advantage by multinational corporations. Supply chain integration would get an international company to an even playing field with their competition. Effective use of the postponement strategy would allow a multinational corporation to rise above its competition and provide its customers with exactly what they need - the right product at the right price when they need it (at the right time). Postponement enables demand pooling which, in turn, enhances demand forecasts, improves warehouse management, and streamlines transportation management. Managing these components of the value chain, as well as shortening lead times, gives companies an international time-based (speed) competitive advantage.

MC-13 **Monday, July 26, 1999**
13:30 - 15:00 **Pavilion East**

Industry Application-2: Chemical and Petroleum Industry
Chair: Donald A Hicks, University of Texas at Dallas

MC-13.1 - Management of Technology in a Chemical Company: Insights for R&D Effectiveness

Yuka Baba, Mitsubishi Chemical Corp.
Makoto Morita, Mitsubishi Chemical Corp.
Keisuke Wada, Mitsubishi Chemical Corp.

Improvement of R&D productivity has been approached by focusing effectiveness and efficiency of R&D activities separately. Attempts on organizational culture change through implementation of management methodologies and skills, focusing on human issues, organizational dynamics, and education issues shall be presented.

MC-13.2 - Strategic Re-Orientation of the Chemical Industry with Process Costing Under a Value-Oriented Management System

Carsten Lelke, OXENO Olenfinchemie GmbH
Stephan Kress, Universitaet-GH Paderborn

Rationalization in the indirect areas of production at industrial companies has led to an increasing substitution of labor for capital as a production factor. This development has now largely been completed. As a result, there is more and more pressure on indirect corporate divisions that are organizationally located either before or after production and which are currently giving rise to very high blocks of overheads due to the large numbers of staff they require. Process organization, which has been under discussion since the mid-80s, is now being implemented in practice and allows an integrated approach to value creation processes beyond the borders of corporate and functional areas. One of its most important tools is process costing, a method which creates cost transparency even for indirect areas of overheads and which integrates these into cost-oriented control over management processes. In this article we wish to present the results of a conceptual study of the introduction and application of process costing at a company in the chemical industry, with special consideration of computerized support provided by standard software.

MC-13.3 - Application of Just-In-Time Principles to the Chemical Industry

Amjad Abu-Ali, Cleveland State University
Bahman Ghorashi, Cleveland State University

The paper focuses on the implementation of JIT principles in a process industry environment and the necessary modifications in the methodology when applied to specialty chemical industry. Specifically the studies performed on the current practices of one specialty chemicals manufacturer is presented together with the recommendations made for the improvement of these practices.

MC-13.4 - Identification, Evaluation, and Selection of Petroleum Exploration and Development, and Reserve Acquisition Investments

Razif Razak, Portland State University
Dundar F Kocaoglu, Engineering Management Program

This paper is based on a study of the identification, evaluation and selection (IE&S) decisions for petroleum exploration and develop-

ment (E&D), and reserve acquisition investments in US petroleum companies. The paper presents and discusses the results of a survey conducted among the petroleum companies, and identifies the relationships between decision-making processes and performance of the company.

MD-01 **Monday, July 26, 1999**
15:30 - 17:00 **Galleria-1**

New Product Development 1
Chair: John R Callahan, Carleton University

MD-01.1 - Implementation of the Product Life Cycle in OPSD: Effective Use of a Common Process in Achieving Cultural Change and Business Results

Tugrul U. Daim, Intel Corporation
Chris Galluzzo, Intel Corp.
Peggy Kessinger, Intel Corp.
Stephanie Kratochvil, Intel Corp.
Sarah Nesland, Intel Corp.
Greg Rosencrans, Intel Corp.
Perry Swanson, Intel Corp.
Sheri Williams, Intel Corp.

This paper examines the implementation of the Product Life Cycle (PLC) in the OEM Platform Solutions Division (OPSD) of Intel Corporation. This is one of the first successful implementations of a PLC at Intel in terms of organizational acceptance, conformance, and corresponding influence on business results. Therefore, the methods and tools used will be examined. This study covers the implementation from 1996 through 1998, and begins with relevant business and cultural issues.

MD-01.2 - Use of Conjoint Analysis and Design of Experiments in Designing Projection Displays

Candace Petersen, C. Petersen Consulting
Lars Yoder, Texas Instruments

One of the greatest challenges in developing technology products is the incorporation of “voice of the customer” into design efforts. This paper describes how Texas Instruments combined Design of Experiments and Conjoint Analysis techniques into a process for defining projection display attributes based on customer value trade-offs.

MD-01.3 - Cognitive Maps of Product Development: An Object-Based Approach

John R. Callahan, Carleton University

The cognitive maps of design managers in a large development project are captured using coordination structure. These maps are related to the roles and responsibilities of managers, and demonstrate the lack of a shared view of project structure that is possible among managers even within the same functional area.

MD-02 **Monday, July 26, 1999**
15:30 - 17:00 **Galleria-2**

R&D Management - 1
Chair: Onno W. F. Omta, University of Groningen

MD-02.1 - Development of a Gap Assessment Strategy for R&D Management

Amit Shah, Cleveland State University
Bahman Ghorashi, Cleveland State University

A gap assessment strategy is developed to determine the status of a company’s R&D operations. Among the specific factors that were considered are the following: the ability to respond to rapid and unexpected changes in the marketplace; optimization of R&D process to the point where the concept-to-market time is minimized; and the capability to produce future product extensions.

MD-02.2 - Best Practices in Sponsored Research

Arthur Ticknor, Duquesne University

At PICMET ’97, a project aimed at improving the effectiveness of research projects was described including a diagnostic profile and a workshop for its application. This paper presents the findings of the workshop. Described are key problems that inhibit sponsored research success and best practices that address them.

MD-02.3 - Strategic Management of R&D in Australian High Technology Companies

Ziqi Liao, Nanyang Technological University

This paper empirically examines various competitive strategies and their impact on corporate R&D. The results suggest that Australian high-tech companies have been aware of the integration between R&D decision-making and strategic management, and tend to use a high value-added strategy with a focus on limited market segments in directing their R&D programs and projects.

MD-02.4 - Benchmarking R&D Best Practices in Long and Short Life Cycle Industries

Onno W. F. Omta, University of Groningen
F.T.J.M. Fortuin, University of Groningen

This paper presents the results of a cross-industry survey among major R&D intensive companies. The life cycle based differences in R&D and best practices in long- and short-life cycle industries were examined.

MD-03 **Monday, July 26, 1999**
15:30 - 17:00 **Galleria-3**

Management of Technological Innovation 2
Chair: Georges Haour, IMD- International Institute for Management Development

MD-03.1 - The Relationship of Technology and Business in an Innovation Process

Zdenek Vostracky, University of West Bohemia
Miroslav Sebesta, University of West Bohemia

Technological innovations play an important role in the future. The “S” curve describes an evolution of technology as well as an evolution of business. From the time of the early period of R&D dominance until the technological maturity is reached there exist critical times for strategic decisions. These strategic decisions include a variety of criteria and depend also upon the capability to develop the market. We will discuss the relationship between technological “S” curve and market development as a tool for the optimization of decisions from the point of view of values of intellectual property, licensing, products, and market evolution as strategic policy.

MD-03.2 - Integrating Innovations with Business Requirements: A Telecommunications Case Study

Linda Wilkins, Monash University
Philip Branch, Monash University

The contention of this paper is that effective organizational policies and processes for integrating technology in planning for the company are relatively rare largely because business managers tend to pay insufficient attention to its strategic potential and merely manage it as a black box via an annual budget. Evidence for this contention is

drawn from analysis of survey results of major Australian companies and an analysis of outcomes from a recent workshop for IT managers.

MD-03.3 - Growth Through Technological Innovation: Entrepreneurial Distributed Innovation for Business Renewal

Georges Haour, IMD- International Institute for Management Development

This paper discusses companies' growth by effectively leveraging technical innovations for two types of firms: technical start-ups and large technology-intensive firms. It is argued that these two types of companies are rapidly becoming more dependant on each other and that following the precursor model of the biotechnological sector, firms will increasingly spin in, as well as spin off innovation projects at various stages of maturity. The framework of a distributed innovation system is presented, which involves a variety of actors. Firms indeed need to organise accordingly and, for this, should learn from the practices of totally different sectors, such as the entertainment industry; also, the mission of the Research and Development (R&D) function will have to be redefined.

MD-04 **Monday, July 26, 1999**
15:30 - 17:00 **Parlor B**

Program/ Project Management 3
Chair: Leonard J Olive, Bureau of Transportation Engineering and Development

MD-04.1 - Organizational Context for Project Management

Charles Keating, Old Dominion University

There is little debate concerning the utility of project management tools and methods for planning, scheduling, and control of temporary initiatives to produce a unique product or service. This paper develops a framework for understanding the assumptions necessary for effective deployment of the project management approach. Understanding the degree to which an organization is compatible with these assumptions may determine the readiness to effectively deploy project management methods.

MD-04.2 - Using Organizational Engineering to Build Defect Free Systems, On Schedule and Within Budget

Joseph Kasser, University of Maryland

Today's software and systems development life cycle paradigm is characterized by large cost overruns, schedule slips, and dramatic performance deficiencies in weapon, C4I, and automated information systems. This paper describes an alternative paradigm that can produce defect free systems on schedule and within budget.

MD-04.3 - Multiproject Management System Implementation

Iffet Iyigun, Arcelik A.S. - R&D Center

In this paper, a multi-project management system implementation for an R&D Center, organized under a strong project matrix structure with more than 100 employees, is discussed. The system is based on the integration of a commercial project management software coupled with database application. The implementation process along with the needs analysis and lessons learned during the implementation are discussed.

MD-04.4 - Risk Prevention in Outsourced Projects

Jozsef Gyorkos, University of Maribor
Ivan Rozman, University of Maribor
Marin Silic, Government Centre of Informatics, Rep. of Slovenia

In this paper experience gained by quality assurance for large outsourced IT projects is described. An outline of the paper follows: 1) Introduction (environment and problem description, multidisciplinary projects); 2) The approach (the scope of the quality system, assessment group, principles (product and process focus) and results); 3) Lessons learned (risk prevention and group coordination, balancing between formality and schedule).

PANEL: MD-05 **Monday, July 26, 1999**
15:30 - 17:00 **Parlor C**

Technology Management Education 2: Innovative MOT Education for the New Millennium: University Programs that Combine Science, Engineering, and Business
Moderator: Anne D Henriksen, James Madison University

Panelist(s): Richard M Roberds, James Madison University
William Flannery, University of Texas-San Antonio
Russell Jamison, University of Illinois at Urbana Champaign

Successful MOT requires a combination of skills in science, engineering, technology, and business. Effective MOT education must therefore combine training in all of these areas. But there are many bureaucratic and cultural barriers to implementing MOT programs that cross discipline and institutional boundaries. This panel will consist of three directors of interdisciplinary educational programs, at both the graduate and undergraduate level, who are successfully linking technical and business training. In two of the cases, the programs involve at least two different colleges within the university, but in the third, a new degree program has been formed that fundamentally integrates science, engineering, technology, and business throughout the curriculum.

MD-06 **Monday, July 26, 1999**
15:30 - 17:00 **Studio**

Information/ Knowledge Management 3
Chair: Janice E Carrillo, Washington University

MD-06.1 - Achieving Return on Critical Knowledge

Joyce Thompsen, Achieve Global

Critical Knowledge Areas represent unique bodies of knowledge which lie at the core of the value proposition for an enterprise. A new business model entitled Return on Critical Knowledge, or ROCK, can be used for managing these Critical Knowledge Areas in an integrated strategic approach. This new model and a case study for identifying and measuring Critical Knowledge Areas are presented.

MD-06.2 - Leveraged Knowledge Creation: Role of Technical Services as External Sources of Knowledge

Christiane Hipp, Mannesmann Pilotentwicklung
Oliver Gassmann, Schindler Lifts Ltd.

Companies have to face the fact that research and development is becoming increasingly complex and product cycles shorter. This forces firms to reorganize their innovation and learning process by trying to combine internal know-how with all kinds of external sources of knowledge. This paper will analyze the role of specialized technical services and their contribution to the performance of their customers.

MD-06.3 - The Link Between Successful Process Change and Knowledge Creation

Janice Carrillo, Washington University
Cheryl Gaimon, Georgia Institute of Technology

The critical link between successful process change and knowledge creation is examined. Specifically, a model is given to investigate the impact of investment in preparation and training to enhance process

change effectiveness. Also, we explore the tradeoff between the long-term increase in capacity sought and the short-term disruptions during implementation.

MD-07 **Monday, July 26, 1999**
15:30 - 17:00 **Directors**

Technology Management 1: Technological Intelligence Deriving from Electronic Information Resources
Chair: Alan L Porter, Georgia Institute of Technology

MD-07.1 - Engineering and Technology Management: Intelligent or Otherwise?

Alan Porter, Georgia Institute of Technology

Both engineers and managers tend to rely upon extremely limited information as they manage technology. In particular, the lack of external information or competitive technological "intelligence" threatens their ability to perform effectively. This paper explores the relative advantages of more active mining of electronic information resources to enhance technology management "intelligence."

MD-07.2 - Mining Foreign Language Information Resources

Robert Watts, U.S. Army Tank-Automotive and Armaments Command
Alan Porter, Georgia Institute of Technology

Competitive intelligence in a global economy demands information on technological developments reported in languages other than English. This paper provides early results of an effort to mine foreign text sources. It compares French- and English-based profiles of "combustion control" systems technology development based on one Pascal database search set.

MD-07.3 - User Centered Approach for the Design of Knowledge Discovery Systems Used in Technology Innovation Management

Anustup Nayak, Capital One Financial Corporation

The domain of Technology Innovation Management (TIM) stands to gain immensely from the advances in Knowledge Discovery in Database (KDD). KKD is a suite of tools and techniques that exploit rich sources of electronic information to derive novel, nontrivial and actionable "nuggets" of knowledge. The objective is to illustrate how KDD is a complex task interweaving man, machine and organizations and to propose a design methodology to make KDD systems more usable in the TIM domain.

MD-08 **Monday, July 26, 1999**
15:30 - 17:00 **Council**

Collaboration for Technology Management 3
Chair: Nieves Arranz, Dpto. Economia Aplicada e Historia Economica, UNED

MD-08.1 - The University-Industry Organization in European Union Research and Innovation Programs: An Empirical Study

J.C. Fernandez de Arroyabe,
Nieves Arranz, Dpto. Economia Aplicada e Historia Economica, UNED

The European Union leads all its politics of I+ID (Investigation and Development) through the development of international projects in which cooperate several types of agents who belong to different European countries. These developments are really forming networks of technology cooperation in which university/industry organizations have a very relevant participation. The empirical study analyzes the role of university/industry organizations in the different joined projects of technology and investigation financed by the European Union.

MD-08.2 - International Cooperation as a Tool to Promote the Collaboration Between Universites, Research Centers and Industry in Brazil

Maria Celeste Vasconcelos, Federacao das Industrias de Minas Gerais - FIEMG
Marta Tavares Ferreira, Programa de Pos-graduacao em Ciencia da Informacao-UFMG
Maria Fatima Abreu, CETEC

Several forms have been used in the cooperation among universities, research centers and industries. This work analyzes a cooperative project, in the environmental area, accomplished by the Brazilian industrial segment, the public sector and a German institution. It focuses on the importance of the international cooperation as a form of partnership promotion.

MD-08.3 - An Opportunity for Financial Gain by Collaborating with British Universities

Andrew Chisholm, University of East London
Peter Hogarth, Bournemouth University

How would your organization like to use British Universities for financial gain? British Universities can offer many talents and expertise to the industrial community. One way is to commercialise academic projects. Bournemouth University has developed a process to do this. This process can be adopted and modified to suit your organisation.

PANEL: MD-09 **Monday, July 26, 1999**
15:30 - 17:00 **Forum**

Managing An External Research Program
Speaker: Ann Bynum, Intel Corp.

Funding external university research is a critical part of looking beyond a company's current product line. Maximizing your investment in any research program requires a good internal sponsor to be a champion for the researcher and bring the technology back into the business. Ann Bynum of Intel Corporation's Research Communication team will share the team's programs for extracting value from university-sponsored research and its model of how research results are transferred back into Intel's internal research labs.

MD-10 **Monday, July 26, 1999**
15:30 - 17:00 **Cabinet**

Data Envelopment Analysis 1
Chairs: Rolf Sare, Oregon State Universityand Shawna Grosskopt, Oregon State University

MD-10.1 - Organizational Restructuring: A Robust DEA-Based Procedure

Shlomo Maital, MIT Sloan School of Management and CAES
Alexander Vaninsky, Netanya Academic College

The correct choice of inputs and outputs in Data Envelopment Analysis (DEA) procedures poses major difficulties. Results tend to be sensitive to the set of inputs/outputs chosen. We propose to combine DEA with a special method of Index Number Theory to draw conclusions about changes in organizational structures for improving efficiency that do not depend on specific choice of inputs and outputs. Thus we come to the DEA-based procedure that is robust with respect to inputs and outputs. A numerical example is given.

MD-10.2 - A Comparison of Efficiency Measurement Using Data Envelopment Analysis and Regression in the Utility Industry

Janice Forrester, Cytera Systems, Inc.
Timothy Anderson, Portland State University

This paper examines the empirical results of two independent studies in the utility industry, one that used regression and one that used DEA. Also investigated are the theoretical differences between the manner in which regression and DEA separate variation into that which is caused by noise and that caused by inefficiency.

MD-10.3 - Using Data Envelopment Analysis for Evaluating Alternative Software Development Process Configurations

Peter Ghavami, Enron
Timothy Anderson, Portland State University

A software development process was evaluated for 257 different configurations. These 257 configurations were then compared using a variety of DEA models to determine best relative configurations.

MD-11 **Monday, July 26, 1999**
15:30 - 17:00 **Executive**

Virtual Enterprises 1
Chair: Lynne F Baxter, Heriot-Watt University

MD-11.1 - Viewing Business-to-Business Electronic Commerce As An Innovation: Issues for Management

Larry Shirland, The University of Vermont
Ronald Thompson, The University of Vermont

Business-to-Business (B2B) transactions comprise the fastest growing segment of Electronic Commerce (e-commerce). Revenues generated from B2B e-commerce are forecast to exceed $200 billion by 2001, and $1 trillion by 2010. This paper uses the perspective of B2B e-commerce as an innovation, and identifies important issues for managers and researchers.

MD-11.2 - Electronic Markets: A Social Analysis of Technology

Ian Graham, University of Edinburgh
Lynne Baxter, Heriot-Watt University

Electronic markets are seen as a major element in the emerging information society, with systems replacing existing intermediaries to lower transaction costs and search costs for buyers. This paper analyses one of the earliest industries adopting this: the trading of slaughter livestock. Four failures of systems are considered with reference to the social analysis of technology.

MD-11.3 - Electronic Commerce: Creating Competitive Opportunities in Brazilian Supermarkets

Lidia Segre, Universidade Federal de Rio de Janeiro
Roberto Bastos, COPPE/UFRJ - Universidade Federal do Rio de Janeiro

Information technologies being adopted at service industries make electronic commerce (EC) a priority in order to achieve competitive advantages and obtain business opportunities. This paper focuses on Brazilian supermarkets' technological improvements and explores the management in the EC environment to support organizational changes helping to keep distributed services across the supply chain.

MD-12 **Monday, July 26, 1999**
15:30 - 17:00 **Senate**

Manufacturing Management - 1
Chair: David J Sherwin, Vaxjo University

MD-12.1 - Pareto Optimal Production Scheduling by Meta-Heuristic Methods

Tapan Bagchi, Indian Institute of Technology
T.D. Srinivas, Indian Institute of Technology
K. Jayaram, Indian Institute of Technology

This paper develops multi-objective solutions to production scheduling situations modeled as flowshops, job shops and open shops. The methodology is meta-heuristic, one inspired by evolutionary algorithms. Our method introduces enhancements to the Nondominated Sorting Genetic Algorithm (NSGA), a method recently proposed, which produces Pareto-optimal solutions to numerical multi-objective problems. One key enhancement introduced is called here the Elitist Nondominated Sorting Genetic Algorithm (ENGA). The object is singular: solve a variety of multi-objective optimization problems, and do it efficiently. The final solutions evolved are all Pareto-optimal.

MD-12.2 - Achieving the Potential Benefits of Advanced Manufacturing Technology - A Study of Swedish Metal Working Companies

Patrik Jonsson, Vaxjo University

The paper empirically concludes that a key to success for heavy users of advanced manufacturing technology is to improve the infrastructure (worker empowerment, training, self-managed teams, quality leadership and inter-functional design teams), to emphasize decentralized preventive maintenance, and to develop a manufacturing strategy where flexibility is an important capability.

MD-12.3 - Sequencing Heuristic for Flexible Assembly Systems with Mixed Volume Production and Stochastic Processing Times

Oleg Gusikhin, University of Michigan
Rahul Caprihan, Dayalbagh Educational Institute
Kathryn Stecke, University of Michigan

The paper focuses on the sequencing aspects of a flexible assembly system functioning in a build-to-order environment. A sequencing heuristic, based on the trade-off of pulling low volume parts ahead in the input sequence while delaying the high volume parts, is proposed and analyzed, and its effectiveness demonstrated for a hypothetical study system.

MD-13 **Monday, July 26, 1999**
15:30 - 17:00 **Pavilion East**

Industry Application-3: Automotive Industry
Chair: Grace M Bochenek, U.S. Army Tank Armaments & Automotive Research

MD-13.1 - A Method to Measure the Rate of Technological Advance in the Automotive Industry

Corrado Storto, University of Naples Federico II

This paper describes a method, and the assumptions on which it is based, used to develop an index useful to measure the technology content of a car. This method is based on published data and on the judgements of industry experts. It defines the technology content (TC) of a car as a function of certain features of the car. Furthermore, the method is applied to a sample of 216 cars sold in the Italian market from the early 70s to the early 90s with the aim to measure the rate of technological advance in the Italian automotive market in the last two decades.

MD-13.2 - Using High-End Visualization Technology—a CAVE to Design Future Military Vehicles

Grace Bochenek, U.S. Army Tank Armaments & Automotive Research
James Ragusa, University of Central Florida

The U. S. Army, as a strategic technology and innovation management initiative, has endorsed the use of virtual environments for vehicle system design, development, and acquisition. This paper

describes virtual design activities and a CAVE system that could significantly improve team-based activities and decrease overall systems cost and development schedules.

MD-13.3 - Complementary Innovation: Systems and Technologies Toward the Electric Vehicle

Alan Pilkington, University of London

The paper explores the inherent relationship between stand-alone products and their technological sub-systems. The development of the electric vehicle, explored in the paper, was found difficult to explain using existing theories because innovation is needed at the vehicle sub-system as well as the final product level.

MD-13.4 - Linkage of Ford Production System and QS-9000 Quality Standard

Dana Johnson, Wayne State University
Mark Johnson, Ford Motor Company

The discussion will look at the linkages between two major manufacturing strategic initiatives: Ford Production System (FPS) and Quality System Requirements QS-9000 Automotive Quality Standard. Background information, commonalities, unique features, and barriers to successful implementation will be the primary focus. This area represents a candidate for empirical research.

ME-01 **Monday, July 26, 1999**
17:15 - 18:45 **Galleria-1**

New Product Development 2
Chair: James Ritchie, Heriot-Watt University

ME-01.1 - Front-Loading Problem-Solving: Implications for Development Performance and Capability

Stefan Thomke, Harvard University
Takahiro Fujimoto, University of Tokyo

The paper focuses on the identification and solving of problems during earlier phases of product development - a concept that we define as front-loading - as a way to increase performance. Using a problem-solving perspective, we develop a conceptual model of front-loading and present related examples and case evidence from development practice.

ME-01.2 - Accelerating Team Learning in New Product Development

David Green, Syracuse University
David Wilemon, Syracuse University

It is clear that there is a junction between teams, new product development processes, and learning. Underlying this junction is time. This paper examines how to accelerate new product development by examining the types of learning that need to occur within product development projects.

ME-01.3 - Graduate Enterprise in Manufacturing: A Study of Graduate Employment in the Product Design Sector

Robert Brown, University of Wales Institute
Alan Lewis, University of Wales Institute

This paper will present findings of the Graduate Enterprise in Manufacturing (GEM) project. The project focused upon the way in which small manufacturing companies undertake the product development process and the role which graduates play in this process. Findings are based on detailed questionnaire returns from over 500 companies together with in-depth interviews with managers and graduates.

ME-01.4 - Product Design and Manufacturing Methods: Learning the Historical Lesson

James Ritchie, Heriot-Watt University
Ian Black, Heriot-Watt University

The gap between product engineering functions has been reduced through techniques such as concurrent engineering. Using globalised virtual-technologies a new product development paradigm is becoming apparent. This paper draws from the historical lessons and outlines a novel “full circle” model that predicts the future evolution of competitive product design methods.

ME-02 **Monday, July 26, 1999**
17:15 - 18:45 **Galleria-2**

R&D Management - 2
Chair: Erol Eren, Gebze Instiute of Technology

ME-02.1 - R&D Activities of National and Foreign-Owned Firms in Turkish Manufacturing

Asim Erdilek, Case Western Reserve University

This paper analyzes, using CHAID (Chi-squared Automatic Interaction Detector) and logistic regression, the R&D expenditures of national and foreign-owned establishments in Turkish manufacturing. Most manufacturing industry establishments, which are small-scale, do not conduct any R&D. The larger the foreign ownership percentage share, the larger the employment size, the higher the average wages and salaries, the greater is the likelihood of having R&D expenditures.

ME-02.2 - Network of Performance Indicators: The Case of a Brazilian Research Center

Marly Monteiro de Carvalho, Technological Research Institute of Sao Paulo State
Solange Machado, Sao Paulo University

This article presents the network of performance indicators prepared for IPT-Technological Research Institute of Sao Paulo. These indicators reflect the missions of the Institute, and should be used to guide the management agreement between the Executive Board and the technical divisions, as well as establish the ranking of the divisions.

ME-02.3 - Science and Technology Indicators: A Framework for the Kingdom of Saudi Arabia

Aymen Kayal, KFUPM

Science and technology indicators are important to both the private and government sectors. They are used to plan and monitor research and development (R&D), and to evaluate the capabilities and performance of R&D institutes and facilities. This paper proposes a number of standardized OECD science and technology indicators suitable for adoption by the Kingdom of Saudi Arabia (KSA).

ME-02.4 - The Evaluation of Innovative and Technological Management Consciousness of Leading Turkish Firms

Erol Eren, Gebze Instiute of Technology
Emre Kabadayi, Gebze Institute of Technology
Azize Sahin, Gebze Institute of Technology

This research is conducted on the top 250 Turkish firms concerning their R&D abilities and activities. The aim was to investigate the correspondence between theory and practice and consciousness of R&D among these companies. The research sample was determined as 84 firms according to the size of their investment and human resources in R&D abilities and activities. The response rate from the 84 companies that were included in the study was 52.3 percent. Among the interesting results of this research the following items should be

mentioned. Some firms evaluated the R&D activities for new product development as a strategy of their change management. On the other hand, most of the firms evaluated the existing product improvement as their strategy. The firms in the same industry make some collaborative R&D activities in order to reduce R&D costs and to increase R&D efficiency and effectiveness. But it also was found that the level of cooperation for R&D activities among companies was inversely related to the level of technology.

ME-03 **Monday, July 26, 1999**
17:15 - 18:45 **Galleria-3**

Management of Technological Innovation 3
Chair: Dogus E Kuran, ALCATEL

ME-03.1 - The Concept of the Integrated Innovation Process

Pascal Savioz, Swiss Federal Institute of Technology Zurich
Erich Sannemann, Swiss Federal Institute of Technology Zurich

Building on the idea of innovation platforms, the traditional innovation process can be seen from a different perspective as consisting of a product innovation process and a technology innovation process. This paper describes how firms can explore these innovation platforms to deploy their competencies to different markets. An example drawn from the field of bionics illustrates the application of the model.

ME-03.2 - Reducing the Uncertainty in Managing Breakthrough Technological Innovations

Richard Leifer, Rensselaer Polytechnic Institute

From an information processing (IP) perspective, breakthrough innovation has substantially greater information processing requirements (IPR) at the beginning phases of the innovation process than does incremental innovation, requiring management processes with substantially greater information processing capabilities (IPC). A four-year, longitudinal study suggests what these management differences consist of.

ME-03.3 - Innovation Acceleration Methodologies

Gideon Samid, Virginia Technology Corporation

Codification of tools and means to measure, rate, and accelerate innovation. Management and innovation, once two separate poles on the technology globe, have now merged and emerged as a winning proposition: applying quantified tools to the elusive process of realizing new knowledge and applying it for a set purpose. Early encouraging results are reported from a method based on using cost estimate credibility as a metrics for innovation progress. Another metrics is based on quantified measurements of the quality of the textual explanation of the innovated subject. Up-to-date results will be reported at the conference.

ME-04 **Monday, July 26, 1999**
17:15 - 18:45 **Parlor B**

Program/ Project Management 4
Chair: George J Titus, Temple University

ME-04.1 - Using Project Management Software in Different Work Environments

Matthew Liberatore, Villanova University
Bruce Pollack-Johnson, Villanova University

Using a random survey of PMI members, we analyze the factors influencing selection, usage, and future development of PM software. The findings lead to a categorization of the differences in usage patterns by industry, experience, and package. Software adopters should consider these findings concerning industry practice and individual circumstances.

ME-04.2 - Novelty in IT Development Projects: A Case Study of Practices in a Large Canadian Bank

Karim Hirji, IBM Canada Ltd.
Oscar Hauptman, Carleton University
Lindsay Phillips, Institute for Learning

A case study of IT development projects was undertaken in a leading Canadian bank. Four concurrent and interdependent technology intensive development projects were examined over a 12-month period between 1995 and 1996. The insights from this qualitative study suggest that alternative approaches to organizing and delivering development projects in the IT domain may positively influence project outcomes.

ME-04.3 - A Graphic Programming Tool to Perform PERT and Monte Carlo Analysis

Paul Hamilton, Jr., Intel Corp.

This paper presents a graphic language program for general usage by project managers to perform PERT and Monte Carlo analysis on projects of small to moderate size . The program performs Monte Carlo analysis on the project model and outputs the results in a format compatible with spreadsheet programs.

ME-05 **Monday, July 26, 1999**
17:15 - 18:45 **Parlor C**

Technology Management Education 3
Chair: Olav Solem, Norwegian University of Science and Technology

ME-05.1 - Greater Knowledge Base for Teachers in Design and Technology

Krishan Kumar, University of Botswana

The paper presents a critical review of the current practice of educating teachers for the subject area of 'Design and Technology' taught in secondary schools in several countries. While the students are understandably taught the subject through projects by employing the paradigm of 'learning by doing', there is little justification for student teachers to be trained by the same method. The paper presents a conceptual framework, a possible structure and methodology for a programme leading to a Bachelor's Degree in Design and Technology.

ME-05.2 - Developments and Trends in Engineering Management Education in Australia and New Zealand in the Nineties and Trends Towards the Third Millennium

Olav Solem, Norwegian University of Science and Technology
Edmund Young, Flinders University of South Australia

The authors examine some significant developments in engineering management education in Australia and New Zealand in the nineties. One of the authors, Young, was chairman of the Institution of Engineers, Australia (IE Aust) committee which developed the Guidelines for implementing the "10% Rule" which required all four year engineering undergraduate courses to have a minimum of 10% of course content of "management and management related subjects" for IE Aust accreditation. In the mid-nineties Professor Solem spent his sabbatical year in Australia researching management of technology and surveyed engineering management education in Australia. Developments in New Zealand are outlined with the assistance of Emeritus Professor Daniel L. Babcock of the University of Missouri-Rolla who was IE Aust Distinguished Visitor in 1991 lecturing in engineering management in all Australian States and who also visited New Zealand in 1992. The implementation of the "10% Rule," growth of graduate programs in engineering management in both countries, issues and trends in engineering

management education towards the Third Millennium are examined. The influence of overseas developments in engineering management organisations especially in Asia will affect these two South Pacific Countries.

ME-06 **Monday, July 26, 1999**
17:15 - 18:45 **Studio**

Information/ Knowledge Management 4
Chair: Karol I Pelc, Michigan Technological University

ME-06.1 - The Knowledge Structures Analyzed by the Organizational Dimensions

Sandra Pereira, Universidade Federal de Santa Catarina
Edson Pinheiro de Lima, Universidade Federal de Santa Catarina
Lucinaldo dos Santos Rodrigues, Universidade Federal de Santa Catarina

The advances in information technology are transforming the enterprises operations and opening new possibilities for integrating and leveraging organizational capabilities. The turbulence of the environment is influencing an internal organizational behavior in order to understand the dynamic and complexity of the external elements. This behavior is emergent for new approaches of a management based on resources, capabilities, competencies and especially knowledge as strategical drivers. The purpose of this paper is to describe knowledge structures formulated by the analysis of some organizational dimensions related to structure, technology, strategy, management processes and individual scripts, which are embedded in the organizational culture.

ME-06.2 - Pattern for Capital and Knowledge Accumulation in the Technology-Based Firms

Jin Chen, Zhejiang University
Qingrui Xu, Zhejing University,
Yongyi Shou, Zhejiang University

Technological innovation is important for enterprises to gain market competitiveness. Due the importance of competencies in the technological innovation, more and more technology-based firm will focus on the competency accumulation process and its management. Based on case studies, the authors put forward paths for Chinese enterprises to accumulate more capital and knowledge to support technological innovation.

ME-06.3 - Multiple Perspectives on Knowledge Generating Networks

Karol Pelc, Michigan Technological University

Analysis of knowledge generating networks is based on the multiple perspective method developed by H. A. Linstone. Personal, organizational and technical perspectives allow identifying the properties of knowledge networks. Those properties have impact on different functions of knowledge networks in R&D and they determine effectiveness of such networks. Functions of knowledge networks are presented and compared for two classes of creative processes: basic scientific research and technological R&D.

ME-07 **Monday, July 26, 1999**
17:15 - 18:45 **Directors**

Technology Management 2
Chair: Marko Torkkeli, Lappeenranta University of Technology

ME-07.1 - Technology Evaluation and Selection Practices and Resulting Impacts in the Electronics Manufacturing Industry

Tugrul U Daim, Intel Corporation
Dundar F Kocaoglu, Portland State University

This study presents the technology evaluation process in the U.S. electronics manufacturing industry. A survey questionnaire was sent to electronics manufacturing companies in the U.S. to collect data about the relationships among the system elements. Multivariate statistical methods and an expert panel were used to quantify and clarify the relationships. The companies in the U.S. electronics manufacturing industry are using eleven major groups of evaluation attributes: Flexibility and Efficiency, Strategic Attributes, Manufacturing Floor Requirements, Product Development, Tactical Costs, Strategic Costs, Competitiveness, Operational Social Concerns, Strategic Social Concerns, Uniqueness, and Industry Trends. They utilize three major groups of evaluation methodologies: Analytic Tools, Financial Tools, and Modeling Tools. The resulting impacts are: Organizational and Operational Competitiveness, Market and New Product Development Competitiveness.

ME-07.2 - Technology Acquisition, A Measure of Technology Discontinuities: A Case Study of Thai Technology-Based Manufacturing Industry

Prasopchoke Pramongkit, Assumption University
Boonmark Sirinaovakul, Assumption University
Teay Shawyun, Assumption University

The Asian crisis is expected to make Thai export industries undergo the structural reform as their over-reliance on inputs from imports and heavy investments in machinery and technology transfer. This has caused high current account deficit for years without the complementary improvement in capabilities and competence. As such, the Technology Discontinuity concept will be used for this study to measure the technology utilization of Thai technology-based manufacturing industries. The model developed will explain required variables and its composition for firms to upgrade technology acquired to enhance technology productivity of firms in the country. The Option Theory will be applied as an explanatory tool to recommend the governance choices at firm level acquiring technological know-how. The result of the study will help to understand Thai technology-based manufacturing industries, its structures and would help develop a framework for industrial policy for Thailand.

ME-07.3 - Use of GDSS for of Technology Selection: New Integrated CAD-System for an Entire Company

Petteri Piippo, Lappeenranta University of Technology
Marko Torkkeli, Lappeenranta University of Technology
Markku Tuominen, Lappeenranta University of Technology

Selection of technologies in a company is a complex, multiperson and multicriteria task. Group Decision Support Systems (GDSS) offer many potential benefits for promoting technology selection processes. The purpose of this paper is to clarify real advantages and problems of GDSS in supporting technology selection in companies. Advantages and disadvantages are illustrated by a real CAD-system selection application.

ME-07.4 - Knowledge Network of the Contemporary Interdisciplinary Study of Organization and Technology: From Bibliometrics to Epistemology

Yender Lee, McGill University
Hamid Etemad, McGill University

By analyzing 11,649 citations of 419 related source articles, this paper examines the intellectual foundations of the emerging contemporary sub-field of organization and technology (CISOT). Most influential documents (articles and books), scholars and journals as the key nodes of this knowledge network are identified and their respective distributions presented.

ME-08 **Monday, July 26, 1999**
17:15 - 18:45 **Council**

Collaboration for Technology Management 4

Chair: Tim Kotnour, University of Central Florida

ME-08.1 - The Metal Processing Institute: A Focused Industry-University Alliance

Chickery Kasouf, Worcester Polytechnic Institute
Diran Apelian, Worcester Polytechnic Institute
P. Ulf Gummeson, Worcester Polytechnic Institute

Cutbacks in government funding have resulted in an increased emphasis on research support from industry and other agencies. This paper traces the development of the Metal Processing Institute (MPI) at Worcester Polytechnic Institute (WPI) from the generation of the research agenda and the development of credibility within the industry through the allocation of resources and dissemination of results to the benefit of both industry and the university.

ME-08.2 - University-Industry Collaboration for Radical Innovation in Flat Glass Manufacturing

John Dismukes, University of Toledo
F. Frank Chen, Univertiy of Toledo
Mark Vonderembse, University of Toledo
Rebecca Bennett, University of Toledo
Peter Gerhardinger, Pilkington Libbey-Owens-Ford Co.
William Caldwell, Pilkington Libbey-Owens-Ford Company
Rudy Okkerse, Pilkington Libbey-Owens-Ford Company
S. Chandrasekaran, The University of Toledo

End user demand for a growing variety of automotive glass products motivates the flat glass industry to address system-wide improvement and develop radical innovations in technology and operations. To address these issues, a multidisciplinary research team from The University of Toledo Colleges of Engineering and Business Administration, together with engineers and managers from Pilkington Libbey-Owens-Ford, are taking a unique approach to identification and implementation of radical innovation. The research methodology employed combines modeling of the current flat glass manufacturing value chain with assessment of organizational structure and culture. Results include an overall equipment effectiveness (OEE) assessment of flat glass manufacturing from raw materials to fabricated glass parts, modeling of the strongly coupled process steps for part cutting and furnace tempering of glass windows, and the evaluation of current versus ideal culture required to implement radical innovation.

ME-08.3 - Understanding Industry-Government-University Technology Development Partnership Needs in the Aviation /Aerospace Industry

Tim Kotnour, University of Central Florida

The contribution of this paper is a description of the partnership needs among industry, government, and the educational system for technology development. A three-part research study involving an industry survey, industry/government interviews, and a faculty survey was conducted. Industry, government, and faculty associated with aviation/aerospace in the state of Florida were the sample population. The results define the partnership needs for technology research and development. Suggested actions for partners to start, stop, and continue doing are also defined.

PANEL: ME-09 **Monday, July 26, 1999**
17:15 - 18:45 **Forum**

Engineering & Technology Management Journals
Moderator: Dundar F Kocaoglu, Portland State University

Panelist(s): Ted Eschenbach, Engineering Management Journal/University of Alaska-Anchorage
Ryo Hirasawa, Science Policy and Research Management/NISTEP
Harold A. Linstone, Technological Forecasting and Social Change/Portland State University
Robert M. Mason, Technovation/Florida State University

Editors of the major journals in engineering and technology management will describe the philosophy of each journal and discuss the critical issues in the field from their perspectives. A question/answer period will follow the brief presentations.

ME-10 **Monday, July 26, 1999**
17:15 - 18:45 **Cabinet**

Data Envelopment Analysis 2
Chair: Timothy R Anderson, Portland State University

ME-10.1 - Primal and Dual DEA Measures of Capacity Utilization

Rolf Fare, Oregon State University
Shawna Grosskopf, Oregon State University

This paper extends earlier work on specification of output capacity and utilization in an output oriented DEA framework (which we refer to as primal approach) to what we call a dual approach, which introduces input prices and cost. This provides a link to the traditional measures of capacity in the economics literature based on cost functions. This also provides several alternative DEA options for applied work.

ME-10.2 - Warehouse Benchmarking Using Weight Restricted Data Envelopment Analysis

Paul Gilbarg, Portland State University
Keith Hollingsworth, Morehouse College
Michael Cole, University of Arkansas
Timothy Anderson, Portland State University

A benchmarking study of warehouses around the U.S. using Data Envelopment Analysis was reexamined with the addition of weight restrictions.

ME-10.3 - A New Technique for Estimating Confidence Intervals on DEA Efficiency Estimates

Janice Forrester, Cytera Systems, Inc.
Timothy Anderson, Portland State University

Previous Chance Constrained DEA approaches are surveyed followed with a new approach to Chance Constrained DEA. An example is given of calculating a confidence band for the estimated production function such that we can specify with a predetermined level of confidence an interval containing the most likely production function.

ME-11 **Monday, July 26, 1999**
17:15 - 18:45 **Executive**

Virtual Enterprises 2
Chair: Oliver Gassmann, Schindler Lifts Ltd.

ME-11.1 - Virtual Valleys: Internet Based Communities for Regional Cooperation

Wilhelm Dangelmaier, University of Paderborn
Winfried Felser, University of Paderborn
Rainer Grobbel, University of Paderborn

The Internet represents a technology that will in the near future drastically change the structures of the existing production, logistics and service networks. These structures will be “virtualized,” existing limits will dissolve, and new limitations of virtual organizations will arise. In this contribution, two examples of virtualized and regional networks as well as one model for a systematic procedure are outlined.

ME-11.2 - Managing 'Virtual' Innovation: The Challenge for the Small Business

Paul Jackson, Brunel University

This paper is concerned with such emerging technologies as groupware and intranets. It draws on the study of small businesses in the UK and Holland to examine developments in 'virtual' forms of working. The paper highlights the particular issues faced by small businesses during such innovation and discusses how these can be better managed.

ME-11.3 - Organizing Virtual R&D Teams: Towards a Contingency Approach

Oliver Gassmann, Schindler Lifts Ltd.
Maximilian Zedtwitz, Harvard University

Our research focuses on the virtual project organization and its decentralized management. Based on 204 interviews in 37 technology-intensive multinational companies we illustrate our findings with examples from Hewlett-Packard, Hitachi, MTU, BMW, Daimler-Benz, Xerox, and ABB. We identified four forms of virtual team organization: decentralized self-organization, system integrator as a coordinator, core team as a system architect, and centralized venture team. The success of virtual teams depends on the consideration of the type of innovation, the systemic nature of the project, the mode of knowledge involved, and the degree of resource bundling.

ME-12 **Monday, July 26, 1999**
17:15 - 18:45 **Senate**

Manufacturing Management - 2
Chair: Kathryn E Stecke, University of Michigan

ME-12.1 - The Impact on Mean Flow Time when Operating a Flexible Manufacturing System as a Programmable Transfer Line

Henry Co, California State Polytechnic University, Pomona
Sharafali Moosa, California State Polytechnic University, Pomona

We examine the impact on flow times when limiting the part types processed simultaneously in an FMS. This operating strategy shifts the emphasis in material handling, storage, and computer control to process planning and system changeover. The advantage is streamlining of material flow, minimizing the bottlenecks and maximizing machine pooling.

ME-12.2 - A Model for the Empirical Analysis of Technological Capabilities of Manufacturing Firms

Horacio Viana, Instituto de Estudios Superiores de Administracion
Maria Antonia Cervilla, Instituto de Estudios Superiores de Administracion

A model of technological learning and competitiveness was constructed for the empirical analysis of technological capabilities of manufacturing firms. The model makes use of factor analysis and included variables related to the strategy of the firm, as well as variables related to techno-managerial and innovation capabilities. A competitive index is constructed which allows determining priority areas of attention. The parameters of the model were obtained from a sample of 241 Venezuelan manufacturing firms.

ME-12.3 - Hierarchical, Object-Oriented Modeling and Simulation as a Tool for Managing the Manufacturing Enterprise

Anne Henriksen, James Madison University

A manufacturing enterprise can be represented as a series of recursive, hierarchical levels consisting of all the functional entities that participate in and impact the firm's activities. These hierarchical levels range from the molecular scale (whose entities are the fundamental physical constituents of the firm's product technologies) to the extended enterprise (whose entities interact with and impact the firm, but over whom the firm has no direct control). Modeling the manufacturing firm in this fashion allows us to investigate how localized events and decisions will impact firm performance and profitability, both on the same level and up and down the hierarchy. This approach can facilitate more effective management of manufacturing technology and enterprise management strategies. The production of biopharmaceuticals will be used to illustrate the application of this model to a typical manufacturing enterprise.

ME-13 **Monday, July 26, 1999**
17:15 - 18:45 **Pavilion East**

Industry Application-4: Service Sector
Chair: Lidia Segre, Universidade Federal de Rio de Janeiro

ME-13.1 - Mobile Computing Terminals and Law Enforcement: An Exploratory Investigation of the Buffalo Police Department

Manish Agrawal, SUNY - Buffalo
H.R. Rao, SUNY - Buffalo
G. Lawrence Sanders, SUNY - Buffalo

The paper explores the factors involved in the successful implementation of mobile computing terminals in the Buffalo police department. Public trust in the police and police control over law violators are identified as key intermediate factors that are affected by the mobile computing terminals. A third factor is job satisfaction. These three factors have an impact on police effectiveness. A model for investigation is developed on the basis of discussions with officers and the postulates have been tested in a pilot study with promising results.

ME-13.2 - Technology and Innovation Management in the Retail Modernization Process: A Comparative Study

J. Tarcisio Trindade, Universidade Estadual de Maringa
Lidia Segre, Universidade Federal de Rio de Janeiro

Through study cases in Brazil and Italy this research work analyzes the adoption of technological and organizational innovations and their impacts on company management and work organization strategies. Collected data are used for a comparative analysis of the retail sector's modernization process in both countries.

MF-14 **Monday, July 26, 1999**
10:30 - 13:30 **Pavilion West**

Poster Session - 1

MF-14.1 - A Guideline for Classification of Intelligent Manufacturing Systems

Sirichan Thongprasert, Chulalongkorn University
Pramual Suteecharuwat, Chulalongkorn University
Parames Chutima, Chulalongkorn University

Intelligent Manufacturing System (IMS) is known as the autonomous or near-autonomous system that can acquire all relevant information through sensing, render decisions for its optimum operation, and implement control functions to achieve the objectives of its manufacturing tasks, including the overhead functions. IMS in Thailand is a very new concept. This research proposes a classification methodology for evaluating the levels of intelligence of the machines, cells, lines, areas, factories, and the entire manufacturing system. The proposed methodology is devised to provide a clear boundary for IMS and also can broadly answer how and in which direction a company should introduce intelligent manufacturing into their organization.

MF-14.2 - Process Improvement Priorities in Small Software Companies

Timo Varkoi, Tampere University of Technology
Timo Makinen, Tampere Universtiy of Technology
Hannu Jaakkola, Tampere University of Technology

The paper discusses process improvement activities in small companies. SPICE (ISO/IEC 15504 TR) is used as the main framework for software processes and process improvement. Alternatives and guidelines for the evaluation of software process improvement priorities are presented with examples of real-life priority determinations. The present process capability of the company and the size of it affect the priority determination.

MF-14.3 - Effective Measurement and Evaluation of R&D Quality and Productivity

Doron Meyersdorf, Tefen Ltd.
Ezey Dar-El, Technion
Zeev Bonen, Technion

R&D productivity is defined as the evaluated ratio between the outputs with their long-term consequences, and the inputs invested in achieving those outputs. The paper describes the methodology of constructing and implementing a measurement and evaluation system for R&D quality and productivity in high-tech industries. It summarizes continuous fieldwork done with five leading Israeli firms, which focused on establishing and implementing such a system.

MF-14.4 - An Analysis of the Deployment of R&D Fund Resource in Guangdong Province, China

Jianmei Yang, South China University of Technology
Wang Ding, South China University of Technology
He Zheng, South China University of Technology
He Yuning, Informix Inc.

Indices relative to R&D resources are important economic indices in times of knowledge-based economy. R&D resources deployment is an important issue to the development of science and technology, economy and society. After clearly defining the concept of R&D resources, this paper makes an analysis to present the situation of R&D resources and makes an analysis to present the situation of R&D resources deployment in GuangDong province with its research structure, subjection structure, district structure, industry structure and discipline structure. Then we make a comparison with the situation in developed countries and districts and present our opinion about the optimization to R&D resources deployment in GuangDong.

MF-14.5 - Defining Computerised Business System Requirements for Small- to Medium-Sized Enterprises (SMEs)

Mark Zalud, Coventry University
Derek Steeple, Coventry University

SMEs contemplating the purchase and implementation of computerised manufacturing and business control systems are faced with a wide and complex variety of vendor offerings. This paper presents a framework by which these companies can define their requirements and evaluate the vendor offerings effectively, thereby enabling a structured and robust selection decision.

MF-14.6 - Project Management Through Productivity Levels Data Base - The Engineering Projects Case

Georgia Batista, Cidade Universitaria
Cosmo Filho, Universidade Federal da Paraiba

Under an operational view, productivity levels and other related performance data may be used to sustain management decisions and to monitor the working projects process. This paper shows how this data base utilization contributes to plan and control the production operations into an engineering projects shop.

MF-14.7 - Successful Electronic Commerce Implementation: A Business Results Model

Pamela Specht, University of Nebraska at Omaha

Reports of failures of electronic commerce (EC) to bring in additional revenue are increasing. A literature review reveals a lack of recommended business procedures for successful EC implementation. A model relating business strategy, EC strategy, and business results is presented, emphasizing the need to develop a business case.

MF-14.8 - Using Team Based Process as an Educational Medium for an Undergraduate Production and Operations Management Course

Dana Johnson, Wayne State University

This paper will discuss the methods, benefits, and obstacles to instruct an undergraduate Production and Operations Management course at Wayne State University. Transfer of training methodologies as an instructional tool within an academic setting will be discussed.

MF-14.9 - Managing a Summer Intern Program in a Large Corporation

Michael Richerson, Boeing

Offering a summer intern program can be a way of attracting top students from area colleges. However, a successful program does more than just create a few job openings. It provides a development opportunity for the students. In addition to the work performed, development can include company overview presentations, tours of company sites and operations, meetings with upper management and having an assigned mentor. Also an intern program gives the student and the company a chance to assess each other before entering into a longer term relationship.

MF-14.10 - Efficacy of Virtual Organization Concept in Enhancing Business Operations— A Case Study in Malaysian Fashion (Footwear) Industry

Avvari Mohan, University Telekom
Tan Lee, University Telekom
Tay Kam, University Telekom
Loh Choon, University Telekom
Quah Teong, University Telekom

Malaysia is crossing the threshold into the information age. With the setting up of the Multimedia Super Corridor, Malaysian organisations have access to next generation telecommunication networks and information technologies. Thus even small and medium sized organisations are able to do business globally and open themselves to new forms of partnerships and commerce. In our study, we look at applications of the Virtual Organisation concept which has been made possible through the availability of these next-generation information technologies. The case study looks at the applications of the available information and telecommunication infrastructure to reorganise and enhance business operations of a footwear manufacturing organisation.

MG-14 **Monday, July 26, 1999**
14:00 - 17:00 **Pavilion West**

Poster Session - 2

MG-14.1 - Managing Product Improvement with Quality Tools and Factors

Sarfaraz Ali Syed, Tabouk Electricity Co.

The design of a product begins with an idea and continues through a variety of planning, design, manufacturing and testing phases until actual production begins and the product is made available to the

customer. Attaining the highest quality at the lowest cost is emerging as a major manufacturing challenge. To meet these tough and contradictory goals requires continuous improvement at all levels of product development, i.e., from idea to market. This paper outlines the use of Quality Factors and Tools in the product development cycle and addresses the methodology to convert each quality function into product improvement expressed in the producer's language.

MG-14.2 - Managing Technology of America's Infrastructure

Robert Cerveny, Florida Atlantic University
Samuel Stephenson, Florida Atlantic University

The nation's defense, prosperity and quality of life are increasingly dependent upon judicious management of the technology of complex networks of interlinked computer systems and dedicated computer networks. At a rapid pace the nation's critical infrastructures - energy, finance, telecommunications, transportation and vital human services - are becoming more and more dependent on management's assessment and implementation of technology-based strategies for infrastructure protection from physical and cyber attacks.

MG-14.3 - Simulation Technologies in Heavy Truck Process Engineering

Mario Revellino, IVECO S.P.A.
Luigi Saggese, IVECO S.P.A.
T De Muro, IVECO S.P.A.

The spread use of shape and drawing digital form, can allow automotive vehicle product development time reduction. This can represent a noticeable competitive factor in the field of industrial vehicles, where specialized product to be produced in low or niche volume, are the standard rule. In this paper some of the main application of product and process simulation are described.

MG-14.4 - A Simulation Tool for Automated Guided Vehicle Systems

Bulent Sezen, Gebze Institute of Technology
M.P. Deisenroth, Virginia Polytechnic Institute & State University
Gul Okudan, Gebze Institute of Technology

The design and control of an Automated Guided Vehicle (AGV) system is a complex issue and needs planning prior to the implementation of the system. This project provides an analysis tool for evaluation of a variety of AGV systems. A generic AGV simulator has been developed by using the AGV library of a commercial simulation package, SIMPLE++. SIMPLE++ is an object-oriented modeling and simulation environment. Object orientation provides higher development speed, ease of modification, and reduced complexity. The generic AGV simulator is also capable of reading the layout data from an AutoCAD drawing.

MG-14.5 - Management of Technology: A Political Process Approach

Christian Koch, Technical University of Denmark

Despite the argued revisionist character of the MOT movement, most Management of Technology writings fail to address enterprise developments as political processes, where visions, coalitions and emergence are central features.The paper reports on a participant's observation study of management of technology processes.

MG-14.6 - Managing High-Tech Computer Security Against Smart and Persistent Intruders

George Ross, Virginia Technology Corporation
Gideon Samid, Virginia Technology Corporation

Yesterday computer security was perceived as a passive lock, once applied then forgotten about today computer security is an going effort, a war against a range of "infotruders" who get smarter and remain persistent in proportion to the data treasure under attack. The question addressed here is how to build management guidelines, how to budget, and allocate resources in order to achieve proper balance between what is necessary to secure information, and what is a panic-driven "Maginot line," which costs too much and protects too little.

MG-14.7 - Managing Quality System for High Performance

Claudemir Gimenez, UNICAMP/FEM/DEMA
Geraldo Telles, UNICAMP

Companies dispute market share among local and global companies, and customers are very important for these companies. Quality arise as tool for maximise opportunities in this environment. This article presents a work developed during last year (1997) in a subsidiary of U.S. autoparts company in Brazil. The company designed its own quality system. This system identified and solved problems. Customers and suppliers are considered in this system. Sections of this work include management system, quality values, data management of internal operations (e.g. manufacturing, engineering, and planning), analysis and use of data for decision making, quality planning, benchmark information, design of new products, and quality assurance of external suppliers.

MG-14.8 - Manufacturing Fitness for Technology Transfer

Jay Varzandeh, California State University
Kamvar Farahbod, California State University

The problems associated with technology management and technology transfer are complex, unstructured and poorly defined. The tremendous increase in business globalization in recent years, on the other hand, requires fast and efficient transfer of manufacturing technology around the world. The notion of fitness for technology transfer can provide an understanding of how well a manufacturing process and capability can be transferred between home and host organizations. As the starting phase of the entire transfer process, the fitness assessment phase provides results that feed into the packaging and monitoring phases that must follow. This paper describes the necessity of technology transfer in today's manufacturing environments and presents a comprehensive framework, which can explore the mechanisms of transferring technology. Moreover, this study promotes the formation of a strategic alliance for facilitating the smooth and fast transfer of technology. Also, the phases of manufacturing technology transfer are discussed and the role of manufacturing fitness assessment phase in determining the fastness and ease of the transfer is emphasized.

MG-14.9 - Applying "Lean" Techniques to Computer Support Services

Michael Richerson, Boeing

Lean manufacturing techniques were originally developed to improve factory operations. In the factory these techniques reduced inventory, reduced defects, reduced the distance parts traveled through the factory and clustered operations on the same part in the same area of the factory. When applied to computer support services, lean techniques can reduce backlog of service requests, reduce flow times, reduce defects and improve customer satisfaction.

TB-01 **Tuesday, July 27, 1999**
10:00 - 11:30 **Galleria-1**

New Product Development 3
Chair: Yee-Yeen Chu, National Tsing-Hua University

TB-01.1 - Risk Management Heuristics in New Product Development

Antonie de Klerk, University of Pretoria

New product development projects are unique from a risk-management perspective: the risks are high and the very nature of such pro-

jects is to reduce this risk. This paper examines project risk management in new product development, focusing on technical risk and identifying a number of relevant heuristics from the fields of product and systems development.

TB-01.2 - Knowledge Transfer in New Product Development

Charles O'Mara, University of Western Sydney
Paul W.B. Hyland, University of Western Sydney
Terry Sloan, University of Western Sydney

Capturing the lessons learned in product innovation projects is one way to apply the principles of continuous improvement to innovation management. In this paper we report on research carried out with an Australian aerospace firm and examine how the lessons learn in developing new products are transferred to subsequent as well as exisiting projects.

TB-01.3 - Operational Agility in Taiwan's Microelectronics and Information Industry

Yee-Yeen Chu, National Tsing-Hua University
Wen-How Pyi, National Tsing Hua University

This paper presents a study directed to the investigation of the agility of Taiwan's microelectronics and information industry. The paper addresses the business practices and indicators that reflect the rapid development and manufacturing capabilities as well as flexible management structures that support an agile organization in response to the rapidly changing environment.

TB-02 **Tuesday, July 27, 1999**
10:00 - 11:30 **Galleria-2**

R&D Management -3: R&D Portfolio Management
Chair: Michael M Menke, Value Creation Associates

TB-02.1 - The Diverse Personalities of Portfolio Management: Variations on a Theme

Michael Menke, Value Creation Associates

Portfolio management has become an important R&D management approach to ensure that R&D resources are deployed in support of business strategy and to maximize the return on the R&D investment. However different organizations, both users and consultants, have very different portfolio management approaches. This paper identifies the key features and distinctions of three fundamental approaches that we call cost-based, time-based and value-based. Although these approaches individually use quite different methodologies and metrics, it is possible and desirable to integrate them into one comprehensive R&D strategic management process.

TB-02.2 - Decision Analysis in Early Pharmaceutical Development

Les Bell, Searle Research and Development

Pharmaceutical research is characterized by high risks and long time horizons, yet the rewards for making the right decisions can be substantial. At Monsanto we have created a flexible decision analysis process that allows us to examine individual project strategies and to understand portfolio optimization issues.

TB-02.3 - Assessing the Validity of a Group Decision Support System

Martin Read, University of Portsmouth
Tony Gear, Universtiy of Glamorgan

The paper describes a case study concerning the use of a Group Decision Support System (GDSS) to help senior research and development managers in the pharmaceutical industry determine a Development Portfolio, and addresses issues concerned with the validity of the use of the GDSS in this context.

TB-02.4 - Prototype-Based Life Cycle Costing in R&D

Markus Pfohl, Universitaet Stuttgart

In R&D 75 to 85 percent of accumulated product life cycle costs are determined, even though only five to seven percent of these costs are inccured to this time. This gap between cost detemination and cost accumulated, and the fact that the development and marketing of new products is related to increasing investments, requires a life-cycle oriented perspective in the R&D: life-cycle cost and life-cycle profitability of an object have to be analysed. Recent developments in technologies of Rapid Prototyping allow one to use more realistic prototypes in the early stages of R&D. The prototypes could be used as a means of communication. They help to explicate the implicit knowledge which process the representatives of the different functions, like R&D, marketing, logistics, etc., of the producers, the suppliers and the customers. So the prototypes are an excellent instrument to support the product life cycle cost and profitability analysis.

TB-03 **Tuesday, July 27, 1999**
10:00 - 11:30 **Galleria-3**

Management of Technological Innovation - 4
Chair: Jeff Butler, Manchester Business School

TB-03.1 - Global Innovation Teams: A Requirement for the New Millennium

Kathleen Wheatley, Syracuse University
David Wilemon, Syracuse University

Global teamwork is becoming a requirement at all levels of the firm from strategy to product development. This new requirement creates many issues that need addressing in order to capture the potential synergies associated with global teams. Some actions/guidelines are presented here that can assist global team leaders as they manage their teams in the next millennium.

TB-03.2 - A Practical Model for Technology and Innovation Management

Jeff Butler, Manchester Business School
Javier Ruiz, Manchester Business School

A three-part model is used in a European guide to technology and innovation management. The model describes technology management practices and the innovation process and introduces practical tools and techniques. It facilitates strategic development, operational efficiency and a learning philosophy, and integrates these into an overall business performance for SMEs and large companies. Innovation and technology management can be audited to improve business performance.

TB-03.3 - Public Research and Industrial Innovations

Marian Beise, University of Karlsruhe

This paper deals with the short-term effects of publicly funded research at universities, polytechnics and federal research labs on industrial innovations in Germany. In questioning 2,300 companies we found that less than one tenth of innovating firms have introduced innovations between 1993 and 1995 that would not have been developed without public research. We discuss the characteristics of these companies that benefit from the findings of public research institutions and the most supportive research institutes.

TB-04 **Tuesday, July 27, 1999**
10:00 - 11:30 **Parlor B**

Technology Transfer - 1
Chair: Kiyoshi Niwa, University of Tokyo

PAPERS AND PANELS

TB-04.1 - Information Technology Transfer to Egypt

Sherif Kamel, American University in Cairo

The introduction of computing into Egypt started in the 1950s. However, the use and applications were limited to a few sectors and industries. During the early 1980s and with the introduction of personal computers worldwide, a major evolution involving information, computing and communication technologies penetrated the society in Egypt affecting major public and private sector organisations in Egypt. Such transformation has had socio-economic implications on the nations' development and growth. This paper demonstrates the information technology diffusion across different sectors and its vital role in building an information-based society in Egypt.

TB-04.2 - A Normative Model for the Planning and Implementation of International Technology Transfer

K. Ramanathan, University of Western Sydney Nepean

International technology transfer (ITT) has become an important component of international business in the current era of globalization and liberalization. Yet, both buyers and sellers of technology find that the process continues to be problematic. This paper proposes a normative approach that could be of value to transferee managers responsible for planning and implementing technology transfer.

TB-04.3 - University-Industry Technology Transfer in Japan: Will the American Model Work for Japan?

Steven Collins, University of Washington
Hikoji Wakoh, Kanagawa Industrial Technology Research Institute

Japan's government is undertaking major reforms aimed at stimulating technology transfer from universities to industry. Filing patents and negotiating licenses, however, are radically new activities for universities; supporting institutions are few, and firms have little experience managing the transfer process. Expected results, therefore, will take time to achieve.

TB-04.4 - Technology Transfer and International Trade: Exploring the Relationship Between the International Transfer of Technology and International Trade Theory

Lance Brouthers, University of Texas at San Antonio
John McCray, University of Texas at San Antonio
William Flannery, University of Texas at San Antonio

The globalization of international business in recent years has generally been attributed to high technology industries. This paper proposes that there is a previously unexplored relationship between international transfer of technology and the product lifecycle theory of international trade. More specifically, there appears to be strong correlation between maturity of the product as defined by the product lifecycle and the method of technology transfer.

PANEL: TB-05 **Tuesday, July 27, 1999**
10:00 - 11:30 **Parlor C**

Making the Corporate Culture Produce Increased Profits
Moderator: Yong-In Shin, Intel Corp.

Panelist(s): John V Harker, InFocus Systems, Inc.
Roger Tunks, The Richard-Rogers Group, Inc.

It is often said that organizational culture is the "soft side" of running a company. The truth is, it is the "hard side." It drives expenses, revenue and ultimately profits. Organizational culture is clearly about money. Every organization has a culture, and whether it is planned or evolved, it is in place. Highly competitive and successful organizations take charge of their culture to create a win for employees, the company and the customer. The challenge is in making it happen. This presentation is about leading cultural change. More than "what to do," the emphasis will be on the "how to" make it happen. Regardless of whether you are a large or small company, or a division, the examples and techniques discussed will have a direct application. You will walk through a dramatic case study about InFocus Systems. You will gain insight into how a 500-employee electronics manufacturing company was able to make a crucial course correction to truly become a "first choice employer and supplier." You will examine how in a time of fast growth, they overcame the challenge of aligning the views and values of hundreds of new employees into an already effective culture. Topics covered will include the seven deadly sins of cultural drift. You will examine the latest method in building an effective organizational culture with hustle, truth telling, team alignment, and dedicated employee commitment.

TB-06 **Tuesday, July 27, 1999**
10:00 - 11:30 **Studio**

Information/ Knowledge Management 5
Chair: Keith Martin, Fairfield University

TB-06.1 - Knowledge Medium for the Global Design

Yasukazu Aoki, Duo Systems Co., Ltd.
Toshiharu Taura, The University of Tokyo
Masanobu Muranaka, Nippon Steel Corp.
Yoshinori Kohno, Mitsui Engineering & Shipbuilding Co., Ltd.
Yutaka Yamada, Nippon Unisoft Corp.
Terueki Ogawa, Sony Chemicals Corp.
Tominori Yamada, Tubal-Cain Engineering Consultant

This paper describes a new concept, "Global Design," and proposes a system realizing this concept. The system is based on the "Activity Chain Model" which can easily capture, accumulate and transfer dynamic design information including histories of products and intent by focusing on design activities and links between them.

TB-06.2 - Growing Pains: Introducing EDI in Mexico

Victoria Erosa, Universidad La Salle, Mexico

In today¥s highly dynamic, unpredictably changing business environment, Mexican firms are facing the challenge of introducing Electronic Data Interchange (EDI) for survival and for competitiveness. Results of a research conducted to identify the barriers for EDI adoption in the Mexican industry reveal that the main reason for the adoption is the pressure of major business partners and that most frequent barriers are change resistance and the need of expertise for the operation. Implications of these findings for promotion strategies at the EDI National Committee level are discussed.

TB-06.3 - The New Technical Paradigm: The Enhanced Role of Chief Information Officers

Keith Martin, Fairfield University

With increasing complexities and costs of information technology, chief information officers have become extremely important members of corporate executive groups. They oversee the application of information technology, and participate in decision-making processes based on the outputs of that technology. Their impact is intensified when the enterprise is engaged in global operations. This paper reports on a recent survey of CIOs regarding their organization's deployment and support of global systems, and analyzes how they are meeting organizational needs and expectations.

TB-07 **Tuesday, July 27, 1999**
10:00 - 11:30 **Directors**

Technology Management 3
Chair: Sergio Takahashi, University of Sao Paulo

PAPERS AND PANELS

TB-07.1 - Reaching Competitiveness Through Technology Acquisition in the Electronics Manufacturing Industry

Tugrul U Daim, Intel Corp.
Dundar F Kocaoglu, Portland State University

This paper presents the results of a study conducted throughout the US electronics manufacturing industry. The study identified three major technology acquisition strategies: Research and Education, Networking, In House/vendors. The results indicate that there are correlations among between the technology acquisition strategies and the results attained by those companies.

TB-07.2 - Strategic Model for Justification, Adoption and Implementation of Advanced Manufacturing Technologies

Fernando Scandiuzzi, University of Sao Paulo
Sergio Takahashi, University of Sao Paulo

This work has as its objective to propose a strategic model for choice, justification, adoption, implementation and evaluation of acting of the Advanced Manufacturing Technologies (AMT), as well as the responsible factors for the success or failure of such implementations and its relationships with the other elements of the organization.

TB-07.3 - Information Technology Diffusion: A Comparative Case Study of Intranet Adoption

George Zolla, Naval Postgraduate School

This exploratory study identifies factors that influence the adoption and diffusion of intranet technology. A comparative case study of bipolar organizations is used to identify crucial implementation factors and create an innovation adoption model. A strategic approach for the adoption and diffusion of intranet technology is then presented.

TB-08 **Tuesday, July 27, 1999**
10:00 - 11:30 **Council**

Collaboration for Technology Management 5
Chair: David V Gibson, IC2 Institute

TB-08.1 - On Soft-Incubator as Collaboration for Technology Management

Tomofumi Sumita, University of Electro-Communications
Masahito Shimazaki, University of Electro-Communications

The purpose of this paper is to discuss the function of Japanese-style soft-incubator. The concept of soft-incubator will be explained as a useful collaboration for technology management among industry-university-government. The soft-incubator is expected to support venture business creation.

TB-08.2 - On Regional Research and Development Policy: The Case of the Tohoku Intelligent Cosmos Plan

Kensei Araya, Fukushima University

During these 10 years, in the northeastern parts of Japan (Tohoku region), we have developed a unique regional R&D policy called the Tohoku Intelligent Cosmos Plan. This paper includes the proceedings and the analyzed characteristics of the plan with some conclusive remarks.

TB-08.3 - Incubating Learning and Innovation Poles in Developing Regions Worldwide

David Gibson, IC2 Institute
Pedro Conceicao, University of Texas at Austin
Julie Nordskog, University of Texas at Austin
Sunil Tanhka, Center for Global Studies
Jennifer Burtner, University of Texas at Austin
Chris Stiles, University of Texas at Austin
Jason Mittman, University of Texas at Austin

This study defines the concept, need, elements, operations, and success metrics of incubating and developing learning & innovation poles. Part I focuses on the conceptual and theoretical framework for incubating learning & innovation poles worldwide. Part II defines an operational agenda to be funded and implemented as a major project for incubating learning & innovation poles in targeted areas within select regions in Latin America and the Caribbean (LAC). There are three primary objectives: to establish learning networks within and across potential and emerging innovation poles in the LAC and to link these regions with keys and more developed partner regions in the US and Canada; to increase regionally based abilities to put "knowledge to work" through the linking of talent, technology, capital, and know-how regionally and globally; to foster sustainable job and wealth creation for the select LAC regions; and to use these areas as "learning laboratories" and role models for other LAC regions.

PANEL: TB-09 **Tuesday, July 27, 1999**
10:00 - 11:30 **Forum**

Women in Engineering Management
Moderator: Janice L Forrester, Cytera Systems, Inc.

Panelist(s): Beverly Arnoldy, Society of Women Engineers
Christine Riley, Intel and Board of Trustees for the Women in Engineering Programs and Advocates Network
Joann Hughes, PG&E
Eric J Kangas, Hewlett-Packard
Stacey Ewton, DAT Services

In recent years there has been a steady decline in women in EM. The cause of this decline is yet unknown. This panel session will actively discuss issues related to women in engineering management. Those who attend will leave with a better understanding of the issues and perhaps indications as to the cause of the decline. Some of the discussion topics are as follows:

- Is there a difference between the support that a male engineer and a female engineer receive in industry/academics? If so, how could your organization better support women in engineering/engineering management?
- What actions or changes can be suggested to organizations so that they can better support female engineers and managers? Are they realistic and able to be implemented?
- Do the prospective engineering students get sufficient information about the engineering profession at high school? Is there a difference between the preparation of male and female students for engineering careers?
- What are the attractors / detractors for women in engineering management?

* What really happens in the field? How does industry treat engineers for recognition, promotions, salary, etc? Is there a perceived or real difference in the salary levels and the salary limits between male and female engineers/engineering managers?

TB-10 **Tuesday, July 27, 1999**
10:00 - 11:30 **Cabinet**

Decision Making in Technology Management 1
Chair: Jang W Ra, University of Alaska-Anchorage

TB-10.1 - Analysis of the Sum of the Inverse Column Sums (SICS): An Alternative Consistency Measure for Pairwise Comparisons

Gary Kretchik, University of Alaska-Anchorage
Jang Ra, University of Alaska-Anchorage

This paper introduces an alternative consistency measure for pairwise comparison matrices called the Sum of the Inverse Column Sums (SICS). The SICS methodology improves upon existing consistency measures with respect to ease of calculation, interpretation of the results and spreadsheet adaptability. However, there are two problems inhibiting widespread use of the SICS metric. First, questions exist concerning the validity of the algorithm. Second, the bound limit conjecture remains unproved for all matrices. Therefore, in addition to introducing the SICS methodology, this paper through the use of simulation and statistical arguments resolves the two problems with the method.

TB-10.2 - Managing Solution (Product) Knowledge: Integrated Decision-Making for Sustained Competitive Advantage

Bill Barnard, Barnard-Norman Associates
Richard Norman, Barnard-Norman Associates

Today's markets require solutions, not products. This paper describes an advanced support process for defining the integration of solution decision-making teams and their marketing objectives. It focuses on supporting business marketing strategy definition and technology fit to customer needs, but can be adapted to fit other objective models. This integrated process provides a means that confidently answers major project management "bottleneck" questions. As we enter the Knowledge Era, integrated solution knowledge will be the lifeblood for competitive organizations.

TB-10.3 - Application of AHP and MAU in the Selection of Rural Alaskan Airports at Which to Test Remote Video for Information Gathering

James Buckingham, University of Alaska-Fairbanks
Jang Ra, University of Alaska-Anchorage

Current automated methods for gathering weather and runway condition information at remote public airports in Alaska are limited. This paper establishes the feasibility of using remote video to complement existing systems. It uses two multi-criteria decision making techniques - AHP and MAU - to recommend the most qualified airstrips in Interior Alaska at which to conduct a one-year test of this technology.

TB-11 **Tuesday, July 27, 1999**
10:00 - 11:30 **Executive**

Virtual Enterprises 3
Chair: Alptekin Erkollar, University of Klagenfurt

TB-11.1 - Participation in Virtual Organisations: The Union Responses

Christian Koch, Technical University of Denmark

Despite most of the hype on virtual organisations, the introduction does not necessarìly produce or develop a high trust situation. The paper reports on Scandinavian union responses to virtualization, with case examples of manufacturing enterprise groupings. Despite explicit technology promoting policies by unions, participation in management of technology is not granted but was taken by the shop stewards and their unions.

TB-11.2 - A Methodology for Eliciting Expert Knowledge in Virtual Engineering Environments

James Ritchie, Heriot-Watt University
John Simmons, Heriot-Watt University
Richard Dewar, Heriot-Watt University
Ian Carpenter, University of Durham

This paper explains how assembly planners are non-intrusively interrogated whilst immersively assembling virtual reality-modeled products. Product/process knowledge can be formalised, proving that techniques exist which can elicit 'expert' knowledge using VR. This may have profound implications for the integrated and globalised virtual technology-based engineering environments of the next century.

TB-11.3 - Planning in Virtual Enterprises Using the NETSIM Approach

Alptekin Erkollar, University of Klagenfurt
Wilfried Krug, Dual Zentrum GmbH
Heinrich Mayr, University of Klagenfurt

This paper deals with the question of integrating PPC and simulation for improving the production planning within a virtual enterprise. A strategy is presented which starts from traditional network technique as is used by PPC-Systems, transforms a PPC planning network into a simulation model, uses that model for simulation experiments in order to find an acceptable production schedule, and re-transforms that schedule for execution by the PPC-system.

TB-12 **Tuesday, July 27, 1999**
10:00 - 11:30 **Senate**

Manufacturing Management - 3
Chair: Michael H Cole, University of Arkansas

TB-12.1 - The Integrated Management to Research, Development and Realization for Manufacturing Engineering

Masaharu Kinoshita, Toshiba Corporation
Hugo Tschirky, Swiss Federal Institute of Technology

The entire process from research and development to realization was reviewed for manufacturing engineering. To successfully realize a final goal of this process, a technology refining cycle is necessary. There are two refining cycles: the principle refining cycle and productivity refining cycle. They correspond to the research-to-development and development-to-realization stages, respectively.

TB-12.2 - Insights from Manufacturing Scheduling for Work Allocation in Knowledge-Intensive Firms

Linda Brennan, Mercer University
Robert Orwig, Mercer University

Work allocation is a critical function for knowledge-intensive firms, affecting a firm's financial performance, output quality, system throughput and capacity, customer service and worker satisfaction. This research builds on established practices used for assigning work within manufacturing systems to suggest ways in which to manage knowledge-intensive firms.

TB-12.3 - An Organic Approach to the Evolution of Manufacturing Technology

Hilal Hurriyet, University of Western Sydney, Nepean
Rakesh Agrawal, University of Western Sydney, Napean

Each individual manufacturing technology has an important characteristic that could be vital for the planners and designers of the factory of the future (FOF). But the sophisticated evolution process surprisingly proved that instead of setting scenarios or making predictions for the FOF, focusing on the interactions of its components will give us better direction . The "organic evolution" is going to create the FOF and not the known characteristics.

TB-13 **Tuesday, July 27, 1999**
10:00 - 11:30 **Pavilion East**

Industry Applications-5: Semiconductor Manufacturing
Chair: Lynn Moyers, Phoenix Technologies

TB-13.1 - Wafer Fab Control via Distributed Pricing Mechanism

Weidong Lin, Nanyang Technological University
Robert de Souza, Nanyang Technological University

This paper presents a generic framework of decentralized shop floor control via pricing mechanism for wafer fabrication facilities, in which a variety of control tasks are distributed to different control agents. According to our framework, when a customer order arrives, the customer agent will determine the releasing of this order through negotiation with the resource agent. Similarly, the work area agents will make decisions for individual machines. The competitive equilibrium can be realized through auction-based pricing mechanism. The initial result indicates that this novel approach significantly improves the system performance and simplifies the procedure of the traditional control rules for wafer fabrication systems.

TB-13.2 - Yield/Cost Modeling for Electronics Wafer Fabrication and Evaluation of the Impact of Minimum Acceptable Die Yield Criteria on Statistical Wafer & Die Yields and Costs

Carmo D'Cruz, Harris Semiconductor

In electronics wafer fabrication, the minimum acceptable die yield (MADY) criteria has often been a bone of contention and one of the root causes of inherent conflict between the engineering and manufacturing functions. Traditionally, the engineering group has been responsible for keeping the die yields high (and presumably the die costs low) and, therefore, set a higher value for MADY (which is used to discern between a good wafer and a reject wafer). The manufacturing group, on the other hand, is responsible for keeping the manufacturing costs (wafer costs) low, and they would prefer a lower value for MADY since this would result in a higher number of acceptable (good) wafers and a lower number of rejects, thus keeping the manufacturing costs low. In this paper, a yield/cost model has been derived to link upstream customer-defined specifications and design/technical criteria with the fab process constraints/capabilities and downstream wafer and die yields and costs for simple electronics transducer wafer fabrication. Additionally, a statistical model has been developed, and when used in conjunction with the yield/cost model, it attempts to diffuse the conflict between engineering and manufacturing and maximize profits through better cost effective decisions by predetermining the impact of the MADY criteria on the statistical wafer and die yields and hence on the costs.

TB-13.3 - Managing Technology and Innovation in Electronics Wafer Fabrication with a TQM Perspective

Carmo D'Cruz, Harris Semiconductor

Technology is a key resource for corporate profitability & growth. A company's manufacturing function can be a formidable competitive weapon if its workforce & technological capabilities are tuned to meet the firm's strategic needs. Wafer fabrication encompasses the manufacturing processes that create tiny electronic circuits, and the technological innovation involved is incremental & continuous to minimize process disruptions. Managing technology and innovation in the socio-techno-economic realm of manufacturing involves mediating between the external forces for change and the internal forces for stability. The TQM perspective provides a format for such compromise. In this paper some of the contemporary world-class manufacturing practices that promote incremental innovation are examined, and the implementation of TQM at a small electronics company is discussed. A yield/cost model to predetermine the cost of product and link customer-defined specifications to design criteria/process constraints is described. The proliferation of the process capability index as an easily understood measure of product/process goodness throughout the organization is demonstrated.

TB-13.4 - A Yield Management Strategy for Semiconductor Manufacturing Based on Information Theory

Charles Weber, MIT Sloan School of Management
Vijay Sankaran, SEMATECH
Kenneth Tobin, Jr., Oak Ridge National Labs
Gary Scher, Sleuthworks, Inc.

A model based on information theory, which allows technology managers to choose the optimal strategies for yield management in the semiconductor industry, is presented. The knowledge extraction rate per experimentation cycle and knowledge extraction rate per unit time serve as benchmarking metrics for yield learning. They enable managers to make objective comparisons of apparently unrelated technologies. Combinations of four yield analysis tools — electrical testing, automatic defect classification, spatial signature analysis and wafer position analysis — are examined in detail to determine an optimal yield management strategy for both the R&D and volume production environments.

TC-01 **Tuesday, July 27, 1999**
13:30 - 15:00 **Galleria-1**

New Product Development 4
Chair: Tugrul U Daim, Intel Corporation

TC-01.1 - Product Definition for Effective Customer Order Processing: A Customer-Oriented Approach

Xuehong Du, The Hong Kong University of Science & Technolgy
Jianxin Jiao, The Hong Kong University of Science & Technology
Mitchell Tseng, The Hong Kong University of Science & Technology
Wai Lo, Computer Products Asia-Pacific Ltd., Artesyn Technologies
Xuan Liu, Computer Products Asia-Pacific Ltd., Artesyn Technologies

Product definition is both critical and time consuming. A Customer-Oriented Approach (COA) for product definition in order processing has been proposed and applied to an electronic product. By identifying customer requirement patterns and functional requirement templates, a customer oriented classificatory knowledge base is constructed to facilitate translating individual customer requirements to product specifications responsively.

TC-01.2 - Organizational Learning on New Product Success, Rapid Prototyping, and Speed-to-Market

Gary Lynn, Stevens Institute of Technology

Ali Akgun, Stevens Institute of Technology

Although organizational learning is important, we know surprisingly little about how to measure it. This study operationalizes organizational learning in a new product development team context and tests its effect on Rapid Prototyping, Speed to Market and overall New Product Success (NPS). By studying 78 new product teams, we have found that two forms of learning (Declarative and Procedural Knowledge) impact NPS. Declarative is significantly positively correlated to Rapid Prototyping, Speed to Market and NPS. Procedural Knowledge is not significantly correlated to Rapid Prototyping, Speed to Market and NPS.

TC-01.3 - Driving Behavioral Change in Implementing New Processes in New Product Development in the High Tech Environments

Sarah Nesland, Intel Corp.
Tugrul U Daim, Intel Corp.

This paper reviews the New Product Development Process in high tech environments and addresses a common problem encountered in

changing processes. The major challenge in introducing any change successfully depends on the success of accomplishing behavioral change.

TC-02 **Tuesday, July 27, 1999**
13:30 - 15:00 **Galleria-2**

R&D Management - 4
Chair: Gil Latz, Portland State University

TC-02.1 - Management of Research and Technological Innovation

Philip Gardner, University of British Columbia
Vijay Verma, TRIUMF

Research and development management is the art of organising and motivating a team of scientists, engineers and manufacturers, and dealing effectively with uncertainties. Effective leadership is the key to successful management of R&D programs. This paper provides an overview of leadership challenges encountered in several research projects involving innovative technologies at TRIUMF - Canada's national sub-atomic physics research facility.

TC-02.2 - Proposal of "Culturability" As An Index of R&D Management

Takuro Munezawa, Niigata University

Culture has been defined as the whole lifestyle built by new knowledge and technology. Sony's Walkman has realized the new world-wide culture of walking while listening to individual stereos. Seeing these phenomenon, I propose "culturability" as a new product, meaning the potential of the new product to build a new culture as one of indices of R&D Management, which I proposed in PICMET '97.

TC-02.3 - A Corporate Technology Stock Model - Financially Sustainable Research and Technology Development

Akio Kameoka, Toshiba Corporation
Sei-ichi Takayanagi, Toshiba Corporation

A Corporate Technology Stock (CTS) model based on "depreciation" and its numerical simulations have suggested providing a new methodology for effective corporate technology management. This paper proposes a consistent CTS model that covers financially sustainable Research and Technology Development (RTD) in a company, from the viewpoint of cyclic profit return for re-investments.

TC-02.4 - Juglar Cycles and Their Effects on Technological Changes

Masatami Iwamoto, Kagawa University
Chuzo Iwamoto, Hiroshima University
Tadatoshi Yamada, Mitsubishi Electric Corp.

"Juglar cycles" affect changes of R&D at intervals of 10 years in Japan. There have been five recurring cycles in the last half-century since World War II. We are presently at the beginning of the sixth cycle. Based on their periodicity, this paper discusses R&D management for the coming decade.

TC-03 **Tuesday, July 27, 1999**
13:30 - 15:00 **Galleria-3**

Management of Technological Innovation 5
Chair: Terry R Schumacher, Rose-Hulman Institute of Technology

TC-03.1 - Science Based Accelerated Technological Innovation

Ruzica Petkovic, Exxon Research & Engineering Company
John Dismukes, University of Toledo
L. Cohen, Exxon Research and Engineering Company

Driven by the business need for the efficient movement of gas to market, a new science-based technological innovation, advanced linepipe technology, is under advanced development at Exxon. By providing access to gas resources that are relatively remote from the markets, this technology can be instrumental in the development of reserves that would otherwise be considered uneconomic. This paper provides a complete description of the complex system used to bring science concepts to commercial reality for the first time. Each element of the system, starting with identification of the need to the successful achievement of the challenging task, is discussed separately and together as an integrated system.

TC-03.2 - The Speed and Acceleration of Technological Innovation: A Co-opetitive Dynamics Perspective of the Small Satellites Industry

Elias Carayannis, The George Washington University
Robie Samanta Roy, Institute for Defense Analysis
Jeffrey Alexander, Washington CORE

We develop a conceptual outline of the nature, structure, and dynamics of technological innovation, and especially its speed and acceleration. We then link our outline to empirical evidence in the small satellite manufacturing sector in the US and abroad, focusing on factors affecting technology development and commercialization by small firms.

TC-03.3 - Simulation Training for Innovation Champions

Terry Schumacher, Rose-Hulman Institute of Technology

Encouraging innovative practice in mature, stable, change-resisting organizations is a topic of interest. Champions are especially important in mature organizations because routines are well-established and there is considerable resistance to innovation due to its routine-disrupting nature. The simulation described here provides training in the champion role.

TC-04 **Tuesday, July 27, 1999**
13:30 - 15:00 **Parlor B**

Technology Transfer - 2
Chair: Richard F Deckro, Air Force Institute of Technology

TC-04.1 - Measures of Knowledge and Their Relevance to Technology Transfer

Meir Russ, Franklin University, MBA
Robert Fineman, Q Squared Knowledge Management, Inc.

Technology Transfer is defined as the transfer of knowledge, to include the "transformation" of knowledge into viable commodities that create value in the marketplace. Recently, learning or knowledge acquisition was identified as possibly the sole source for sustainable competitive advantage in the market place. Researchers have generally failed to identify the key direct measures of knowledge in this context. This case study is used to illustrate a framework to measure the knowledge.

TC-04.2 - IT-Enabled International Market Research for Technology Transfer: A New Paradigm

Nazmun Nahar, University of Jyvaskyla
Kalle Lyytinen, University of Jyvaskyla
Najmul Huda, Tallinn Technical University

By utilizing technology through international technology transfer, companies can internationalize successfully. International market research for technology transfer is very time-consuming and expensive when using conventional approaches. This study presents a methodology that facilitates the selection of appropriate markets and suitable technology recipients from around the world by cost efficiently using new information technologies.

TC-04.3 - Measuring Return on Investment (ROI) for Military to Private Sector Technology Transfer

Richard Franza, Bentley College
Rajesh Srivastava, Air Force Institute of Technology

Government policy indicates maximizing return on investment on research and development as a fundamental reason for technology transfer. Since no models exist to evaluate transfer ROI, this paper presents a framework for such a model, developed to capture macro-economic effects, tangible and intangible returns, and to support comparisons among transfer opportunities.

TC-05 **Tuesday, July 27, 1999**
13:30 - 15:00 **Parlor C**

Technology Management Education 4
Chair: Charles S Elliott, Arizona State University

TC-05.1 - Real World Technology Management Education: Using the TEC Algorithm

Lynda Aiman-Smith, North Carolina State University
David Baumer, North Carolina State University
Stephen Markham, North Carolina State University
Angus Kingon, North Carolina State University
Michael Zapata III, North Carolina State University

We present the TEC Algorithm: complete sets of procedures used in an experiential learning process to prepare graduate students to find, assess, and commercialize technologies in high technology startups. The TEC algorithm and program, in the context of real-world entrepreneurship, teaches the entire business and technical development process.

TC-05.2 - Using Industry-University Partnerships for MOT Educational Enhancement

Charles Elliott, Arizona State University
Marc Snow, Raytheon Systems Co.
Al Winn, Boeing

The Joint Arizona - Consortium for Manufacturing and Engineering Education for Tomorrow (JACME2T) is a self-supporting group consisting of five major Arizona industries - Motorola, Boeing, AlliedSignal, IBM and Raytheon - and the three state universities - Arizona State University, University of Arizona and Northern Arizona University. It grew out of a Technology Redeployment Project (TRP) grant administered through NSF. Two of its many projects to date include the development of a statewide Masters in Engineering degree program which will be available totally on-line and a unique curriculum development group dedicated to Integrated Product and Process Development which is developing new one-credit modules and non-credit programs to be jointly taught by industry and university staff in several MOT areas. This paper outlines the efforts to date, additional programs developed and plans for the future.

TC-06 **Tuesday, July 27, 1999**
13:30 - 15:00 **Studio**

Information/ Knowledge Management 6
Chair: Robert J Parden, Santa Clara University

TC-06.1 - Measuring Information Systems Effectiveness: An Ongoing Challenge for CIOs

Loretta Evans, George Washington Uni., Bell Atlantic, NSI

CIOs are often in the position of justifying Information Systems resources especially when the business is not doing well overall. Being able to sensibly measure and communicate during difficult financial times is essential to meeting Information Systems goals of delivering quality products on time. A measurement concept, the System Enterprise Measurement Method is introduced to arm Chief Information Officers with measures that provide the value of information systems to the business of other executives.

TC-06.2 - Improving Information Technology Systems Through Adaptive User Interfaces

Roger Brill, University of Central Florida
James Ragusa, University of Central Florida

The "information overload" problem anticipated for the future will be compounded as information expands exponentially in the next millennium. This paper describes past and present research efforts designed to improve information technology (IT) systems through the creation of adaptive user interfaces.

TC-06.3 - Coalition Leadership for the Knowledge Age

Robert Parden, Santa Clara University

Achieving the knowledge age potential requires much higher levels of collaboration, than we are experiencing today. Individualism, left over from frontier days, still dominates. There is a requirement for documentation, knowlege sharing for synergistic problem solving, and standardized knowledge indexing where new technology isn't the solution. Leadership at every level is required to develop a coalition attitude appropriate to the knowlege age.

TC-07 **Tuesday, July 27, 1999**
13:30 - 15:00 **Directors**

Technology Management 4
Chair: Juett R Cooper, Marshall University

TC-07.1 - Organization and Individual Correlates to the Adoption of Internet Technologies

Juett Cooper, Marshall University
Rick Weible, Marshall University

In this paper we identify individual adopter individual and organizational variables that explain some of the variance in organizational adoption of Internet Technology by MIS professors. The evidence suggests Internet Technology consist of multiple dimensions that should be considered in research and practice of managing Internet Technology.

TC-07.2 - Analysis of Mobile Telephone Diffusion

Hannu Jaakkola, Tampere University of Technology
Markus Kajanto, Nokia Group
Yrjo Neuvo, Nokia Group

Diffusion models are tools used to manage the complexity of the diffusion process of products and technologies. There are several studies modelling the process in a mathematical form. Simplifying the original phenomenon produces the mathematical form of the diffusion process. This simplification will cause loss of the information describing and explaining the behaviour built into the process; typically the model parameters are not tightly bound to the original process. This paper describes an alternative approach concentrating on the principles of the process more than on mathematical exactness. The paper applies this approach to the analysis of the mobile telephone diffusion. The paper concentrates, after a short introduction of the modelling principles, on an application discussing the mobile telephone diffusion process.

TC-07.3 - What Affects the Economic Performance of Industrial Technology — A Case Study

S. Chul Yoon, Seoul National University

This study regarded technology as a system and examined systemic factors that affect the economic performance of the technology. Using

the systems approach to the analysis of a Korean company that imported both product and process technology to produce diesel engines, this study developed a model for engineers to utilize to predict the economic performance of the technology in the market.

TC-08 **Tuesday, July 27, 1999**
13:30 - 15:00 **Council**

Collaboration for Technology Management 6
Chair: Alan L Porter, Georgia Institute of Technology

TC-08.1 - Outsourcing and the Development of Competencies

Anders Nielsen, Aalborg University

No company can be expected to master all technologies or areas of knowledge. This makes out-sourcing and reliance on external sources a necessity for every company. Departing from a knowledge-based perspective on competencies this paper will discuss how suppliers (and other external partners) can contribute to the competence development process.

TC-08.2 - Role of 'Champions of Collaboration' in Fostering Inter-Organizational Collaboration

Richard Smith, Simon Fraser University at Harbour Center
Mohi Ahmed, Simon Fraser University

Rapid technological change, globalization, increasing competition and concern about sustainability are influencing inter-organizational collaboration. This paper examines the role of 'champions of collaboration' — individuals who foster inter-organizational collaboration in the innovation process. A comprehensive literature review and case studies are used to describe new mechanisms that enhance inter-organizational collaboration.

TC-08.3 - Assessment of R & D Collaboration by Patent Data

Thorsten Teichert, Kiel University
Holger Ernst, Christian- Albrechts Universitaet

Patent data are disclosed as a means for assessing collaborative activities and their dynamics. A framework for measurement is provided. Derived measures cover descriptive statistics, measures of collaborative strategy, positioning of partners and collaboration outcomes. They form the basis for an application in the automotive industry.

TC-08.4 - Coauthorship as a Measure of University-Industry Research Interaction in Japan

Kenneth Pechter, University of Tokyo
Sumio Kakinuma, National Center for Science Information Systems

How closely do academia and industry in Japan collaborate in the research process? We address this question through the window of coauthored papers. Our main finding is that coauthorship between Japanese industry and universities is rising, from 23% of all industry papers in 1981 to about 46% in 1996.

PANEL: TC-09 **Tuesday, July 27, 1999**
13:30 - 15:00 **Forum**

Outsourcing Technology for New Product Development
Chair: Charles H. Kimzey, Office of the Secretary of Defense
Moderator: Sam Kurokawa, Vanderbilt University

Panelist(s): Michiyuki Uenohara, Chairman, NEC Research Institute
Christopher King, Planar Corp.
Erwin "Al" Herman, Planar Corp.

Conflicting trends of shorter product life cycles, increasing technological complexity and reduced long-term company R&D are making it increasingly difficult for internal development to satisfy corporate technology needs. One consequence is that companies are increasingly looking to external sources to complement internal efforts. By inviting four executives from the US and Japan, this panel discussion explores management practices to obtain technology for new products from sources external to the firm.

TC-10 **Tuesday, July 27, 1999**
13:30 - 15:00 **Cabinet**

International Issues in Technology Management 3: Engineering and Technology Management in Africa
Chair: Antonie de Klerk, University of Pretoria

TC-10.1 - Business Process Reengineering for Sustained Process Improvement: A South African Case Study

Andre Watkins, Rand Afrikaans University
Leon Pretorius, Rand Afrikaans University
Alwyn Strauss, Rand Afrikaans University

Business Process Reengineering would normally culminate in a requirement for Change Management (or vice versa) to be introduced to ensure sustained process improvement, formidable tasks in their own right. Should this, however, be undertaken against the background of a forced intervention, a new approach is required to ensure ultimate success.

TC-10.2 - Leadership and Management Competencies for Technology Organizations in Developing Countries

Dietmar Winzker, Cubex Engineering Mgmt Systems (Pty) Ltd

The development of the appropriate personal and functional competencies is a critical factor in any organization. This paper discusses the development of leadership and management competencies for personnel in technology organizations and draws on the experience gained in the South African high tech industry. Developing countries such as South Africa had to follow an evolutionary, yet systematic approach which proved to be very effective within a relatively short period. With the new priorities and new challenges in South Africa today, the process of developing effective management and leadership competencies relatively quickly and over a broad spectrum of functions is considered even more important.

TC-10.3 - Towards an Innovative Management Information System to Assist in the Strategic Management of Consulting Engineering Firms in a Transitional South African Environment

T. Marshall, VKE Engineers
Leon Pretorius, Rand Afrikaans University
H . P . Langenhoven, SA Federation of Civil Engineering Contractors
Alwyn Strauss, Rand Afrikaans University

The transitional nature of post-apartheid South Africa complicates the strategic management of consulting engineering firms. This paper describes the development of a simple MIS to extend strategic planning horizons. Development included economic data analysis and a series of surveys at 370 firms. Trends can now be forecast for several key business areas.

TC-11 **Tuesday, July 27, 1999**
13:30 - 15:00 **Executive**

Technology-Based Organizations 1
Chair: Eileen Van Aken, Virginia Polytechnic Institute and State University

TC-11.1 - Corporate Culture: Dynamics and Ethics

Richard Brinkman, Portland State University

The current dynamics of corporate culture reside in a vicious circle of CEO profits. Policies of restructuring have pursued a "low road"

of wage-cost reduction. While the results of these policies have been negative for the American middle class, the poor and the economy, overall, CEO and corporate profits have increased.

TC-11.2 - Ethics in the Technology Industry

David Fritzsche, Pennsylvania State Great Valley Graduate Center

Respondents from a high tech company were asked to respond to a series of vignettes containing ethical dilemmas. The dilemmas represent the five categories of ethical problems managers have listed as being the most troubling or reprehensible issues faced: bribery, coercion, deception, theft and unfair discrimination.

TC-11.3 - A High Performance Work System: Definitions, Concepts, and Practices

Theodore Sienknecht, Virginia Polytechnic Institute and State University
Eileen Van Aken, Virginia Polytechnic Institute and State University

Based on a review of High Performance Work System (HPWS) literature, we define a prescriptive framework with five foci necessary to achieve a HPWS. We compare this framework with actual practices based on an analysis of existing team and quality management research and actual practices from state quality award applications.

TC-12 **Tuesday, July 27, 1999**
13:30 - 15:00 **Senate**

Manufacturing Management - 4
Chair: Bonnie Boardman, University of Arkansas

TC-12.1 - Shop Floor Logistics: Technology Management Issues

Michael Cole, University of Arkansas
Thomas Landers, University of Oklahoma

Shop floor logistics integrates intra-facility material flows as a link in the global supply chain. This approach achieves materials efficiency through demand-pull point-of-use systems and intelligent tracking technologies. The paper outlines an integrating theory of shop floor logistics and discusses relevant technology management issues.

TC-12.2 - Customer Order Process Modeling Using Activity Chains

Stig Tabs, Aalborg University
Ari Barfod, Aalborg University

Today customers place increasing demands on companies for Mass Customisation that require a reduction in delivery time as well as price. The article presents possible types of problems and necessary measures to take when changing to customer focused production. The Activity Chain Model is introduced as a tool for processing a change.

TC-12.3 - The New Manufacturing Organization Paradigm: Relations with Technology, Flexible Adaptation, and Performance

Frank Gertsen, Aalborg University

This study is a departure from the idea of exploring the prevailing manufacturing organization paradigm, defined by a number of organizational features such as flatter organizations, more team work, and more employee participation, etc. Data from a global manufacturing strategy survey indicates that companies have recently moved toward the paradigm. Further analysis indicates that companies that comply with the organizational paradigm also tend to have a stronger technological basis, to be more flexible in adapting changes, and to perform better in many areas.

TC-13 **Tuesday, July 27, 1999**
13:30 - 15:00 **Pavilion East**

Industry Applications-6: Software Development

Chair: Christian Koch, Technical University of Denmark

TC-13.1 - Collaborative Knowledge Teams: The Case of a Software Project Team at Seagate

James Sena, California Polytechnic State University
Rami Shani, California Polytechnic State University
Michael Stebbins, California State University

In a field study of a Seagate Software project team, we examined four sub-team's overall functioning and creativity. Factors considered included technology support, team member relationships, decision making, performance and meeting deadlines, attention to quality, and innovation and creativity. Results varied, revealing less reliance on computer aided support and more on social support. Creativity was recognized and supported, but was at times hampered.

TC-13.2 - Software Process Improvement under Duress: Experiences of SPI in a Town Hall in Argentina

Jorge Boria, Schlumberger IT Sourcing
Alejandro Bianchi, Liveware IS SA

Software Process Improvement (SPI) traditionally involved large companies in developed countries (or in India). A success story of an SPI intervention in Argentina's second largest city municipality shows that small budgets can achieve great results if process improvement is grounded in needs and a continuous activity.

TC-13.3 - Small is Beautiful: Customer Driven Software Development

Henrik A. Hansen, Technical University of Denmark
Christian Koch, Technical University of Denmark
Allan Pleman, Technical University of Denmark

A small Danish software house develops ERP-software, in collaboration where user-producer relations are the central drivers, and secures customer loyalty. The mode of collaboration leads to context-dependent benefits and shortcomings. This reactive development strategy creates a niche at the marketplace but produces internal organisational problems and obstacles.

TD-01 **Tuesday, July 27, 1999**
15:30 - 17:00 **Galleria-1**

New Product Development 5
Chair: Louis Lefebvre, Ecole Polytechnique

TD-01.1 - The Leverage of Global Organizations and Tools for New Product Development

John Grzinich, IBM Corp.
Arun Chandra, Somerset Design Center

Requirements for new product development processes are being driven by joint ventures, multi-location development, outsourcing, mergers, and worldwide marketing. The result is large high-technology development projects that cross location, company, and country boundaries. This paper describes product development organization structures and new product development management tools that address the latest business trends. These new tools for managing large complex global projects utilize workgroup and collaborative computing information technologies. This paper will identify and examine product development organization structures and new development process tools that address the latest business trends. The framework, structure, and leverage of these new tools will be examined. Workgroup and collaborative computing technologies are playing an ever-increasing role in product development, and applications employing these technologies can be used in new product

development for competitive advantage. The paper will show how the new tools for the product development process are being deployed to address the latest business trends by capitalizing on the advancements in communications and collaborative computing technology.

TD-01.2 - Does Product Development Success Increase As Disruptive Technologies Are Evaluated?

Tugrul U Daim, Intel Corp.
Yonca Daim, Portland State University

This paper reviews new product development projects published previously and examines how companies define their next generation of products and develop them while watching the market for potential disruptive technologies and take precautions for those with potential to influence the market place. The study includes a quantification methodology of the product development capabilities of the companies discussed in the case studies. Hypothesis testing was used to identify the relationship between the product development capabilities and the product success.

TD-01.3 - Dimensions of Process Oriented Technological Developments Across Different Phases of the Product Life Cycle

Avvari Mohan, Universiti Telekom
K. Krishnaswamy, Indian Institute of Science
Kim Soo, Korea Advance Institute of Science and Technology

This paper reports the findings of a survey aimed at understanding the dimensions of process oriented technological developments (TDs) in different phases of the Product Life Cycle (PLC). The study is based on a survey done in a sample of Indian machinery manufacturing organisations in the context of the economic liberalisation in India, which has allowed free imports of technology and goods. This has brought about a greater need for continuous TDs to obtain sustainable competitive benefits throughout the PLC. Various dimensions of process-TDs were obtained through a factor analysis and the results suggested the relative importance of the dimensions of TDs varied according to the phase of the PLC.

TD-01.4 - Key Issues in Managing the Product Development Process in Very Small Manufacturing Companies

Alan Lewis, University of Wales Institute
Robert Brown, University of Wales Institute, Cardiff

This paper identifies a number of key issues which bear upon the success of the product development process in very small companies. Through the development of case studies of collaborations between small companies and design consultants, the paper identifies the generic issues which must be taken into account when managing product development in such companies.

TD-02 **Tuesday, July 27, 1999**
15:30 - 17:00 **Galleria-2**

R&D Management - 5
Chair: Schumpeter Tamada, The Ministry of International Trade and Industry

TD-02.1 - Framework and Tools for the Quality of R&D

Kari Leppala, VTT Electronics
Jorma Taramaa, VTT Electronics
Olli Vuorinen, VTT Electronics

The essence of industrial R&D is to create knowledge-based capability in the form of technology and product platforms. A quality view of R&D stimulates appraisal of process attributes. We present a model and engineering framework using project implementation as backbone. Technical realisation reflects a "calm technology metaphor," which allows soft adaptation with existing processes and workflow.

TD-02.2 - Foreign Direct Investment in Industrial Research in the Pharmaceutical and Electronics Industries: Result from a Survey of Multinational Firms

Walter Kuemmerle, Harvard University

This paper examines motives, location characteristics, inter-temporal characteristics and modes of entry for foreign direct investment (FDI) in research and development (R&D). The paper is based on a detailed empirical survey of laboratory sites established by 32 large multinational companies.

TD-02.3 - Empirical Study on Effectiveness of Research and Experiment Tax Credit

Schumpeter Tamada, The Ministry of International Trade and Industry

The innovation strategy of firms is influenced by the tax treatment of innovation-related investment, especially R&D. Tax incentives present unique advantages as a tool for stimulating R&D. Using empirical data of companies that cover more than 80% of the private R&D expenditure in Japan, this paper demonstrates the effectiveness of the R&D tax credit and makes some policy recommendations.

TD-03 **Tuesday, July 27, 1999**
15:30 - 17:00 **Galleria-3**

Management of Technological Innovation 6
Chair: Halime I Sarihan, TUBITAK-Marmara Research Center

TD-03.1 - Managing the Internal Processes of Innovation in SME's

David Birchall, Henley Management College
Jean-Jacques Chanaron, Groupe ESC Grenoble

The case for supporting innovation in SME's is being strongly supported in many regions not only by politicians but also by those leading larger organizations. SME's are seen as being important generators of new jobs and new energy into local economies. They are seen as a source of new products for larger corporations. They are also important within the supply chains of the latter who push for innovation in introducing new ways of working so as to cut production and distribution costs. The authors will examine the innovation processes within SME's based on a cross-country survey of SME innovation practices. The survey includes data from innovative SME's in three regions within Europe allowing analysis of the extent to which these SME's follow a defined process and the outcomes resulting from the processes. The authors will review their findings in relation to policy issues as well as means for improving the effectiveness of the processes themselves.

TD-03.2 - Normative, Mimetic and Structural Influences in the Adoption of Process Innovation: The Case of Household Wood Furniture Producers

Juett Cooper, Marshall University
Cynthia West, USDA Forest Service

Previous work on the adoption of process innovation exempts institutional theory as a significant factor in innovation adoption. We found evidence that suggests mimetic and normative pressures influence the adoption of process innovation. In addition, we found that the relationship between organization structure, institutional pressures and innovation adoption change with innovator category.

TD-03.3 - The Innovation and R&D Strategies of Business in a Globalizing World

Halime Sarihan, TUBITAK-Marmara Research Center

Technological innovation and R&D are an important source of competitive advantage. There are several strategies for innovation and R&D. But how and why do you select certain strategies? This article examines the strategies for innovation and R&D of business in a globalizing world.

TD-04 **Tuesday, July 27, 1999**
15:30 - 17:00 **Parlor B**

Technology Transfer - 3
Chair: Glenn B Dietrich, University of Texas at San Antonio

TD-04.1 - Training and Technology Transfer Issues in Major Engineering Projects in Vietnam

Le Nguyen Binh, Monash University
Linda Wilkins, Monash University

This paper addresses technology transfer issues and principal strategies informing current infrastructure development in Vietnam. Two cases studies are cited-one being a telecommunication development project, the other a cable stayed bridge engineering structural project. The principal authors' major involvement in each of these projects will be drawn on to demonstrate critical stages in implementing strategic directions.

TD-04.2 - Transfer of Technology Management/TQ to Poland - International Collaboration Project

Bohdan Oppenheim, Loyola Marymount University
Zbigniew Przasnyski, Layola Marymount University

This paper describes the establishment of a Center for Technology Management and Total Quality at two technical universities in Poland. In two years, 100 trainers and 1000 managers and faculty were trained in Poland and four Polish faculty were trained in the US. The Center became self-sufficient financially and is implementing plans for the future.

TD-04.3 - Technology Transfer in a Complex Environment

Glenn Dietrich, University of Texas at San Antonio
Margaret Shipley, University of Houston - Downtown

This paper suggests that competitive environment is a major factor that influences the technology transfer and adoption with a business. The modern competitive environment is becoming increasingly dynamic, suggesting those traditional methods for technology transfer and implementation can be enhanced with the application of chaos and complexity theories. This paper develops a technology transfer framework based on two of the new sciences.

PANEL: TD-05 **Tuesday, July 27, 1999**
15:30 - 17:00 **Parlor C**

Technology Management Education 5: Growing Distance Learning at the Graduate School of Management and Technology in the University of Maryland University College
Moderator: Joseph Kasser, University of Maryland University College

Panelist(s): David Cohen, University of Maryland University College
Claudine Schweber, University of Maryland University College

The Graduate School of Management and Technology in the University of Maryland University College (UMUC) provides courses using distance learning techniques to students anywhere on Earth. This panel discusses how UMUC upgraded courses via a Web Initiative in Teaching (WIT) effort starting in the summer of 1998. The upgrade faced the problem of providing a virtual classroom in an asynchronous environment. The discussion presents some of the problems encountered and overcome and will be illustrated with real-time examples of distance education over the World Wide Web.

TD-06 **Tuesday, July 27, 1999**
15:30 - 17:00 **Studio**

Information/ Knowledge Management 7
Chair: Hannu Jaakkola, Tampere University of Technology

TD-06.1 - Stakeholders Analysis of the Airstrip Information Reporting System in Rural Alaska

James Buckingham, University of Alaska-Fairbanks
Jang Ra, University of Alaska-Anchorage

This paper proposes a sequential methodology for developing a comprehensive stakeholder diagram that can assist in analyzing project stakeholders' influences. This methodology is applied in weather and runway condition reporting systems improvements for rural airstrips in Alaska.

TD-06.2 - Information Processing and Enabling Technology in a Canadian Financial Services Company: A Study of Data Warehousing

Karim Hirji, IBM Canada Ltd.
John Moore, University of Waterloo
Ji-Ye Mao, University of Waterloo
Niall Fraser, University of Waterloo

The purpose of this study was to understand the impact of organizational change on information processing requirements and the role of a specific enabling technology in support of information processing. A case study of a data warehousing project in a financial services company provides qualitative data for testing a specific instance of a general proposition.

TD-06.3 - Database Implementation for a Software Process Assessment Model

Timo Makinen, Tampere Universtiy of Technology
Timo Varkoi, Tampere University of Technology
Hannu Jaakkola, Tampere University of Technology

The technical report ISO/IEC 15504 (SPICE) is a model for software process assessment, improvement and capability determination. In this paper we present the conceptual model of SPICE (Part 2 & Part 5) and its database implementation. We also discuss how the database can be used effectively to support the application of SPICE. Database queries show, for example, the relationships that otherwise could be overlooked between different elements of SPICE.

TD-07 **Tuesday, July 27, 1999**
15:30 - 17:00 **Directors**

Technology Management 5
Chair: Dietmar H Winzker, Cubex Engineering Mgmt Systems (Pty) Ltd

TD-07.1 - Customer Specification Configuration and Operational Issues in Small- to Medium-Sized Enterprises (SMEs)

Mark Zalud, Coventry University
Derek Steeple, Coventry University

Basic computerized business system requirements for SMEs lie in the areas of financial planning and control, product data management, manufacturing planning and usually some simple computer-aided design. This paper describes the relationships and integration needs between these systems dependent upon the complexity of customer specification requirements and manufacturing and procurement requirements.

TD-07.2 - System Engineering Management for High Technology Industries in Developing Countries

Dietmar Winzker, Cubex Engineering Mgmt Systems (Pty) Ltd

The paper discusses the system engineering process as it evolved in the South African high tech industry within the constraints of sanctions. The imposed constraints forced the development of an accelerated, yet highly effective system engineering approach in industry. This in turn resulted in a streamlined, cost-effective and practical management process to ensure the technical integrity of complex engineering programs. This methodology is suitable for developing countries embarking on the establishment of a competitive high tech industry.

TD-07.3 - Vietnam's Strategy of Technology Development: Some Managerial Issues

Nguyen Si Loc, MOSTE/Management Training Institute

In Vietnam there have been attempts to set forth long term guidelines for science and technology development. This based upon the analysis drawn from the last decade of reform in the field. The author has addressed some issues of management of S&T from the stand point of endogenous capacity building. Participation in S&T planning and related problems have been discussed, the case of telecommunication has been introduced as example.

TD-08 **Tuesday, July 27, 1999**
15:30 - 17:00 **Council**

Strategic Management of Technology 1
Chair: Ove Granstrand, Chalmers University of Technology

TD-08.1 - The Future of Strategic Planning: Learning and Viability of a Process of Change in the Information Society

Luiz Bueno da Silva, Universidade Federal da Paraiba, Cidade Universitaria
Marcio Botelho da Fonseca Lima, Universidade Federal da Paraiba
Francisco Pareira Fialho, Federal Uni. of Santa Catarina

The objective of this paper is to establish conjectures about strategic planning in the information society. In that sense, at last, the consistency of the predictions exhibited in this paper is evaluated, especially the existence of the sunk costs as strong dynamic restriction, that can influence in a considerable way the formulation of strategies in the industrial and services companies.

TD-08.2 - Transformation of a Czech Industrial Company's Business Program

Milan Sulak, University of West Bohemia
Zdenek Vostracky, University of West Bohemia

The leading Czech industrial company focusing on the production of electrical locomotives had to change its business strategy after the breakdown of Eastern European markets. Before the breakdown the company produced over 200 electrical locomotives a year for the Eastern European countries and now it produces only around 40 electrical locomotives a year for that region. The paper deals with the feasibility of using modern strategic tools for the company transformation: strategic innovation program with elements of product diversification including electrical locomotives, tramways, etc., and use of the results of the competition's strategic analysis and process reengineering. We will describe and introduce implementation of the strategic innovations in this company.

TD-08.3 - Strategic Management of Intellectual Property

Ove Granstrand, Chalmers University of Technology

The emergence of the pro-patent era in the U.S. in the 1980s is symptomatic of a transition towards intellectual capitalism. As a consequence, intellectual property (IP) issues have entered the agendas of strategic management in industry at large. This paper presents a conceptual framework for IP strategies, technology strategies and business strategies, together with results from a study of corporate practices in Japan, and the notions of multiprotection and total IP strategies.

TD-10 **Tuesday, July 27, 1999**
15:30 - 17:00 **Cabinet**

Management of Engineers and Scientists 1
Chair: Anthony D Wilbon, The George Washington University

TD-10.1 - Leadership: A Critical Success Factor in IT Project Management

Mohan Thite, Griffith University

This empirical research explored successful leadership styles for IT project managers. The results indicated that a combination of transformational and technical leadership behaviours augment the effectiveness of transactional leadership leading to high project success. While there is no one leadership style that is effective in all project situations, the study recommends an underlying yet flexible style characterised by organisational catalyst, intellectual stimulation, behavioural charisma, and contingent reward behaviours for enhanced leadership effectiveness.

TD-10.2 - Engineers and Engineering in the U.S. and Japan: What have We Learned from Comparative Studies?

Leonard Lynn, Case Western Reserve University

Comparative studies of "Japanese engineering practices" have increasingly been replaced by focussed searches for "best practices" at specific Japanese firms. This review applauds this transition, but argues that researchers need to devote more attention to the institutional aspects of engineering through comparative international studies of engineering in the U.S., Japan and elsewhere.

TD-10.3 - An Empirical Investigation of Technology Literacy at the Executive Management Levels and Firm Performance

Anthony Wilbon, The George Washington University

Past research posits that executive technology literacy influences strategy development, technology adoption, and firm success (Lefebvre, Mason & Lefebvre, 1997; Thong & Yap, 1995; McGee & Dowling, 1994). This research analyzes the executive technology literacy and performance relationship in computer-related initial public offerings (IPOs). Empirical analysis supports the hypotheses that executive technology experience influences performance.

TD-11 **Tuesday, July 27, 1999**
15:30 - 17:00 **Executive**

Technology-Based Organizations 2
Chair: Larry A Mallak, Western Michigan University

TD-11.1 - The Integration of Engineering and Management in Technology-Based Organizations: A Three Dimensional Approach

Edmund Young, Flinders University of South Australia

This paper presents a three-dimensional view of the integration of engineering and management in technology-based organisations. The management process is viewed in a different dimension or plane to the different engineering and business functions. Engineering management is a pervasive task that extends from the top or general management to the lowest level of supervision in the organisation. There are at least five different levels in large-technology-based organisa-

tions, and the engineer may experience a number of shifts from a primary shift of a technical specialist to supervisor or leader of small team, to secondary and other shifts to top or senior management. At each of these levels, different managerial skills, knowledge and expertise are required. Simplistic theories of management like decision making, managerial roles etc should be critically examined to assess whether they are relevant to engineering management practice and engineering management education and training. The three-dimensional model presents a more realistic view for engineering management practice.

TD-11.2 - An Organizational Assessment Method for Transformation Efforts

Antonio Freitas Rentes, Virginia Polytechnic and State University
Eileen Van Aken, Virginia Polytechnic and State University
Ray Butler, Virginia Polytechnic and State University

This paper describes a methodology for organizational situation assessment, which integrates improvement concepts and tools, including team-level and organization-level assessment tools and the Current Reality Tree from the Theory of Constraints. This assessment method presented here is part of the Analyzing Current Situation step of an organizational transformation methodology, which is also briefly described.

TD-11.3 - Toward a Theory of Organizational Resilience

Larry Mallak, Western Michigan University

Workers today are experiencing rapid amounts of change from many sources. Several disciplines have approached this issue from their unique perspectives. How individuals and organizations respond to change affects key outcomes. This paper works toward a unified theory of resilience to help us embrace and manage organizational change effectively.

TD-12 **Tuesday, July 27, 1999**
15:30 - 17:00 **Senate**

Quality Management - 1
Chair: Elzbieta Trybus, California State University-Northridge

TD-12.1 - Benchmarking, Multi-Criteria Evaluation Model, and ISO 9000 Registration

Elzbieta Trybus, California State University-Northridge
Ewa Konarzewska-Gubala, Wroclaw University of Economics

Basic steps of the ISO 9000 registration process are discussed and a Multi-Criteria Evaluation (MCE) Model is presented for the application in selecting an ISO 9000 registration agency. For the selection of criteria we propose a benchmarking approach. Once the criteria are selected, management adopts the model.

TD-12.2 - Total Quality Management in a Joint-Venture Company: A Case Study

Elzbieta Trybus, California State University-Northridge
Ginter Trybus, California State University-Northridge

A case study on transferring both technology and the total quality management (TQM) is presented in this paper. The firm is located in Poland and is manufacturing water-filled radiators for heating. The key factors leading to success were the full commitment of the top management and the total involvement of every employee together with technological investments.

TD-12.3 - New Product Development Process and Total Quality Management

Anant Bellary, University of Queensland
D.N.P. Murthy, University of Queensland

As the product life cycles become shorter, continuous improvement in the new product development processes is critical to ensure survival and growth of manufacturing firms. A search for an NPD process that delivers on time, and within budget new products with specified quality attributes is more intense than ever. The Total Quality Management (TQM) paradigm provides the framework to achieve this. Past research shows that two significant drivers of product performance are (i) an effective NPD process model and (ii) appropriate metrics to measure the quality of the NPD process. In this paper we deal with these two issues. We develop an integrated model of NPD process based on the TQM paradigm and define a range of performance metrics to measure the NPD process quality.

TD-13 **Tuesday, July 27, 1999**
15:30 - 17:00 **Pavilion East**

Industry Applications-7: Service Sector
Chair: A. Graham R Bullen, University of Pittsburgh

TD-13.1 - Productivity Measurement in the Service Sector: A New Approach Necessity

Georgia Batista, Cidade Universitaria
Cosmo Filho, Universidade Federal da Paraiba
Marcos Dunda, Cidade Universitaria

The traditional concept about productivity that was born into the manufacturing environment has been used to determinate performance levels into the biggest part of the organizations that are looking for more competitiveness and profitability. However, the service activities present peculiar characteristics, which need to be considered in this analysis. This paper shows a case study in an engineering project shop, involving the difficulties and distortions when classical concepts are used in the non-manufacturing environment.

TD-13.2 - Financial Product Innovation: A Strategically Competitive System Engineering Approach to Financial Engineering

Nicolaas Piquito, Rand Afrikaans University
Leon Pretorius, Rand Afrikaans University
Alwyn Strauss, Rand Afrikaans University

Financial product development is a complex process, analogous to that found in conventional engineering. This typically intangible process may be strategically optimised by using the complimentary elements of competitive product decision theory in conjunction with established system engineering principles. In so doing the organisation's innovative product development capability is enhanced.

TD-13.3 - Performance Analysis of an Institutional Natural Gas Vanpool Program Using GIS Technology

Emilia Rabbani, University of Pittsburgh
A. Graham Bullen, University of Pittsburgh

Vanpooling is an organized ridership arrangement that uses vans to transport people from their home to place of employment on a regular basis. This paper evaluates an Institutional Natural Gas Vanpool Program and presents a GIS database that allows managers to analyze and formulate appropriate planning strategies for the program.

TF-14 **Tuesday, July 27, 1999**
10:30 - 13:30 **Pavilion West**

Poster Session - 3

TF-14.1 - A Platform to Cooperative Creation by Which to Organize Research Consortia in the Field of Healthcare Through Governmental-Academic-Industrial Collaboration

Kunihiko Taniguchi, Osaka Science & Technology Center
Yusaku Ogawa, Osaka Science and Technology Center
Keiji Wakisaka, Osaka Science and Technology Center
Mie Katayama, Osaka Science and Technology Center
Tatsushi Ikushima, Osaka Science and Technology Center
Haruyo Kamura, Osaka Science and Technology Center

We have developed a "A Platform for Cooperative Creation" by which to organize research consortia in the field of healthcare comprising governments, universities, and industries so that they can jointly engage in research programs provided by governments. The concept of this Platform can be applied to other fields as well.

TF-14.2 - Impacts of New Technology Introduction in the Textile Industry Lay Out-The Case of Joao Pessoa City/Brazil

Djosete Santos da Costa, Universidade Federal da Paraiba
Celso Rodrigues, Universidade Federal da Paraiba

The present study analyses the current impacts resulting from the introduction of technological innovations in the textile companies' layout in Jo„o Pessoa City, Brazil. After the opening of the national market, the Brazilian companies started to adopt a strategy of the existent technological lateness in comparison with foreign textile companies.

TF-14.3 - Business Process Reengineering in the Early Stages of a Corporation's Life Cycle

Li Cai, Jilin University of Technology

The paper holds that Business Process Reengineering (BPR) plays different roles in different stages of the corporation life cycle. But what had been discussed most is absolutely focused on stable and declining stages that do not fit for corporations in early development stages. The paper then provides possible ways to apply BPR in young enterprises.

TF-14.4 - Teaching Undergraduates Fundamental Engineering Management

John Goulding, Electroglas, Inc.

Developing products that require a high degree of cross-functional integration places new demands upon undergraduate education. This paper discusses the results of teaching fundamental Engineering Management concepts, such as concurrent and simultaneous engineering, GANTT/CPM scheduling, decision making, and uncertainty and risk analysis, to undergraduate mechanical and electrical engineering students.

TF-14.5 - Exploring Models and Formalizing Knowledge to Identify Potential Customers

Fernando de Almeida, University of Sao Paulo
Jose de O. Siqueira, University of Sao Paulo

Creating models and formalizing knowledge in an organization may be difficult. This paper discusses the interest in using a model to help in identifying potential customers, considering his potential behavior and probability of buying a product, the level of demand and the product's saturation in the market. Analytical models and techniques like statistics, neural networks and innovation diffusion models are discussed.

TF-14.6 - A Case Study of Design Management in Thermal Systems Environment

Leon Pretorius, Rand Afrikaans University
G. Coetzee, Rand Afrikaans University

One of the critical actions in the management of engineering design is the decision to be made amongst various viable design concepts. This paper again emphasizes the importance of decision making in the design process of a typical air conditioning system for a medium-sized multi-user facility where quality and cost are major drivers.

TF-14.7 - Use of the Information Technologies, Work in Team and Work Organization: Contributions of the Innovation Economy

Marcio Botelho da Fonseca Lima, Universidade Federal da Paraiba
Luiz Bueno da Silva, Universidade Federal da Paraiba, Cidade Universitaria
Francisco Pareira Fialho, Federal University of Santa Catarina

The objective of this paper is to define some criterions to take in account to choose the best groupware adapted to teams. Finally, one can conclude that the diffusion of the groupware can be restrained according to the difficulty in transforming the tacit knowledge in coded knowledge.

TF-14.8 - Management of Technology Specialization Program

Alan Garcia Lira, University Autonoma de Yucatan Merida

Universidad Autonoma de Yucatan started a Management of Technology program in 1990 to address executives and faculty dealing with innovation. This program has been updated twice, has bearing on reseach in MOT, and graduated five generations of students. The analysis and development of this program is presented in this paper.

TF-14.9 Performance Measurement in New Product Development: Concepts and Literature Review

Dwi Larso, Oregon State University
Marla Hacker, The Performance Center

Delivering new products to market on an increasingly fast pace has become a key success factor for many companies in the global economy. Research on improving new product development (NPD) has increased in recent years. NPD performance improvement approaches and performance metrics are evolving. This paper discusses what we currently know and what we still donít know about how to improve performance in NPD.

TG-14 **Tuesday, July 27, 1999**
14:00 - 17:00 **Pavilion West**

Poster Session - 4

TG-14.1 - Comparative Study on Structural Transformation of R&D Funds in P.R. China and U.S.A.

Fan Baoqun, Zhejiang University
Xu Qingrui, Zhejiang Universtiy

The R&D resource allocation was examined from the following dimensions: 1. From the structure of R&D expenditure by funding source, 2. Structure of R&D expenditure by implementers, and 3. The nature of R&D. A comparison of the structural transformation of R&D expenditures by funding source in the US, some EC countries and China was performed.

TG-14.2 - Technology and Rural Development: Assessing Technology Needs of the Southeastern Anatolia Project in Turkey

M. Atilla Oner, TurkConsult Innovation and Technology Relay Center
Nuri Basoglu, Bogazici University
Erkan Ture, Marmara University

The Southeastern Anatolia Project, when completed, will make possible the irrigation of 1.7 million hectares of land and the annual production of 27 billion kW of electric energy in Turkey. It is expected that the regional income level will increase fivefold . To complete the project, the Turkish government plans to spend 20 billion USD until 2010 in addition to ca. 13 billion already spent. A project of this size needs continuous monitoring and control. This paper

attempts to assess the technology needs of the project using the PET (politics, economics, technology) methodology developed by Institute of Prospective Technological Studies in Seville, Spain.

TG-14.3 - Knowledge: Accumulation, Diffusion and Reactivation within Organization

Jiang Wei, Zhejiang University
Qingrui Xu, Zhejing University
Baohua Xiang, Zhejiang University

In knowledge-oriented companies, knowledge will become the primary factor that leads them to the competitive advantage. How to manage a firm's knowledge resource has come to our routine thinking. According to the process-based view, this paper regards knowledge management includes such processes as knowledge learning and creation, accumulation, diffusion and reactivation, etc. Then, it examines the knowledge diffusion process, knowledge accumulation model, and knowledge reactivation and management.

TG-14.4 - Contributions for the Understanding the Concurrent Engineering

Kazuo Hatakeyama, Centro Federal de Educacao Technologica do Parana
Carla Cristina Gouvea da Costa, EPUSP

The aim of this paper is to contribute to the understanding of Concurrent Engineering implantation and implementation process in organizations. It is studied as a work methodology, used in product development, strategically utilized to stay competitive, in response to an increasing demand for more complex and diversified products.

TG-14.5 - International Collaborations for Success: The Korea Superconducting Tokamak Advanced Research (KSTAR) Project

Gyung-Su Lee, Korea Basic Science Institute
Robert Simmons, Princeton University

Fusion is the power source of the stars, and the need to develop fusion as a viable energy source is compelling for long-term energy needs. Large and highly technical projects such as the Korea Superconducting Tokamak Advanced Research (KSTAR) Project are proving that innovative management and leveraging of international knowledge and expertise can yield significant benefits.

TG-14.6 - Innovative Technology in Bogie Design - A Case Study

Satria Darsa, Ergonomitama KIPTMI

Innovative technology in bogie design (case study) railway transportation means in developing countries should be improved to greet the coming millennium. Most of them were designed and built 100 years ago. Curves and up and down terrain cannot be straightened. Bigger, heavier, longer, and faster trains made the wheels housed in the barber three-piece boggy wear rapidly. Innovative technology modified it to become steering boggy. By using Statistical Analysis Method it was proven that the wearing of the wheels occurred more slowly.

TG-14.7 - Competing By Software Development Project Standardization

Christian Artmann, Portland State University

The Capability Maturity Model (CMM) of the Software Engineering Institute (SEI) is said to provide a well-defined framework for the evaluation of software-process maturity. This model is briefly described and compared with the project management standards developed by the Project Management Institute. Afterwards, the impact of these models on project driven software companies is discussed and the issues, trends and timeline of the current research are identified.

TG-14.8 - OP-RIP: A Case History in Machine Vision Manufacturing

John Goulding, Electroglas, Inc.

Automating an operation in a manufacturing plant requires a high degree of pre-installation systems engineering and post-installation process integration. This paper describes a machine vision system used to find defects and optimize the value of products. Islands of automation not run at full capacity are shown to yield maximum profit.

TG-14.9 - Qualitative of Productivity Gains with Incorporation of Technological Innovation - The Case of TELPA Company

Cesar Barbosa da Lima, Cidada Universitaria
Djosete Santos da Costa, Universidade Federal da Paraiba

This work tries to show the important gains of productivity that the Telecommunication Company of Paraìba State, Brazil obtained with new technologies in its productive process. Basically, the productivity gains to be analyzed with the physical area use, climatization use, energy use and labor use; likewise the reliability level of the system, always comparing the Analogical Switching Central with the Digital Switching Central, this last one considered as Technological Innovation of the operational plant of the Company.

TG-14.10 - Experiences in Collaboration Between University and Business Incubator

Alan Garcia Lira, University Autonoma de Yucatan Merida

Collaboration between Universidad Autonoma de Yucatan and the Mexican governemtn produced the business incubator of Yucatan. Further collaborative work was then made with incubator and tenants, hwich involved counseling and support, a search of specialized data, meetings with renowned advisors, and feasibility studies.

WB-01 **Wednesday, July 28, 1999**
10:00 - 11:30 **Galleria-1**

New Product Development 6
Chair: Sam Kurokawa, Vanderbilt University

WB-01.1 - Outsourcing Technology for New Product Development

Charles Kimzey, Office of the Secretary of Defense
Sam Kurokawa, Vanderbilt University
Robert Nash, Vanderbilt Universtiy

Conflicting trends of shorter product life cycles, increasing technological complexity and reduced long term company R&D are making it increasingly difficult for internal development to satisfy corporate technology needs. One consequence is that companies are increasingly looking to external sources to complement internal efforts. This paper summarizes a study to examine management practices in both Japan and the US to obtain technology for new products from sources external to the firm.

WB-01.2 - Industry Clockspeed and Dynamics: Appropriate Pacing of New Product Development

Janice Carrillo, Washington University

Empirical literature defines an industry's clockspeed as a measure of the dynamic nature of the industry. Among other things, the rate of new product development is found to be associated with an industry's clockspeed. Using a simple analytic model, an optimal industry clockspeed is derived, and competitive dynamics are analyzed relative to the derived industry standard.

WB-01.3 - Managing the Fuzzy Front-End of the New Product Development Process

Jongbae Kim, Syracuse University
David Wilemon, Syracuse University

PAPERS AND PANELS

Since a product is more likely to be successfully developed and marketed through careful management of the "upfront or fuzzy front-end (FFE)" activities, product developers need to thoroughly understand the FFE and prepare strategies for managing it. In this paper, we define the FFE as the planning stage, which is the period between when an opportunity is first considered and when an idea is judged ready for development. We classify the consequences of the FFE into outcomes, time, and people dimensions. We suggest strategies to manage the FFE by assigning a FFE manager or a team; by understanding the nature and sources of FFE ambiguity; by building an information system; by providing organizational support for FFE activities; and by finding supporters, partners, and alliances.

WB-02 **Wednesday, July 28, 1999**
10:00 - 11:30 **Galleria-2**

R&D Management - 6
Chair: Steven T Walsh, University of New Mexico

WB-02.1 - A Comparison of Traditional and Integrated Research and Development Methodologies

Dean Mullen, Cleveland State University
Bahman Ghorashi, Cleveland State University

This paper offers an assessment of team integrated methodology to improve product quality and reliability, reduce cost and time-to-market, and cultivate cross-functional thinking in the pursuit of breakthough products. Furthermore, this concept establishes priorities, creates realistic targets and facilitates the transitions of a product or process as it moves from function to function.

WB-02.2 - Key Inventors: Implications for Human Resource Management in R&D

Holger Ernst, Christian- Albrechts Universitaet

This paper presents the results from an empirical study, that analyses the distribution of patenting output of inventors working in the chemical, electrical and mechanical engineering industry in 43 German companies. The findings of this study suggest that the technological performance of inventors defined by the number and quality of filed patents is highly concentrated. In particular, a very small group of key inventors is responsible for the major part of the company's technological performance and, thus, for the company's competitiveness. This knowledge, in turn, results in major consequences for the human resource management in R&D.

WB-02.3 - Pragmatic Methods for Evaluating Company Resources and Competences

John Mills, University of Cambridge
Michael Bourne, University of Cambridge
Michael Gregory, University of Cambridge
Ken Platts, University of Cambridge
Andy Neely, University of Cambridge

This paper describes the use of resource and competence evaluation methods in a central research laboratory. The political and cognitive issues raised are analysed, and the method is improved to reduce evaluation time and provide a record for investigating the validity of the evaluation.

WB-02.4 - A Value Creation Model for Measuring and Managing the R&D Portfolio

Bruce Kirchhoff, New Jersey Institute of Technology
Steven Walsh, University of New Mexico
Mathew Merges, Lucent Technologies
Joseph Morabito, Lucent Technologies

A growing body of evidence suggests that just as companies are facing an ever increasing pace of technological change their rate of investment in research and development is undergoing close scrutiny and firms are unable to respond effectively. The greatest concern arises over the development of a productivity decision support system for research driven innovation projects and then applying information from the system to manage the portfolio of projects for the benefit of the enterprise. To address this concern, we review the research-based history of measuring R&D productivity and we then present a new decision support model developed by the Advanced Technology Division of Lucent Bell laboratories to measure and manage its technology commercialization process. The model consists of a set of attributes which includes financial, technology and product life cycles, markets and intellectual assets. The inter-relationships among these attributes can be visually displayed. The integration of all attribute information leads to better informed management decisions for value creation. The value created derives from the balanced scorecard of the attributes rather than an emphasis on any one attribute, e.g. financial performance.

WB-03 **Wednesday, July 28, 1999**
10:00 - 11:30 **Galleria-3**

Management of Technological Innovation 7
Chair: Walter Kuemmerle, Harvard University

WB-03.1 - Functional versus Capability-Oriented Innovation Management in Multinational Firms

Walter Kuemmerle, Harvard University
Richard Rosenbloom, Harvard University

This paper argues that innovation management in multinational firms can be enhanced by distinguishing two types of geographically dispersed facilities: capability-augmenting ones and capability-exploiting sites ones. The paper shows that this distinction rather than the established distinction of research sites versus development sites facilitates resource allocation decisions and strategic cooperation with local knowledge providers. An analysis of 8 matched case studies as well as a statistical analysis with 156 R&D sites supports this argument. Please send correspondence to: Walter Kuemmerle, Assistant Professor, Harvard Business School, Morgan Hall T45, Soldiers Field, Boston, MA 02163 Tel. (617) 495-6353, Fax (617) 496 4066, e-mail: wkuemmerle@hbs.edu Keywords: Management of R&D Sites; International R&D Management; Research vs. Development

WB-03.2 - An Assessment of Innovation Management Performances of Turkish Industrial Companies

Sirin Elci, Technology Development Foundation of Turkey

This paper reports a pilot study carried out to assess innovation management performances of Turkish industrial companies as a basis of the innovation management program of Technology Development Foundation of Turkey, an organization established to support technological innovation projects of industrial companies in Turkey.

WB-03.3 - Experience Gained on Technology Innovation in Turkey and Suggestions for Future Improvements

Erol Inelmen, Bogazici University

Universities, research centers, government, science/technology development agencies and business enterprises in Turkey have recognized the importance that mutual cooperation has in enhancing industrial development. This paper puts in perspective the present situation in technology innovation with the purpose of suggesting

new policies that will allow the economy to match the level of development of more experienced countries as we enter the new millennium.

WB-04 **Wednesday, July 28, 1999**
10:00 - 11:30 **Parlor B**

Entrepreneurship 1
Chair: Pier A Abetti, Rensselaer Polytechnic Institute

WB-04.1 - Entrepreneurships in Global Business

Olavi Uusitalo, University of Jyvaskyla

Starting innovative firms must use unique ways to succeed in their small global market segments. Because of scarce resources the companies have to use complementary assets in both upstream and downstream. We explore the organizing of businesses of three different types of manufacturers: consumer goods producers, industrial component and industrial systems sellers.

WB-04.2 - Intrapreneurships in R&D Management

Olavi Uusitalo, University of Jyvaskyla

It is said that big businesses are not innovative. In order to challenge this we evaluate the level of intraprenuership of large organizations by exploring different types of globally diffused innovations. The innovations are float glass process, flash melting process, SAMI inverters, Xylitol, an artificial sugar, and Benecol, a colesterol lowering margarine.

WB-04.3 - Underground Innovation in USA, Europe and Japan

Pier Abetti, Rensselaer Polytechnic Institute

We analyze the phenomenon of underground (i.e.: hidden, unauthorized or forbidden) innovation in research, development, and engineering organizations. We discuss the underlying reasons, management's official and unofficial attitudes, and the detailed process until the innovation emerges or is killed. We present cases from USA, Europe, and Japan, and establish the key factors leading to ultimate success or failure.

PANEL: WB-05 **Wednesday, July 28, 1999**
10:00 - 11:30 **Parlor C**

Technology Management Education 6: Preparing Leaders for the Next Century
Moderator: H. Chik M. Erzurumlu, Portland State University

Panelist: William Swart, Old Dominion University

Emerging leaders of the 21st centry are in the classrooms today. Students entering college this year were all born in the computer age and lived through the information revolution from the beginning. They will have the responsibility for creating the knowledge-driven society of the next century and leading it. Educational institutions are faced with numerous challenges and endless opportunities to prepare a whole generaton of these "knowledge-age" people for leadership in a world where information is the backbone of the society and technology is the dominant force shaping the future. Critical issues, strategic directions and alternative approaches for academinc institutions and industry/university/government partnerships needed to meet the challenges will be discussed. A question/answer period will follow the presentation.

WB-06 **Wednesday, July 28, 1999**
10:00 - 11:30 **Studio**

Information/ Knowledge Management 8
Chair: Matti Verkasalo, Nokia Telecommunications

WB-06.1 - A Path-Model of Knowledge Creation in Small Manufacturing Firms

Eugenio Corti, University of Naples Federico II
Corrado Storto, University of Naples Federico II

This paper presents the findings of a study aimed at investigating the influence that some factors, which describe the cognitive, social, and management environment during technical problem solving, have on the generation of new knowledge in small manufacturing firms. Using path analysis on an a priori theoretical model of influences of some constructs on knowledge generation, we show that two dimensions of problem complexity - context uncertainty and ambiguity - influence the amount and quality of knowledge generated during technical problem-solving through the mediation of eight management practices and behaviors adopted during problem solving. Ninety-one cases of technical problem solving occurring during product innovation were studied.

WB-06.2 - The Information Society: Impacts in the Organizational Structure, in the Telework and in the Workers' Health

Marcio Botelho da Fonseca Lima, Universidade Federal da Paraiba
Luiz Bueno da Silva, Universidade Federal da Paraiba
Francisco Pareira Fialho, Federal University of Santa Catarina

The aim of article is to establish conjectures on the probable characteristics of the companies' evolution that will act in the environment of the information society. The appearance of various European documents in favour of the development of the information society seem to have little relevance in the context of theoretical and empirical arguments.

WB-06.3 - Experiences on the Efficiency Index Method in Assessing the Performance of Knowledge Dissemination in a Business Environment

Matti Verkasalo, Nokia Telecommunications
Pentti Lappalainen, University of Oulu

Accessibility of knowledge is of crucial importance to the success of modern businesses. Face-to-face and other traditional communication methods need to be enhanced by computer-based tools to meet the requirements of the present business environment. Objective analysis is necessary to make adoption of these tools reasonable. This paper suggests a model for the engineering knowledge dissemination process in today's telecommunication business. It is based on a set of characteristic attributes of the process which are used to derive a numerical Efficiency Index expressing the disseminating performance. Validity of the method was then tested by several pilot studies carried out in Nokia Telecommunications' business environment. Substantial improvement of knowledge dissemination was indicated by the results collected. Based on the experiences obtained, a new knowledge dissemination infrastructure is introduced and its global implementation described. The ultimate goal of the system is to provide an easy access to knowledge with minimum effort and delay to all the members of the company business community.

WB-07 **Wednesday, July 28, 1999**
10:00 - 11:30 **Directors**

Technology Management 6
Chair: Thomas W Mason, Rose-Hulman Institute of Technology

WB-07.1 - Technology and Innovation Management: Leading the Way to (New) Enterprise Science

Hugo Tschirky, Swiss Federal Institute of Technology

In the concepts of general management technology is a neglected factor of entrepreneurial decisions. The unbalanced content of current

general management approaches appears to be consequential of the fact that they were developed within institutions dominated by economic and social sciences. Redefining the knowledge basis of general management approaches is suggested by introducing the concept of "enterprise sciences." Its range of cognition is determined two-dimensionally, on the one side by the sciences related to enterprises and on the other by a prioritarion order of non-trivial entrepreneurial problems.

WB-07.2 - A Model for Assessing the Effect of New Technologies on Production

Kudret Yurtseven, Eastern Mediterranean University
Walter Buchanan, Oregon Institute of Technology

The model proposed is intended to be a tool for assessing the effect of new technologies on production. It is a dynamic, discrete-time, and a stochastic model, based on an aggregation of products and production processes, allowing system engineers to study the influence of important technological parameters on productivity.

WB-07.3 - Impact Assessment and Emerging Technologies

Thomas Mason, Rose-Hulman Institute of Technology

Technological breakthroughs are exciting, but they are not always profitable for those who discover and nurture the emerging technology. Being a first mover can lead to a dominant position as a standard setter. It can also lead to pioneering mistakes and failure. This paper describes a framework for anticipating the direct and indirect consequences of a technology and shows how such knowledge can help overcome barriers to entry and then protect the new market position once it is established.

WB-08 **Wednesday, July 28, 1999**
10:00 - 11:30 **Council**

Strategic Management of Technology 2
Chair: Christian Artmann, Portland State University

WB-08.1 - A Strategic Framework for Information Technology Planning

Michael Usrey, University of Colorado
K. Radhakrishan, U S West Advanced Technologies

Most frameworks for planning of Information Technology (IT) projects are based on functional models of the organization, where investments are justified based on rate of return analysis comparing an existing, manual process with an automated substitute. The Malcolm Baldridge National Quality Award (MBNQA) is considered herein as the basis for strategic approach IT planning. The benefits and shortcomings of this approach are discussed. The lack of consideration for the protection of intellectual property is identified as a key shortcoming, not only in the context of IT planning, but also in the broader context of MBNQA as a business assessment tool.

WB-08.2 - Understanding Mergers

Audrey Alvear, Portland State University
Christian Artmann, Portland State University
Janice Forrester, Cytera Systems, Inc.
Chiung - Hui Huang, Portland State University
Peerasit Patanakul, Portland State University
Pornthep Suteerachai, Portland State University
Dolores Thompson, Portland State University
Duncan Mottershead, Electro Scientific Industries, Inc.

It is the intent of this paper is to assist in the understanding of mergers and how they occur. To simplify matters we structured the quantifiable descriptors and the qualitative issues in such a manner as to illuminate the events associated with the merger and predict success in the event the merger proceeds.

WB-08.3 - The Daimler/Chrysler Merger: A Success?

Audrey Alvear, Portland State University
Christian Artmann, Portland State University
Janice Forrester, Cytera Systems, Inc.
Chiung - Hui Huang, Portland State University
Duncan Mottershead, Electro Scientific Industries, Inc.
Peerasit Patanakul, Portland State University
Pornthep Suteerachai, Portland State University
Dolores Thompson, Portland State University

The automotive industry faced major changes last year and is consolidating further. A key initiating event was the Daimler-Benz AG's merger with the Chrysler Corporation. The purpose of this paper is to analyze the strategic intents of this merger, the potential benefits and threats of the new company, and its impact on the automobile industry.

PANEL: WB-09 **Wednesday, July 28, 1999**
10:00 - 11:30 **Forum**

Technological Forecasting and Social Change: Looking Back and Looking Ahead
Moderator: Harold A Linstone, Portland State University

Panelist(s): Joseph P Martino, University of Dayton Research Institute
Alan L Porter, Georgia Institute of Technology
Fred Y Phillips, Oregon Graduate Institute of Science & Technology

On the occasion of the 30th anniversary of this journal, several of the individuals long associated with the field will look back at its development and forward to its evolution in the coming years. Of rising importance are expected-to-be insights drawn from complexity science, multiple perspectives, and technology monitoring using extended data bases. The growing popularity of foresight studies using Delphi will also be noted. Panel participants include Harold Linstone (moderator), Joseph Martino, Alan Porter, and Fred Phillips.

WB-10 **Wednesday, July 28, 1999**
10:00 - 11:30 **Cabinet**

International Issues in Technology Management 4
Chair: Sergio E Gouvea da Costa, University of Sao Paulo

WB-10.1 - Strategic Flexibility as a Key Weapon in a Competitive Environment: A Brief Study Applied to the Brazilian Machine-Tools Industry

Sergio Gouvea da Costa, University of Sao Paulo
Afonso Fleury, University of Sao Paulo

In this work the competitive dimensions of manufacturing and the concepts of strategic flexibility and operations-based strategy are dealt with; an analysis is developed having as illustration the comparison of the evolutionary trajectories undertaken by five companies of the Brazilian machine-tool industry, being Brazilian ones or subsidiary companies of multinational companies with production activities in Brazil.

WB-10.2 - Brazilian Technological Based Companies: Distinctive Characteristics

Marly Monteiro De Carvalho, Cidade Universitaria
Joao Filho, IPT
Solange Machado, Sao Paulo University
Roque Rabechini Jr., Technological Research Institute of Sao Paulo State

The paper intends to identify critical success factors of Brazilian technological-based companies. A survey of 47 companies, including

120 entrepreneurs, was done. Several characteristics are analyzed such as the source of the technology and capital, profiles of both the entrepreneurs and the business, geographical localization and institutional support.

WB-10.3 - Innovation in Microprocessor Systems in Europe: The European Commission's "Open Microprocessor Systems Initiative (OMI)"

Rosalie Zobel, The European Commission

OMI was launched in 1989 by a group of European companies and the European Commission. The process of bringing everyone together to define and implement a strategy led to the novel R&D management concept of the focused cluster, which became a model for other similar initiatives of the European Commission.

WB-11 **Wednesday, July 28, 1999**
10:00 - 11:30 **Executive**

Technology-Based Organizations 3
Chair: Derek Steeple, Coventry University

WB-11.1 - Organisational Values and World Class Performance

Mark Hooper, Coventry University
Derek Steeple, Coventry University

This paper reports on the implementation of a methodology for detailing organisational values and measuring their influence on organisational performance. The work takes a grounded approach based on a large corpus of mission statements. A link is made between the mesh of values through an organisation and the resulting world class performance.

WB-11.2 - Should the Japanese Corporate Governance Model be Harmonized to the Global Standard?

Shigeo Kagami, Case Western Reserve University

The Japanese corporate governance model needs to evolve itself to better serve the changing external environments. However, given the different advantages of its corporate governance system and its deep-rooted institutional backgrounds, it is neither desirable nor feasible for Japan to adopt a single model of governance as the world standard. Japan should be cautious against blindly introducing U.S. or European ways of governance, as it would cause confusion in Japanese business community and possibly lead to the situation where Japan would "throw its baby out with the bathwater."

WB-11.3 - Study of Relationship Between Organizational Learning and Quality Systems in Brazilian Mechanic Industry

Dario Alliprandini, Universidade Federal de Sao Carlos
Pedro de Costa, Universidade Federal de Sao Carlos

This is an exploratory case study focused on Brazilian mechanic industries in a running research that intends to analyze companies that are certified in quality systems and search how this certification can leverage changes that could provide and sustain organizational learning in these companies and help them to be "learning organizations."

WB-12 **Wednesday, July 28, 1999**
10:00 - 11:30 **Senate**

Quality Management - 2
Chair: Victor P Babarovich-Hansen, Mintek

WB-12.1 - Quality Management in Product Development: The Second Generation of Three Products

Victor Babarovich-Hansen, Mintek
Dave Hulbert, Mintek

Quality actions and tools used in developing three products for the mineral processing industry are examined. This approach has proved to help make these new technologies more acceptable to the industry. The environment for development, front-end analysis, execution, value of the information before testing and other quality tools are presented.

WB-12.2 - Reengineering Manufacturing Systems Using Organizational Macromolecules

Julio Macedo, Institute Strategies Industrielles
Helene Langlois, Institut Strategies Industrielles

A new approach for simultaneous reengineering is presented. This approach utilizes fuzzy cognitive maps for identifying the target organization of the problematic process from the knowledge of the performer firms. The approach is applied to reengineer a pharmaceutical laboratory.

WB-13 **Wednesday, July 28, 1999**
10:00 - 11:30 **Pavilion East**

Industry Application-8: Software and Hardware Development
Chair: Sean Barnum, Complete Business Solutions Inc.

WB-13.1 - The Politics of Software Innovation

Morten Vendelo, Copenhagen Business School

Drawing on theories of power in organizations and organizational learning this paper analyzes a case of new business creation in a software firm, thereby seeking a better understanding of the impact of politics and organizational learning on both resource allocation processes and innovation management. The paper proceeds as follows. First, it presents selected theories of organizational learning and politics of organizations, condensing these into a theoretical framework. Second, it describes the case, called Financial Products, thereafter presenting the analysis of the politics of innovation in the case, and finally, it concludes and draws some implications for the management of innovation.

WB-13.2 - Customer-Value Engineering the Software Development Process

David Raffo, Portland State University
Robert Harmon, Portland State University
Stuart Faulk, University of Oregon

Traditional software design practices inadequately link customer value to the critical software design decisions that impact those drivers. The result is often a mismatch between customer expectations, the software's capabilities, and the company's business goals that cannot easily be corrected. This paper proposes a new Value-Based Software Engineering (VBSE) approach that systematically links software design decisions to business goals. In the VBSE process, both business decisions and technical software design decisions are based on common goals tied to measurable customer value. The VBSE process supports a complete development cycle from the systematic analysis of customer value drivers, through design, to validation of the delivered product. The VBSE technology provides a framework for applying advanced architectural design and product-line software engineering methods to yield higher quality, lower cost, and reduced time to market.

WB-13.3 - Reusability as a Strategic Management Practice in the Computer Industry

Sean Barnum, Complete Business Solutions Inc.
Gina Austin, EDS

Yonca Daim, Portland State University
Zareer Cursetjee, Cleanpak
Sarunya Premjai, Portland State University
Anil Khanna, Lattice Semiconductor
Manivannan Thavasi, Portland State University
Gerard Rousseau, Tektronix

The objective of this research was to investigate the current state of strategic reuse in the computer industry and provide a good overview of its capabilities and future prospects to allow the reader to make an initial determination if this technology is a good fit for achieving their organization's strategic goals. The research data was collected using a combination of an in-depth literature search validated by a field study of interviews with senior technical leaders in the computer industry.

WC-01 **Wednesday, July 28, 1999**
13:30 - 15:00 **Galleria-1**

New Product Development 7
Chair: David Wilemon, Syracuse University

WC-01.1 - Integration, Learning and Continuous Improvement in the Product Development Process: A Core Competence Reference Model and Exploration Study in Brazilian Companies

Dario Alliprandini, Universidade Federal de Sao Carlos
Jose Carlos de Toledo, Universidade Federal de Sao Carlos

This paper presents the results of an ongoing study about the relationship between integration, continuous improvement and learning in the product development process. The study was been conducted in four Brazilian companies from the automotive industry. The variables were analyzed by a matrix to compare them with the managerial practices and show the intensity of this relationship qualitatively and subjectively. The initial results show that integration, learning and continuous improvement are not routinely used by managers. However, some aspects of these three factors are adopted: required standards, approaches that were identified by benchmarking in other companies, and techniques applied by a TQM program. A model is proposed that allows the identification and management of core competencies in the product development process.

WC-01.2 - Uncertainty and Distance as Determinant Factors in Portfolio Management and Strategic Alliances

Robin Bartholomew, Manchester Business School
Alan Pearson, University of Manchester

This paper presents a system, illustrated by a case study, which quantifies the Radical/Incremental nature of NPD projects, by examining their Uncertainty and Distance characteristics. It then explores how this system can guide the development and appraisal process, support project selection and termination decisions, and indicate appropriate organisational and exploitation options.

WC-01.3 - Key Issues in New Product Development Controllability Improvement: Lessons Learned from European High-Tech Industries

Kristian Rautiainen, Helsinki University of Technology
Casper Lassenius, Helsinki University of Technology
Jukka Nihtila, Theseus Institute
Reijo Sulonen, Helsinki University of Technology

An interview study reveals the problems companies face trying to improve the controllability of their new product development (NPD). The primary improvement area at the moment is the front end of the NPD process. Other improvement areas include the visibility and tracking of projects, and communication between people and projects.

WC-01.4 - Perceptions of the Product Development Process

David Wilemon, Syracuse University
Gloria Barczak, Northeastern University

Increasingly, cross-functional teams are being used to develop new products. But what do these team members really think about the new product development (NPD) process? This study examines team member perceptions about the clarity, purpose and effectiveness of the NPD process as well as the major difficulties encountered throughout the process. Implications for managing NPD teams are presented.

WC-02 **Wednesday, July 28, 1999**
13:30 - 15:00 **Galleria-2**

R&D Management - 7
Chair: Ville Ojanen, Lappeenranta University of Technology

WC-02.1 - A Groupware Tool for R&D Project Selection for Distributed Company Environment

Jouni Koivuniemi, Lappeenranta University of Technology
Petteri Piippo, Lappeenranta University of Technology
Markku Tuominen, Lappeenranta University of Technology
Hannu Karkkainen, Lappeenranta Universtiy of Technology

This paper describes a groupware tool for R&D project selection. It covers the whole selection process from idea gathering to the final analysis phase. The tool supports the cooperation of experts from different departments to synthesize their knowledge and to define the best projects in a distributed, global company environment.

WC-02.2 - Problems and Promotion of R&D Project Selection in Finnish High-Tech Manufacturing Companies

Petteri Piippo, Lappeenranta University of Technology
Hannu Karkkainen, Lappeenranta Universtiy of Technology
Ville Ojanen, Lappeenranta University of Technology
Markku Tuominen, Lappeenranta University of Technology

Many different methods have been developed for R&D project selection. However, few studies have practically analyzed the problems of selection processes in companies. In this study we have comprehensively analyzed important practical problems of R&D project selection in five high-tech Finnish manufacturing companies, and clarified effective means to solve these problems.

WC-02.3 - Selection of R&D Performance Measures from the Whole Company's Point of View

Ville Ojanen, Lappeenranta University of Technology
Hannu Karkkainen, Lappeenranta Universtiy of Technology
Petteri Piippo, Lappeenranta University of Technology
Markku Tuominen, Lappeenranta University of Technology

Several factors influence the selection of suitable R&D performance measures. We have determined five important factors to be taken into account when selecting appropriate measures. Based on interviews with 50 people and on an analysis of R&D measures in five industrial companies and earlier studies, we present a framework for R&D performance measure selection.

WC-03 **Wednesday, July 28, 1999**
13:30 - 15:00 **Galleria-3**

Management of Technological Innovation 8
Chair: Kumiko Miyazaki, Tokyo Institute of Technology

WC-03.1 - Comparative Innovation Trajectories of US and Japan - the Case of Robotics

Kumiko Miyazaki, Tokyo Institute of Technology
Nageswaran Kumaresan, Tokyo Institute of Technology

In this paper, an analysis is made of the capabilities and the competitive position of the innovation system in Japan in the field of robotics, using patent, publications, market related and interview data. Based on the Techno-Economic Network model, an analysis is carried out to analyze the three poles of activity, Science, Technology and the Market, focusing on knowledge flows. A comparison is made with the situation in the US.

WC-03.2 - The Taiwanese System of Innovation in the Information Industry

Shih-Chang Hung, National Tsing Hua University

This paper shows the importance of national systems in the innovation process, based on the illustrative case study of Taiwan's information technology (IT) industry. The study of this case demonstrates that (1) strong firms, (2) industrial networks, (3) government industrial policy, (4) statutory bodies, (5) education institutions, (6) financial institutions and (7) transnational corporations all matter to the technological diffusion success.

WC-04 **Wednesday, July 28, 1999**
13:30 - 15:00 **Parlor B**

Entrepreneurship 2
Chair: Russell W Wright, University of Illinois

WC-04.1 - How the Social Network Can Boycott a Technological Change: A Grounded Theory for Innovation Failure in a Small Organization

Diego Macri, University of Bologna
Maria Tagliaventi, University of Bologna
Fabiola Bertolotti, University of Bologna

A technological change can be partially or totally boycotted during its implementation. The initial sponsors of an innovation can end up causing its failure. It is only within a social network that the implications of an innovation become visible to the actors thus creating a misfit between their professed and performed attitudes. A study of the introduction of a new Information System in an Italian small firm has been carried out.

WC-04.2 - The Valuation of Initial Public Offerings in Knowledge Intensive Industries

Russell Wright, University of Illinois

This paper examines the valuation of Initial Public Offerings (IPOs) from 1990 to 1997. We argue that underwriters' attempts to price are impossible due to the tacitness and intangibility of the resources involved.

WC-04.3 - Research on Capital Policy for Technological Innovation Capability in Chinese Firms

Lin Guanli, Fuzhou University
Qingrui Xu, Zhejiang University
Shou Yongyi, Zhejiang University
Jin Chen, Zhejiang University
Lin Xing, Fuzhou University

This paper describes the current situation of financing technological innovation in Chinese firms. Firms have a lack of R&D capital in developing countries, whereas the situation differs in China. On the basis of a case study, some capital policies are presented, including supports from government, innovative entrepreneurship, and venture capital industry with Chinese characteristics.

WC-05 **Wednesday, July 28, 1999**
13:30 - 15:00 **Parlor C**

Technology Management Education 7
Chair: Herman J Migliore, Portland State University

WC-05.1 - Bridging Industrial "Best Practices" and Learning in Business Schools: The Value of a Model and a Process Orientation

Robert Mason, Florida State University
Dieter Schmidt, Groupe ESC-Grenoble

This paper presents a framework for understanding and applying information technology to the processes of learning in business schools. The paper arises from a concern that business schools are like the proverbial "cobblers' children" (who were poorly shod) in the sense that we do not always apply to our own operations the concepts we espouse and teach to our students. In particular, we observe that industrial best practices that might have considerable value are not always applied in business schools. The authors discovered, through independent educational design experiences, the value of a process orientation to educational design and the value of an experiential model of learning. The paper summarizes the experiences that led to this finding through two brief case studies, one from the US and one from France. The paper suggests that a process approach and the experiential learning model together provide a framework for understanding how educators (faculty and administrators) can adapt industrial best practices to designing and managing learning experiences. The paper illustrates this for the application of information technology to learning. The paper concludes with a discussion of other trends and best practices that may be particularly useful in the design and management of learning experiences.

WC-05.2 - Updating the Technical Manager

Gene Simons, Rensselaer Polytechnic Institute
Christopher Lucarelli, Rensselaer Polytechnic Institute
Lois Peters, Rensselaer Polytechnic Institute

This paper discusses how the turbulent business environment has expanded the role of management development programs to be more strategic in helping drive the flexibility, commitment, and competitiveness of organizations. The discussion includes a review of the trends in management development, the links between management development and strategy, and role of managerial skills in gaining a sustained competitive advantage. Finally, the application of management development programs at a multinational corporation is discussed.

WC-05.3 - Pedagogy and Technology in Distance Learning

Frederick Betz, University of Maryland

Distance learning systems require a close integration of pedagogical systems and technological systems. Choice of the pedagogical system is fundamental to fulfill the educational mission but does require consideration of the technological capabilities and constraints. This is illustrated by the selection of a graduate seminar pedagogical form as suitable for the present technology delivery system in place at the University of Maryland University College. Experience with delivering a graduate seminar form over the Internet is discussed and evaluated.

WC-06 **Wednesday, July 28, 1999**
13:30 - 15:00 **Studio**

Information/ Knowledge Management 9
Chair: Anabela Sarmento, Universidade do Minho

WC-06.1 - Developing Organizational Processes Based on Knowledge

Edson Pinheiro de Lima, PPGEP/EPS/UFSC
Zaira Ramos Benitez, PPGEP/EPS/UFSC
Sandra Leandro Pareira, PPGEP/EPS/UFSC
Celia c. Zago Ferreira, PPGEP/EPS/UFSC
Lucinaldo dos Santos Rodrigues, PPGEP/EPS/UFSC
Ruy Farias Silva, PPGEP/EPS/UFSC

In an economics approach, its knowledge repository and the dynamics and complexity of its relationships could characterize an organization, and these elements evolve in the conversion process of goods and services defining its operations. A modern approach for a strategy formulation establishes the key elements of the process - the organizational capabilities and resources. But as an organization builds these elements in a strategic way, this question is partially answered by the construction of a set of core competencies guided by an organizational intention, and it is supported by an organizational architecture. The process of developing, leveraging, sharing and strengthening is not completely answered by this theory, and a strategic theory based on knowledge could be an interesting synthesis. The main purpose of this work is to describe this process of converting knowledge assets into systems, goods and services, supported by organizational abilities

WC-06.2 - The Adoption of Groupware in Organizations: The Portuguese Case

Anabela Sarmento, Universidade do Minho
Mario Lousa, Instituto Superior Politecnico de Gaya
Altamiro Machado, Universidade do Minho

The adoption of collaborative work technologies is changing the organisation of work, the way people work, the knowledge and skills associated to the tasks performed and the organisation learning curve. In order to study what technologies are being (or will be) introduced, we passed a questionnaire to the 529 biggest Portuguese enterprises and made a descriptive analysis. The aim of this paper is to present some results about the adoption of collaborative technologies such as groupware and workflow.

WC-07 **Wednesday, July 28, 1999**
13:30 - 15:00 **Directors**

Technology Management 7
Chair: Bruce M Taggart, Portland State University

WC-07.1 - Technology Assessment in Iranian Industries

Mohammad Zanjani, Industrial Management Institute

According to a research contract between the Industrial Managemenet Institute and Ministery of Industries, we studied about 180 factories in about 24 industries such as automobile, textile, casting, rolling, cement and so on. We used the technology Atlas in this project. Presenting the results of this study and also the results of another study for offering a suitable structure for managing science and technology activities in Iran are the subjects of this paper.

WC-07.2 - Technology Assessment of Fisheries

Alan Garcia Lira, University Autonoma de Yucatan Merida

This document presents five years of research on fisheries industry of Yucatan, Mexico. The main firms have moved from out-of-date processes to HACCP and GMP to remain competitive, and considerable investments have been made. This industry was assessed contrasting critical elements, technological position and trends at three time points.

WC-07.3 - Tools for Technology Management: Dimensions and Issues

Clare Farrukh, University of Cambridge
Robert Phaal, University of Cambridge
David Probert, University of Cambridge

This paper considers the dimensions of technology management tools and the characteristics of a tool catalogue that will meet industrial needs. Ongoing work to list and categorise existing tools in the context of strategic technology management is described and the insights derived into current industrial concerns in this area are discussed.

WC-08 **Wednesday, July 28, 1999**
13:30 - 15:00 **Council**

Strategic Management of Technology 3
Chair: John F Mills, University of Cambridge

WC-08.1 - Leveraging Tecnological Core Competencies: Concept and Application

Stefan Koruna, Swiss Federal Institute of Technology

Since the publication of Prahalad and Hamelís paper on core competencies in 1990, the literature on the so-called resource-based view has received growing acceptance not only among academics but increasingly among practicioners. This paper addresses the creation and leveraging of dynamic capabilities.

WC-08.2 - Core Competence-oriented Target Engineering: Concept and Application

Stefan Koruna, Swiss Federal Institute of Technology

Looking at the U.S. annual patent statistics, Canon is scoring year after year top-level results. One of the main reasons behind this innovation success is the company's ability in building and nurturing technological platforms which provide the basis for accessing a large number of markets. In this paper, the two authors explain the company's innovation and technology competence development strategy.

WC-08.3 - Performance Measures of Sustaining and Developing Competences and Capabilities

Michael Bourne, University of Cambridge
John Mills, University of Cambridge
Andy Neely, University of Cambridge
Ken Platts, University of Cambridge
Huw Richards, University of Cambridge

Traditional financially based performance measurement systems have been criticized for destroying the competitiveness of the manufacturing industry. Modern performance measurement systems take a more balanced approach, but in practice the development, innovation and learning measures are the hardest to design. This paper will examine the issues surrounding the development of performance measures to sustain and develop competences in manufacturing companies using illustrations drawn from a case study.

PANEL: WC-09 **Wednesday, July 28, 1999**
13:30 - 15:00 **Forum**

Private-Public Sector Partnership for Knowledge Transfer and Commercialization
Moderator: Diane Vines, Office of the Chancellor

Panelist(s): John Sibert,
Dwight Sangrey, President, Santa Fe Technologies, Inc.
David V Gibson, IC2 Institute

The panel will review alternative models to facilitate the transfer of ideas from the university to the marketplace. Discussion will include such successful models as the Ben Franklin Program and IC Square

by individuals involved in their development. Why were these models successful? What mistakes were made? How might such partnerships by structured in Oregon?

WC-10 **Wednesday, July 28, 1999**
13:30 - 15:00 **Cabinet**

International Issues in Technology Management 5: Management of Engineering and Technology in Africa
Chair: Antonie M de Klerk, University of Pretoria

WC-10.1 - TQM In South African Industry: The Vehicle for Global Competitiveness

Dietmar Winzker, Cubex Engineering Mgmt Systems (Pty) Ltd

The paper discusses the development of quality principles as practiced in the South African high tech industry and is elucidated with suitable examples. The evolution of the high tech industry in South Africa was the main driver for quality improvements and has resulted in constant striving for TQM principles. Elements of TQM were introduced gradually, and as awareness for TQM continues to grow in the SA industry through the introduction of the South African Business Excellence Model (SABEM), this will lead to increased global competitiveness. The SA approach to TQM and the growth process grew out of the necessity for global competitiveness and can serve as an example for other developing nations.

WC-10.2 - Industry, Government and Technical Professional Human Resources in Developing Countries: Lessons from the Botswana Government Bursary Program

Douglas Rebne, Al Akhawayn University
Lilybert Machacha, University of Botswana

International technology transfer via localization of technology-oriented work is an important but poorly understood issue. We apply foreign direct investment theory in arguing that MNC Technology and Human Resource Management functions may constructively influence local public policy on technical career development. The bursary education system of Botswana, a less-developed country, is used to illustrate this thesis.

WC-11 **Wednesday, July 28, 1999**
13:30 - 15:00 **Executive**

Technology-Based Organizations 4
Chair: Rochelle Young, Old Dominion University

WC-11.1 - Developing Effective Social Structures Using Knowledge Processes

Rochelle Young, Old Dominion University

The focus of this paper is to provide a framework for developing effective social structures using knowledge processes. This framework is useful in understanding how technology and its processes can be managed within the social structure of the organization. Knowledge processes are pertinent to the development of effective social structures that not only embrace new technologies, but also create technology through systemic knowledge creation, sharing and implementation. The premise of this notion is that technology whether in the form of computing hardware, software application, and/or applied science, can be combined with the expertise, skill, and experience of organizational members. Supporting this premise is the belief that technologies are not confined to a specific application, business, or industry, and culture, but are applicable to all aspects of the organization. With this in mind, it is the belief of the author that knowledge processes, originating from members' social constructs, experience, and the like can be combined to provide a basis for managing new technology. This theoretical framework has served as a template for researching how practitioners, scientists, and business personnel integrate new technology into the work place and move towards successful policy development for managing technology.

WC-11.2 - Organizational Commitment in Adverse Job Conditions

Maria Filomena Ricco, Centro Tecnico Aeroespacial - CTA
Roberto Coda, Universidade de Sao Paulo USP/FEA

The purpose of this research is to clarify the apparent discrepancy between organizational behavior theories and the researchers' behavior of the Brazilian Aerospace Technical Center. Specifically, the study uses the Meyer and Allen's three-component model (affective, normative and continuance) to elucidate the kind of organizational commitment occurred in adverse job conditions.

WC-12 **Wednesday, July 28, 1999**
13:30 - 15:00 **Senate**

Quality Management - 3
Chair: Jack M Kloeber, Jr., Air Force Institute of Technology

WC-12.1 - Implementing Process Re-engineering: Challenges and Opportunities

Phil Baker, Coventry University
David Medori, Coventry University

Suppliers to automotive original equipment manufacturers are under increasing pressure to become more agile and provide just-in-time supply whilst reducing operational costs. This paper discusses the challenges faced by a first-tier automotive supplier in the development and implementation of a process re-engineering project which was designed to address these issues.

WC-12.2 - Reengineering Training for Performance Improvement

Dennis Kulonda, University of Central Florida

It has been estimated that the direct expenditures on formal training was $59.8 Billion but measuring results is difficult. A process is described and developed for both measuring the results and improving the results of the training.

WC-12.3 - A Model for Process Re-development in a Small & Medium Enterprise

T. S. Wong, Winkler Industrial Company Ltd.
Walter W.C. Chung, Hong Kong Polytechnic University

A small to medium enterprise (SME) has to innovate its traditional management wisdom to meet the challenge of change. In the context of industry, academic and government collaboration, this paper describes a case study which illustrates how an SME acquires manufacturing best practice to reform its processes and gain competitive advantage.

WC-13 **Wednesday, July 28, 1999**
13:30 - 15:00 **Pavilion East**

Industry Applications-9: Health Care
Chair: Karen B Eden, Oregon Health Sciences University

WC-13.1 - Superconductivity at General Electric (1960-1990): From Science to Technology to Products and Profits

Pier Abetti, Rensselaer Polytechnic Institute

We follow the evolution of superconductivity at General Electric, from scientific research that led to a Nobel Prize, to technological innovation in materials and magnets, and finally to global leadership in Magnetic Resonance Imaging (MRI) medical diagnostic systems. By

analyzing new product risk, we show why GE first encouraged a spin-off and then reentered the field after a ten-year hiatus.

WC-13.2 - Flavor of the Day: Management of Healthcare Resources

Anthony Narsing, University of Alberta
John Whittaker, University of Alberta

Rampant changes in the delivery of Canada's healthcare system are driven by deep cuts, which have resulted in lost economic and productive opportunities. This study examines the management techniques employed by a large 750-bed teaching hospital in managing its operating budget. It also illustrates an application of a stochastic MRI model an as example of applying sound engineering management techniques to solve process problems. Use of engineering management techniques such as stochastic modeling will improve operating and economic efficiencies, which are all aimed toward long-term healthcare reform.

WC-13.3 - Information Technology Selection Process and Perceived Impacts in Physician Practices

Karen B Eden, Oregon Health Sciences University
Dundar F Kocaoglu, Portland State University

The objective of this research was to identify the relationships between the selection process and the perceived impacts of information technology on the physician's practice. A telephone survey was conducted with office representatives of 407 physician practices in Oregon. The descriptive results are presented in this summary paper. Relationships were identified between the selection process and the perceived impacts of the software on the practice. These relationships are not directly presented in this paper but are summarized, and recommendations are made to physician practices for selecting software.

WD-02 **Wednesday, July 28, 1999**
15:30 - 17:00 **Galleria-2**

R&D Management - 8
Chair: Albert Rubenstein, Senior Strategy Group

WD-02.1 - Coping with Downsizing and Outsourcing - The Virtual Corporate Research Lab

Albert Rubenstein, Senior Strategy Group

Many corporate research labs have been pressured to downsize, outsource, or go out of business vs. divisionalized R&D. This paper discusses some causal factors and some actions that can be taken by surviving CRLs, to re-establish their credibility and relevance to the changing corporate scene, including evolving into "virtual CRLs."

WD-02.2 - Case Studies in Achieving Client-Centered R&D Organizations

J. Andre Potworowski, TMA - Technology Management Associates

This paper explores the application of creative problem solving tools to help focus R&D and technical organizations on the needs of their clients. Because of the engaging nature of a creative problem solving session, researchers are more likely to buy in to the findings in significantly less time than they would with a more prescriptive management consulting approach. Three case studies are presented.

WD-02.3 - Reorganization of an Industrial R&D Center: A Case Study

Refik Ureyen, Arcelik, A.S.
Iffet Iyigun, Arcelik A.S. - R&D Center
Sertac Koksaldi, Arcelik A.S.

Industrial R&D organizations tend to change their organizational structures and management principles to respond more rapidly to changing internal customers' and external environmental needs. R&D organizations have to balance flexibility and freedom for creativity with the well-defined structure to prevent chaos. Similar drivers were present for Arcelik R&D Center has been established in 1991. In this paper, we are going to discuss the needs and results of an organizational change in an R&D department and share the experiences of our reorganization practice.

WD-03 **Wednesday, July 28, 1999**
15:30 - 17:00 **Galleria-3**

Management of Technological Innovation 9
Chair: Pier A Abetti, Rensselaer Polytechnic Institute

WD-03.1 - The Development of High-Speed Non-Impact Printers by General Electric (Failure) and by Xerox (Success)

Pier Abetti, Rensselaer Polytechnic Institute

We present two parallel cases describing the early development of high-speed non-impact printers. We analyze the various phases during the processes of technological innovation and discuss the key organizational, technical, marketing, and management factors that led to failure at General Electric and to commercial and financial success at Xerox.

WD-03.2 - Innovation Process in a Diversity Context: Diffusion of Material Innovations in Packaging Industry

Saadet Iyidogan, Galatasaray University

The aim of this paper is to analyze the configuration of technological learning in a diversity context, in the case of the French packaging industry. It suggests an analysis based on the concept of learning-by-connecting, which tries to illustrate, within a Sectoral System of Innovation, the determinants of the technological learning mechanisms. In this respect, the paper tries to explain the complementarity dynamics of: 1) knowledge and transformation of learning forms, 2) the pre-eminence of logic of combination in the Sectoral System of Innovation of the packaging industry, 3) learning-by-connecting in packaging industries, and 4) its new spatial tendencies.

WD-03.3 - Case Analysis on the Correlation Between Enterprise Reform and Technological Innovation in China

Kaisheng Ding, Beijing University of Posts & Telecommunications
Xueyuan Zhang, Beijing University of Posts & Telecommunications
XiongJian Liang, Beijing Univeristy of Posts & Telecommunications

The statistical data shows that the main force of technological innovation is the government in China, which is different from that in the USA and Japan, where enterprise plays the most important role to drive the technological innovation. Technological innovation can be classified into active innovation and passive innovation. Most Chinese enterprises are under passive innovation, although China has carried out a market economy. The main one among factors hindering technological innovation in Chinese enterprises is the lack of a good innovation mechanism. In order to build this mechanism, an enterprise should become one market entity that aims to self-develop and obtain maximum market share in the long term. However, the reformation of state-owned enterprises has not yielded such a result in China. In order to become a technology-strong country, China should push up the process of reformation, and formulate some policies to guide technological innovation of enterprise through market ways, which is helpful for enterprises to become the main force of technological innovation.

WD-05 **Wednesday, July 28, 1999**
15:30 - 17:00 **Parlor C**

Technology Management Education 8
Chair: H. Chik M. Erzurumlu, Portland State University

WD-05.1 - Instructional Blueprinting: A Systems Engineering Approach to Workforce Development

William Swart, Old Dominion University
Steven Duncan, US Army Training Support Center

The paper describes two examples of how the principles of systems engineering have been implemented to develop instructional processes; in particular, the new methodology for developing training solutions for the workforce: Instructional Blueprinting. The paper discusses two distinctly different training problems and explains how the application of Instructional Blueprinting led to the appropriate solution in each.

WD-05.2 - The Student Enrollment and Course Tracking System Meta-Project

Joseph Kasser, University of Maryland
Victoria Williams, Keane Federal Systems, Inc.

This paper discusses an innovation in teaching the Systems and Software Development Life Cycle (SDLC) in the Graduate School of Management and Technology at University of Maryland University College. The innovation is a Meta-Project that takes the form of a series of linked projects across the four classes that cover the SDLC. The benefits that the Meta-Project provides the student with are a better understanding of the interaction between the phases in the SDLC, and a better ability to cope with the vagueness of the real world.

WD-05.3 - Measurement of Results in Academic Environment

Nuket Yetis, Marmara University

Marmara University Faculty of Engineering has applied for the 1999 Award of EFQM as a public institution. Since 1993, TQM techniques have been applied to improve both the administrative and educational/training processes. One of the most challenging issues in applying TQM in an academic environment is the measurement of results. The problems faced to measure the results and the solutions applied will be discussed in this paper.

WD-06 **Wednesday, July 28, 1999**
15:30 - 17:00 **Studio**

Information/ Knowledge Management 10
Chair: Haydn J Powell, TWI

WD-06.1 - MORN: Multimedia Object Relation Network: A Knowledge System to Support Research Projects

Nuri Basoglu, Bogazici University
M. Atilla Oner, TurkConsult Innovation and Technology Relay Center

MORN is an object-based system where concept index, external and internal links can be manipulated from multimedia objects. The system is a knowledge base applied as an information infrastructure of the research project on "Technology and Rural Development: Assessing Technology Needs of Southeastern Anatolia Project in Turkey," whose members are located in different parts of a city.

WD-06.2 - One Solution to the IT Labour Shortage

Wolfgang Strigel, Software Productivity Centre

The labour shortage in information technology is becoming one of the biggest challenges for the software industry. Most suggested solutions increase the supply side. We believe that this approach will help but it cannot be the whole solution. This paper describes a project to address the demand side by increasing the productivity in a measurable way.

WD-06.3 - SAP R/3 - An IT Plague or the Answer to the Tailors Dream?

Christian Koch, Technical University of Denmark

The IT market of ERP systems have significantly changed over the last 7-10 years, at least in Denmark manufacturing enterprises used to close "partner-like" collaboration with their IT-supplier, who now face mass produced packaged software. This challenges the skills of technology managers. Can they cope with the IT-plague? Do they suffer from the "power of default," the use of standard settings of parameters, or can they tailor anything to anybody?

WD-06.4 - JoinIT - A Knowledge Trading Development for the 21st Century

Haydn Powell, TWI
S. Jones, TWI
A Churley, TWI

As Internet information trading moves toward the sale of knowledge, new business approaches will be required. These are being explored through JoinIT - a prototype knowledge trading service. The approach taken by a research and technology organisation as a means of repositioning its business to a mass knowledge market is presented with an example of technical problem solving in a virtual environment.

WD-08 **Wednesday, July 28, 1999**
15:30 - 17:00 **Council**

Strategic Management of Technology 4
Chair: Bruce M Taggart, Portland State University

WD-08.1 - From Emerging Technology to Competitive Advantage

Kathleen Wheatley, Syracuse University
David Wilemon, Syracuse University

With technology constantly advancing, new opportunities are often created that become the driving force of an organization. How do managers integrate and manage emerging technologies? The answer to this question is a key determinant of competitive advantage. This presentation offers a framework for managing emerging technologies.

WD-08.2 - Aligning Strategy and Technology Using Roadmaps: Emerging Lessons from the NCMS 'MATI' Project

Michael Radnor, Northwestern University
John Peterson, Lucent Technologies Inc.

This paper proposes a revision to the traditional business value chain model of the corporation and offers some insights into selected 'management of technology' related constructs and tools that can help lower the hurdles for the mid to large size technology intensive company. The constructs and tools reflect real time lessons being learned from a consortium of major US firms, academia, and government agencies in a unique and unprecedented collaboration analyzing the strategic management of technology and related organizational processes (Management of Accelerated Technology Insertion - MATI).

WD-08.3 - The Link Between the Performance Measures and Competitive Strategies: The Strategic Performance Modeling and Measuring Index

Gul Okudan, Gebze Institute of Technology
Susan Murray, University of Missouri-Rolla

One of the mistakes for a company is to use the wrong set of performance measures for managing and evaluating its value-chain activities while aiming to gain a competitive advantage with a predetermined strategy. The losses due to this mistake may increase under the market conditions of increased uncertainty and rapid change. This study reviews the link between the competitive strategy, pro-

duction and operations management and performance measures, and proposes the Strategic Performance Modeling and Measurement Index (SPMMI) for agile competitors as a tool to effectively manage their value-chain activities.

PANEL: WD-09 **Wednesday, July 28, 1999**
15:30 - 17:00 **Forum**

IEEE - USA
Moderator: Merrill Buckley, President-Elect, IEEE USA

IEEE (Insitute of Electrical and Electronics Engineers) is the largest engineering society in the world. Founded in 1884, its membership has grown to more than 300,000 worldwide. IEEE-USA is the biggest component of the institute representing the U.S. portion. Merrill Buckley is the former president of IEEE and the president-elect of IEEE USA. He will discuss his vision about the strategic direction of IEEE USA and answer questions from the participants.

WD-11 **Wednesday, July 28, 1999**
15:30 - 17:00 **Executive**

Technology-Based Organizations 5
Chair: Gretchen E Matthern, LMITCO

WD-11.1 - Influence of the Type of Technology on the Organization Design

Radmil Polenakovik, University St's Cyril & Methodius - Skopje
Todor Kralev, University St's Cyril & Methodius - Skopje

Twenty-five enterprises have been examined. It was analyzed how certain type of technology (unit, series, mass and process technology) is related to the different kinds of organizations structure, size of organizations, "age" of the enterprise, number of qualified employees, number of hierarchical levels and span of management (control).

WD-11.2 - Information Technology and Changes in Organizational Interfaces

Xiaobo Wu, Zhejiang University

This paper discusses the impact of information technology on enterprise's functional interfaces, especially in developing country. Based on a case study made of a Chinese refrigerator manufacturing company, the changes in functional interfaces were examined in three dimensions: new paradigm of interfacing "technology push" and "market pull", knowledge management in the interfacing, and the crafting of core competence.

WD-11.3 - Matrix Management of a Functional Organization During Change: Case History

Jeremiah McCarthy, Lockheed Martin Idaho Technology Company
Gretchen Matthern, Lockheed Martin Idaho Technology Company

This paper discusses management of a functional department where the matrix structure is introduced and a new company has consolidated activities of five separate companies. It relates department experiences over a four-year period and makes conclusions about department management efforts.

WD-12 **Wednesday, July 28, 1999**
15:30 - 17:00 **Senate**

Quality Management - 4
Chair: Michael H Cole, University of Arkansas

WD-12.1 - Managing for Quality in the High-Tech Environment

Patricia Coulthard, Clark College
Robert Eder, Portland State University

The relationship between the behavior of work group managers and quality is examined. This correlational field study is based upon senior-manager assessment of work group performance and employee perceptions of manager behavior. The results indicate specific management practices advanced by quality professionals may not be as universally effective as portrayed.

WD-12.2 - Preventive Logistics Systems

Stefan Schmidt, Technical College Munich

Total Productive Maintenance (TPM) and Change Over Reduction Engineering (CORE) are fundamental parts of the Just-in-Time production system and a way to increase productivity and quality. The costs and quality of manufactured products are largely determined at the design stage. The present state and planned development of the design for the complete life cycle with the savings of administrative and logistical costs is shown using a German company as an example. Not only the quality of the product, but also the quality of the logistics is important for the competitiveness. Introduced are a range of industrial applications and some selected results of projects in Germany.

WD-12.3 - Continuous Improvement in a Captive Shop Environment

Michael Wagoner, Boeing

This paper documents a process of ongoing, continuous improvement within a captive shop environment using the Theory of Constraints. Six cycles of finding and eliminating the constraint to improvement are discussed. The application of the "Thinking Processes" provided a clear, long lasting focus for Boeing's Printed Circuit Board Center. The improvements collectively contributed to a greater than 150 percent increase in throughput, a 75 percent reduction in lead-time, a 60 percent reduction in work-in-process, and an on-time delivery performance approaching 150 percent.

WD-13 **Wednesday, July 28, 1999**
15:30 - 17:00 **Pavilion East**

Industry Application-10: Automotive Industry
Chair: Morgan D Pope, Portland State University

WD-13.1 - Institutional Relations of Small Autoparts Firms in Brazil

Alessandra Rachid, Universidade Federal de Sao Carlos

Firms are redefining their organizational structure, they are decentralizing their productive activities, and new forms of relation with suppliers are emerging. These changes may represent an opportunity to small firms, despite their specific difficulties. This paper will analyse 10 small Brazilian autoparts firms and how the relations with big clients and other institutions help their innovative process.

WD-13.2 - The Impact of the WTO on Taiwan's Automobile Industry

Chih-Tung Hsiao, Ta-Hwa Institute of Technology
Chun-wen Yang, Ta-Hwa Institute of Technology
James Lin, Huafan University

Taiwan's automobile industry has been protected by a government subsidiary program for a long time. However, it is believed that Taiwan's earlier participation in the World Trade Organization (WTO) will benefit the automobile industry in Taiwan. This article looks at how the Taiwanese automobile industry builds up its business strategies to capture the timing for adapting themselves to the impact of free trade from joining the WTO.

WD-13.3 - An Empirical Study of the Labor and Capital Production Functions of the Chinese Automobile Industry

Chih-Tung Hsiao, Ta-Hwa Institute of Technology

James Lin, Huafan University
Wen-Den Chen, Ming Chuan University

To estimate the labor and capital production functions, this research studied 426 Chinese automakers using the additive non-parametric models. The findings are: 1) the labor and capital production functions are evidently different in terms of the influence to the production value, 2) there is serious implicit unemployment, and 3) the comparison shows that the non-parametric approach is more general and explanative.

WD-13.4 - A Survey of Manufacturing Practice and Organisational Change within the Automotive Rubber Industry

Mark Hooper, Coventry University
Clive Winters, Coventry University

This paper reports on the findings of a survey carried out between 1997 and 1998 of automotive rubber component manufacturers within the UK, USA and Germany. The survey reports on the pattern of implementation of a number of tools and techniques of modern manufacturing management, production and systems.

WF-14 **Wednesday, July 28, 1999**
10:30 - 13:30 **Pavilion West**

Poster Session - 5

WF-14.1 - The Technological Transfer in the Textile Industry - A Case in the Paraiba State

Djosete Santos da Costa, Universidade Federal da Paraiba
Cesar Emanoel de Lima, Universidare Federal da Paraiba
Francisco Cavalcanti da Silva, Universidade Federal da Paraiba

Due to the presence of the external competitor in the Brazilian market starting from the 1990s and for presenting a technological lateness related with the international competitors, the national started to invest in technological restructuring of its productive system. In this view, shows the technology transfer influence over organizations competitivity.

WF-14.2 A Simulation Model of New Product Development

Todd Hansberry, Wacker Siltronic

Recently the new product development literature has considered using the metaphor of producing NPD projects to gain further insight into the NPD process. This approach is examined with an application of a manufacturing simulation system in the semiconductor industry.

WF-14.3 - Intranet: Controlling the Costs and the Investments

Rosana Goncalves, Universidade de Sao Paulo
Alvaro Neto, Universidade de Sao Paulo
Geciane Porto, Universidade de Sao Paulo

In this work is presented a model of controlling costs and investments in intranets based upon economical considerations on maximal welfare. The center that provides the communications service via intranet is considered a business unit and a profit center. Its revenues come from tariffs established according to the congestion costs.

WF-14.4 - An Investigation into the Realm of Chaordic Alchemy

Tricia Hiley, Royal Melbourne Institute of Technology
Gary Bunn, Kelly & Lewis Pty. Ltd

As we approach the next millennium we need to be mindful of the alchemist's imagination. As leaders of technological organisations we need to consider reframing our understanding from the current post-industrial perspective to the emerging holistic systems perspective. This paper explores the skilful use of imagination and reflection as the alchemical ingredients in the transmutation of chaos and order into the chaordic organisation—the flexible, creative, adaptive and technologically innovative organisation of the next millennium.

WF-14.5 - Issues in the Planning of Strategic Information Systems: An Exploratory Study

R. Srinivasan, Indian Institute of Science
Eswarapu Ravi, Indian Institute of Science

In the context of economic liberalization and large-scale investments by corporate India in information systems for strategic intent, it is necessary to identify the issues that are considered important in the planning of a Strategic Information System (SIS). This paper develops a conceptual framework for understanding the dimensions of SIS planning issues and reports the findings of a survey done in sample organizations operating in India to understand the perception of information system planners of various organizations (Indian & MNC, Manufacturing & Service) in the development of a SIS.

WF-14.6 - Knowledge Management: A Strategic Tool for the New Millennium

Akkanad Isaac, Governors State University

This paper presents an assessment of knowledge management based on the experience of several consulting companies.

WF-14.7 - Decision Making in Technology Development for Radioactive Waste Management and Cleanup

Thomas Kiess, U.S. National Research Council

A recent National Research Council report reviewed decision-making processes within the technology development office associated with the U.S. Department of Energy's Environmental Management program. Highlights of this report's findings and recommendations are presented here. Decision process steps involve identifying technology needs and funding appropriate development projects to address them.

WG-14 **Wednesday, July 28, 1999**
14:00 - 17:00 **Pavilion West**

Poster Session - 6

WG-14.1 - The Use of Fuzzy Cognitive Maps to Study Innovation Processes in Small Firms

Corrado Storto, University of Naples Federico II
Eugenio Corti, University of Naples Federico II
Giuseppe Zollo, University of Naples Federico Ii

This paper has two objectives. First, we present a method for constructing cognitive maps based on the analysis of natural language and a fuzzy representation of fuzzy propositions. Second, we apply this method to study how new knowledge is created during new product development.

WG-14.2 - IT/Telecommunications Investment and Corporate Growth

Akkanad Isaac, Governors State University

This paper examines the relationship between IT investment and corporate profitability. Several measurement problems are highlighted. Experience of major corporations is used to develop a framework to forecast returns from investments in emerging technologies.

WG-14.3 - FMADM Using a Simplified Centroid-based Arithmetic Process for an Integrated Manufacturability Management Model

Bernard Jiang, Yuan-Ze University
Chi-Hsing Hsu, Yuan-Ze University

This paper presents a fuzzy multiple attribute decision making (FMADM) using a simplified centroid-based arithmetic method for implementing an integrated manufacturability management model. The method is simple and can be used to handle large-scale FMADM problems, such as product design and manufacturing analysis. Thus the analysis cycle can be shortened with more attributes considered.

WG-14.4 - Innovation Through AirShip Technology

Benjamin Berry, Providence Health System

Today, ground and air transportation remains effective but separate modes of operation. Cars are relegated to streets and highways and benefits of aircraft are not realized until they are airborne. Using Resonant Macrosonic Synthesis (RMS) and hydraulic turbine propulsion, this paper introduces a new class of transportation system — The AirShip. An Oregon company, AirShip Technologies, is developing this Vertical Lift Transport Vehicle to fly 300 to 400 feet above ground as well as drive on city streets.

WG-14.5 - Organizational Design of Automanagement Teamworks Supported by Competitive Performance

Carolina Fares, University de Sao Paulo
Sergio Takahashi, University of Sao Paulo

This work has the objective of studying the organizational design of teamwork in a perspective of competitive performance: cost, time, flexibility, quality and innovation. This study presents an integrated analysis with organizational structure, the team variables and the capabilities of teams. A case study in a service company is presented.

WG-14.6 - Strategizing Corporate Information Technology into the Millennium

Loretta Evans, George Washington University, Bell Atlantic, NSI

Given that the millennium is the priority for firms for the coming years, the role of information system should be straightforward. However, satisfying internal customers who are awaiting technical solutions that are neither operational nor millennium-related is a challenge that requires attention even if nothing can be done immediately.

WG-14.7 Explaining Managerial Satisfaction with Government Support of Technology Start-Ups: An Empirical Study of the Innovation Ontario Corporation

Stephen Preece, Wilfrid Laurier University
Grant Miles, University of North Texas
Mark Baetz, Wilfrid Laurier University

A program involving government equity positions in early-stage technology-based firms is empirically evaluated using responses from a survey of 75 CEOs participating in the program. Variables including dependence on government funding, level of interference, and perceptions of procedural justice (among others) are related to overall satisfaction with the program.

HB-01 **Thursday, July 29, 1999**
10:00 - 11:30 **Galleria-1**

Policy Issues in Technology Management - 1
Chair: Dragan Milosevic, Portland State University

HB-01.1 - Aligning National Policy and Technology: Of Tofflerian Waves and Strategic Technologies

John Peterson, Lucent Technologies Inc.
Kenneth Wofford, Xerox Corporation

Redistribution of state assets (socio-political power, intellectual capital and economic investment) has serious economic, political, social and security consequences. Unfortunately, macro economics remains the real driver of national priorities, even though it seldom links directly to innovation, business strategy, and the technology driven management and operational practices that are the primary drivers of localized second order socio-political (national technology) considerations. A parallel approach championing an innovation infrastructure to create and leverage regional growth engines and knowledge-based competitive entities will be presented.

HB-01.2 - Building Effective Public R&D Programmes

Paul Timmers, European Commission, DGIII-Industry

The design of public R&D programmes raises questions about issues such as key actors involved, balance between fundamental and applied work, etc. Answering them requires understanding the possible programme design approaches. An inventory is presented, with an analysis as to strategy development, along with a description of the programme design approaches of the European Union's ESPRIT IT programme.

HB-02 **Thursday, July 29, 1999**
10:00 - 11:30 **Galleria-2**

R&D Management - 9
Chair: Ryo Hirasawa, Japan National Institute of Science & Techology Policy

HB-02.1 - Factors That Determine the R&D Structure of a Multi-National Company: A Questionnaire Survey

Sam Kurokawa, Vanderbilt University
Kenzo Fujisue, University of Tokyo
Brian Parker, Vanderbilt University

It is becoming a strategically important decision where multi-national companies (MNCs) should conduct their engineering and R&D activities. By surveying American, European and Japanese MNCs, this paper investigates: 1) why MNCs globalize their technologies; 2) types of problems they face in globalizing their technologies; and 3) how MNCs manage these problems.

HB-02.2 - R&D Organizational Process on Liquid Crystal Display: An Internationally Comparative Analysis Based on Patents

Tomohiro Ijichi, Japan National Institute of Science & Techology Policy
Ryo Hirasawa, Japan National Institute of Science & Techology Policy

This paper aims at clarifying the mechanism of R&D processes in the organizations. It analyses the organizational processes for developing liquid crystal displays at fourteen organizations in the United States, Europe, Korea and Japan. It indicates differences on the management of the accumulation and utilization of R&D competence among the organizations.

HB-02.3 - Integrating Research and Development in the Subsidiaries of Transnational Companies: Cultural and Other Issues

Linda Wilkins, Monash University
Dilek Karaomerlioglu, Chalmers University of Technology

Globalization and subcontracting in high tech areas of electronic engineering and software development and the implications of these developments are gaining increasing attention from the media. We investigate some of the implications for transnational companies moving along the spectrum from the traditional R&D management role to an approach where R & D activities are integrated so that the entire network behaves as a coordinated whole (cf Kuemmerle,1997).

HB-02.4 - Lead Markets and the International Allocation of R&D

Marian Beise, University of Karlsruhe

Has the globalisation of markets shifted the traditional focus of foreign R&D on regional markets towards regions of research excellence? This paper argues that the importance of foreign R&D in regional lead markets has even increased. A lead market is a regional market that foreshadows future global needs: once local innovations have been developed in close collaboration with local users, they can also be launched on other markets. By locating R&D units in the lead-market, firms can lower the risk of locking in to idiosyncratic environments and generate true global innovations.

PANEL: HB-03 **Thursday, July 29, 1999**
10:00 - 11:30 **Galleria-3**

The Technologies and Technology Management of ESI - Electro Scientific Industries, Inc.
Moderator: Duncan Mottershead, Electro Scientific Industries, Inc.

Panelist(s): Barry Glasgow, Electro Scientific Industries, Inc.

Electro Scientific Industries, Inc., headquartered in Portland, Oregon, USA, designs and manufactures sophisticated products used around the world in electronics manufacturing including laser manufacturing systems for semiconductor yield improvment; production and test equipment for the manufacture of surface mount ceramic capacitors; laser trim systems for precise electrical tuning of circuits; precision laser and mechanical drilling systems for electronic interconnection; and machine vision systems. This session will describe the products, the types of technologies that are involved in these products, and how ESI manages these technologies to continuously develop its expertise and product offerings.

PANEL: HB-05 **Thursday, July 29, 1999**
10:00 - 11:30 **Parlor C**

Technology Management Education 9: The Use of Technology in Delivery of Online Education

Moderator: Yong-In Shin, Oregon Graduate Institute of Science and Technology

Panelists: LaVonne Reimer Young, Cenquest, Inc.
Yong-In Shin, Oregon Graduate Institute of Science and Technology
Fred Phillips, Oregon Graduate Institute of Science and Technology

OGI and Cenquest have formed an innovative partnership to deliver OGI's MS degree over the Internet using online collaboration and communication tools as well as high-bandwidth multimedia components currently located on CD-ROM. Cenquest has crafted a new content-development model which might be described as Internet Pedagogy. Internet Pedagogy involves the application and integration of Internet and learning technologies with the student's experience as the primary driver. The panel will discuss tradeoffs between technologies that push the limits of the Internet versus technologies that are reliable in a variety of settings. The panel will also address the technologies from other perspectives such as whether the interface overwhelms the content and ways in which the interface facilitates accelerated learning and learning retention.

HB-06 **Thursday, July 29, 1999**
10:00 - 11:30 **Studio**

Information/ Knowledge Management 11
Chair: Lois S Peters, Rensselaer Polytechnic Institute

HB-06.1 - Knowledge Integrated Management

Sergio Takahashi, University of Sao Paulo

This paper proposes a framework to analyze Knowledge Management in enterprises in an systemic approach with the following knowledge elements: types, modes of conversion/interchange between individuals, groups, organization, inter-organization and environment; skills; measures; systems and networks; and strategies of learning organization. Knowledge Management is analyzed in a manufacturing company.

HB-06.2 - The Generation of Control Management to Determine the Success of Knowledge Management

Hans Burgel, Unversitat Stuttgart
Hannes Saeubert, Arthur D. Little International, Inc.

Knowledge management has the potential to contribute to a company's success. However, the credibility of this contribution depends on its measurability. Although knowledge management and economic success is connected by multiple cause and effect chains, their nexus can be explained by steering measures. The proposed paper offers a structured approach to generate corresponding measures based on field research.

HB-06.3 - Inter-firm Knowledge Management and Technology Development in Radical Innovation

Lois Peters, Rensselaer Polytechnic Institute

Entrepreneurial motives in establishing inter-firm alliances (IFAs) during radical innovation (RI) include technological learning, exploring suitable infrastructure for new businesses and building political capital. Inter-firm alliances (IFAs) entail knowledge acquisition, creation, distribution and demonstration. These IFA knowledge management practices are aimed at technology, market and company process problem solving.

HB-07 **Thursday, July 29, 1999**
10:00 - 11:30 **Directors**

Decision Making in Technology Management 2
Chair: Roger Stough, George Mason University

HB-07.1 - AHP and the Assessment of Community Fire Risk in the City of Hampton, Virginia

Abel Fernandez, Old Dominion University
Derya Jacobs, Old Dominion University
Charles Keating, Old Dominion University
Paul Kauffman, Old Dominion University

As part of the accreditation process under the National Fire Service Accreditation program, the City of Hampton, Virginia has recently completed a prototype community fire risk assessment in which every structure was classified to a risk category. A risk metric derived from a [Consequence, Frequency] doublet quantified the risk associated with individual structures. Consequence and frequency values were derived based on an AHP model and empirical data, respectively.

HB-07.2 - Mathematical Decision Support for Rapid Response Policy and Management Decisions

Roger Stough, George Mason University

The paper reviews the rapidly developing literature on the use of mathematical decision support in supporting rapid response policy and management decisions. An example of the use of a dynamic regional economic model to support local economic development desicion making in the National Capital region is used to demostrate the concept

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HB-08 **Thursday, July 29, 1999**
10:00 - 11:30 **Council**

Strategic Management of Technology - 5
Chair: Tom Long, Planar Advance

HB-08.1 - Technology Sourcing: The Link to Make-or-Buy

Laura Canez, Unversity of Cambridge
David Probert, University of Cambridge

This paper discusses different options for technology sourcing resulting from undertaking a strategic make-or-buy analysis. Selling, licensing-out, creating alliances, licensing-in and acquisitions are some of the possible options presented in this document. Examples from industrial cases are used to illustrate technology sourcing alternatives.

HB-08.2 - Culture May Be More Important Than Strategy

Tom Long, Planar Advance

This study developed a framework for understanding the relationship of culture and organizational strategy from a systems prespective. The integrated Pyramid Model was developed to explain the constraints of culture on organizational strategy. Culture is seen as acting as a filter on incoming information from the external environment as well as from internal strategic mandates.

HB-08.3 - How Do Firms Perform Effective Competency Development

Steven Walsh, University of New Mexico
Jonathan Linton, New Jersey Institute of Technology

A growing body of evidence suggests that distinctive technological competence provides the basis for superior firm performance. However, few if any firms posses all the prerequisite competencies required for a given technology-product-market paradigm as they enter that market. This paper explores the different ways in which existing firms develop and intensify competence in response to the changing requirements of industry standard products over time and discovers that technology is an important factor in determining which learning strategies should be employed for competence development.

PANEL: HB-09 **Thursday, July 29, 1999**
10:00 - 11:30 **Forum**

EMPH (Engineering Management Program Heads) Meeting
Moderator: Dundar F Kocaoglu, Portland State University

Engineering and Technology Management (ETM) educators do not have a formal representative entity to address issues common to all programs. The objective of this session is to continue with the intiial discussions.

PANEL: HB-10 **Thursday, July 29, 1999**
10:00 - 11:30 **Cabinet**

Engineering and Technology Management: Doctoral Student Colloquium
Moderator: Timothy R Anderson, Portland State University

Panelist(s): Patrik Jonsson, Vaxjo University
Charles Weber, MIT Sloan School of Management
Michael H Cole, University of Arkansas

This session will provide current graduate students, recent graduates and prospective students in the fields of engineering and technology management the opportunity to meet and exchange hard-earned lessons.

PANEL: HB-11 **Thursday, July 29, 1999**
10:00 - 11:30 **Executive**

Technology Based Organizations 6: Applying Technology to Improve the Practice of Management
Moderator: Joseph Kasser, University of Maryland

Panelist(s): David Cohen, University of Maryland University College
John O Aje, University of Maryland University College
Donald L Goff, University of Maryland University College

If management is about making timely and correct decisions, then information technology (IT) can be used to make sure the appropriate information is available when needed. Traditional skills here are management information systems (MIS) and communications. IT can be used in the form of wizards or expert systems. These systems can act as management consultants in notebook computers and increase the probability of correct decisions. Traditional skills here are knowledge engineering and expert systems. Other aspects to be discussed are the other ways IT can be used, including speeding up communications throughout the organization: e-mail, faxes, phone, the Internet, and remote meetings, for example.

HB-12 **Thursday, July 29, 1999**
10:00 - 11:30 **Senate**

Environmental Issues in Technology Management 2
Chair: Kusha Janati, Portland State University

HB-12.1 - Technology Requirements for Population and Economic Growth

Kenneth Simons, University of London

Benchmark technological goals for the next century are estimated using a global simulation model of society, economy, and the environment. The technology targets set goals that world society apparently must achieve to ensure that desired levels of population and economic growth can be supported. The estimates are developed using the first major global simulation model, World3, for which I discuss results of alternative model assumptions and sensitivity analyses.

HB-12.2 - SME's Environmental Performance: Determinants and Impacts

Louis Lefebvre, Ecole Polytechnique
Elisabeth Lefebvre, Ecole Polytechnique

The paper analyzes empirical evidence from 368 environmentally responsive small- and medium-sized enterprises (SMEs) operating in four industries. Results demonstrate that environmental performance cannot be viewed as a unidimensional concept and that determinants of environmental performance depend on the dimension retained. Impacts of environmental initiatives on firms' innovativeness and competitiveness are much stronger in the electric and electronic products industry whereas environmental responsieveness does not necessarily translate into hard financial results (either in terms of cost reductions or additional revenues) for the printing industry. However, impacts on product and process innovations as well as on managerial innovations are positive and significant for all four industries.

HB-12.3 - Environmental Management in a Beverage Factory : The Case of the Antarctica in Mato Grosso

Marco Neves, Av. Beira Rio

The Antarctica Beer Company, in its strategy planning, conceived the installation of a unit in Cuiab·, capital of state of Mato Grosso. The initial project, however, caused serious conflict with environmental preservation organizations both public and private. According to these organizations, Antarctica, in the process of making its products, would use the water from the Cuiab· River, considering that the factory was to be built close to the city's water treatment station. It was feared that the industrial activity would compromise the quality of the water distributed to the population. This article analyses the process of environmental management used by the Company to install its production unit, as well as the results obtained.

HB-13 **Thursday, July 29, 1999**
10:00 - 11:30 **Pavilion East**

Industry Applications-11
Chair: Markus Kieninger, FAW

HB-13.1 - Main Characteristics of Product Design in Brazilian Sanitary Metal Industry

Solange Machado, Sao Paulo University
Ricardo de S. Moretti, Sao Paulo University
Geraldine Bosco, Sao Paulo University
Renata Rocha Faria, Sao Paulo University

This article presents the main features of Sanitary Metal Industry in Brazil, focusing on management patterns of product design and innovation in Brazilian companies. The final objective is to subsidize government policies aimed to improve the Brazilian design. The global leader in this segment, Italy, has a very specialized market and a good supply of design services. Otherwise, the Brazilian market is strongly concentrated with few and high-cost design services. Consequently, only the big companies can afford the costs of new product development.

HB-13.2 - Design Support for Primers

Markus Kieninger, FAW
Thomas Kampke, FAW
Michael Mecklenburg, Interactiva Biotechnology GmbH

Internet technology not only supports a make-to-order manufacturing or distribution process but it can also support a possibly preceding consuling on demand step. This ammounts to solving a design problem and it appears to be of increasing importance in e-commerce. This is illustrated for a case in genetic analysis, namely for the design of hybridization primers.

HB-13.3 - Competitive Strategies: The Brazilian Textile & Garment Industries

Marly Monteiro De Carvalho, Cidade Universitaria
Neusa Serra, Cidade Universitaria

A diagnosis of the Brazilian textile-garment industries is presented. Two major competitive approaches have been detected; the first one is the modernization and core competencies strategies, and the second one the design approach. The current work is directed towards case studies and analysis.

HB-13.4 - Retail Automation Technology and its Impacts on the Retail Production Chain

Roque Rabechini Jr., Technological Research Institute of Sao Paulo State
Solange Machado, Technological Research Institute of Sao Paulo State
Fabio Mariotto, EAESP

Brazilian retail businesses have been investing in retail automation technologies to improve their operational efficiency/competitiveness. These investments were prompted by the economic stabilization and the opening of the Brazilian information technology market. This paper examines the possible impacts of the use of made information technology by Brazilian retail businesses.

HB-14 **Thursday, July 29, 1999**
10:00 - 11:30 **Pavilion West**

Resource Management 1
Chair: Franz Rad, Portland State University

HB-14.1 - Using the Theory of Constraints to Discover Breakthrough Solutions

James Holt, Wasington State University - Vancouver

Compromise blocks rapid advancement. “Faster requires lighter.” “Stronger requires heavier.” “To be really better requires faster and stronger.” This paper demonstrates how the Theory of Constraints tools focus creative thought to create breakthrough solutions, even paradigm shifts. Assumptions vanish and physical conflicts evaporate, negative side effects are trimmed.

HB-14.2 - Intermodal Transportation Routing Problem

Bonnie Boardman, University of Arkansas

This paper presents a method that has been developed to solve intermodal transportation routing problems. The author has developed a decision support system to aid users in determining the least cost path(s) through an intermodal network. The methodology and development of the software system are discussed.

HB-14.3 - The Art of Managing Information for Benchmarking and Productivity Improvement

Nitya Karmakar, University of Western Sydney, Hawkesbury

We are living in the era of globalization, economic liberalization and technological innovation that are affecting all facets of life; for example, industries, education, commerce and entertainment. The management of information is now of vital importance for any business. There are now tremendous attempts to revolutionize Industries using information technology (IT). In the growing knowledge-based economy, firms need to produce required knowledge workers for economic development in the 21st century. The paper analyses the importance of new technology; for example, Electronic Commerce (E-Commerce) for improving productivity and benchmarking in an organization.

HC-01 **Thursday, July 29, 1999**
13:30 - 15:00 **Galleria-1**

Policy Issues in Technology Management - 2
Chair: Nohad A Toulan, Portland State University

HC-01.1 - Recent Trends of Japanese Industrial Policy: Giant Leap from Technology to Innovation Policy

Kenzo Fujisue, University of Tokyo
Manabu Eto, Ministry of International Trade and Industry
Schumpeter Tamada, Ministry of International Trade and Industry

The Japanese economy is now stunned with depression, which might lead to a world-level economic crisis. Therefore, the Japanese government is now trying to reinvent technology policy to innovation policy along with restructuring governmental agencies. This paper shows the background data and thoughts of this reinvention and recommends several policy choices, which would be useful to other countries in an economic slowdown.

HC-01.2 - A Study on Foreign National Researchers in Korean Research Organizations and Policy Recommendations

Deok Soon Yim, Science & Technology Policy Institute
Yongwook Jun, Chung-Ang University

With the globalization trend of S&T activities, Korean research organizations have begun to utilize foreign researchers. The performance of foreign researchers seems satisfactory, but there are many problems too. This paper identifies the performance factors of foreign researchers in Korean research organizations and searches for the best management practices and S&T policies.

HC-01.3 - International Comparison on Structural Transformation of R&D Funds Source and Chinese Choice of Transformation

Qingrui Xu, Zhejing University,
Baoqun Feng, Zhejiang University

Since the beginning of the 1990s, profound changes have taken place in the world pattern, and the competition in science and technology is becoming the core of international strife. Therefore, R&D funds become the essential condition for a nation to acquire long-term competitive advantage and international competitiveness. So, it’s very important for a country to timely adjust its structure of R&D funds on the basis of its characters and national need. Based on this

view, this paper compares the three aspects of structural transformation process, i.e. the structure of R&D funds by source, the structure of R&D funds by performing sector, and the structure of R&D funds by character of work in P.R.China and US. The main conclusions in this paper are: 1) the structure of R&D funds by source in the US has undergone three phrases from government-dominance type to industry-dominance type since the 1960s; 2) the structure of R&D funds by performing sector in the US and many developed countries turned into a traditional "single-assistant" type into a "double-assistant" type in order to fit the new technology-economy paradigm shift; and 3) the structure of R&D funds by character of work in the US stresses the stability of the R&D system and has a high share of basic research. Using the United States' experience for references, strategic choices this paper suggested on transformation structure for P.R.China are that the source structure of R&D funds transforms into government-industry type step by step, changes institutes into enterprises with larger paces and enforces basic research funds input and human capital investment. Key words: Structural transformation, R&D funds, Competitive advantage

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HC-02 **Thursday, July 29, 1999**
13:30 - 15:00 **Galleria-2**

R&D Management - 10
Chair: Joseph P Martino, University of Dayton Research Institute

HC-02.1 - The Impact of Government R&D Expenditures on U.S. Technology Advancement

Michael Winthrop, Air Force Institute of Technology
Richard F Deckro, Air Force Institute of Technology
Jack Kloeber, Jr., Air Force Institute of Technology

Traditionally, the United States has not set a specific national technology policy or plan seen in many other nations. However, the U.S. government does spend large amounts of money on research and development (R&D) through such agencies as the Department of Defense (DoD) and National Aeronautics and Space Administration (NASA). This work investigates the relationship between defense and space expenditures on R&D and national technology advancement in the aerospace industry. Lag relationships between technology advancement and R&D expenditures are examined and modeled.

HC-02.2 - The Impact of Partner-Fit on Progress and Success of European Multi-Partner Research Projects

Hans Georg Gemuenden, University of Karlsruhe
Thomas Lechler, University of Karlsruhe

The better the partners' fit, comprising social fit (trust and commitment), resource fit (competence and complementarity) and goal fit (goal clarity and compatibility), the better cooperative R&D-projects will progress and succeed. Data from 393 European respondents pertaining to 193 ESPRIT projects show a significant positive correlation with project success for all six variables. A path analysis with the core variables competence, trust, and goal clarity explains 44% of the variance of project success. By including variables characterizing the progress of the project (quality of project management, escalation of inter-organizational conflicts and changes of the goals), the variance rises to 65%.

HC-02.3 - Research & Development in Turkey

Joseph Martino, University of Dayton Research Institute

This paper describes the status of Research & Development (R&D) in Turkey. An overall picture is first presented. Then examples are described, drawn from a consumer goods firm, a consumer electronics firm, and a government research laboratory. A final section makes some observations on the future development of Turkish R&D.

HC-02.4 - Development of Technological Innovation in China: Core Competence-Based Innovation Portfolio

Qingrui Xu, Zhejing University,
Bin Guo, Zhejiang University
Yi Wang, Zhejiang University

During past decades, Chinese industry has made great progress in technological innovation facilitating and capabilities building. But unfortunately, as for some firms in China, there still exists dominant strategic thinking that views the innovation activities as static, linear, and isolated, thus making technology strategy separate from corporate strategy, thus making them often face the dilemma of low efficiency in transferring technology into profit. Under this situation, a shift to a new paradigm for innovation management, i.e., core competence-based portfolio innovation, is the urgent mission to integrate technological, organizational and institutional factors from a strategic perspective on the knowledge-based view. In this paper, the locus of China's technological innovation is introduced first. Based on this, the necessity for a paradigm shift in technological innovation is presented. Then core competence, innovation portfolio, and the interaction between them are discussed. Some cases of core competence-based innovation are provided as well as some patterns of a firm's competence building and enhancing. Finally, the role of government in technological innovation is also discussed.

PANEL: HC-03 **Thursday July 29, 1999**
13:30-15-00 **Galleria 3**

Organization and Individual Influences in Adoption of Internet Technologies
Moderator: Juett R Cooper, Marshall University

Panelist(s): Anatole Schaff, Tektronix, Inc.
Bruce M Taggart, Portland State University

Firms are rapidly pursuing the utilization of Internet techologies to promote business to business and end user commerce. While numerous works promote the use of Internet technologies within the organization, little has been written to assess the relationship of organizational and individual characteristics with the successful adoption of Internet Technologies such as business to business commerce, video conferencing, and telecommuting. Based upon their experiences with applying and disseminating the use of Internet Technologies, the panelists will participate in a lively and far ranging session on how to successfully adopt Internet Technologies for companies, universities, and individuals. Active participation from the audience is expected in this session.

HC-05 **Thursday, July 29, 1999**
13:30 - 15:00 **Parlor C**

Technology Management Education 10
Chair: William R Wells, University of Nevada Las Vegas

HC-05.1 - Web-Based Education for Professional Advancement

John Goulding, Electroglas, Inc.

The asynchronous nature of web-based instruction allows professionals to take university courses "any place, any time, and at any pace." This paper reviews the objectives and development of a web-based classroom at Portland State University. Such courses address the needs of engineers who have difficulty attending the traditional classroom.

HC-05.2 - Videoconferencing in MOT Courses: A Case of Cross-Cultural Communication and Collaboration

Richard Smith, Simon Fraser University
Clement Wang, National University of Singapore

Discussions of educational benefits from interactive technology in teaching have suffered from an extreme mentality, with most accounts being either wildly optimistic or harshly critical. We examine some of these claims and critiques, and offer our own insights based on a joint MOT course between a Canadian and a Singaporean university.

HC-05.3 - The Bare Bones of Internet-Based Learning: A Case Study

Arthur Preston, Queensland University of Technology
Susan Inglis, Queensland University of Technology
Peter Horchner, Alliance Consulting & Management

Internet-based learning offers potential in geographically dispered industries where off-the-job traning is not efficient. A desicion support model for educating managers in the Australia red meat precessing industry has been developed and trailed. The process coaches managers through a dignosis of cost of quality issues to produce presentation data and graphics and also through the implementation of subsequent change.

PANEL: HC-06 **Thursday, July 29, 1999**
13:30 - 15:00 **Studio**

Innovation and Organizational Change Program at NSF
Moderator: Joseph Hennessey, National Science Foundation

Panelist(s): Mariann Jelinek, National Science Foundation

NSF's Innovation and Organizational Change Program (IOC) seeks to improve the performance of organizations (industry, education, nonprofit and other) through partnerships between organizations and researchers that focus on theories, concepts and methods of innovation and organization change. Targets include organization learning and redesign, strategic and cultural change, quality and process improvement, new product and service development, and technology integration, among other topics. The panelists will discuss the program objectives and answer questions from the audience.

HC-07 **Thursday, July 29, 1999**
13:30 - 15:00 **Directors**

Management of Engineers and Scientists 2
Chair: Loretta Evans, George Washington Uni., Bell Atlantic, NSI

HC-07.1 - Engineers as Managers: A Conceptual Model of Transition

Ravi Seethamraju, University of Western Sydney, Napean
Rakesh Agrawal, University of Western Sydney, Napean

Transition of engineers into management is influenced by several factors. Based on an empirical study of engineers in Australia, a conceptual model of the transition is proposed in this paper. According to this model, individual, educational and organisational factors influence the process of transition and as well as each other, within the overarching influence of societal factors.

HC-07.2 - Traits of Successful Technology Managers

Loretta Evans, George Washington University, Bell Atlantic, NSI

So much research in team management is geared toward the manager and little for the other members of the team. Team members are managers of themselves. What do the highly demanded team members have that makes them so desirable; and, can those traits be taught to other team members?

HC-08 **Thursday, July 29, 1999**
13:30 - 15:00 **Council**

Strategic Management of Technology 6
Chair: Gil Latz, Portland State University

HC-08.1 - The Problem of Timing in Standard-Setting

Vittorio Chiesa, CNR-ITIA and Politecnico di Milano
Raffaella Manzini, LIUC
Giovanni Toletti, Politecnico di Milano

Timing is one of the main dimensions of standardization strategy. In the paper, through the analysis of the literature about standard-setting and an empirical analysis of the Multimedia and Home Automation sectors in Italy, we investigate the problem of defining the most appropriate timing of standardization. In particular, we deal with two matters. First, we investigate the reasons that can induce a firm to standardize before or after the introduction of the technology on the market (i.e. ex-ante or ex-post standardization). Then we analyze whether, given the previous decision, it is better to achieve an early or late standardization.

HC-08.2 - Transformation of Technology in Its Existing Form and Value-Added Activities

Ping Lan, Queensland University of Technology

This paper examines how a firm's value-added activities are affected by transformation of technology in its three existing forms, i.e. software, mediumware and hardware. It suggests that gaining competitive advantages for a firm rely on how it matches its own technology transformation process to the larger one in which it operates.

PANEL: HC-09 **Thursday, July 29, 1999**
13:30 - 15:00 **Forum**

Planning Session for PICMET '01
Moderator: Dundar F Kocaoglu, Portland State University

PICMET '01 is scheduled for July 22-26, 2001. Its planning will start immediately after PICMET '91. This is the kick-off session for it. The scope, theme and strategies of the next PICMET will be discussed and preliminary assignments will be made in this session. All participants interested in taking an active role in PICMET '01 are invited to join the discussions

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HC-13 **Thursday, July 29, 1999**
13:30 - 15:00 **Pavilion East**

Industry Application-12: Semiconductor Industry
Chair: Nile W Hatch, University of Illinois

HC-13.1 - Improving the Efficiency and Effectiveness of Integrated Circuit Manufacturing Technology Development

Samar Saha, VLSI Technology, Inc.

This paper presents a new technology development paradigm for the semiconductor industry. This new approach offers a great potential for a significant reduction in the development cycle-time and cost over the conventional development paradigm. The potential risks of the new approach and the strategies to manage these risks are described.

HC-13.2 - Vertical Disintegration in the Semiconductor Industry

Nile Hatch, University of Illinois
Russell Wright, University of Illinois

Recently, the semiconductor industry has seen a polarization of new firms who perform either R&D or manufacturing, but not both. We attribute this "vertical disintegration" to increasing product modularity,, increasing scale and cost of manufacturing facilities, and relationship specific investments that facilitate contracting between design and manufacturing firms.

HC-13.3 - Modular Technologies and the Time-to-Market Process-Maturity Tradeoff

Nile Hatch, University of Illinois

Modular process technologies mitigate the tradeoff between time-to-market pressures and the cost of immature technologies in the semiconductor industry. Additionally, new process modules represent investments in manufacturing capabilities that can be incorporated into future generations of technologies, making possible new technologies that otherwise may not have been feasible.

HC-14 **Thursday, July 29, 1999**
13:30 - 15:00 **Pavilion West**

Resource Management 2
Chair: Paul Gilbarg, Portland State University

HC-14.1 - The Rhythms of High Technology Firms: Nonlinear Dynamics and Strategic Analysis

Gregory Daneke, Arizona State University

The focus of this discussion is the implications (both theoretical and practical) of a new generation of tools and concepts derived from advances in nonlinear dynamical systems (e.g. chaos and complexity of studies). Primary among these tools are simulations involving "artificial agents" which learn and adapt through processes represented by "genetic algorithms" and "cellular automata." These tools in the hands of students of strategic management offer a direct challenge to the dominance of neo-classical economic theory in game theoretic or industrial organization approaches to strategic choice of high tech firms.

HC-14.2 - Optimizing Resource Allocation for Earthquake Retrofit in Portland, Oregon

Thomas McCormack, St. Martin's College
Franz Rad, Portland State University

Cost-benefit analysis is used to select an optimal group of buildings for earthquake retrofit, maximizing the number of lives saved and value of property damage avoided per dollar spent. An analysis of Portland identifies an optimal retrofit program consisting of 12 percent of the building inventory, resulting in an estimated 98 percent reduction in loss of life.

HC-14.3 - Analyzing, Modeling and Simulating the New Business and Market Development Process

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In this paper we propose a methodology to model innovation processes. The modelling is based upon interviews with a number of experienced managers. The knowledge of these managers is codified using cognitive mapping techniques. Subsequently these cognitive maps are translated into causal diagram and ultimately in a computer model. To keep the essentials of the non-linear behaviour of the innovation process intact during the modelling process of simplification, special attention is given to recognize the various non-linear mechanisms and driving forces. After each step, feedback is asked from the interviewed managers. Furthermore, the model is validated using some typical cases. Up until now the methodology is applied in cooperation with two companies, one in the steel industry and one in the food industry. Both companies have decided to continue the exercise and after further elaboration use them as support tools in strategic decision making.

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