


Dr. Sam Limo specialized in Digital Communication. He successfully defended his dissertation, “Investigating the Determinants of Organizational Intention to Use Push to Talk Over Cellular Technology and Related Innovations” in March 2015 (pending award).
Technology Management, a sine-qua-non for the globalized world marketplace

The 1990s with the signing of major trade treaties like NAFTA and the entry of China into the World Trade Organization created sharp challenges to corporations in the USA. The doors to the world were essentially thrown open and companies started a race to gain price advantages in manufacturing and labor costs. They also had access to a world market in engineering and design talent predominantly in Asia Pacific, specifically China and India. This initiated a process of relocation of manufacturing and R&D from the west to the east. Design centers were opened in several cities in Asia, entire production lines moved to locations in South America and the Orient to lower production costs.

The decade starting with year 2000 saw a new paradigm in new product development. Product design and manufacture became a multi-sited global operation. To quote one significant example, Nokia made phones which had Texas Instrument processors designed in India and France and manufactured in Taiwanese semiconductor fabrication plants. Application and System software for the phones was created in India and system testing conducted in Santa Barbara California before final release.

The above example highlights the following challenges in technology management:

1. Differing time zones
2. Different nationalities, cultures and languages
3. The need for better team work is now exponentially increased
4. Intellectual Property (IP) management demands coverage over multiple continents and carries more risk
5. The continuous dialog needed between engineering and manufacturing is logistically complicated due to the time zone and language differences
6. Different regulatory regimes impose greater demands on legal departments

The list above includes only the most important factors in a globalized product design effort. In such a context it is imperative that engineers and managers are trained to think with a global mindset regarding the ‘quality’, ‘cost’ and ‘time’ yardsticks of performance. Design centers now compete with each other and bid for work based on quality, cost and time.

Modern technology management curriculums train students to succeed in the arena of corporations competing on a global stage. Students are trained in Six Sigma techniques and Lean Manufacturing concepts that find direct application in the evaluation of engineering groups and their design techniques. Legal courses in intellectual property management equip students with a knowledge of how IP is identified, managed and safeguarded across national boundaries.

The cornerstone of the technology management degree is training in research methodology. It culminates in the fruition of a research thesis. Internships courses where a program of work on a specific topic can be planned with a faculty member for exploratory research on which a final thesis can be based. This gives a technology management graduate tools that can be carried into the workplace directly and applied. Working individually with a Program Planning Committee Chair who has experience in industry and is acutely aware of the leading edge of academic research is invaluable.

To sum up, technology management is a specialized field which demands special skills for success in a globalized economy. A program in Technology Management is a sine-qua-non for success in the modern, multi-sited global corporation.

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Construction Management

As a technology management practitioner, it is important to understand that developments in one industry or field of study can affect another. Currently, the construction industry is utilizing Building Information Modeling (BIM). BIM is a process in which the building model, schedule and costs are all brought together into one system. This assists the construction industry by helping to reduce cost and allows individuals to better visualize the construction process.

Once the construction process is finished these models can still be utilized this time by the owner of the project. There has already been some industry discussion about using BIM models in retaining construction information to assist with the maintenance of the structure. However, another area BIM models can assist is within Human Resources and Industrial Training. These model are representative of the 3-D space within a structure, they can be utilized for safety training of employees to raise awareness of fire exits, extinguishers and first aid kits located within the structure. If more in-depth training is required then these 3-D models can be imported into video game software. That way a simulation could be developed to allow an organizations emergency response team to practice within the structure without having to disrupt individuals working.

This is just an example how a process in one industry can be implemented into another. Technology has a wonderful way of being flexible between industries. As Technology Management practitioners, we have a responsibility to seek out and understand how technology can assist other fields!

Digital Communication

Security Weaknesses in Industrial Network Protocols

What is an industrial network protocol? A network protocol is a pre-arranged communication method between two devices. The most ubiquitous protocol that connects computers on a network together is the Ethernet protocol. Now consider a manufacturing shop floor. There are many intelligent devices in a shop floor that control manufacturing processes and automate assembly line tasks. A PLC or Programmable Logic Controller is the equivalent of a PC with the difference that it carries out control tasks like controlling the speed of a conveyor belt rather than run spreadsheets, word processing or an email program.

PLCs can be connected to each other over networks using protocols that are called industrial network protocols. Two good examples are Fieldbus and Profibus. Industrial networks have lagged behind computer networks in the area of security. It is very easy to eavesdrop on an industrial network to collect data or compromise devices.

One of the well-known cases of industrial network espionage was the Stuxnet worm. Stuxnet was intended for the nuclear enrichment facilities at Natanz and Bushehr in Iran [1]. The transmission vehicle was a USB flash drive which when plugged into computers would initiate the infection. It carried out a man-in-the-middle attack on the Profibus network that connected PLCs. The PLCs controlled the speed of the centrifuges which was a vital step in the nuclear raw material enrichment process. Iran’s nuclear program suffered as a result of this attack.

Reference:

Manufacturing systems

A Disruptive Technology in Manufacturing

Clayton Christensen is credited with coining the phrase disruptive technology in his 1995 HBR article as a technology that “…introduce a very different package of attributes” (Bower & Christensen, 1995). A manufacturing technology that certainly brings a different package of attributes and one regularly characterized as a disruptive technology is Additive Manufacturing (AM) (LLNL, 2015). Conventional or subtractive manufacturing starts with a raw stock and removes material to achieve the final product. In contrast AM, commonly recognized as 3D Printing, is a lean process that forms the end shape by adding material. AM technology is finding application in the aerospace and medical device industries and rapidly progressing towards broader commercial applications through R&D funding and general global interest.

The AM process was initiated in 1986 by Carl Deckard, the system combined CAD and computer control to create a process that selectively laser sinters parts layer by layer. The original inspiration behind AM was to create prototype parts, hence the early label “Rapid Prototyping.” With the advancements in computational power and the realization of the benefits of complex external and internal geometries, AM is making headway as a large-scale manufacturing alternative. Various processes exist, Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM) are a few. Mori Seiki has introduced Lasetec 65 AM, a five axis CNC Machine with integrated laser deposition AM, a video demonstration is at the link below. A significant effort is required for process control and material property characterization to advance the technology, but it is hard not to associate the overused disruptive technology term with AM.

References


Human Resource Development & Industrial Training

The Performance Prism

Of the various existing performance management models, the performance prism has seen the light through Neely, Adams and Kennerley in 2002 to address the complexity of an organization’s rapport with its various stakeholders, within the environment of its unique operational and functional setting. The performance prism is a prevailing and comprehensive framework that guides the management’s attention to the important aspects for a long lasting success and practicality, which will enable organizations to plan, construct, manage and control, and revitalize their performance management and measurement systems in a manner that is appropriate to the particular atmospheres of their working environments. According to Neely, Adams and Kennerley (2002) “a prism refracts light, it illustrates the hidden complexity of something as apparently simple as white light. So it is with the performance prism, it illustrates the true complexity of performance measurement and management” (p. 5).

The performance prism is a based on the notion that organizations thrive to be successful and maintain their success in the long run in a business world that is constantly changing. The performance prism attempts to establish five different fundamental organizational questions for management to draw upon, in order to assess the true scope of the organization’s performance management issues, which provide a comprehensive outlook on the performance. The five facets of the Performance Prism encourage the managerial core to reflect on and respond to these subjects: 1- Stakeholders’ satisfaction, 2- Stakeholders’ contribution, 3-Strategies, 4- Processes, and 5- Capabilities.

The organization’s strategic orientation for a long lasting success.

The performance prism is one of the recently elaborated performance management models, it is considered to be a second generation performance management framework since it was recently created in 2002. Its particularity as a unique framework lies in its ability to include all the company’s stakeholders in the process, which increases an organization’s chances of reaching its desired goals and satisfying all its stakeholders.

Reference

The American Society for Quality (ASQ) is holding their annual conference May 4-6 in Nashville, TN. The theme for the conference this year is “Transforming the World Through Innovation, Inspiration, and Leadership. The focus areas for this year’s conference are: Innovation, Leadership, Risk and Change, Practical Application of Quality Tools, Techniques, and Methodologies, and The Future of Quality. For those who have never attended the conference, it can be a great place to network and keep up to date on the latest issues and breakthroughs in quality and related fields.

ASQ is considered one of the leading organizations in the U.S. in the field of quality. They offer training, certifications, and literature in the field of quality. They provide certifications as a Biomedical Auditor, Calibration Technician, HACCP Auditor, Software Quality Engineer, and many more. Another important aspect of the organization is the opportunity to actively participate in local sections, publish papers or journal articles, and a vast library of quality related publications that are an excellent source for research and information. More information can be found at: http://asq.org/index.aspx

They have a link to universities that offer programs in quality fields. Here is the link to ISU:

Reference

http://asq.org/qualityprogress/tools-resources/college-university-programs/indiana.html
Lake Erie, part of the Great Lakes system in North America supplies water to around 23.5 million Americans [1]. The city of Sandusky in Ohio is one of the cities that depend on Erie for their water. Algae blooms that occur every year in the lake affect water quality and make it unusable. A team from Bowling Green State University is now leading an effort to study the algae blooms. The effort is to be concentrated on detection and early warning. The project leader is Dr. George Bullerjahn a professor of biological sciences. Dr. Bullerjahn’s current research interests concern microbial physiology and cyanobacteria which makes him well qualified to delve into the algae bloom problem. Specifically on his web page he talks about ‘nitrifying communities in freshwater environments’.

Algae blooms thrive in nutrient rich waters that contain nitrogen and phosphorous. These are the two main inputs for fertilizer which enter rivers and streams from farms and eventually end up in lakes. The water rich in these plant nutrients then causes algae blooms [2]. The project team also includes Dr. Michael McKay who is the director of the Marine Program at BGSU. Sensors are deployed in the lake and will gather and upload data via satellite link and sent to the team’s cellphones creating a real-time data acquisition network. The team’s work is particularly in pressing need considering that last summer Toledo residents had to bring water from outside the city when an algae bloom hit their water supply. The problem is seen as so serious that the Ohio regents allocated $2 million to investigate the cause of the nutrient richness of the water, dead zones, agricultural impact and human health.

References

On March 2nd it was announced that the Golden LEAF Foundation has awarded a 1.75 million dollar grant to East Carolina University in partnership with Pitt Community College to establish the Biopharmaceutical Workforce Development and Manufacturing Center of Excellence. The need for this center was recognized because regional pharmaceutical employers such as Patheon, Hospira and Manyne Pharma continue to expand their operations in the area around East Carolina University. These firms require employees who are technically skilled in drug design and discovery, packaging development, manufacturing and quality control/ assurance. These new employees would add to the already over 8,000 individuals employed in pharmaceutical manufacturing in the region. This center of excellence has four main goals: 1. Educating students and workers for highly-regulated pharmaceutical development and manufacturing environments. 2. Enabling workers to be immediately productive in complex jobs requiring multi-disciplinary skills, knowledge and abilities. 3. Reducing initial time to productivity for new workers and associated costs of mistakes. 4. Equipping students and workers with sufficient cultural, business and regulatory knowledge.

In conclusion Ted Morris, associate vice chancellor states that “ECU continues to play a leading role in the growth of North Carolina’s advanced manufacturing industries and workforces”.

Students in a manufacturing technology course at Indiana State University worked on a technological project that required designing, manufacturing, constructing and testing aerial machines. It is also important to note that the parts used for the construction were manufactured using a 3-D printer. A project that created the buzz among the students and faculty community at ISU, and that has never been done before.

Dr. Alister McLeod in the college of technology assigned this challenge to his students as part of his class requirements. The students took the project seriously and had to come up with a plan to create tri-copter and quad-copter drones. One of the students testimonies revealed how challenging but fun the project was; the project required a lot of thinking and research. These machines parts are made in a brand new Stratus Fortus 3D printer on campus. It has also been reported that the 3-D printer cost the College of Technology at ISU at a total of $60,000, which
purpose of this project has also required the students to have a better understanding of how new technology are being introduced. The students and the faculty in the College of Technology have learned a lot from this experience, and it is clear this type of experiential learning projects needs to be sustained to allow the students to have the best hands-on-learning experience.

Reference:

North Carolina A&T State University

Winter Pollution Study at NCAT
Members of the NCAT Atmospheric Chemistry and Physics Group are working with scientists from 14 other institutions this winter to study the dynamics of winter time air pollution. The study is focusing on the Mid-Atlantic region and will gather data that will shed light on how chemical processes that are involved in pollution vary in the winter time.

Pollution is a year-around occurrence but the way it works in the winter has not been studied as much as it has during the summer months. This project is being done under the aegis of the National Oceanic and Atmospheric Administration (NOAA) and specifically it is called Wintertime Investigation of Transport, Emissions and Reactivity (WINTER) an apt acronym.

During the warm summer months that are more photo chemically active there is strong oxidant formation which leads to quick production of secondary pollutants like ozone and organic aerosol. In winter, primary pollutants that are short lived like NOx (mono-nitrogen oxides, NO and NO2, VOC (Volatile Organic Compound) and SO2 (Sulphur Dioxide) oxidize more slowly. Since they are therefore present longer in the atmosphere they tend to affect wider geographic areas that are down wind. There is little data presently to understand this.

The data collection is to be done using NSF (National Science Foundation) C-130 aircraft for a period of six weeks. Data collection from an aircraft is not straightforward as Dr. Marc Fiddler one of the A&T research chemist states. Factors like weight of the instrument, power consumption, size and fast sampling due to the speed of the plane have to be factored in.

References

University of Central Missouri

The UCMO Launches Alumni Advisor Network
In a move to improve the networking capabilities and expand on job opportunities of UCMO’s 13,000 students, UCMO has partnered with Evisors to create a career-advising network. This network is designed to connect the more than 86,000 UCMO alumni with the current student body to help mentor, conduct mock interviews, critique resumes, and provide career advice. Networking has long been a source of job opportunities for students at other universities and UCMO is seeking to take advantage of networks to help place their students in today’s extremely competitive job market.

The network allows alumni to either create an account or import their LinkedIn profiles and takes approximately 3 minutes to complete. Students can register with their UCMO email account and be in the system within a few minutes. For those UCMO alumni and students interested in the network, it can be accessed at https://ucm.evisors.com/. Since the January launch of the network, more than 250 alumni have signed up, with more rolling in daily.

This information was originally reported by Dalene Abner of UCMO and the full write-up can be accessed at: http://www.ucmo.edu/news/alumni_advisors.cfm
Dr. Gerald W. Cockrell is a Professor Emeritus of Electronics and Computer Engineering Technology at Indiana State University, Terre Haute, with a B.S., M.S., from Indiana State University, and Doctorate from Indiana University, Bloomington. He was awarded the Honored Doctorate from St. Petersburg State University of Aerospace Instrumentation in Russia in 2008. His area of specialization is in Process Automation Systems and Project Management. He has done consulting in these areas for a number of Indiana-based and international corporations.

Dr. Cockrell has presented numerous papers on Internet based distance laboratory methods. He develops and presents industrial training programs in the fields of automation systems technology and project management to students around the world. He has written two books on project management for the technical professional.

He served as PI and project manager for a major grant awarded by the National Science Foundation. The AutomationTek program delivers interactive technician training modules to students in two and four year degree and non-degree programs.

Dr. Cockrell served as ISA President in 2009. He continues to offer education and training programs to industry.

Dr. Sharon Rouse is one of recent graduates and is the Director of Engineering Technology at Mitchell Community College in Statesville, N.C. Her career started in the community college system as a machining and manufacturing student. While working in manufacturing, she attended school and taught part time until she became a full time instructor for Machining Technology as the only female machining instructor in the state. Now as a director, most of her work is administrative, however she still teaches machining, manufacturing, and mechanical engineering courses at my school and on site at local companies.
GENERAL INFORMATION

The consortium program is offered in cooperation with Bowling Green State University, East Carolina University, Indiana State University, North Carolina A&T State University, and the University of Central Missouri. The doctoral program meets the needs of today’s technical professionals. An academically rigorous program of study, the Doctor of Philosophy Program in Technology Management offers research and scholarship experiences and in-depth study in a specialization selected from the areas of:

- Construction Management
- Digital Communication System
- Human Resource Development and Industrial Training
- Manufacturing Systems
- Quality Systems

For Additional information about the PhD in Technology Management, visit our website at http://technology.indstate.edu/consortphd/
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Profiles
Dr. A. Mehran Shahhosseini is the Director of the PhD Program Consortium.
Siham Lekchiri was admitted to the PhD program in Fall 2010. She specializes in Human Resource Development & Industrial Training.
Anand Richard was admitted to the PhD program in Fall 2014. He specializes in Digital Communication.
Bryan Waineo was admitted to the PhD program in Fall 2013. He specializes in Manufacturing Systems.
Larry Brown was admitted to the PhD program in Spring 2013. He specializes in Quality Systems.
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