Center for Innovation in Product Development (CIPD)

Massachusetts Institute of Technology

Innovation in product development - new ways to define, design, and deliver products and services

The Vision: CIPD foresees a dynamic future for product development:
new products will be developed through just-in-time collaborations of globally distributed teams linked seamlessly by web-based tools and processes. The collaborations will be formed by means of a "services marketplace" where lead firms will find the world's best "knowledge purveyors"-suppliers of information, components, and support services. The Mission: we will lay the conceptual groundwork for, and contribute core components to, a product development infrastructure that will help companies succeed in the services marketplace that we envision.

In pursuing this mission, we use industrial sites as our laboratories. Working with engineers and managers in product development (PD) environments, we extend our fundamental understanding of the PD process and provide innovative improvements to current practice.

CIPD is an interdisciplinary program between MIT's School of Engineering and Sloan School of Management. We link the best ideas of academia with the best experience of industry to drive our research, education, deployment, and outreach programs. The entire product development system becomes our domain as we help companies to conceive, develop, deliver, and support families of products and services.

Research

CIPD research is directed by our vision that product development will be dispersed, global, and driven by new information and communication technologies. As product development becomes increasingly complex and distributed, our research provides the breakthrough knowledge, tools, and methods that can propel an organization's PD teams. CIPD researchers investigate those facets of product development that allow organizations to fully exploit today's constantly changing markets and technologies. We pursue seven integrated research initiatives that span the entire PD process:

Virtual Customer (VC): Our VC initiative bridges the gap between the marketplace and the product designers by bringing the customer directly into the PD process. Recent advances in on-line data collection allow product developers to engineer systems at almost the same time that they gather customer input. Developers can now dramatically cut the lag time between product deployment and customer response. We provide tools and methods for getting customer input rapidly, effectively, and inexpensively.

Platform Architecture (PA): If a firm produces only a few simple products, it can successfully develop each of

them independently of the others. As the firm increases the number and complexity of its products, however, it increases its PD effectiveness by evolving from a product-by-product approach to a system approach-one that considers the simultaneous development of a portfolio of products with common features. We call the set of common features the product platform. For example, an auto manufacturer might produce a frame or chassis that is common to several of its vehicles, thus saving substantially in development and production costs. Our PA initiative helps firms to evolve from a product-by-product approach into a rapid and multi-product system-by-system approach.

Distributed Object-based Modeling Environment (DOME): Computer systems that model new products can be overwhelmingly complex. For example, the design of an automobile door can require the coordinated efforts of dozens (if not hundreds) of designers, engineers, and suppliers. Each may work simultaneously in distant locations and on radically different platforms. Project DOME integrates these efforts in a user-friendly Web-based environment that allows all developers to take part in the modeling process at the same time. They can do this (1) without intermediary assistance from computer programmers, (2) without departing from their preferred set of product development tools, and (3) without losing control of proprietary information.

Information Flow Modeling (IFM): This initiative explores visual representations of the PD process-models that aid product developers and managers in understanding the multifaceted systems they work within. We can present information flows as task models, design parameter models, organizational models, or combinations of these. We can simulate these models dynamically and obtain statistical predictions of time and cost. By distilling intricate PD systems into their essential components, we can provide maps through domains of increasing complexity.

Incentives and Boundaries (IB): Because we are developing concepts, methods, and tools that work in real organizations, our research focuses not only on PD's technical aspects, but also its social, organizational, and competitive context. Real people in real organizations act in their own best interests. Effective organizations encourage their people with incentives that benefit both the individual and the organization. In the services marketplace that we envision, incentives must cross the internal boundaries of the organization and reach the virtual enterprises beyond it.

Implementation Dynamics (ID): Many organizations attempt to improve their product development process,

only to face struggle and ultimate failure. Even though people within the organization may favor the new tools and methods over existing ones, many organizations' attempts at process improvement fail. Why? This initiative seeks to understand (1) the dynamics of PD process improvement, and (2) the design of sustainable improvement programs.

Product Development Integration Laboratory (PDIL): CIPD established the Integration Lab to foster intellectual ties with engineers and scientists from industry. We want to facilitate a two-way flow of ideas that encourages their participation in the Center's research and education programs. We also want to assist in the transfer of knowledge and technological advances to industry.

Industrial Collaboration/Technology Transfer

From its inception, CIPD has involved its sponsor organizations in every phase of its development. Our sponsors serve as co-owners of the Center. They benefit from CIPD's achievements, and in turn help to define the research, deployment, and education agendas. Through the efforts of the Governing Board and the Executive Council, both of which include senior industrial representatives, sponsors review the Center's strategic plans and guide its programs. In addition to suggesting key areas of research, they also provide locations to implement that research, an arrangement that establishes the first stage in the deployment of groundbreaking ideas. Moreover, the needs of our sponsors guide the development of our courses and degree programs; sponsors themselves help to develop and to teach those courses.

Deployment is actively underway on a company-by-company basis. The Center has established a network of people who contribute to the Center research, deployment, and educational programs at each sponsoring company. Our practice of conducting student research at company sites plants the research results firmly within industry, and builds advocates inside the company.

Education

CIPD's educational strategy is to train product development professionals who can drive major improvements in PD capability. We structure our educational and outreach programs to provide the curricular materials, course offerings, and degree programs for engineers, industrial managers, graduate students, undergraduates, and high school students that integrate the best in formal education, ongoing research, and industrial practice. The best ideas of our research and deployment programs continually feed the education curriculum.

PD21, the Education Consortium for Product Development Leadership in the 21st Century, is a joint effort between MIT and the Rochester Institute of Technology, University of Detroit-Mercy, and Naval Postgraduate School-Monterrey. This consortium has developed a master's degree program in product development that offers a dual degree in engineering and management. The program is distinguished by a rigorous PD curriculum that can focus on specific industry sectors.

Corporate PD courses developed at universities and corporate sites offer product development professionals access to new ideas, tools, and methods generated by our research.

A new family of *graduate courses and majors at MIT* joins management concepts with those of engineering in the context of product development.

Undergraduate courses teach the process of competitive product development in both engineering and management education at MIT. Product development is a "contact sport," and CIPD helps students to realize it as an extremely exciting career choice.

The Center's *REU Program* partners with MIT's Summer Research Program to bring talented women and underrepresented minority students to MIT's research laboratories under the tutelage of experienced scientists and engineers-Center faculty members, postdoctoral fellows, and advanced graduate students.

Project FAIHM (pronounced "fame," an acronym derived from the project's members-FIRST, Autodesk, Institute for Women &Technology, Hewlett Packard, and MIT): this program encourages young women to become leaders in the design of technology. CIPD joined with the other project partners to build a program that engages young women and their high school teachers in FIRST Robotics Competitions. FIRST (For Inspiration and Recognition of Science and Technology) is a national program that organizes an annual competition for high school students and their academic and industrial mentors.

Facilities

CIPD students use numerous facilities throughout MIT. The Pappalardo Lab, a 20,000 sq. ft. prototyping facility, can accommodate a wide variety of state-of-the-art equipment. The Undergraduate Product Development Laboratory is a 25,000 sq. ft. facility established in part by CIPD with an equipment grant from NSF. The Product Development Integration Lab (PDIL) can demonstrate the feasibility of Web-based product development systems that integrate CIPD research with that of commercial

enterprises and other universities. The lab also makes new technologies available for undergraduate, graduate, and professional education.

CIPD headquarters are on the second floor of MIT's historic Building E60. While Center faculty generally have offices in their home departments, some of their students have offices in Center headquarters. Other student offices and lab/demo space are in newly renovated rooms near the Department of Mechanical Engineering in MIT's Building 5.

Center Configuration

The Center is an interdisciplinary research and education program that joins students and faculty from MIT's schools of management and engineering. Moreover, more than 75 engineers and managers from collaborating companies actively contribute to the Center's programs. Center engineering team members are from the School of Engineering's departments of aeronautics and astronautics, civil engineering, electrical engineering and computer science, and mechanical engineering. These departments house more than 75% of the engineering students at MIT. In addition, about 20% of the faculty members in the Sloan School of Management participate in the Center's research and education programs.

Center Headquarters

Center for Innovation in Product Development
Massachusetts Institute of Technology
Building E60-205
77 Massachusetts Avenue
Cambridge, MA 02139

Tel: 617-253-3645 • Fax: 617-258-0485
Email: cipd@mit.edu
Homepage: http://www.mit.edu/cipd

Center Co-Director: Prof. Maurice Holmes
617-258-0566 • mholmes@mit.edu

Center Co-Director: Prof. Steven Eppinger
617-253-2045 • seering@mit.edu

Executive Director: Mr. Nils Nordal
617-253-8754 • nnordal@mit.edu

Director of Industrial Collaboration: Ms. Kathleen Wang
617-253-4748 • kwang@mit.edu

Acting Communications Coordinator: Mr. Michael Mack
617-258-0693 • mmack@mit.edu