TECH TRENDS IN PLM UPDATE

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MARCH 2011

SAVE THE DATE:
THURSDAY, APRIL 7
DESIGN/SIMULATION COUNCIL WORKSHOP
Details on p. 2

Scorecard and Benchmark for Digital Manufacturing Systems

Rich Wells, Program Director, Mechatronics Council for Digital Manufacturing, CPDA

Collaborative Product Development Associates (CPDA) has completed an industry scorecard and benchmark assessing the relative positions of leading users and the maturity of their digital manufacturing practices. The scorecard captures input from over a half-dozen industry leaders and ranks these companies across five broad categories. Scorecard participants included high volume producers from the consumer goods and food processing industry, along with medium volume producers from the automotive sector, and lower volume producers from industrial machinery industries.

The digital manufacturing scorecard seeks to establish a framework of common terminology for integration and optimization of the diverse activities currently fragmenting manufacturing design efforts. It covers five high level categories that include thirty-two specific criteria. These were assessed

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Digital Manufacturing: Challenges and Best Practices

Panel Discussion on the Top Priorities for End Users and Solution Providers

Moderated by Rich Wells, Program Director, Mechatronics Council for Digital Manufacturing, CPDA

Leading end users and vendors gathered at PLM Road Map™ 2010 to discuss critical issues companies face with Digital Manufacturing, which offers the promise of improved productivity, sustainability, and quality through the leverage of manufacturing simulations, information management, and real-time controls.

Kicking off the panel discussion, Tim Storer of Procter & Gamble commented on knowledge re-use, the top priority for users participating in CPDA's Benchmark for Digital Manufacturing. The reuse of models and designs transforms exploratory knowledge into a base commodity where it becomes extensible and portable. It may then be reused in multiple places without having to reinvent the knowledge. It is not just a way to speed up the efficiency of the P&G design process in the front end, but it represents an essential approach for global management of complexity.

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2011 EVENTS: MARK YOUR CALENDARS

WORKSHOP
Design/Simulation Council
Thursday, April 7
Cincinnati

WORKSHOP
Mechatronics for Innovation
June 8-10
Milwaukee

CONFERENCE
17th Annual PLM Road Map™
October 4&5
Metro Detroit

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Design/Simulation Council Workshop 2011

Thursday, April 7 **Cincinnati, OH**

Join CPDA and members of the Design/Simulation Council; explore the latest thinking on the critical issues facing design and simulation:

* Meeting the needs of the workgroup to manage simulation work-in-process data
* Simulation integrated with CAD: Is it for experts?
* Case studies: Knowledge capture and simulation automation
* A simulation framework: User requirements and a best practices scorecard
* Progress made and critical issues for the Design/Simulation Council

Learn answers to the following questions:

* What are the strategies for the successful implementation of simulation and CAE for product development and manufacturing?
* What are the priorities and critical needs of end users in the industry for simulation integration, and what is the current level of technology in response to those needs?
* What is the level of success associated with advanced efforts in applying analysis at the conceptual design phase?
* Why should my company be implementing CAE data management or a simulation framework?
* How do I develop a strategic case for implementing a simulation framework?
* What are the cultural and organizational barriers to implementation and how can I get beyond them?
* How do others successfully navigate the minefield of the status quo – installed PDM systems, corporate IT architecture standards, and the inflexible rules of established business systems?
* What pitfalls have been experienced along the way and how can they be avoided?

Presentation abstracts can be found throughout this newsletter for our featured speakers:

David Rottenberger, Procter & Gamble

Dr. Horatiu C. German, General Motors

Daniel O. Kim, Nissan Technical Center, NA

More information including registration for this event:
http://cpd-associates.com/download/index.cfm?download=DSCWorkshop411&company=

CPDA welcomes new advisors...

KEVIN C. CRAIG, Ph.D., and **FRED R. STOLFI, Ph.D.** have joined us as advisors on **Digital Manufacturing** and on the **Integration of Mechatronic Development.**

Bios can be found on pages 4 and 5 of the newsletter. Please join us in welcoming Kevin and Fred.

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during detailed three-hour discussions with the end users within each company, to ensure a solid understanding of their capabilities and their utilization of digital manufacturing processes and technologies. Interviews were conducted either by telephone or in person.

A ranking of maturity classifies company performance on a 1-to-5 rating for each of the criteria. The low end represents little capability often supported by ad hoc initial actions. The high end captures an optimized organizational management that includes deliberate activity optimization and continuous improvement.

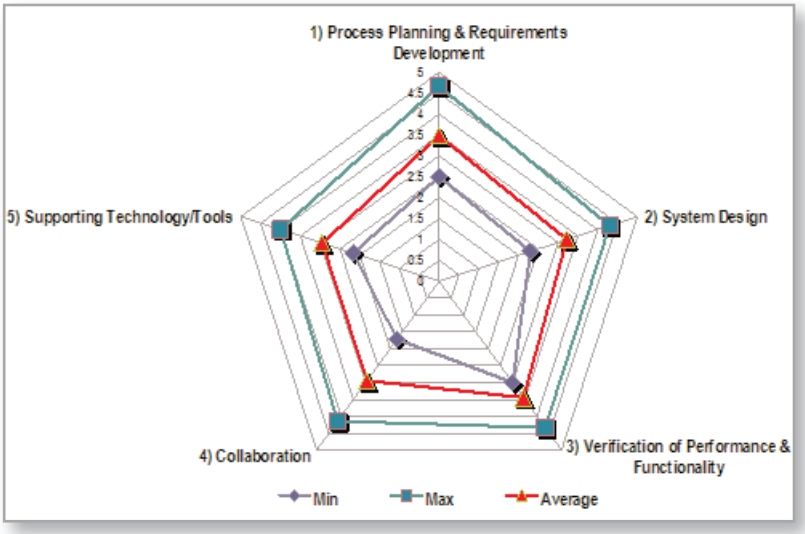

FIGURE 1: Digital Manufacturing – Summary of Results by Category

As summarized in Figure 1, the leaders reported strong results with an average maximum score of 4.3 across all categories. Mature optimization and continuous improvement practices occurred in each major category. However, few of the companies participating in the benchmark depicted a high level in most categories, contributing to a lower average score for the group overall of 3.2.

In general, this scorecard successfully captures the maturity levels for digital manufacturing across companies and industries. While maturity rankings align with expectations, wide variances appeared across nearly all the detailed criteria. Also, gaps were found in early planning and up-front manufacturing system design. By implementing the best practices documented in this report, companies can transform their business by reducing costs and offering greater product variety.

The comments below summarize several observations and recommendations within each major category of the scorecard. The full detailed report reviews the results for the thirty-two specific criteria.

Process Planning and Requirements Development

The planning of manufacturing processes and facilities encompasses a complex range of inputs, from customer requirements to existing capabilities, and capacities internal to the organization as well as those of suppliers. Knowledge of such information is generally dispersed throughout the enterprise and is often untapped when developing requirements for new projects. The gathering of such information and mapping to customer requirements requires extensive efforts and coordination. In general, most companies did a good job of supporting requirements reviews with external suppliers, but did not fully implement programs internally. While the participants generally did effectively assemble the relevant personnel at periodic meetings, they relied ad hoc on internal experts to resolve issues that arose, without systematically capturing their expertise. Methods and tools for knowledge capture and reuse should be implemented. There is also a need to develop and implement systems that link manufacturing and product parameters, to move away from document-centric to object-centric approaches, and to rely on simulation for capability and capacity planning.

"Methods and tools for knowledge capture and reuse should be implemented. There is also a need to develop and implement systems that link manufacturing and product parameters, to move away from document-centric to object-centric approaches, and to rely on simulation for capability and capacity planning."

One company in particular reported impressive and consistent efforts with strong results in five of the six criteria, while a second scored well in three. These strong results from the two companies, which

reflect focused and disciplined efforts, lifted the average to the highest level across all categories.

Manufacturing System Design
Results for this category reflect a strong focus on the end results such as quality and efficiency, with limited efforts in manufacturing to up-front issues that could be far more effectively addressed earlier in the development phases. Participants drive toward real-time production-line reconfiguration. Up-front simulation and design efforts would better leverage cost efficiencies.

Ten criteria represent digital manufacturing system design. One addresses the overall system design process. Five represent the classic simulation processes aimed at increased manufacturing efficiency. Four concern additional manufacturing goals such as safety, sustainability, flexibility, and quality.

Manufacturing Verification of Performance & Functionality
Verification involves the process of quantitatively comparing the results of an activity to original requirements. This category focuses on three key verification criteria covering early simulation activities for manufacturing processes, initial efforts to commission a manufacturing line prior to production launch, and ongoing quality and efficiency checks while in production. The results-oriented manufacturing organizations depicted typical priorities within these three phases of verification. That is, the monitoring of key performance metrics takes precedence over all pre-launch activities on the production floor.

With the second-highest average rating, the strong results for this category reflect the current focus in manufacturing to concentrate on the end-of-the-line results rather than leveraging efforts up front. The need arises to strengthen process simulations to reduce time necessary for pre-launch activities. Similarly, confidence must be improved in simulation fidelity with closed loop verification processes.

Collaboration
Collaboration represents one of the two most challenging categories among scorecard participants. People initiatives within the organization often define the success of the enterprise. Synergies develop when employees understand their roles and responsibilities, readily access pertinent information, and are actively involved in decision-making. The scorecard attempts to capture the maturity level of digital manufacturing collaboration among successful companies. Participants generally consider themselves needing the most improvement in this category and average ratings are consistently among the lowest of all categories. Software must provide smooth transitions for data transfer across functions and domains. Users must find, create, and mentor innovative platform leaders to accelerate use of digital manufacturing initiatives. Moreover, many still must advance from relying on engineering change notices to an enterprise change management system that keeps all involved updated on a real-time basis.

Supporting Technology and Tools
This category presented the least variation among participants with the companies demonstrating a strong emphasis on results. Weak up-front efforts pulled the results down such that the category represented one of the two most challenging among scorecard participants. There needs to be a concerted effort to leverage early

KEVIN CRAIG, Ph.D.
has joined CPDA as an advisor on Digital Manufacturing and on the Integration of Mechatronics Development.

Kevin first presented for CPDA at PLM Road Map™ 2010. In 2008, he joined the faculty of the Marquette University College of Engineering as a professor in the Department of Mechanical Engineering, and as the Robert C. Greenheck Chair in Engineering Design. His mission is to integrate discovery learning and multidisciplinary design throughout all years and all departments in the college. Previously, he served eighteen years at Rensselaer Polytechnic Institute as a professor in the Mechanical Engineering Department and also as the Director of Core Engineering for the School of Engineering. He taught and conducted research in mechatronic system design, control systems, modeling, dynamics, and the study of active materials and their application in design. He developed the Mechatronics program at RPI, which included an extensive teaching and research laboratory and several graduate and senior-undergraduate-level courses in mechatronics, and he graduated twenty Ph.D. students in mechatronics. Kevin received the 2006 RPI School of Engineering Education Excellence Award and the 2006 RPI Trustees' Outstanding Teacher Award. He is the author of over thirty refereed journal articles and over fifty refereed conference papers.

lifecycle technical decision making. Also, digital manufacturing software must combine industry best practices with system intelligence to support simplified user interfaces and to drive multi-physic capabilities.

Top Priorities
Each of the participants selected three of the thirty-two criteria that represent the highest value to their companies, and thus are the most important to focus on for improvement.

Overall, the survey respondents ranked two future priorities as their highest. First, participants across multiple industries focused on the need to capture lessons learned. Second, they concentrated on the need to improve collaboration across technical functions, fully supported by change management systems that update all personnel in real time rather than relying on ad hoc manual systems using Word or Excel.

The full report analyzes the detailed results for the thirty-two criteria in the five categories, and highlights specific issues that require attention. In general, three consistent themes are reinforced that have already been highlighted above. Extension of digital manufacturing methods up front in the design process continues to present an area needing improvement. Collaboration across functions and mechatronics domains continues to challenge organizational effectiveness. Capturing and utilizing lessons learned from previous projects represents a priority going forward.

For a listing of best practices documented across all criteria, the report appendix details both typical characteristics and best practices for each of the five broad categories of the scorecard.

Rich.Wells@cpd-associates.com
(Published 1/6/2011, 23 pages) *Download the full report **here**.*

FRED STOLFI, Ph.D. joined CPDA as an advisor on Digital Manufacturing and on the Integration of Mechatronics Development in early 2011.

Fred has over twenty-five years of proven experience in all aspects of advanced product development, engineering management, research, analysis, modeling, simulation, design, development, and testing. As a senior lecturer and adjunct associate professor, Fred currently teaches in the Mechanical Engineering department of Columbia University, with over ten years of experience in education. He designed, developed, and teaches a highly rated new graduate course in Mechatronics and Embedded Microcomputer Control. Previously, he formed ELMETECH (ELectro-MEchanical TECHnology) LLC, an independent engineering consulting firm. Fred served as a project leader and research scientist for Xerox Corporation from 1988 to 2001. He worked with Philips Electronics beginning in 1979, and he started his career with SCM Corporation in 1976, where he was a member of the technical staff. The holder of nine U.S. and foreign patents, Fred has published over thirty papers in the areas of engineering design, mechatronics, control systems, and cryogenics.

Design/Simulation Council Workshop 2011

Thursday, April 7 – Cincinnati, OH

Featured Case Study #1:
Applying SLM in Consumer Packaged Goods

David Rottenberger, Procter & Gamble

Procter & Gamble has chosen Dassault Simulia's SLM product for Simulation Lifecycle Management. In this talk David Rottenberger will share P&G's experience to date with implementing SLM in a CPG company. P&G leverages modeling and simulation across a broad range of scientific and engineering work processes, in such domains as consumer, molecular, biological, FEA, empirical, and manufacturing. As the IT Manager for P&G's M&S community David has a unique vantage point regarding the opportunities and challenges related to SLM.

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The primary method for accelerating re-use stems from establishing and supporting a culture that seeks to commoditize knowledge as quickly as possible rather than hold that knowledge just in individuals. Given the capabilities of the design tools serving mechanical and electrical CAD, control or process management has the fundamental capability to meet our needs the majority of the time. P&G is able to reuse the design components from the mechanical side and sub-circuits from the electrical CAD, as well as software algorithms in the controllers. Assembling all these elements together has been their strategy.

Just a few years ago, the company primarily created designs entirely from scratch. Today, a significant portion of its efforts reuse directly or build on previously existing designs. Tim expects that effort to double as they continue improving efficiency.

Today, there is a lack of complete knowledge within any particular user group. Moreover, it will be cost-prohibitive for one single set of users to try to solve this challenge on its own. The solution needs to grow organically across industry. Forums like this conference with cross-industry collaboration represent a method for all of us to effectively promote the re-use of our entire cross-disciplinary knowledge.

Axel Rodriguez from Rockwell then reviewed efforts by his company and the controls industry in general to help manufacturers reuse information in designing effective control systems to support production. About ten years ago, a transition began from the traditional Programmable Logic Controllers, or PLCs, into Programmable Automation Controllers, or PACs. The new PACs make it far easier to build data structures because they are closely related to the actual needs and better aligned to other disciplines. They support the ability to implement a modular approach to configuring the control devices. It started with the packaging of pieces of code without an association to particular functions. The next level built on pieces of control data that directly relate to the user's equipment. This enables users of particular equipment

"The primary method for accelerating re-use stems from establishing and supporting a culture that seeks to commoditize knowledge as quickly as possible rather than hold that knowledge just in individuals."

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Design/Simulation Council Workshop 2011

Thursday, April 7 – Cincinnati, OH

Featured Case Study #2:

Model-Based Systems Engineering Integrating SysML and CAD

Dr. Horatiu C. German, General Motors

The process of electrification of automobiles is a good example of new / emerging technology applied in an existing sector that highlights the need for a systematic approach towards designing and engineering the products. It also presents an excellent opportunity to embrace and implement new ideas and technologies that can help reduce the time-to-market and improve the robustness for our vehicles.

This presentation will take a look at one such new approach, Model-Based Systems Engineering (MBSE), together with the underlying technologies and enablers. One major enabler of MBSE is a new, open-standard based, modeling language called SysML. There is an urgent need for integrating the tools that implement SysML within the engineering and IT environments used in the industry (i.e., PLM, CAD, CAE, CAT, and productivity packages). Results from a pilot project on integration between SysML and NX (the GM-approved CAD package) will be shared.

NEXT ABSTRACT

to store and reuse control objects from libraries that are associated to their equipment. The ability to create libraries of objects means that anyone who wants to use pieces of code associated to certain functions or objects across multiple disciplines can store that together with the rest of the functionality. It is then subject to change management.

As everyone moves toward better integration of the manufacturing disciplines with initial product design, this introduces the need for flexible import/export capabilities and open platform support. Everyone can do a much better job with the integration of the design of the product and the definition of how the product is actually manufactured. Rockwell also understands that there is no one single way or one single software tool in the market to solve the challenges. Even within companies, multiple tools will be used. Their approach is as open as possible and provides interfaces to whatever the customers decide to use.

Daniel King from General Motors highlighted their development of a strategy for re-use of manufacturing knowledge with the Bill of Process, a description of how something is made. Typically, the bill of process covers the step-by-step description of how a product gets put together, or assembled, or produced from a machining, stamping, or injection molding process. It also describes all the inputs and outputs to manage with the process flow. Another important input, particularly in manual assembly and discreet manufacturing, is the labor.

One of the advantages with the bill of process approach is that it can be decomposed to drill down into increasing detail to readily illustrate how the bill of material was formulated. It can also describe items such as the actual machinery and equipment requirements to define a bill of equipment, including the tooling used. In regards to the labor content, it may drive down into the standardized-work job description for an assembler to detail the time taken, the job instruction sheets, and the ergonomic aspects designed by their industrial engineers. It provides a more complete overview of the manufacturing process as a planning tool to drive down into requirements planning for material, labor, machinery, and equipment.

Tom Hoffman from Siemens PLM then addressed the second highest priority for users in the CPDA benchmark concerning configuration and change management across functions and across mechatronics domains. The requirement to identify a single source must be clearly recognized, and the standardization of processes also entails legwork. Companies have to take a look at their organization and all the players involved to identify them and to make sure they are all on board with any proposed change. Those players must provide information about how they operate and their interactions with others. It has to be done up front to identify critical items such as the proper workflows. Who gets specific information and when do they get it? Everyone, including controls engineers and robotics engineers, has a function within the process.

In order to accomplish process standardization, a broader scope is needed. It's also critical to avoid becoming bogged down. By taking off smaller chunks, the needed flexibility can be built to control the data. This reduces the frustration out of otherwise overly complex and difficult implementations. Customers have been very successful with this approach. Honda presented at a recent symposium in Chicago, and stated that Siemens PLM really brought people and tools together. With all the people agreeing on a strategy and providing input, life was much easier with the implementation on the backend. *(Continues on p. 8)*

"The ability to create libraries of objects means that anyone who wants to use pieces of code associated to certain functions or objects across multiple disciplines can store that together with the rest of the functionality. It is then subject to change management."

Axel Rodriguez also commented that the need to control and monitor who makes changes has risen as security becomes a bigger issue. The security of the control systems and the risks of unintended access to system-level security will become an even bigger priority over the next several years, and the solution can leverage the enterprise-level change management.

Tim Storer and Dan King both discussed the need for collaboration across multiple functions, and the rising requirement for models and systems to talk to each other in real time. The interfaces between different simulation environments have become a high priority. Overall, the needs for manufacturing operations and controller logic are similar to many mechatronic systems models on the product development side. For an effective solution, the PLM software suppliers and the simulation software group in particular need to adopt the same approach as Rockwell has in opening up their interfaces.

They then considered the tradeoffs involved with one system that does everything versus the alternative of different systems all working together. From Procter & Gamble's perspective, the company will never have one single consolidated set of tools. Rather than forcing everyone to rely on one approach, multiple toolsets operate as clients of the overall data management system. These client tools specifically meet the complex needs of their particular environments. Then, P&G centralizes on one single tool, or method, for facilitating the collaboration between tools. By centralizing on this intermediary capability, any tools that connect within the framework provide unique flexibility and capability.

The panel discussion closed on the tradeoffs between best-in-class technology versus consistent data modeling. Legacy issues, re-use tradeoffs, standardization, collaboration across functional groups, and the frequency of changes all influence any decision to go with something new or to reuse a legacy approach.

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(Published 1/13/2011, 15 pages)

*Download the full report **here**.*

"From P&G's perspective, the company will never have one single consolidated set of tools. Rather than forcing everyone to rely on one approach, multiple toolsets operate as clients of the overall data management system. These client tools specifically meet the complex needs of their particular environments."

Design/Simulation Council Workshop 2011

Thursday, April 7 – Cincinnati, OH

Featured Case Study #3:

Implementation Frameworks of Simulation Data Management in Nissan Technical Center, NA

Daniel O. Kim

NISSAN TECHNICAL CENTER, NA

In recent years, one of the main challenges for Simulation Data Management (SDM) has been to create a value proposition to justify the cost of resources needed. To address the concerns stated and to make a business case in the actual work place, a practical implementation framework has been suggested in terms of process automation and data management along with design quality maturity. The suggested implementation framework includes the following steps in both process automation and data management: Step 1) process automation with automatic job submission, automatic catalog uploading and indexing for existing legacy data, Step 2) Single disciplinary common model, CAD meta data interface with common model and Step 3) Multi disciplinary common model creation and direct interface with CAD PLM system. A pilot project has been conducted on Step 1 and is planned on Step 2 in VDSS (Visual Decision Support System) developed by ESI Group, which considers Nissan's current vehicle development process. Promising ROI is expected by shortening model set up time through automated process as well as by streamlining the model update process associated with design release during digital evaluation phases.

More information including registration for this event:

http://cpd-associates.com/download/index.cfm?download=DSCWorkshop411&company=

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MARK YOUR CALENDAR

PLM ROAD MAP™ 2011

October 4 & 5, 2011

The Inn at St. John's – Plymouth, MI

PLM Road Map™ 2011 is a strategic conference focusing on the transformation of product development approaches to serve a new value proposition involving the detailed reconciliation of data and processes across global engineering functions.

Presentations will consider the global transformation of product development and its impact on the full product lifecycle including people and processes; how new tools and innovative technology can be used to address rising complexity; enabling synergistic integration across electronic, mechanical, and software disciplines; the lessons that can be learned by embedding simulation across the entire product lifecycle, and more.

Join top industry analysts from CPDA, key industry players, and front-line implementation experts as they share their experiences in making technology work, by driving efforts up front early in design, and by continuously incorporating cross-disciplinary knowledge and feedback.

Eye on Technology offers PLM Road Map™ attendees the opportunity to learn about the latest breakthroughs in PLM-related technology. Interact one-on-one with the hottest players in the industry.

Exhibitors: Opportunities are limited.

For more information about PLM Road Map™ 2011 or Eye on Technology contact Cheryl Peck: cheryl.peck@cpd-associates.com

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