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Best Practices for Implementing Digital Simulation and Analysis: *Five Lessons from Savvy Consumer Electronics Program Managers*





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Cutting costs without compromising quality – that’s the business driver for digital simulation and analysis use in today’s consumer electronics industry. Packing more features, capability and customer appeal into each new product is a baseline requirement for success. But fierce price competition is pushing manufacturers to reduce development and production costs even as they continue adding features and inventing new product. Another constraint – getting all this done within the industry’s brutally short product cycles, where time-in-market is often months not years and development schedules may be just 12 weeks. To discover how CAE usage is evolving to target this matrix of challenges, we interviewed program managers, engineering executives and discipline leads at some of the world’s top consumer electronics firms. From our research we distilled five best practices:

Manage simulation data and processes Practitioners singled out the dearth of commercially available “PDM for CAE” as their biggest unmet need today. To attack it, map CAE data flows to discover what tools need closer integration. Develop libraries of materials properties and correlations with physical test data. Document company-standard simulation work processes, and automate them. Seek out solution providers competent and willing to help integrate tools and craft data management environments that put simulation data in meaningful context.

Rationalize the make/buy decision Commercial off-the-shelf (COTS) solutions typically account for 70-80% of CAE usage in consumer electronics companies. But the internally developed applications that make up the remaining 20-30% are seen as delivering a major portion of the total value of CAE. Where these companies justify internal development is in areas involving proprietary knowledge that confers competitive advantage.

Optimize simulation/test tradeoffs A primary objective of using CAE is to reduce the number of physical prototypes required to develop new product. Indeed, a key metric for gauging the value of simulation is its success in reducing prototype counts – the business impact is to remove both time and cost from product development.

Qualify and select solution providers Unlike CAD and PDM decisions, CAE purchases are controlled by the analysis groups. Technical criteria are paramount in selecting point solutions. But in seeking CAE data management, tool integration and process

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optimization, factor in solution providers' competence in integrating diverse functionality, openness to integrating internally developed codes, data management foundation technologies, stability and longevity.

Manage people factors Tie the mission of the simulation team directly to the company's business goals. Elevate the focus from simply delivering analysis results to solving business and technology problems, and improving the company's processes for productizing technology and delivering it to market.

BUSINESS DRIVERS AND CONSTRAINTS

What business goals are best-practice leaders seeking through more effective use of simulation and analysis? Most important are cost reduction and quality improvement.

At one company we studied, the focus used to be quality, but today is cost:

"...the motivation to use simulation tools has shifted over time. It used to be that improving product quality was the primary driver. More recently, reducing cost has become a driver. [Our company's] annual report as well as other documents suggest that reducing cost is a high-priority corporate goal. The 2004 annual report explicitly states a target of 10% reduction of the total cost to sales ratio by March 2007. This will be achieved in part by 'a rethink of design concepts, standardization and sharing of components and modules.' Much of the company's manufacturing is now done in high-value centers like China..." – Japanese consumer electronics manufacturer A

At this company, criteria for gauging CAE's success are, first, reduction in prototype counts and, second, standardization and capture of corporate knowledge.

At another company we studied, emphasis has shifted the other way. The business driver for using CAE used to be reducing product cost to compete with low-cost manufacturing centers, especially China. But today the key driver is quality, to meet Quality Engineering (Six Sigma) goals:

"...quality is the primary driver – Quality Engineering (Six Sigma)..." – Mr. SAITO SEIICHI, Chief Technologist, Corporate Product Technology Group, and Assistant to GM, R&D Strategy and Planning Office, Fujitsu Laboratories Ltd.; Mr. KAZUYUKI UJIE, General Manager, Development Innovation Center, Corporate Product Technology Group; Mr. KOJI ITO, General Manager, System CAD Development Division, Corporate Product Technology Group; and Mr. MITSUAKI HASHIGUCHI, Director, Industry Business Unit, System Division; FUJITSU LIMITED

What simulation results are used for, and by whom, is also evolving. One company reports it has now expanded its application of CAE beyond analyzing product performance to include visualization and virtual-reality presentations of material qualities and appearance to project participants outside the analysis group:

"...simulation and analysis has recently become important as a tool for visualization, in addition to performance analysis. Higher-quality simulation enables all members of the design team to make decisions using the reference 3D model..." – Japanese consumer electronics manufacturer A



Beyond this, the company has moved to tie the mission of the simulation team more directly to the company's business goals. In the past, the focus was simply on making the best use of simulation technology. But today the team's mission is framed as solving business and technology problems, and improving the process of productizing technology and delivering it to market.

But maximizing CAE's impact involves much more than simply buying the best technology and handing it off to an analyst or discipline lead. Contemporary best practice also focuses on making more efficient use of existing resources – engineering staff, tool investments, corporate knowledge and processes. In fact no one we interviewed named software budgets as a constraint on the business impact of simulation and analysis – all identified time, human resources, and technology gaps as limiting factors.

"...we could not deploy more [CAE software] immediately, even if it were free..." – Japanese consumer electronics manufacturer A

The most important of these constraints is availability of analysts and skilled engineers, one company reports:

"...constraints are the skills of our existing pools of engineers..." – Fujitsu

One best practice we found for overcoming this constraint is to institute in-house training courses to strengthen and advance the skills of its analysts and engineers.

Another constraint is a shortage of commercially available databases of material properties and other information that would make simulation easier and more efficient:

"...we need more libraries of material properties, performance specs, etc. to justify more CAE. Materials and component databases are a current limitation..." – Fujitsu

Good vendor support is also important in making the most effective use of CAE, according to this company.

In all, our research found that increasing CAE's business impact depends on five tightly focused best-practice areas:

- Manage simulation data and processes
- Rationalize the make/buy decision
- Optimize simulation/test tradeoffs
- Qualify and select solution providers
- Manage people factors

MANAGE SIMULATION DATA AND PROCESSES

Consumer electronics companies, like the automotive powertrain manufacturers we studied, named CAE data management as the biggest unsolved technological problem limiting the value of simulation and analysis today.



In the absence of commercially available solutions, companies are attacking the problem through in-house development. These initiatives focus on capturing and archiving simulation-related knowledge, and improving analysis-based product development processes:

“...one of the goals of the simulation group is to standardize the storage of know-how. Another is to innovate design procedures and processes. Yet another is to solve specific target problems. Today’s simulation data management tools are cobbled together from in-house systems – spreadsheets, documents, databases, etc. PDM tools are perceived to be inadequate for this purpose...” – Japanese consumer electronics manufacturer A

A critical constraint that better CAE data/process management can address is limited availability of people and time. As noted above, our research found that limited availability of skilled professionals is a much greater obstacle to getting more value from simulation than availability of software tools or software budget. Best practice for overcoming this is to use knowledge capture and data/process management to make more efficient use of existing investments in both staff and software.

A related goal of these activities is securing corporate knowledge assets against generational turnover in the workforce:

“...one objective is to transfer knowledge to younger engineers. The Japanese engineering work force is graying. However, design engineers are very busy and the product lifecycles are very short – both of which make it difficult to transfer simulation know-how...” – Japanese consumer electronics manufacturer A

Another valuable objective is to help product development make better use of knowledge gained in manufacturing:

“...one of the constraints on the use of more simulation is to find better ways to integrate fabrication experience. The product development process has manufacturing process dependencies which are not readily addressed by today’s simulation processes. Nor do today’s PDM systems help manage these dependencies...” – Japanese consumer electronics manufacturer A

No less important than managing simulation results is managing and automating data transfer between disparate simulation/analysis tools. This problem is somewhat less daunting in consumer electronics than in automotive powertrain – the consumer electronics companies we studied typically use five or six key simulation applications, compared with 30 or more in automotive powertrain development – but the need is still there. Also important is automating geometry transfer between CAD and CAE.

“...we have in house tools and processes to achieve this...” – Fujitsu

This company developed software to make CAD-CAE data exchange easier. The tool is a pre-processor that uses 3D geometry from any of the company’s commercial CAD systems to generate a simplified finite element mesh for input to its CAE solvers, then helps provide feedback from analysis to design.



RATIONALIZE THE MAKE/BUY DECISION

Rationalizing the make/buy decision is about managing the tradeoffs between commercial off-the-shelf (COTS) software and internally developed tools. Our research found that consumer electronics companies judge COTS software to meet their needs in many but not all circumstances. Where these companies justify in-house development is in areas involving proprietary knowledge seen to confer competitive advantage:

“...approximately 80% [of all simulation] is done with COTS, 20% with in-house applications. In-house applications are restricted to areas where competitive differentiation is at stake, for example, simulation of ink drop dynamics. [Our] inkjet heads can deposit picoliter droplets – we have an in-house application for droplet simulation...”
– Japanese consumer electronics manufacturer A

Although internal applications account for a minority of total CAE usage, their value is seen as disproportionately high:

“...[CAE usage is] 70% COTS, 30% in-house, [but] the value is in reverse proportions...”
– Fujitsu

One focus of in-house development is to fill a gap in commercial offerings by compiling databases of material properties and other information to make CAE both more effective and more convenient to use:

“...we also have built libraries of materials, test correlations, process information...” – Fujitsu

Another focus, as noted above, is building inter-tool and inter-process linkages, such as software for tying CAD and CAE environments together.

OPTIMIZE SIMULATION/TEST TRADEOFFS

A major goal of using CAE is to reduce the number of physical prototypes required to develop new product:

“...a key metric [for gauging success of simulation] is the number of physical prototypes required...” – Japanese consumer electronics manufacturer A

The objective is to find all problems digitally, before the first physical test. The business impact of reducing prototype counts is to remove both time and cost from product development.

Success to date has been somewhat mixed:

“...in some areas the use of simulation has driven down trial times for testing. In other areas the impact on testing has been minimal...” – Japanese consumer electronics manufacturer A



Beyond being a cheaper, faster substitute for physical test, simulation is a powerful tool for exploration and discovery of phenomena that would be cost- and time-prohibitive to find through physical test, if not impossible:

QUALIFY AND SELECT SOLUTION PROVIDERS

Unlike CAD and PDM purchase decisions made by corporate committees with heavy IT involvement, analysts call the shots in simulation/analysis tool purchases.

"...analysis and simulation heads make these calls [CAE purchase decisions]..." – Japanese consumer electronics manufacturer A

"...analysis and simulation leads run the show..." – Fujitsu

Nonetheless, it's important that simulation/analysis purchase decisions be grounded in not only technical but also business criteria. Current best practice is to separate these two variables: evaluate one set of solution providers on their ability to deliver the latest solver or mesher, and evaluate another set on their ability to help tie disparate tools together, streamline work processes, secure and shepherd corporate knowledge assets, and provide change-management expertise and support.

Technical evaluation criteria

- Functionality of solvers
- Functionality of meshers, gridders, other tools for problem setup and results execution

Current best practice is to treat point solution providers somewhat opportunistically, evaluating technologies and adopting them as they become proven.

Business evaluation criteria

- Openness to integrating internally developed codes
- Competence as an integrator of diverse functionality
- Commitment to providing:
 - Simulation data management framework
 - Process automation tools
 - Knowledge capture tools
- Attractiveness as long-term partner
- Commitment to providing help with process change



MANAGE PEOPLE FACTORS

One challenge in optimizing use of simulation and analysis has to do with organizational, cultural and people issues. In the consumer electronics companies studied, we found fewer cultural impediments to optimal use of simulation and analysis than in any other industry we investigated. Nevertheless, as in other industries, our research found that best practice focuses on two areas:

- Create incentives for discipline leads, analysts and engineers to take ownership
- Reinforce executive awareness

Create incentives for discipline leads, analysts and engineers to take ownership

One best practice we discovered is to tie the mission of the simulation team to the company's business goals. In one company we studied, the focus in the past was simply on making the best use of simulation technology. But today the team's mission is framed as solving business and technology problems, and improving the company's processes for productizing technology and delivering it to market.

We also found initiatives to broaden who benefits from the work of the simulation group. One company reports it has now expanded its application of CAE beyond analyzing product performance to include visualization and virtual-reality presentations of material qualities and appearance for the benefit of project members outside the analysis group:

"...simulation and analysis has recently become important as a tool for visualization, in addition to performance analysis. Higher-quality simulation enables all members of the design team to make decisions using the reference 3D model..." – Japanese consumer electronics manufacturer A

To overcome the constraint of not enough trained professionals, one company has instituted in-house training courses to build the CAE skills of its engineers. A related best practice is deploying knowledge-capture tools and CAE process templates.

Reinforce executive awareness

Our research found that C-level awareness of simulation and analysis depends on the background of the company's senior executives. CAE awareness in the executive suite is highest in companies where top management has an engineering background:

"...simulation has fairly high [C-level] visibility, as our last three CEOs all served in an engineering/product development capacity..." – Japanese consumer electronics manufacturer A

In general, the simulation/analysis groups in consumer electronics companies appear to have higher visibility – and to be held more accountable – than in some other industries we studied, notably the U.S. auto industry:

"...performance [of the CAE department] is reviewed two or three times each year [in a presentation to] the CEO, [plus] monthly reporting of results to the business unit director or division manager..." – Fujitsu



An especially important gauge of performance of the analysis groups is whether they deliver results rapidly enough to impact product development – critical in the very short product development cycles prevalent in consumer electronics:

“...performance is judged by the business units. Response time is very important...” – Fujitsu

How to strengthen and reinforce executive awareness and backing? Align simulation/analysis with key business drivers and ongoing company-wide initiatives – Quality Engineering (Six Sigma), Lean Design, quality and efficiency programs that directly impact cost and schedule.

SIX NEXT STEPS

To put these best practices into action, what can program managers and others do to get started?

Manage simulation data and processes For most organizations this is a new area where best practices are still being developed and validated. One way to start is to assemble a multidisciplinary team – include representatives from the analysis groups, design, test, and program management – to audit current practices, identify gaps and bottlenecks, and develop detailed recommendations for improvement. Seek out a commercial developer with competent foundation technology, and willing to provide support.

Rationalize the make/buy decision Make this an agenda item in planning and budgeting. Audit your current expenditures on both commercial software and internally developed tools, and revisit this allocation in each future budget cycle. Benchmark your organization against competitors.

Optimize simulation/test tradeoffs Audit three past projects – one highly successful, one typical and one that could have gone better – to gauge whether superior management of the tradeoffs between simulation and test contributed to the success. Use the audit to map existing processes for design refinement and validation, and identify opportunities for improvement.

Qualify and select solution providers In your organization's next procurement cycle, revisit your qualification and selection policies for simulation solutions to ensure they address your requirements not only for superior point functionality but also for simulation data management, tool integration and process optimization. Factor in solution-provider stability, longevity and change management experience.

Manage people factors **Create incentives for discipline leads, analysts, and engineers to take ownership** – Tie the mission of the simulation team directly to the company's business goals. Elevate the focus from simply delivering analysis results to solving business and technology problems, and improving the company's product development process. Institute in-house training courses to raise engineers' CAE skill levels. **Reinforce executive awareness** – Arrange regular presentations of simulation/analysis achievements and business contributions to both top management and business-unit heads. Especially target C-level executives who have engineering backgrounds.



Benchmark your organization against best practice leaders To create change in an organization, a powerful spur to action is to start by benchmarking the organization's maturity level against industry best practices. Using this report as a starting point, compare practices in your organization with those of your most successful rivals. Identify areas where more effective use of simulation and analysis would put you in the lead.



***Best Practices for Implementing
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Five reports that reveal how savvy program managers at the world's leading manufacturers are implementing digital simulation and analysis to create business value.

Digital simulation and analysis is key to making better products more quickly at lower cost. But maximizing the technology's business impact requires far more than just buying the right point functionality and handing it off to the analysis department. Spar Point interviewed program managers and discipline leads at top-ranked manufacturers around the world to find out how they do it – what best practices have they developed to use simulation and analysis to break through the critical business constraints their companies face today?

Each of these concise, industry-focused reports details five best-practice lessons from savvy program managers. Use this exclusive intelligence to benchmark your company against industry best practices – learn where you excel, where to improve and how. And discover key learnings in other industries that you can apply to your own efforts.

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