Sharing CAE Responsibilities Between OEM & Suppliers: Emerging Issues

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ABSTRACT

Automotive industry observers note that a transformation is occurring where automotive OEMs are delegating more responsibilities to their suppliers. Instead of purchasing individual components, the OEMs are purchasing sub-assemblies. The suppliers are expected to do their own engineering.

Many in the CAE community realize that there are many challenges to be faced in coordinating CAE activities between automotive OEMs and suppliers. This paper will not answer all of the issues and challenges, but will summarize what the issues are and what technologies and expertise will be deployed to help resolve the issues.

The new product development landscape includes a new concept - the concept of competition between OEM and supplier as to which organization takes on which portions of the product development process. The engineering group with the best business proposition will get the work. Engineering groups must be more business-minded in order to be able to compete in this new landscape.

MARKET PRESSURES

The automotive industry of the early 21st century is driven by consolidation. Industry watchers expect the number of independent automotive companies to shrink from the current situation (~20) to somewhere between 5 and 7. Industry analysts from Pricewaterhouse Coopers stated:

> *"Moreover, E-business practices are likely to increase the pace of product innovation and thereby shorten the duration of competitive advantage even further. Ultimately, the cost of rapidly innovating and delivering new products will force competitors in the industry to re-think their competitive positions...some will fail, some will be acquired, and some will merge with another competitor."* [1]

The automotive industry will have winners and losers, where the winners are the remaining independent automotive companies. Analysts at PricewaterhouseCoopers believe that innovation is the key to success:

> *"Although Economies of Scale strategies will continue to dominate the thinking of executives searching for greater returns to investors, the companies most likely to succeed in the Second Automotive Century will be those that innovate the way they develop, design and deliver products and services to the consumer."* [1]

INDUSTRY RESPONSE

The needed innovation for OEMs is to take a fresh look at their suppliers. The OEMs are realizing that they can't afford to continue doing as much of the work themselves as they have been doing [2]. They must give more responsibility to their suppliers, especially their Tier One suppliers. An industry analyst at Ernst & Young observed:

> *"Original equipment manufacturers (OEMs) are abdicating certain non-core functions to automotive suppliers in order to slim operations and reduce costs. As a result, Tier One suppliers are being required to perform and integrate more steps of the automotive manufacturing process, to do them better, and to accomplish them in close synchronization with the global business plans of the Big Three. For those suppliers who accept the heavier workload, the rewards are large-scale contracts and strategic relationships with automakers. Companies unable or unwilling to respond to the changes will be consumed or left out of the supply chain."* [3]

Ernst & Young [4] predicts that the supplier of the 21st century will have:

- global reach,
- deep research and development capabilities, and
- a "critical mass" of around $3 billion-plus annual turnover.

This speaks to a dramatic consolidation in the supplier industry simultaneous with growth in total supplier revenue. Industry watchers have varied but similar forecasts:

- 25 to 30 “mega-suppliers”; > 30,000 suppliers in 1986, will become only 5,000 by 2003 [5, 6]
- By 2010, there will be no more than 20-30 major system suppliers globally [7]
- The level of merger & acquisition activity among suppliers rose almost fourfold between 1988 and 1997 [8]

The remaining suppliers will be different from today’s suppliers. It is clear that they will do more of their own engineering and R&D. It is clear that they will use the internet extensively. It is clear that they will pursue a global market. They will become more closely integrated with their customers (in a recent study [9] this was rated very important by 79% of the suppliers that were surveyed).

What are the effects of these trends (in the paragraph above) on the engineering function? Some possibilities are explored in the questions below:

- Will supplier engineering job descriptions change?
- Will supplier employee qualifications be redefined?
- Will supplier engineering processes be enlarged?
- Will supplier engineering be more visible to their customers as well as their lower tier suppliers?
- Will the flow of engineering data outside of each supplier organization increase?

The answer to all of the above questions is an emphatic YES, and supplier engineering organizations are going to change as a result. The mix of design and manufacturing engineers will trend towards a more even balance as OEMs ask suppliers to take on subsystem design. Successful suppliers will establish a strong design engineering capability, including strong Computer-Aided Engineering (CAE) capabilities.

In the section below we will discuss critical success factors for the automotive industry and how they are impacted; not only by the change in responsibilities between automotive OEMs and suppliers, but also by the internet and new business-to-business (B2B) initiatives.

The following section will focus on CAE and how it must evolve in response to changes in the industry. A comparison will be made between the value provided by internet and B2B capabilities and the value that should be provided by CAE.

CRITCAL FACTORS

The earlier sections of this paper describe the substantial changes that are occurring in the automotive industry. A primary trend is that suppliers are taking on an increased engineering responsibilities. It is interesting to note that even with the ongoing transition, the competitive success factors have remained the same:

- Cost
- Time-to-Market
- Performance

Cost is a vitally important differentiator. It has become less critical in the prosperous economies of the 1990s, but remains important. Even when a primary automobile is selected with status and performance in mind, a second or third car may be selected with cost in mind. A minimum quality standard is expected. Given that quality, cost is the driver that establishes value for those market segments.

Time-to-market remains very important in the constantly changing automotive market. In the last few years in the US market, those automotive companies who were slow to offer a mini-van with two sliding doors found themselves at a severe disadvantage to their competition. More recently, the race to offer SUV derivatives, whether SUV/Pickup hybrids or small SUVs, emphasized the value of a short time-to-market.

Supply-chain management software has been developed with the purpose of improving the speed and efficiency of the interaction between supplier and their customers. Robert Briggs, a general manager at Caterpillar stated, "We have to have intelligent, real-time capability within our factories, and we have to be able to collaborate with our suppliers in real-time." [10] The following benefits have been achieved from the application of supply chain management software [10]:

- An engine plant reduced engine throughput time from 17 hours to under 12 hours.
- An engine plant increased inventory turns from 32 to nearly 50.
- An tin mill improved on-time delivery from 75% to a high-90% rate.
- An tin mill planning function that used to require three full-time employees is now done by one person in 15 minutes per day.
- A steel company increased its ability to apply inventory to orders by more than 20%.
- A steel company decreased its finished good inventory by 15%.

Estimates of the overall cost savings range from 5 to 20 percent [11,12]. The lower estimates of saving come from those who say that most optimistic estimates "understate the challenges that automakers and suppliers face in implementing the necessary channel changes."

The Roland Berger report [12] estimates that 70% of the cost savings will come from reduced product development, inventory, manufacturing, sales, G&A, transportation, and warranty costs. Note that CAE can and should impact product development, manufacturing and warranty costs. Only 30% of the savings is expected to come from the reduced material costs due to an internet-based B2B marketplace, that has received so much publicity recently.

A pilot program, the Manufacturing Assembly Project (MAP) [13], studied the effect of applying supply chain management tools, starting from OEMs and going through four tiers of suppliers. This pilot program was initiated by the Automotive Industry Action Group (AIAG). They found that the time to move information from the OEMs to the bottom of the supply chain fell from more than a month to a reduced time of 11 to 13 days. The AIAG feels that with further improvement the lead time can be reduce to one

day per tier. An overall estimate was that improved communication within a multi-level supply chain could save the automotive industry approximately $1 billion per year.

In summary, current supply chain management initiatives and internet-based B2B initiatives have resulted in significant cost and time savings. Even more will be expected in the future. As an analyst with McKinsey & Company put it [14]:

> *"With RFIs and RFQs not generated in real time, decisions affecting a company's overall strategy and goals have to be made on the spot – and this requires accurate, up-to-the-minute data on true costs, pricing strategy, capacity planning and other key variables if the decisions are to be sound ones."*

Many automobile buyers place a high priority on vehicle **performance**. Some consider their purchase to be a status symbol. Others spend a significant amount of time in their car and are willing to pay extra to have a more pleasant experience. These customers expect a vehicle that is quiet, smooth and powerful; that visibly displays the quality of its manufacture; that handles well, and that has no failures during years of use.

Having the right first time product quality is rated as "very important" by 50-80% of the global supplier community [9] and is viewed as a key factor in retaining long-term business with vehicle manufacturers.

The supply chain and B2B initiatives have received much attention, and deservedly so, because they have resulted in significant business benefits to those who have implemented them. It is interesting to note that these techniques have little potential to improve product performance, other than improvements in component quality due to improved communication within the supply change.

OPPORTUNITY FOR CAE

The supply chain and B2B initiatives will eventually result in a parity in pricing and speed (or time-to-market). Suppliers who can't keep up with the leaders will be acquired or will go out of business. The differentiator will become to the third success factor, product performance. The challenge will be to develop innovative new designs while preserving the gains in pricing and speed that were achieved with earlier initiatives.

Lance Ealey of McKinsey & Company made some significant observations about the importance of CAE in the product development cycle. He stated the following [15] with regards to an interview with Glenn Gardner, the man responsible for the original Chrysler minivan and the first LH platform (e.g. Intrepid):

> *"Computer-modeling simulations of technical systems will also be key, and most carmakers are already working to perfect them. Gardner makes and interesting distinction here, saying that while the modeling of technology must be a given, so must the modeling of the processes used during product development. The idea here is to create a business model similar to the technical models that doesn't require excessive human interaction. Compliance and validation testing cycles can be cut significantly as technical models improve in accuracy and car company confidence in them grows. Gardner notes that a company doesn't have to*

actually crash test a vehicle: what it must do it certify that the vehicle will pass such a test – and be willing to be held responsible if it doesn't. Likewise, mandating a "two winter" test cycle might be needlessly conservative as computer models become more predictively accurate…"

Ealey also stated:

"As important as compressing the time after concept approval is, streamlining the concept approval process itself will also be necessary. The goal is to achieve concept approval quickly… Again, computer simulation and display technologies can help tremendously here, allowing design changes that might have taken weeks if done physically to be completed in hours."

Wayne Collier of D.H. Brown points out that traditional systems engineering must become more "decision centric" if it is to serve the supplier chain [16]. During the concept exploration phase data must quickly flow both down (requirements) and up (design alternatives) in order to develop the best possible system. Collier points out that "verifiability remains essential," and that verification must be fast enough to provide timely feedback to support continuous evolution during the design process.

OEMs and suppliers need to develop new engineering processes and new expertise in order to achieve the above critical success factors in an industry where company relationships and organizational structures are rapidly evolving. The ability to perform virtual prototyping and virtual testing on the computer is crucial to achieving the above goals. But more than expertise is required. Engineering process enhancements are needed to perform these tasks early in the design task, when product performance information can have the largest impact. The vision is to have a cost-effective engineering process where form, in fact, does follow function.

CAE tools that focus on engineering tasks (MSC.Software's products, for example) need to be supplemented with collaborative tools that provide structure for the engineer to work through the broader engineering process.

GAP ANALYSIS

Improvements in CAE can impact the automotive industry to a similar degree to improvements in business-to-business practices. However, CAE is not receiving anywhere near the attention that is being given to B2B initiatives. It is worthwhile to consider why CAE is not perceived to be as valuable as B2B initiatives. The problem does not seem to be technical hurdles or lack of ideas. Table 1 illustrates the approach that can be followed by CAE in order to attain the benefits similar to those that are considered attainable by B2B improvements. A technical challenge is the uncertainty of whether or not CAE has the breadth and fidelity to completely replace certain physical prototypes and testing that are currently common practice. Much progress has been made and benefits realized, but more work is needed in selected areas.

Table 1 – Comparison of B2B and CAE Methods

	B2B Transaction	CAE
Route to time savings: Fast information flow	Internet, Intranet	Enterprise-wide Intranet
Route to cost savings:	Trade exchange, PDM	Reduced testing and prototypes
High efficiency outsourcing:	Trade exchange	Performance Target Cascading, CAE in purchasing
Route to increased performance:	Improved Collaboration (dependent upon CAE)	Fast validation of new concepts

The biggest problem for CAE is the lack of understanding of its specific financial value to an organization. Often the CAE group is considered as a cost center (an expense) that is needed to put a check mark on designs before the product is released to the market. People who work in the CAE function may know many examples where CAE was use to:

- Reduce testing by providing the same data through simulation.
- Refine a design when a problem was discovered late in the design process, avoiding product introduction delays.
- Improve a design by trimming weight.
- Reduce costs by validating the use of a less expensive replacement component.

Those involved in CAE often do not take the time to assess the financial benefits that their organization receives from CAE. The benefits, if estimates, could very well become large financial sums, but are not known by top management. As a result, CAE is too often considered to be only an expense by top management.

A change is needed to improve the situation. The steps in Figure 1 need to be followed. First, those in CAE need to find out what are the business goals for the organization. This information may be available from CAE management. If not, additional research is needed. A starting point is the companies annual report. Internal presentations from company management may indicate business priorities and competitive challenges. Once the business goals are known, CAE goals can be set that will contribute to achieving the business goal. For example, if there is a business goal to reduce cost, try to set a CAE goal to identify where a product might be over engineered. Costs can then be reduced by reducing weight or substituting a less expensive material. Likewise, if competitive pressures demand increased product performance, set CAE goals to provide fast feedback up-front in the design process. Make CAE the enabler to proceed with promising new design concepts.

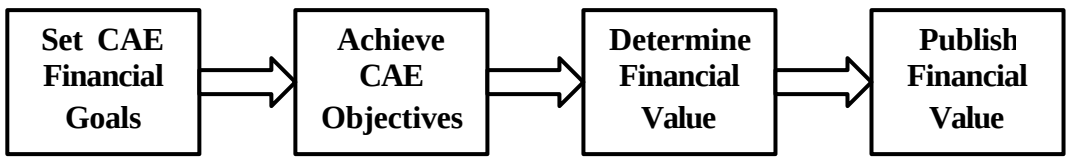

Figure 1 – Steps for Gaining Recognition of CAE Value

Once the goals have been set, then they must be accomplished. It may not be easy to get resources allocated to new activities. Of course the best pilot projects are those with the minimum risk to the CAE group and with the highest payoff.

Once each goal is achieved, its value must be determined. The determination of value is a science in itself [17; chapters 2,3]. The right questions need to be asked, and they probably need to be asked outside of the engineering organization.

- "How many more units do you expect to sell over the next 12 months with this performance improvement?"
- "What would it have meant if the product introduction had been delayed three months?
- "What was it costing us when 15% of the product that we were shipping snapped the upper left flange while under warranty?"
- "What does it mean to be able to increase the production rate on the assembly line by 10%?"
- "How much do we plan to save by reducing the thickness of the XYZ plate by 1 mm? Does that include both material and shipping costs?"

It may be that the people you ask will not know the answer to some of these questions. If not, help them understand the importance of knowing this information and challenge them find out the needed information. It is important to build up the capability of the organization to recognize value.

Once the value is known, it needs to be communicated properly. The precision of the value data must be evaluated. Where there is uncertainty, the value should be understated. For example, if a rough estimate of savings is $500,000 per year, it is better to say something like, "We are confident that we are saving at least $250,000 per year, and we have had saving estimates of twice that amount." Of course, if the understated value does not make the financial point that you would like to make, then don't release the information. You have the choice of either getting more accurate data or moving on to the next value opportunity.

Ultimately, value information should be used to show the Return on Investment (ROI) for the CAE function. Senior management should come to understand how many dollars of value they receive for each dollar they invest in CAE.

The alternative for CAE groups who don't know their value is to face continuously reduced budgets each year. The needed funding will not be available to adapt to the changing product development landscape between OEMs and suppliers. The funding not allocated to CAE will go to other groups know their value (maybe B2B initiatives, etc.) Competitors with CAE groups who know their value will have more CAE funding and will produce much more CAE value.

CONCLUSIONS

A broad set of references have been introduced that establish the continuing business pressures on the automotive industry and the changing landscape of the automotive enterprise (each OEM and their suppliers) as it responds. CAE is viewed as an essential function in the product development process by business analysts. Aggressive increases in CAE activity are not being proposed because of the lack of data regarding the business benefit.

The emergence of improved communication and collaboration through the internet is resulting increased competition between organizations, and in many industries the competition is considered to be global. Less apparent is the fact that evolving relationships between automotive OEMs and suppliers is resulting in direct competition between the engineering (including CAE) groups within an automotive enterprise.

It would be naïve to think that the engineering groups will win the competitive battles based upon their technical merits. Rather, it behooves each engineering organization to develop the business knowledge to present their competitive case as a business proposition.

Suggestions have been provided that will help CAE groups pursue and achieve financial objectives and to determine and communicate the value of their efforts. Successful engineering groups will know their value (including ROI) and will operate their engineering groups as small businesses within the automotive enterprise.

REFERENCES

[1] *A2C: The Second Automotive Century*, PricewaterhouseCoopers , page 3 (Introduction), published 2000, see http://www.pwcglobal.com/auto

[2] *The Emergence of the Tier 0.5 Suppliers*, Automotive World, June 15, 2000.

[3] *Profile of Tomorrow's Automotive Supplier*, Executive Summary, Ernst & Young, 1998, see http://www.ey.com/global/gcr.nsf/US/Library-Manufacturing-Ernst_&_Young_LLP

[4] *Profile of Tomorrow's Automotive Supplier*, Introduction, Ernst & Young, 1998, see http://www.ey.com/global/gcr.nsf/US/Library-Manufacturing-Ernst_&_Young_LLP

[5] *Automotive Supply Chain Management*, The Economist Intelligence Unit, March 16, 2000, see http://store.eiu.com/A009des.html

[6] *Profile of Tomorrow's Automotive Supplier*, Introduction, Ernst & Young, 1998, see http://www.ey.com/global/gcr.nsf/US/Library-Manufacturing-Ernst_&_Young_LLP

[7] *A2C: The Second Automotive Century*, PricewaterhouseCoopers , page 7 (Future structure of manufacturing), published 2000, see http://www.pwcglobal.com/auto

[8] Mergers and Acquisitions in Automotive Components – The New Deal Terrain –, Anderson Consulting, p. 1, 1999, see http://www.ac.com/services/automotive/auto_news2.html

[9] JBA 1998 Survey – Supply Chain Strategies : Part 2, GEAC, February 5,1999, see http://just-auto.com/features_detail.asp?art=70.

[10] Doug Bartholomew, Supply Chain Moves Online, Industry Week, March 20, 2000, see http://www.industryweek.com/CurrentArticles/asp/articles.asp?ArticleID=771.

[11] Andy Gerrar, A Rough Guide to the Web for Automotive Suppliers, Automotive World, July 26, 2000, see http://www.just-auto.com/features_detail.asp?art=240.

[12] E-Commerce in the Auto Industry: Evolution Not Revolution, Roland Berger & Partners, July 17, 2000, see http://just-auto.com/features_detail.asp?art=231.

[13] *Mapping Out a Better Supply Chain for all Tiers*, GEAC, March 9, 1999, see http://just-auto.com/features_detail.asp?art=23.

[14] Lance Ealey, *Trade Exchanges: Instruments of Destruction or Powerful Profit Tools*, McKinsey & Company, August 4, 2000, Cleveland, Ohio, see http://just-auto.com/features_detail.asp?art=249&sct=fotv.

[15] Lance Ealey, *In Search of the 12-Month Car*, McKinsey & Company, Cleveland, Ohio.

[16] Wayne Collier, *Systems Engineering in the Supply Chain*, D.H. Brown Associates, Inc., June 7, 2000, Detroit, Michigan.

[17] Mack Hanan and Peter Karp, *Competing on Value*, AMACOM (a division of the American Management Association, 1991, New York, ISBN 0-8144-5036-9.