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Automotive toolmaking tricknology : Applying NUMMI's concepts to tool and diemaking

Cut diemaking costs in half

By Gary Gathen
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In 1984 the Fremont, Calif. GM assembly plant shuttered under the strain of horrible management-labor relationships. Toyota offered to reopen the plant in a joint venture with GM implementing its Toyota Production System. Tool and diemaking shops can apply the same NUMMI concepts to revitalize their companies and reinvent themselves.

The U.S. tool and die industry is weathering great storms of change. Diemakers in low-wage countries are rapidly eroding domestic shops' market share, and as a result, domestic shops are dropping like boat anchors. In Michigan alone, more than 30 percent of die shops closed between 2000 and 2005, according to The Detroit News March 7 article, "Factories for sale: Machinery auctioned off to global buyers." The article's author stated, "At the start of this decade, there were 57,000 workers in Michigan's tool and die field, many of them highly paid. When the state last counted three years ago, about 39,000 remained."

U.S. shops have been told by their customers that their foreign competitors' prices are 50 percent lower. The question is how to compete with these low-wage price differentials.

NUMMI Genesis

In 1984 the Fremont, Calif., GM assembly plant shuttered under the strain of one of the worst management-labor relationships in all its plants (see [sidebar](#)). At the same time, Toyota was considering whether its production method, the Toyota Production System (TPS), would work in the American manufacturing climate. Rather than investing in the cost and time to build a greenfield plant, Toyota made GM an offer it couldn't refuse: Let's reopen the plant with new equipment, under a new name, under Toyota management, and share the costs and benefits.

This joint venture that resulted was named New United Motor Manufacturing Inc. (NUMMI). In less than three years, NUMMI became one of the most efficient and productive automotive plants in the country, and most of the former work force was rehired. Today NUMMI employs roughly 5,500 team members—4,700 of them UAW members, according to the company.

Partnership Paid Off

Toyota verified the feasibility of its TPS in the U.S. (Americanized as lean manufacturing), and GM gained a reinvented assembly plant in the framework of Toyota's vaunted production system, which became a show-and-tell site for GM's management and staff to visit, study, and emulate in other GM plants—a win-win situation.

Since that experimental undertaking, which is still flourishing after nearly 25 years, Toyota has opened 10 plants of its own in the U.S. and in 2007 came within an

| Stage | Percentage |
|-----------|------------|
| Delay | 89% |
| Process | 7% |
| Transport | 2% |
| Inspect | 2% |

Figure 1
A study conducted at a die shop revealed that the storage/delay stage represented the best opportunity for kaikaku, or leap in improvement.

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eyelash of being the world's largest auto manufacturer (falling short by less than 3,500 units, 0.05 percent behind GM, according to the Associated Press).

Moreover, the NUMMI venture has introduced other concepts that tool and die shops can learn from, such as fostering fair competition by accepting competitive bids from global, as well as regional, sources; working hand in hand with customers and suppliers; and applying TPS manufacturing methods to produce higher-quality dies faster at a lower cost.

The NUMMI business model is not new, by the way. Other manufacturing entities use it, including GOCO (government-owned, contractor-operated) munitions plants, such as the Joliet, Ill., arsenal. This concept, properly applied, could rescue the North American tool and die industry from its current freefall.

How can the tool and die industry avail itself of the benefits to be gained from the NUMMI concept?

NUMMI Concept Fundamentals

1. Smartnership. The Smartnership concept (smart partnership) begins by forming a partnership of one or more automotive OEMs; Tier 1 and Tier 2 stampers/suppliers; and large, medium, and small diemakers and their suppliers that are committed to make the smart thing happen. It is the antithesis of the more commonly taken ivory tower stance: "We are the customer, you are the supplier; we make the rules for you to follow and we call it a partnership."

For example, the Golden State Automotive Manufacturers Association (GAMA), originated by Toyota, is composed of qualified companies that have supplied NUMMI for at least one year and that are truly willing to improve.

2. Tricknology. The TPS and other methodologies, such as the theory of constraints and Six Sigma®, are combined with the latest technologies to dramatically reduce costs and die delivery times. Learning current best practices in die design and build developed among the participants and creating new ways to use technologies comprises tricknology (tricks of the trade in the best use of technology).

3. Die Factory System. A lean tool- and diemaking model called a Die Factory System applies lean concepts to diemaking. Waste, or non-value-added time, is the enemy of all manufacturing. The identification and elimination of every kind of waste defines lean manufacturing. The system starts by focusing on the large opportunities to improve—picking the low-hanging fruit—a process that Toyota calls *kaikaku*, a leap in improvement.

One excellent target for *kaikaku* is the upfront activity required to enter a new job into the system. Often as much as a week passes before preliminary work is done, such as requesting missing information from the customer; deciding who will engineer, design, or build the dies; and getting paperwork approvals into place. This process can easily be done in a single day.

Another prime target for a leap in improvement is the engineering and design stage, if properly planned. Two die designers can reduce the total design time by half or more if they can communicate directly with each other in the same room.

A third area for easy picking is one-piece flow. Although counterintuitive, passing each die-in-process to the next step, instead of doing an entire batch of, say, all the cutting steels, and then moving the whole completed batch can halve the processing time. A good way to demonstrate this concept is by simulation using a LEGO® block exercise. Even then, many diemakers have difficulty accepting this concept.

Only four things can be done to a die component:

1. It is processed by machining, heat treating, polishing, or plating, which makes the piece more complete, and that adds value in the eyes of the customer.
2. It is moved around the shop or to and from outside processing such as welding, which does not add value but is necessary.
3. It is inspected, which ensures that the die is being made correctly and also enables value to be added.
4. It is stored or its usage is delayed. This is pure waste. This neither enables processing nor adds value.

Some improvement can be made by focusing on reducing die movement and inspection, but die storage and usage delay is a much more fertile area for cost reduction (see **Figure 1**).

The Die Factory System may help die shops meet the pricing levels of shops in low-cost-labor countries because it takes a total system approach to diemaking,

reducing die storage and usage delay time. Value-stream mapping makes the waste visible. Once waste is exposed, everyone can figure out ways to eliminate it.

First, a die shop creates a value-stream map of its current processes. Next, it creates an ideal value-stream map that is then implemented. Other graphical tools include Gantt charts, which make the delays apparent in calendar time; Pareto charts that show where the most improvement opportunity lies among families of parts being made; and process maps, which show timing of the subassembly and final assembly of the complete die. In addition, the Die Factory System applies Eliyahu Goldratt's theory of constraints and Six Sigma principles.

A growing number of North American manufacturing plants are on what is called a lean journey; however, few, if any, tool and die shops have gotten onboard. A knowledgeable consultant may be able to eliminate detours and blind alleys.

Within three to five years, typical, traditional shops may reduce diemaking costs by as much as one-half and to lower lead-times by up to 75 percent. That may sound like an impossible dream, but so have many other never-been-done-before ideas.

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NUMMI Plant—A Before and After Picture

There is another side to the NUMMI story that bears relating. Because TPS and lean practices involve the human aspects in manufacturing, people's attitudes change as a result of the respect they show each other, the team's structure, acceptance of responsibility, and pride in the work performed.

A longtime employee described this change in his own attitude in the book *Diagnosing and Changing Organizational Culture* by Kim Cameron and Robert Quinn. Under the old plant culture, he and other unhappy employees resorted to dirty tricks such as putting loose screws inside welded auto subassemblies to create incessant rattles that could never be corrected, or putting half-eaten sandwiches behind door panels to emit the strong odor of rotting food.

But after the plant reopened as NUMMI, that all changed.

All employees were given their own business cards; each person was empowered to decide the title to be printed on the card. The previously mentioned longtime employee selected director of welding improvement as his title. This so changed his attitude that when he went to sports arenas and other large parking lots, he sought cars that had been built at NUMMI and placed his business card under their windshield wipers with his hand-written note on the back of the card: "I made your car. Any problems, call me."

Gary Gathen

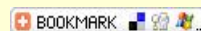
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