

II. The Tool and Die Industry

Many tool and die makers have gone bankrupt during the first years of the new millennia. This study was commissioned to better understand the underlying causes for the demise of these shops, including a benchmarking study comparing selected Japanese (2) and US die shops (4). The results from the benchmarking study are presented in various places in the report.

The information presented in the report was derived from the literature, interviews with industry experts, working with different organizations in the industry, the results of the benchmarking study, and CAR's extensive knowledge of the world automotive industry.

A. Challenges for the Tool and Die Industry Sector

The tool and die (T&D) industry, particularly in Michigan, has always experienced large fluctuations in demand with high and low cycles lasting several years. In Michigan, where nearly 50% of the tool and die industry is automotive related, the cycles are a way of life, and companies have learned to expand and contract over time. Figure 1 illustrates the employment cycle for Michigan's tooling companies since 1970. These cycles are largely related to the introduction of major vehicle programs in the automobile companies. The questions being asked by T&D companies now is when will the next up-tic begin, will the demand return to full-employment levels, and will the demand support prices that allow T&D companies to make a profit?

Two factors contributing to the down turn are overcapacity and foreign competition. Most T&D manufacturers believe that there is a significant over-capacity in the world and domestic market (by 30% to 50%), with developing countries (mostly in Asia) continuing to build new capacity with the intent of supplying North America.

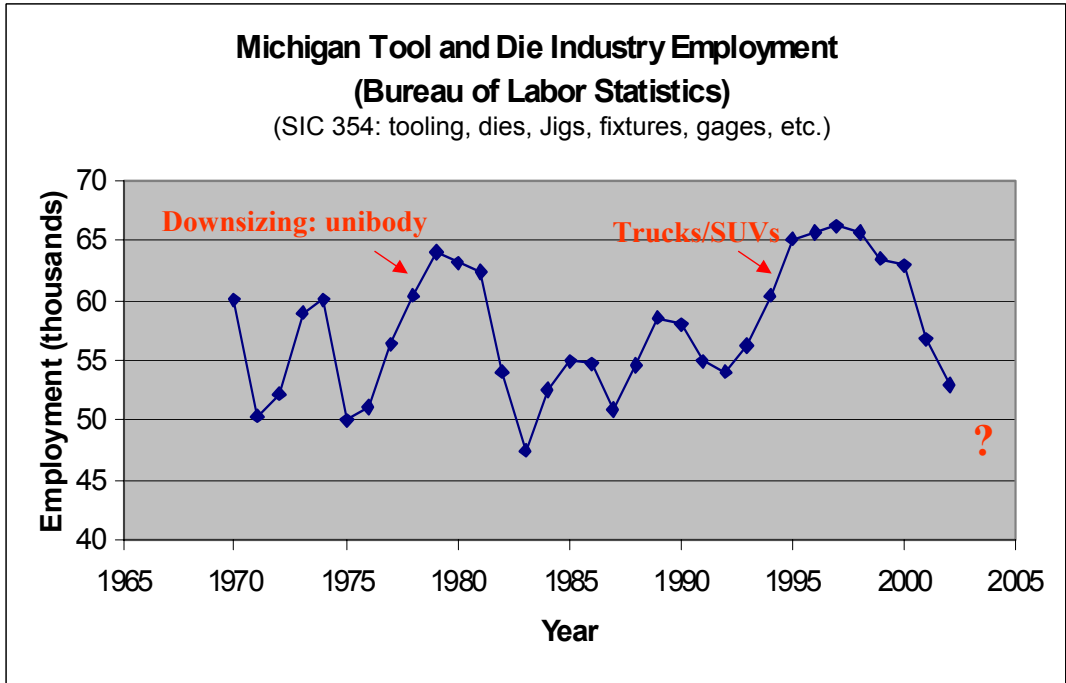


Figure 1 – Michigan Tool and Die Employment Cycle.

On the surface, it would appear from the cycles in Figure 1 that all the industry has to do is wait for the next upturn, and business will continue as usual. In fact, when you compare the concerns of T&D companies back in 1975 with those of today, not much has changed (see Figure 2). Dominant concerns in 1975 included: foreign competition, increasing productivity (at the T&D shops), over supply, and low profit margins. All these issues are with us today. All these factors continue to put pressure on the industry today. So what has changed?

The concern that the downturn is, in fact, a re-structuring of the industry stems from the competitive changes at the automobile OEM level. The T&D industry sector is a microcosm of the automobile industry. International competition is intense with over-capacity, particularly in the major developed countries (North America, Europe and Japan). This has led to falling market share by the Big-3 – the principal customers of the domestic T&D industry. A primary mechanism to re-gain market share is to introduce new vehicle models that generate increased sales. The major bottleneck of introducing new programs is funding, which in turns places pressure on lowering tooling costs.

	1975 (1)	2002
Capacity Increase		
Increased foreign competition	X	X
Productivity gains	X	X
Shortage of Skilled Help	X (die maker)	○ (engineer)
Unfair Competition		
Excess capacity	X	X
Pricing below costs	X	X
Reduced Demand		
Foreign competition	X	X
Captive shops	X	X
Customer technology		○X
Unsupportive Government Policies		
Exchange rates		○X
Taxes	X	X

Figure 2 – Comparison of Issues Critical to Tool and Die Companies in 1975 Versus 2002.

Company	Relative Die Costs
Honda	X
Big-3 A	2.6 X
Big-3 B	2.8 X
Big-3-C	3.1 X

Figure 3 – Big-3 Relative Die Costs With Honda.

The cost efficiencies of many of the Asian companies are well recognized, which affords them a competitive advantage at gaining market share. A recent industry study, for example, shows the Big-3 OEMs have a significant tool and die cost disadvantage with respect to Honda in the car body (see Figure 3). The Big-3 die costs are over 2.5 times greater than Honda's die costs. Honda's timing is also considerably faster at

tooling construction and tryout, although not to the same magnitude as the die cost differential (see section II.C Competitive Observations). The Big-3 recognize the need to reduce this competitive disadvantage, and that a significant transformation of the domestic tooling industry may be necessary.

One of the mechanisms the Big-3 is using to push down prices is on-line auctions. In spite of the negative reaction by long-term suppliers, the OEMs have managed to reduce prices with auctions, particularly during times of over-capacity. It was recently reported that DaimlerChrysler has been purchasing dies at 30% to 40% below conventional prices from just a couple of years ago. Although providing short-term cost relief and sending a message to the T&D industry, the auction approach is counter to the Asian (including Honda) collaborative supplier model. For example, suppliers to Honda see their relationships as open, collaborative, and long-term. The reward for this relationship includes less volatile demand cycles and cost-reducing cooperation (such as two-way sharing of product/process design knowledge), albeit with lower overall operating profit margins.

Other changes by the automotive companies are forcing suppliers to assume a greater portion of the OEM's financial liability and investment risk. The percent of annual capital expenditures by the supplier base has increased steadily for the past several years reaching approximately 66% in 1999 (IRN, 2002). No part of the supply industry is affected more than tool and die where the manufacturing lead times are long and the expenditures are high. Previous payment schemes were progress-based, for example, providing 30% at contract signing, 30% upon final design approval, 30% upon shipment, and 10% upon final validation at the customer facility. Under such a plan, the supplier could generally finance work-in-process through local banks when necessary. The new payment proposals, which are replacing the traditional progressive payments, at best, pay 100% upon shipment to the customer. Other proposals defer payment until final validation at the customer, or later. One proposal is to pay for dies on a production part basis, by amortizing the investment over the projected life of production on a piece-part basis. This pushes final payment out even further and adds additional payment risk. A further complexity has occurred from sourcing dies to tier-1 stamping companies (thus pushing the tool and die supplier back to a tier-2 supplier). The tool and die supplier

must negotiate payment from a smaller, tier-1 company. Under these payment conditions and with the instability in the market, many banks have avoided tool and die financing, because of the higher risk in receiving payment altogether.

Although a traditionally cyclical business, there is strong evidence that the industry is re-structuring in a substantial, long-term way. The outlook for small (under 10-15 employees), independent and entrepreneurial tool and die shops is very grim. These small shops will likely need to identify their niche and then team up with larger companies that pool together resources to supply a greater variety of bundled products and services. The cost pressures on the larger shops will also force them to continuously evaluate their strengths and maintain a technical edge. Foreign competition is forcing the domestic auto companies to “share the pain” with the suppliers. Although many see the foreign tool and supply companies as the cause of the domestic problem, the true cause is the competitive pressures being experienced by the auto companies.

B. State and Federal Involvement

The difficulties experienced by the tool and die industry, particularly in Michigan, have been recognized by state and federal agencies. In addition to commissioning this study, the Michigan Economic Development Corporation (MEDC) has been supporting the industry through several initiatives including support to the Michigan Manufacturing Technology Center (MMTC). The MMTC (www.mmtc.org) provides services to the industry in the form of training and consulting for small manufacturers throughout the state. The MMTC leverages funds from state and federal sources to support the needs of Michigan manufacturers.

The federal government recently became actively involved with the tool and die industry when the International Trade Commission (ITC) began an investigation into the competitive conditions vis-à-vis foreign competition. They wish to ascertain whether or not other countries are competing fairly in their pricing of tools and dies to North American customers. The ITC report is expected in October 2002.

Representing Michigan’s tooling industry to the federal and state government is the Coalition for the Advancement of Michigan Tooling Industries (CAMTI).

“CAMTI’s mission is to direct federal and state government attention to the issues facing Michigan’s tooling companies and affected communities. It will also advocate for legislative and regulatory initiatives that will advance their interests.”

The CAMTI website (www.camti.org) contains information on pending legislation, ITC committee transcripts, and dates of upcoming events that would be of interest to the tooling industry.

A report written in spring 2002 by IRN, Inc. for The Right Place Program (a regional economic development organization serving west Michigan) provides an overview of the industry issues and ongoing initiatives. The report, *“A Competitive Assessment of the Die and Mold Building Sector – A West Michigan Perspective,”* provides a summary of issues based on research and broad perspectives gleaned from interviews with tool and die companies and industry experts.

C. Competitive Observations

A number of benchmarking studies have been conducted showing the cost and lead-time advantages Asian automakers have over the domestic companies. All the major Japanese automakers are recognized as having competitive or superior performance, and have had this advantage for many years. The Japanese companies are known for their efficiency and lean production methods, and better implementation of these practices will undoubtedly improve the competitive performance of North America companies (see section III.B Lean Practices). Lean design and manufacturing practices, along with new technologies in engineering and high-speed milling have greatly increased tool and die production capacity without any increase in labor hours or facility space.

These lean methods can be applied in North America. One North American tool and die operation indicated that they increased their capacity from the early 1990s to 2002 by 50% without any increase in additional resources, and that they expect a 25% increase to continue over the next few years. This result was largely attributed to implementing lean techniques, focusing on core competencies, and setting up the business as a production-oriented facility, rather than treating each job as a project.

There are several key distinctions between the Asian and North American markets that are important to understand. The Japanese customer-supplier model is different, and simply saying North American suppliers are not competitive is incomplete. A key aspect of the Asian relationships is that it evolves over the long-term as a formal partnership, and includes fine-tuning manufacturing and engineering around product expectations (we might refer to this as product design standards). The North American business model has evolved with suppliers competing against each other on every program, and any program could be very different from any past one. Although tools and dies could be taken by a North American supplier and produced by a Japanese source, it is not clear that it could be done more cheaply. In other words, because the Japanese OEMs and their supply network have fine-tuned their processes to be cost efficient for a specific product design standard, a Japanese supplier might not be able to generate Honda prices for tools from a domestic company's part design, since their processes are not fine-tuned to the domestic company's design standards.

	Tool & Die Suppliers	
	North America	Asia
Product Design	Complex	Simpler
Tryout	Many presses and extensive experiences	Few presses and limited tryout
Functional Build	Organizational difficulties	Natural process
Engineering Changes	Many (complex designs)	Few (simpler designs and early manufacturing input)
Die Standards	Unique to OEM	Unique to supplier

Figure 4 – Comparison of Asian and North American Companies.

Some of the key differences that help account for the performance differences between Asian and North American suppliers are shown in Figure 4. As illustrated in Figure 3, there can be significant tooling cost advantages under the Asian model, and particularly in the case of Honda, that model was developed for the purpose of minimizing cost. However, in North America, the customer-supplier business model evolved differently with more complex objectives than focusing primarily on cost. Few would argue that in North America product design complexity for styling advantages tends to be a priority over developing simpler designs for the purpose of manufacturing

simplicity. Consequently, more engineering changes tend to occur, and more extensive tryout is required. In general, the Asian supply model is not robust to implementing a large number of engineering changes during die construction, whereas the North American suppliers have had to learn to accommodate these disruptions. The streamlined Asian process has also been developed around dies with a single die design standard. All die construction processes (engineering, patterns, castings, machining, assembly and tryout) can be developed assuming a single standard, thus greatly reducing costs. Finally, the functional build method of accepting a die (dimensionally) provides a significant advantage over companies trying to make every measured dimension on the part conform to statistical criteria, e.g., $Cpk > 1.33$. Functional build is described later in this report (see section IV.D Functional Build).

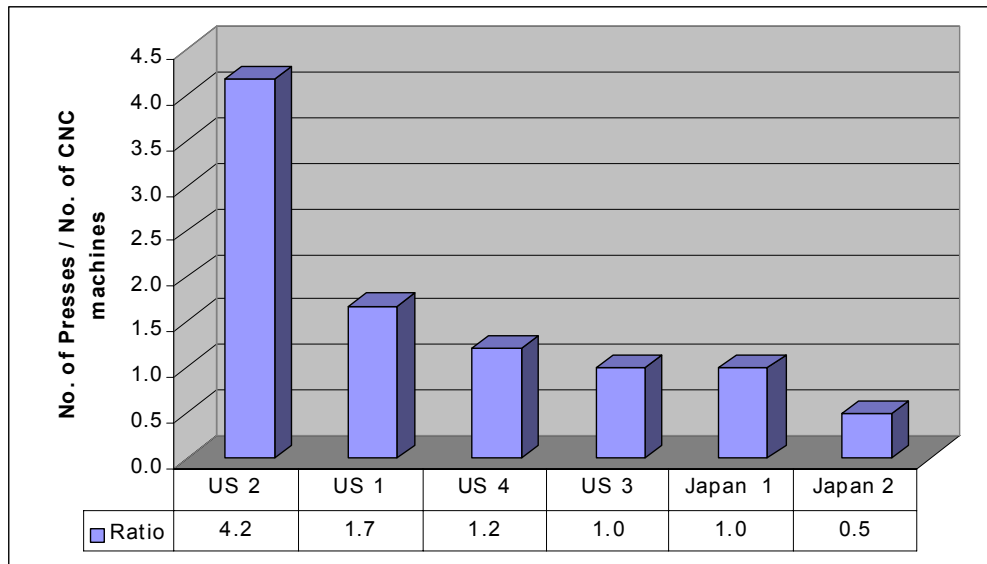


Figure 5 - Tryout Presses per CNC Machine Tool.

Benchmarking data collected for this report illustrates the difference in tryout between Asian and North American shops. Figure 5 shows for the four North American suppliers, the ratio of tryout presses per CNC machine tool varied from 4.2 to 1.0. For the two Japanese companies the range was from 1.0 to 0.5. Japanese die suppliers generally have less equipment to tryout at the die construction source because:

- Less tryout is needed (lower complexity parts and fewer engineering changes require implementation at the end of the process).

- More tryout is performed at the customer’s location in the production press where more accurate re-work decisions can be made, and where other related parts can be compared for assembly using functional build.
- Tryout is not seen as a core business practice.

Related to cost is the amount of time the shops spend on creating dies (see Figure 6). Analysis of the benchmark data shows that the time it takes to complete a set of dies differs dramatically between the Japanese and the US companies. The Japanese take approximately 20 weeks to complete a die, whereas the US companies take approximately 35 weeks to complete a die (44%) difference. The Japanese take about the same amount of time to design dies and to procure castings (patterns and castings are 100% outsourced by everyone). The major differences are in the machining and assembly and in die tryout. The Japanese suppliers are approximately 60% faster than the US shops. The assembly speed is largely due to: elimination of assembly through die simplification (reduction in inserts and cams), design simplification, standardized processes, prepackaged assembly part kits (standard parts such as screws, hoses, etc. are prepared for the specific job elsewhere and ready when the assembly process is started). The tryout speed difference is largely due to the factors mentioned previously: lower part complexity and functional build.

timing (weeks)	US avg	Japan avg	% of US
Die design	4.6	5.3	-14%
patterns and castings	5.8	5.1	11%
machining and assembly	16.4	6.4	61%
tryout	7.6	2.8	64%
total	34.4	19.5	44%

Figure 6. Comparative Timing of Die Construction Steps.

There is no reason to believe that the North American tool and die technical capability is second to general Asian or European capabilities. There is also little question that lower cost dies can be sourced either by using the Asian model, or by sourcing dies to countries with very low labor costs. The challenge of sourcing complex tools and dies to low labor countries, e.g. China, is that they are just beginning to develop

the necessary technical expertise, and the risk of failure would be high. An allegiance between a domestic supplier for difficult dies, and a low cost supplier in a developing country for simpler dies certainly has potential. Or similarly, a relationship where engineering is performed domestically and machining and assembly performed in low-wage countries has merit. A major concern, however, with both of these options is that over time the foreign partners will develop their own technical expertise at the expense of the domestic company. An alternative collaborative model proposed later in this report largely replicates the strengths of the Asian model within the constraints found in North America.

The domestic auto companies recognize the value of sourcing tools and dies to local companies. Cost related advantages of local suppliers include:

- Lower logistical costs (shipping, travel, communication, etc.).
- Better communication, which is especially important for complex tools and dies.
- More familiarity by the local companies with domestic requirements (design, tryout, die standards, etc.).
- Better able to implement engineering changes.
- Shorter lead and response time due to improved communications and shorter shipping times.

The domestic automakers, although pressed to reduce their costs, see both a technical and cost advantage to sourcing tools and dies locally. One industry manager indicated that the value, or premium associated with sourcing dies overseas in Asia could be up to 30%. In other words, everything else being equal, an automaker might be willing to pay up to 30% more to source a tool or die domestically rather than in Asia.