2021 NORTH AMERICA MOLD AND TOOL & DIE INDUSTRY SUMMARY

The current problems facing the North America Mold and Tool & Die industry are significant:

- Covid -19 variance.
- Material supplies delays.
- 30% overcapacity.
- Technology improvements that lower the barrier for others to enter the market.
- Lower demands from automotive companies due to reduced number of new vehicles, greater part integration, and increased part carryover.
- Increased customer demands to provide more services and lower price by 5% annually.

Although some of these factors have come and gone before, this pandemic economic downturn is considered to be different from previous downturns, because there has been a change in the manner in which the automotive industry operates do to supply's. We are seeing a gradual upturn month by month with increasing opportunities for tool suppliers. Both the OEM and their suppliers are under intense global competition and must cut cost and change the way they do business, both internally as well as between one another. The above factors are permanent and not going to disappear as the automotive compete; hence as the industry restructures and develop new business models, such as the coalition approach during supply's and demands for materials inventories and shipments.

Global competition data shows some countries can make Molds & Dies at 1/3 the cost in approximately one-half the time. These differences can be attributed to 3 basic reasons: lean operations, simpler part designs from their customers, and closer supply chain-customer relationships. This latter factor is particularly important as it drives, in part, the simpler part designs, and because it enables both parties to identify system level cost reduction opportunities, such as functional build and on time launches.

It is imperative that M T&D shops adopt lean practices. These practices have been shown to lower cost and improve manufacturing performance. It is proven that

lean practices lower time and cost in the manufacturing function, such as machining, assembly, and tryout.

The M-T&D shops must learn to collaborate with their customers. For example, they can form alliances that offer broader range of services to their customers including project management and functional build. Collaborative efforts can drive tooling cost down through the following functions:

- Manufacturing & Engineering Efficiencies- 10%
- Alliance Efficiencies- 5%
- Product Design Input- 10%
- Lean Tooling Standards- 5%
- Functional Build- 10%
- Supply Chain Management-5%

The OEMs must entertain such alliance as viable options for offshoring partners. They can only succeed if the OEMs learn to work with the alliance to reap the benefits of the system cost savings such as: shipping, staging, tryouts, and maintenance of tools. These cost savings will require early design input, the creation of lean tooling standards, changing the part approval process (PPAP), and the implementation functional build processes at supplier's and potentially at the customer's site.

The local, state, federal government can support the coalition model by

- Funding the creation of alliance or initial development into the structure of alliance for various industries or customers (automotive, furniture, etc.).
- Providing funds for education and adoption of lean manufacturing method.
- Providing funding to support alliance cost reduction initiative.

WHAT THE TOOL SUPPLIER NEED TO CONSIDER

A. Best Practices of "Best" Shops.

A recent study in Europe surveyed approximately 50 M-T&D shops in Europe and South America to identify the characteristics associated with high performing shops. High performing M-T&D shops had a long-term (3 year minimum) record of steady workflow of profitable work. The five factors that had a high degree of correlation with high performing shops were:

- Companies had focused processes – they had clearly defined core competencies, out-sourced non-core services, and developed niche specialties. This extended to equipment selection, strategic sourcing partners, and careful commitment to strategic customers thru engaged sales & marketing partners.
- A higher than average effort was extended to new jobs early in the production cycle. A higher level of project planning and engineering attention was applied before work made it to the shop floor.
- Companies practiced continuous improvement in planning and operations, with an emphasis on their chosen core competencies.
- Machine tool planning (setup and machining) and programming was rigorously developed using centralized resources. The attempt was to minimize reliance on shop floor personnel for this activity during periods when the CNC machines could be cutting metal (thereby increasing machine utilization).
- Highly motivated workforce – employees that enjoyed their work and cared about company performance.

The report found that companies that excelled at these practices experienced superior performance and efficiency. The performance of these companies averaged 25% shorter lead times, 35% lower labor content, up to 60% less time

on the machine tools for Molds or Dies, and a much higher percent of spindle cutting time. Hence, the molds or dies are only on the machines while they are being cut instead of waiting on the machines while the machines are being programmed.

B. Lean Practices

Most M-T&D shops outside of Asia do not have close, dedicated, and collaborative relationships with their principal customers. M-T&D shops tend to be small, Independent, and very entrepreneurial, either serving a broad customer base with multiple services, or providing a small niche product. Since the early 80s, the North American M-T&D shops have evolved and become more sophisticated.

The factors associated with M-T&D shop performance are part of the benchmarking effort and derived from several sources including the Big 3 automotive industry, Japanese, and North American M-T&D owners, and Global-ACS industry research. The specific observations noted in the sections to follow are based on actual implementations and strategies seen at the most successful shops. Given the dynamic nature of the industry, M-T&D shops today have made progress with the positive performance factors mentioned in Section II A. or probably have not survived the current market pressures. All shops, however, need to continuously work towards the implementation of these lean practices.

1. **Project Management –** Effective project management has been recognized in one of the most significant developments at today's world – class mold-tool and die shops, because it requires disciplines that instill a standardized managed workflow. The role of M-T&D project management is to schedule resources (engineering, machine tools, assembly personnel, tryout presses, etc.) and plan for the timely execution of many task (including purchasing parts and outsourcing services). Many companies use software such as Microsoft Projects Manager. The key to effective project management is having predictable events that can be planned. Reducing the uncertainty of events, like tryout or the unplanned engineering change is important, as well as having a system that is flexible enough (robust) to adapt to unplanned situations. Two measures of effective project management are efficient

use of company resources and reliable prediction of completion dates. A part of project management is to effectively anticipate and manage engineering changes. The system must be able to process engineering changes without significantly deteriorating performance. Decisions about when to implement changes (immediately or batch until later) are key considerations.

2. **Synchronous Process Flow –** Synchronous process flow is consistent with effective project management. The term synchronous is used to suggest production line style manufacturing for M-T&D. Molds-Tools and Dies move through the shop in a production line fashion with all resources needed at every point in the process ready for the job when it gets to the downstream operation. Synchronous production requires standardized work, standardized bill of materials and resource demand at each work center. Certain design and production aspects of construction are standardized so that "bundles" of components are pre-packaged and ready for the tool. This maximizes off the shelf supplies rather than re-engineering or special ordering parts when needed and, thereby, lowers cost. Although unplanned events, such as machine tool breakdown, engineering change, sick employee, etc., can disrupt synchronous flow, manufacturing process needs to be designed to be robust to these events, which will occur, even though their frequency and timing is uncertain. Value stream mapping is one technique that can help identify and eliminate bottlenecks in the process flow. One technique to move an operation toward a production orientation is to begin measuring and managing the shop floor based on throughput of tools. The unit of production measurement is "tool produced," rather than the more traditional perspective of selling hours of capacity. This significant distinction requires tool design/production standardization and will help maximize capacity. For example, one US shop has doubled their capacity in terms of tools sets produced without increasing their available labor hours. They implemented lean practices that targeted the number of tools produced.
3. **Process Specialization –** Process specialization is also consistent with synchronous flow in that different individuals in the shop become specialists in their job function. This is again analogous to the production

line where each operator has a specifically assigned task. The old model with a craftsman toolmaker, which often was the project manager for his tool, is obsolete. The toolmaker skills, while still very valuable should be focused toward the engineering and problem solving part of the process. Other individuals should focus on their respective specialties, such as project management (which includes scheduling), engineering design, machining, machine tool programming, setup, tryout, etc.

4. **Understanding of cost –** Many OEMs indicated that they believe that the M-T&D shops do not recognize their cost structure, leading to sub-optimal business decisions and non-competitive quotes. A typical approach taken by shop is to develop an hourly rate for collection of services and use the rate to quote job. This rate might, for example, aggregate several costs (including machine tools, computer software, etc.), and assign an hourly rate based on the labor hours involved, irrespective of the capital equipment involved. Suppliers with a broad range of capabilities (full-service supplier) have complex cost structure that demands closer scrutiny. The activity-based costing (ABC) approach has been recommended for business with a complex range of equipment and services. ABC is an accounting method for allocating overhead charges based on an equipment/space/overhead resource leasing per unit time concept. This also supports lean initiatives, as ABC is much simpler to implement if there are standard work times and the infrastructure is in place to monitor the time of each operation. With ABC, the company can better evaluate the economic viability of certain assets and make better decisions regarding:
    - Developing quotes.
    - Upgrading capital equipment and technology.
    - Expanding capabilities (into engineering, tooling repair, prototype development, tryouts, etc.), and
    - Focusing on cost reduction opportunities.
5. **Reduced Paper-** Today most every shop is 100% electronic data transfer from process design to cutter path generation.
6. **Machine Tool Utilization-** Overall manufacturing efficiencies is heavily correlated with percent of spindle cutting time on the machine tools. Unfortunately, most North American shops do not formally measure

their machine utilization. Some companies measure machine tool utilization by including setup, run time, etc. Estimated machine times range from 60% to 85%. However, “lean” companies rigorously measure their machine utilization emphasizing spindle cutting time. High performing shops strive for spindle cutting time in excess of 90% of machine time (less preventive maintenance). Factors contributing to a high spindle cutting time include standardized locators for quick load and unload of work piece/jig, debugged CNC machine programs prior to changeover (using simulation or other methods for validation). Preset tooling, and load/unload pallet automation. Average tool changeover times in the North American range from 0.5 to 4 hours. In lean shops they range from 18 minutes to 1 hour.

7. **Technology –** Companies need to stay current on the latest manufacturing and engineering technologies as high speed cutting tools, laser welding, CAD/CAM technologies, and engineering design and simulation tools. When effectively applied, machining centers can achieve 24-hour operations with an operator to machine ratio from 1:2 to 1:3. The North American companies typically have 1 person per machine and are moving towards 0.5 operators per machine. The lean shops have fewer than 1 per machine and operators some machinery unmanned at night. Engineering design tools are evolving where excellent product feasibility analysis is becoming standard, and spring back prediction is improving. Simulations are extending to manufacturing simulations of tools in the production press, taking into account material handling automation and scrap metal removal. Automakers use this information to maximize production speeds, and they are to expect M-T&D suppliers to share in this responsibility.
8. **Development of Core Competencies –** Many tool shops actually provide a subset of products and services from a broad range of possible ones, for example:
    - Tools
    - Dies/Molds
    - Fixtures
    - Patterns (for castings)
    - Engineering design (tools/dies/molds)

- Feasibility engineering (product design)
- Tooling tryout
- Prototype development
- Production launch support

Some full service suppliers provide many or all of these services along with many more. Although the full service supplier offers many advantages in some circumstances, particularly when fast turnaround is required or when a customer lacks industry knowledge or ability to manage may subtasks, the concern that is raised is whether or not a supplier can be competitive with all these services at the same time. Without specialization, some of these capabilities may come at high costs because of sporadic utilization and experience- a further reason to consider activity based costing analysis so as to determine the cost of non-fully utilized assets. Some suppliers can become more competitive by developing niche capabilities from a subset of this list. Although there is a clear need at times for a full service supplier, many world class companies specialize in fewer areas so that they will always be recognized as an industry leader with a few critical capabilities, rather than a generally good supplier of many capabilities. Process specialization includes having strategic suppliers that can execute operations either more efficiently than the primary shop (perhaps with lower labor costs, etc.), or can readily handle simpler operations, like 2-D machining. Reserving the more critical operations/capacity. Like 3-D machining, where there may be a competitive advantage at primary shop.

9. **Centralized Engineering –** It would be difficult today to compete in complex M-T&D construction without a major emphasis in a central engineering function. Centralized engineering is consistent with reducing (or eliminating) the craftsmanship approach of tool making on the shop floor. Although most auto companies would like to see the need for sophisticated engineering design to decrease and let M-T&D sourcing compete as a commodity from labor costs, the intellectual content in M-T&D is one of the unique attributes of this product; so developing this capability is important.

In closing we are seeing North American customer for large Molds & Dies asking all offshore supplier to quote DDP also have partners in the North America to support tryout, engineering changes, and maintenance support.