ABHAY VADHAVKAR

Global Tooling Supplier Selection

It was the summer of 2006. Ramona Parmantie had a huge responsibility on her shoulders as the Stamping Tooling Sourcing Manager at American Global Car Company (AGCC). The task in front of her was to develop a global strategy for sourcing stamping tooling, and time was running short following the implementation of the Accelerated Product Development Process (APDP) in her company. With the new process, parts that were previously manufactured using temporary tooling are now required to be manufactured by hard dies were required much sooner than previously. This was required in order to stay competitive with the Japanese automakers, which were capable of developing and bringing vehicles to market with much shorter lead times than AGCC.

Parmantie cringed. Sourcing stamping tooling was a highly complex process, with numerous variables to consider before she could formulate any recommendations. As Parmantie reflected,

> *First of all, there's the size of the program, or the number of tools to be produced. The size of a program or the number of tools is dependent on the amount of change to the sheet metal parts of the body. Typical sheet metal parts include hoods, doors, body sides, decklids, fenders and roof. Exactly how many parts will be new for the program? Then, I need to think about the complexity of each part. Geographic considerations also come into play… for example, I remember one time when tooling was sourced in China with little consideration for the amount of time it took to transport parts produced using hard or volume production tools into the United States. Large stampings had to be air-freighted to the US, which subsequently had to be explained. Ugh! What ended up is that not a whole lot of savings were actually realized making the case for total cost analysis.*
>
> *Additionally, the current workload in specific die shops also needs to be considered… we can't have a situation where the die shop can't give AGCC a proper priority because they have other customers' tools tying up their heavy equipment – like numerically controlled (NC) 5 axis mills and tryout presses. Timing is always critical. And, then there's the issue of whether it's a concurrent program globally, or manufacturing is done in a single location. If it's a concurrent program globally, there definitely is a lot to be gained by sourcing duplicate sets of tools in the same die shop!*
>
> *I need to come up with some kind of an objective evaluation method for sourcing of stamping tooling… something that would be acceptable both globally and*

within each local organization. Not only that, but before a die shop can be sourced with a given set of stamping tools, it would have to be acceptable to the product development folks, manufacturing, purchasing and program management.

Geez… I need to have this finished up by Monday of next week. That leaves me a whopping total of five days to get this figured out. Ugh!

AGCC and the Auto Industry

AGCC was a global automobile manufacturer, with various divisions around the world. Although its largest market by volume had historically been in the United States, the company was rapidly expanding in South East Asia, India and South America. European operations had been volatile and were not always as reliable as a source of profits as it had been in the past. On the other hand, markets in South East Asia, specifically China, Thailand and Vietnam had been rapidly growing. The company had to continually freshen the look of its products in traditional markets, such as USA, Western Europe and Australia, but also while adding new plants in the South East Asian countries, Brazil, India and even South Africa, where the competition for expansion was relentless and establishing AGCC's brands before its competitors did was paramount.

In 2005, globalization across scores of industries was at a peak. In the auto industry, more than ever, it was recognized that the more profitable companies – like Toyota and Honda – had determined how to produce virtually identical vehicles on multiple continents, with great customer acceptance and minimal engineering costs, which amounted to improved profitability. Their strategy was to engineer a vehicle once and manufacture the exact same vehicle except for local regulatory requirements, in every region. North American auto companies had alluded to needing geographically unique vehicles; however, development costs and investment made them reconsider, especially after their competitors were able to sell essentially the same vehicles on multiple continents without hurting their market share.

It was this realization, Parmantie recalled, that resonated with AGCC's top management. Consequently, the decision was made to produce virtually identical vehicles, therefore minimizing the number of local platforms for vehicles. In fact, a directive was issued to reduce the number of platforms, and make vehicles as common as possible, only varying from that policy when it was absolutely necessary to meet local safety, fuel economy, emissions, and other standards. Almost all of the engineering was to be common, as well as manufacturing processes were to be as common as possible. Replication supports centralization of manufacturing tooling sourcing as well.

Specifically in 2006 – and amidst increasingly fierce competition – the need for rapid freshening of product lines was becoming even more critical. Freshening a product line in the automotive

business entailed redesigning and producing new body parts, which meant entirely new stamping tooling to produce those parts. This included parts such as hoods, fenders, doors, roofs, decklids, liftgates, bodysides, floor pans, and numerous other parts that required significant expertise and effort to create stamping tooling. This type of stamping tooling needed to be designed to meet AGCC's global specifications, so as to produce high quality parts consistently, at high production rates, and requiring minimum amounts of maintenance.

Historically, the focus was mainly on the price quoted for each stamping die set or tools. The lowest bidder got the work, as long as AGCC's management was reasonably sure that the specific die shop was capable of delivering the tools. Other than that, there was very little consideration given to anything else. "Ah… those were the 'old days,'" mused Parmantie.

However, given AGCC's global operations and the need to continually freshen products, this meant that the company's various divisions needed to freshen car lines all at the same time… simultaneously! This, of course, was what made Parmantie's task all the more challenging.

Information Gathering

The benefits of globally sourcing common tooling for identical parts were quite obvious. "For one thing," surmised Parmantie, "we can obtain lower costs, due to buying in larger quantities. And secondly, with centralized purchasing, we won't have the duplication of efforts that would result if every manufacturing location around the world was making its own purchasing decisions." The issues concerning her are capacity planning to ensure that a supplier sourced multiple copies of the same dies can get the dies done in time and provide a price break for higher volume; that different dies sourced to the same supplier do not pay higher prices due to higher demand. Although she wondered if centralization was the best solution or perhaps some type of a hybrid solution, her management seemed to have their minds made up. She knew that someday she had to raise that question but now was not the time.

The quality of tooling was, of course, a primary consideration. This depended on a number of factors, but especially upon a potential supplier's capabilities, including those related to: (1) die process; (2) die design; (3) draw die development; (4) machining; (5) tryout; (6) build; (7) part checking; (8) pattern making; and (9) NC (numerical control) programming… plus other, miscellaneous kinds of things, such as a supplier's areas of specialization or expertise. Parmantie began developing a list. "I'm also going to rate the importance level of each factor," she resolved. "I'll use a 1 – 10 scale, where 1 is low importance and 10 is extremely important. That way, a potential supplier can be evaluated more objectively… we can assess each supplier based on not only what it *has* or *does*, but on how well each capability matches up with what's important to *us*." (See Exhibit 1.)

The most important factors, according to Parmantie's list, were:

1. **Die Design and Development Capability:** This was the foundation of stamping tooling. Without the ability to design and develop dies using computer aided design (CAD), a die shop would not have the ability to produce high quality dies. In the past, die shops were dirty, oily places where men (women were extremely rare until recently) crawled into dies with a lot of grinding and polishing gear to create dies that made parts. And in those days, the quality of parts and the reliability of dies were nowhere near the level required by 2006 auto manufacturers and their customers.
2. **NC Capability:** A die shop's ability to efficiently and accurately create NC cutter paths was also extremely critical to producing quality dies that could reproduce parts to the specifications established by design engineers. Quality of dies is defined by their ability to produce parts that are consistent in dimensional and surface appearance requirements at pre-determined rate of parts per hours with minimal maintenance. These cutter paths are used to machine dies accurately, in order to minimize the tryout time.
3. **Press Availability and Tryout Capability:** Once dies were machined, they needed to be bolted to appropriate presses that closely replicated the actual production presses. The process of working on these dies until they produced quality parts and do so consistently is called "tryout." This tryout process lasts anywhere from two to ten weeks, depending on the complexity of the parts that would be produced from the die set being worked upon. This was usually the most time-consuming part of the process and was commonly interrupted by product or manufacturing initiated changes, as well as parts off these dies for test vehicle builds.
4. **Short Lead Times:** With the competitive nature of the automotive business, lead times from the start of die design to die "buy-off" – or approval to ship dies to the production site – was as important as the cost for building dies since delay of dies into production could mean delay of delivery of vehicles to dealerships. Dies had to be available to produce parts in the production facility well before volume production of vehicles begins. Since she began working at AGCC in 1998, lead times had been cut from 42 weeks to 28 weeks from start of die designs to die buy-off. "A classic example of what 'turbo marketing' has meant to American automakers," Parmantie muttered to herself.
5. **Program Management Capability:** With the complexity involved in producing stamping dies with multiple castings, steels, punches, buttons, cams, followers, air and nitrogen cylinders, etc. that went into a single set of dies – each having varying lead times for delivery – program management capabilities were extremely critical. All the while maintaining die delivery timing, the die shop was also responsible for supporting early test vehicle build schedules and managing engineering changes that interrupted the tryout process.

At the opposite end importance-wise were these factors she considered least important:

1. **Type of Dies:** With ability to source dies to multiple suppliers, this could be adjusted by only sourcing dies to the specific die shops that they were capable of handling.
2. **Number of Engineers:** Expertise, rather than sheer number of engineers, mattered more.
3. **Experience with Certain Types of Sheet Steel or Aluminum:** Similar to the type of dies, sourcing of dies to make parts with certain types of sheet steel could be adjusted by sourcing dies to specific die shops.
4. **Die Design Software Used:** Ability to effectively use die design software and communicate issues with AGCC mattered more than the specific brand of software used.
5. **Crane Capacity:** Sourcing could be adjusted, based on the size of dies that each shop could handle.

She paused, setting her mechanical pencil aside. "Besides needing technical competence, this evaluation also needs to include financial factors and the supplier's program management skills." She picked up her pencil and resumed her work (see Exhibit 2). "Yup… timing is imperative," she reflected. "I'd better assign a10 to lead times."

As she created this list and started to assign weighting factors, she felt overwhelmed. She realized more than ever that the items she'd begun to outline were only a part of all the considerations that the company had to deal with, and that she didn't have all the answers. She felt a strong need to involve other experts in their fields within the company who could help her with the process of creating this evaluation system. So, she went to see her boss, Jonathan Davide.

"Jonathan, I need some help and I need your opinion on this," she said to him. "I think I need to involve experts in die construction, die tryout, as well as people from the program management and purchasing areas to help me with weighting all the factors that need to be considered in evaluating die shops."

To her delight (and relief), Davide replied, "What a great idea! Not only will your evaluation system be more accurate but also it will be far better accepted by the people who will be living with the sourcing decisions we will be making."

With her boss' approval, Ramona conducted several meetings with experts from various departments, such as die construction, die tryout, material planning and logistics (MP&L), finance, program management, and purchasing to agree upon the factors and their importance. She was thus able to create an evaluation template that was far superior to what she could have done by herself. As well, she had been assured that all parties would support her sourcing decisions. "I think I'm making headway," reflected Parmantie.

Parmantie proceeded to share this evaluation template (see Exhibit 3) with Davide, since she felt far more reassured now that rather than just she, a panel of experts helped create the evaluation

process. She's also used her leadership skills to bring about the consensus necessary for their approval. So impressed was Jonathan that he took it upon himself to call the department managers from AGCC's internal die shop to ask for an expert from both die construction and die tryout to join Parmantie on a global journey to evaluate first-hand die shops, using the evaluation process that they had helped create. As well, he contacted managers from the MP&L department, and purchasing departments to include an expert from each to join her on her journey. Finance and Program Management areas offered to support via audio and video conferences at any time of day or night on a consulting basis.

Thus Parmantie and a team of experts were deployed to evaluate 45 die shops globally across South East Asia, East and West Europe and South America. The task was to come back to Davide and the department managers from the internal die shop, MP&L, finance, program management and purchasing with a recommendation on the viability of these shops to produce specific families of tools that met AGCC's cost, quality and timing requirements for all its global vehicle programs. If the team collected information from die shops, they could be classified according to four major categories as follows, with typical examples of parts produced with these dies:

1. Complex Outer Panel Dies: Body Sides, Door Inners, Door Outers
2. Simple Outer Panel Dies: Hood Inner, Hood Outer, Roof
3. Complex Structural Panel Dies: Quarter Panel Inner, Dash Panel, Floor Pan
4. Simple Structural Panel Dies: Pillar Inner, Roof Header, Seat Cross Member

Then, after compiling all the information, Parmantie could assign a ranking to each supplier within each category, based on program timing and the die shop's specific workload, as well as the geographic region that needed the dies. The equipment and expertise required for each category is different. For example, for outer panel dies, the die shop needs to be trained to evaluate surface quality, which tends to be subjective and have the equipment such as a "green room", which is used to view defects on panels. Outer panel dies also require chrome plating facilities nearby since the die punch must be chrome plated prior to shipping dies to the production plant. Chrome plating is required so parts will be produced with a mirror finish required for exterior parts to look good after paint.

Geographic region mattered since the die's delivery had to be via ocean freight and the time from door to door could vary from three to ten weeks besides adding another layer of complexity. Packaging that meets global commercial standards, customs clearances, size and weight limitations in ocean liners and using environmentally safe corrosion resistant materials are some of the many issues that must be considered when globally sourcing tooling.

Supplier Evaluation

Once Parmantie and her team returned from their exhausting world tour of potential die shops, it was time for the team to force rank each die shop within their capability category and develop a recommendation for Davide and the other managers. Based on knowledge that various global manufacturing sites were competing against each other, the decision to centralize was already made by upper management. Ramona's task was to develop a methodology acceptable to multiple organizations within AGCC and come up with recommendations for sourcing. As she sifted through all the reports that had been accumulated, she had to smile and reflect upon the culturally rich experience she had while evaluating these die shops worldwide. The evaluation was not easy at all, especially in countries like Japan where "yes" doesn't necessarily mean "yes"… but it means your question is understood. Or countries like Turkey where close personal relationships must be developed before shops are willing to share what they are capable of doing, since many of the die shops are family owned for generations. Of course, the language barrier was most prevalent in countries like China where people either didn't speak English or were too shy to speak in English with non-Chinese even when they knew how. Clearly a cultural coach and familiarity with the language in the different regions would be beneficial. Yet after reviewing and evaluating all the data, she often wondered if her analyses of these die shops would match their resulting performance once they were sourced with AGCC's dies. The only way she would know would be to source them with new tooling or dies and then compare their results to her team's predictions. Using a weighting strategy was one way to mitigate the risk of sourcing dies to a shop whose results were as yet unknown to AGCC.

She was concerned that the team recommendations must include an implementation strategy by panel type and by region to avoid jeopardizing a vehicle launch because the dies for a major panel like a side aperture were not proven on-time during tryout. The cultural issues in each region supported local regional sourcing to overcome any language issues and provide the close support needed to solve launch problems in assembly and to incorporate any engineering changes that may arise. There were other questions that she and her team needed to address in order to finalize their recommendations to Davide and upper management. Perhaps by coordinating the final supplier selection decision in a region with the Purchasing, Product Development, Manufacturing Engineering and Production organizations the benefits of centralized purchasing and regional ownership and autonomy could be achieved. She decided to meet with her team one more time to discuss these concerns and any other questions that should be addressed to formalize the evaluation process. She started to draft the agenda for their discussion.

Exhibit 1: Stamping Engineering & Tool Manufacturing Capabilities

(Source: Company records)

Factor	Importance	Score (0-10)
A. Die Process Capability		
1. Type of Die processing system	2	
2. # of Die Process Engineers	2	
If outside, partnered w/ Design House Name:		
3. Experience with type of panels:		
a) Outer skin panels	5	
b) Inner panels	5	
c) High Strength Steel Parts	2	
d) Dual Phase Material Parts	2	
4. Knowledge of AGCC Engineering and specification requirements (Part tolerance requirements)	5	
B. Die Design Capability		
1. Die designs done in-house	2	
If outside, partnered w/ Design House Name:		
2. Type of software used for computerized die designs	2	
3. # of Die Designers	2	
4. # of licenses for each software used	1	
5. Experience with AGCC Die Design & Construction Standards	5	
6. Ability to access AGCC Die Designs In:		
a) Software brand A	10	
b) Software brand B	7	
c) Software brand C	10	
C. Draw Die Development Capability		
1. # of developments done in house	2	
2. # of Draw Development engineers	2	
3. Ability to access AGCC Draw Die Development in Catia V5	10	
D. Engineering Simulation Capability		
1. Type of software used	2	
2. # of CAE engineers, experience level	4	
3. # of licenses for each software used	2	
4. Does supplier have an autoweb account?	10	
5. Engineered Draw bead capability (NC cut bead size & shape based CAE simulated material flow)	5	
E. Machining Capacity		
1. 2D capability	9	
(Can an entire die shoe be mach. in one set-up?)		
2. 3D Capability (are all details 100% NC cut?)	9	
3. Wire burn capability	4	
4. In-house laser capability for blank development	1	

F. Tryout Capacity		
1. # of presses available for tryout, size & tonnage	10	
2. # of press operators available	9	
3. Decoiler and feeder systems available	3	
4. Capability to perform Circle Grid Analysis	2	
G. Build Capacity		
1. Overhead Crane Capacity	3	
2. # of bays / bay sizes	3	
H. Part Checking Capability		
1. CMM capability and size	8	
2. White lighting scanning capability	3	
I. Pattern Making Capability		
1. Ability to make foam patterns for castings	5	
2. Ability to NC machine patterns (cut layers then glue up layers)	2	
3. Equipment to inspect finished pattern for proper dimensions	5	
J. NC Programming:		
1. Capability to create NC cutter path for 3D Part Surface	10	
2. Capability to create Linear NC programs off-line.	8	
3. Ability to detect interference with castings during programming	5	
K. Unique Capabilities not listed in evaluation form	2	

Exhibit 2: Commercial Business and Program Management

(Source: Company records)

Factor	Importance	Score (0-10)
PURCHASING / COMMERCIAL BUSINESS		
L. Commercial Business		
1. Annual turnover in US dollars	2	
2. Capital Investment	2	
3. Overall number of employees	5	
4. Lead times required for tooling	10	
5. Experience with tandem and transfer dies	6	
PROGRAM MANAGEMENT		
M. Program Management		
1. No. of experienced program management personnel	8	
2. AGCC Computer System Access (Metaphase/TcE)	7	
3. Provide on-site support at AGCC in Detroit area	5	

Exhibit 3: Die Shop Evaluation Template

(Source: Company records)

COMPANY: ABC Tool and Die Company

Date: 11-Sep-2006

Evaluator: R. Parmantie

STAMPING ENGINEERING & TOOL MANUFACTURING	Weight Factor	Score (0-10)	Answer / Comments
A. Die Process Capability			
1. Type of Die processing system	2		
2. # of Die Process Engineers	2		
If outside, partnered w/ Design House Name:			
3. Experience with type of panels:			
a) Outer skin panels	5		
b) Inner panels	5		
c) High Strength Steel Parts	2		
d) Dual Phase Material Parts	2		
4. Knowledge of AGCC Engineering 1294 specification requirements (Part tolerance requirements)	5		
B. Die Design Capability			
1. Die designs In-house	2		
If outside, partnered w/ Design House Name:			
2. Type of software used for computerized die designs	2		
3. # of Die Designers	2		
4. # of licenses for each software used	1		
5. Experience with AGCC WDX Die Design & Construction Standards	5		
6. Ability to access AGCC Die Designs In:			
a) Software brand A	10		
b) Software brand B	7		
c) Software brand C	10		
C. Draw Die Development Capability			
1. # of developments done in house	2		
2. # of Draw Development Engineers	2		
3. Ability to access AGCC Draw Die Development in Catia V5	10		
D. Engineering Simulation Capability			
1. Type of software used	2		
2. # of CAE engineers, experience level	4		
3. # of licenses for each software used	2		
4. Does supplier have an autoweb account?	10		
5. Engineered Draw bead capability (NC cut bead size & shape based CAE simulated material flow)	5		

E. Machining Capacity			
1. 2D capability (can an entire die shoe be mach. in one set-up)	9		
2. 3D Capability (are all details 100% NC cut)	9		
3. Wire burn capability	4		
4. In-house laser capability for blank development	1		
F. Tryout Capacity			
1. # of presses available for tryout, size & tonnage	10		
2. # of press operators available	9		
3. Decoiler and feeder systems available	3		
4. Capability to perform Circle Grid Analysis	2		
G. Build Capacity			
1. Overhead Crane Capacity	3		
2. # of bays / bay sizes	3		
H. Part Checking Capability			
1. CMM capability and size	8		
2. White lighting scanning capability	3		
I. Pattern Making Capability			
1. Ability to make foam patterns for castings	5		
2. Ability NC machine patterns (cut layers then glue up layers)	2		
3. Equipment to inspect finished pattern for proper dimensions	5		
J. NC Programming:			
1. Capability to create NC cutter path for 3# / Part Surface	10		
2. Capability to create Linear NC programs off-line.	8		
3. Ability to detect interference with castings during programming	5		
K. Unique Capabilities not listed in evaluation form	2		
Total Stamping Engineering & Tool Mfg.	200		
PURCHASING / COMMERCIAL BUSINESS			
L. Commercial Business			
1. Annual turnover in US dollars	2		
2. Capital Investment	2		
3. Overall number of employees	5		
4. Lead times required for tooling	10		
5. Experience with tandem and transfer dies	6		
Total Commercial Business	25		
PROGRAM MANAGEMENT			
M. Program Management			

1. No. Experienced Program Management Personnel	8		
2. AGCC Computer System Access (Metaphase/TcE)	7		
3. Provide On-site Support at AGCC in Detroit area	5		
Total Program Management	20		

EVALUATION SUMMARY

	Stamping Engineering & Tool Manufacturing	Purchasing / Commercial	Program Mgt
Sub-score:			
Overall Weighting Factors:	**Stamping Engineering & Tool Manufacturing**	**Purchasing / Commercial**	**Program Mgt**
Stamping Engineering & Tool Manufacturing			
Purchasing / Commercial Business			
Program Management			
Total Score (%):			
Stamping Engineering & Tool Mfg. ==>			
Purchasing / Commercial ==>			
Program Management ==>			
Total Score ==>			

Glossary of Terms:

1. Stamping: Using a device called a stamping press, parts are produced out of a thin, flat sheet of metal in a series of dies to cut and form metal into various shapes. Examples of such parts are fenders, hood outers, door inners, etc.
2. Hard dies: Industry term for production stamping tooling capable of producing thousands of identical parts that create the metal body of an automobile. Conversely, temporary tools that produce a few hundred parts but are much quicker and easier to create are called "soft tools".
3. Die shops: Factories that create production stamping tooling. Also called "Tool & Die" shops or simply "Tool" shops.
4. Numerically controlled (NC) 5 axis mill: Machine capable of removing or shaving metal from castings to shape it to a form that will be capable of stamping desired parts.
5. Tryout Press: A stamping press used to simulate production conditions but not used for production. Most companies utilize tryout presses to evaluate dies while the production presses are producing other parts.
6. Globally concurrent programs: Same vehicles that start volume production at the same time in multiple locations thus requiring all product and process compatibility issues to be concurrently resolved as well. Almost always such programs consist of launching the same vehicle on different continents.
7. Roles:
    a. Product Development: Organization responsible to design parts that meet customers functional and aesthetic requirements.
    b. Manufacturing: Organization responsible for consistently and efficiently producing parts that meet customer and product development engineer's requirements.
    c. Purchasing: Organization responsible for contracting between the company and the supplier. Stamping tooling is considered non-production material since the tooling does not end up on a vehicle. In contrast, production materials are parts that end up on the vehicle as delivered to the customer.
    d. Program Management: Organization that defines and maintains standards for a vehicle project to make sure every event has the proper material in correct quantities and all tooling is delivered on time to meet quality, cost and timing targets.
8. Platform: The structure upon which the upper body of the vehicle is joined. At times multiple variants of a vehicle are built upon a common platform minimizing the need to engineer an all new powertrain and chassis.
9. Die Process: Multiple steps or stations where flat metal gets shaped until the desired part is produced.
10. Die Design: An exact scale line or pictorial representation of stamping tooling which guides engineers and die-makers in producing the die necessary to produce stampings.

11. Draw Die Development: Process by which die engineers create the first operation in the stamping process called the "draw die". This die takes a flat metal piece called a "blank" and shapes in the form of the part. Subsequent operations or stations are required to add the rest of the features such as flanges, holes and slots to finish the part.
12. Machining: Process by which material is removed from a casting until the desired shape is achieved and the stamping die or tooling can be used to produce stampings.
13. Tryout: A process which includes a series of controlled experiments that result in a set of stamping dies capable of producing parts that meet the target quality levels and production rates.
14. Build: The process of assembling multiple cast and machined parts that constitute a die operation.
15. Part Checking: Process of evaluating a part to determine if it meets design specifications.
16. Pattern Making: Process of creating a full size "Styrofoam" representation of stamping die castings which are used to create a sand mold. This sand mold is then used to pour molten metal and create the casting which is subsequently machined to produce the die.
17. NC Programming: Control of a process or machine by encoded commands that are commonly prepared by a computer to machine castings which are used to create stamping dies.

SUGGESTED QUESTIONS:

Q1. IS CENTRALIZATION A GOOD DECISION OR IS A HYBRID SOLUTION BETTER?

Q2. HOW SHOULD PARMANTIE DEVELOP/FORMALIZE THE VALUATION PROCESS?

Q3. SHOULD THE EVALUATION CRITERIA BE TAILORED TO EACH DIE PART FAMILY (i.e., COMPLEX OUTER, SIMPLE OUTER, COMPLEX STRUCTURE, SIMPLE STRUCTURE)?

Q4. SHOULD THE CRITERIA BE DIFFERENT FOR VEHICLE PROGRAMS IN DIFFERENT REGIONS OF THE WORLD (i.e., NORTH AMERICA, SOUTH AMERICA, EUROPE, and ASIA PACIFIC)?

Q5. TECHNOLOGY FOR BUILDING TOOLS IS CHANGING FAST IN THE INDUSTRY. HOW SHOULD THE EVALUATION PROCESS BE ADAPTED TO KEEP IT EFFECTIVE (e.g., TECHNOLOGY CHANGES, PERFORMANCE DEFICIENCIES)?

Q6. CAN THE EVALUATION PROCESS BE ADAPTED TO OTHER PRODUCTS, SERVICES OR INDUSTRIES? WHICH ELEMENTS REMAIN THE SAME AND WHICH ONES NEED TO CHANGE?