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Disclaimer

The mention of company and organization names in this report is intended to provide the reader with useful information, and is in no way an endorsement of these companies and organizations.

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Abstract

Efficiency performance contracts (EPCs) for small and medium enterprises (SMEs) are a market-based approach that rewards suppliers for improving efficiency and reducing waste in SME operations through pollution prevention and energy efficiency innovations. However, prior research has shown that purchases typically covered by EPCs - such as metalworking fluids, chemicals, paint, electricity, or natural gas – are usually too small in SMEs to support traditional EPC programs.

This report addresses the possibility of combining two or more of these purchases under one EPC, or linking them to a larger purchase, such as tooling. This project assisted and monitored the progress of six Illinois SMEs in the metalworking industry as they explored the adoption of EPCs and the expansion of these EPCs to include multiple purchase areas.

Results indicate that an EPC based on tooling is clearly practical and beneficial for many SMEs. SME managers expressed interest in expanding tooling management EPCs to include metalworking fluids, and developing EPCs based on energy or paint purchases. However, no EPC other than tooling management has yet been adopted by an SME participating in the project. Though the recent economic downturn is likely to focus greater management attention on cost-cutting strategies such as EPCs, adoption is likely to be slow without significant assistance to reduce uncertainty and risk.

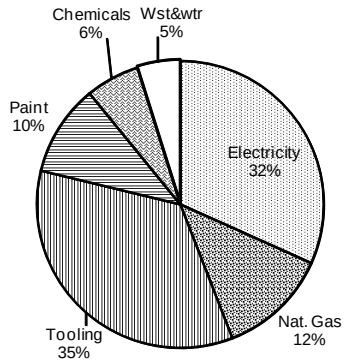
Introduction

SMEs and Efficiency Performance Contracting

In prior research it has been noted that small and medium-sized enterprises (SMEs) have a significant economic and environmental impact in the State of Illinois. Yet they have been slow to adopt pollution prevention and energy-efficiency (P2E2) technologies and practices that could both reduce waste and increase profitability (Bierma and Waterstraat, 2000 and 2004; Bierma and Marsch 2008a). Three barriers have been identified as particularly important in understanding why SMEs have been slow to adopt P2E2 technologies (Bierma and Waterstraat, 2000):

1. **Lack of Core Competence** – Many aspects of SME operations are critical to environmental performance yet are outside the core competence of management and staff. In the metal products fabricating industry, for example, these "non-core" areas often include energy, metalworking fluids and other chemicals, tooling, paint, water and wastes. Additional research has confirmed that these areas are typically not as well managed by SMEs as areas within their core competence (Bierma and Marsch, 2008a).

Figure 1. Typical annual spend in non-core areas for SME metal product fabricators (based on Bierma and Marsch, 2008a).



Moreover, annual spending in these areas commonly exceeds $500,000 for SMEs with 100 or more employees. A typical division of this spend is presented in Figure 1, though the relative expense in each area can vary considerably based on the specific operations at the SME (Bierma and Marsch, 2008a). These non-core areas represent a significant opportunity for environmental and financial improvement.

2. **Incorrect Incentives** – Traditional supply relationships discourage efficiency. Standard pricing - $/lb or $/gallon – rewards suppliers for volume, not value. Efficiency, under such incentives, is in direct opposition to the financial interests of the supplier. Suppliers often have the expertise needed to improve efficiency, but are unlikely to share more information than is needed to avoid losing the account. Thus, a wealth of expertise on efficiency improvement generally goes untapped.

3. **Operation-specific Approaches to System-wide Problems** – Inefficiency in production operations is often the result of attempting to manage pieces of the operation independently rather than optimizing the process as a whole (Bierma and Marsch, 2008a). Plants typically try to control costs and solve problems on an operation-specific basis. This is particularly problematic when many parts of the process are outside a company's core competence, as discussed above. SME managers report that involving suppliers in efficiency improvement efforts often results in "finger pointing," where the failure of one supplier's efforts are ' lamed on actions of another supplier making changes elsewhere in the system. Though the

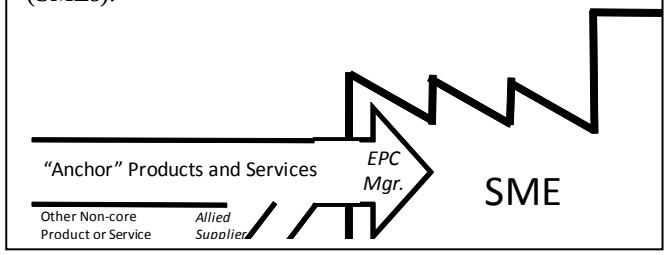
plant and suppliers may be aware of the need to optimize the system as a whole, the market provides no mechanism for this type of optimization. Thus, many innovations that could dramatically improve efficiency are not adopted.

A number of innovative supply strategies have been developed in response to the first two barriers. These include strategies such as chemical management services (CMS), energy savings performance contracting (ESPC), and resource management (RM). What all of these strategies have in common is a supplier incentive structure that aligns the financial interests of the supplier and customer to improve efficiency. These programs have been proven to work well for large businesses with spending in each area (energy, chemicals, waste, etc.) in excess of $1 million per year (Bierma and Waterstraat, 2000).

However, SMEs generally do not spend enough in any one area to support these programs. In our prior research, we found that the best hope of bringing the benefits of these innovative supply programs to SMEs was by combining two or more of these areas under a single supplier (Bierma and Marsch, 2008a). By using a single supplier, the supplier would be provided with sufficient revenue to cover the marketing, research, and implementation costs involved in these programs.

The general structure of an "efficiency performance contract" (EPC) is presented in Figure 2. It is based upon an "anchor" set of products and services, such as tooling or paint that represent a relatively large expense for the SME. The primary or sole supplier of these products and services serves as the EPC manager, coordinating purchase and delivery, but also working with plant staff to identify and implement efficiency improvements. The financial relationship between SME and supplier rewards the supplier for efficiency improvements.

Figure 2. General structure of an efficiency performance contract (EPC) for small and medium enterprises (SMEs).



In order to increase the expenditure covered by the EPC to the point where it would be financially sustainable, the anchor supplier develops alliances with suppliers of other non-core products and services. For example, a tooling supplier might develop alliances with a metalworking fluid supplier and a lighting supplier. All the products and services are coordinated through the EPC manager, so that the plant continues to work with a single point person for the suppliers. The contract is structured so that the EPC manager has a financial incentive to create greater efficiency in all of the products and services covered by the contract.

The primary financial benefit from grouping a number of non-core expenses under a single EPC, as opposed to creating individual contracts with each supplier, is reduced costs to suppliers for marketing and research. Once suppliers are allied, they are more likely to be able to provide products or services where any one of them serves as the "anchor" supplier, significantly reducing the marketing expenses of winning a plant contract. In addition, EPC managers will be able to perform much of the preliminary research needed to identify efficiency improvement opportunities for any of the products or services covered by the contract. For example, a tooling

supplier serving as an EPC manager would be able to identify many opportunities for improving metalworking fluid efficiency or even opportunities for upgrading to more efficient lighting in the plant. This ability to take advantage of the "eyes and ears" of an EPC manager who is already spending significant time in the plant could significantly reduce costs for all of the allied suppliers.

EPC Options

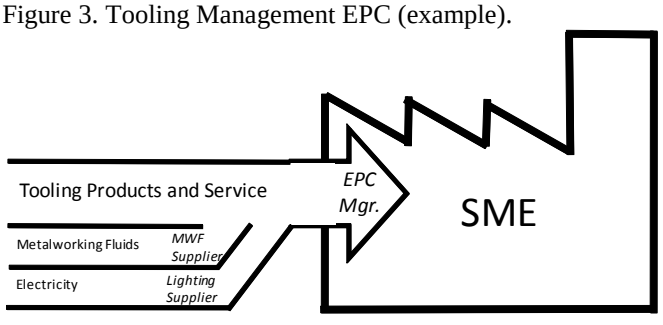
The work discussed in this report focused primarily on three EPC "anchor" options: tooling management, paint management, and energy management (Bierma and Marsch, 2008a). In each case, a single expenditure (tooling, paint, electricity for lighting) would provide the "anchor" for initiating the EPC, but the program can grow systematically to include other, logically-related expenses. Each of the EPC options is explained in more detail below.

Tooling Management – Tooling is typically one of the largest non-core expenses for SME metal products manufacturers (Bierma and Marsch, 2008a). The tooling management EPC option is built around a primary (or sole) tooling supplier. Though many tooling suppliers offer programs called "tooling management," this EPC option is based upon a contractual relationship that rewards the supplier for improving tool use efficiency through process improvements. To do this, the supplier must become an integral part of many plant operations, from sourcing to tool crib management to process engineering. The tooling supplier brings tooling expertise to these operations. Tooling suppliers have an incentive to improve efficiency either by sharing in the savings or through mandated annual savings targets (usually a percentage of annual tooling expenditure).

Local tooling distributors are well-placed to serve as tooling management providers. Distribution of tooling is less exclusive than for many industrial supplies, so tooling manufacturers are more willing to sell through any distributor a plant wishes to use. Thus, a plant's decision to choose a particular tooling distributor to run the program need not be linked with decisions about which tools to purchase.

Though a tooling management program might be limited to tooling supply at the beginning of the program, there are a number of ways the program could expand to include other expenses (Figure 3). Of particular interest is metalworking fluids (MWFs). Environmentally, MWFs are a greater concern than tooling and are more difficult to manage and dispose of safely (Narita and Fujimoto, 2009). In machining operations, MWFs can have a significant impact on tool performance and tool life (Byers, 2006). Thus, integrating MWFs under a tooling management program has the potential to improve machining efficiency and reduce costs. Annual savings targets can include both tooling and MWFs. For example, a more expensive MWF that significantly extends tool life can result in net savings and be counted towards the tooling manager's annual

Figure 3. Tooling Management EPC (example).



savings target. Because most tooling distributors lack expertise in MWF chemistry, an alliance with a MWF distributor is likely to be required.

It may also be possible for tooling management to include certain energy-efficiency improvements, particularly those that do not require significant expertise to recognize and evaluate preliminarily. A good example of this is lighting. A tooling manager can be easily trained to recognize inefficient plant lighting and calculate estimated savings and return on investment from upgrading. Energy savings can count against the program's annual savings targets. An alliance with a lighting company or energy consultant might be required. It might also be possible to offer financing for energy-efficiency improvements (see Energy Management, below, for details).

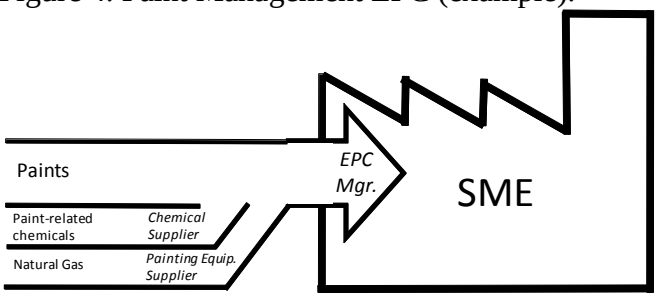
Some tooling management programs already include a number of maintenance, repair, and operating (MRO) items. Though this program has less environmental impact than MWFs and energy, reducing MRO waste can have environmental and financial benefits. Again, savings in MRO purchases could be counted against annual savings targets.

Paint Management – Paint is one of the largest non-core expenses for metal products manufacturers that paint their own products. Paint also has a significant impact on quality. There are some chemical management service (CMS) programs at large plants that primarily focus on paint (Bierma and Marsch, 2008a). A paint-oriented EPC program for SMEs appears feasible given the size and importance of the paint spend for many SMEs. Similar to tooling management, the program can be driven by annual savings targets. However, unlike tooling, paint is usually distributed directly through the manufacturer. If the paint management program is initiated with a paint manufacturer, it is less likely that they would be willing to supply a competitor's paint, even if it were more desirable for the plant. This may not be a significant barrier, however, as plants are often hesitant to switch paints, given their importance to product quality.

Though these programs can begin with supplying only paint, there are a number of other costs that could be logically incorporated. One logical expansion is chemicals used to pretreat parts in preparation for painting (such as cleaning and phosphating solutions) as well as solvents used for paint clean-up. This could require an alliance with a chemical supplier.

Another expansion can include energy related to pretreating and curing (Figure 4). Final paint quality can be strongly influenced by the pretreating and curing operations, so paint supply personnel are often very familiar with these operations in the plants they supply. It would not be difficult to train these personnel to recognize and preliminarily evaluate certain energy-saving improvements such as rinsing and evaporation controls, air knife drying, oven cycling controls, or stack economizers. Energy savings

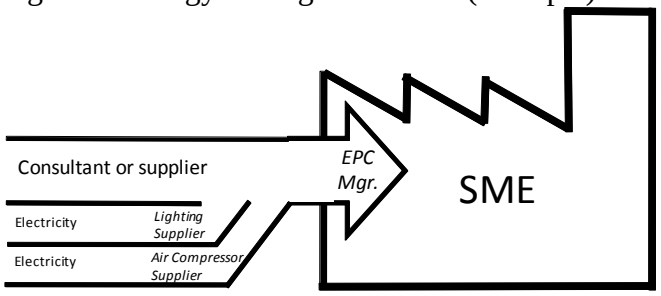
Figure 4. Paint Management EPC (example).



can count against annual savings targets. An alliance with a painting equipment or energy services company might be required. It might also be possible to offer financing for energy-efficiency improvements (see Energy Management, below, for details).

Energy Management – Energy might seem like a single spending category, or at most, two - electricity and natural gas. However, the uses of energy are so varied that the expertise needed to make energy-efficiency improvements is spread among a large number of companies. Examples include lighting, space heating and cooling, process heating (including steam), compressed air, and motors. An energy management EPC would require alliances between suppliers of each of these items. Unlike tooling and paint management, it is not obvious which supplier should be the EPC manager, working directly with the plant and coordinating the activities of the other suppliers. Alternatively, the role of the EPC manager could be performed by a third party. A logical third party company would be an energy services company (ESCO). Most ESCO's are large, well-financed companies that work with large, non-profit institutions such as schools, hospitals, and government facilities. As noted in our previous research, these large ESCO's are not interested in the SME market (Bierma and Marsch, 2008a). However, there are small energy consulting firms that might be willing to take on the role of EPC manager with SMEs (Figure 5).

Figure 5. Energy Management EPC (example).



The financial incentive for the EPC manager under an energy management program can be structured in several ways. Revenue can be derived from the sale of energy-efficient products, such as fluorescent lighting. Alternatively, revenue might be generated by sharing the savings produced from energy-efficiency improvements. Revenue might even be generated through financing the improvements. Some energy-efficiency improvements are so low in risk – such as lighting upgrades – that it may be possible to bank-finance the improvements through the "tier 1" provider[1]. That is, the "tier 1" provider could borrow the money needed to purchase and install the new lighting. They would then lease the lighting to the plant at a monthly rate less than energy savings that the plant will realize from the improvements. Thus, the plant would see immediate savings and avoid having to raise capital. The "tier 1" provider would make their profit either on the difference between the lease rate and the loan expense, or in collecting lease payments longer than it takes to pay off the loan, or both.

[1] Manufacturers sometimes refer to companies in their supply chain as tier 1 and tier 2 providers. The terms indicate the commercial distance in the relationship between the manufacturer and provider.

An additional potential source of revenue is carbon credits. Depending upon the carbon market, the energy-efficiency improvements could qualify for carbon credits to be sold to another company. A particularly promising option that was explored in this research project was an alliance with the Delta Institute of Chicago, a non-profit organization that helps finance energy-efficiency and other investments that will improve environmental performance. Moreover, Delta is a member of the Chicago Climate Exchange (CCX). They have expressed an interest in financing SME energy-efficiency improvements, receiving the lease payments and then selling the carbon credits on CCX.

Another value-added service that could be provided by the "tier 1" provider is coordinating the various energy-efficiency incentives available from government and utility sources. In Illinois, this includes both the federal tax incentives for lighting and other improvements, and the utility incentives for a variety of electricity-saving improvements. The federal incentives, in particular, can be complex and are unlikely to be utilized by an SME without expert assistance.

Research Objectives

This research builds upon previous work performed with a number of SME metal products fabricators in Illinois (Bierma and Marsch, 2008a). With a primary focus on three types of EPCs (tooling management, paint management, and energy management), this work sought to answer the following questions:

1. What are the drivers and barriers in the adoption of EPCs among SME metal products fabricators?
2. What are the drivers and barriers for suppliers in entering the EPC market?
3. What are the future prospects for EPCs and what might be done to increase the rate of adoption?

Methods

The author worked with ISTC staff – principally Dan Marsch and Mike Springman – to identify SMEs ready to consider implementing an EPC. Three companies from our prior research projects agreed to continue participation in the current research. Three additional companies agreed to join the research.

The author and ISTC staff attended meetings with company staff and between company staff and suppliers. Drivers, barriers, and ultimate progress in developing EPCs were identified from these meetings and interviews. We also interviewed and assisted existing or potential suppliers to understand the drivers and barriers to providing, or participating in, an EPC.

Results

Results by plant are presented in Appendix A. The most important findings are summarized below.

Tooling Management is the Most Promising EPC

Efficiency Performance Contracts (EPCs) limited in scope to tooling clearly work in mid-sized metal products manufacturing facilities. Of the six facilities in the study, two had successful and expanding tooling management programs (Plants A and B) and one had begun a program with early positive results (Plant C). Two of the tooling suppliers studied indicated that EPCs are a rapidly expanding part of their business. Another supplier, who recently began offering tooling management programs, indicated that they are currently negotiating a number of contracts with SMEs. Plant A has had such success with tooling management that it has been adopted corporate-wide and is now used at its six plants across the country. Separate, brief case studies for Plants A and B are presented in Appendices 2 and 3, respectively. A case study summarizing the tooling management programs at both of these plants has been published in the March, 2008, issue of Tooling & Production Magazine (Bierma and Marsch, 2008b).

All of the tooling management programs used annual savings targets. At two of the plants, this target took the form of a percentage of the contract value. At one of the plants, it took the form of a target tooling-cost-per-part produced.

However, the tooling management programs at these plants did not accomplish the goal of more broadly improving SME efficiency and environmental performance by expanding to cover other products and services. In addition, adoption of tooling management programs faced significant barriers in some plants. Each of these points is discussed in more detail below.

Slow Expansion Beyond Tooling – None of the plants have successfully included metalworking fluids in the program. Plant A experimented with the inclusion of metalworking fluids but it was not successful. The primary reason for the failure was that, unlike tooling, the tooling supplier had a distribution agreement with a single metalworking fluid supplier. When that metalworking fluid failed to perform adequately, the plant reverted to sourcing metalworking fluids outside the contract. This difference in the local distribution of tooling and MWFs represents a significant barrier to the expansion of tooling management programs. Local MWF distributors most commonly have exclusive distribution agreements with a single MWF manufacturer, making it difficult for a local distributor to offer a plant a wide variety of MWFs from which to choose. All though the market seems to be evolving in the direction of less-exclusive local distribution (becoming more like tooling), this exclusive behavior may be a barrier for some time to come.

Plant A continues to be interested in including metalworking fluids in the tooling management program, given the potential savings from properly matching tools and metalworking fluids, and plans to work with their tooling supplier to find a successful arrangement. All three tooling suppliers involved in the study expressed interest in finding a way to successfully include metalworking fluids in their programs.

All three tooling management programs included selected maintenance, repair, and operating (MRO) items in the tooling management program with good success, indicating that the suppliers are able to handle supply management for items beyond tooling. However, the supply of MRO items focused primarily on ordering, delivery, inventory, and distribution and did not include a systematic investigation of how the use of MRO items could be accomplished more efficiently. None of the programs are currently considering expansion into other areas such as chemicals or energy. None of the suppliers expressed confidence in being able to properly manage such items or to be able to contribute to efficiency improvements.

Price and Sole-Sourcing Concerns Continue to be Barriers – Price and sole-sourcing continue to be concerns that inhibit progress for plants that considered, but have not yet adopted, tooling management. Plant D initially expressed a strong interest in tooling management. The author and ISTC staff helped them develop a request for proposals (RFP) and interview candidate suppliers. However, instead of selecting a single supplier, the plant split 90% of its tooling spend between two suppliers and chose not to include annual savings targets. The program continues to focus on price and selected services (such as expedited delivery or sharpening) instead of efficiency improvement. Though the plant is pleased with its selection of suppliers, they have not experienced the savings and process improvements observed at Plants A and B.

Several of the plants without tooling management appeared uncomfortable with the supply relationship inherent in tooling management. Purchasing and engineering/manufacturing personnel, in particular, did not seem comfortable with a relationship in which price is secondary (to total cost) and the supplier is intimately involved in tooling selection decisions. Most plants continued to want multiple suppliers who would compete to provide the lowest price on tooling selected by the plant.

Energy Management is Promising but Still Untested

A number of plants expressed interest in comprehensive energy-efficiency programs and had preliminary discussions with potential suppliers including energy consulting companies, lighting suppliers, motor suppliers, and general electrical equipment suppliers. Several plants implemented energy-efficiency improvements, but no plant established an ongoing energy management program.

There appear to be significant opportunities for energy savings in metal fabricating facilities. The most important typically are lighting and compressed air. In plants that are air-conditioned, significant energy savings from HVAC improvements are often possible. However, motors do not appear to be an important source of energy savings. Motor audits conducted by motor suppliers as part of this project indicated that almost all motors in these facilities are specialty motors that cannot be easily upgraded to high-efficiency.

With regard to natural gas consumption, space heating is generally not a major expense because of heat generated from production equipment. However, for powder coating operations, the drying and curing ovens are major consumers of natural gas. Audits conducted in this study by

paint, paint equipment, and energy consulting companies suggest that significant savings opportunities exist. Ovens were insulated, but there was no system in place to regularly evaluate and maintain insulation. No plant was using stack economizers. Oven entry and exit systems appeared to be only marginally effective at preventing leakage. There was also no automated system to minimize gas consumption during gaps in production.

Two barriers, in particular, seemed to contribute to this lack of progress:

1. **Lack of Interested Suppliers** – There are a number of suppliers that could potentially serve as "tier 1" energy managers – lighting suppliers, motor suppliers, air compressor suppliers, paint suppliers, and paint equipment suppliers. However, none expressed a desire to take on this role with an SME. All would be willing to be participants in an energy management program, but saw it as an opportunity for sales. Energy consulting companies expressed greater interest and were more flexible in their possible sources of their revenue – sales, services, documented energy savings, or financing.

   One company in particular, Energy Solution, Inc., of St. Louis participated throughout the project and met with management at many of the plants in the study. Discussions between this company, Delta Institute of Chicago, and the author suggest that financing by the Delta Institute, arranged by the energy consultant, could be used to create a lease arrangement with an SME. Recently, Energy Solutions announced it had also formed an agreement with a local bank to provide financing. However, financing would probably have to exceed $200,000 to cover loan initiation and management costs. At the time of this writing, no energy management program had been initiated with an SME.

2. **Uncertainty Among SMEs** – SME managers seemed intrigued by the idea of an energy management program, but because no such program has yet been implemented, managers considered it too risky. A number of SMEs implemented selected energy-efficiency improvements uncovered in the audits performed as a part of this project, but none chose to pursue an energy management approach.

Paint Management had Little Appeal to Suppliers

Paint suppliers, paint equipment suppliers, and an energy consultant that specializes in painting systems expressed little interest in deviating from their current business models. Equipment suppliers and the consultant enjoy single-transaction revenue relationships with their customers. Maintaining an ongoing relationship with an SME in order to continue receiving revenue was not attractive. Paint suppliers receive revenue from ongoing supply relationships, but are not intimately involved in improving painting operations on a routine basis. Moving in this direction was not appealing. The fact that most paint is distributed directly from paint manufacturers, rather than through local distribution companies, probably contributes to this view.

While it is too early to rule out paint management as a viable EPC for SMEs, this approach seems to have less promise than tooling management or energy management.

Discussion

Efficiency Performance Contracting (EPC) offers an opportunity for SMEs to leverage the expertise of their suppliers to improve efficiency, reduce costs, and reduce waste. EPCs that are based upon a single large spend (such as tooling, paint, or electricity) have the potential to expand and cover other spends (such as metalworking fluids, chemicals, or natural gas) through alliances between suppliers.

Tooling management is clearly an EPC that works for SME metal product fabricators. The plants studied in this project indicate that tooling management can produce significant savings for the plant and significant business opportunities for their tooling supplier.

However, no tooling management program successfully expanded beyond tooling and selected maintenance, repair, and operating (MRO) supplies. In addition, no EPC based on paint or energy has been initiated. This slow rate of diffusion for EPCs suggests that there remain significant barriers for both SMEs and suppliers.

The most important barriers seem to be related to risk and uncertainty for both SMEs and the suppliers. Tooling management is spreading most quickly in part because there are excellent, proven examples – such as Plants A and B – that show the program works. No examples exist for the other EPCs envisioned in this work. It may be necessary to provide intensive short-term assistance, including financial assistance, to establish pilot EPCs of the type envisioned in this work.

Most of this project was undertaken during a time of relatively high business activity. The primary interest of SMEs was meeting production demands. Meanwhile, suppliers were experiencing a healthy sales volume through traditional sales programs. Under such conditions, there is less incentive to attempt innovative programs to improve efficiency. The recent economic downturn could create more favorable conditions for EPCs as plants focus on cost-cutting and suppliers seek new ways of supplementing declining revenues.

The potential benefits of successful EPCs could be significant in terms of business profitability, the State economy, and the environment (Bierma and Marsch, 2008a). However, adoption of EPCs is likely to continue to be slow without outside assistance to overcome barriers of risk and uncertainty.

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Appendix 1

Results by Plant

Plant A

(This plant is a continuing participant. It was designated Plant A in the previous research report - Bierma and Marsch, 2008a)

Plant A is Hitachi Metals Automotive Components (HMAC) (formerly Hitachi/Nukabe Automotive, Inc.) in Effingham, Illinois. They are identified by name in this report because they agreed to a publicly-distributed case study (see Appendix 2).

Facility Statistics:
Employees: 120
Square footage: 130,000

Products and Processes
Plant A manufactures a variety of components for the automobile industry. Operations are predominantly precision machining. Most parts are received as rough castings and are machined to tolerances specified by customers, which include both U.S. and foreign automakers. Relatively little assembly is performed.

Progress
Plant A has the most successful efficiency performance contract of all the plants studied in this project. Though it is limited to tooling, it demonstrates the working relationship between plant and supplier that can lead to significant efficiency improvements and savings. The program has produced a data system able to track tooling cost per unit of product manufactured. This has allowed high-cost machining operations to be identified, studied, and improved. The result has been a tooling cost reduction of more than 40%. The Tooling Management program at Plant A is a model for other plants seeking to implement EPC. Because of the success of the program at the Illinois plant, it has been adopted corporate-wide and is now being implemented at plants in Pennsylvania, Ohio, and South Carolina.

However, the plant has struggled to expand the program beyond tooling and selected MRO items. Plant personnel understand the potential value of including metalworking fluids in the program, encouraging the overall optimization of the machining process. However, the initial attempt to include metalworking fluids failed because the tooling management company had an alliance with a specific metalworking fluid supplier. When that brand of metalworking fluids did not perform well, the tooling management company had no business relationships in place to bring in alternative suppliers and their expertise. Plant A continues to work with their tooling management company to be able to include a wide variety of metalworking fluids, as well as metalworking fluid expertise, within the tooling management program.

A case study on the efficiency performance management program at Plant A is contained in Appendix 2.

Plant B

Plant B is Haldex Hydraulics Corporation in Rockford, Illinois. They are identified by name in this report because they agreed to a publicly-distributed case study (see Appendix 3).

Facility Statistics:

Employees: 450
Square footage: 125,000

Products and Processes

Plant B performs manufacturing and assembly of external gear pumps, pump/motor packages, fluid motors, hydraulic valves, and AC and DC power systems. Operations include conventional, computer numerical control (CNC), and specialized machining; grinding; precision boring; assembly; and manual and automated test facilities. Customers are primarily in the heavy equipment industry.

Progress

Plant B has more experience with tooling management EPC than any other plant studied in this project. Similar to the program at Plant A, it is limited to tooling and selected MRO items, but demonstrates the working relationship between plant and supplier that can lead to significant efficiency improvements and savings.

The program was structured with annual savings targets for the tooling management company. It is expected to meet those targets primarily through machining and tooling management efficiency improvements rather than tooling purchase price reductions. Initial benefits included a reduction in tooling inventory from almost $1 million to about $250,000. Improved data collection and analysis early in the program allowed significant improvements in machining processes in subsequent years. The plant estimates ongoing savings in excess of $200,000 per year.

However, the program has not expanded to include metalworking fluids, other chemicals, or energy. While both the plant and supplier have expressed interest in such expansion, there are no current initiatives for this.

A case study on the EPC program at Plant B is contained in Appendix 3.

Plant C

Facility Statistics:

Employees: 35
Square footage: 40,000

Products and Processes

Plant C is a low-volume job shop serving a wide variety of customers, performing both production and prototype machining and assembly.

Progress
Plant C was very interested in exploring all aspects of efficiency performance contracting, particularly tooling and energy. After initial meetings with the company, management began negotiations with a number of tooling suppliers, ultimately choosing Sanders Tools & Supplies of Peoria. The contract gave Sanders all of the tooling and much of the MRO expenses for the plant. Sanders implemented crib management software and worked to coordinate it with the plant's production management software. The contract also included annual savings targets of 10%. Though price concessions contributed to this goal the first year, the plant recognized that price is not the source of sustainable savings. As the plant's general manager stated, "We understand that they are going to get us cheaper prices when they are available, and when it doesn't hurt their ability to make a living, but what we really want is for Sanders to work closely with us to make process improvements." In the first year, they exceeded their goal of 10% savings, achieving an overall savings of more than 30% of the value of the contract.

Plant C also investigated several energy management options. Working with the author and ISTC staff, the plant brought in three motor or electrical component suppliers. Though the plant uses a large number of motors, almost all of them are specialty motors that could not be replaced with high-efficiency motors. Three lighting contractors were also brought in. Replacement of the existing lighting with high-bay fluorescent looked financially promising. A small energy consulting company was also brought in and worked with the plant on financing/leasing the lighting.

Unfortunately, with the recent economic downturn, the plant has lost considerable business and recently closed. This terminated the tooling management contract and prevented any future progress on energy management.

Plant D

(This plant is a continuing participant. It was designated Plant E in the previous research report - Bierma and Marsch, 2008a)

Facility Statistics:
Employees: 400
Square footage: 225,000

Products and Processes
Plant D manufactures thousands of different products for the heavy equipment industry. The plant uses a variety of metal fabricating processes, including extensive machining operations. Many of its products are painted and require pretreatment, powder coating, and thermal curing operations. The enormous variety of parts manufactured at the plant results in low-volume production runs, frequent tool changes, and difficulties in tracking process efficiencies.

Progress
Plant D has been interested in the full spectrum of efficiency performance contract options, including tooling, chemicals, paint, and energy.

The author and ISTC staff worked extensively with this plant on a tooling management program. We set up and accompanied plant staff on visits to Plants A and B to learn from their successes, as well as worked with plant staff to put out a request for proposals (RFP), reviewed proposals, and interviewed the promising suppliers. Ultimately, the plant decided not to use a sole-source provider, but instead split most of the tooling spend between two suppliers. Also, the contracts did not focus on joint research and improvement of machining operations and did not include annual savings targets to be reached through process improvements. As a result, tooling supply at this plant is closer to a standard tooling supply program than an efficiency performance contract.

Plant D also expressed interest in energy management. The author and ISTC staff worked with the plant to bring in lighting suppliers, motor suppliers, and an energy service company. Results of the motor management assessment indicated that most of the motors were custom and did not offer the opportunity for efficiency improvement. The lighting assessment indicated good opportunities for efficiency improvement by upgrading to high-bay fluorescent lighting. The plant initiated a lighting trial in a portion of the plant that had been plagued by poor lighting fixtures. Results were positive and the plant upgraded that portion of the plant, but is not upgrading the remaining plant despite a reasonable projected return on investment. On its own, the plant also made a number of other energy-saving improvements to their paint pretreatment process.

A paint process automation specialist was also brought in to evaluate the painting process and explore opportunities for a paint management program. The plant implemented a number of improvements, including the purchase of an automated chemical control system for the paint pretreatment process.
Overall, Plant D has made significant efficiency improvements. However, these improvements were implemented individually, largely by plant staff. At present, no efficiency performance program is in place at this plant.

Plant E

(This plant is a continuing participant. It was designated Plant C in the previous research report - Bierma and Marsch, 2008a)

Facility Statistics:
Employees: 40
Square footage: 40,000

Products and Processes
Plant E produces metal products for a wide variety of customers. During the study period, operations at the company's smaller machine facility were consolidated into the 40,000 square foot powder coating facility. Today, the single facility includes limited machining, metal fabrication, and assembly and warehouse operations, but is dominated by powder coat operations. Powder coat operations include pretreatment in a five-stage washer (alkaline cleaning, phosphating, and sealing) followed by oven drying, powder coating, and thermal curing.

Progress
Plant E has experienced extreme fluctuations in business volume over the study period. At the beginning of the study period, the plant was running a skeleton crew on one shift four days per week. Near the end of the study period, the plant was running two shifts per day, six days per week. These business fluctuations occupied most of the management's time, and were probably partially responsible for a lack of progress at the plant.

This plant has a long history of research cooperation with ISTC and has expressed great interest in efficiency performance contracting. In our previous research, this plant involved its paint, chemicals, and equipment suppliers in exploring performance contract opportunities. However, the small scale of the facility was a significant barrier.

In the current study, the plant focused primarily on energy management. Several lighting suppliers were brought in, an energy service company, and a State of Illinois energy auditor. Plans for lighting upgrades were made, but the company owner never approved funding. Recent utility incentives have rekindled interest in the lighting upgrade.

At present, no efficiency performance program is in place in this plant.

Plant F

Facility Statistics:
Employees: 250
Square footage: 330,000

Products and Processes
Plant F produces pipe, valves, and fittings for government, utility, and industrial customers. Plant operations include turning, milling, grinding, tapping and drilling. The plant works primarily with iron and brass.

Progress
Initial meetings with Plant F indicated significant opportunities for efficiency improvements in tooling, metalworking fluids, and energy. At that time, the plant used multiple tooling suppliers and two metalworking fluid suppliers. However, the corporate office had recently begun a purchasing consolidation initiative, and plant-level changes in tooling and fluid suppliers were not possible, pending final corporate purchasing decisions. Identification of savings opportunities with plant lighting early in the study period did result in the plant upgrading their lighting. While this was a beneficial step for energy conservation, it reduced the opportunity for an energy management program since revenue from lighting improvements is probably essential for a financially viable program.

Approximately a year-and-a-half after initial the meetings, the corporate purchasing consolidation effort was complete and the plant was free to pursue its own tooling and fluid supply initiatives. The author and ISTC staff met with plant staff to update them on tooling management opportunities. At the time of this writing, plant staff members are contacting Plants A and B for tours and to discuss tooling management experiences.

Appendix 2

Tooling Management Case Study: Hitachi Metals Automotive Components and Decatur Custom Tool, Inc.

Background

Hitachi Metals Automotive Components (HMAC) operates a precision machining and assembly facility that produces automotive parts including manifolds, brackets and suspension components for many of the major automotive companies. The company has a history of commitment to quality and continuous improvement, obtaining certifications such as TS16949, Ford Q1, and ISO 14001. The plant has also earned the Nissan Zero Defect Award and Honda Quality Award. HMAC currently has approximately120 employees at the 130,000 ft^2 facility.

In 2003, HMAC recognized that to make significant progress in improving machining operations and holding down costs, they needed more than just good tooling suppliers. They needed a tooling technology partner that would work closely with the plant, sharing both the risks and rewards. As Joe Forbes, HMAC General Manager, explained, "We know we need tooling – anyone can supply us with that. What we are really after is the technical support, a technology partner."

HMAC began negotiating a unique tooling management agreement with one of its tooling suppliers, Decatur Custom Tool, Inc. (DCT) of Decatur, Illinois. DCT had established tooling management programs with other facilities in Illinois, Indiana, and Missouri, providing inventory management, tool tracking, and logistical support. But HMAC wanted more than that. They wanted a tooling management company that was just as committed to continuous improvement as they were. So they included two unique provisions: (1) annual savings targets, and (2) cost tracking on a cost-per-unit-produced basis. HMAC believed that these provisions would align the interests of both companies, and keep them focused on continuous process improvement.

The Tooling Management Program

In 2004, DCT became the tier 1 tooling supplier, managing the 40-plus tier 2 tooling suppliers to the plant. They took ownership of all tooling inventory, not charging HMAC until a tool was issued to an operator. They automated the tool crib process (installing vending machines and electronically tracking tool use and inventory) which eliminated outages and decreased delivery times. These improvements won acceptance from machine operators. The initial three-year agreement had phased in targets for DCT. Year 1 had a savings target of approximately 10% of the annual tooling spend. Year 2 would involve a move to cost-per-unit tracking, with a savings target of an additional 10% to come from process improvements. Year 3 required an additional 10% cost-per-unit savings target from process improvement. In addition to tooling, DCT also began supplying a number of MRO items, particularly safety products. The second three-year

agreement had reduced annual savings targets, recognizing that much of the "low hanging fruit" had already been picked.

A key component of the program is information. Using the data collected in the electronic tool tracking system, HMAC and DCT were able to reliably calculate the tooling cost for all of the products at the plant. This prepared them to move beyond traditional tooling management and into systematic process improvement. "We used a Pareto approach," notes Forbes. "From the data we could easily identify the three products with the highest tooling costs. Then, for each of those products, we identified the five tools that contributed the most to those costs."

One by one, they focused on each of the high-cost machining operations. "We collected data on the machine, the tool, the part, existing speeds and feeds – all the critical data," explained Mike Moran, Vice President of DCT. "Then we invited in the tooling suppliers to study the process and recommend tooling to test." One recent example is the milling operation on a manifold production line, which contributed 50% of the tooling cost for that product. "We've probably tested five or six cutters on the milling machine in the last six months," commented Moran. "And each test can last up to three weeks." But the results have been worth it. Not only was the best tool able to complete the operation in one pass instead of two, tool life was extended three-fold.

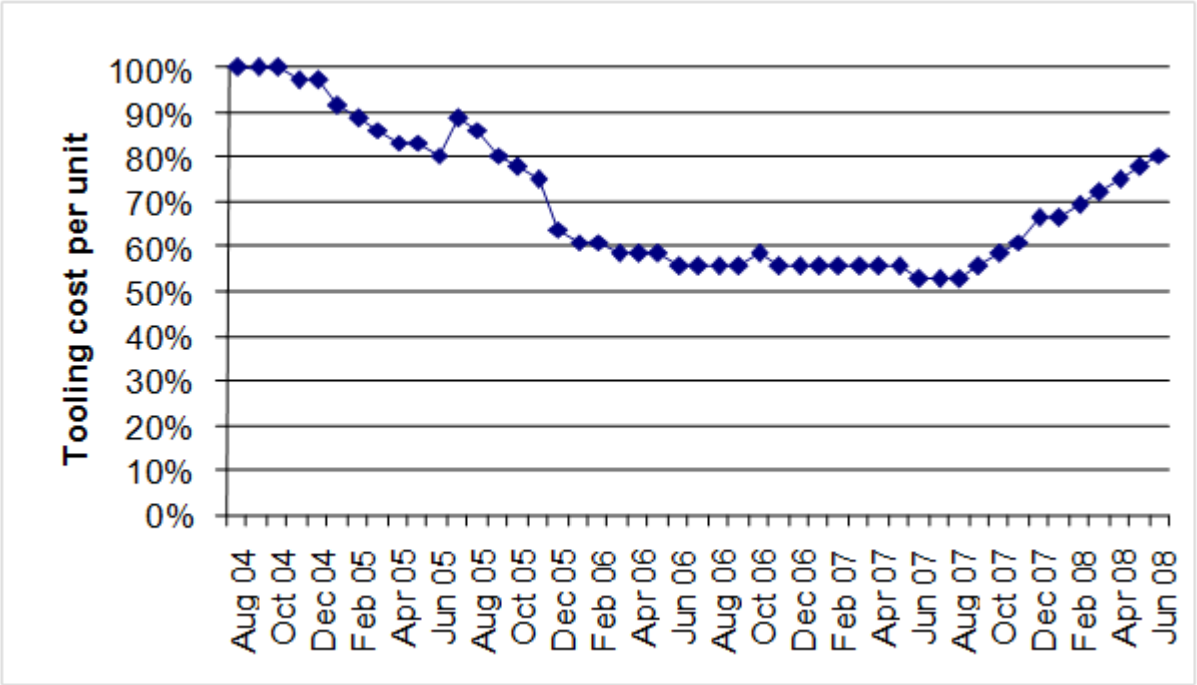
Program Benefits

Between re-negotiated pricing with tier 2 suppliers and several like-for-like tool substitutions, Year 1 produced hard tooling savings that exceeded the 10% savings target. In addition, HMAC saved on the cost of holding inventory, freight, and expedited order payments, and was able to better utilize staff, originally devoted to tooling inventory management, to focus on process improvement and cost reduction. The savings in purchase orders alone was significant. HMAC estimates that it costs them $30-$50 to process a P.O., and now they only issue one each month – to DCT.

Through the systematic approach to process improvement made possible by the data collected in Year 1, DCT and HMAC accomplished a 30% reduction in tooling cost-per-unit in year 2, far exceeding their 10% target. They also exceeded their 10% target in Year 3. As Moran explained, "Testing and tooling improvement – it's our bread and butter. We keep an eye on the technology, we go to the tooling trades shows, watch the tooling publications, maintain contacts throughout the tooling industry. It's our core competence, whereas it's just a distraction for many of our customers."

Tooling costs continued to decline even after the initial three-year agreement, primarily through process improvements identified by HMAC and DCT staff (see Figure 6). In 2007, a major new production line was installed to produce a new product with significant machining requirements. HMAC recognized that this would dramatically increase tooling costs, and monthly tooling costs-per-unit increased to higher than the original 2004 baseline. However, once the new production line was operating smoothly, HMAC and DCT applied the same systematic process to begin bringing tooling costs down. The annual moving average data in Figure 6 reflect new tooling costs incurred in 2007. The cost-per-unit tracking system also allows the program to adjust to changes in production volume, which would otherwise confound a flat-fee system.

Figure 6. Moving yearly average tooling cost-per-unit produced under the tooling management program (August 2004 is baseline).



Coolant Management

To capitalize on the successful relationship created by the tooling management program, HMAC asked DCT to develop a coolant management program. The coolant supplier would not only provide the logistical support needed to manage the coolant, but will also have an annual savings target. As with tooling management, it would be a flat dollar savings target the first year, but would evolve to a coolant cost-per-unit fee and savings target by the second year. This would insure that continuous improvement in coolant use efficiency is an integral part of the program.

DCT had an existing business relationship with one coolant supplier, so in developing a coolant management program, that supplier was brought in to the plant to replace the existing coolant. However, the plant found that the new coolants did not perform as well as pervious coolants, despite testing numerous formulations.

Ultimately, the coolant management program was terminated and the plant switched coolants. However, the working relationship between HMAC and DCT remained strong and at the time of this writing they are exploring a new coolant management program that is more flexible in its coolant options.

Other Benefits

Though performance is measured in hard savings, it is many of the intangibles that assure HMAC that they have made the right decision with DCT. The process improvements have

reduced cycle times and increased production flexibility. It has even saved on machine wear and electricity by achieving the same production with fewer hours of machine operation. Plant personnel previously devoted to tooling inventory management have been able to focus more time on process improvement and cost reduction.

Training has been another important intangible. Hill noted that "DCT has done a lot of training for us as part of this program. Some of it is just basic training on machining and machine tools. Or it might focus on coolants or new machine tool technologies."

Another intangible is the unique role that DCT plays in the relationship between HMAC and their tier 2 tooling suppliers. As Mike Moran of DCT explained, "HMAC needs to stay in touch with these suppliers if they want to stay on the cutting edge. But all that contact use to take a lot of time for HMAC personnel. Under the new agreement, HMAC still makes the decisions, they still have control, but we facilitate the process. We not only respond to contacts from suppliers, we go out and solicit suppliers to address priority problems in the plant. Our suppliers are a great resource – we need to keep them interested in doing business with us."

But overall, it may be the working relationship that has developed between the two companies that is most valuable. It is not a trust that has come easily, but from open and honest communication. "When we're holding something up," commented Forbes, "they let us know. And if they're holding something up, we let them know. We are critical of them and they are critical of us – but we have built trust without building animosity."

The Future

Due to the success of the tooling management program at the Effingham plant, Hitachi Metals America, Ltd. (HMAC's parent company) decided to implement the program at all of its six facilities in the United States. Following an extensive sourcing process, DCT won the contract. Tooling management programs are now being implemented in North Carolina, South Carolina, Ohio, Pennsylvania, and Tennessee.

When the tooling management went corporate-wide, MRO items were dropped from the contract because the corporation already had a corporate MRO provider. However, HMAC continues to look at ways to include metalworking fluids under the tooling management program. They recognize that optimizing the machining process is going to require careful matching of tooling, metalworking fluid, and machining requirements. This is expected to be an important part of tooling management development at HMAC in the coming years.

Appendix 3

Tooling Management Case Study: Haldex Hydraulics Corporation and Engman-Taylor Company, Inc.

Background

Haldex Hydraulics Corporation performs manufacturing and assembly of hydraulic systems at its 125,000 ft^2 Rockford, Illinois plant, employing about 500. The plant is both ISO 9001 and 14001 certified and serves customers primarily in the heavy equipment industry. They began a tooling management program in 1992 with Engman-Taylor Company (ETCO) of Menomonee Falls, Wisconsin. ETCO has undertaken similar programs since 1987, primarily in Wisconsin, Illinois, and Iowa. The program evolved considerably over the years and in 2000, management of the program shifted from purchasing to manufacturing engineering, signifying a greater focus on production, budgeting, and cash flow management. "Everyone had to understand that we manage tooling because we want to be more profitable," explained Terry McCormick, manager of manufacturing engineering. "Everyone knows they are going to have an expense for tooling, but if it's not managed well, it can have a significantly greater impact on your financial position."

The tooling management program at Haldex began in 1992, but has undergone a series of changes over the years. Brian Nelson, Vice President of Haldex Hydraulics, was then manager of manufacturing engineering at the Rockford Plant. "I started tracking the amount of time machines were down due to lack of tools. It was quite high. Yet we had a lot of money tied up in tooling inventory – over $800,000." ETCO was already supplying tooling to the plant and when they approached Nelson about an integrated supply relationship it seemed a good fit with the company's need to bring greater control to the tool crib. Nelson was pleased with the results. "Within 18 months machine down-time due to tooling stock-outs dropped to almost zero. The cash tied up in tooling dropped to around $250,000. Today, even though we have grown from a $35 million company to a $100 million company, our tooling inventory is still around $200,000."

In 2000, control of the integrated tooling management program in Rockford shifted from the purchasing department to manufacturing engineering. Terry McCormick, manager of manufacturing engineering explained, "Manufacturing is the point of use, and we are being held responsible for the tooling budgets. It makes sense that we should manage the integrated supply program." McCormick worked with ETCO to bring greater control to tool purchasing and inventory, with an emphasis on managing cash flow as opposed to price bidding. ETCO also expanded their role in process optimization, overseeing the involvement of tooling manufacturers in solving machining problems in the plant.

The Tooling Management Program

Today, the tooling management program at the Rockford plant covers perishable tooling, gages, fixtures, tooling repair, and related equipment. Of the approximately $2 million that Haldex

spends annually in these areas, more than 80% is covered by the program with ETCO. In addition, a variety of MRO products are supplied through the program, as are special purchases that are part of capital investment projects. However, it is not an exclusive-supply relationship. ETCO is not well-positioned to supply some of Haldex's tooling and MRO needs. "I wouldn't want to be a sole supplier," noted Dick Star, Chairman of Board of ETCO. "We have an obligation to get people the best product that works. There are times when the best product, for one reason or another, isn't available to us."

ETCO provides two on-site personnel: a customer service representative and a crib attendant. The customer service representative works to improve tooling processes, from inventory and handling to machining. He coordinates efforts with the major tooling manufacturers to study priority machining processes in the plant and develop more cost-effective alternatives. He also manages tool and MRO purchases and data collection. The crib attendant oversees day-to-day crib management, including receiving and restocking. ETCO also provides quality assurance services for all purchases through the program.

Haldex pays for these services through the price of the products, rather than a management fee. Yet, Haldex is confident that they receive very competitive pricing. "On most tools, ETCO can leverage a much better discount from manufacturers than the plant can," explained McCormick. "Not *every* tool, but on the package as a whole, I know we are getting a good price. There are some tools that ETCO does not get a good distributor discount, but if you start micro-managing tool purchases, you drive yourself crazy and we are back to where we were before the integrated supply program."

Brian Nelson elaborated, "If you break items out of the agreement and source them yourself, you might get a better price, but then you have to order them, receive them, do the quality assurance, inventory them, and pay the invoices. That's a significant cost. Is it worth the price savings? Typically the answer is 'No'."

While tool reordering, receiving, and inventory are managed by ETCO, decision-making authority still rests with Haldex. Early in the program, Haldex and ETCO worked together to establish re-order points and to further automate the purchasing process. Change is carefully controlled. Changes to the quantities or types of tools purchased require justification – typically data – as well as the signoff of Haldex. "We have had a successful and long-term relationship with Engman-Taylor," explained McCormick, "but if they substituted a tool without our permission, they'd be out of the plant tomorrow."

"The plant can't abdicate its involvement or responsibility for tooling management just because you have an integrated supply program," noted Nelson. The program is more like a partnership rather than outsourcing.

As McCormick explained, "The bottom line is that if you are going to ask a supplier to step into an integrated tooling supply program and you do *not* participate – and I mean actively participate – don't do it. You will fail."

A master contract is negotiated yearly between Haldex and ETCO. It includes anticipated products and pricing, services, and personnel. Importantly, it also includes improvement targets. While many of these targets address cost savings, they may also include other performance measures, such as stock-outs, set-up time, cycle time, etc.

Program Benefits

The greatest benefits have been in process improvement. “Process savings have been our greatest source of savings,” explained Nelson. “It’s not what a lot of people would expect. Most people think about saving on price. But it is process savings, and then administrative savings, that provide the greatest benefits.”

The process improvements began with better data on tool consumption. With control over purchasing, inventory, and distribution of tools, Haldex and ETCO have been able to make much more effective use of the MRO product management software at the plant (CribMaster®). “With the data coming out of the program, I could begin to track our tooling cost per standard production hour,” noted Terry McCormick. “I can track this down to the individual machine and even to the subprocess – specific machines performing specific operations. We can also aggregate up – to machine groups, departments, and the plant as a whole.”

The ready of such detailed data has led to a number of benefits for the plant. “We can use Pareto analysis to identify the operations with the highest tooling costs,” explained McCormick. Once priority operations are identified, ETCO coordinates the improvement effort, bringing in the major tooling companies and conducting tests of the most promising tools. Recalling an early success, McCormick commented, “We undertook a project to improve an area that had grown in production significantly, and had the highest cost ratio in the plant. Using our data, we were able to focus on the three or four specific machining operations that were the biggest problem.” The joint effort by Haldex and ETCO had dramatic results. “We cut our tooling costs in half. In the first year alone, we saved $150,000. When we rolled the changes out to similar operations, the savings were $350,000.”

The net result has been year-to-year improvements in tooling efficiency. “Over the last five years, Haldex has seen a 16% improvement in productivity,” noted McCormick. “But our tooling and MRO costs per standard hour have remained constant. That’s about $100,000 in new savings – or costs avoided - every year.”

Haldex also estimates that the program saves about $100,000 per year in personnel costs, though no Haldex employees have been laid off. “No one has lost their job from cost saving efforts at Haldex,” noted Nelson. “In addition to taking advantage of retirements, some workers moved over to Engman-Taylor’s payroll. “Our current Engman-Taylor tooling specialist is one of our former employees who approached me and asked to make the move to ETCO.” He was very interested in tooling and thought the experience and opportunity with Engman-Taylor would be better for him. It has been fantastic for us. Now ten years later, his son works in our tool crib.”

All of this comes on top of benefits realized early in the program, such as improved pricing from consolidation of purchases, and improvements in tooling logistics. As previously noted, tooling inventory dropped from over $800,000 to about $250,000 in the first 18 months of the program.

Greater control of tooling logistics also resulted in productivity gains. Noting the benefits of the early program, Brian Nelson recalled, “Machine down-time from tooling outages went to almost zero within the first 18 months. I used to have 150 invoices a month coming from the tooling houses; now I have 2. I used to have a receiving inspection person that all they did was inspect and certify tooling; now that task is handled by Engman-Taylor. And we freed-up valuable floor space. You can imagine how much floor space $800,000 in tooling inventory took up.”

Another benefit of the accurate and detailed tooling data has been improved budgeting and pricing. “Based on production forecasts for the coming year, I can develop my tooling budget very accurately, using the cost-per-standard-hour data,” explained McCormick. “When forecasts change, I can change my budget to match it.” In new-product pricing, McCormick has also found the data to be invaluable. “As manager of ME, I’m part of the cost development team for any new item. I can see early on if this product is going to go through processes with high tooling costs. Sometimes we can modify the production plan to reduce costs, but we always have a more accurate picture of our tooling costs to use in pricing.”

But McCormick believes one of the greatest benefits of the integrated tooling management program has been cash flow. “A key to success on a month-to-month basis is cash flow. You can buy a year’s worth of inventory for a particular tool to take advantage of a discount, but you’ve got a negative cash flow – plus you’ve tied up your cash in inventory that you may not need. Once you’ve gotten control of your usage, your supply lead time, and your inventory, you get control of your cash flow. That’s what we’ve been able to do through this program with Engman-Taylor.”